TOWN OF CHAPEL HILL

Town Hall
405 Martin Luther King Jr. Boulevard
Chapel Hill, NC 27514

Item Overview

Item #: 11., **File #:** [21-0769], **Version:** 1 **Meeting Date:** 10/13/2021

Receive Updated Risk Assessment for Police Station Property.

Staff:
Maurice Jones, Town Manager
Mary Jane Nirdlinger, Deputy Town Manager
Laura Selmer, Economic Development Specialist
John Richardson, Community Resilience Officer

Department:
Manager's Office

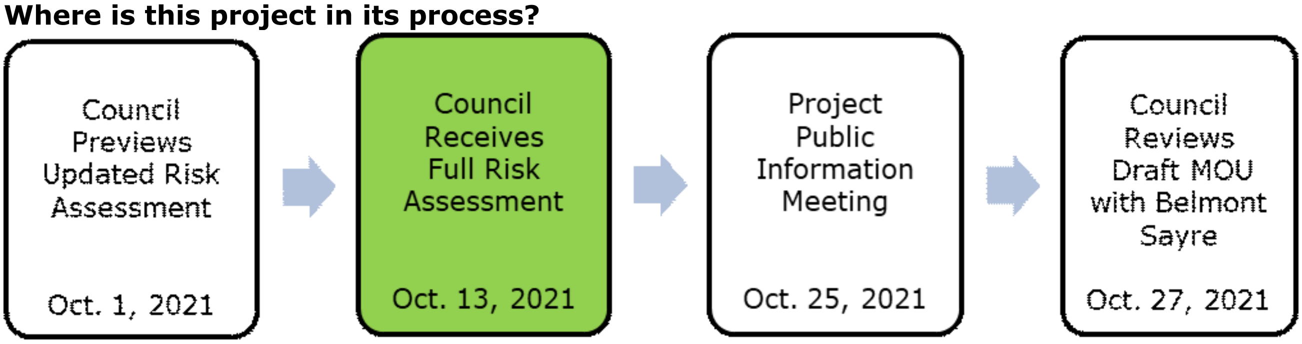
Overview: The Town Council continues to consider the long-term land use and remediation options for the Police Station property, located at 828 Martin Luther King Jr Blvd. The latest option includes the Town entering into the North Carolina Brownfields Program and partnering with Belmont Sayre, a local developer, to create a mixed-use redevelopment of the property that could include a new Municipal Services Center, retail, and housing. As part of this process, the Town continues to work with environmental consulting services firm, Hart & Hickman, to complete an updated Human Health and Ecological Risk Assessment. This assessment will help the Town to better understand risk under the current land use scenario and possible future redevelopment scenarios. See the attached presentation, executive summary, and full report for findings and details.

Recommendation(s):

That the Council receive the attached presentation and report and continue to provide guidance, as needed.

Fiscal Impact/Resources: The cost of the updated risk assessment was $28,700. Additional fiscal impacts will be discussed as part of other items related to the potential future land uses and remediation options for the property.

Where is this project in its process?



Attachments:

- Consultant Presentation
- Risk Assessment Executive Summary
- Risk Assessment Report

The Agenda will reflect the text below and/or the motion text will be used during the meeting.

PRESENTER: Genna Olson, Principal Geologist, Hart & Hickman

RECOMMENDATION: That the Council receive the attached presentation and report and continue to provide guidance, as needed.

Risk Assessment Results

Prepared by

hart hickman

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October 1, 2021

Topics of Discussion

- Introduction & Background
- Human Health Risk Assessment
- Ecological Risk Assessment
- Conclusions & Recommendations

Introduction & Background

- Mixture of coal combustion products (CCPs) and construction debris buried across much of the property.
- Primary compounds of concern are metals.

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Introduction & Background

2020 interim remedial measures:

- Excavation of coal combustion products (CCPs) along Bolin Creek Trail
- Stabilization of embankment and stormwater management controls

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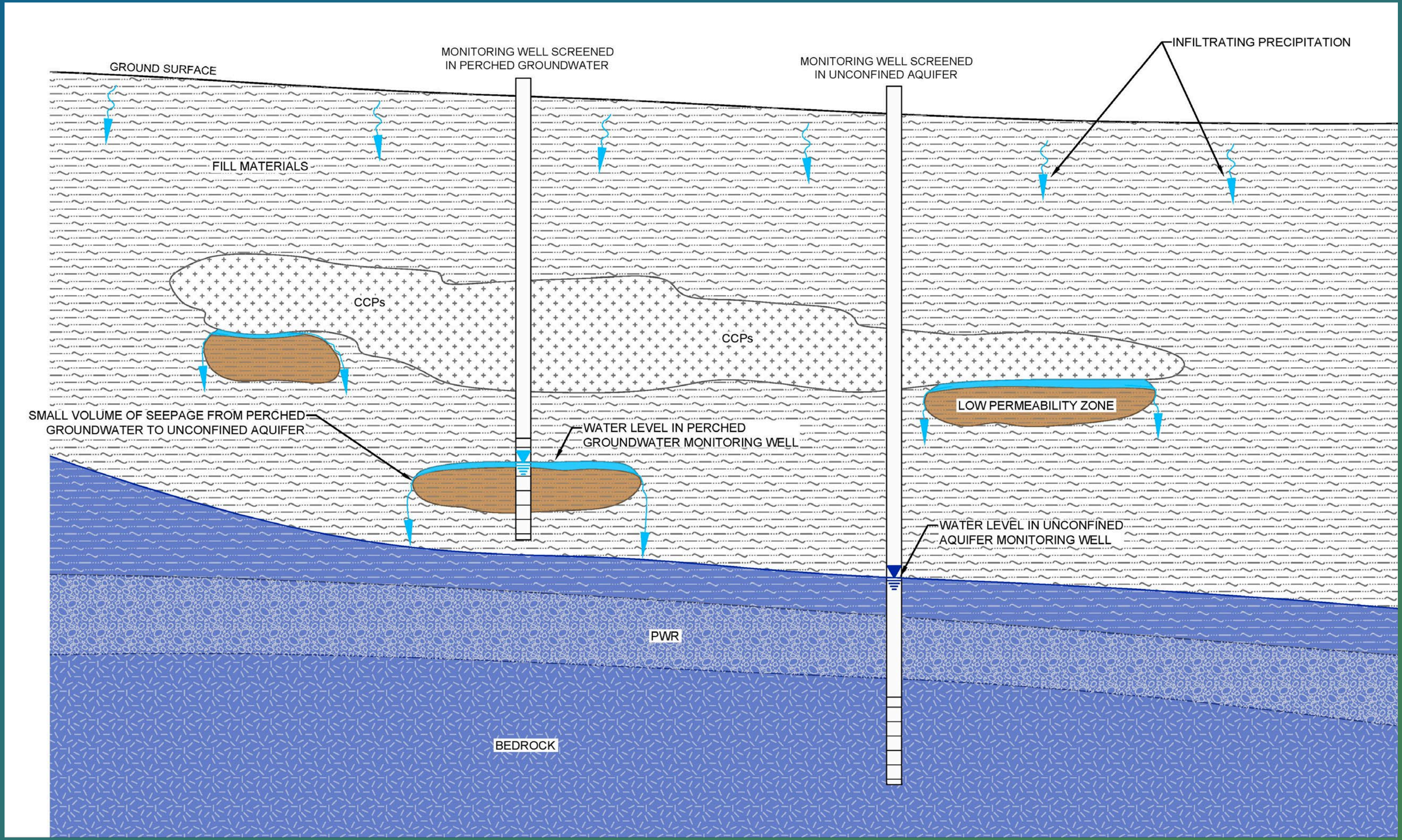
Introduction & Background



- Some elevated concentrations of metals in perched water within fill materials, but limited or no groundwater impact in wells screened in non-fill zones in the underlying aquifer.
- No significant impact to surface water in Bolin Creek.
- No groundwater users (such as water supply wells) in the area.

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Introduction & Background

- Prior risk assessment focused on area of greenway. Concluded that interim remedial measures effectively reduced risk such that greenway trail is safe for use.
- More comprehensive human-health and ecological risk assessment recently performed for the site as a whole. Goal was to define the final measures recommended under the current land use scenario and possible future redevelopment scenarios.

synTerra
Science & Engineering Consultants
511 Keisler Dr # 102, Cary, NC 27518 | 919.858.9898

Human Health and Ecological Risk Assessment Report

828 Martin Luther King, Jr. Boulevard Property
Chapel Hill, North Carolina

May 6, 2021

Prepared for:

Town of Chapel Hill
Chapel Hill, North Carolina

Prepared By:

SynTerra Corporation
Cary, North Carolina

Kevin P. Kelt, G.I.T.
Project Geologist

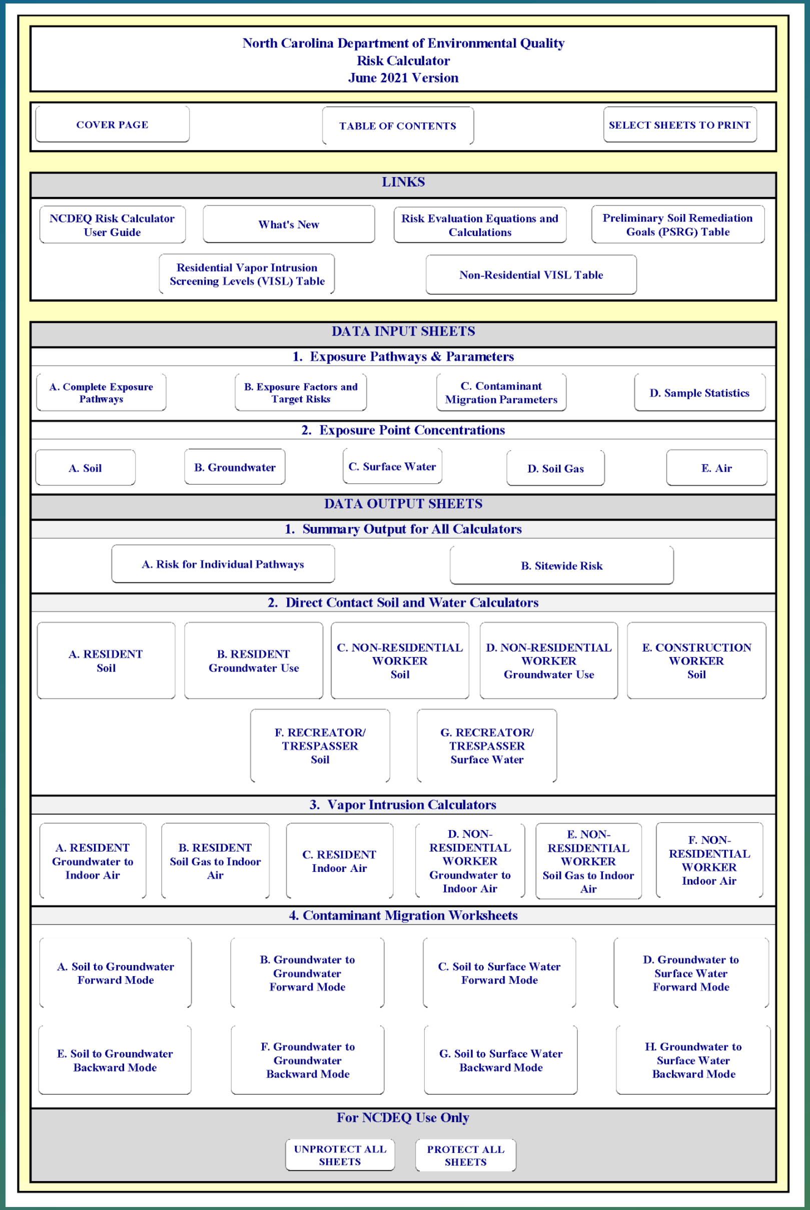
David L. Duncklee, P.G.
Senior Hydrogeologist

Kenneth Rudo, Ph. D
Toxicologist

Topics of Discussion

- Introduction & Background
- **Human Health Risk Assessment**
- Ecological Risk Assessment
- Conclusions & Recommendations

Human Health Risk Assessment


North Carolina Department of Environmental Quality
Risk Calculator
June 2021 Version

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What's New
Risk Evaluation Equations and Calculations
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Residential Vapor Intrusion Screening Levels (VISL) Table
Non-Residential VISL Table

DATA INPUT SHEETS

1. Exposure Pathways & Parameters

A. Complete Exposure Pathways
B. Exposure Factors and Target Risks
C. Contaminant Migration Parameters
D. Sample Statistics

2. Exposure Point Concentrations

A. Soil
B. Groundwater
C. Surface Water
D. Soil Gas
E. Air

DATA OUTPUT SHEETS

1. Summary Output for All Calculators

A. Risk for Individual Pathways
B. Sitewide Risk

2. Direct Contact Soil and Water Calculators

A. RESIDENT Soil
B. RESIDENT Groundwater Use
C. NON-RESIDENTIAL WORKER Soil
D. NON-RESIDENTIAL WORKER Groundwater Use
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3. Vapor Intrusion Calculators

A. RESIDENT Groundwater to Indoor Air
B. RESIDENT Soil Gas to Indoor Air
C. RESIDENT Indoor Air
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E. NON-RESIDENTIAL WORKER Soil Gas to Indoor Air
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4. Contaminant Migration Worksheets

A. Soil to Groundwater Forward Mode
B. Groundwater to Groundwater Forward Mode
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E. Soil to Groundwater Backward Mode
F. Groundwater to Groundwater Backward Mode
G. Soil to Surface Water Backward Mode
H. Groundwater to Surface Water Backward Mode

For NCDEQ Use Only

UNPROTECT ALL SHEETS
PROTECT ALL SHEETS

- Risk assessment calculations performed using the DEQ Risk Calculator.
- Recommendations to address exceedances of acceptable risk levels could include remediation, land-use restrictions (LURs), or other measures.

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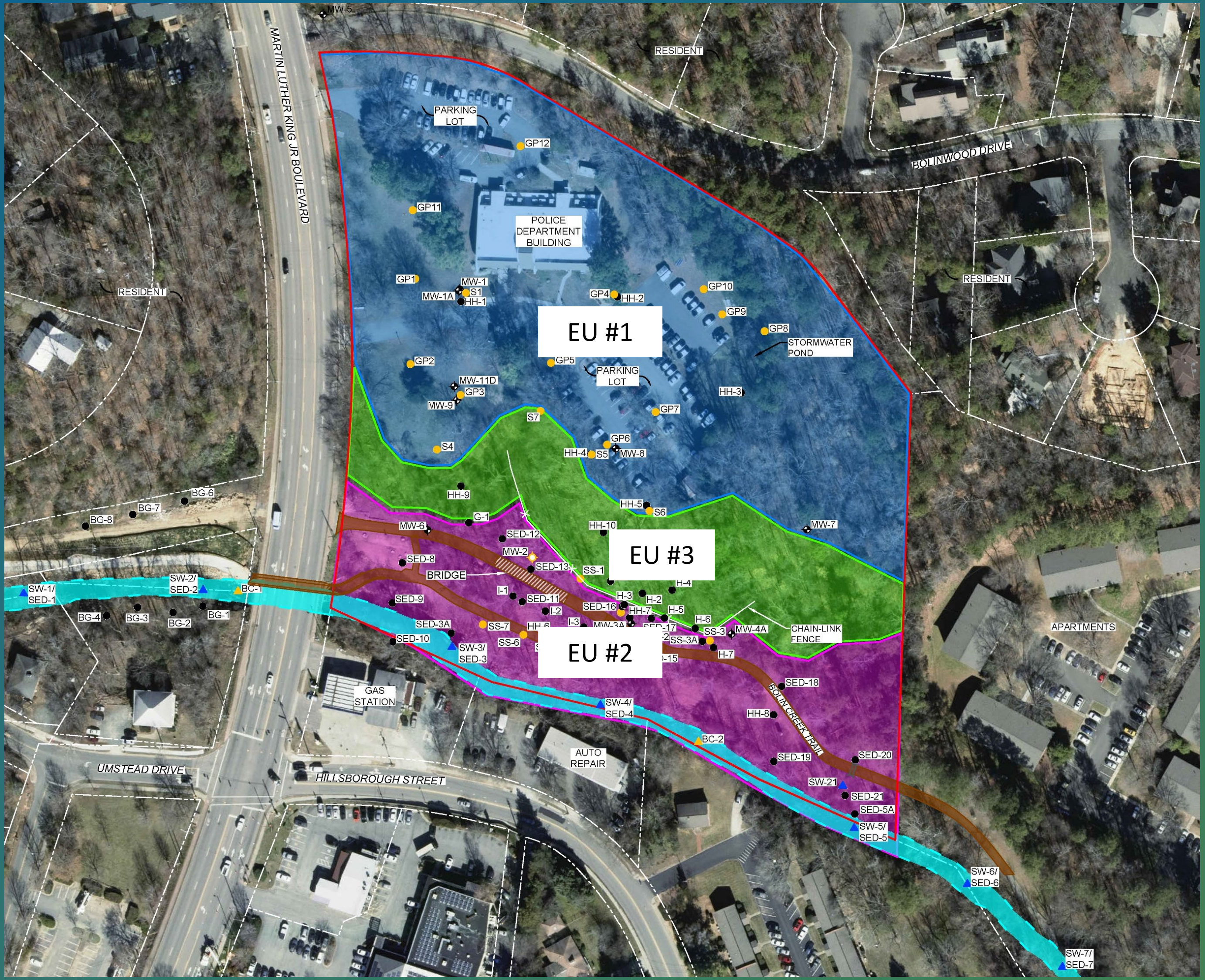
Human Health Risk Assessment - Exposure Pathways Evaluation



- Exposure Unit (EU) = Areas of similar land-use and exposure characteristics
- Evaluated risk for both current and possible future site occupants.
- EU #1 – Upper Level
  - Residents
  - Non-residential workers
  - Construction workers
- EU #2 – Lower Level
  - Greenway user
  - Construction workers
- EU #3 - Embankment
  - Current exposure minimal, evaluated future risks for all possible users to identify whether additional measures needed.

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Human Health Risk Assessment - Exposure Pathways Evaluation

Exposure Pathway	Evaluation
SOIL Direct contact soil exposure pathway – dermal contact, ingestion, or outdoor inhalation of particulates from impacted soil or coal combustion products (CCPs)	Pathway evaluated for all three exposure units.
SURFACE WATER Direct contact surface water exposure pathway – dermal contact or ingestion of impacted surface water	Pathway evaluated for surface water in Bolin Creek (Exposure Unit #2).
STREAM SEDIMENT Direct contact sediment exposure pathway – dermal contact, ingestion, or outdoor inhalation of particulates from impacted stream sediment	Pathway evaluated for stream sediment in Bolin Creek (Exposure Unit #2).
VAPOR INTRUSION Migration of volatile vapors into buildings	Pathway not complete because no volatile compounds present.
GROUNDWATER Direct contact groundwater use pathway – ingestion, dermal contact, or inhalation associated with water supply well use	Pathway not complete because no water supply wells present and land-use restriction preventing future installation of water supply wells proposed.

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Human Health Risk Assessment - Exposure Parameters

Reasonable maximum exposure (RME) – the highest exposure reasonably likely to occur, generally assumed to be in the range of the 90th and 99.9th percentiles (US EPA, 2001).

90 to 99.9% of time people will be exposed at levels less than risk assessment assumes.

- DEQ default exposure parameters used for resident, non-residential worker, and construction worker, which represent RME.
- For greenway user, site-specific values calculated which represent 98^{th} percentile based on trail survey.

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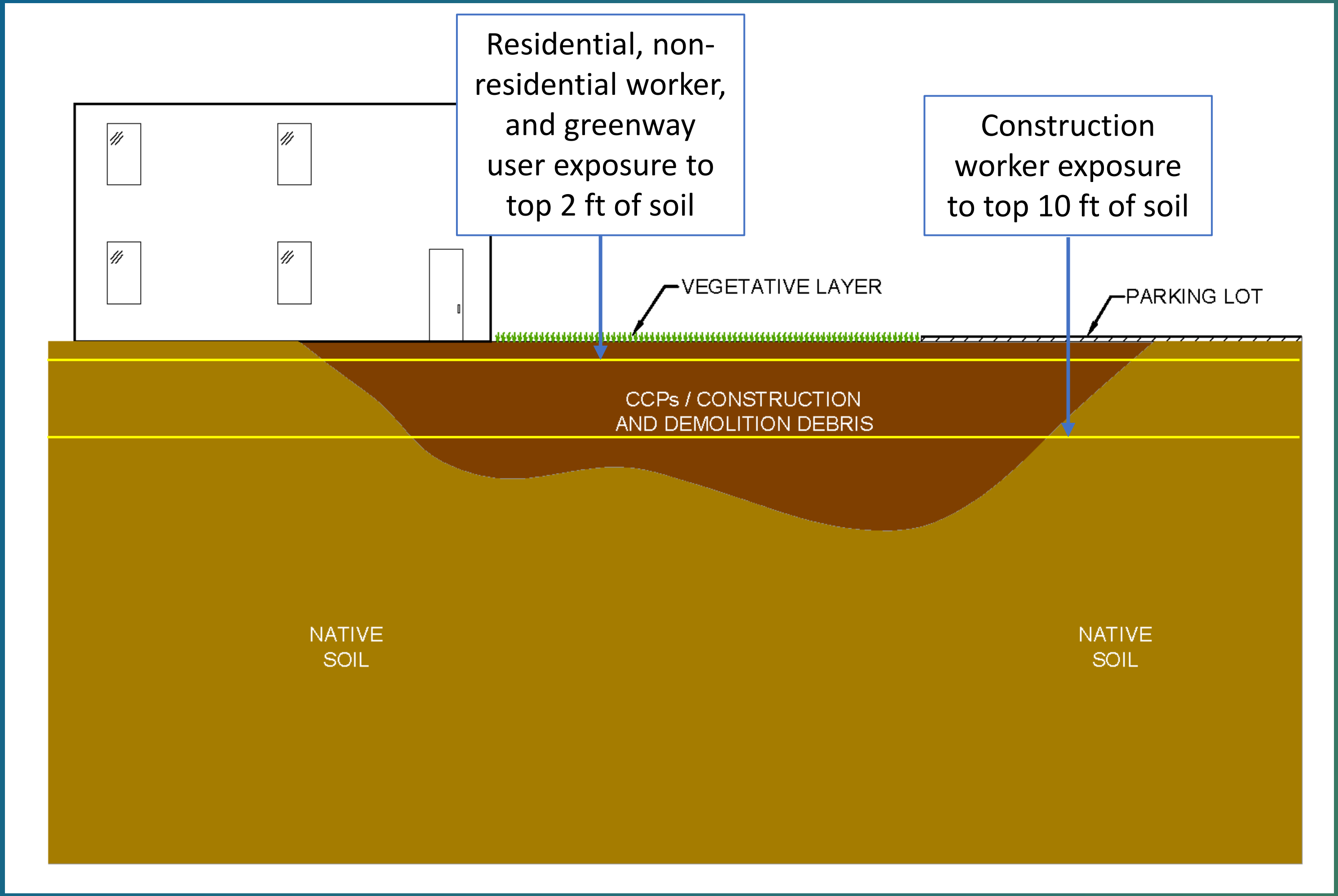
Human Health Risk Assessment - Exposure Point Concentrations

- Metals are naturally occurring in North Carolina soils.
- Metals representative of naturally occurring conditions removed for the purpose of defining areas where remediation or other measures needed to address risks.

Human-Health Risk Assessment – Exposure Point Concentrations



- Risk calculations used maximum concentrations in designated depth zone.
- If deeper samples exposed during grading and not covered by impervious surfaces post-redevelopment, recommend additional risk evaluation or cover with 2 ft of clean fill.

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Human Health Risk Assessment – Target Risk Levels

- Based on EPA and NCDEQ risk assessment guidance, exceedances of the following target risk levels will be considered “triggers” for additional action:
  - Non-cancer hazard index > 1
  - Cancer risk > 1 in 10,000 (10^{-4})
- Per typical Brownfields redevelopment process, actions may be performed to minimize exposure even if target risk levels are not exceeded.

Non-cancer hazard index (HI) or hazard quotient (HQ) = The ratio of the amount of a contaminant a person is exposed to versus the amount that may cause non-cancer harmful effects.

Individual Excess Lifetime Cancer Risk (CR) = Increase over background in an individual’s probability of getting cancer over a lifetime due to exposure to a chemical.

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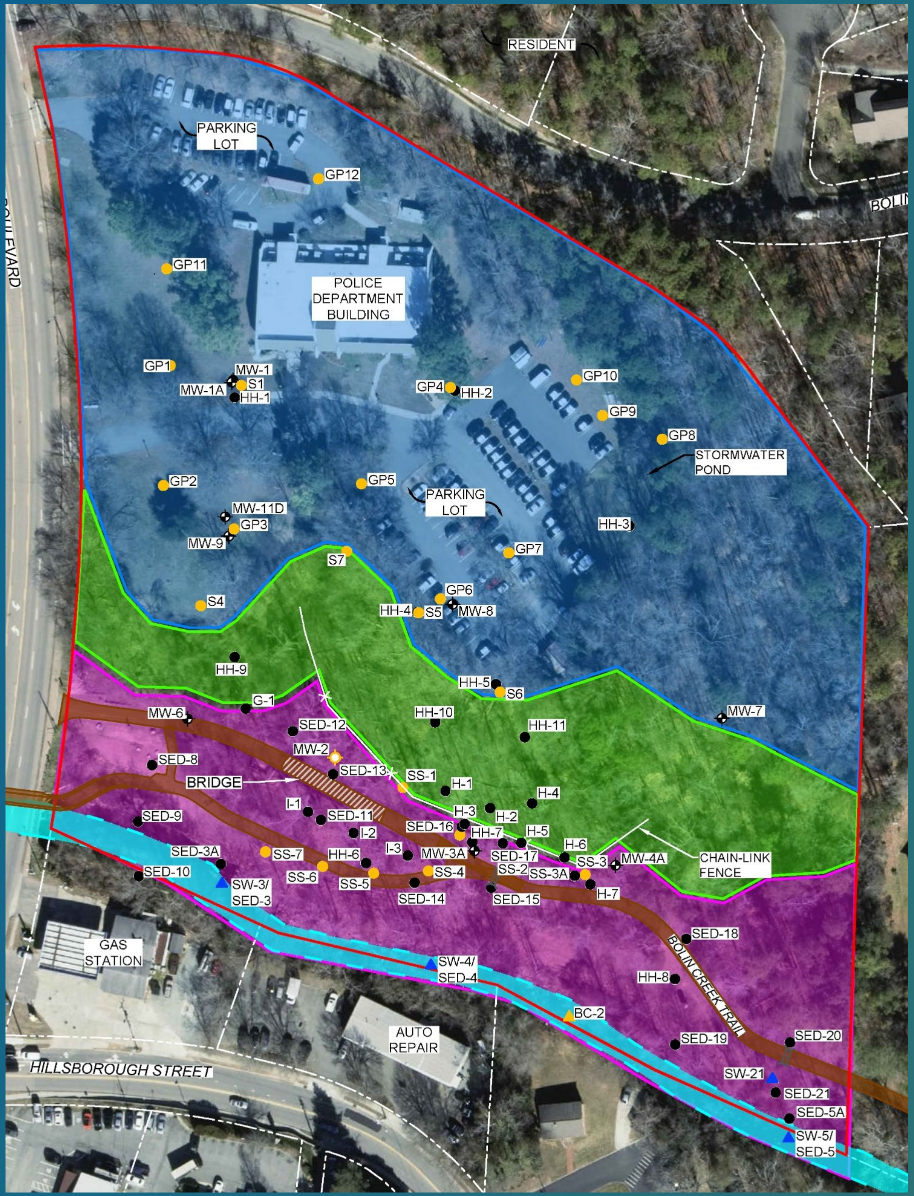
Human-Health Risk Assessment – Non-Residential Worker



Exposure assumptions:

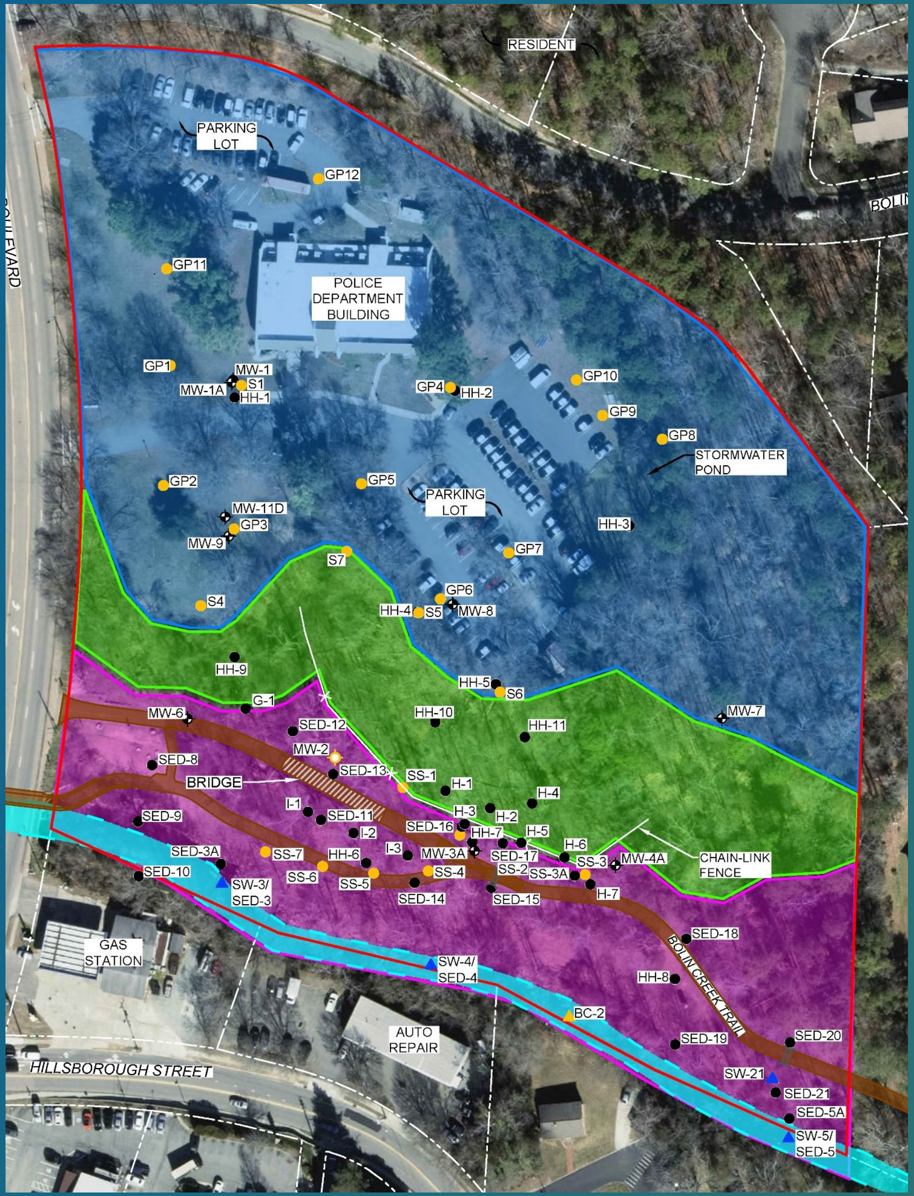
- Exposure for 25 yrs, 250 d/yr, and 8 hr/d.
- Dermal exposure of head, hands, and forearms.
- Ingestion of 100 mg/d of soil.

Risk assessment results:

- No exceedances of acceptable risk levels.

Site considered safe for current or future non-residential workers.

Human-Health Risk Assessment – Greenway User



Exposure assumptions:

- Adult exposure for 20 yrs, 364 d/yr, and 1 hr/d.
- Child exposure for 6 yrs, 52 d/yr and 0.5 hr/d.
- Dermal exposure of head, hands, forearms, lower legs, and feet.
- Ingestion of 200 mg/d of soil by a child and 100 mg/d of soil by an adult.

Risk assessment results:

- No exceedances of acceptable risk levels.

Site considered safe for current or future greenway users.

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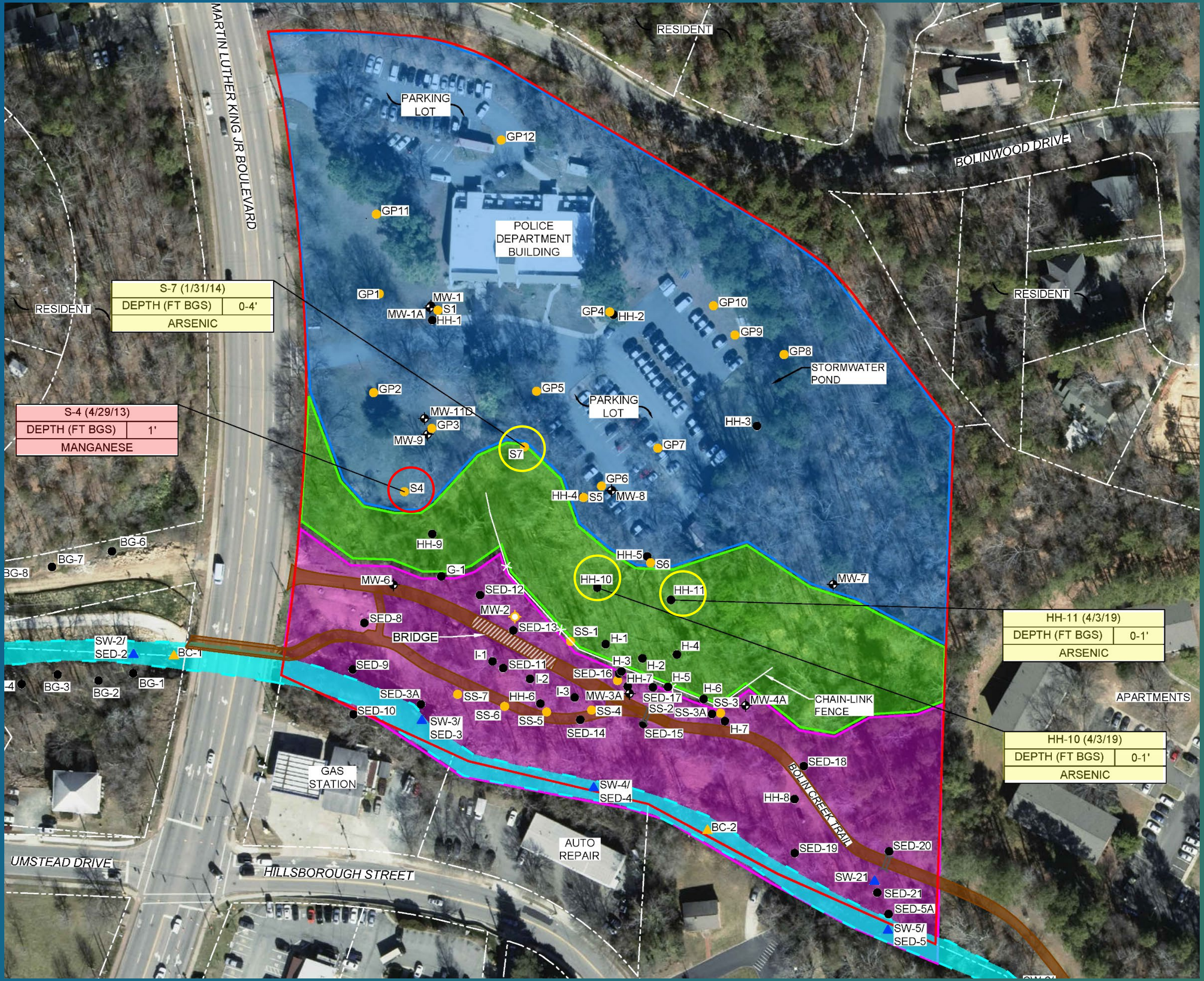
Human-Health Risk Assessment - Resident



Exposure assumptions:

- Exposure for 6 yrs as a child and 20 yrs as an adult, 350 d/yr, and 24 hr/d.
- Dermal exposure of head, hands, forearms, lower legs, and feet.
- Ingestion of 200 mg/d of soil by a child and 100 mg/d of soil by an adult.

Risk assessment results:

- Samples in yellow indicate coal combustion products (CCPs) in embankment area. Recommend addressing in conjunction with permanent measures for embankment.
- For sample in red (S-4), recommend remediation or other measures to address impacts.

No current residents, risk management recommendations apply if site is redeveloped for residential use.

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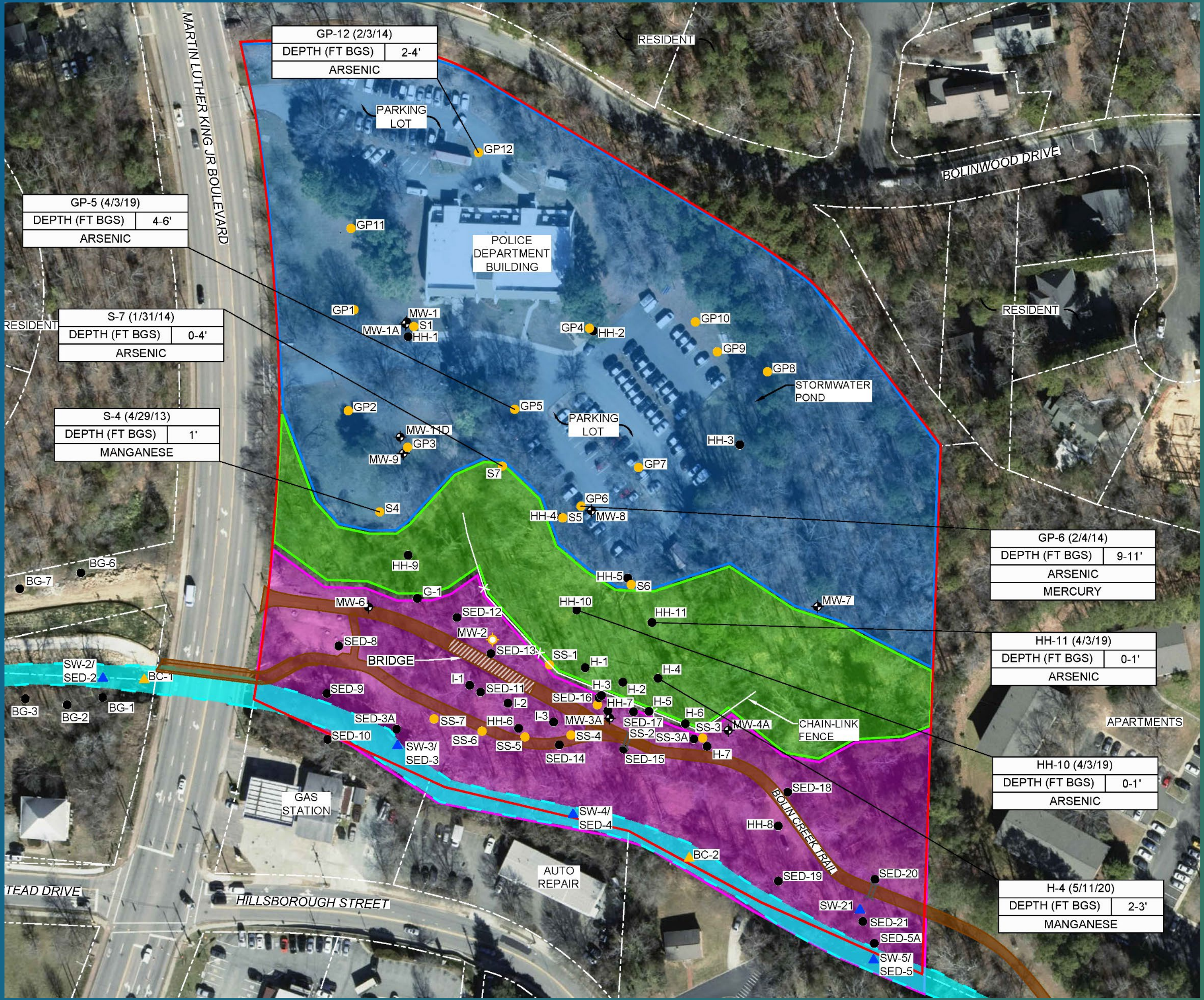
Human-Health Risk Assessment – Construction Worker



Exposure assumptions:

- Exposure for 1 yr, 250 d/hr, and 8 hr/d.
- Dermal exposure of head, hands, and forearms.
- Ingestion of 330 mg/d of soil.
- Significantly increased outdoor inhalation of particulates.

Risk assessment results:

- Several samples with exceedances.
- Recommend Environmental Management Plan (EMP) requiring personal protective equipment (PPE) and other measures to eliminate construction worker exposures.

Future construction worker risk can be addressed via EMP.

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Topics of Discussion

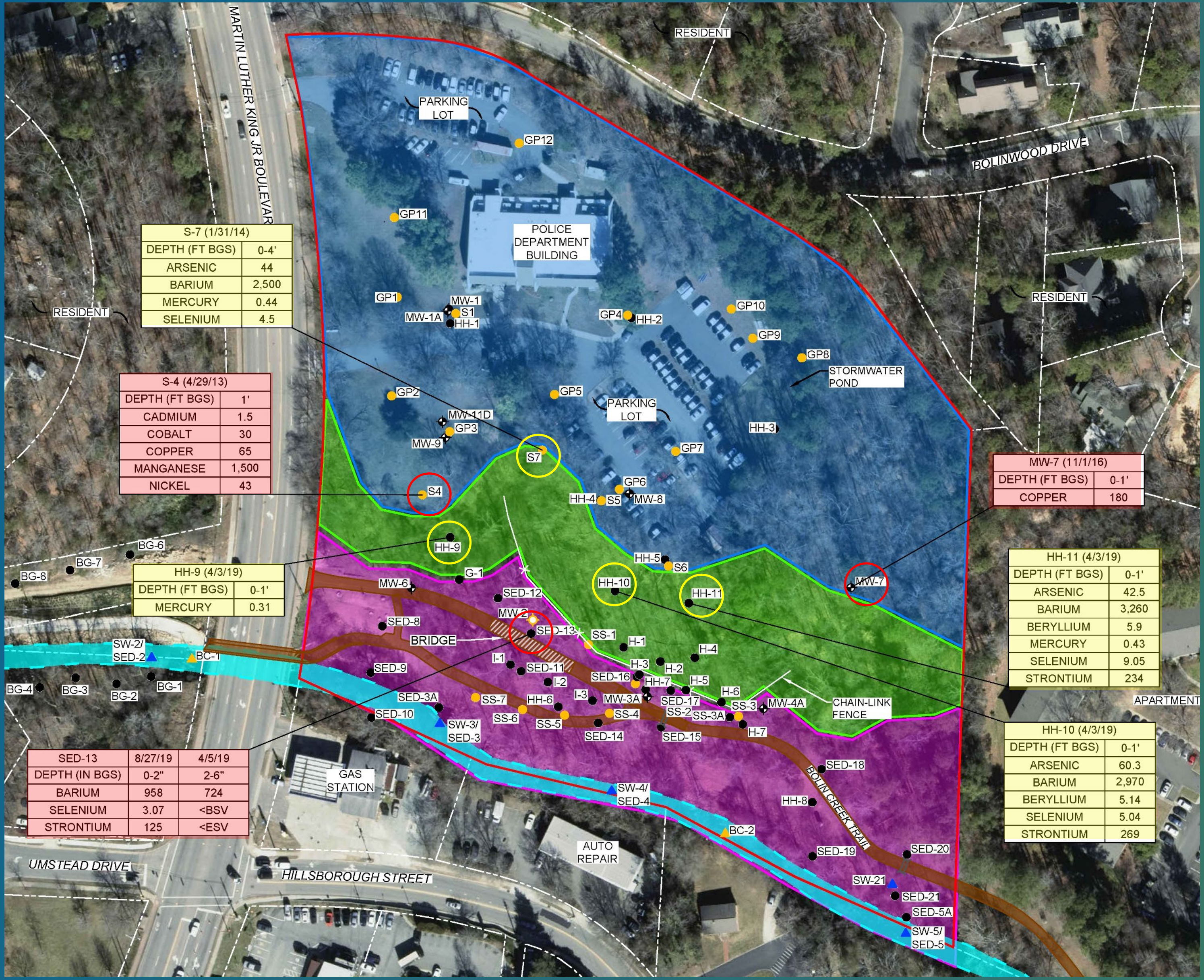
- Introduction & Background
- Human Health Risk Assessment
- **Ecological Risk Assessment**
- Conclusions & Recommendations

Ecological Risk Assessment Results

- Initial screening level comparison of concentrations to EPA Ecological Screening Values (ESVs).
- EPA ESVs are based on conservative endpoints and ecological effects data, and represent preliminary screening criteria to evaluate the potential for ecological risk (or lack thereof). Not considered remediation goals.
- Compared concentrations of stream sediment, surface water, and soil (0-2 ft) above background levels to EPA ESVs.

Image reference: KY Department of Fish & Wildlife Resources

Ecological Risk Assessment Results



S-7 (1/31/14)	
DEPTH (FT BGS)	0-4'
ARSENIC	44
BARIUM	2,500
MERCURY	0.44
SELENIUM	4.5

S-4 (4/29/13)	
DEPTH (FT BGS)	1'
CADMIUM	1.5
COBALT	30
COPPER	65
MANGANESE	1,500
NICKEL	43

HH-9 (4/3/19)	
DEPTH (FT BGS)	0-1'
MERCURY	0.31

SED-13	8/27/19	4/5/19
DEPTH (IN BGS)	0-2"	2-6"
BARIUM	958	724
SELENIUM	3.07	<BSV
STRONTIUM	125	<ESV

MW-7 (11/1/16)	
DEPTH (FT BGS)	0-1'
COPPER	180

HH-11 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	42.5
BARIUM	3,260
BERYLLIUM	5.9
MERCURY	0.43
SELENIUM	9.05
STRONTIUM	234

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3
BARIUM	2,970
BERYLLIUM	5.14
SELENIUM	5.04
STRONTIUM	269

- No exceedances of EPA Ecological Screening Values (ESVs) in surface water or stream sediment in Bolin Creek, which is most ecologically sensitive area.
- Samples in yellow indicate exceedances of ESVs in embankment area. Recommend addressing in conjunction with permanent measures for embankment.
- Samples in red indicate exceedances of ESVs in upper or lower level soil. DEQ does not commonly require evaluation of ecological risks for soil. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measures to address or further evaluate potential ecological risks in the area of these samples.

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Topics of Discussion

- Introduction and Background
- Human Health Risk Assessment
- Ecological Risk Assessment
- **Conclusions & Recommendations**

Conclusions & Recommendations

- Human-health risk is safe for current site uses (non-residential workers and greenway users).
- Ecological risk is acceptable for Bolin Creek.
- For the area of the embankment, recommend implementation of permanent measures to prevent erosion and address exposed coal combustion products (CCPs), which exceed acceptable risk levels for a resident, construction worker, and ecological receptors.
- If the site is redeveloped for residential use, recommend remediation or other measures to address impacts in the upper level in the area of sample S-4.
- Outside of the embankment area, ecological risk screening indicated localized exceedances of Ecological Screening Values (ESVs) at three sample locations. DEQ does not commonly require evaluation of ecological risks for soil. If required by DEQ or if the Town wishes to take voluntary actions, recommend remediation or other measures to address or further evaluate risks in the area of these samples.
- Recommend Environmental Management Plan (EMP) manage risks to construction workers.

Conclusions & Recommendations

- Risk calculations based on 0-2 ft samples for residents, non-residential workers, and greenway users, and 0-10 ft samples for construction worker. If deeper samples exposed during grading and not covered by impervious surfaces post-redevelopment, recommend additional risk evaluation or cover with 2 ft of clean fill.
- Recommend land use restriction (LUR) preventing the future installation of water supply wells at the site.
- Final LURs will be detailed in a Brownfields Agreement (BFA). The BFA will be filed on the deed for the property, and requires annual certification that LURs are being complied with in perpetuity.

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Questions?

Smarter Environmental Solutions

Executive Summary
Risk Assessment
828 Martin Luther King Jr. Boulevard
Chapel Hill, Orange County, North Carolina

Hart & Hickman, PC (H&H) has completed human health and ecological risk assessment activities for the property located at 828 Martin Luther King (MLK) Jr. Boulevard in Chapel Hill, Orange County, North Carolina (site). This document provides an executive summary of the risk assessment background, methodology, and results. Refer to the Risk Assessment Report dated October 7, 2021 for details regarding the assessment.

Background Information

Previous assessment activities indicated that the site was initially used as a borrow pit from the late 1950s to early 1960s, and then was used as a fill site by a previous owner for construction debris and coal combustion products (CCPs) from the mid-1960s to the mid-1970s. In the early 1980s, the Town of Chapel Hill (Town) acquired the property and constructed a building that is currently used for police department operations. The site consists of an upper level where the borrow pit was located which is now occupied by the police department building and associated parking areas, and a lower level adjacent to Bolin Creek where the Bolin Creek Trail (hereinafter also referred to as the greenway) is located. The upper and lower levels are separated by a steep embankment. The site layout and area of CCPs are depicted on Figure 1.

Assessment activities were conducted to investigate potential environmental impacts associated with CCPs at the site from 2013 to 2020. The investigation activities included collection and laboratory analysis of CCPs, groundwater, soil, sediment, and surface water samples. The results of the assessment activities identified concentrations of certain metals in soil and CCP samples and in perched groundwater zones within the fill material. However, groundwater assessment activities identified limited to no impacts in the underlying unconfined aquifer downgradient of the fill area. Assessment activities also identified no significant impacts to stream sediment or surface water in Bolin Creek.

Preliminary risk assessment activities were performed to evaluate risks for greenway users in the trail area in 2019. Based on the results, interim remedial measures (IRMs) were implemented in

2020. IRMs included excavation and off-site disposal of soil and exposed CCPs along Bolin Creek Trail, stabilization and cover of exposed CCPs along the embankment between the upper and lower portions of the site, and temporary measures to address stormwater and erosion control in the area of the embankment. Additional risk assessment activities performed after IRMs concluded that the greenway trail is safe for users. Under present conditions, CCP fill material at the site is covered by at least 2 ft of soil cover, with the exception of localized areas in the upper level with 1 to 2 ft of soil cover and areas of exposed CCPs along the embankment.

The Town is considering redevelopment of the site and has entered the site into the North Carolina Department of Environmental Quality (DEQ) Brownfields Program. The Town requested that H&H perform the additional risk assessment activities documented in this report to define the final measures recommended for the site as a whole to address CCP impacts, both under the current land use scenario and possible future redevelopment scenarios.

Risk Assessment Methodology

The risk assessment activities were completed in general accordance with DEQ and United States Environmental Protection Agency (EPA) risk assessment guidance (DEQ, 2020, DEQ, 2021a, EPA, 2018a, EPA, 2018b). For the purpose of risk characterization, the site was divided into three exposure units (EUs) that represent areas of similar land use and potential receptors. EU #1 encompasses the upper level in the vicinity of the existing police department building and associated parking areas, EU #2 encompasses lower level in the area of Bolin Creek and the adjacent Bolin Creek Trail, and EU #3 encompasses the embankment between EU #1 and EU #2. The exposure units are depicted on Figure 2.

For the human-health risk assessment, an exposure pathway evaluation was performed to identify pathways by which residents, non-residential workers, construction workers, or greenway trail users could be exposed to impacted media within each EU. Risks were calculated for each complete exposure pathway assuming conservative reasonable maximum exposures. The DEQ Risk Calculator was used to calculate potential cancer risk (CR) and non-cancer hazard index (HI). Based on EPA and DEQ guidance (DEQ, 2021a, EPA, 2018b) remediation or other measures to address risks are recommended for calculated CR above one in 10,000 (1.0E-04) or HI of greater than 1.0.

The ecological risk assessment activities were limited to an initial screening comparison of detected concentrations to the Ecological Screening Values (ESVs) established by EPA Region 4. Per DEQ and EPA guidance (DENR, 2003, EPA, 2018a), EPA ESVs are based on conservative endpoints and ecological effects data, and represent preliminary screening criteria to evaluate the potential for ecological risk (or lack thereof). ESVs are not intended to represent remediation goals, and in some cases further data evaluation can be performed instead of proceeding directly to remediation for cases where ESVs are exceeded.

The primary compounds of concern for the site are metals associated with CCPs; however, naturally-occurring background levels of metals are also present, which are derived from the natural elemental composition of the source rock underlying the site. Background samples collected from the site contained concentrations of certain metals exceeding DEQ Preliminary Soil Remediation Goals (PSRGs) in soil and stream sediment, which are attributed to naturally-occurring metals in the parent bedrock. EPA and DEQ do not require remediation of concentrations below background levels (EPA, 2002, DEQ, 2021), since these concentrations represent naturally occurring conditions that are not associated with contamination sources. Note also that DEQ PSRGs are initial screening levels based upon conservative exposure assumptions. In accordance with EPA and DEQ guidance, risk management recommendations for the site are based on risk calculations with background metals excluded.

Human-Health Risk Assessment Results

The human-health risk assessment results indicated the following:

- Human-health risk was evaluated for possible future residents in the area of EU #1 (upper level) and EU #3 (embankment). The results of the risk evaluation indicated that acceptable risk levels were exceeded for a future resident in both units (with and without background concentrations included), with risks being driven by the following sample locations: the manganese concentration in soil sample S-4 in EU #1 (upper level), and the arsenic concentrations in samples S-7, HH-10, and HH-11 in EU #3 (embankment). The samples exceeding acceptable risk levels for a possible future resident are depicted on Figure 3.

- Human-health risk was evaluated for possible current or future non-residential workers in the area of EU #1 (upper level) and EU #3 (embankment). The results of the risk evaluation indicated acceptable risk levels for a non-residential worker in both units. Therefore, the site is considered safe for non-residential workers.
- Human-health risk was evaluated for possible future construction workers in the area of all three exposure units (upper level, lower level, and embankment). The results of the risk evaluation indicated that acceptable risk levels were exceeded for a construction worker in all three units, with multiple samples identified as risk drivers. If background concentrations are removed, acceptable risk levels were exceeded for a construction worker in EU #1 (upper level) and EU #3 (embankment). The samples exceeding acceptable risk levels for a possible future construction worker are depicted on Figure 4.
- Human-health risk was evaluated for possible current and future greenway users in the area of EU #2 (lower level) and EU #3 (embankment). The results of the risk evaluation indicated acceptable risk levels for greenway users in both units. Therefore, the site is considered safe for greenway users.

<u>Ecological Risk Assessment Results</u>

The results of the ecological risk screening indicated the following:

- The area of Bolin Creek (EU #2) is the area with the highest likelihood of potential ecological receptors. The results of the risk evaluation indicated no significant ecological risk for surface water and sediment in Bolin Creek.
- Exceedances of ESVs for multiple metals were identified in samples of exposed CCPs collected along the embankment in EU #3 (S-7, HH-9, HH-10, and HH-11).
- Localized exceedances of ESVs were also identified at two soil sample locations within EU #1 (S-4 and MW-7) and one individual soil sample location within EU #2 (SED-13).

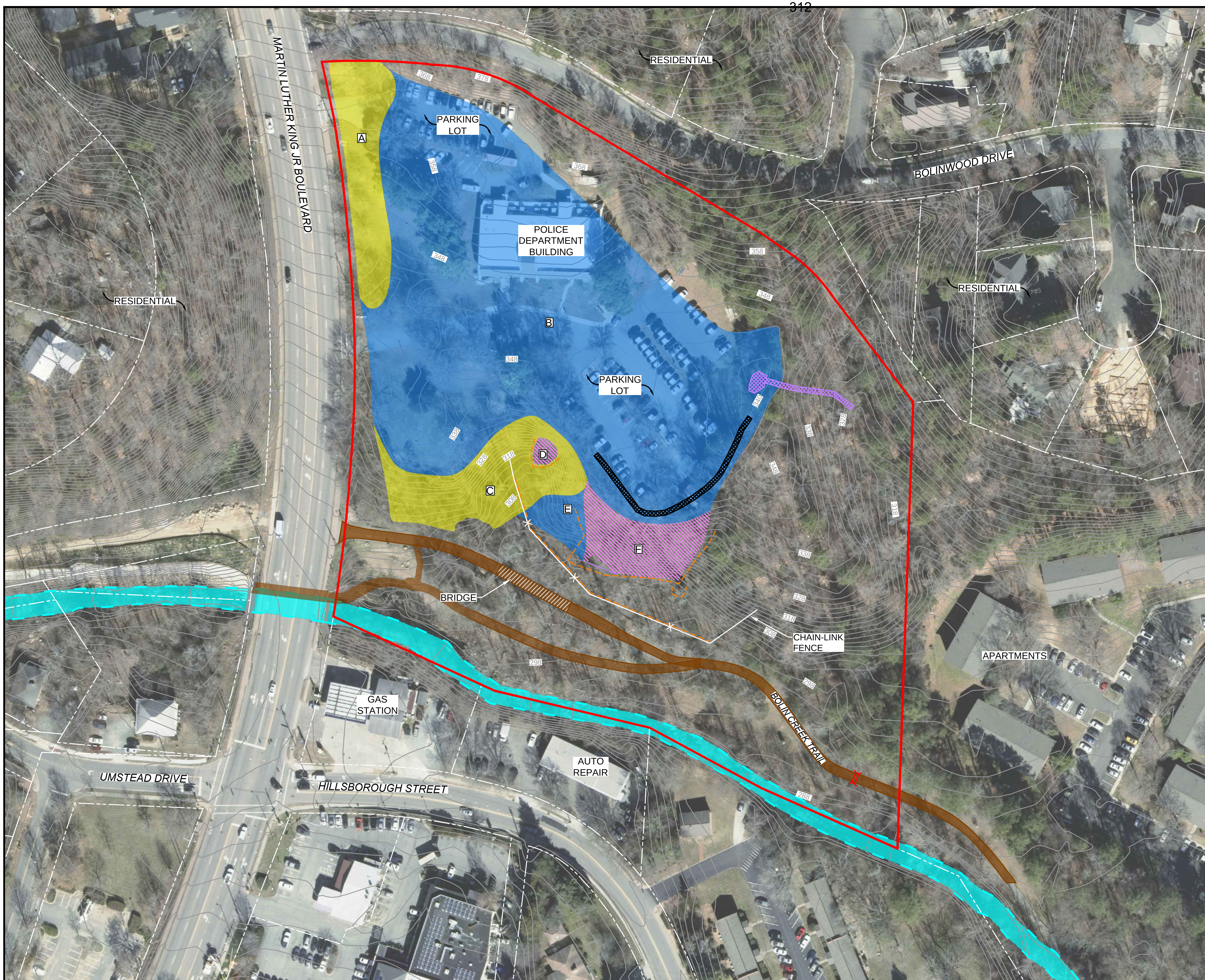
The samples exceeding ESVs for ecological receptors are depicted on Figure 5.

<u>Recommendations</u>

H&H's recommendations to address potential human-health and ecological risks identified as part of the risk assessment are detailed below. In addition to recommendations related to specific sample locations which are drivers for potential risks, in some cases land-use restrictions (LURs) are recommended to confirm the assumptions made during the risk assessment activities remain valid. LURs are expected to be specified in a future Brownfields Agreement with the DEQ Brownfields Program, which will be filed on the deed for the property and remain in perpetuity. The Brownfields Program requires annual certifications from the property owner that LURs are being complied with in perpetuity, which will confirm that potential risks addressed via LURs will be managed long-term.

- Exposed CCPs are present in the area of the embankment. The risk evaluation indicated exceedances of acceptable risk levels for a resident, construction worker, and/or ecological receptors based on metals concentrations in several samples of exposed CCPs collected in the embankment area (S-7, HH-9, HH-10, and HH-11). The potential for erosion to transport CCPs from the area of the embankment into the greenway area is considered an additional concern. The Town implemented temporary measures to minimize the potential for erosion as part of the IRMs implemented in 2020; however, H&H recommends implementation of permanent measures to address exposed CCPs and prevent erosion in the embankment area. These measures could effectively be performed in conjunction with site redevelopment activities.
- If the site is redeveloped for residential use, H&H recommends remediation or other actions (ex., excavation, impervious cover to prevent exposure, resampling to verify concentrations) to address impacts in the upper level in the area of sample S-4.
- Outside of the embankment area, the ecological risk screening indicated localized exceedances of ESVs at two soil sample locations within EU #1 (S-4 and MW-7) and one individual soil sample location within EU #2 (SED-13). DEQ does not commonly require evaluation of ecological risks for soil (DEQ, 2021c). As such, DEQ may not require additional actions with regard to the exceedances of ESVs in these samples. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measures to address or further evaluate potential ecological risks in the area of samples S-4, MW-7, and SED-13.

- To address construction worker risks, H&H recommends implementation of an anticipated LUR requiring preparation of an Environmental Management Plan (EMP), which will detail measures to prevent construction worker exposure, manage impacted soil, and minimize the potential for off-site migration during construction (i.e., redevelopment) activities.
- The risk assessment calculations were based on soil samples collected at depths of 0 to 2 feet below ground surface (ft bgs) for a resident, non-residential worker, and greenway user, and samples collected at depths of 0 to 10 ft bgs for a construction worker. If impacted soil or CCPs at deeper depths are exposed during site redevelopment, additional risk evaluation should be performed to confirm that potential exposure to these soils does not exceed acceptable risk levels. If the site is redeveloped, the Brownfields Program will also likely require confirmatory sampling and risk evaluation in areas of potentially impacted soil or CCPs that are not covered by impervious surfaces (buildings, pavement, etc.) or at least 2 ft of clean fill.
- H&H recommends a LUR preventing the future installation of water supply wells or other use or exposure of groundwater at the site.



LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- 328 TOPOGRAPHIC CONTOUR ELEVATION (FT MSL)
- CCP UNDER > 2 FT COVER
- CCP UNDER < 2 FT COVER
- CCP EXPOSED AT GROUND SURFACE (HYDROSEEDED)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- SILT FENCE
- STORM DIVERSION CHANNEL
- STORM OUTFALL CHANNEL
- A CCP AREA DESIGNATION

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

SITE MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 6-22-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 1

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

TITLE
SAMPLE LOCATION AND EXPOSURE UNIT MAP

PROJECT
TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 2

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 3, 9/21/2021 8:53:22 AM, shaynes

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3

SAMPLE DEPTH
CONCENTRATION (mg/kg)
RISK DRIVERS

NOTES:

1. ONLY COMPOUNDS THAT DRIVE EXCEEDANCES OF ACCEPTABLE RISK LEVELS (CARCINOGENIC RISK > 1.0E-04 AND HAZARD INDEX > 1.0) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE

N
APPROXIMATE
0 115 230
SCALE IN FEET

TITLE
RESIDENTIAL HUMAN HEALTH RISK DRIVERS MAP

PROJECT
TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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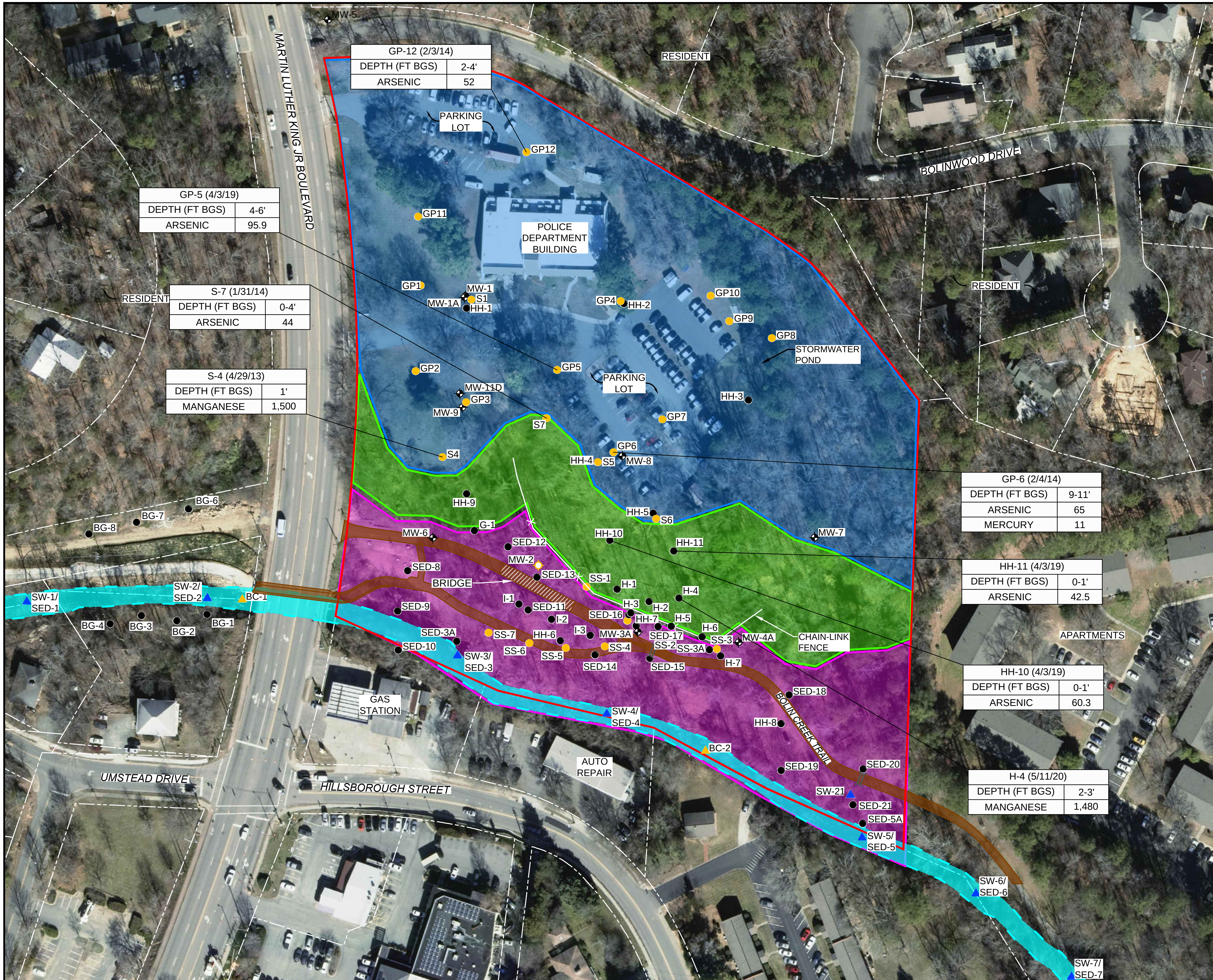
License # C-1269 / #C-245 Geology

DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 3

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 4A, 9/30/2021 4:12:16 PM, shaynes



LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
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- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3

SAMPLE DEPTH

CONCENTRATION (mg/kg)

RISK DRIVERS

NOTES:

1. ONLY COMPOUNDS THAT DRIVE EXCEEDANCES OF ACCEPTABLE RISK LEVELS (CARCINOGENIC RISK > 1.0E-04 AND HAZARD INDEX > 1.0) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

CONSTRUCTION WORKER HUMAN HEALTH RISK DRIVERS MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
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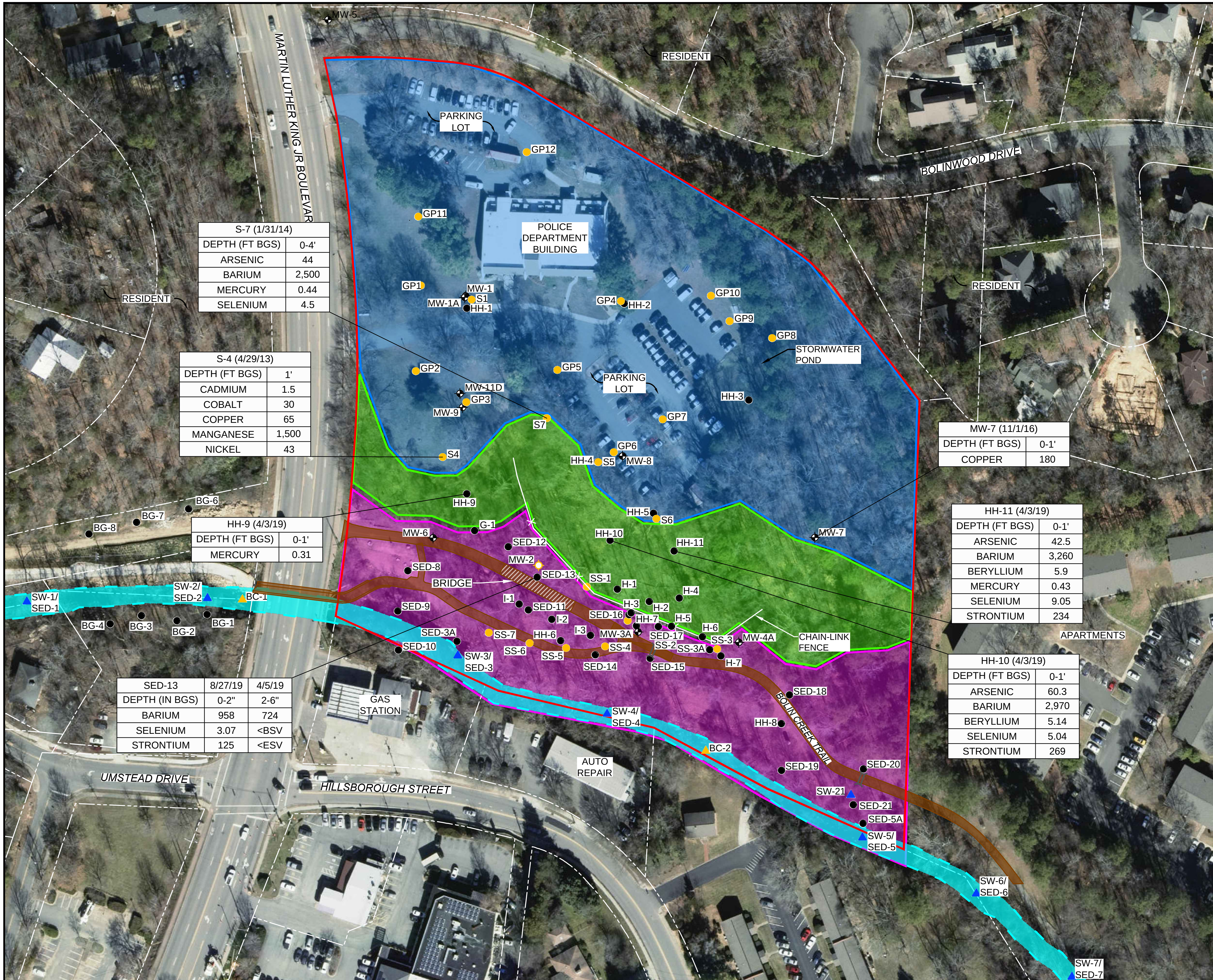
DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 4

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 4B, 9/30/2021 4:16:41 PM, shaynes



S-7 (1/31/14)	
DEPTH (FT BGS)	0-4'
ARSENIC	44
BARIUM	2,500
MERCURY	0.44
SELENIUM	4.5

S-4 (4/29/13)	
DEPTH (FT BGS)	1'
CADMIUM	1.5
COBALT	30
COPPER	65
MANGANESE	1,500
NICKEL	43

HH-9 (4/3/19)	
DEPTH (FT BGS)	0-1'
MERCURY	0.31

SED-13	8/27/19	4/5/19
DEPTH (IN BGS)	0-2"	2-6"
BARIUM	958	724
SELENIUM	3.07	<BSV
STRONTIUM	125	<ESV

MW-7 (11/1/16)	
DEPTH (FT BGS)	0-1'
COPPER	180

HH-11 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	42.5
BARIUM	3,260
BERYLLIUM	5.9
MERCURY	0.43
SELENIUM	9.05
STRONTIUM	234

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3
BARIUM	2,970
BERYLLIUM	5.14
SELENIUM	5.04
STRONTIUM	269

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE

SAMPLE DEPTH

CONCENTRATION (mg/kg)

CONSTITUENT

S-4 (4/29/13)	
DEPTH (FT BGS)	1'
CADMIUM	1.5
COBALT	30
COPPER	65
MANGANESE	1,500
NICKEL	43

NOTES:

1. ONLY SAMPLES EXCEEDING ECOLOGICAL SCREENING VALUES (ESVs) AND BACKGROUND SCREENING VALUES (BSVs) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE
   IN BGS = INCHES BELOW GROUND SURFACE
   mg/kg = MILLIGRAMS PER KILOGRAM

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

ECOLOGICAL RISK DRIVERS MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

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License # C-1269 / #C-245 Geology

DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 5

Risk Assessment Report

828 Martin Luther King Jr. Blvd. Property
Chapel Hill, North Carolina
IHSB Site No. NONCD0001486
Brownfields Project No. 21061-17-060

H&H Job No. TCH-009
October 7, 2021

C-1269 Engineering
#C-245 Geology

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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Risk Assessment Report
828 Martin Luther King Jr. Blvd. Property
Chapel Hill, North Carolina
H&H Job No. TCH-009

Table of Contents

Section **Page No.**

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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List of Appendices

Risk Assessment Report
828 Martin Luther King Jr. Blvd. Property
Chapel Hill, North Carolina
H&H Job No. TCH-009

1.0 Introduction

This Risk Assessment Report has been prepared by Hart & Hickman, P.C. (H&H) to document the results of human health and ecological risk assessment activities completed for the property located at 828 Martin Luther King (MLK) Jr. Boulevard in Chapel Hill, Orange County, North Carolina (site).

The site is comprised of one land parcel that is approximately 10.24 acres in size and contains a two-story approximately 35,000 sq ft building located in the north-central portion. The building and associated parking areas are currently used for police department operations by the Town of Chapel Hill (Town). South of the police department operations area, the topography slopes downward along an embankment to a lower area where Bolin Creek and the Bolin Creek Trail (hereinafter also referred to as the greenway) are located. Prior to purchase of the site by the Town, the site was used by the previous owner as a borrow pit and fill site for coal combustion products (CCPs) and construction debris. The primary compounds of concern (COCs) associated with the site are metals associated with CCPs. A site location map is included as Figure 1, and a site map is included as Figure 2.

The purpose of this recent risk assessment is to evaluate the potential risk to human health or ecological receptors associated with the CCPs at the site, and whether additional remedial actions or other measures are warranted to address these risks. As discussed in Section 2.0 below, interim remedial measures were implemented by the Town in 2020 which included removal of exposed CCPs along the Bolin Creek Trail. The risk assessment activities were completed in general accordance with North Carolina Department of Environmental Quality (DEQ) and United States Environmental Protection Agency (EPA) risk assessment guidance (DEQ, 2020, DEQ, 2021a, EPA, 2018a, EPA, 2018b).

This Risk Assessment Report is organized into sections to include the following:

- Site Background Information (Section 2.0)
- Environmental Setting (Section 3.0)
- Summary of Environmental Conditions (Section 4.0)
- Human Health Risk Assessment (Section 5.0)
- Ecological Risk Assessment (Section 6.0)
- Conclusions and Recommendations (Section 7.0)
- References (Section 8.0)

2.0 Site Background Information

2.1 Site Location and Surrounding Land Use

The site is located at 828 MLK Jr. Blvd. in Chapel Hill, Orange County, North Carolina. The location of the site is shown in Figure 1, and a general layout of the site including the building, pavement, drainage features, vegetation, and greenway features is illustrated in Figure 2. The approximate geographical coordinates of the site are: 35°55'36.69"N latitude and 79°03'10.47"W longitude. The site parcel is zoned R-2 Residential 2 (4 units/acre) by the Town of Chapel Hill.

Adjacent properties are zoned as R-2, with the exception of southern adjacent properties. Southwest and southeast adjacent properties are zoned as R-4 Medium Density Residential Conditional (10 units/acre) and the south adjacent properties are zoned as NC Neighborhood Commercial.

The surrounding properties are occupied by the following:

- North and Northeast – Bolinwood Drive with residential properties located beyond
- East – Stratford Hills Apartments complex followed by vacant land
- South – Bolin Creek followed by Lloyd Tire & Alignment and Mobil-branded gas station/Run-In-Jim's convenience store
- West – MLK Jr. Blvd. followed by vacant land with residential properties located beyond

2.2 Site Description

The site is comprised of one land parcel that is approximately 10.24 acres in size and contains a two-story approximately 35,000 sq ft building located in the north-central portion of the site that is currently used for police department operations. Asphalt parking lots are located in the northwestern and central portions of the site, and wooded areas are located in the southern and eastern portions of the site. Bolin Creek traverses the southern portion of the site, and a portion of the Bolin Creek Trail is located in the southern portion of the site just north of and parallel to Bolin Creek. The site topography consists of an elevated area where the police building and associated parking lots are located which slopes along an embankment to the south to a lower area along Bolin Creek where the Bolin Creek Trail is located. Chain-link fencing prevents access from the Bolin Creek Trail to the embankment along certain portions of the trail. Site topography is indicated in Figure 1.

2.3 Site History

2.3.1 Site Ownership and Operational History

As indicated by Orange County Tax Records, the owner of the facility prior to the Town was Richard W. Sparrow, who initially operated the site as a borrow pit from the late 1950s to the early 1960s, and then as a fill site from the mid-1960s to the mid-1970s. The Town acquired the property in 1980 and constructed the site building in the early 1980s. The building has been used for police department operations by the Town since its construction. Additional municipal offices have also been located within the site building.

The Town is currently evaluating potential on and off-site locations for mixed-used redevelopment that may include the Municipal Services Center, residential housing, and retail. As part of the evaluation process, the Town applied for entry into the DEQ Brownfields Program, and received eligibility (Brownfields Project No. 23022-19-068) via a Letter of Eligibility dated October 1, 2019.

2.3.2 Previous Environmental Investigations

Evidence of subsurface impacts associated with CCPs was first identified at the site during a *Phase I & Limited Phase II Environmental Site Assessment* completed by Falcon Engineering, Inc. in 2013. Investigation activities were then performed by Falcon and H&H under the direction of the DEQ Inactive Hazardous Sites Branch (IHSB) between 2013 and 2016, and culminated in a *Phase II Remedial Investigation (RI) Report* dated August 14, 2017. The investigation activities included collection and laboratory analysis of CCPs, groundwater, soil, stream sediment, and surface water samples. In addition, an evaluation was performed to identify where the CCPs were potentially exposed at the ground surface.

In 2019, the Town contracted Duncklee & Dunham (D&D) and Dr. Ken Rudo of Rudo Toxicological Consultants (Rudo) to complete a preliminary human health and ecological risk assessment for the site. The risk assessment focused on the area of Bolin Creek and the Bolin Creek Trail, and included an evaluation of interim remedial measures (IRMs) to better control the risk profile of the site. Prior to performing the risk assessment, D&D and Rudo identified certain data gaps and requested that additional assessment be completed to support the risk assessment activities. In response, H&H performed additional drainage pathway soil assessment, fill material evaluation, and groundwater assessment, which is documented in a *Results of Post-Data Gap Assessment Report* dated December 1, 2020.

The initial risk assessment results concluded that interim measures, including removal of surficial coal ash in selected locations in the lower part of the site, would be protective of greenway trail users. In 2020, IRMs were implemented. IRMs included excavation and off-site disposal of soil and exposed CCPs along Bolin Creek Trail, stabilization and cover of exposed CCPs along the embankment between the upper and lower portions of the site, and temporary measures to address stormwater and erosion control in the area of the embankment. Specifically, approximately 1,004 tons of soil/CCPs at the base of the embankment and along Bolin Creek were excavated and transported off-site for disposal. In addition, super silt fencing and hydroseed were placed along the embankment, and a new storm water diversion channel was installed. The interim measures are documented in an *Interim Remedial Measures Report* dated April 19, 2021.

Following completion of the 2020 IRMs, D&D (now part of SynTerra Corporation) completed a *Human Health and Ecological Risk Assessment Report* dated May 6, 2021, which focused on potential risks in the area of Bolin Creek and the greenway trail. With regard to human health risk, the report concluded that the greenway trail is safe for users. With regard to ecological risk, the report concluded that ecological risk was likely minimal, but recommended additional evaluation for certain constituents.

The Town requested that H&H perform additional risk assessment activities with the intent of defining the final measures recommended to address CCP impacts, both under the current land use scenario and possible future redevelopment scenarios. The results of the risk assessment performed by H&H are documented in this report. The risk assessment performed by H&H covered the site as a whole, including both the greenway trail area and the area of the current municipal operations.

As referenced in Section 2.3.1, the site has been accepted into the NC Brownfields Program, and mixed-used redevelopment that includes the Municipal Services Center, residential housing, and retail is being contemplated for the site. The Brownfields Program implements standard measures designed to address human-health risks for all projects, and did not request that the Town prepare this Risk Assessment Report. However, the Town voluntarily elected to contract H&H to complete the Risk Assessment in order to provide better explanation and transparency to the public regarding how risks will be addressed for the site. Should the Town Council decide to move forward with redevelopment of the site, future remediation, risk management, and/or redevelopment activities would be performed under the oversight of the Brownfields Program.

3.0 Environmental Setting

3.1 Site Topography

The site property is located in the Piedmont Physiographic Province of North Carolina. The Piedmont province is a plateau that divides North Carolina's mountain and coastal plain regions. It has variable topography, with elevations ranging from approximately 300 feet above mean sea level (msl) in the eastern portion to approximately 1,500 feet msl in the western portion. The Piedmont is separated from the Coastal Plain region by a fall line, or the point in which rivers transition from rocky, shallow streams to smooth-flowing streams.

Overall, the site slopes to the south from an elevation of approximately 375 ft msl near Bolinwood Drive to an elevation of approximately 300 ft above msl near Bolin Creek, which transverses the southern boundary of the site. The site topography is segmented into two gently graded areas referred to as the "upper level" and the "lower level" that are separated by a steep embankment which generally runs east-west. The upper level includes the northern and central portion of the site where the building and asphalt parking lots are located. The lower level of the site gently slopes to the southeast toward Bolin Creek and includes the Bolin Creek Trail.

3.2 Surface Water Hydrology

The land surface across the site generally slopes to the south toward Bolin Creek. Stormwater infrastructure in the upper level was upgraded in October through November 2020 to minimize the potential for runoff from the upper level to the lower level. Super silt fencing was installed along the flanks of the embankment and in other areas in the vicinity of the trail to minimize the potential for stormwater to carry CCPs to the area of the trail and greenway. Portions of the embankment were also hydroseeded with grass seed and a biodegradable growth medium to provide erosion resistance to the slopes. In addition, stormwater upgrades were implemented in the police parking lot and an existing stormwater outfall channel so that stormwater is diverted from the embankment where CCPs are present at or below land surface which minimizes the potential for future erosion of soil/CCPs along the embankment. Note that these are considered interim measures to address erosion along the embankment, and the Town is considering permanent measures to be implemented in conjunction with site redevelopment activities. Locations of site drainage features which discharge surface water to Bolin Creek are depicted in Figure 2.

Bolin Creek and its tributaries are classified by DEQ as Class WS-V, Nutrient Sensitive Waters (NSW) surface water bodies, and are part of the Cape Fear River basin. Class WS-V surface waters are protected as upstream water supplies draining to waters used as drinking water supplies. These waters are also protected for Class C uses, including secondary recreation, fishing, wildlife, fish consumption, aquatic life including propagation, survival, and maintenance of biological integrity, and agriculture. Secondary recreation includes wading, boating, and other uses involving human body contact with water where such activities take place in an infrequent, unorganized, or incidental manner. A NSW classification is a supplemental classification to identify waters needing additional nutrient management due to excessive microscopic or macroscopic vegetation growth.

Bolin Creek discharges into Little Creek, which feeds into Jordan Lake. Jordan Lake discharges to the Haw River, which joins with the Deep River to form the Cape Fear River.

3.3 Geology

The site is located in the Piedmont Geologic Province of North Carolina, which consists of metamorphic and igneous crystalline bedrock overlain by a region of fractured and folded metamorphic and igneous crystalline bedrock. According to the Geologic Map of North Carolina (1985), the bedrock in site area is described as metamorphosed granitic rock. More detailed references (Cunningham and Daniel, 2001) describe the underlying bedrock as meta-igneous and meta-volcanic felsic rocks. Meta-igneous felsic rocks are light colored, massive to foliated metamorphosed igneous rock bodies, commonly with local shearing and jointing. Meta-volcanic felsic rocks are primarily dense, fine-grained, light colored felsic tuffs and felsic crystal tuffs, commonly with local shearing and phyllitic zones.

Based on previous assessment activities, the native shallow soil generally consists of silty clay saprolite which is approximately 5 to 15 ft thick. In areas where fill material is not present, the saprolite is underlain by a partially weathered rock (PWR) zone that is approximately 5 ft thick, and the PWR is underlain by bedrock. Depth to bedrock at the site generally ranges from approximately 10 to 15 ft bgs in the northern portion of the site near Bolinwood Road and in the southern portion of the site near Bolin Creek. Depth to bedrock in the central portion of the site where fill material has been placed is approximately 45 ft to 50 ft bgs. In areas where fill has been placed, the shallow cover soil generally consists of clayey silt fill which, in some locations, appears to be mixed with CCP. See Section 4.2 for a discussion of the extent and thickness of buried fill material across the site.

3.4 Hydrogeology

The occurrence and movement of groundwater in the Piedmont is within two separate yet interconnected water-bearing zones. A shallow water-bearing zone occurs within the saprolite (and may include alluvium near streams), and a deeper zone occurs within the underlying bedrock. Groundwater in the shallow saprolite zone occurs in the interstitial pore spaces between the grains comprising the unconsolidated saprolitic soils. Groundwater in this zone is typically under water table or unconfined conditions. Groundwater movement is generally lateral from recharge areas to small streams which serve as localized discharge points.

The occurrence and movement of groundwater in the underlying water-bearing zone within the crystalline bedrock is controlled by secondary joints, fractures, and faults within the bedrock. On a regional scale, the direction of groundwater flow is typically from highlands to major streams and groundwater sinks. The saprolite has a higher porosity than the bedrock and serves as a reservoir which supplies water to a network of fractures in the bedrock.

Based on the results of groundwater monitoring completed at the site, the direction of groundwater flow in the uppermost unconfined aquifer is south-southeast across the site towards Bolin Creek. The depth to groundwater is approximately 7 to 10 ft bgs in the most upgradient portion of the site near Bolinwood Road, and 1 to 6 ft bgs in the most downgradient portion of the site near Bolin Creek. Groundwater is present at deeper depths in the central portion of the site where the natural ground surface elevation has been modified due to fill placement. Groundwater has been measured in the existing monitoring wells in the fill area at depths ranging from approximately 30 to 40 ft bgs. However, prior assessment activities also identified evidence of perched groundwater in the fill material, which is separated from the main underlying unconfined aquifer. As such, the groundwater depths measured in some monitoring wells (MW-1A, MW-1, MW-8, and MW-9) appear to reflect perched groundwater zones rather than the main underlying aquifer. Uncontrolled fill areas such as the site, in which layers with significantly different permeabilities are placed next to one another (i.e., debris with sand or a gravel zone immediately overlying a silt or clay layer) have a high potential for perched groundwater zones. Refer to the *Results of Post-Data Gap Assessment Report* prepared by H&H and dated December 1, 2020 for additional discussion of lines of evidence for perched groundwater conditions.

Historical tables and figures are included in Appendix A, including a summary of monitor well construction and historical groundwater elevation data, a geologic cross-section, and an unconfined aquifer potentiometric map.

4.0 Summary of Environmental Conditions

The primary COCs associated with the site are metals associated with CCPs. Naturally-occurring background levels of metals are also present at the site. An explanation of background concentrations, extent of CCPs, and brief summaries of the site-specific COCs in soil, groundwater, surface water, and sediment are presented in the sections below. Summaries of historical data for site soil, groundwater, surface water, and sediment are included in Appendix A.

4.1 Background Conditions

Metals, including the COCs for the site, are naturally occurring within North Carolina soils. These compounds are derived from the natural elemental composition of the source rock and compound concentrations are a reflection of the rock composition. Background samples collected from the site contained concentrations of certain metals exceeding DEQ Preliminary Soil Remediation Goals (PSRGs) in soil and stream sediment, which are attributed to naturally-occurring metals in the parent bedrock. EPA and DEQ do not require remediation of concentrations below naturally occurring background levels (EPA, 2002, DEQ, 2021). Therefore, evaluation of site-specific background levels is important in determining remedial goals. Note also that the DEQ PSRGs are initial screening levels based upon conservative exposure assumptions. DEQ allows that final remedial goals be based upon a risk evaluation using the DEQ risk calculator as discussed further in Section 5.0.

In order to determine whether metals detections at the site are related to fill materials or represent background levels, H&H calculated site-specific Background Screening Values (BSVs). Based on EPA guidance (EPA, 2015a, 2018a, 2018b), the BSVs for metals in soil consist of 95% upper tolerance limits (UTLs) with 95% coverage determined using EPA's ProUCL calculator (EPA, 2015a). Due to a more limited data set which introduces more uncertainty in output of the ProUCL calculator, the BSVs for stream sediment and surface water consist of the lower of the maximum detected background concentration or twice the mean of background concentrations. Appendix B contains details regarding the basis for the BSVs and documentation of the calculations. The BSVs are referenced in subsequent sections of this report when evaluating whether concentrations detected in individual samples represent background conditions or evidence of contamination.

4.2 Extent of CCPs

Based on prior assessment activities, fill materials placed at the site consist primarily of construction and demolition debris and fill soil intermixed with zones of CCPs. The thickness of the CCP zones primarily ranges from less than 1 ft to 3 ft, with some thicker zones up to 10 ft. Fill materials were identified to depths of approximately 40 ft, although the deepest that CCPs were observed was approximately 29 ft.

In the upper level of the site, CCPs are capped with clayey silt that ranges in thickness from less than 1 ft to approximately 10 ft thick, with most areas having greater than 2 ft of soil cover. CCP is exposed at the surface along the eastern and central portions of the embankment that separates the upper and lower levels of the site. CCPs in the western portion of the embankment are covered but with soil that is less than 2 ft thick. Erosion of CCPs along some portions of the embankment historically resulted in deposition of a layer of CCPs in the lower level of the site north and south of the Bolin Creek Trail. However, CCPs in the lower level were excavated as part of the 2020 IRMs, and no significant CCPs are currently present in the lower level.

4.3 Soil and CCP Concentrations

Over 70 samples of soil and/or CCPs have been collected at the site over the course of historical assessment activities. Concentrations of COCs for samples that were not removed during the 2020 IRMs were compared to the current DEQ residential health-based PSRGs, industrial/commercial health-based PSRGs, and protection of groundwater PSRGs. Concentrations of metals were also compared to site-specific BSVs prior to comparison to PSRGs. The results of this comparison indicated concentrations of arsenic, barium, cobalt, manganese, mercury, and selenium above current PSRGs and BSVs, with arsenic being the most commonly detected constituent. Note that PSRGs are not intended as remediation goals and are based on conservative risk assumptions. DEQ guidance recommends comparison of concentrations to PSRGs for initial screening purposes, but final remediation goals may be determined based on risk evaluation performed using the NC Risk Calculator, as discussed further in Section 5.0.

4.4 Groundwater

Multiple groundwater monitoring events have been performed at the site over the course of historical assessment activities. Concentrations of COCs in groundwater samples were compared to 15A NCAC 02L .0202 Groundwater Standards (2L Standards). As previously mentioned, prior assessment data indicate that there are perched water zones in the fill material, and groundwater samples collected from shallow wells in the fill are monitoring these perched zones. Perched groundwater is likely present in some zones of CCPs or just below zones of CCPs. Concentrations of metals above 2L Standards in groundwater samples from these wells (MW-1A, MW-1, MW-8, and MW-9) are associated with the presence of CCPs within or near perched groundwater. Some impacted perched groundwater may eventually migrate through underlying unsaturated zones to groundwater in the main underlying unconfined aquifer; however, this migration is slow and of low volume. As such, there is limited or no groundwater impact in monitoring wells which are screened in non-fill zones in the unconfined aquifer, including well MW-11D located directly below the fill and shallow downgradient monitoring wells MW-3A and MW-4A which are located downgradient of the fill area.

4.5 Surface Water

Surface water samples have been collected from Bolin Creek during four sampling events completed in 2013, 2014, 2016, and 2019 from three upstream locations, three locations adjacent to the site, and three downstream locations. A surface water sample was also collected from a drainage pathway at the site. No COCs were detected in surface water samples at concentrations above 15A NCAC 2B Section .0100 Surface Water Quality Standards (2B Standards). Based upon the surface water sample results, there is no evidence of surface water impact at the site which would warrant further assessment or remediation.

4.6 Stream Sediment

Stream sediment samples have been collected from Bolin Creek during two sampling events completed in 2016 and 2019 from two upstream locations, two locations adjacent to the site, and three downstream locations. Concentrations of COCs were compared to the current DEQ residential health-based PSRGs, industrial/commercial health-based PSRGs, and protection of groundwater PSRGs. Concentrations of metals were also compared to site-specific BSVs prior to comparison to PSRGs. Manganese and/or hexavalent chromium were detected in two samples at concentrations above PSRGs and site-specific BSVs. As previously mentioned, note that PSRGs are not intended as remediation goals and are based on conservative risk assumptions. DEQ guidance recommends comparison to PSRGs for initial screening purposes, but remediation goals are determined based on risk evaluation performed using the NC Risk Calculator, as discussed further in Section 5.0.

5.0 Human-Health Risk Assessment

H&H evaluated potential human-health risks associated with COCs detected in soil, groundwater, stream sediment, and surface water, and whether actions are warranted to address these risks. Actions could include remediation activities, implementation of land-use restrictions (LURs), or other measures to prevent exposures. Should the Town Council decide to move forward with redevelopment of the site, LURs are expected to be included in a Brownfields Agreement (BFA) with the DEQ Brownfields Program, which would be filed on the deed for the property and remain in perpetuity.

Risk assessment calculations were performed using the DEQ Risk Calculator (June 2021), which is an Excel-based calculator tool developed by DEQ that evaluates human-health risks using equations and inputs that have been approved by DEQ and are consistent with EPA risk assessment guidance. The methodology for the risk evaluation was in general accordance with the risk assessment procedures detailed in DEQ and EPA risk assessment guidance (DEQ, 2020, DEQ, 2021a, EPA, 2018b).

5.1 Exposure Pathways Evaluation

An exposure pathway refers the mechanism by which people could potentially be exposed to COCs. A complete exposure pathway means that there is potential for human exposure to COCs, while an incomplete exposure pathway means that exposure is not possible due to absence of COCs, absence of receptors, or inaccessibility (i.e., surface cover such as pavement, no water supply well usage, etc). An exposure pathways evaluation was performed to identify current and potential future complete pathways for receptor exposure to site COCs. Below is a list of exposure pathways and a discussion of whether each pathway is complete for the site. For convenience, these pathways are addressed using the same naming conventions and order used in the DEQ Risk Calculator.

<u>Direct Contact Soil and Water Exposure Pathways</u>

- Direct contact soil exposure pathway – This pathway covers health-based soil exposure via ingestion, dermal contact, or outdoor inhalation of volatiles and particulates. Receptor scenarios considered for this exposure pathway are detailed below.
  - Resident – Site use is currently non-residential; therefore, the direct contact soil exposure pathway is currently incomplete for the resident scenario. Under a future scenario, this exposure pathway could become complete in certain areas if the site is used for residential purposes.
  - Non-residential worker – The direct contact soil exposure pathway is currently complete for non-residential workers in the area of the police department building where impacted soil is not covered by pavement, building floor slabs, or non-impacted soil cover. Under a future land use scenario, this exposure pathway could become complete in additional areas if building floor slabs, pavement, or non-impacted soil cover are removed.
  - Construction worker – Per DEQ guidance (DEQ, 2021a), the Risk Calculator uses very conservative default inputs that represent worst-case situations and may result in overly restrictive risk values when evaluating the construction worker pathway. Therefore, the results of the construction worker evaluation performed using the Risk Calculator should not drive a cleanup level. Instead, the results are intended to be used to help guide safety concerns for imminent or potential future construction activities. An Environmental Management Plan (EMP) detailing methods to prevent construction worker exposure and manage impacted soil during construction activities is required by the Brownfields Program and will be specified in a LUR. Implementation of this EMP will result in the direct contact soil exposure pathway being incomplete for a construction worker. This pathway was evaluated as part of the risk assessment to help identify potential areas of concern to be addressed by the EMP, but does not drive proposed remediation goals.
  - Recreator – The southern portion of the site is used as a public green space and contains the Bolin Creek Trail for recreational use; therefore, this pathway is currently complete for greenway users under both the current and future land use

scenarios. For consistency, the recreator receptor is referred to as a greenway user throughout this report.

- Direct contact groundwater use exposure pathway – This pathway covers health-based groundwater exposure via ingestion, dermal contact, or inhalation associated with use of groundwater from a water supply well. For the subject site, assessment data do not indicate groundwater impacts extending beyond the site property boundary, no water supply wells are currently present at the site, and a LUR preventing the future installation of water supply wells is proposed as part of the BFA. Implementation of this LUR will result in the groundwater use exposure pathway being incomplete. Therefore, this pathway was not evaluated as part of the risk assessment. However, possible direct contact with surface water and sediment from groundwater seepage to surface water is considered an exposure pathway as discussed below.
- Direct contact surface water exposure pathway – This pathway covers health-based surface water exposure via ingestion or dermal contact during a recreational scenario. This pathway is considered complete for greenway users in the area of Bolin Creek under both the current and future land use scenarios.
- Direct contact sediment exposure pathway – This pathway covers health-based stream sediment exposure via ingestion, dermal contact, or outdoor inhalation of volatiles and particulates. This pathway is not specifically covered in the DEQ Risk Calculator. Per DEQ guidance (DEQ, 2021a), this pathway was evaluated by entering sediment concentrations under the direct contact soil exposure pathway for a greenway user in the area of Bolin Creek. However, note that this approach overestimates risk since sediment will usually be covered by water, which limits human exposure and eliminates inhalation risk.

Vapor Intrusion Exposure Pathway

- Vapor intrusion exposure pathway – The vapor intrusion pathway covers indoor inhalation risk due to intrusion of volatile organic compound vapors from subsurface soil and/or groundwater into buildings. COCs for the site are non-volatile metals associated with CCPs; therefore, this pathway is not considered complete.

Contaminant Migration Pathways

- The contaminant migration pathways evaluate leaching of compounds from soil to groundwater, and migration of impacted groundwater towards either a downgradient water supply well or a downgradient surface water body. The Risk Calculator contains tools for predictive modeling of these pathways; however, per DEQ guidance (DEQ, 2021a), groundwater monitoring data that confirm the plume is stable and unlikely to impact a downgradient receptor are more reliable to support risk management decisions. As discussed in Section 4.3, groundwater monitoring data for the site indicate limited or no groundwater impact in monitoring wells which are screened in non-fill zones in the unconfined aquifer. Groundwater impacts, if any, will not migrate beyond the site property boundary due to the hydraulic barrier formed by Bolin Creek. In addition, as discussed in Section 4.4, surface water monitoring data indicate no significant impacts to Bolin Creek. Based on monitoring data, contaminant migration pathways are not considered a concern for the site.

5.2 Exposure Unit Designations

For the purpose of risk characterization, the site was divided into exposure units (EUs) that represent areas of similar land use and potential receptors. Three EUs were defined for the site, and the EUs are depicted in Figure 3. A description of each EU and associated exposure pathways is provided below.

- EU #1 encompasses the upper level in the vicinity of the existing police department building and associated parking areas. EU #1 is currently non-residential. Future redevelopment may include residential use. Therefore, calculations were performed to evaluate the soil direct contact pathway for a resident, non-residential worker, and construction worker within EU #1. The direct contact groundwater use pathway will be managed via a LUR preventing the installation of water supply wells. No surface water or stream sediment are located within EU #1.
- EU #2 encompasses the area of Bolin Creek and the adjacent trail area, which is also referred to as the lower level of the site. EU #2 is currently used for recreational

purposes only. EU #2 is located within a flood zone; therefore, commercial or residential redevelopment is not viable. Calculations were performed to evaluate the soil, surface water, and stream sediment direct contact pathways for a greenway user, and the soil direct contact pathway for a construction worker within EU #2. The direct contact groundwater use pathway will be managed via a LUR preventing the installation of water supply wells.

- EU #3 encompasses the embankment between EU #1 and EU #2. The embankment is not currently in use and partially fenced off to prevent access from the adjacent EU #2 greenway area. Although occupancy and uses of EU #3 are inherently limited due to the steep slope, calculations were conservatively performed to evaluate the soil direct contact pathway for a resident, non-residential worker, construction worker, or greenway user within EU #3. The direct contact groundwater use pathway will be managed via a LUR preventing the installation of water supply wells. No surface water or stream sediment are located within EU #1.
- Note that the potential for erosion to transport impacts from the area of the embankment (EU #3) into the greenway area (EU #2) is an additional concern. The Town implemented temporary measures to minimize the potential for erosion as part of the IRMs implemented in 2020; however, H&H recommends implementation of permanent measures to prevent erosion in conjunction with site redevelopment activities.

5.3 Exposure Point Concentrations

Exposure point concentrations were defined for the soil, sediment, and surface water direct contact exposure pathways. Analytes considered in the risk assessment conservatively included all detected constituents designated by DEQ as COCs requiring analysis for the site (see DEQ letter dated February 11, 2016). The data sets used for the risk assessment included the following:

- The soil EPC data set included the full set of historical soil sampling data, with several exceptions. First, soil samples that were excavated during the 2020 IRMs were removed from the data set. Secondly, at locations that were sampled more than once, only the more recent samples were included in the data set. Lastly, based on EPA risk assessment guidance (EPA, 2018b), soil samples collected at depths 2 ft bgs or less were used for risk calculations for residents, non-residential workers, and greenway users, and samples collected at depths of 10 ft bgs or less were used for risk calculations for construction workers. Note that if impacted soil or CCPs at deeper depths are exposed during site redevelopment, additional risk evaluation should be performed to confirm surface soils do not exceed acceptable risk levels. If the site is redeveloped, the Brownfields Program will also likely require confirmatory sampling and risk evaluation in areas of potentially impacted soil or CCPs that are not covered by impervious surfaces (buildings, pavement, etc.) or at least 2 ft of clean fill.

- For surface water, more recent data is considered most representative of current conditions, but EPCs also need to account for possible variations in surface water concentrations over time. To account for potential variability over time, the surface water EPC data set included surface water samples collected within the past five years (2016 and 2019 sampling events).
- For stream sediment, two sampling events have been performed to date in 2016 and 2019. The locations sampled in 2016 were resampled in 2019, so the 2019 is considered most representative of current conditions and was used as the EPC data set.

Per DEQ guidance (DEQ, 2020), maximum concentrations for each constituent of concern detected in the referenced data sets were used as the EPCs. Following initial risk calculations, the EPC dataset was further refined to exclude metals detected at concentrations below site-specific BSVs. As previously discussed, the BSVs established for the site consisted of the 95% UTL with 95% coverage for background soil, and the lower of two times the mean or the maximum detected concentration for background surface water and sediment. EPC tables are included in Appendix C.

5.4 Exposure Parameters

The default exposure parameters incorporated in the DEQ Risk Calculator were used for the risk evaluation for a resident, non-residential worker, and construction worker. These exposure parameters are consistent with EPA default exposure parameters (EPA, 2021), where established, and are intended to represent a reasonable maximum exposure (RME) scenario. RME is defined by EPA as the highest exposure that is reasonably expected to occur at a site, generally assumed to be in the range of the 90th and 99th percentiles (EPA, 2001). To calculate risks specific for greenway users, H&H calculated site-specific exposure factors based on greenway user polling data collected by the Town. Specifically, for adult and child exposure frequency, soil exposure time, and water exposure time, H&H used values equal to or more conservative than the 98th percentile of responses reported during the greenway user survey. This approach is consistent with RME as defined by EPA, and represents “worst-case” exposures. Following is a brief summary of the most pertinent exposure parameters, but please refer to the NC Risk Calculator documentation in Appendix C for a full list of exposure parameters used in the calculations:

- Residential exposure for 6 years (yrs) as a child and 20 yrs as an adult (26 yrs total), 350 days per year (d/yr), and 24 hours per day (hr/d).
- Non-residential exposure for 25 yrs (adult only), 250 d/yr, and 8 hr/d.
- Construction worker exposure for 1 yr (adult only), 250 d/yr, and 8 hr/day.
- Greenway user exposure for 6 yrs as a child and 20 yrs as an adult (26 yrs total), 364 d/yr and 1 hr/d as an adult, and 52 d/yr and 0.5 hr/d as a child.
- Dermal contact with soil parameters assumes exposure of head, hands, forearms, lower legs, and feet for a resident and greenway user, and exposure of head, hands, and forearms for a non-residential worker and construction worker.
- Soil ingestion parameters assume ingestion of 200 milligrams per day (mg/d) of soil by a child (greenway user or resident), and 100 mg/d of soil by an adult (greenway user, resident, or non-residential worker). Increased ingestion of 330 mg/d of soil is assumed for a construction worker.
- Significantly increased outdoor inhalation of particulates is assumed for a construction worker, with assumed particulates at levels greater than the National Ambient Air Quality Standard established under 40 Code of Federal Regulations Part 50 for particle pollution.

5.5 Toxicity Factors

The conservative default toxicity factors incorporated in the DEQ Risk Calculator were used for the risk evaluation. Note that these toxicity factors account for possible development effects for pregnant women.

5.6 Risk Assessment Results

For the direct contact pathways, the DEQ Risk Calculator calculates values for potential cancer risk (CR) and potential non-cancer hazard quotient (HQ) or hazard index (HI) as described below:

- CR is defined as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. For example, a CR of one in 10,000 (1.0E-04) indicates one person in 10,000 may have an increased risk of cancer due to exposure to a chemical.
- HQ is defined as the ratio of the amount of a contaminant a person is exposed to versus the amount that may cause non-cancer harmful effects, while HI is defined the sum of HQs for individual contaminants for a given scenario. For example, a HI of less than 1 indicates the exposure is unlikely to cause non-cancer harmful effects.

For each receptor scenario, CR and HQ values for complete exposure pathways are summed to determine the cumulative risk for each receptor. The cumulative CR and HI values for each receptor are then compared to the DEQ acceptable risk values. DEQ considers a cumulative CR of 1.0E-4 and HI of 1.0 or less to be acceptable (DEQ, 2021a). Similarly, EPA considers exceedances of a CR of 1E-04 and HI of 1 to be triggers requiring remediation or other actions to reduce exposures (EPA, 2018b).

Note that calculated cumulative CR and HI values do not include risks associated with lead. Currently, there is no EPA reference dose or cancer potency factor to quantify risks associated with exposures to lead. Exposure risks to lead are characterized based on predicted blood lead levels. The DEQ Risk Calculator flags a lead concentration when the concentration exceeds the DEQ health-based residential or industrial/commercial PSRGs for lead (400 mg/kg and 800 mg/kg, respectively). Lead has not been detected at concentrations above DEQ health-based

PSRGs in samples collected at the site; therefore, lead is not considered to be a compound posing a significant risk for the site.

Cumulative CR and HI values calculated for each exposure unit and receptor scenario are summarized in Table 1. Risk calculator documentation is included in Appendix C. A discussion of the results is presented below.

5.6.1 Exposure Unit #1 – Upper Level

EU #1 covers the upper level in the area of the existing police department building. In the area of EU #1, calculated CR and HI values do not exceed DEQ acceptable risk limits for a non-residential worker. Therefore, the area of EU #1 is considered safe for non-residential workers, and no further evaluation of this exposure unit/receptor is considered warranted.

For a future resident in EU #1, the calculated cumulative CR value is acceptable; however, the calculated HI value exceeds the DEQ acceptable risk level of 1, both with and without background concentrations included. As previously referenced, background concentrations are excluded when determining remedial goals for the site. With background levels excluded, the COC driving the risk level above 1 is limited to manganese within the S-4 sample. This sample was collected at a depth of 1 ft bgs in the wooded area southwest of the police department building during the initial site assessment activities in April 2013, as reported in the Phase I & Limited Phase II Environmental Site Assessment prepared by Falcon Engineering and dated July 18, 2013. If the site is redeveloped for residential use, H&H recommends remediation (ex., excavation, cover to prevent exposure) or other actions (ex., resampling to verify concentrations) to address impacts in the area of sample S-4. Samples driving exceedances of residential risk levels are identified on Figure 4A.

For a construction worker, the calculated cumulative CR value was acceptable; however, calculated HI value exceeds the DEQ acceptable risk level of 1, both with and without background concentrations included. The COCs driving the risk level greater than 1 include manganese, arsenic, and mercury. Samples driving exceedances of construction worker risk levels are identified on Figure 4B. As previously discussed, the Risk Calculator uses very conservative default inputs that represent worst-case situations and may result in overly restrictive risk values when evaluating the construction worker pathway. Construction worker risks will be managed via a LUR requiring preparation of an EMP, which will detail measures to prevent construction worker exposure, manage impacted soil during construction activities, and minimize the potential for off-site migration of impacted soil via surface water or windborne pathways.

5.6.2 Exposure Unit #2 – Lower Level

EU #2 covers the lower level in the area of the greenway trail and Bolin Creek. For a current and future greenway user, the calculated CR and HI values do not exceed DEQ acceptable risk limits. Therefore, the area of EU #2 is considered safe for greenway users, and no further evaluation of this exposure unit/receptor is considered warranted.

For a construction worker, the initial evaluation including background levels indicated the calculated cumulative CR value was acceptable, but the calculated HI value exceeds the DEQ acceptable risk level of 1. If background levels are excluded, the calculated CR and HI values do not exceed DEQ acceptable risk levels. Because risks associated with contamination do not exceed acceptable risk levels, no remediation or other measures are considered warranted to address construction worker risks in EU#2. However, the Brownfields Program will likely require an EMP for the site as a whole, including EU #2, which will detail measures to prevent construction worker exposure, manage impacted soil during construction activities, and minimize off-site migration pathways.

5.6.3 Exposure Unit #3 - Embankment

EU #3 covers the area of the embankment between the upper and lower level. As previously noted, EU #3 is not currently used and occupancy is limited by fencing and a steep slope; however, H&H conservatively evaluated the same receptors designated for the upper and lower levels for this exposure unit.

For a potential current or future greenway user, the calculated CR and HI values do not exceed DEQ acceptable risk limits. Therefore, the area of EU #3 is considered safe for greenway users, and no further evaluation of this exposure unit/receptor is considered warranted.

For a potential current or future non-residential worker, the calculated CR and HI values do not exceed DEQ acceptable risk limits. Therefore, the area of EU#3 is considered safe for non-residential workers, and no further evaluation of this exposure unit/receptor is considered warranted.

For a potential future resident, the calculated cumulative CR value was acceptable; however, calculated HI value exceeds the DEQ acceptable risk limit, both with and without background levels included. With background levels excluded, the COC driving the exceedance is arsenic in samples S-7, HH-10, and HH-11. CCPs are exposed in areas of the embankment and the samples driving the risk exceedance were CCP samples. H&H recommends remediation or other measures (several examples given above) to address exposed CCPs in the area of the embankment. Samples driving exceedances of residential risk levels are identified on Figure 4A.

For a construction worker, the calculated cumulative CR value was acceptable; however, the calculated HI value exceeds the DEQ acceptable risk level, both with and without background levels included. The COCs driving the exceedance include manganese and arsenic. Samples driving exceedances of construction worker risk levels are identified on Figure 4B. Construction worker risks will be managed via a LUR requiring preparation of an EMP, which will detail measures to prevent construction worker exposure, manage impacted soil during construction activities, and minimize potential off-site migration.

6.0 Ecological Risk Assessment

Due to the presence of potential ecological receptors in the area of Bolin Creek, H&H conducted initial screening activities related to ecological risk assessment. Based on DEQ guidance (DEQ, 2021b), the initial screening activities consisted of comparison of detected concentrations to the Ecological Screening Values (ESVs) established by EPA Region 4. The Guidelines for Performing Screening Level Ecological Risk Assessments within the Division of Waste Management (DENR, 2003) and EPA Region 4 Ecological Risk Assessment Supplemental Guidance (EPA, 2018a) were consulted during the initial screening; however, please note that H&H's evaluation did not constitute a full Screening Level Ecological Risk Assessment (SLERA).

Per DEQ and EPA guidance (DENR, 2003, EPA, 2018a), EPA ESVs are based on conservative endpoints and ecological effects data, and represent preliminary screening criteria to evaluate the potential for ecological risk (or lack thereof). ESVs are not intended to represent remediation goals. The purpose of the initial ESV screening activities performed by H&H was to evaluate whether additional actions are warranted to further evaluate or address ecological risks for the site. This section details the EPCs used for the screening, and the results of the ESV screening for surface water, sediment, and soil.

6.1 Exposure Units

The ecological risk assessment included evaluation of data with respect to the same exposure units established in the human health risk assessment. The EUs were further evaluated with respect to the potential for significant ecological receptors to be present, as detailed below.

- EU #1 encompasses the upper level in the vicinity of the existing police department building. Ecological receptors are less likely to be present in the area of EU #1 due to the buildings and pavement associated with the police department building. However, some ecological receptors could potentially be present in the wooded areas surrounding the facility; therefore, this unit was conservatively screened for ecological risk. No stream sediment or surface water are located within this unit, so the only complete exposure pathway for ecological receptors is surface soil exposure.

- EU #2 encompasses the area of Bolin Creek and the adjacent trail area. EU #2 is considered the unit with the highest likelihood of potential ecological receptors. Complete exposure pathways for ecological receptors include surface soil exposure, sediment exposure, and surface water exposure.
- EU #3 encompasses the embankment between EU #1 and EU #2. The potential for ecological receptors in this area is considered moderate. No stream sediment or surface water are located within this unit, so the only complete exposure pathway for ecological receptors is surface soil exposure.
- As previously discussed, note that the potential for erosion to transport impacts from the area of the embankment (EU #3) into the greenway area (EU #2) is an additional concern. The Town implemented temporary measures to minimize the potential for erosion as part of the interim remediation measures implemented in 2020; however, H&H recommends implementation of permanent measures to prevent erosion in conjunction with site redevelopment activities.

6.2 Exposure Point Concentrations

Analytes considered in the risk assessment conservatively included all detected constituents designated by DEQ as COCs requiring analysis for the site (see DEQ letter dated February 11, 2016). Similar to the human-health risk assessment, the data set used for the risk assessment included the following:

- The surface water EPC data set included surface water samples collected within the past five years (2016 and 2019 sampling events).
- The stream sediment EPC data set included the most recent samples collected in 2019.
- The soil EPC data set included the full set of historical soil sampling data with the exception of (1) soil samples that were excavated during the 2020 IRMs, (2) locations that were resampled, in which case only the latest data was included, and (3) samples collected at depths of more than 2 ft bgs. Samples collected from 0 to 2 ft bgs were used

based on prior guidance from DEQ personnel. This is consistent with or more conservative than EPA guidance, which recommends collection of samples for terrestrial ecological risk assessment at depths on the order of 25 to 30 cm, or 0.8 to 1 ft (EPA, 2015b).

Maximum concentrations for each constituent of concern detected in the referenced data sets were used as the EPCs. Concentrations were initially compared to ESVs directly without consideration of background concentrations. Where concentrations exceeded ESVs, concentrations were also compared to the established site-specific BSVs to evaluate exceedances potentially attributable to contamination rather than background conditions. As previously discussed, the BSVs established for the site consisted of the 95% UTL with 95% coverage for background soil, and the lower of two times the mean or the maximum detected concentration for background surface water and sediment.

6.3 Ecological Screening Evaluation

The results of the ecological risk evaluation for the soil, stream sediment, and surface water exposure pathways are detailed below. COCs identified at concentrations above BSVs and ESVs are shown on Figure 5.

6.3.1 Soil Ecological Screening

The designated soil EPCs within the three exposure units were compared to the EPA Soil ESVs as summarized in Table 2. The results of the comparison for each exposure unit are discussed below.

<u>Exposure Unit #1</u>

Within EU #1 (upper level), soil concentrations were identified above the EPA ESVs in multiple samples. However, the majority of the detections are below the site-specific BSVs and therefore considered representative of background conditions. Concentrations above both EPA ESVs and BSVs were identified only in soil samples S-4 and MW-7.

Sample S-4 contained cadmium, cobalt, copper, manganese, and nickel at concentrations above ESVs and BSVs. As previously discussed, this sample was collected at a depth of 1 ft bgs in the wooded area southwest of the police department building during the initial site assessment activities in April 2013. This sample was also identified as a driver for residential risk exceedances during the human health risk assessment.

Sample MW-7 is a soil sample collected from the boring for well MW-7 at a depth of 0-1 ft bgs in 2016. This sample contained copper at a concentration above both the ESV and BSV. This sample was collected in the eastern portion of the site approximately 120 ft cross-gradient of the area of CCPs. The detected concentration is higher than copper concentrations collected from CCPs in the source area. Based on review of the data, the copper detected in sample MW-7 is likely not associated with the CCP disposal area and is considered an outlier. Additional sampling may be beneficial to confirm concentrations in the area of well MW-7.

It should be noted that DEQ does not commonly require evaluation of ecological risks for soil (DEQ, 2021b). As such, DEQ may not require additional actions with regard to the exceedances of ESVs in S-4 and MW-7. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measure to address or further evaluate potential ecological risks in the area of samples S-4 and MW-7.

<u>Exposure Unit #2</u>

Within EU #2 (lower level), soil concentrations were identified above the EPA ESVs in multiple samples. However, the majority of the detections are below the site-specific BSVs and therefore considered representative of background conditions. Concentrations above both EPA ESVs and BSVs were identified only in sample SED-13 which is a drainage pathway sample located near the bridge of the Bolin Creek Trail.

At the SED-13 location, samples were collected at both 0-2 and 2-6 inches bgs. Barium was detected at concentrations above the ESV and BSV in both sample depths. Selenium and strontium were also detected at concentrations above the ESVs and BSVs in the 0-2-inch bgs sample depth.

As previously referenced, DEQ does not commonly require evaluation of ecological risks for soil (DEQ, 2021b). As such, DEQ may not require additional actions with regard to the exceedances of ESVs in SED-13. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measure to address or further evaluate potential ecological risks in the area of sample SED-13.

Exposure Unit #3

Within EU #3 (embankment), concentrations were identified above both EPA ESVs and BSVs in each sample collected (S-7, H-9, H-10, and H-11). Constituents detected above ESVs and BSVs include arsenic, barium, beryllium, mercury, selenium, and strontium. CCPs are exposed in areas of the embankment and the samples indicating exceedances were CCP samples. H&H recommends remediation or other measures to address exposed CCPs in the area of the embankment.

6.3.2 Stream Sediment Ecological Screening

The designated stream sediment EPCs in the area of Bolin Creek (EU #2) were compared to the EPA Sediment ESVs, as summarized in Table 3. The results of the comparison indicated barium in samples SED-4 (Adjacent to the site) and SED-5 (Downstream near the southeast property boundary) and total chromium in samples SED-4 (Adjacent) and SED-7 (Downstream and off-site) at concentrations above the EPA ESVs. For these exceedances, concentrations were then compared to the established BSVs. The concentrations were found to be below the BSVs, and are therefore considered representative of background conditions. The fact that these constituents represent background conditions is further confirmed by the detection of both barium and chromium at concentrations above EPA ESVs in the upgradient background sediment samples collected at the site.

Note that Table 3 also lists EPA Region 4 Refinement Screening Values (RSVs) for sediment. The RSVs are based on less conservative ecological effects data, and are intended to be used as a second-tier screening where ESVs are exceeded. Although sediment concentrations appear indicative of background conditions and therefore do not warrant remediation, the concentrations (including those at background locations).do not exceed RSVs and therefore are not considered a significant ecological risk.

6.3.3 Surface Water Ecological Screening

The designated surface water EPCs in the area of Bolin Creek (EU #2) were compared to the EPA Region 4 Acute and Chronic Surface Water ESVs, as well as the NC 2B Standards. The ESVs and 2B Standards for some constituents vary based on hardness. Based on historical sampling, the average hardness in Bolin Creek was calculated as 54.5 milligrams per liter (mg/L). Based on this value, the published ESVs based on a hardness of 50 mg/L were used. NC 2B Standards were derived using the DEQ Hardness-Dependent Metal Calculator dated July 26, 2021, and the average site-specific hardness of 54.5 mg/L. For constituents with no established 2B Standard, concentrations were compared to the NC In-Stream Target Values for Surface Water (July 26, 2021).

Table 4 provides a summary of surface water EPCs in comparison the referenced ecological screening criteria. As shown, no concentrations were found to exceed EPA Region 4 Acute and Chronic Surface Water ESVs, NC 2B Standards, or NC In-Stream Target Values for Surface Water.

7.0 Conclusions and Recommendations

H&H has completed human-health and ecological risk assessment activities for the property located at 828 MLK Jr. Boulevard in Chapel Hill. The purpose of the risk assessment activities was to evaluate potential human health and ecological risks for CCPs at the site under the current land use scenario and possible future redevelopment scenarios. The risk assessment was performed in general accordance with DEQ and EPA risk assessment guidance (DEQ, 2020, DEQ, 2021a, EPA, 2018a, EPA 2018b), using conservative inputs intended to represent reasonable maximum exposure scenarios. A summary of the results is presented below.

<u>Human-Health Risk Assessment Results</u>

The human-health risk assessment results indicated the following:

- Human-health risk was evaluated for possible future residents in the area of EU #1 (upper level) and EU #3 (embankment). The results of the risk evaluation indicated that acceptable risk levels were exceeded for a future resident in both units (with and without background concentrations included) with risks being driven by metals in the following locations:
    - In the area of EU #1 (upper level), the driver for unacceptable risk levels for a resident is the manganese concentration in soil sample S-4.
    - In the area of EU #3 (embankment), the drivers for unacceptable risk levels for a resident are arsenic concentrations in samples S-7, HH-10, and HH-11.
- Human-health risk was evaluated for possible current or future non-residential workers in the area of EU #1 (upper level) and EU #3 (embankment). The results of the risk evaluation indicated acceptable risk levels for a non-residential worker in both units. Therefore, the site is considered safe for non-residential workers under both current and future use scenarios.
- Human-health risk was evaluated for possible future construction workers in the area of all three exposure units (upper level, lower level, and embankment). The results of the risk evaluation indicated acceptable risk levels were exceeded for a construction worker in all three units. If background concentrations are removed, acceptable risk levels were exceeded for a construction worker in EU #1 (upper level) and EU #3 (embankment).

- Human-health risk was evaluated for possible current and future greenway users in the area of EU #2 (lower level) and EU #3 (embankment). The results of the risk evaluation indicated acceptable risk levels for greenway users in both units. Therefore, the site is considered safe for greenway users.

Ecological Risk Assessment Results

The results of the ecological risk screening indicated the following:

- The area of Bolin Creek (EU #2) is the area with the highest likelihood of potential ecological receptors. The results of the risk evaluation indicated no significant ecological risk for surface water and sediment in Bolin Creek.
- Exceedances of ESVs for multiple metals were identified in samples of exposed CCP collected along the embankment in EU #3 (S-7, HH-9, HH-10, and HH-11).
- Localized exceedances of ESVs were also identified at two soil sample locations within EU #1 (S-4 and MW-7) and one individual soil sample location within EU #2 (SED-13).

Recommendations

H&H's recommendations to address potential human-health and ecological risks identified as part of this risk assessment are detailed below. In addition to recommendations related to specific sample locations which are drivers for potential risks, in some cases LURs are recommended to confirm the assumptions made during the risk assessment activities remain valid. LURs are expected to be covered under a future BFA, which would be prepared under the jurisdiction of the DEQ Brownfields Program and filed on the deed for the property. The Brownfields Program requires annual certifications from the property owner that LURs are being complied with in perpetuity, which will confirm that potential risks addressed via LURs will be managed long-term.

- Exposed CCPs are present in the area of the embankment. The risk evaluation indicated exceedances of acceptable risk levels for a resident, construction worker, and/or ecological receptors based on metals concentrations in several samples of exposed CCPs collected in the embankment area (S-7, HH-9, HH-10, and HH-11). The potential for erosion to transport CCPs from the area of the embankment into the greenway area is considered an additional concern. The Town implemented temporary measures to minimize the potential for erosion as part of the interim remediation measures implemented in 2020; however, H&H recommends implementation of permanent measures to address exposed CCPs and prevent erosion in the embankment area. These measures could effectively be performed in conjunction with site redevelopment activities.

- If the site is redeveloped for residential use, H&H recommends remediation or other actions (ex., excavation, impervious cover to prevent exposure, resampling to verify concentrations) to address impacts in the upper level in the area of sample S-4.
- Outside of the embankment area, the ecological risk screening indicated localized exceedances of ESVs at two soil sample locations within EU #1 (S-4 and MW-7) and one individual soil sample location within EU #2 (SED-13). DEQ does not commonly require evaluation of ecological risks for soil (DEQ, 2021b). As such, DEQ may not require additional actions with regard to the exceedances of ESVs in these samples. If required by DEQ or if the Town wishes to take voluntary actions, H&H recommends remediation or other measures to address or further evaluate potential ecological risks in the area of samples S-4, MW-7, and SED-13.
- To address construction worker risks, H&H recommends implementation of an anticipated LUR requiring preparation of an EMP, which will detail measures to prevent construction worker exposure, manage impacted soil and minimize the potential for off-site migration during construction (i.e., redevelopment) activities.
- The risk assessment calculations were based on soil samples collected at depths of 0 to 2 ft bgs for a resident, non-residential worker, and greenway user, and samples collected at depths of 0 to 10 ft bgs for a construction worker. If impacted soil or CCPs at deeper depths are exposed during site redevelopment, additional risk evaluation should be performed to confirm that potential exposure to these soils does not exceed acceptable risk levels. If the site is redeveloped, the Brownfields Program will also likely require confirmatory sampling and risk evaluation in areas of potentially impacted soil or CCPs that are not covered by impervious surfaces (buildings, pavement, etc.) or at least 2 ft of clean fill.
- H&H recommends a LUR preventing the future installation of water supply wells or other use or exposure of groundwater at the site.

8.0 References

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Table 1 (Page 1 of 1)
Summary of Human Health Risk Assessment Results
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

RISK ASSESSMENT RESULTS INCLUDING BACKGROUND CONCENTRATIONS								
Exposure Pathway	Residential		Non-Residential Worker		Construction Worker		Greenway User	
	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index
Exposure Unit #1 - Upper Level								
Soil Direct Contact	2.4E-05	**3.6E+00**	4.8E-06	2.4E-01	7.0E-06	**1.1E+01**	N/A	N/A
Exposure Unit #2 - Lower Level								
Soil Direct Contact	N/A	N/A	N/A	N/A	1.4E-06	**3.6E+00**	8.4E-06	4.1E-01
Sediment Direct Contact	N/A	N/A	N/A	N/A	N/A	N/A	1.8E-06	9.1E-02
Surface Water Direct Contact	N/A	N/A	N/A	N/A	N/A	N/A	3.2E-07	1.7E-02
Cumulative Risk for Exposure Unit #2*	N/A	N/A	N/A	N/A	1.4E-06	**3.6E+00**	8.7E-06	4.2E-01
Exposure Unit #3 - Embankment								
Soil Direct Contact	9.4E-05	**3.1E+00**	2.0E-05	2.2E-01	4.4E-06	**8.8E+00**	3.4E-05	4.6E-01

RISK ASSESSMENT RESULTS EXCLUDING BACKGROUND CONCENTRATIONS								
Exposure Pathway	Residential		Non-Residential		Construction Worker		Greenway User*	
	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index	Carcinogenic Risk	Hazard Index
Exposure Unit #1 - Upper Level								
Soil Direct Contact	2.1E-05	**1.3E+00**	4.7E-06	9.1E-02	5.4E-06	**1.1E+01**	N/A	N/A
Exposure Unit #2 - Lower Level								
Soil Direct Contact	N/A	N/A	N/A	N/A	8.1E-07	3.9E-01	8.0E-06	7.5E-02
Sediment Direct Contact	N/A	N/A	N/A	N/A	N/A	N/A	7.1E-13	2.1E-03
Surface Water Direct Contact	N/A	N/A	N/A	N/A	N/A	N/A	3.2E-07	1.7E-02
Cumulative Risk for Exposure Unit #2	N/A	N/A	N/A	N/A	8.1E-07	3.9E-01	8.3E-06	9.1E-02
Exposure Unit #3 - Embankment								
Soil Direct Contact	8.9E-05	**2.1E+00**	2.0E-05	1.5E-01	3.4E-06	**8.5E+00**	3.3E-05	3.1E-01

Notes:
N/A = Not applicable
Bold Red indicates an exceedance of NCDEQ acceptable risk levels (Carcinogenic Risk <1.0E-04 and Hazard Index <1.0).
* Cumulative risk calculated for EU #2 since more than one exposure pathway is complete. Cumulative risk indicates the higher of the sediment or soil risk, combined with the surface water risk. This is considered appropriate since a receptor could not be exposed to both soil and sediment at the same time and the same exposure pathways are covered by both risk calculations.

Table 2 (Page 1 of 1)
Soil Ecological Screening Table
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth (ft or in bgs)	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	lead	manganese	mercury	nickel	selenium	strontium	thallium	vanadium	zinc
Site-Specific BSV[1]				3.015	87.86	0.929	0.313	5.725	70.2	70.2	36.31	77.3	59.11	1,149	0.256	19.49	2.503	43.19	0.981*	227	230
EPA Region 4 Soil ESV[2]				18	330	2.5	0.36	0.34	26	23	13	28	11	220	0.013	38	0.52	96	0.05	7.8	46
Upper Level Samples (Exposure Unit #1)																					
S-4	04/29/13	CCP	1 ft	14	24	ND	**1.5**	NA	NA	22	**30**	**65**	**20**	**1,500**	0.011	**43**	ND	NA	ND	**21**	**120**
HH-1	11/03/16	Soil	0-1 ft	5.9	120	1.00	<0.29	**0.45**	20.55	21	7.9	25	**27**	**350**	**0.052**	8.8	**0.69**	31	<0.58	**48**	**50**
	11/03/16[5]	Soil	0-1 ft	3.4	110	0.79	<0.35	**0.54**	19.46	20	8.4	17	**18**	**360 BH**	**0.067**	12	<0.71	30	<0.71	**41**	35
HH-2	11/03/16	Soil	0-1 ft	4.9	140	0.93	<0.29	**0.43**	13.57	14	12	21	**30**	**260**	**0.085**	5.9	**1.0**	25	<0.58	**48**	43
HH-3	11/03/16	Soil	0-1 ft	9.9	200	1.30	<0.33	**0.46 J**	17.54	18	7.8	**31**	**24**	**350**	**0.076**	8.9	**2.4**	36	<0.65	**53**	**100**
HH-4	11/03/16	Soil	0-1 ft	2.4	72	1.00	<0.28	**0.50**	**44.5**	**45**	**16**	**37**	2.3	**630**	<0.023	33	<0.56	42	**0.60**	**73**	**70**
HH-5	11/03/16	Soil	0-1 ft	2.4	73	0.75	<0.30	<0.14	23	**23**	8.4	19	9.3	**410**	<0.025	14	**1.2**	23	<0.60	**39**	**51**
HH-6	10/27/16	Soil	0-1 ft	NA	NA	NA	NA	<0.33	20	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
HH-7	10/27/16	Soil	0-1 ft	NA	NA	NA	NA	<0.61	22	22	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-7	11/01/16	Soil	0-1 ft	2.6	67	0.87	<0.30	**0.89**	9.11	10	3.9	**180**	7.6	100	**0.030**	2.9	<0.59	6.7	<0.59	**61**	**46**
Embankment Samples (Exposure Unit #3)																					
S-7	01/31/14	CCP	0-4 ft	**44**	**2,500**	NA	ND	**1.4**	**27.6**	**29**	NA	NA	**11**	NA	**0.44**	NA	**4.5**	NA	NA	NA	NA
HH-9	04/03/19	CCP	0-1 ft	3.37	131	0.398 J	0.178 J	<1.29	12.7	12.7	5.97	14.5	NA	**260**	**0.31**	3.59	**0.722**	33.2	NA	NA	NA
HH-10	04/03/19	CCP	0-1 ft	**60.3**	**2,970**	**5.14**	0.162 J	<1.60	13.8	13.8	9.84	**51.3**	NA	73.3	**0.22**	17.1	**5.04**	**269**	NA	NA	NA
HH-11	04/03/19	CCP	0-1 ft	**42.5**	**3,260**	**5.9**	0.220 J	**0.467 J**	18.7	19.2	**13.4**	**55.3**	NA	113	**0.43**	23.5	**9.05**	**234**	NA	NA	NA
Lower Level Samples (Exposure Unit #2)																					
SS-7	02/18/16	Soil	2-12 in	3.1	84	0.60	ND	NA	NA	14	6.9	15	**13**	**500**	**0.038**	5.9	ND	31	ND	**37**	37
HH-8	10/27/16	Soil	0-1 ft	3.6	100	1.00	<0.30	<0.35	19	19	12	**29**	**18**	**570**	**0.036**	9.0	<0.60	28	<0.60	**52**	**54**
MW-6	11/02/16	Soil	0-1 ft	2.9	38	0.61	<0.26	0.21 J	9.79	10	9.5	23	**12**	**570**	**0.082**	8.2	**1.0**	22	**0.81**	**31**	**77**
SED-3A	04/05/19	Soil	0-1 ft	3.45	33.9	0.418 J	<0.582	<1.16	17.4	17.4	**16.5**	6.97	NA	**560**	<0.0054	5.82	0.237 J	9.6	NA	NA	NA
SED-5A	04/04/19	Soil	0-1 ft	1.25	13.5	0.156 J	<0.571	**0.352 J**	13.2	13.6	5.95	**39.1**	NA	**243**	0.0071	4.38	<0.571	10.9	NA	NA	NA
SED-8	04/05/19	Drainage Pathway Soil	2-6 in	2.41	49.1	0.313 J	0.122 J	<1.25	12.0	12	7.01	14.3	NA	**423**	**0.063**	4.66	**1.01**	15.2	NA	NA	NA
SED-9	04/05/19	Drainage Pathway Soil	2-6 in	1.16	33.8	0.199 J	<0.660	**0.461 J**	21.6	22.1	9.11	10.1	NA	**431**	**0.013**	6.68	<0.660	16.7	NA	NA	NA
SED-10	04/05/19	Drainage Pathway Soil	2-6 in	1.29	24.4	0.118 J	0.221 J	**0.418 J**	12.0	12.4	4.43	10.8	NA	195	**0.037**	4.03	0.273 J	8.1	NA	NA	NA
SED-12	08/27/19	Drainage Pathway Soil	0-2 in	4.73	102	0.765 J	0.214 J	<1.68	**27.6**	**27.6**	6.17	23.1	NA	**341**	**0.042**	7.69	**0.961**	25.4	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	3.97	122	0.499 J	0.204 J	<1.74	9.45	9.45 B	6.04	19.7	NA	**319**	**0.077**	4.95	**1.36**	32.8	NA	NA	NA
SED-13	08/27/19	Drainage Pathway Soil	0-2 in	12.4	**958**	1.56	0.284 J	<2.03	**29.4**	**29.4**	**13.9**	**38.9**	NA	**538**	**0.12**	19.2	**3.07**	**125**	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	14.5	**724**	1.1	0.171 J	<1.58	14.0	14	7.58	27.1	NA	**563**	**0.075**	8.73	**1.69**	70.5	NA	NA	NA
SED-18	04/05/19	Drainage Pathway Soil	2-6 in	4.53	137	0.534 J	<0.689	<1.38	18.7	18.7	11.1	**28.2**	NA	**464**	**0.051**	9.00	**1.85**	32.6	NA	NA	NA
SED-19	04/05/19	Drainage Pathway Soil	2-6 in	1.55	20.0	0.161 J	<0.588	**0.435 J**	21.7	22.1	7.98	8.38	NA	**266**	0.0073	4.94	0.334 J	15	NA	NA	NA
SED-20	04/05/19	Drainage Pathway Soil	2-6 in	0.792	31.4	0.152 J	<0.687	<1.37	5.76	5.76 B	4.5	9.1	NA	**360**	0.012	2.19	0.263 J	11.5	NA	NA	NA
SED-21	04/05/19	Drainage Pathway Soil	2-6 in	1.12	25.9	0.149 J	<0.591	<1.18	20.9	20.9	4.44	6.58	NA	**221**	0.011	2.70	0.286 J	12.8	NA	NA	NA
Excavation H-3	05/11/20	Soil	1-2 ft	2.41	71.0	<3.28	<1.31	**0.410 J**	**40.2**	**40.6**	**14.1**	**43.4**	NA	**251**	0.0485 J	12.5	**1.46 J**	58.1	NA	NA	NA
Excavation H-5	05/11/20	Soil	1-2 ft	1.10 J	74.5	<3.04	<1.22	**0.497 J**	21.1	21.6	8.25	16.9	NA	**558**	<0.0486	6.77	<3.04	32.2	NA	NA	NA
Excavation H-6	05/11/20	Soil	1-2 ft	1.02 J	96.0	<2.97	<1.19	<1.19	14.9	14.9	7.57	10.7	NA	**557**	0.0222 J	4.03	<2.97	20.5	NA	NA	NA
Excavation H-7	11/09/20	Soil	0-1 ft	1.10 J	73.7	0.767 J	<1.22	<1.22	8.04	8.04	3.68	15.0	NA	**233**	**0.022**	4.63	0.479 J	9.6	NA	NA	NA
Excavation I-1	04/08/20	Soil	1-2 ft	2.91	67.2	<2.77	<1.11	**0.457 J**	**26.2**	**26.7**	**13.0**	18.3	NA	**594**	**0.042**	8.25	<2.77	26.3	NA	NA	NA
Excavation I-2	04/08/20	Soil	1-2 ft	3.65	74.1	<2.85	<1.14	0.313 J	23.3	**23.6**	12.0	21.4	NA	**544**	**0.022**	8.70	<2.85	17.2	NA	NA	NA
Excavation I-3	04/08/20	Soil	1-2 ft	2.18	61.5	<2.88	<1.15	**0.387 J**	13.1	13.5	9.23	19.5	NA	**419**	**0.019**	6.02	<2.88	13.3	NA	NA	NA

Notes:

Concentrations reported in milligrams per kilogram (mg/kg).

1) Site-Specific Background Screening Value (BSV) represents 95% upper threshold level (UTL) with 95% coverage calculated using EPA ProUCL 5.1.

*Insufficient data to calculate 95% UTL; therefore, site-specific BSV indicates 2x mean concentration with non-detectable concentrations calculated as half the reporting limit

2) EPA Region 4 Soil Ecological Screening Value (ESV) (March 2018).

Bold denotes concentration above or equal to EPA Soil ESV.

Bold/Shaded denotes concentration above or equal to EPA Soil ESV and site-specific BSV.

NA = Not Analyzed

J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.

Table shows constituents detected in soil samples collected between 0 and 2 ft bgs, excluding background samples, samples that have been excavated, and samples collected from locations resampled at a later date. Refer to Appendix A for a summary of additional sampling data.

Table 3 (Page 1 of 1)
Stream Sediment Ecological Screening Table
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

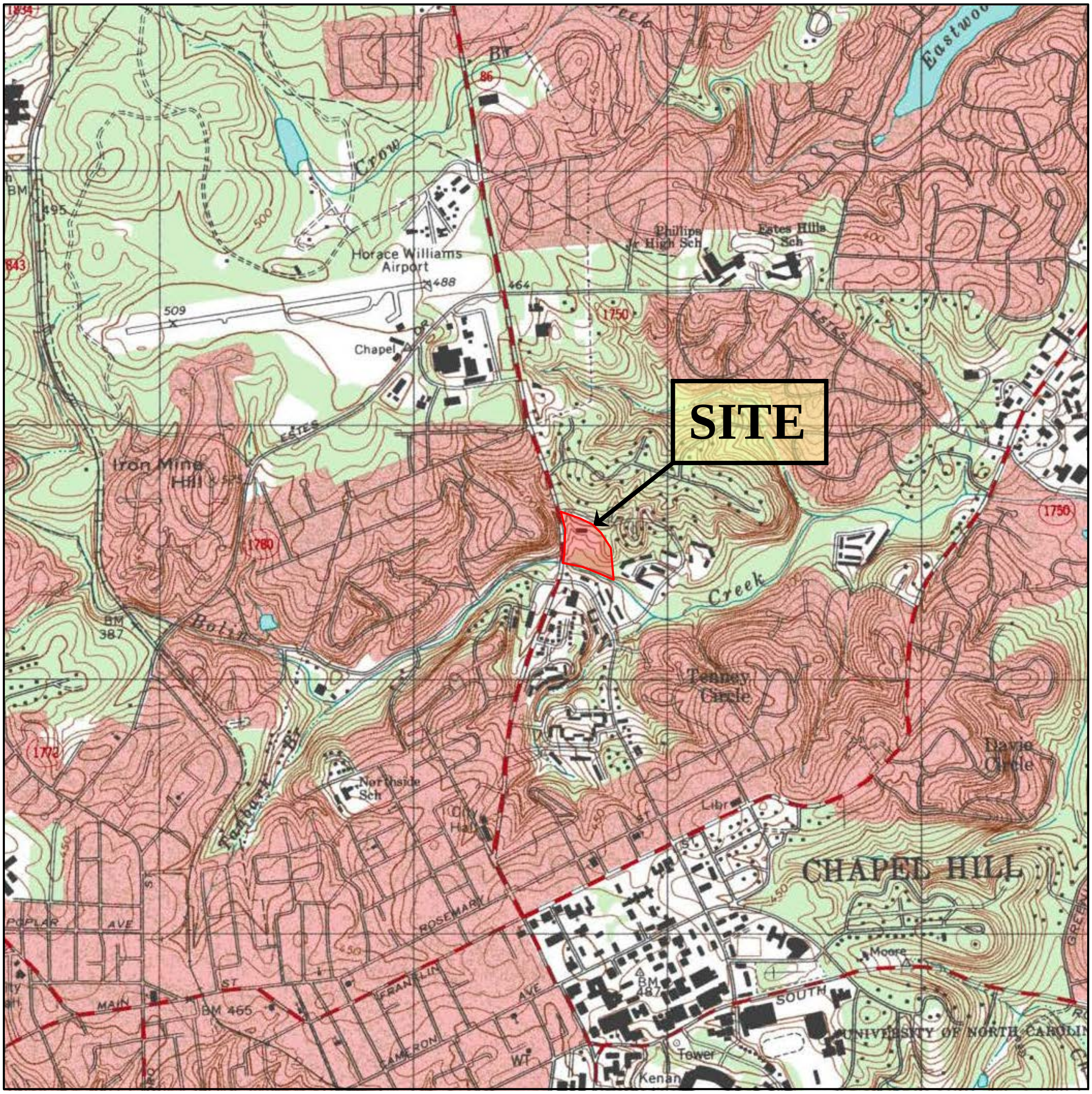
Sediment Sampling Point ID	Sample Date	arsenic	barium	beryllium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	manganese	mercury	nickel	selenium	strontium
Site-Specific BSV(1)		2.74	38.4	0.48	0.79	69.5	70	16.388	13.8	759	0.0078	9.92	0.409	16.9
EPA Region 4 Sediment ESV(2)		9.8	20	NS	NS	NS	43.4	50	31.6	460	0.17*	22.7	0.72*	NS
EPA Region 4 Sediment RSV(3)		33	60	NS	NS	NS	111	NS	149	1,100	0.17*	48.6	1.2*	NS
SED-3 (Adjacent)	04/05/19	1.36	16.4	0.111 J	0.670 J	13.5	14.2	5.18	20.2	225	0.0054 J	4.81	<0.607	9.2
SED-4 (Adjacent)	04/05/19	2.35	**20.3**	0.191 J	0.456 J	63.8	**64.3**	7.26	8.39	293	0.0080	10.5	0.344 J	30.7
SED-5 (Downstream)	04/04/19	1.82	**24.3**	0.233 J	0.595 J	16.8	17.4	5.9	8.86	399	<0.0035	4.86	<0.617	6.2
SED-6 (Downstream)	04/04/19	1.96	17.3	0.247 J	0.517 J	24.9	25.4	6.57	9.25	308	0.0058	7.15	<0.643	8.4
SED-7 (Downstream)	04/04/19	1.35	16.4	0.179 J	0.995 J	59.4	**60.4**	6.47	6.77	262	0.0025 J	9.04	<0.635	8.1

Notes
Concentrations reported in milligrams per kilogram (mg/kg).
1) Site-Specific Background Screening Value (BSV) indicates two times the mean detected background concentration or maximum detected background concentration, whichever is smaller
2) EPA Region 4 Sediment Ecological Screening Value (ESV) for freshwater (March 2018)
3) EPA Region 4 Sediment Refinement Screening Value (RSV) for freshwater (March 2018)
*Indicates the lower of the aquatic versus wildlife based ESVs and RSVs.
Bold denotes concentration above EPA Sediment ESV.
Bold/Shaded denotes concentration above EPA Sediment ESV and site-specific BSV.
Red denotes concentration above EPA Sediment RSV.
Red/Shaded denotes concentration above EPA Sediment RSV and site-specific BSV.
NS = Not Specified
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
Table shows constituents detected in the most recent set of surface water samples, excluding background samples. Refer to Appendix A for a summary of additional sampling data.

Table 4 (page 1 of 1)
Surface Water Ecological Screening Table
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Surface Water Sampling Point ID	Sample Date	arsenic	barium	total chromium(4,5,6)	cobalt	copper(4,5)	manganese	nickel(4,5)	selenium	strontium
Site-Specific BSV(1)		0.44	27	0.53	0.16	1.2	22.2	0.33	0.11	100
NC 2B Standard(2)		10(t)	1,000(t)	11	1.6(7)	5.33	NS	25(t)	5(t)	14,000(7)
EPA Region 4 Surface Water ESV (Acute)(3)		340	2,000	16	120	7.3	1,680	261	20	48,000
EPA Region 4 Surface Water ESV (Chronic)(3)		150	220	11	19	5.16	93	29	5	5,300
SW-3 (Adjacent)	11/03/16	<10	27	<5.0	<5.0	<10	34	<10	<20	100
	11/03/16(8)	<10	27	<5.0	<5.0	<10	33	<10	<20	110
	04/05/19	0.45	25.7	0.62	0.26	2.8	37.4	0.50	0.11 J	88.8
SW-4 (Adjacent)	11/03/16	<10	27	<5.0	<5.0	<10	25	<10	<20	110
	04/05/19	0.42	23.6	<0.50	0.14	1.0	24.6	0.26 J	0.10 J	89.1
	04/05/19(8)	0.41	23.7	<0.50	0.14	0.98	24.8	0.26 J	0.088 J	87.7
SW-5 (Downstream)	11/03/16	<10	26	<5.0	<5.0	<10	24	<10	<20	100
	04/04/19	0.40	16.9	<0.50	0.14	0.88	19.5	0.21 J	0.12 J	81.8
SW-6 (Downstream)	04/04/19	0.40	16.9	<0.50	0.14	0.84	18.7	0.21 J	0.11 J	81.3
SW-7 (Downstream)	04/04/19	0.42	18.4	<0.50	0.16	1.1	23.1	0.23 J	0.10 J	86.7
SW-21 (Drainage Pathway)	04/05/19	0.40	32.1	0.73	0.36	3.2	29.5	0.62	0.11 J	69.9
	04/05/19(9)	0.15	18.3	<0.50	0.094 J	3.1	9.3	0.43 J	<0.50	43.5

Notes:
Concentrations reported in micrograms per liter (µg/L).
1) Site-Specific Background Screening Value (BSV) indicates two times the mean detected background concentration or maximum detected background concentration, whichever is smaller.
2) North Carolina Surface Water Quality Standard (NC 2B Standard) adopted per 15A NCAC 2B Section .0100. Unless otherwise noted, values are the lowest of the Freshwater, Water Supply, and Human Health values because Bolin Creek is a WS V classification surface water.
3) EPA Region 4 Surface Water Ecological Screening Value (ESV) for freshwater (March 2018).
4) 2B Standards derived using site-specific hardness data for surface water samples SW-1 through SW-7 and the DEQ Hardness-Dependent Metal Calculator dated July 26, 2021. Mean hardness for these samples was 54.5 mg/L. Value shown is the lower of the acute versus chronic values.
5) EPA ESVs based on estimated hardness of 50 mg/L, which is the value reported by EPA closest to the measured site-specific hardness
6) 2B Standard shown for total chromium indicates the lower of the hexavalent and trivalent chromium values.
7) No 2B Standard established, value shown is the NC In-Stream Target Values for Surface Water (July 26, 2021). Value shown is the lower of the acute versus chronic values.
8) Duplicate sample taken.
9) Sample was field filtered.
Bold denotes concentration above NC 2B Standard.
Bold/Shaded denotes concentration above NC 2B Standard and site-specific BSV.
Red denotes concentration above EPA Surface Water ESV (lower of acute or chronic).
Red/Shaded denotes concentration above EPA Surface Water RSV and site-specific BSV.
NS = Not Specified
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
(t) = Based upon measurement of total recoverable metal. See 15A NCAC 02B .0211 for more information.
Table shows constituents detected in surface water samples within the past five years, excluding background samples. Refer to Appendix A for a summary of additional sampling data.



N

APPROXIMATE

0 2000 4000

SCALE IN FEET

U.S.G.S. QUADRANGLE MAP

CHAPEL HILL, NORTH CAROLINA, 2002

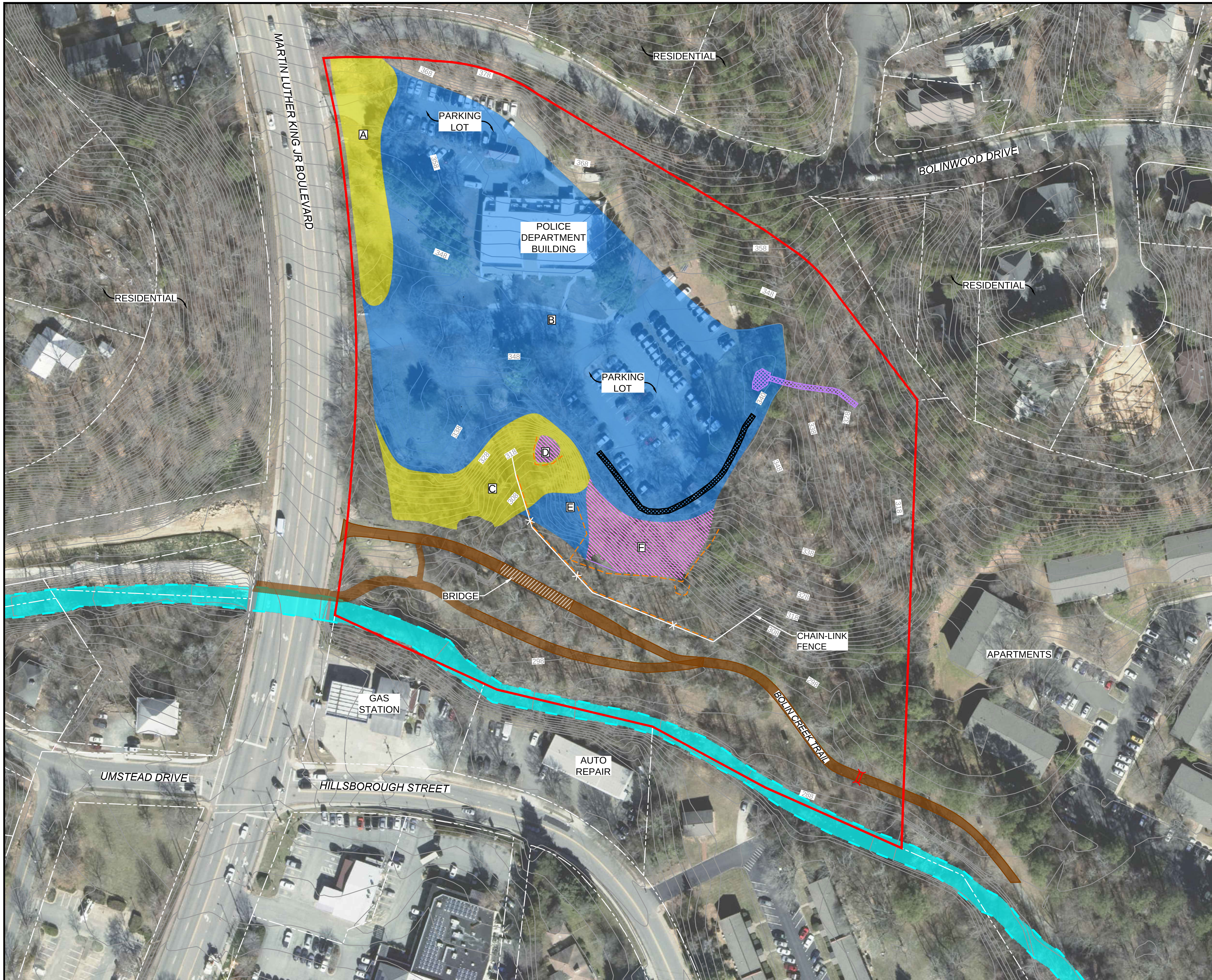
QUADRANGLE
7.5 MINUTE SERIES (TOPOGRAPHIC)

TITLE
SITE LOCATION MAP

PROJECT
TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS
2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE:	9-10-21	REVISION NO:	0
JOB NO:	TCH-009	FIGURE NO:	1



LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- 328 TOPOGRAPHIC CONTOUR ELEVATION (FT MSL)
- CCP UNDER > 2 FT COVER
- CCP UNDER < 2 FT COVER
- CCP EXPOSED AT GROUND SURFACE (HYDROSEEDED)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- SILT FENCE
- STORM DIVERSION CHANNEL
- STORM OUTFALL CHANNEL
- A CCP AREA DESIGNATION

TITLE

SITE MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 6-22-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 2

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\TCH.009 20210622-FIG2.dwg, FIG 2, 9/10/2021 1:16:15 PM, shaynes

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

SAMPLE LOCATION AND EXPOSURE UNIT MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

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704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 3

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 3, 9/21/2021 8:53:22 AM, shaynes

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3

SAMPLE DEPTH

CONCENTRATION (mg/kg)

RISK DRIVERS

NOTES:

1. ONLY COMPOUNDS THAT DRIVE EXCEEDANCES OF ACCEPTABLE RISK LEVELS (CARCINOGENIC RISK > 1.0E-04 AND HAZARD INDEX > 1.0) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

RESIDENTIAL HUMAN HEALTH RISK DRIVERS MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

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SMARTER ENVIRONMENTAL SOLUTIONS
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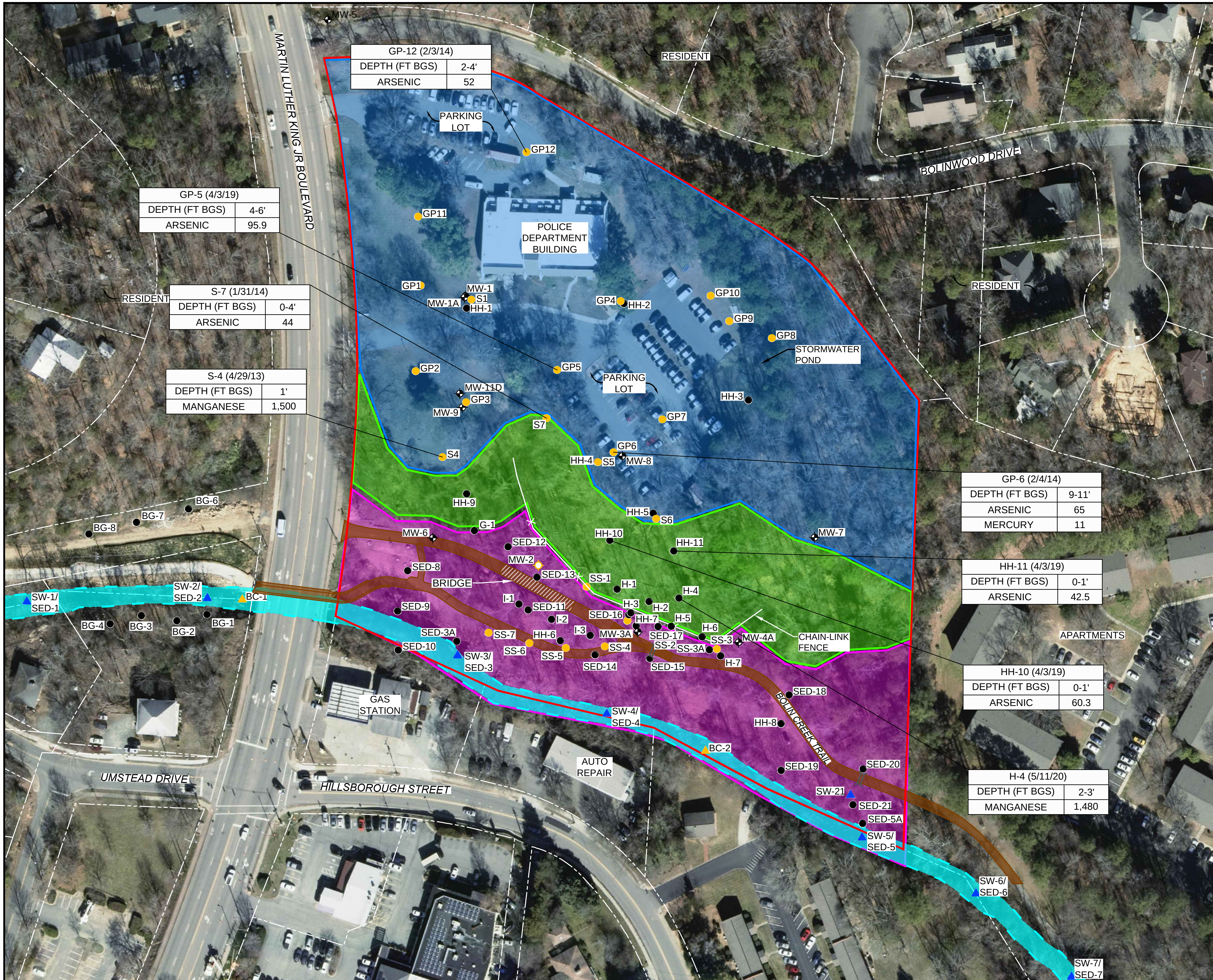
License # C-1269 / #C-245 Geology

DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 4A



LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
- SOIL SAMPLE LOCATION (H&H)
- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3

SAMPLE DEPTH

CONCENTRATION (mg/kg)

RISK DRIVERS

NOTES:

1. ONLY COMPOUNDS THAT DRIVE EXCEEDANCES OF ACCEPTABLE RISK LEVELS (CARCINOGENIC RISK > 1.0E-04 AND HAZARD INDEX > 1.0) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE

N

APPROXIMATE

0 115 230

SCALE IN FEET

TITLE

CONSTRUCTION WORKER HUMAN HEALTH RISK DRIVERS MAP

PROJECT

TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

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SMARTER ENVIRONMENTAL SOLUTIONS
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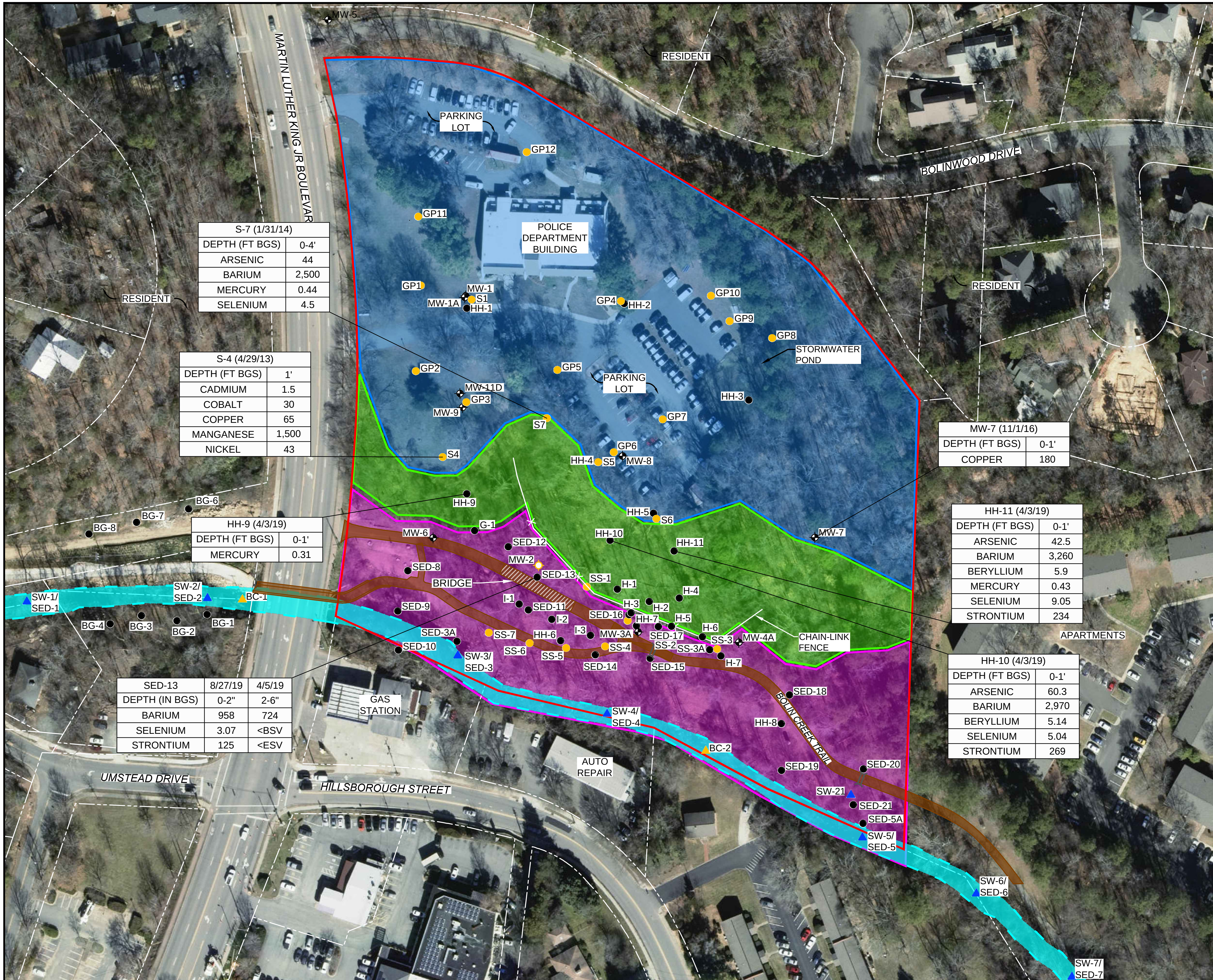
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 4B

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 4B, 9/30/2021 4:16:41 PM, shaynes



S-7 (1/31/14)	
DEPTH (FT BGS)	0-4'
ARSENIC	44
BARIUM	2,500
MERCURY	0.44
SELENIUM	4.5

S-4 (4/29/13)	
DEPTH (FT BGS)	1'
CADMIUM	1.5
COBALT	30
COPPER	65
MANGANESE	1,500
NICKEL	43

HH-9 (4/3/19)	
DEPTH (FT BGS)	0-1'
MERCURY	0.31

SED-13	8/27/19	4/5/19
DEPTH (IN BGS)	0-2"	2-6"
BARIUM	958	724
SELENIUM	3.07	<BSV
STRONTIUM	125	<ESV

MW-7 (11/1/16)	
DEPTH (FT BGS)	0-1'
COPPER	180

HH-11 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	42.5
BARIUM	3,260
BERYLLIUM	5.9
MERCURY	0.43
SELENIUM	9.05
STRONTIUM	234

HH-10 (4/3/19)	
DEPTH (FT BGS)	0-1'
ARSENIC	60.3
BARIUM	2,970
BERYLLIUM	5.14
SELENIUM	5.04
STRONTIUM	269

LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- MONITORING WELL LOCATION (H&H)
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- DRAINAGE PATHWAY, SURFACE WATER/SEDIMENT SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXPOSURE UNIT #1 - UPPER LEVEL
- EXPOSURE UNIT #2 - LOWER LEVEL
- EXPOSURE UNIT #3 - EMBANKMENT

SAMPLE ID & DATE
SAMPLE DEPTH
CONCENTRATION (mg/kg)
CONSTITUENT

S-4 (4/29/13)	
DEPTH (FT BGS)	1'
CADMIUM	1.5
COBALT	30
COPPER	65
MANGANESE	1,500
NICKEL	43

NOTES:

1. ONLY SAMPLES EXCEEDING ECOLOGICAL SCREENING VALUES (ESVs) AND BACKGROUND SCREENING VALUES (BSVs) ARE SHOWN.
2. FT BGS = FEET BELOW GROUND SURFACE
IN BGS = INCHES BELOW GROUND SURFACE
mg/kg = MILLIGRAMS PER KILOGRAM

N
APPROXIMATE
0 115 230
SCALE IN FEET

TITLE
ECOLOGICAL RISK DRIVERS MAP

PROJECT
TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
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DATE: 9-10-21	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 5

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-009 - Police Station - Remedial Services\Risk Assessment\Figures\Figures_20210831.dwg, FIG 5, 9/21/2021 9:00:43 AM, shaynes

Appendix A

Historical Data Tables and Figures

Table A-1 (page 1 of 2)
Summary of Post-IRM Soil Analytical Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth (ft or in bgs)	aluminum	antimony	arsenic	barium	beryllium	boron	cadmium	calcium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	iron	lead	magnesium	manganese	mercury	molybdenum	nickel	potassium	selenium	silver	sodium	strontium	thallium	vanadium	zinc
Site-Specific BSV(1)				NA	ND	3.015	87.86	0.929	NA	0.313	NA	5.725	70.2	70.2	36.31	77.3	NA	59.11	NA	1,149	0.256	NA	19.49	NA	2.503	NA	NA	43.19	0.981*	227	230
PSRG - Protection of Groundwater(2)				110,000	0.90	5.8	580	63	45	3.0	NS	3.8	360,000	NS	0.90	700	150	270	NS	65	1.0	7.1	130	NS	2.1	3.4	NS	1,500	0.28	350	1,200
PSRG - Residential Health-based(2)				16,000	6.3	0.68	3,100	31	3,100	14	NS	0.31	23,000	NS	4.7	630	11,000	400	NS	380	2.3	78	310	NS	78	78	NS	9,400	0.16	78	4,700
PSRG - Industrial/Commercial Health-based(2)				230,000	93	3.0	47,000	470	47,000	200	NS	6.5	350,000	NS	70	9,300	160,000	800	NS	5,600	9.7	1,200	4,700	NS	1,200	1,200	NS	140,000	2.3	1,200	70,000
Upper Level Samples																															
S-4	04/29/13	CCP	1 ft	23,000	ND	14	24	ND	NA	1.5	9,900	NA	NA	22	30	65	59,000	20	9,000	1,500	0.011	NA	43	680	ND	ND	150	NA	ND	21	120
S-5	01/31/14	CCP	0-4 ft	NA	NA	37	2,800	NA	NA	ND	NA	1.3	19.7	21	NA	NA	NA	10	NA	NA	0.30	NA	NA	NA	3.2	ND	NA	NA	NA	NA	NA
S-6	01/31/14	CCP	0-4 ft	NA	NA	43	3,200	NA	NA	ND	NA	2.7	19.3	22	NA	NA	NA	12	NA	NA	0.42	NA	NA	NA	6.1	ND	NA	NA	NA	NA	NA
GP-1	02/03/14	CCP	8-12 ft	NA	NA	3.5	86	NA	NA	ND	NA	ND	8.8	8.8	NA	NA	NA	26	NA	NA	0.083	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
GP-2	02/03/14	CCP	26-28 ft	NA	NA	41	1,100	NA	NA	ND	NA	ND	19	19	NA	NA	NA	11	NA	NA	0.24	NA	NA	NA	4.0	ND	NA	NA	NA	NA	NA
GP-3	02/03/14	CCP	10-12 ft	NA	NA	48	1,200	NA	NA	ND	NA	0.53	22.47	23	NA	NA	NA	39	NA	NA	0.42	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
GP-4	02/04/14	CCP	10-12 ft	NA	NA	59	2,900	NA	NA	ND	NA	ND	20	20	NA	NA	NA	11	NA	NA	0.51	NA	NA	NA	5.8	ND	NA	NA	NA	NA	NA
GP-5	02/04/14	CCP	4-6 ft	NA	NA	72	2,800	NA	NA	ND	NA	ND	19	19	NA	NA	NA	9.5	NA	NA	0.33	NA	NA	NA	2.6	ND	NA	NA	NA	NA	NA
	04/03/19	CCP	4-6 ft	NA	NA	95.9	2,350	5.46	NA	<0.956	NA	0.836 J	12.3	13.1	7.05	50.9	NA	NA	NA	34.7	1.2	NA	11.1	NA	12	NA	NA	325	NA	NA	NA
	04/03/19(3)	CCP	4-6 ft	NA	NA	95.9	2,630	6.99	NA	<0.931	NA	0.712 J	16.2	16.9	10.3	62.5	NA	NA	NA	53.4	0.39	NA	17.1	NA	13	NA	NA	308	NA	NA	NA
GP-6	02/04/14	CCP	9-11 ft	NA	NA	65	850	NA	NA	ND	NA	ND	19	19	NA	NA	NA	27	NA	NA	11	NA	NA	NA	4.1	ND	NA	NA	NA	NA	NA
	04/04/19	CCP	9-10 ft	NA	NA	6.73	178	0.758	NA	0.118 J	NA	<1.11	10.0	10	5.18	11	NA	NA	NA	687	0.050	NA	6.24	NA	0.88	NA	NA	21.7	NA	NA	NA
GP-7	02/04/14	CCP	10-12 ft	NA	NA	55	1,700	NA	NA	ND	NA	ND	19	19	NA	NA	NA	11	NA	NA	0.26	NA	NA	NA	4.3	ND	NA	NA	NA	NA	NA
GP-8	02/04/14	CCP	11-15 ft	NA	NA	54	4,100	NA	NA	ND	NA	ND	20	20	NA	NA	NA	9.2	NA	NA	0.29	NA	NA	NA	4.5	ND	NA	NA	NA	NA	NA
GP-11	02/04/14	CCP	4-6 ft	NA	NA	16	450	NA	NA	ND	NA	ND	16	16	NA	NA	NA	23	NA	NA	0.35	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
GP-12	02/04/14	CCP	2-4 ft	NA	NA	52	2,000	NA	NA	ND	NA	ND	19	19	NA	NA	NA	14	NA	NA	0.28	NA	NA	NA	2.1	ND	NA	NA	NA	NA	NA
HH-1	11/03/16	Soil	0-1 ft	NA	<0.29	5.9	120	1.00	NA	<0.29	NA	0.45	20.55	21	7.9	25	NA	27	NA	350	0.052	NA	8.8	NA	0.69	NA	NA	31	<0.58	48	50
	11/03/16(3)	Soil	0-1 ft	NA	<0.35	3.4	110	0.79	NA	<0.35	NA	0.54	19.46	20	8.4	17	NA	18	NA	360 BH	0.067	NA	12	NA	<0.71	NA	NA	30	<0.71	41	35
HH-2	11/03/16	Soil	0-1 ft	NA	<0.29	4.9	140	0.93	NA	<0.29	NA	0.43	13.57	14	12	21	NA	30	NA	260	0.085	NA	5.9	NA	1.0	NA	NA	25	<0.58	48	43
HH-3	11/03/16	Soil	0-1 ft	NA	<0.33	9.9	200	1.30	NA	<0.33	NA	0.46 J	17.54	18	7.8	31	NA	24	NA	350	0.076	NA	8.9	NA	2.4	NA	NA	36	<0.65	53	100
HH-4	11/03/16	Soil	0-1 ft	NA	<0.28	2.4	72	1.00	NA	<0.28	NA	0.50	44.5	45	16	37	NA	2.3	NA	630	<0.023	NA	33	NA	<0.56	NA	NA	42	0.60	73	70
HH-5	11/03/16	Soil	0-1 ft	NA	<0.30	2.4	73	0.75	NA	<0.30	NA	<0.14	23	23	8.4	19	NA	9.3	NA	410	<0.025	NA	14	NA	1.2	NA	NA	23	<0.60	39	51
MW-7	11/01/16	Soil	0-1 ft	NA	<0.30	2.6	67	0.87	NA	<0.30	NA	0.89	9.11	10	3.9	180	NA	7.6	NA	100	0.030	NA	2.9	NA	<0.59	NA	NA	6.7	<0.59	61	46
Embankment Samples																															
S-7	01/31/14	CCP	0-4 ft	NA	NA	44	2,500	NA	NA	ND	NA	1.4	27.6	29	NA	NA	NA	11	NA	NA	0.44	NA	NA	NA	4.5	ND	NA	NA	NA	NA	NA
HH-9	04/03/19	CCP	0-1 ft	NA	NA	3.37	131	0.398 J	NA	0.178 J	NA	<1.29	12.7	12.7	5.97	14.5	NA	NA	NA	260	0.31	NA	3.59	NA	0.722	NA	NA	33.2	NA	NA	NA
HH-10	04/03/19	CCP	0-1 ft	NA	NA	60.3	2,970	5.14	NA	0.162 J	NA	<1.60	13.8	13.8	9.84	51.3	NA	NA	NA	73.3	0.22	NA	17.1	NA	5.04	NA	NA	269	NA	NA	NA
HH-11	04/03/19	CCP	0-1 ft	NA	NA	42.5	3,260	5.9	NA	0.220 J	NA	0.467 J	18.7	19.2	13.4	55.3	NA	NA	NA	113	0.43	NA	23.5	NA	9.05	NA	NA	234	NA	NA	NA
Lower Level Samples																															
SS-7	02/18/16	Soil	2-12 in	NA	ND	3.1	84	0.60	ND	ND	NA	NA	NA	14	6.9	15	NA	13	NA	500	0.038	ND	5.9	NA	ND	ND	NA	31	ND	37	37
HH-8	10/27/16	Soil	0-1 ft	NA	<0.30	3.6	100	1.00	NA	<0.30	NA	<0.35	19	19	12	29	NA	18	NA	570	0.036	NA	9.0	NA	<0.60	NA	NA	28	<0.60	52	54
MW-6	11/02/16	Soil	0-1 ft	NA	<0.26	2.9	38	0.61	NA	<0.26	NA	0.21 J	9.79	10	9.5	23	NA	12	NA	570	0.082	NA	8.2	NA	1.0	NA	NA	22	0.81	31	77
SED-3A	04/05/19	Soil	0-1 ft	NA	NA	3.45	33.9	0.418 J	NA	<0.582	NA	<1.16	17.4	17.4	16.5	6.97	NA	NA	NA	560	<0.0054	NA	5.82	NA	0.237 J	NA	NA	9.6	NA	NA	NA
SED-5A	04/04/19	Soil	0-1 ft	NA	NA	1.25	13.5	0.156 J	NA	<0.571	NA	0.352 J	13.2	13.6	5.95	39.1	NA	NA	NA	243	0.0071	NA	4.38	NA	<0.571	NA	NA	10.9	NA	NA	NA
SED-8	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	2.41	49.1	0.313 J	NA	0.122 J	NA	<1.25	12.0	12	7.01	14.3	NA	NA	NA	423	0.063	NA	4.66	NA	1.01	NA	NA	15.2	NA	NA	NA
SED-9	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	1.16	33.8	0.199 J	NA	<0.660	NA	0.461 J	21.6	22.1	9.11	10.1	NA	NA	NA	431	0.013	NA	6.68	NA	<0.660	NA	NA	16.7	NA	NA	NA
SED-10	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	1.29	24.4	0.118 J	NA	0.221 J	NA	0.418 J	12.0	12.4	4.43	10.8	NA	NA	NA	195	0.037	NA	4.03	NA	0.273 J	NA	NA	8.1	NA	NA	NA
SED-12	08/27/19	Drainage Pathway Soil	0-2 in	NA	NA	4.73	102	0.765 J	NA	0.214 J	NA	<1.68	27.6	27.6	6.17	23.1	NA	NA	NA	341	0.042	NA	7.69	NA	0.961	NA	NA	25.4	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	3.97	122	0.499 J	NA	0.204 J	NA	<1.74	9.45	9.45 B	6.04	19.7	NA	NA	NA	319	0.077	NA	4.95	NA	1.36	NA	NA	32.8	NA	NA	NA
SED-13	08/27/19	Drainage Pathway Soil	0-2 in	NA	NA	12.4	958	1.56	NA	0.284 J	NA	<2.03	29.4	29.4	13.9	38.9	NA	NA	NA	538	0.12	NA	19.2	NA	3.07	NA	NA	125	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	14.5	724	1.1	NA	0.171 J	NA	<1.58	14.0	14	7.58	27.1	NA	NA	NA	563	0.075	NA	8.73	NA	1.69	NA	NA	70.5	NA	NA	NA
SED-18	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	4.53	137	0.534 J	NA	<0.689	NA	<1.38	18.7	18.7	11.1	28.2	NA	NA	NA	464	0.051	NA	9	NA	1.85	NA	NA	32.6	NA	NA	NA
SED-19	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	1.55	20.0	0.161 J	NA	<0.588	NA	0.435 J	21.7	22.1	7.98	8.38	NA	NA	NA	266	0.0073	NA	4.94	NA	0.334 J	NA	NA	15	NA	NA	NA
SED-20	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	0.792	31.4	0.152 J	NA	<0.687	NA	<1.37	5.76	5.76 B	4.5	9.1	NA	NA	NA	360	0.012	NA	2.19	NA	0.263 J	NA	NA	11.5	NA	NA	NA
SED-21	04/05/19	Drainage Pathway Soil	2-6 in	NA	NA	1.12	25.9	0.149 J	NA	<0.591	NA	<1.18	20.9	20.9	4.44	6.58	NA	NA	NA	221	0.011	NA	2.7	NA	0.286 J	NA	NA	12.8	NA	NA	NA
Excavation G-1	04/16/20	Soil	2-3 ft	NA	NA	3.68	58.8	<3.08	NA	<1.23	NA	0.478 J	20.0	20.5	5.73	14.5	NA	NA	NA	193	0.052	NA	6.94	NA	<3.08	NA	NA	6.2	NA	NA	NA
Excavation H-1	05/11/20	Soil	1-2 ft	NA	NA	1.16	37.2	<2.76	NA	<1.10	NA	<1.10	20.1	20.1	10.7	15.3	NA	NA	NA	412	<0.0442	NA	5.80	NA	<2.76	NA	NA	29.3	NA	NA	NA
Excavation H-2	05/11/20	Soil	1-2 ft	NA	NA	1.93	100	<3.25	NA	<1.30	NA	0.578 J	43.8	44.4	19.1	59.2	NA	NA	NA	265	0.0494 J	NA	16.2	NA	1.58 J	NA	NA	56.8	NA	NA	NA
Excavation H-3	05/11/20	Soil	1-2 ft	NA	NA	2.41	71.0	<3.28	NA	<1.31	NA	0.410 J	40.2	40.6	14.1	43.4	NA	NA	NA	251	0.0485 J	NA	12.5	NA	1.46 J	NA	NA	58.1	NA	NA	NA
Excavation H-4	05/11/20	Soil	2-3 ft	NA	NA	2.03	67.1	<3.04	NA	<1.22	NA	0.388 J	25.8	26.2	20.8	24.0	NA	NA	NA	1,480	0.0237 J	NA	7.81	NA	<3.04	NA	NA	38.1	NA	NA	NA
Excavation H-5	05/11/20	Soil	1-2 ft	NA	NA	1.10 J	74.5	<3.04	NA	<1.22	NA	0.497 J	21.1	21.6	8.25	16.9	NA	NA	NA	558	<0.0486	NA	6.77	NA	<3.04	NA	NA	32.2	NA	NA	NA
Excavation H-6	05/11/20	Soil	1-2 ft	NA	NA	1.02 J	96.0	<2.97	NA	<1.19	NA	<1.19	14.9	14.9	7.57	10.7	NA	NA	NA	557	0.0222 J	NA	4.03	NA	<2.97	NA	NA	20.5	NA	NA	NA
Excavation H-7	11/09/20	Soil	0-1 ft	NA	NA	1.10 J	73.7	0.767 J	NA	<1.22	NA	<1.22	8.04	8.04	3.68	15.0	NA	NA	NA	233	0.022	NA	4.63	NA	0.479 J	NA	NA	9.6	NA	NA	NA
Excavation I-1	04/08/20	Soil	1-2 ft	NA	NA	2.91	67.2	<2.77	NA	<1.11	NA	0.457 J	26.2	26.7	13.0	18.3	NA	NA	NA	594	0.042	NA	8.25	NA	<2.77	NA	NA	26.3	NA	NA	NA
Excavation I-2	04/08/20	Soil	1-2 ft	NA	NA	3.65	74.1	<2.85	NA	<1.14	NA	0.313 J	23.3	23.6	12.0	21.4	NA	NA	NA	544	0.022	NA	8.70	NA	<2.85	NA	NA	17.2	NA	NA	NA
Excavation I-3	04/08/20	Soil	1-2 ft	NA	NA	2.18	61.5	<2.88	NA	<1.15	NA	0.387 J	13.1	13.5	9.23	19.5	NA	NA	NA	419	0.019	NA	6.02	NA	<2.88	NA	NA	13.3	NA	NA	NA

Table A-1 (page 2 of 2)
Summary of Post-IRM Soil Analytical Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
<u>H&H Job No. TCH-009</u>

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth (ft or in bgs)	aluminum	antimony	arsenic	barium	beryllium	boron	cadmium	calcium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	iron	lead	magnesium	manganese	mercury	molybdenum	nickel	potassium	selenium	silver	sodium	strontium	thallium	vanadium	zinc
Site-Specific BSV[1]				NA	ND	3.015	87.86	0.929	NA	0.313	NA	5.725	70.2	70.2	36.31	77.3	NA	59.11	NA	1,149	0.256	NA	19.49	NA	2.503	NA	NA	43.19	0.981*	227	230
PSRG - Protection of Groundwater[2]				110,000	0.90	5.8	580	63	45	3.0	NS	3.8	360,000	NS	0.90	700	150	270	NS	65	1.0	7.1	130	NS	2.1	3.4	NS	1,500	0.28	350	1,200
PSRG - Residential Health-based[2]				16,000	6.3	0.68	3,100	31	3,100	14	NS	0.31	23,000	NS	4.7	630	11,000	400	NS	380	2.3	78	310	NS	78	78	NS	9,400	0.16	78	4,700
PSRG - Industrial/Commercial Health-based[2]				230,000	93	3.0	47,000	470	47,000	200	NS	6.5	350,000	NS	70	9,300	160,000	800	NS	5,600	9.7	1,200	4,700	NS	1,200	1,200	NS	140,000	2.3	1,200	70,000
Background Samples																															
MW-5 (background)	11/02/16	Soil	0-1 ft	NA	<0.30	2.1	76	0.99	NA	<0.30	NA	0.43 J	17.57	18	27	49	NA	4.0	NA	710	<0.023	NA	5.0	NA	<0.59	NA	NA	25	<0.59	190	47
	11/02/16	Soil	6-7 ft	NA	<0.27	1.4	61	0.60	NA	<0.27	NA	0.81	38.19	39	19	18	NA	0.55	NA	940	<0.020	NA	20	NA	<0.53	NA	NA	29	<u>**2.3**</u>	67	75
BG-1 (background)	11/03/16	Soil	0-1 ft	NA	<0.28	1.9	36	0.39	NA	<0.28	NA	0.87	17.13	18	6.3	16	NA	25	NA	310	0.033	NA	5.4	NA	1.6	NA	NA	15	<0.57	34	43
	11/03/16	Soil	2-3 ft	NA	<0.29	2.3	45	0.48	NA	<0.29	NA	<0.12	19	19	7.3	18	NA	43	NA	440	0.280	NA	6.2	NA	1.6	NA	NA	15	<0.57	35	49
BG-2 (background)	11/03/16	Soil	0-1 ft	NA	<0.28	1.9	45	0.50	NA	<0.28	NA	0.84	16.16	17	7.4	18	NA	32	NA	410	0.045	NA	4.9	NA	1.1	NA	NA	14	<0.56	35	44
	11/03/16	Soil	2-3 ft	NA	<0.27	1.9	52	0.53	NA	<0.27	NA	0.70	23.3	24	7.5	20	NA	26	NA	450	0.038	NA	7.9	NA	1.7	NA	NA	19	<0.55	37	45
BG-3 (background)	11/03/16	Soil	0-1 ft	NA	<0.30	1.7	44	0.43	NA	<0.30	NA	0.21 J	23.3	16	7.5	15	NA	25	NA	410	0.024	NA	5.1	NA	1.4	NA	NA	46	<0.60	37	40
	11/03/16	Soil	2-3 ft	NA	<0.27	2.2	56	0.54	NA	<0.27	NA	0.88	21.12	22	7.5	18	NA	29	NA	410	0.040	NA	5.2	NA	1.2	NA	NA	19	<0.53	40	46
BG-4 (background)	11/03/16	Soil	0-1 ft	NA	<0.29	1.7	50	0.50	NA	<0.29	NA	<0.13	19	19	9.5	16	NA	22	NA	450 BH	0.026	NA	6.0	NA	<0.59	NA	NA	16 A	<0.59	53	50
	11/03/16	Soil	2-3 ft	NA	<0.33	2.0	53	0.52	NA	0.38	NA	0.50 J	22.5	23	11	23	NA	21	NA	460 BH	0.054	NA	8.5	NA	<0.65	NA	NA	19	<0.65	51	230
BG-6 (background)	04/03/19	Soil	0-1 ft	NA	NA	2.05 O1	64.4	0.625	NA	0.177 J	NA	5.34	39.4	44.7	14.4	26.4	NA	NA	NA	448 J6	0.022	NA	12.8	NA	0.562 J	NA	NA	17	NA	NA	NA
	04/04/19	Soil	2-3 ft	NA	NA	2.29	66.3	0.507 J	NA	0.139 J	NA	<1.19	22.9	22.9	14.7	32.3	NA	NA	NA	467	0.032	NA	7.78	NA	0.828	NA	NA	16.8	NA	NA	NA
BG-7 (background)	04/03/19	Soil	0-1 ft	NA	NA	1.97	52.7	0.410 J	NA	0.136 J	NA	<1.16	70.2	70.2	18.9	36.4	NA	NA	NA	813	0.025	NA	12.8	NA	0.543 J	NA	NA	22.6	NA	NA	NA
	04/04/19	Soil	2-3 ft	NA	NA	<u>3.08</u>	77.9	0.430 J	NA	0.108 J	NA	<1.16	27	27	16.3	32.5	NA	NA	NA	548	0.023	NA	6.2	NA	0.502 J	NA	NA	24.3	NA	NA	NA
BG-8 (background)	04/03/19	Soil	0-1 ft	NA	NA	1.8	52.4	0.370 J	NA	0.0951 J	NA	<1.14	24.5	24.5	21.8	62.8	NA	NA	NA	759	0.0072	NA	9.04	NA	0.485 J	NA	NA	24.4	NA	NA	NA
	04/04/19	Soil	2-3 ft	NA	NA	1.66	47.6	0.293 J	NA	0.0918 J	NA	<1.14	21.7	21.7	23.5	60.2	NA	NA	NA	732	<0.0067	NA	7.86	NA	0.306 J	NA	NA	25.1	NA	NA	NA

Notes:
Concentrations reported in milligrams per kilogram (mg/kg).
1) Site-Specific Background Screening Value (BSV) represents 95% upper threshold level (UTL) with 95% coverage calculated using EPA ProUCL 5.1.
*Insufficient data to calculate 95% UTL; therefore, site-specific BSV indicates 2x mean concentration with non-detect concentrations calculated as half the reporting limit.
2) North Carolina Department of Environmental Quality (DEQ) Preliminary Soil Remediation Goals (PSRGs) (June 2021)
3) Duplicate sample taken
Bold denotes concentration above or equal to Protection of Groundwater PSRG and site-specific BSV
Shading indicates concentration above or equal to Residential PSRG and site-specific BSV.
<u>Underlining</u> indicates concentration above or equal to Industrial/Commercial PSRG and site-specific BSV
ND = Not Detected; NA = Not Analyzed; NS = Not Specified; NC = Not Calculated
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
O1 = Analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.
BH = Method blank greater than one-half laboratory reporting limit, but sample concentration greater than 10x the method blank.
A = Continuing Calibration Verification standard recovery (82%) is less than the lower control limit (90%). Result has possible low bias.
Excavated sample locations are not shown in table.
Analytical Methods
Metals by EPA Method 6010C or 6020B
Hexavalent Chromium by EPA Method 7196 or 7199 (Phase II RI and April 2019 Data Gap Samples)
Mercury by EPA Method 7471B

Table A-2 (page 1 of 1)
Summary of Stream Sediment Analytical Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Sediment Sampling Point ID	Sample Date	antimony	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	lead	manganese	mercury	nickel	selenium	strontium	thallium	vanadium	zinc
Site-Specific BSV[1]		ND	2.74	38.4	0.48	ND	0.79	69.5	70	16.388	13.8	7.1	759	0.0078	9.92	0.409	16.9	ND	37	34
PSRG - Protection of Groundwater[2]		0.90	5.8	580	63	3.0	3.8	360,000	NS	0.90	700	270	65	1.0	130	2.1	1,500	0.28	350	1,200
PSRG - Residential[2]		6.3	0.68	3,100	31	14	0.31	23,000	NS	4.7	630	400	380	2.3	310	78	9,400	0.16	78	4,700
PSRG - Industrial/Commercial[2]		93	3.0	47,000	470	200	6.5	350,000	NS	70	9,300	800	5,600	9.7	4,700	1,200	140,000	2.3	1,200	70,000
SED-1 (Upstream)	10/27/16	<0.32	1.2	12	<0.32	<0.32	0.24 J	22.76	23	3.9	4.2	4.0	180	<0.026	3.8	<0.64	6.9	<0.64	19	19
	04/05/19	NA	1.95 O1	38.4 J6	0.249 J	<0.636	0.428 J	65.0	65.4 J3, J6	7.63	8.42	NA	449 J6	0.0078	7.1	0.409 J	8.4	NA	NA	NA
SED-2 (Upstream)	10/27/16	<0.33	2.1	20	0.48	<0.33	<0.40	36	36	7.8	8.0	7.1	330	<0.025	7.2	<0.65	11	<0.65	37	34
	10/27/16[3]	<0.32	2.5	17	0.45	<0.32	<0.40	49	49	6.5	9.1	6.7	290	<0.026	6.0	<0.63	12	<0.63	35	31
	04/05/19	NA	2.74	29.6	0.305 J	<0.619	0.796 J	56.3	57.1	**20.9**	13.8	NA	**811**	0.0053 J	9.16	0.306 J	16.9	NA	NA	NA
	04/05/19[3]	NA	2.02	17.4	0.222 J	<0.617	0.546 J	69.5	70	7.29	6.79	NA	347	0.0051	9.92	0.237 J	8.8	NA	NA	NA
SED-3 (Adjacent)	10/27/16	<0.32	1.6	21	0.37	<0.32	<0.39	30	30	6.2	7.4	6.9	220	<0.026	6.8	<0.64	12	<0.64	29	35
	04/05/19	NA	1.36	16.4	0.111 J	<0.607	0.670 J	13.5	14.2	5.18	20.2	NA	225	0.0054 J	4.81	<0.607	9.2	NA	NA	NA
SED-4 (Adjacent)	10/27/16	<0.33	1.2	8.4	<0.33	<0.33	<0.38	34	34	3.5	5.2	3.5	130	<0.027	5.0	<0.65	6.4	<0.65	16	20
	04/05/19	NA	2.35	20.3	0.191 J	<0.586	0.456 J	63.8	64.3	7.26	8.39	NA	293	0.0080	10.5	0.344 J	30.7	NA	NA	NA
SED-5 (Downstream)	10/27/16	<0.31	1.4	44	0.41	<0.31	<0.37	51	51	9.5	8.6	22	**860**	<0.025	5.3	<0.62	13	<0.62	35	32
	04/04/19	NA	1.82	24.3	0.233 J	<0.617	0.595 J	16.8	17.4	5.9	8.86	NA	399	<0.0035	4.86	<0.617	6.2	NA	NA	NA
SED-6 (Downstream)	04/04/19	NA	1.96	17.3	0.247 J	<0.643	0.517 J	24.9	25.4	6.57	9.25	NA	308	0.0058	7.15	<0.643	8.4	NA	NA	NA
SED-7 (Downstream)	04/04/19	NA	1.35	16.4	0.179 J	<0.635	0.995 J	59.4	60.4	6.47	6.77	NA	262	0.0025 J	9.04	<0.635	8.1	NA	NA	NA

Notes
Concentrations reported in milligrams per kilogram (mg/kg).
1) Site-Specific Background Screening Value (BSV) indicates two times the mean detected background concentration or maximum detected background concentration, whichever is smaller.
2) North Carolina Department of Environmental Quality (DEQ) Preliminary Soil Remediation Goals (PSRGs) (July 2021)
3) Duplicate sample taken.
Bold denotes concentration above or equal to Protection of Groundwater PSRG and site-specific BSVs.
Shading indicates concentration above or equal to Residential PSRG and site-specific BSVs.
Underlining indicates concentration above or equal to Industrial/Commercial PSRG and site-specific BSVs.
ND - Not Detected; NA - Not Analyzed; NS - Not Specified
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
O1 = Analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
J3 = The associated batch QC was outside the established quality control range for precision.
J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.
Analytical Methods:
Metals by EPA Method 6010C, 6020A, or 6020B
Mercury by EPA Method 7470A
Hexavalent Chromium by EPA Method 7199A

Table A-3 (page 1 of 1)
Summary of Surface Water Analytical Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Surface Water Sampling Point ID	Sample Date	aluminum	antimony	arsenic	barium	beryllium	cadmium(3)	calcium	hexavalent chromium	trivalent chromium(3)	total chromium	cobalt	copper(3)	iron	lead(3)	magnesium	manganese	mercury	nickel(3)	potassium	selenium	strontium	silver(3)	sodium	thallium	vanadium	zinc(3)	Hardness
Site-Specific BSV		NA	ND	0.44	27	ND	ND	NA	ND	ND	0.53	0.16	1.2	ND	ND	NA	22.2	ND	0.33	NA	0.11	100	ND	NA	ND	ND	ND	54,000
NC 2B Standard(2)		NS	NS	10(t)	1,000(t)	6.5	0.27	NS	11	45.08	NS	NS	5.33	NS	1.29	NS	NS	0.012(t)	25(t)	NS	5(t)	NS	0.06	NS	NS	NS	70.07	NS
BC-1 (Upstream)	2/5/2014	NA	NA	ND	24	NA	ND	NA	ND	ND	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	ND	NA	NA	NA	NA	NA
SW-1 (Upstream)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	<10	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.44	23.1	<0.10	<0.080	NA	NA	NA	0.53	0.16	1.2	NA	NA	NA	22.2	<0.20	0.29 J	NA	0.096 J	85.3	NA	NA	NA	NA	NA	54,000
SW-2 (Upstream)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	11	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.42	23.2	<0.10	<0.080	NA	NA	NA	0.45 J	0.16	1.1	NA	NA	NA	21.2	<0.20	0.33 J	NA	0.11 J	85.5	NA	NA	NA	NA	NA	53,600
BC-2 (Bolin Creek at Site)	6/20/2013	290	ND	0.90	27	ND	ND	16,000	NA	ND	ND	0.37	2.6	860	0.50	5,300	100	ND	1.2	2,300	ND	NA	ND	7,800	ND	ND	45	NA
	2/5/2014	NA	NA	ND	24	NA	ND	NA	ND	ND	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	ND	NA	NA	NA	NA	NA
SW-3 (Adjacent)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	34	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	11/3/2016[4]	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	33	<0.2	<10	NA	<20	110	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.45	25.7	<0.10	<0.080	NA	NA	NA	0.62	0.26	2.8	NA	NA	NA	37.4	<0.20	0.50	NA	0.11 J	88.8	NA	NA	NA	NA	NA	55,900
SW-4 (Adjacent)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	25	<0.2	<10	NA	<20	110	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.42	23.6	<0.10	<0.080	NA	NA	NA	<0.50	0.14	1.0	NA	NA	NA	24.6	<0.20	0.26 J	NA	0.10 J	89.1	NA	NA	NA	NA	NA	57,100
	4/5/2019[4]	NA	NA	0.41	23.7	<0.10	<0.080	NA	NA	NA	<0.50	0.14	0.98	NA	NA	NA	24.8	<0.20	0.26 J	NA	0.088 J	87.7	NA	NA	NA	NA	NA	54,300
SW-5 (Downstream)	11/3/2016	NA	<5.0	<10	26	<2.0	<1.0	NA	<0.74U	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	24	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	4/4/2019	NA	NA	0.40	16.9	<0.10	<0.080	NA	NA	NA	<0.50	0.14	0.88	NA	NA	NA	19.5	<0.20	0.21 J	NA	0.12 J	81.8	NA	NA	NA	NA	NA	53,400
SW-6 (Downstream)	4/4/2019	NA	NA	0.40	16.9	<0.10	<0.080	NA	NA	NA	<0.50	0.14	0.84	NA	NA	NA	18.7	<0.20	0.21 J	NA	0.11 J	81.3	NA	NA	NA	NA	NA	53,400
SW-7 (Downstream)	4/4/2019	NA	NA	0.42	18.4	<0.10	<0.080	NA	NA	NA	<0.50	0.16	1.1	NA	NA	NA	23.1	<0.20	0.23 J	NA	0.10 J	86.7	NA	NA	NA	NA	NA	54,400
SW-21 (Drainage Pathway)	4/5/2019	NA	NA	0.40	32.1	<0.10	<0.080	NA	NA	NA	0.73	0.36	3.2	NA	NA	NA	29.5	<0.20	0.62	NA	0.11 J	69.9	NA	NA	NA	NA	NA	31,400
	4/5/2019[5]	NA	NA	0.15	18.3	<0.10	<0.080	NA	NA	NA	<0.50	0.094 J	3.1	NA	NA	NA	9.3	<0.20	0.43 J	NA	<0.50	43.5	NA	NA	NA	NA	NA	22,200

Notes:
Concentrations reported in micrograms per liter (μg/L).
1) Site-Specific Background Screening Value (BSV) indicates two times the mean detected background concentration or maximum detected background concentration, whichever is smaller.
2) North Carolina Surface Water Quality Standard (NC 2B Standard) adopted per 15A NCAC 2B Section .0100. Unless otherwise noted, values are the lowest of the Freshwater, Water Supply, and Human Health values because Boli Creek is a WS V classification surface water. Value shown is the lower of the acute versus chronic, where applicable.
3) 2B Standards derived using site-specific hardness data for surface water samples SW-1 through SW-7 and the DEQ Hardness-Dependent Metal Calculator dated July 26, 2021. Mean hardness for these samples was 54.5 mg/L.
4) Duplicate sample taken.
5) Sample was field filtered.
Bold denotes concentration above NC 2B Standard and site-specific BSV.
ND = Not Detected; NA = Not Analyzed; NS = Not Specified
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration
(t) = Based upon measurement of total recoverable metal. See 15A NCAC 02B .0211 for more information.
Analytical Methods:
Metals by 6010C, 6020A, or 6020B
Mercury by 7470A
Hexavalent chromium by 7199A
Total hardness by Standard Method 2340B

Table A-4 (page 1 of 1)
Summary of Well Construction and Groundwater Elevation Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

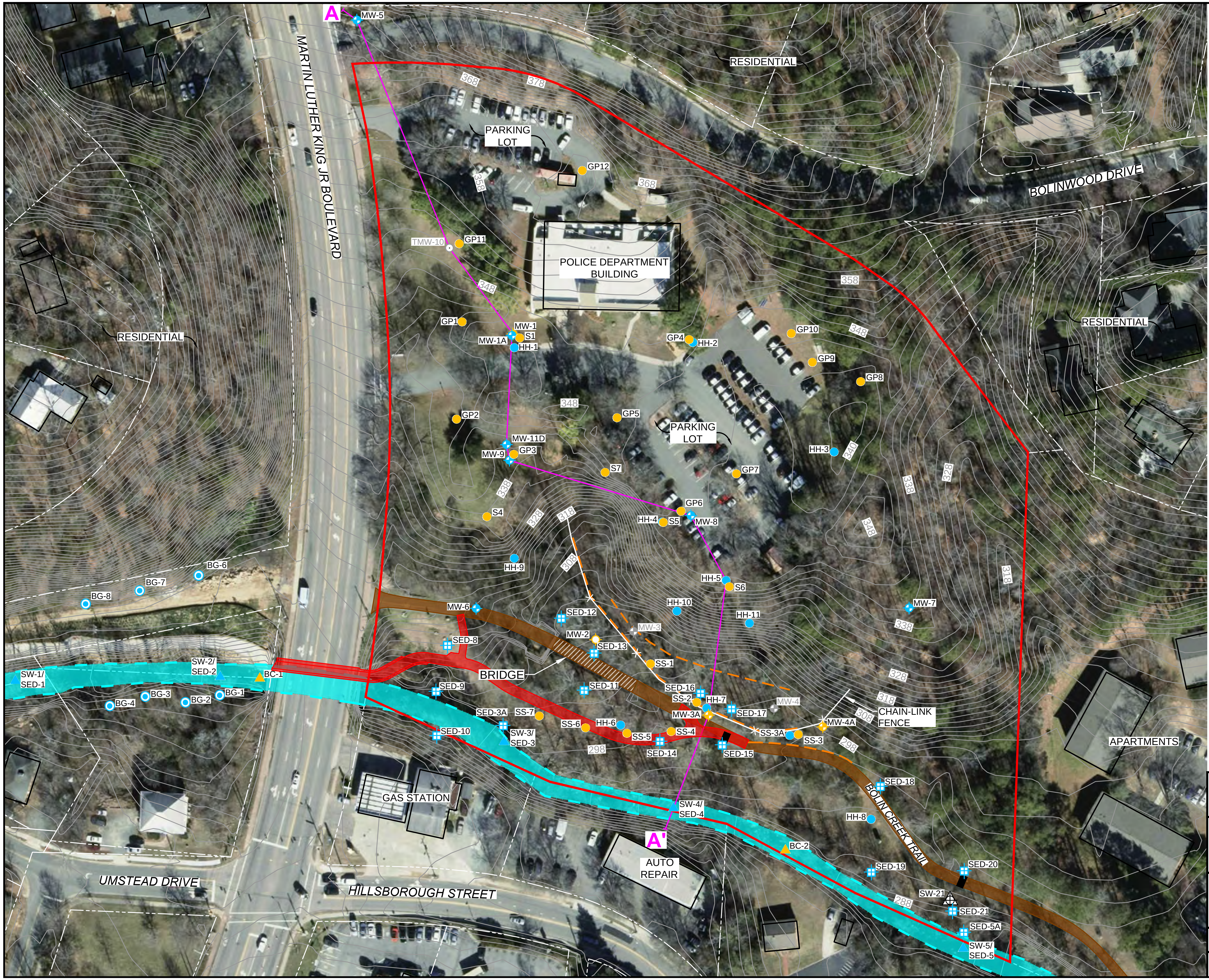
Well ID	Permanent or Temporary	Date Installed	Date Abandoned	Drilling Method	Well Material	Screen Slot Size (in)	Total Depth (ft bls)	Screened Interval	TOC Elevation (ft)	November 9, 2016		April 3, 2019		Sepember 26, 2019		February 12, 2020	
										Depth to Water (ft bls)	Groundwater Elevation (ft)	Depth to Water (ft bls)	Groundwater Elevation (ft)	Depth to Water (ft bls)	Groundwater Elevation (ft)	Depth to Water (ft bls)	Groundwater Elevation (ft)
MW-1	Permanent	4/29/2013	N/A	DPT	2" PVC	0.01	40	30-40	346.12	35.48	310.64	30.90	315.22	35.67	310.45	35.22	310.90
MW-1A	Permanent	9/24/2019	N/A	Sonic	2" PVC	0.01	40	25-40	345.96	--	--	--	--	31.43	314.53	30.27	315.69
MW-2	Temporary	6/20/2013	6/20/2013	HA	Unknown	Unknown	8	Unknown	--	--	--	--	--	--	--	--	--
MW-3	Permanent	1/27/2014	1/7/2015	Auger	2" PVC	0.01	11	6-11	--	--	--	--	--	--	--	--	--
MW-4	Permanent	1/27/2014	1/6/2015	Auger	2" PVC	0.01	9.2	4.2-9.2	--	--	--	--	--	--	--	--	--
MW-3A	Permanent	5/12/2015	N/A	Air Rotary	2" PVC	0.01	16	1-16	298.10	5.91	292.19	2.79	295.31	7.14	290.96	1.34	296.76
MW-4A	Permanent	5/14/2015	N/A	Air Rotary	2" PVC	0.01	19	4-19	298.00	6.72	291.28	3.20	294.80	7.83	290.17	2.22	295.78
MW-5	Permanent	11/2/2016	N/A	Air Rotary	2" PVC	0.01	27.5	17.5 - 27.5	369.33	9.27	360.06	7.03	362.30	10.24	359.09	9.67	359.66
MW-6	Permanent	11/2/2016	N/A	HSA	2" PVC	0.01	17.5	7.5 - 17.5	315.39	9.92	305.47	7.42	307.97	10.54	304.85	6.87	308.52
MW-7	Permanent	11/2/2016	N/A	Air Rotary	2" PVC	0.01	69.5	59.5 - 69.5	339.54	46.97	292.57	43.58	295.96	47.05	292.49	45.09	294.45
MW-8	Permanent	9/24/2019	N/A	Sonic	2" PVC	0.01	44.5	29.5-44.5	343.89	--	--	--	--	40.16	303.73	38.21	305.68
MW-9	Permanent	9/24/2019	N/A	Sonic	2" PVC	0.01	45.0	30-45	339.04	--	--	--	--	26.92	312.12	25.47	313.57
TMW-10	Temporary	9/24/2019	9/24/2019	Sonic	2" PVC	0.01	40.0	25-40	349.35	--	--	--	--	27.23*	322.12*	--	--
MW-11D	Permanent	2/11/2020	N/A	HSA / Air Rotary	2" PVC	0.01	56.0	46-56	339.29	--	--	--	--	--	--	31.85	307.44

Notes:
MW-1, MW-3A, MW-4A, MW-5, MW-6, and MW-7 were surveyed by CE Group on December 8, 2016.
MW-1A, MW-8, MW-9, and TMW-10 were surveyed by H&H on September 26, 2019.
MW-11D was surveyed by H&H on March 3, 2020.
ft = feet; bls = below land surface; in = inches
DPT = Direct Push Technology; HA = Hand Auger; HSA = Hollow Stem Auger
TOC = Top of Casing; -- = Not Specified; N/A = Not Applicable
* = Depth to water gauged on September 24, 2019.

Table A-5 (page 1 of 1)
Summary of Groundwater Analytical Data
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Monitoring Well ID	Sample Date	turbidity	alkalinity	aluminum	antimony*	arsenic	barium	beryllium	boron	cadmium	calcium	hexavalent chromium	trivalent chromium	Total chromium	cobalt*	copper	iron	lead	magnesium	manganese	mercury	molybdenum	nickel	potassium	selenium	silver	sodium	strontium	thallium*	vanadium*	zinc
2L Standard or IMAC		NS	NS	NS	1	10	700	4	700	2	NS	NS	NS	10	1	1,000	300	15	NS	50	1	NS	100	NS	20	20	NS	NS	0.2	0.3	1,000
MW-5 (Background)	11/9/2016	3.8	NA	NA	<0.5	<10	51	<2.0	NA	<1.0	NA	NA	NA	<5.0	0.27 J	<10	NA	<5.0	NA	**580**	<0.2	NA	<10	NA	**23**	NA	NA	190	<2.5	0.39 J	<30
	4/3/2017	8.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4.8	NA	<10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MW-1	5/3/2013	NA	NA	5,600	**5.4**	**85**	**1,100**	1.6	NA	0.17	110,000	NA	NA	**15**	**15**	25	**6,500**	5.8	25,000	**7,600**	ND	NA	12	7,600	2.5	ND	34,000	NA	**1.0**	**38**	52
	2/18/2016	NS	NA	NA	ND	**67**	**1,300**	**11.0**	ND	ND	NA	NA	NA	**100**	**78**	170	NA	**36**	NA	**9,600**	0.26	ND	58	NA	ND	ND	NA	2,900	ND	**260**	330
	2/18/2016[4]	NS	NA	NA	ND	**52**	**1,100**	**8.8**	ND	ND	NA	NA	NA	**86**	**61**	130	NA	**29**	NA	**9,000**	0.21	ND	46	NA	ND	ND	NA	2,700	ND	**200**	260
	11/10/2016	475.0	NA	NA	<0.5	**19**	470	**4.1**	NA	0.15 J	NA	NA	NA	**31**	**32**	57	NA	10	NA	**8,600**	<0.2	NA	21	NA	**23**	NA	NA	2,200	<2.5	**92**	99
	11/10/2016[4]	NA	NA	NA	<0.5	<10	160	0.53 J	NA	<1.0	NA	NA	NA	<5.0	**6.0**	<10	NA	<5.0	NA	**8,000**	<0.2	NA	2.3 J	NA	<20	NA	NA	2,100	<2.5	**1.2 J**	<30
	4/3/2019	7.76	NA	NA	NA	**22.9**	**1,730**	<0.10	NA	<0.080	NA	NA	NA	<0.50	**1.8**	0.33 J	NA	NA	NA	**3,090**	<0.20	NA	0.60	NA	<0.50	NA	NA	4,710	NA	NA	NA
MW-1A	9/26/2019	6.63	NA	NA	NA	**10**	**1,040**	<0.50	NA	<0.40	NA	NA	NA	<2.5	**1.2**	<2.5	NA	NA	NA	**2,420**	<0.20	NA	0.82 J	NA	<2.5	NA	NA	6,360	NA	NA	NA
MW-2	6/20/2013[1]	NA	NA	16,000	0.61	8.3	**1,100**	**5.5**	NA	0.93	260,000	NA	NA	8.4	**23**	**1,200**	**13,000**	**27**	47,000	**1,200**	0.18	NA	70	42,000	18	0.27	52,000	NA	**0.48**	**71**	**2,200**
MW-3	2/5/2014	NA	NA	NA	NA	ND	160	NA	NA	ND	NA	ND	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	2/5/2014[2]	NA	NA	NA	NA	ND	250	NA	NA	ND	NA	ND	NA	**24**	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	8/15/2014[3]	1,500	NA	NA	NA	**51**	**830**	NA	NA	ND	NA	30	NA	**78**	NA	NA	NA	**30**	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	8/20/2014[4]	13.0	NA	NA	NA	ND	220	NA	NA	ND	NA	23	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
MW-3A	7/21/2015	5.7	NA	NA	NA	ND	67	NA	520	ND	NA	ND	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	2/17/2016	1.3	NA	NA	ND	ND	89	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	ND	ND	ND	ND	NA	**23**	ND	NA	2,400	ND	ND	ND
	2/17/2016[2]	1.3	NA	NA	ND	ND	80	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	ND	NA	23	ND	ND	ND	NA	**26**	ND	NA	2,100	ND	ND	ND
	11/9/2016	1.2	NA	NA	<0.5	<10	53	<2.0	NA	<1.0	NA	NA	NA	<5.0	<0.11	<10	NA	<5.0	NA	14	<0.2	NA	<10	NA	**50**	NA	NA	2,400	**5.4 J**	**0.94 J**	12 J
	11/9/2016[2]	1.2	NA	NA	<0.5	<10	53	<2.0	NA	<1.0	NA	NA	NA	<5.0	<0.11	<10	NA	<5.0	NA	15	<0.2	NA	<10	NA	**52**	NA	NA	2,400	**5.3 J**	**0.95 J**	<30
	4/4/2019	0.00	NA	NA	NA	0.15	68.2	<0.10	NA	<0.080	NA	NA	NA	<0.50	0.21	0.55	NA	NA	NA	5.8	<0.20	NA	0.50 J	NA	**34.2**	NA	NA	2,950	NA	NA	NA
MW-4	2/5/2014	NA	NA	NA	NA	**140**	**6,500**	NA	NA	1.7	NA	ND	NA	**930**	NA	NA	NA	**250**	NA	NA	**1.4**	NA	NA	NA	**99**	ND	NA	NA	NA	NA	NA
	8/20/2014[4,5]	<10	NA	NA	NA	ND	75	NA	NA	ND	NA	ND	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
MW-4A	7/21/2015	24.7	NA	NA	NA	ND	64	NA	ND	ND	NA	ND	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	7/21/2015[4]	24.7	NA	NA	NA	ND	61	NA	ND	ND	NA	ND	NA	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
	2/18/2016	189.0	NA	NA	ND	ND	26	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	7.8	NA	49	ND	ND	ND	NA	ND	ND	NA	110	ND	ND	34
	2/18/2016[4]	189.0	NA	NA	ND	ND	33	ND	ND	ND	NA	NA	NA	ND	ND	ND	NA	8.4	NA	41	ND	ND	ND	NA	ND	ND	NA	78	ND	ND	48
	11/9/2016	4.8	NA	NA	<0.5	<10	36	<2.0	NA	<1.0	NA	NA	NA	1.2 J	<0.11	<10	NA	<5.0	NA	140	<0.2	NA	<10	NA	7.2 J	NA	NA	170	<2.5	<0.15	17 J
	4/4/2019	9.43	NA	NA	NA	<0.10	22.5	0.070 J	NA	<0.080	NA	NA	NA	<0.50	0.063 J	0.63	NA	NA	NA	6.0	<0.20	NA	1.5	NA	0.82	NA	NA	73	NA	NA	NA
MW-6	11/9/2016	2.5	NA	NA	<0.5	<10	340	<2.0	NA	<1.0	NA	NA	NA	**29**	<0.11	1.9 J	NA	<5.0	NA	**2,500**	<0.2	NA	22	NA	20	NA	NA	690	<2.5	**1.2 J**	<30
	4/3/2017	7.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	<4.8	NA	<10.0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4/4/2019	4.48	NA	NA	NA	0.14	283	<0.10	NA	<0.080	NA	NA	NA	<0.50	0.33	<0.50	NA	NA	NA	**2,210**	<0.20	NA	0.20 J	NA	0.12 J	NA	NA	752	NA	NA	NA
	4/4/2019[2]	4.48	NA	NA	NA	0.14	279	<0.10	NA	<0.080	NA	NA	NA	<0.50	0.32	0.50 J	NA	NA	NA	**2,160**	<0.20	NA	0.19 J	NA	0.11 J	NA	NA	736	NA	NA	NA
MW-7	11/14/2016	8.9	NA	NA	<0.5	<10	10	<2.0	NA	<1.0	NA	NA	NA	1.3 J	0.17 J	1.6 J	NA	<5.0	NA	140	<0.2	NA	1.6 J	NA	<20	NA	NA	42	<2.5	**1.1 J**	26 J
	4/3/2019	8.95	NA	NA	NA	0.13	4.5	<0.10	NA	<0.080	NA	NA	NA	<0.50	<0.050	0.72	NA	NA	NA	20.5	<0.20	NA	0.43 J	NA	0.10 J	NA	NA	44.9	NA	NA	NA
MW-8	9/26/2019	7.95	NA	NA	NA	6.1	219	<0.10	NA	<0.080	NA	NA	NA	0.51	**4.0**	0.98	NA	NA	NA	**4,880**	<0.20	NA	4.1	NA	<0.50	NA	NA	750	NA	NA	NA
MW-9	9/26/2019	1.74	NA	NA	NA	0.75	394	<0.20	NA	<0.16	NA	NA	NA	<1.0	**1.5**	2.1	NA	NA	NA	**5,060**	<0.20	NA	0.41 J	NA	<1.0	NA	NA	2,160	NA	NA	NA
	2/12/2020	1.10	377,000	NA	NA	0.78J	369	<0.10	NA	<0.10	118,000	NA	NA	<1.0	**2.3**	1.0	NA	NA	26,100	**5,430**	<0.20	NA	<1.0	12,400	<1.0	NA	24,900	2,380	NA	NA	NA
	2/12/2020[2]	1.10	377,000	NA	NA	0.74J	338	<0.10	NA	<0.10	113,000	NA	NA	<1.0	**2.5**	1.1	NA	NA	25,600	**5,170**	<0.20	NA	<1.0	12,100	<1.0	NA	24,100	2,310	NA	NA	NA
MW-11D	2/13/2020	8.59	413,000	NA	NA	1.5	24.1	<0.10	NA	<0.10	45,100	NA	NA	1.7	<1.0	2.2	NA	NA	30,300	14.7	<0.20	NA	5.5	145,000	0.74J	NA	65,400	604	NA	NA	NA

Notes:
Concentrations reported in micrograms per liter (µg/L), except turbidity which is reported in Nephelometric Turbidity Units (NTUs).
2L Standard = North Carolina Department of Environmental Quality (DEQ) 15A NCAC 02L.0202 Groundwater Standards (April 2013).
IMAC = Interim Maximum Allowable Concentration
Bold denotes concentration above or equal to the 2L Standard or IMAC and background levels
ND = Not Detected; NA = Not Analyzed; NS = Not Specified
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
*Reported to the method detection limit instead of laboratory reporting limit.
1) Denotes sample labeled as "Well #1" in the lab report associated with the Limited Phase II ESA prepared by Falcon.
2) Denotes duplicate sample taken.
3) Denotes sample labeled as "Well 1" in the lab report associated with the October 3, 2014 letter prepared by Falcon.
4) Denotes filtered sample.
5) An unfiltered sample was also collected from MW-4 on August 20, 2014 and the results were reported in mg/kg-wet, presumably because of the high sediment load. These data are not included in this table.
Analytical Methods:
Metals by EPA Method 6010C, 6020A, or 6020B
Hexavalent Chromium by EPA Method 7196A / SM3500
Mercury by 7470A/245.1



LEGEND

- SITE PROPERTY BOUNDARY
- BOLIN CREEK
- 101 TOPOGRAPHIC CONTOUR ELEVATION (FT MSL)
- MONITORING WELL LOCATION (FALCON ENGINEERING)
- TEMPORARY MONITORING WELL LOCATION (FALCON ENGINEERING)
- SOIL BORING LOCATION (FALCON ENGINEERING)
- SURFACE WATER SAMPLE LOCATION (FALCON ENGINEERING)
- ABANDONED MONITORING WELL LOCATION
- ABANDONED TEMPORARY MONITORING WELL LOCATION (H&H)
- MONITORING WELL LOCATION (H&H)
- SOIL BORING LOCATION (H&H)
- BACKGROUND SOIL BORING LOCATION (H&H)
- SURFACE WATER SAMPLE LOCATION (H&H)
- STORMWATER CULVERT
- BOLIN CREEK TRAIL
- EXISTING SILT FENCE
- A CROSS-SECTION TRANSECT LINE

NOTE:

EXISTING MONITORING WELLS & OCTOBER/ NOVEMBER 2016 SAMPLING LOCATIONS SURVEYED BY CE GROUP ON DECEMBER 8, 9, & 20, 2016.

N

APPROXIMATE
0 100 200
SCALE IN FEET

TITLE
CROSS-SECTION TRANSECT LOCATION MAP

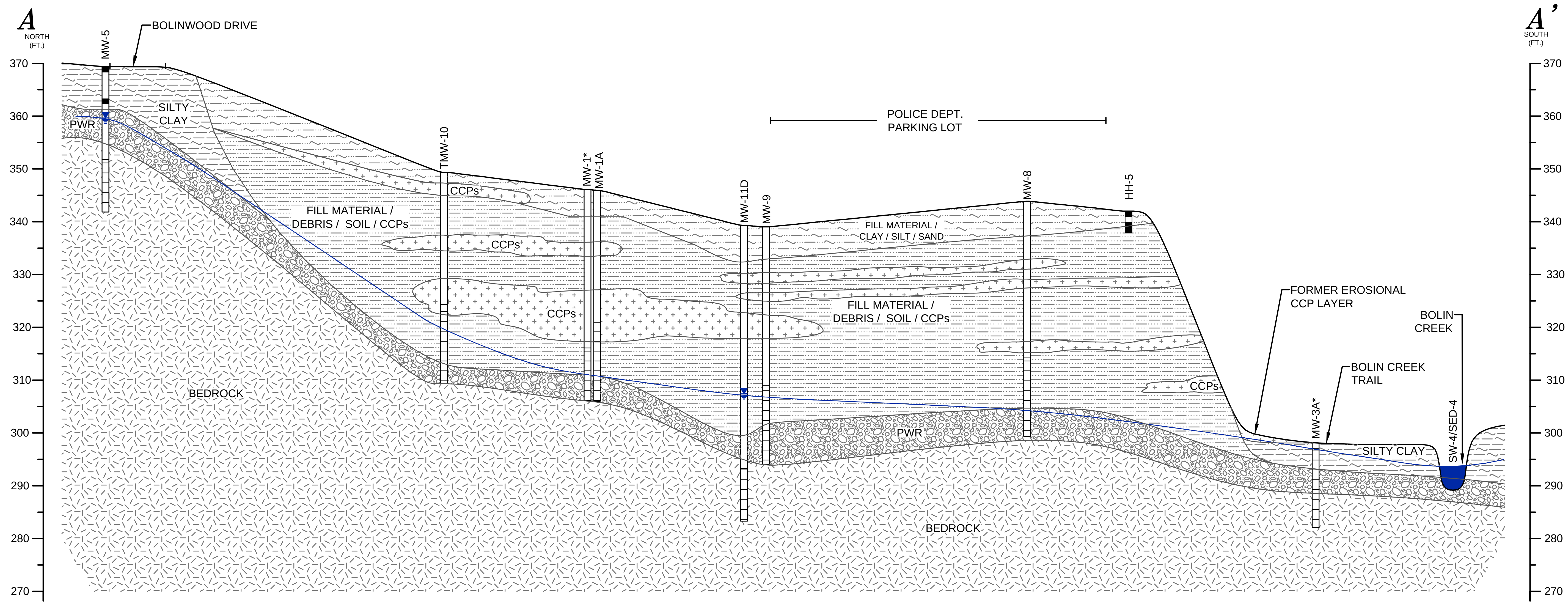
PROJECT
TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 4-22-20	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 3

S:\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-002 - Police Station\Ph II RI Work\Figures\Figures_3.26.20.dwg, FIG 3, 4/22/2020 3:00:11 PM, SVincent



LEGEND

HH-5 — SOIL BORING DEPICTING SAMPLE INTERVAL

MW-5 — MONITORING WELL DEPICTING SCREEN INTERVAL

320 — UNCONFINED AQUIFER (FEBRUARY 2020)

SILTY CLAY

FILL MATERIAL / CLAY / SILT / SAND

COAL COMBUSTION PRODUCTS (CCPs) - THICKER LAYERS

FILL MATERIAL, DEBRIS AND SOIL WITH INTERLAYERED AND INTERMIXED CCPs

PARTIALLY WEATHERED ROCK (PWR)

BEDROCK

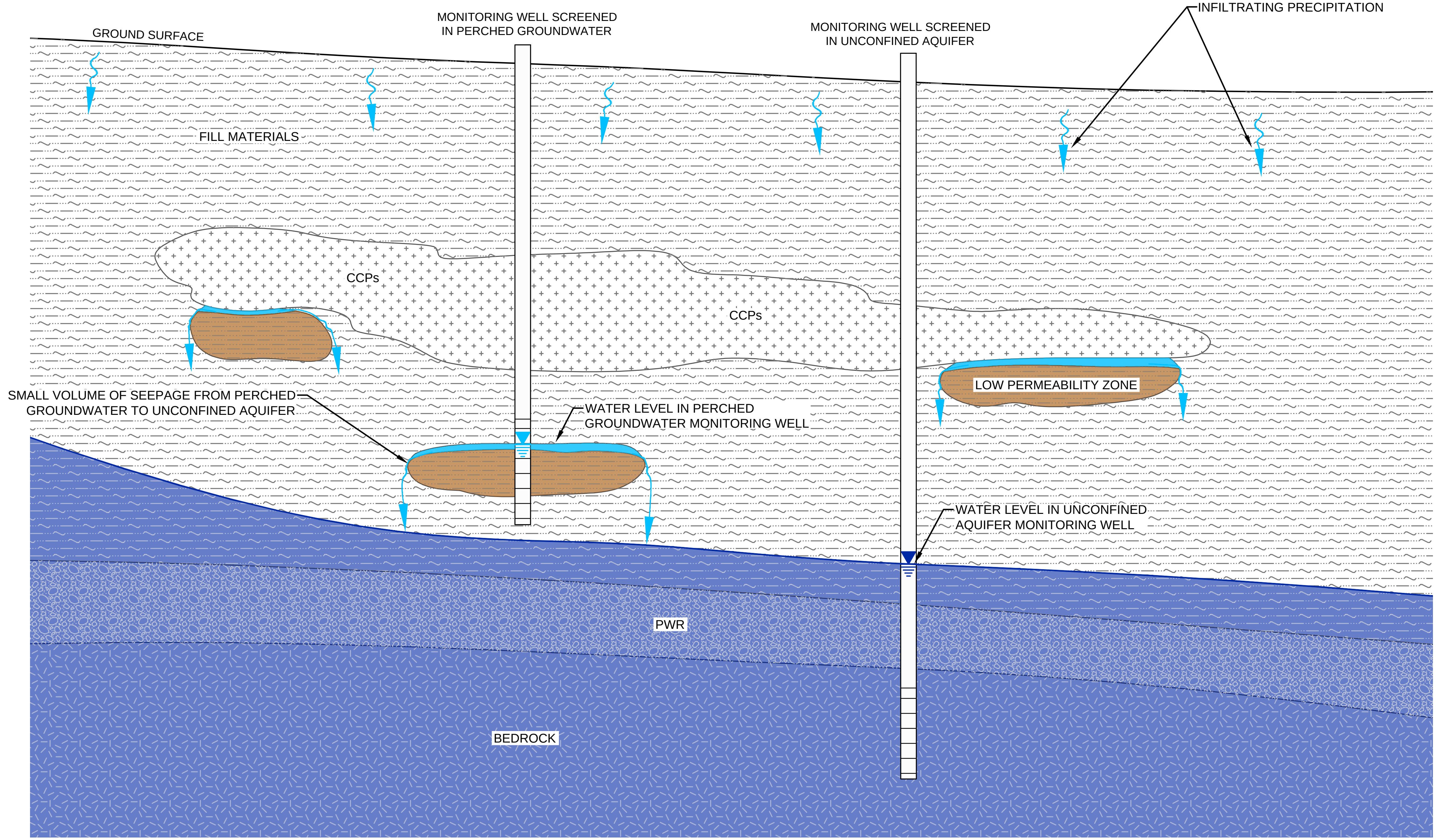
NOTES:

1. REFER TO FIGURE 3 OF THIS REPORT FOR CROSS-SECTION TRANSECT.
2. * INDICATES MONITORING WELL INSTALLED BY FALCON ENGINEERING, INC.
3. WITH THE EXCEPTION OF TMW-10 (GROUNDWATER ELEVATION MEASURED AND WELL ABANDONED ON SEPTEMBER 24, 2019), GROUNDWATER ELEVATIONS MEASURED ON FEBRUARY 12, 2020.
4. GROUNDWATER ELEVATIONS IN FILL (MW-1A, MW-9, AND TMW-10) APPEAR INDICATIVE OF PERCHED GROUNDWATER.
5. SOME CCP LAYERS CONCEPTUALLY INFERRED FOR ILLUSTRATION PURPOSES.

20
0
80
APPROXIMATE SCALE IN FEET

VERTICAL EXAGGERATION = 4X

TITLE CROSS-SECTION A-A'	
PROJECT TOWN OF CHAPEL HILL 828 MARTIN LUTHER KING JR. BOULEVARD CHAPEL HILL, NORTH CAROLINA	
hart hickman SMARTER ENVIRONMENTAL SOLUTIONS	2923 South Tryon Street-Suite 100 Charlotte, North Carolina 28203 704-586-0007(p) 704-586-0373(f) License # C-1269 / #C-245 Geology
DATE: 6-2-20	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 4



NOT TO SCALE

LEGEND

MONITORING WELL DEPICTING SCREEN INTERVAL

UNCONFINED AQUIFER WATER LEVEL

PERCHED GROUNDWATER LEVEL

FILL MATERIALS

COAL COMBUSTION PRODUCTS (CCPs)

LOW PERMEABILITY ZONES (EX: CLAY)

PERCHED GROUNDWATER

PARTIALLY WEATHERED ROCK (PWR)

BEDROCK

UNCONFINED AQUIFER

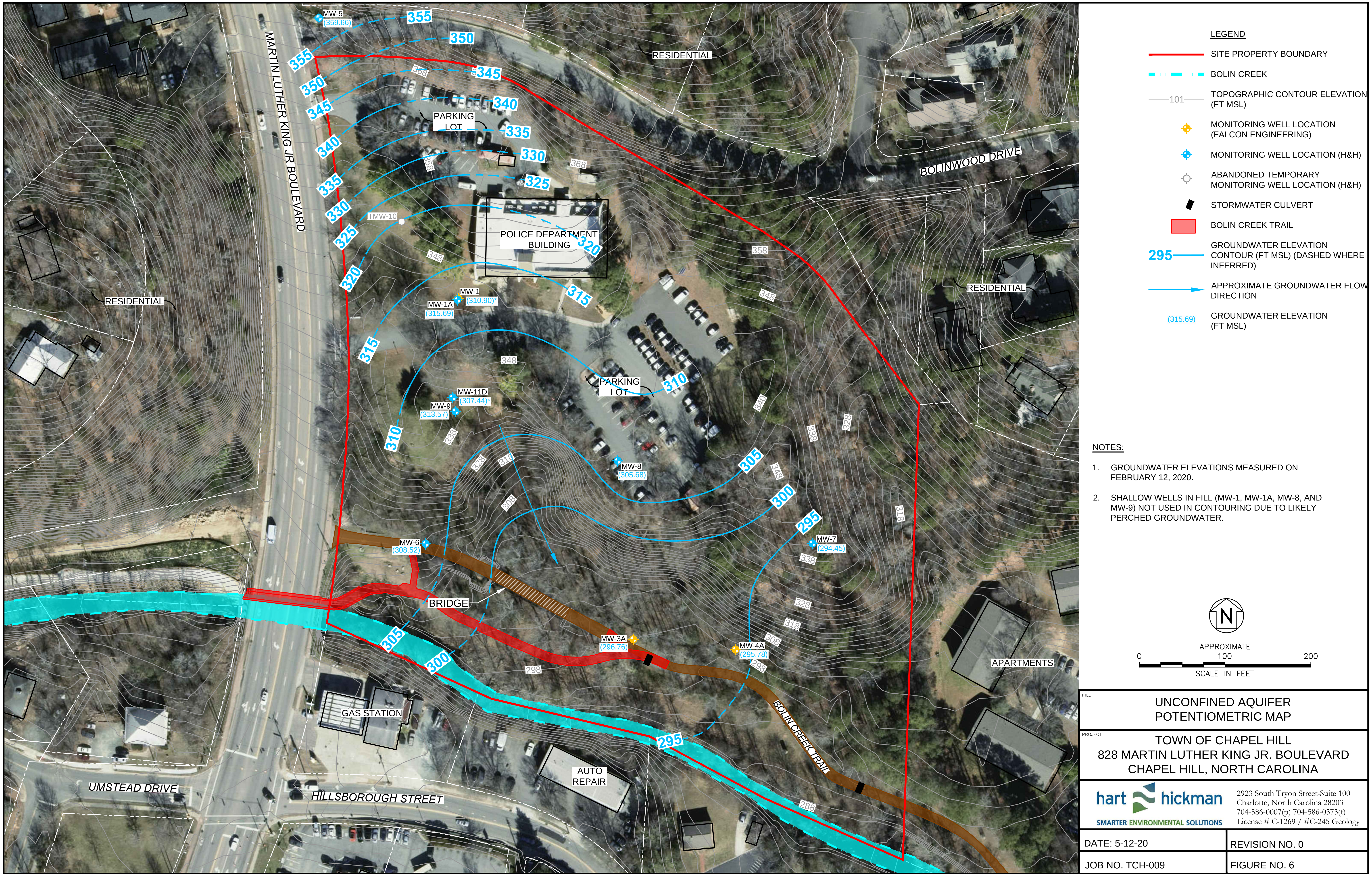
TITLE: CONCEPTUAL DIAGRAM OF RELATIONSHIP BETWEEN PERCHED GROUNDWATER AND UNCONFINED AQUIFER

PROJECT: TOWN OF CHAPEL HILL
828 MARTIN LUTHER KING JR. BOULEVARD
CHAPEL HILL, NORTH CAROLINA

hart hickman
SMARTER ENVIRONMENTAL SOLUTIONS

2923 South Tryon Street-Suite 100
Charlotte, North Carolina 28203
704-586-0007(p) 704-586-0373(f)
License # C-1269 / #C-245 Geology

DATE: 6-3-20	REVISION NO. 0
JOB NO. TCH-009	FIGURE NO. 5



\\hhfs01\MasterFiles\AAA-Master Projects\Town of Chapel Hill (TCH)\TCH-002 - Police Station\Ph II RI Work\Figures\Figures_3.26.20.dwg, FIG 5, 5/11/2020 5:54:49 PM, SVincent

Appendix B

Summary of Background Screening Values Calculations

Appendix B
Calculation of Background Screening Values (BSVs)

In order to determine whether metals detections are related to source materials or represent naturally-occurring background levels, site-specific Background Screening Values (BSVs) were established for the site. This appendix documents the methodology used for the BSV calculations. The ProUCL software version 5.1 (ProUCL) published by the United States Environmental Protection Agency (EPA) was used to calculate statistics on the background metals sets, as described further below. A table summarizing the calculation results and the ProUCL output sheets are included in this appendix.

Soil BSVs

During historical assessment activities, a total of 16 background soil samples were collected at locations upgradient of the site and outside the area of fill material. Prior reports documented calculation of 95% upper confidence limits (UCLs) for soil, which represent the upper boundary of the mean of background concentrations. UCLs are appropriate for background metals evaluations when comparing mean concentrations in the source area to mean background concentrations. However, the risk assessment for the subject site is based on maximum source area concentrations rather mean concentrations. For maximum point source concentration comparisons, EPA guidance indicates that use of the 95% Upper Tolerance Limit (UTL) with 95% coverage is more appropriate (EPA, 2015). This UTL represents the value below which 95% of the population values are expected to fall with 95% confidence.

The calculated BSVs for soil represent the 95% UTLs for the background soil data set, which were calculated using the following steps:

- A 95% UTL was calculated for multiple potential data distributions, including normal, gamma, lognormal, and nonparametric.
- A Goodness of Fit (GoF) test was run on each dataset to determine which distribution fit the background dataset.
- A 95% UTL was selected based on which distribution best fit the dataset:
    - For datasets that potentially fit both the normal and gamma distributions, the 95% UTL for the distribution with the highest coefficient of correlation (R) was used.

- For datasets that only fit either the normal or gamma distribution, the 95% UTL for the distribution which the dataset fit (normal or gamma) was used.
- For datasets that did not fit normal or gamma distributions, but fit the lognormal distribution, the lognormal 95% UTL was used.
- For datasets which did not fit any distribution, the nonparametric 95% UTL was used.

Non-detects were incorporated into the calculations using the Kaplan-Meier (KM) method. For thallium, Pro-UCL was unable to calculate either a 95% UTL or a mean concentration because thallium was detected in only one of the background samples. As referenced below, EPA guidance also references use of two times the mean background concentration as an appropriate method of calculating BSVs. For thallium, a value of two times the mean concentration was calculated using half of the reporting limit as the concentration for non-detect values. Note that this value is less than the maximum concentration detected in site background samples and considered conservative.

Sediment and Surface Water Background Screening Values

During historical assessment activities, a total of four background sediment samples and five background surface water samples were collected at locations upstream of the site and outside the area of fill material. The number of samples is insufficient to calculate a 95% UTL. EPA guidance alternately recommends use of twice the site-specific background mean concentrations as BSVs (EPA, 2018a and 2018b). These values were calculated for the subject site. In some cases, two times the mean concentrations derived values that were higher than the maximum concentrations detected in the background samples. In order to provide for additional conservatism, the BSVs used for sediment and surface water represent the lower of the maximum background concentration or twice the site-specific background mean concentration.

For the purposes of calculating the site-specific background mean concentrations, duplicate sample results were averaged with their parent sample results prior to calculating the background mean concentrations. Additionally, for datasets with non-detect values, the ProUCL software was utilized to calculate the background mean concentrations following the KM method.

Table B-1 (page 1 of 1)
Summary of Background Screening Values (BSVs) for Soil
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Sample ID	aluminum	antimony	arsenic	barium	beryllium	boron	cadmium	calcium	hexavalent chromium	trivalent chromium	total chromium	cobalt
Site Background Data												
MW-5 (0-1)	NA	<0.30	2.1	76	0.99	NA	<0.30	NA	0.43 J	17.57	18	27
MW-5 (6-7)	NA	<0.27	1.4	61	0.60	NA	<0.27	NA	0.81	38.19	39	19
BG-1 (0-1)	NA	<0.28	1.9	36	0.39	NA	<0.28	NA	0.87	17.13	18	6.3
BG-1 (2-3)	NA	<0.29	2.3	45	0.48	NA	<0.29	NA	<0.12	19	19	7.3
BG-2 (0-1)	NA	<0.28	1.9	45	0.50	NA	<0.28	NA	0.84	16.16	17	7.4
BG-2 (2-3)	NA	<0.27	1.9	52	0.53	NA	<0.27	NA	0.70	23.3	24	7.5
BG-3 (0-1)	NA	<0.30	1.7	44	0.43	NA	<0.30	NA	0.21 J	23.3	16	7.5
BG-3 (2-3)	NA	<0.27	2.2	56	0.54	NA	<0.27	NA	0.88	21.12	22	7.5
BG-4 (0-1)	NA	<0.29	1.7	50	0.50	NA	<0.29	NA	<0.13	19	19	9.5
BG-4 (2-3)	NA	<0.33	2.0	53	0.52	NA	0.38	NA	0.50 J	22.5	23	11
BG-6 (0-1)	NA	NA	2.05 O1	64.4	0.625	NA	0.177 J	NA	5.34	39.4	44.7	14.4
BG-6 (2-3)	NA	NA	2.29	66.3	0.507 J	NA	0.139 J	NA	<1.19	22.9	22.9	14.7
BG-7 (0-1)	NA	NA	1.97	52.7	0.410 J	NA	0.136 J	NA	<1.16	70.2	70.2	18.9
BG-7 (2-3)	NA	NA	3.08	77.9	0.430 J	NA	0.108 J	NA	<1.16	27	27	16.3
BG-8 (0-1)	NA	NA	1.8	52.4	0.370 J	NA	0.0951 J	NA	<1.14	24.5	24.5	21.8
BG-8 (2-3)	NA	NA	1.66	47.6	0.293 J	NA	0.0918 J	NA	<1.14	21.7	21.7	23.5
Background Statistics												
North Carolina Background Range(1)	7000 - >100,000	<1.0-8.8	1-18	50-1,000	ND-1.0	ND-100	1.0-10	100-280,000*	NS	NS	7-300	ND-50
Site Specific Background Range	NA	ND	1.4 - 3.08	36 - 77.9	0.293 - 0.99	NA	<0.27 - 0.38	NA	<0.12 - 5.34	16.16 - 70.2	16 - 70.2	6.3 - 27
2x Mean Background	NA	ND	3.994	109.92	1.014	NA	0.28	NA	1.696	52.86	53.26	27.46
Selected 95% UTL with 95% Coverage	NA	NC	3.015	87.86	0.929	NA	0.313	NA	5.725	70.2	70.2	36.31
Recommended Site-Specific BSV(2,3)	NA	ND	3.015	87.86	0.929	NA	0.313	NA	5.725	70.2	70.2	36.31

Sample ID	copper	iron	lead	magnesium	manganese	mercury	molybdenum	nickel	potassium	selenium	silver	sodium	strontium	thallium	vanadium	zinc
Site Background Data																
MW-5 (0-1)	49	NA	4.0	NA	710	<0.023	NA	5.0	NA	<0.59	NA	NA	25	<0.59	190	47
MW-5 (6-7)	18	NA	0.55	NA	940	<0.020	NA	20	NA	<0.53	NA	NA	29	2.3	67	75
BG-1 (0-1)	16	NA	25	NA	310	0.033	NA	5.4	NA	1.6	NA	NA	15	<0.57	34	43
BG-1 (2-3)	18	NA	43	NA	440	0.280	NA	6.2	NA	1.6	NA	NA	15	<0.57	35	49
BG-2 (0-1)	18	NA	32	NA	410	0.045	NA	4.9	NA	1.1	NA	NA	14	<0.56	35	44
BG-2 (2-3)	20	NA	26	NA	450	0.038	NA	7.9	NA	1.7	NA	NA	19	<0.55	37	45
BG-3 (0-1)	15	NA	25	NA	410	0.024	NA	5.1	NA	1.4	NA	NA	46	<0.60	37	40
BG-3 (2-3)	18	NA	29	NA	410	0.040	NA	5.2	NA	1.2	NA	NA	19	<0.53	40	46
BG-4 (0-1)	16	NA	22	NA	450 BH	0.026	NA	6.0	NA	<0.59	NA	NA	16 A	<0.59	53	50
BG-4 (2-3)	23	NA	21	NA	460 BH	0.054	NA	8.5	NA	<0.65	NA	NA	19	<0.65	51	230
BG-6 (0-1)	26.4	NA	NA	NA	448 J6	0.022	NA	12.8	NA	0.562 J	NA	NA	17	NA	NA	NA
BG-6 (2-3)	32.3	NA	NA	NA	467	0.032	NA	7.78	NA	0.828	NA	NA	16.8	NA	NA	NA
BG-7 (0-1)	36.4	NA	NA	NA	813	0.025	NA	12.8	NA	0.543 J	NA	NA	22.6	NA	NA	NA
BG-7 (2-3)	32.5	NA	NA	NA	548	0.023	NA	6.2	NA	0.502 J	NA	NA	24.3	NA	NA	NA
BG-8 (0-1)	62.8	NA	NA	NA	759	0.0072	NA	9.04	NA	0.485 J	NA	NA	24.4	NA	NA	NA
BG-8 (2-3)	60.2	NA	NA	NA	732	<0.0067	NA	7.86	NA	0.306 J	NA	NA	25.1	NA	NA	NA
Background Statistics																
North Carolina Background Range(1)	2.0-20	100 - >100,000*	ND-50	50-50,000*	<2.0-7000*	0.03-0.52	<3-15*	ND	50-37,000*	<0.1-0.8	ND-5.0	<500-50,000*	ND-300	NS	15-300	11-59
Site Specific Background Range	15 - 62.8	NA	0.55 - 43	NA	310 - 940	<0.0067 - 0.28	NA	4.9 - 20	NA	<0.53 - 1.7	NA	NA	14 - 46	<0.53 - 2.3	34 - 190	40 - 230
2x Mean Background	57.7	NA	45.52	NA	1094.6	0.0842	NA	16.336	NA	1.708	NA	NA	43.4	NC	115.8	133.8
Selected 95% UTL with 95% Coverage	77.3	NA	59.11	NA	1149	0.256	NA	19.49	NA	2.503	NA	NA	43.19	NC	227	230
Recommended Site-Specific BSV(2,3)	77.3	NA	59.11	NA	1149	0.256	NA	19.49	NA	2.503	NA	NA	43.19	0.981	227	230

1) North Carolina Soil Background Range taken from Elements in North American Soils, 2nd Edition by James Dragun and Khaled Chekiri
2) Recommended Site-Specific Background Screening Value (BSV) based on 95% UTL with 95% coverage for all constituents except thallium.
3) Thallium did not have enough detects to run ProUCL statistics. Site-specific BSV was calculated as 2x the mean using 1/2 of the reporting limits as the values for non-detects.
NA = Not Analyzed; ND = Not Detected; -- = Not Calculated; UTL = Upper Tolerance Limit
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration
O1 = Analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.
BH = Method blank greater than one-half laboratory reporting limit, but sample concentration greater than 10x the method blank.
A = Continuing Calibration Verification standard recovery (82%) is less than the lower control limit (90%). Result has possible low bias.

Table B-2 (page 1 of 1)
Summary of Background Screening Values (BSVs) for Sediment
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Sediment Sampling Point ID	Sample Date	antimony	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	lead	manganese	mercury	nickel	selenium	strontium	thallium	vanadium	zinc
SED-1 (Upstream)	10/27/2016	<0.32	1.2	12	<0.32	<0.32	0.24 J	22.76	23	3.9	4.2	4.0	180	<0.026	3.8	<0.64	6.9	<0.64	19	19
	4/5/2019	NA	1.95 O1	38.4 J6	0.249 J	<0.636	0.428 J	65.0	65.4 J3, J6	7.63	8.42	NA	449 J6	0.0078	7.1	0.409 J	8.4	NA	NA	NA
SED-2 (Upstream)	10/27/2016	<0.33	2.1	20	0.48	<0.33	<0.40	36	36	7.8	8.0	7.1	330	<0.025	7.2	<0.65	11	<0.65	37	34
	10/27/2016(1)	<0.32	2.5	17	0.45	<0.32	<0.40	49	49	6.5	9.1	6.7	290	<0.026	6.0	<0.63	12	<0.63	35	31
	4/5/2019	NA	2.74	29.6	0.305 J	<0.619	0.796 J	56.3	57.1	20.9	13.8	NA	811	0.0053 J	9.16	0.306 J	16.9	NA	NA	NA
	4/5/2019(1)	NA	2.02	17.4	0.222 J	<0.617	0.546 J	69.5	70	7.29	6.79	NA	347	0.0051	9.92	0.237 J	8.8	NA	NA	NA
Background Statistics																				
Site-Specific Background Range		ND	1.2-2.74	12-38.4	<0.32-0.48	<0.32-<0.636	0.24 J-0.796 J	22.76-69.5	23-70	3.9-20.9	4.2-13.8	4.0-7.1	180-811	<0.026 - 0.0078	3.8-9.92	0.237 J-<0.65	6.9-16.9	<0.63-<0.65	19-37	19-34
Site-Specific Mean(2)		ND	1.958	23.1	0.308	ND	0.395	48.28	48.61	8.194	7.866	5.45	379.5	0.0065	6.76	0.34	9.913	ND	27.5	25.75
2X Site-Specific Mean		ND	3.916	46.2	0.616	ND	0.79	96.56	97.22	16.388	15.732	10.9	759	0.013	13.52	0.68	19.826	ND	55	51.5
Recommended Site-Specific BSV(3)		ND	2.74	38.4	0.48	ND	0.79	69.5	70	16.388	13.8	7.1	759	0.0078	9.92	0.409	16.9	ND	37	34

Notes:
1) Duplicate sample data, average of parent sample and duplicate used in calculations.
2) Site-specific mean for datasets with non-detects calculated using Kaplan-Meier Method via ProUCL version 5.1.
3) Recommended Site-Specific Background Screening Value (BSV) indicates 2x mean background concentration or maximum detected concentration, whichever is lower.
NA = Not Analyzed; ND = Not Detected
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
O1 = Analyte failed the method required serial dilution test and/or subsequent post-spike criteria. These failures indicate matrix interference.
J3 = The associated batch QC was outside the established quality control range for precision.
J6 = The sample matrix interfered with the ability to make any accurate determination; spike value is low.

Table B-3 (page 1 of 1)
Summary of Background Screening Values (BSVs) for Surface Water
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job No. TCH-009

Surface Water Background Sample Location	Sample Date	aluminum	antimony	arsenic	barium	beryllium	cadmium	calcium	hexavalent chromium	trivalent chromium	total chromium	cobalt	copper	iron	lead	magnesium	manganese	mercury	nickel	potassium	selenium	strontium	silver	sodium	thallium	vanadium	zinc	Hardness
BC-1 (Upstream)	2/5/2014	NA	NA	ND	24	NA	ND	NA	ND	ND	ND	NA	NA	NA	ND	NA	NA	ND	NA	NA	ND	NA	ND	NA	NA	NA	NA	NA
SW-1 (Upstream)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	<10	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.44	23.1	<0.10	<0.080	NA	NA	NA	0.53	0.16	1.2	NA	NA	NA	22.2	<0.20	0.29 J	NA	0.096 J	85.3	NA	NA	NA	NA	NA	54,000
SW-2 (Upstream)	11/3/2016	NA	<5.0	<10	27	<2.0	<1.0	NA	<0.74	NA	<5.0	<5.0	<10	<0.2	<5.0	NA	11	<0.2	<10	NA	<20	100	NA	NA	<10	<5.0	<30	NA
	4/5/2019	NA	NA	0.42	23.2	<0.10	<0.080	NA	NA	NA	0.45 J	0.16	1.1	NA	NA	NA	21.2	<0.20	0.33 J	NA	0.11 J	85.5	NA	NA	NA	NA	NA	53,600
Background Statistics																												
Site Specific Background Range		NA	ND	<10 - 0.44	23.1 - 27	ND	ND	NA	ND	ND	<5.0 - 0.53	<5.0 - 0.16	<10 - 1.2	ND	ND	NA	<10 - 22.2	ND	<10 - 0.33 J	NA	<20 - 0.11 J	85.3 - 100	ND	NA	ND	ND	ND	53,600 - 54,000
Site Specific Mean(1)		NA	ND	0.43	24.86	ND	ND	NA	ND	ND	0.49	1.33(3)	1.15	ND	ND	NA	16.1	ND	0.31	NA	0.103	92.7	ND	NA	ND	ND	ND	53,800
2X Site Specific Mean		NA	ND	0.86	49.72	ND	ND	NA	ND	ND	0.98	2.66	2.3	ND	ND	NA	32.2	ND	0.62	NA	0.206	185.4	ND	NA	ND	ND	ND	107,600
Recommended Site-Specific BSV(2)		NA	ND	0.44	27	ND	ND	NA	ND	ND	0.53	0.16	1.2	ND	ND	NA	22.2	ND	0.33	NA	0.11	100	ND	NA	ND	ND	ND	54,000

Notes:
1) Site specific mean for datasets with non-detects calculated using Kaplan-Meier Method via ProUCL version 5.1
2) Recommended Site-Specific Background Screening Value (BSV) indicates 2x mean background concentration or maximum detected concentration, whichever is lower.
3) The Kaplan-Meier mean could not be calculated for Cobalt, as there was only one unique detection. Therefore, the site-specific mean was calculated using 1/2 of the reporting limits as the values for non-detects.
NA = Not Analyzed; ND = Not Detected; NC = Not Calculated
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration

	Background Statistics for Data Sets with Non-Detects
User Selected Options	
Date/Time of Computation	ProUCL 5.18/17/2021 4:10:55 PM
From File	ProUCL Background Inputs.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

antimony

General Statistics			
Total Number of Observations	10	Number of Missing Observations	6
Number of Distinct Observations	5		
Number of Detects	0	Number of Non-Detects	10
Number of Distinct Detects	0	Number of Distinct Non-Detects	5
Minimum Detect	N/A	Minimum Non-Detect	0.27
Maximum Detect	N/A	Maximum Non-Detect	0.33
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable antimony was not processed!

arsenic

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
Minimum	1.4	First Quartile	1.775
Second Largest	2.3	Median	1.935
Maximum	3.08	Third Quartile	2.125
Mean	1.997	SD	0.376
Coefficient of Variation	0.188	Skewness	1.463
Mean of logged Data	0.676	SD of logged Data	0.176

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443

Normal GOF Test		
Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level
Data appear Normal at 5% Significance Level		

Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	2.946	90% Percentile (z)	2.479
95% UPL (t)	2.676	95% Percentile (z)	2.615
95% USL	2.915	99% Percentile (z)	2.871
Gamma GOF Test			
A-D Test Statistic	0.399	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.124	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	33.27	k star (bias corrected MLE)	27.08
Theta hat (MLE)	0.06	Theta star (bias corrected MLE)	0.0737
nu hat (MLE)	1065	nu star (bias corrected)	866.4
MLE Mean (bias corrected)	1.997	MLE Sd (bias corrected)	0.384
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	2.69	90% Percentile	2.502
95% Hawkins Wixley (HW) Approx. Gamma UPL	2.693	95% Percentile	2.667
95% WH Approx. Gamma UTL with 95% Coverage	3.015	99% Percentile	2.996
95% HW Approx. Gamma UTL with 95% Coverage	3.027		
95% WH USL	2.977	95% HW USL	2.988
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	3.069	90% Percentile (z)	2.465
95% UPL (t)	2.705	95% Percentile (z)	2.628
95% USL	3.026	99% Percentile (z)	2.964
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	3.08
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	3.08	95% BCA Bootstrap UTL with 95% Coverage	3.08
95% UPL	3.08	90% Percentile	2.295
90% Chebyshev UPL	3.159	95% Percentile	2.495
95% Chebyshev UPL	3.686	99% Percentile	2.963
95% USL	3.08		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
barium			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	15
Minimum	36	First Quartile	46.95
Second Largest	76	Median	52.55
Maximum	77.9	Third Quartile	61.85
Mean	54.96	SD	11.56
Coefficient of Variation	0.21	Skewness	0.653
Mean of logged Data	3.986	SD of logged Data	0.206
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	84.14	90% Percentile (z)	69.77
95% UPL (t)	75.85	95% Percentile (z)	73.97
95% USL	83.21	99% Percentile (z)	81.85
Gamma GOF Test			
A-D Test Statistic	0.321	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.17	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	25.01	k star (bias corrected MLE)	20.36
Theta hat (MLE)	2.197	Theta star (bias corrected MLE)	2.699
nu hat (MLE)	800.4	nu star (bias corrected)	651.7
MLE Mean (bias corrected)	54.96	MLE Sd (bias corrected)	12.18
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	77.19	90% Percentile	71.03
95% Hawkins Wixley (HW) Approx. Gamma UPL	77.42	95% Percentile	76.4
95% WH Approx. Gamma UTL with 95% Coverage	87.86	99% Percentile	87.18

95% HW Approx. Gamma UTL with 95% Coverage	88.48		
95% WH USL	86.61	95% HW USL	87.18
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.156	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	90.65	90% Percentile (z)	70.16
95% UPL (t)	78.19	95% Percentile (z)	75.62
95% USL	89.16	99% Percentile (z)	87.03
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	77.9
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	77.9	95% BCA Bootstrap UTL with 95% Coverage	77.9
95% UPL	77.9	90% Percentile	71.15
90% Chebyshev UPL	90.71	95% Percentile	76.48
95% Chebyshev UPL	106.9	99% Percentile	77.62
95% USL	77.9		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
beryllium			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	14
Minimum	0.293	First Quartile	0.425
Second Largest	0.625	Median	0.5
Maximum	0.99	Third Quartile	0.533
Mean	0.507	SD	0.154
Coefficient of Variation	0.305	Skewness	2.049
Mean of logged Data	-0.715	SD of logged Data	0.268
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk GOF Test**	

5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	0.897	90% Percentile (z)	0.705
95% UPL (t)	0.786	95% Percentile (z)	0.761
95% USL	0.885	99% Percentile (z)	0.867
Gamma GOF Test			
A-D Test Statistic	0.558	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	14.04	k star (bias corrected MLE)	11.45
Theta hat (MLE)	0.0361	Theta star (bias corrected MLE)	0.0443
nu hat (MLE)	449.4	nu star (bias corrected)	366.5
MLE Mean (bias corrected)	0.507	MLE Sd (bias corrected)	0.15
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	0.787	90% Percentile	0.706
95% Hawkins Wixley (HW) Approx. Gamma UPL	0.788	95% Percentile	0.776
95% WH Approx. Gamma UTL with 95% Coverage	0.929	99% Percentile	0.919
95% HW Approx. Gamma UTL with 95% Coverage	0.936		
95% WH USL	0.912	95% HW USL	0.918
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.169	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	0.962	90% Percentile (z)	0.69
95% UPL (t)	0.794	95% Percentile (z)	0.76
95% USL	0.942	99% Percentile (z)	0.913
Nonparametric Distribution Free Background Statistics			
Data appear Gamma Distributed at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	0.99
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	0.99	95% BCA Bootstrap UTL with 95% Coverage	0.99

95% UPL	0.99	90% Percentile	0.613
90% Chebyshev UPL	0.985	95% Percentile	0.716
95% Chebyshev UPL	1.201	99% Percentile	0.935
95% USL	0.99		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
cadmium			
General Statistics			
Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	11		
Number of Detects	7	Number of Non-Detects	9
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	0.0918	Minimum Non-Detect	0.27
Maximum Detect	0.38	Maximum Non-Detect	0.3
Variance Detected	0.0102	Percent Non-Detects	56.25%
Mean Detected	0.161	SD Detected	0.101
Mean of Detected Logged Data	-1.948	SD of Detected Logged Data	0.491
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.712	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Approximate Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.14	KM SD	0.0682
95% UTL95% Coverage	0.313	95% KM UPL (t)	0.264
90% KM Percentile (z)	0.228	95% KM Percentile (z)	0.253
99% KM Percentile (z)	0.299	95% KM USL	0.307
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.15	SD	0.0648
95% UTL95% Coverage	0.314	95% UPL (t)	0.267
90% Percentile (z)	0.233	95% Percentile (z)	0.257
99% Percentile (z)	0.301	95% USL	0.309
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.646	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level	

K-S Test Statistic		0.267	**Kolmogorov-Smirnov GOF**		
5% K-S Critical Value		0.313	Detected data appear Gamma Distributed at 5% Significance Level		
Detected data appear Gamma Distributed at 5% Significance Level					
Gamma Statistics on Detected Data Only					
k hat (MLE)		4.282	k star (bias corrected MLE)		2.542
Theta hat (MLE)		0.0376	Theta star (bias corrected MLE)		0.0633
nu hat (MLE)		59.94	nu star (bias corrected)		35.59
MLE Mean (bias corrected)		0.161			
MLE Sd (bias corrected)		0.101	95% Percentile of Chisquare (2kstar)		11.2
Gamma ROS Statistics using Imputed Non-Detects					
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs					
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)					
For such situations, GROS method may yield incorrect values of UCLs and BTVs					
This is especially true when the sample size is small.					
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates					
Minimum		0.0789	Mean		0.143
Maximum		0.38	Median		0.131
SD		0.0718	CV		0.503
k hat (MLE)		6.178	k star (bias corrected MLE)		5.062
Theta hat (MLE)		0.0231	Theta star (bias corrected MLE)		0.0282
nu hat (MLE)		197.7	nu star (bias corrected)		162
MLE Mean (bias corrected)		0.143	MLE Sd (bias corrected)		0.0634
95% Percentile of Chisquare (2kstar)		18.48	90% Percentile		0.228
95% Percentile		0.26	99% Percentile		0.33
The following statistics are computed using Gamma ROS Statistics on Imputed Data					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.335	0.339	95% Approx. Gamma UPL	0.266	0.266
95% Gamma USL	0.327	0.33			
Estimates of Gamma Parameters using KM Estimates					
Mean (KM)		0.14	SD (KM)		0.0682
Variance (KM)		0.00465	SE of Mean (KM)		0.0207
k hat (KM)		4.238	k star (KM)		3.485
nu hat (KM)		135.6	nu star (KM)		111.5
theta hat (KM)		0.0331	theta star (KM)		0.0403
80% gamma percentile (KM)		0.197	90% gamma percentile (KM)		0.241
95% gamma percentile (KM)		0.283	99% gamma percentile (KM)		0.371
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.313	0.314	95% Approx. Gamma UPL	0.252	0.25
95% KM Gamma Percentile	0.239	0.237	95% Gamma USL	0.306	0.307
Lognormal GOF Test on Detected Observations Only					
Shapiro Wilk Test Statistic		0.851	**Shapiro Wilk GOF Test**		
5% Shapiro Wilk Critical Value		0.803	Detected Data appear Lognormal at 5% Significance Level		

Lilliefors Test Statistic	0.235	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	0.143	Mean in Log Scale	-2.02
SD in Original Scale	0.0693	SD in Log Scale	0.358
95% UTL95% Coverage	0.327	95% BCA UTL95% Coverage	0.38
95% Bootstrap (%) UTL95% Coverage	0.38	95% UPL (t)	0.253
90% Percentile (z)	0.21	95% Percentile (z)	0.239
99% Percentile (z)	0.305	95% USL	0.318
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	-2.04	95% KM UTL (Lognormal)95% Coverage	0.32
KM SD of Logged Data	0.357	95% KM UPL (Lognormal)	0.248
95% KM Percentile Lognormal (z)	0.234	95% KM USL (Lognormal)	0.311
Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	0.15	Mean in Log Scale	-1.952
SD in Original Scale	0.0648	SD in Log Scale	0.312
95% UTL95% Coverage	0.312	95% UPL (t)	0.25
90% Percentile (z)	0.212	95% Percentile (z)	0.237
99% Percentile (z)	0.293	95% USL	0.304
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	16	95% UTL with95% Coverage	0.38
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.38
95% USL	0.38	95% KM Chebyshev UPL	0.447
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
hexavalent chromium			
General Statistics			
Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	14		
Number of Detects	9	Number of Non-Detects	7
Number of Distinct Detects	9	Number of Distinct Non-Detects	5
Minimum Detect	0.21	Minimum Non-Detect	0.12
Maximum Detect	5.34	Maximum Non-Detect	1.19
Variance Detected	2.493	Percent Non-Detects	43.75%

Mean Detected	1.176	SD Detected	1.579
Mean of Detected Logged Data	-0.27	SD of Detected Logged Data	0.867
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.531	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.463	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.848	KM SD	1.195
95% UTL95% Coverage	3.864	95% KM UPL (t)	3.007
90% KM Percentile (z)	2.379	95% KM Percentile (z)	2.814
99% KM Percentile (z)	3.628	95% KM USL	3.768
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.85	SD	1.225
95% UTL95% Coverage	3.941	95% UPL (t)	3.063
90% Percentile (z)	2.42	95% Percentile (z)	2.865
99% Percentile (z)	3.699	95% USL	3.843
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	1.129	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.394	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.285	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	1.299	k star (bias corrected MLE)	0.94
Theta hat (MLE)	0.905	Theta star (bias corrected MLE)	1.25
nu hat (MLE)	23.38	nu star (bias corrected)	16.92
MLE Mean (bias corrected)	1.176		
MLE Sd (bias corrected)	1.212	95% Percentile of Chisquare (2kstar)	5.757
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	0.791
Maximum	5.34	Median	0.6
SD	1.263	CV	1.598
k hat (MLE)	0.541	k star (bias corrected MLE)	0.482

Theta hat (MLE)	1.46	Theta star (bias corrected MLE)	1.642
nu hat (MLE)	17.33	nu star (bias corrected)	15.41
MLE Mean (bias corrected)	0.791	MLE Sd (bias corrected)	1.139
95% Percentile of Chisquare (2kstar)	3.75	90% Percentile	2.155
95% Percentile	3.078	99% Percentile	5.354

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	5.5	6.852	95% Approx. Gamma UPL	3.222	3.638
95% Gamma USL	5.202	6.412			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.848	SD (KM)	1.195
Variance (KM)	1.429	SE of Mean (KM)	0.322
k hat (KM)	0.503	k star (KM)	0.45
nu hat (KM)	16.09	nu star (KM)	14.4
theta hat (KM)	1.686	theta star (KM)	1.883
80% gamma percentile (KM)	1.383	90% gamma percentile (KM)	2.342
95% gamma percentile (KM)	3.379	99% gamma percentile (KM)	5.956

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	3.926	4.122	95% Approx. Gamma UPL	2.562	2.577
95% KM Gamma Percentile	2.305	2.299	95% Gamma USL	3.753	3.92

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.836	Mean in Log Scale	-0.641
SD in Original Scale	1.23	SD in Log Scale	0.893
95% UTL95% Coverage	5.021	95% BCA UTL95% Coverage	5.34
95% Bootstrap (%) UTL95% Coverage	5.34	95% UPL (t)	2.647
90% Percentile (z)	1.655	95% Percentile (z)	2.29
99% Percentile (z)	4.208	95% USL	4.672

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-0.678	95% KM UTL (Lognormal)95% Coverage	5.725
KM SD of Logged Data	0.96	95% KM UPL (Lognormal)	2.877
95% KM Percentile Lognormal (z)	2.462	95% KM USL (Lognormal)	5.298

Background DL/2 Statistics Assuming Lognormal Distribution

Mean in Original Scale	0.85	Mean in Log Scale	-0.669
SD in Original Scale	1.225	SD in Log Scale	1.045
95% UTL95% Coverage	7.159	95% UPL (t)	3.384

90% Percentile (z)	1.954	95% Percentile (z)	2.857
99% Percentile (z)	5.823	95% USL	6.58
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	16	95% UTL with95% Coverage	5.34
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
Approximate Sample Size needed to achieve specified CC	59	95% UPL	5.34
95% USL	5.34	95% KM Chebyshev UPL	6.218
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
trivalent chromium			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	14
Minimum	16.16	First Quartile	19
Second Largest	39.36	Median	22.7
Maximum	70.2	Third Quartile	25.13
Mean	26.43	SD	13.43
Coefficient of Variation	0.508	Skewness	2.637
Mean of logged Data	3.194	SD of logged Data	0.377
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.668	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	60.32	90% Percentile (z)	43.64
95% UPL (t)	50.7	95% Percentile (z)	48.52
95% USL	59.24	99% Percentile (z)	57.67
Gamma GOF Test			
A-D Test Statistic	1.306	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.272	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.216	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	6.387	k star (bias corrected MLE)	5.231
Theta hat (MLE)	4.139	Theta star (bias corrected MLE)	5.053
nu hat (MLE)	204.4	nu star (bias corrected)	167.4
MLE Mean (bias corrected)	26.43	MLE Sd (bias corrected)	11.56
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	48.8	90% Percentile	41.9
95% Hawkins Wixley (HW) Approx. Gamma UPL	48.63	95% Percentile	47.86
95% WH Approx. Gamma UTL with 95% Coverage	61.37	99% Percentile	60.42
95% HW Approx. Gamma UTL with 95% Coverage	61.72		
95% WH USL	59.86	95% HW USL	60.12
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.831	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.245	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	63.2	90% Percentile (z)	39.55
95% UPL (t)	48.22	95% Percentile (z)	45.36
95% USL	61.3	99% Percentile (z)	58.66
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	70.2
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	70.2	95% BCA Bootstrap UTL with 95% Coverage	70.2
95% UPL	70.2	90% Percentile	38.78
90% Chebyshev UPL	67.95	95% Percentile	47.07
95% Chebyshev UPL	86.76	99% Percentile	65.57
95% USL	70.2		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
total chromium			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	14

Minimum	16	First Quartile	18.75
Second Largest	44.7	Median	22.45
Maximum	70.2	Third Quartile	25.13
Mean	26.63	SD	13.98
Coefficient of Variation	0.525	Skewness	2.394
Mean of logged Data	3.194	SD of logged Data	0.397
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.689	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	61.92	90% Percentile (z)	44.55
95% UPL (t)	51.89	95% Percentile (z)	49.63
95% USL	60.79	99% Percentile (z)	59.16
Gamma GOF Test			
A-D Test Statistic	1.323	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.273	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.216	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.828	k star (bias corrected MLE)	4.777
Theta hat (MLE)	4.568	Theta star (bias corrected MLE)	5.573
nu hat (MLE)	186.5	nu star (bias corrected)	152.9
MLE Mean (bias corrected)	26.63	MLE Sd (bias corrected)	12.18
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	50.36	90% Percentile	42.94
95% Hawkins Wixley (HW) Approx. Gamma UPL	50.22	95% Percentile	49.3
95% WH Approx. Gamma UTL with 95% Coverage	63.88	99% Percentile	62.77
95% HW Approx. Gamma UTL with 95% Coverage	64.37		
95% WH USL	62.25	95% HW USL	62.64
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			

95% UTL with 95% Coverage	66.4	90% Percentile (z)	40.55
95% UPL (t)	49.95	95% Percentile (z)	46.84
95% USL	64.31	99% Percentile (z)	61.39
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	70.2
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	70.2	95% BCA Bootstrap UTL with 95% Coverage	70.2
95% UPL	70.2	90% Percentile	41.85
90% Chebyshev UPL	69.87	95% Percentile	51.08
95% Chebyshev UPL	89.46	99% Percentile	66.38
95% USL	70.2		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
cobalt			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	14
Minimum	6.3	First Quartile	7.5
Second Largest	23.5	Median	12.7
Maximum	27	Third Quartile	18.93
Mean	13.73	SD	6.721
Coefficient of Variation	0.49	Skewness	0.591
Mean of logged Data	2.506	SD of logged Data	0.494
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	30.69	90% Percentile (z)	22.34
95% UPL (t)	25.87	95% Percentile (z)	24.78
95% USL	30.15	99% Percentile (z)	29.36
Gamma GOF Test			

A-D Test Statistic	0.69	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.216	Data Not Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	4.558	k star (bias corrected MLE)	3.745
Theta hat (MLE)	3.011	Theta star (bias corrected MLE)	3.665
nu hat (MLE)	145.8	nu star (bias corrected)	119.8
MLE Mean (bias corrected)	13.73	MLE Sd (bias corrected)	7.092
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	27.93	90% Percentile	23.23
95% Hawkins Wixley (HW) Approx. Gamma UPL	28.34	95% Percentile	27.08
95% WH Approx. Gamma UTL with 95% Coverage	36.31	99% Percentile	35.32
95% HW Approx. Gamma UTL with 95% Coverage	37.53		
95% WH USL	35.29	95% HW USL	36.4
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.215	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	42.66	90% Percentile (z)	23.08
95% UPL (t)	29.93	95% Percentile (z)	27.62
95% USL	40.99	99% Percentile (z)	38.69
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	27
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	27	95% BCA Bootstrap UTL with 95% Coverage	27
95% UPL	27	90% Percentile	22.65
90% Chebyshev UPL	34.51	95% Percentile	24.38
95% Chebyshev UPL	43.92	99% Percentile	26.48
95% USL	27		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			

copper			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	12
Minimum	15	First Quartile	18
Second Largest	60.2	Median	21.5
Maximum	62.8	Third Quartile	33.48
Mean	28.85	SD	15.78
Coefficient of Variation	0.547	Skewness	1.274
Mean of logged Data	3.244	SD of logged Data	0.482
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level	
Data appear Approximate Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	68.68	90% Percentile (z)	49.07
95% UPL (t)	57.36	95% Percentile (z)	54.81
95% USL	67.41	99% Percentile (z)	65.56
Gamma GOF Test			
A-D Test Statistic	0.943	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.742	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.212	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	4.383	k star (bias corrected MLE)	3.603
Theta hat (MLE)	6.582	Theta star (bias corrected MLE)	8.007
nu hat (MLE)	140.3	nu star (bias corrected)	115.3
MLE Mean (bias corrected)	28.85	MLE Sd (bias corrected)	15.2
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	59.22	90% Percentile	49.23
95% Hawkins Wixley (HW) Approx. Gamma UPL	59.64	95% Percentile	57.52
95% WH Approx. Gamma UTL with 95% Coverage	77.3	99% Percentile	75.31
95% HW Approx. Gamma UTL with 95% Coverage	79.13		
95% WH USL	75.1	95% HW USL	76.72
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**	

5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	86.59	90% Percentile (z)	47.55
95% UPL (t)	61.27	95% Percentile (z)	56.66
95% USL	83.28	99% Percentile (z)	78.72
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	62.8
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	62.8	95% BCA Bootstrap UTL with 95% Coverage	62.8
95% UPL	62.8	90% Percentile	54.6
90% Chebyshev UPL	77.65	95% Percentile	60.85
95% Chebyshev UPL	99.75	99% Percentile	62.41
95% USL	62.8		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
lead			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	6
Minimum	0.55	First Quartile	21.25
Second Largest	32	Median	25
Maximum	43	Third Quartile	28.25
Mean	22.76	SD	12.49
Coefficient of Variation	0.549	Skewness	-0.582
Mean of logged Data	2.721	SD of logged Data	1.328
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176
Normal GOF Test			
Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			

95% UTL with 95% Coverage	59.11	90% Percentile (z)	38.76
95% UPL (t)	46.76	95% Percentile (z)	43.29
95% USL	49.93	99% Percentile (z)	51.8
Gamma GOF Test			
A-D Test Statistic	1.256	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.377	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.272	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	1.383	k star (bias corrected MLE)	1.034
Theta hat (MLE)	16.46	Theta star (bias corrected MLE)	22
nu hat (MLE)	27.65	nu star (bias corrected)	20.69
MLE Mean (bias corrected)	22.76	MLE Sd (bias corrected)	22.37
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	74.91	90% Percentile	51.96
95% Hawkins Wixley (HW) Approx. Gamma UPL	86.38	95% Percentile	67.36
95% WH Approx. Gamma UTL with 95% Coverage	126.4	99% Percentile	103
95% HW Approx. Gamma UTL with 95% Coverage	160.3		
95% WH USL	86.44	95% HW USL	102.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.676	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.396	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	726.1	90% Percentile (z)	83.39
95% UPL (t)	195.4	95% Percentile (z)	135.1
95% USL	273.6	99% Percentile (z)	334
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	10	95% UTL with 95% Coverage	43
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	43	95% BCA Bootstrap UTL with 95% Coverage	43
95% UPL	43	90% Percentile	33.1
90% Chebyshev UPL	62.05	95% Percentile	38.05
95% Chebyshev UPL	79.84	99% Percentile	42.01
95% USL	43		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
manganese			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	13
Minimum	310	First Quartile	432.5
Second Largest	813	Median	455
Maximum	940	Third Quartile	715.5
Mean	547.3	SD	182.1
Coefficient of Variation	0.333	Skewness	0.921
Mean of logged Data	6.257	SD of logged Data	0.313
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	1007	90% Percentile (z)	780.7
95% UPL (t)	876.4	95% Percentile (z)	846.9
95% USL	992.3	99% Percentile (z)	971
Gamma GOF Test			
A-D Test Statistic	1.03	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.739	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.281	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	10.67	k star (bias corrected MLE)	8.708
Theta hat (MLE)	51.31	Theta star (bias corrected MLE)	62.85
nu hat (MLE)	341.3	nu star (bias corrected)	278.7
MLE Mean (bias corrected)	547.3	MLE Sd (bias corrected)	185.5
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	899.2	90% Percentile	794.4
95% Hawkins Wixley (HW) Approx. Gamma UPL	903.3	95% Percentile	883.7
95% WH Approx. Gamma UTL with 95% Coverage	1083	99% Percentile	1068
95% HW Approx. Gamma UTL with 95% Coverage	1097		
95% WH USL	1061	95% HW USL	1074

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	1149	90% Percentile (z)	779
95% UPL (t)	918	95% Percentile (z)	872.6
95% USL	1120	99% Percentile (z)	1080
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Lognormal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	940
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	940	95% BCA Bootstrap UTL with 95% Coverage	940
95% UPL	940	90% Percentile	786
90% Chebyshev UPL	1110	95% Percentile	844.8
95% Chebyshev UPL	1366	99% Percentile	921
95% USL	940		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
mercury			
General Statistics			
Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	15		
Number of Detects	13	Number of Non-Detects	3
Number of Distinct Detects	13	Number of Distinct Non-Detects	3
Minimum Detect	0.0072	Minimum Non-Detect	0.0067
Maximum Detect	0.28	Maximum Non-Detect	0.023
Variance Detected	0.00492	Percent Non-Detects	18.75%
Mean Detected	0.0499	SD Detected	0.0701
Mean of Detected Logged Data	-3.402	SD of Detected Logged Data	0.807
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.471	**Shapiro Wilk GOF Test**	

5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level		
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**		
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level		
Data Not Normal at 5% Significance Level				
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution				
KM Mean	0.0421		KM SD	0.0629
95% UTL95% Coverage	0.201		95% KM UPL (t)	0.156
90% KM Percentile (z)	0.123		95% KM Percentile (z)	0.146
99% KM Percentile (z)	0.188		95% KM USL	0.196
DL/2 Substitution Background Statistics Assuming Normal Distribution				
Mean	0.0421		SD	0.065
95% UTL95% Coverage	0.206		95% UPL (t)	0.16
90% Percentile (z)	0.125		95% Percentile (z)	0.149
99% Percentile (z)	0.193		95% USL	0.201
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons				
Gamma GOF Tests on Detected Observations Only				
A-D Test Statistic	1.525	**Anderson-Darling GOF Test**		
5% A-D Critical Value	0.752	Data Not Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.279	**Kolmogorov-Smirnov GOF**		
5% K-S Critical Value	0.241	Data Not Gamma Distributed at 5% Significance Level		
Data Not Gamma Distributed at 5% Significance Level				
Gamma Statistics on Detected Data Only				
k hat (MLE)	1.377		k star (bias corrected MLE)	1.111
Theta hat (MLE)	0.0363		Theta star (bias corrected MLE)	0.045
nu hat (MLE)	35.81		nu star (bias corrected)	28.88
MLE Mean (bias corrected)	0.0499			
MLE Sd (bias corrected)	0.0474		95% Percentile of Chisquare (2kstar)	6.414
Gamma ROS Statistics using Imputed Non-Detects				
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs				
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)				
For such situations, GROS method may yield incorrect values of UCLs and BTVs				
This is especially true when the sample size is small.				
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates				
Minimum	0.0072		Mean	0.0425
Maximum	0.28		Median	0.0255
SD	0.0648		CV	1.526
k hat (MLE)	1.207		k star (bias corrected MLE)	1.023
Theta hat (MLE)	0.0352		Theta star (bias corrected MLE)	0.0415
nu hat (MLE)	38.64		nu star (bias corrected)	32.73
MLE Mean (bias corrected)	0.0425		MLE Sd (bias corrected)	0.042
95% Percentile of Chisquare (2kstar)	6.079		90% Percentile	0.0972
95% Percentile	0.126		99% Percentile	0.193
The following statistics are computed using Gamma ROS Statistics on Imputed Data				
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods				
WH	HW		WH	HW

95% Approx. Gamma UTL with 95% Coverage	0.195	0.2	95% Approx. Gamma UPL	0.128	0.126
95% Gamma USL	0.187	0.19			
Estimates of Gamma Parameters using KM Estimates					
Mean (KM)	0.0421		SD (KM)	0.0629	
Variance (KM)	0.00396		SE of Mean (KM)	0.0164	
k hat (KM)	0.448		k star (KM)	0.405	
nu hat (KM)	14.33		nu star (KM)	12.97	
theta hat (KM)	0.094		theta star (KM)	0.104	
80% gamma percentile (KM)	0.068		90% gamma percentile (KM)	0.119	
95% gamma percentile (KM)	0.174		99% gamma percentile (KM)	0.313	
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.193	0.2	95% Approx. Gamma UPL	0.126	0.125
95% KM Gamma Percentile	0.113	0.112	95% Gamma USL	0.185	0.19
Lognormal GOF Test on Detected Observations Only					
Shapiro Wilk Test Statistic	0.844		**Shapiro Wilk GOF Test**		
5% Shapiro Wilk Critical Value	0.866		Data Not Lognormal at 5% Significance Level		
Lilliefors Test Statistic	0.227		**Lilliefors GOF Test**		
5% Lilliefors Critical Value	0.234		Detected Data appear Lognormal at 5% Significance Level		
Detected Data appear Approximate Lognormal at 5% Significance Level					
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					
Mean in Original Scale	0.0419		Mean in Log Scale	-3.691	
SD in Original Scale	0.065		SD in Log Scale	0.958	
95% UTL95% Coverage	0.28		95% BCA UTL95% Coverage	0.28	
95% Bootstrap (%) UTL95% Coverage	0.28		95% UPL (t)	0.141	
90% Percentile (z)	0.0852		95% Percentile (z)	0.121	
99% Percentile (z)	0.232		95% USL	0.259	
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
KM Mean of Logged Data	-3.68		95% KM UTL (Lognormal)95% Coverage	0.256	
KM SD of Logged Data	0.918		95% KM UPL (Lognormal)	0.133	
95% KM Percentile Lognormal (z)	0.114		95% KM USL (Lognormal)	0.238	
Background DL/2 Statistics Assuming Lognormal Distribution					
Mean in Original Scale	0.0421		Mean in Log Scale	-3.687	
SD in Original Scale	0.065		SD in Log Scale	0.979	
95% UTL95% Coverage	0.296		95% UPL (t)	0.147	
90% Percentile (z)	0.0878		95% Percentile (z)	0.125	
99% Percentile (z)	0.244		95% USL	0.274	
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.					
Nonparametric Distribution Free Background Statistics					
Data appear to follow a Discernible Distribution at 5% Significance Level					
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)					

Order of Statistic, r	16	95% UTL with95% Coverage	0.28
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.28
95% USL	0.28	95% KM Chebyshev UPL	0.325
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
nickel			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	14
Minimum	4.9	First Quartile	5.35
Second Largest	12.8	Median	6.99
Maximum	20	Third Quartile	8.635
Mean	8.168	SD	4.026
Coefficient of Variation	0.493	Skewness	1.97
Mean of logged Data	2.014	SD of logged Data	0.404
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.767	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	18.33	90% Percentile (z)	13.33
95% UPL (t)	15.44	95% Percentile (z)	14.79
95% USL	18	99% Percentile (z)	17.53
Gamma GOF Test			
A-D Test Statistic	0.845	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.949	k star (bias corrected MLE)	4.876
Theta hat (MLE)	1.373	Theta star (bias corrected MLE)	1.675
nu hat (MLE)	190.4	nu star (bias corrected)	156
MLE Mean (bias corrected)	8.168	MLE Sd (bias corrected)	3.699

Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	15.39	90% Percentile	13.12
95% Hawkins Wixley (HW) Approx. Gamma UPL	15.41	95% Percentile	15.05
95% WH Approx. Gamma UTL with 95% Coverage	19.49	99% Percentile	19.12
95% HW Approx. Gamma UTL with 95% Coverage	19.74		
95% WH USL	18.99	95% HW USL	19.22
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.18	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	20.77	90% Percentile (z)	12.57
95% UPL (t)	15.55	95% Percentile (z)	14.56
95% USL	20.11	99% Percentile (z)	19.18
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Gamma Distribution at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	20
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	20	95% BCA Bootstrap UTL with 95% Coverage	20
95% UPL	20	90% Percentile	12.8
90% Chebyshev UPL	20.62	95% Percentile	14.6
95% Chebyshev UPL	26.26	99% Percentile	18.92
95% USL	20		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
selenium			
General Statistics			
Total Number of Observations	16	Number of Missing Observations	0
Number of Distinct Observations	14		
Number of Detects	12	Number of Non-Detects	4
Number of Distinct Detects	11	Number of Distinct Non-Detects	3
Minimum Detect	0.306	Minimum Non-Detect	0.53
Maximum Detect	1.7	Maximum Non-Detect	0.65
Variance Detected	0.258	Percent Non-Detects	25%
Mean Detected	0.986	SD Detected	0.508
Mean of Detected Logged Data	-0.157	SD of Detected Logged Data	0.582

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.895	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.214	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.243	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.854	KM SD	0.481
95% UTL95% Coverage	2.068	95% KM UPL (t)	1.724
90% KM Percentile (z)	1.471	95% KM Percentile (z)	1.646
99% KM Percentile (z)	1.973	95% KM USL	2.03
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.813	SD	0.534
95% UTL95% Coverage	2.16	95% UPL (t)	1.778
90% Percentile (z)	1.497	95% Percentile (z)	1.691
99% Percentile (z)	2.055	95% USL	2.117
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.53	Anderson-Darling GOF Test	
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.205	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	3.662	k star (bias corrected MLE)	2.802
Theta hat (MLE)	0.269	Theta star (bias corrected MLE)	0.352
nu hat (MLE)	87.88	nu star (bias corrected)	67.25
MLE Mean (bias corrected)	0.986		
MLE Sd (bias corrected)	0.589	95% Percentile of Chisquare (2kstar)	12
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.306	Mean	0.859
Maximum	1.7	Median	0.594
SD	0.493	CV	0.574
k hat (MLE)	3.391	k star (bias corrected MLE)	2.797
Theta hat (MLE)	0.253	Theta star (bias corrected MLE)	0.307
nu hat (MLE)	108.5	nu star (bias corrected)	89.5

MLE Mean (bias corrected)		0.859	MLE Sd (bias corrected)		0.514
95% Percentile of Chisquare (2kstar)		11.98	90% Percentile		1.548
95% Percentile		1.84	99% Percentile		2.476
The following statistics are computed using Gamma ROS Statistics on Imputed Data					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.562	2.667	95% Approx. Gamma UPL	1.909	1.943
95% Gamma USL	2.482	2.577			
Estimates of Gamma Parameters using KM Estimates					
Mean (KM)		0.854	SD (KM)		0.481
Variance (KM)		0.231	SE of Mean (KM)		0.127
k hat (KM)		3.156	k star (KM)		2.606
nu hat (KM)		101	nu star (KM)		83.39
theta hat (KM)		0.271	theta star (KM)		0.328
80% gamma percentile (KM)		1.24	90% gamma percentile (KM)		1.564
95% gamma percentile (KM)		1.869	99% gamma percentile (KM)		2.534
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.503	2.604	95% Approx. Gamma UPL	1.871	1.903
95% KM Gamma Percentile	1.745	1.766	95% Gamma USL	2.426	2.516
Lognormal GOF Test on Detected Observations Only					
Shapiro Wilk Test Statistic		0.906	**Shapiro Wilk GOF Test**		
5% Shapiro Wilk Critical Value		0.859	Detected Data appear Lognormal at 5% Significance Level		
Lilliefors Test Statistic		0.181	**Lilliefors GOF Test**		
5% Lilliefors Critical Value		0.243	Detected Data appear Lognormal at 5% Significance Level		
Detected Data appear Lognormal at 5% Significance Level					
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					
Mean in Original Scale		0.859	Mean in Log Scale		-0.305
SD in Original Scale		0.492	SD in Log Scale		0.569
95% UTL95% Coverage		3.101	95% BCA UTL95% Coverage		1.7
95% Bootstrap (%) UTL95% Coverage		1.7	95% UPL (t)		2.062
90% Percentile (z)		1.529	95% Percentile (z)		1.88
99% Percentile (z)		2.771	95% USL		2.962
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
KM Mean of Logged Data		-0.317	95% KM UTL (Lognormal)95% Coverage		3.053
KM SD of Logged Data		0.568	95% KM UPL (Lognormal)		2.032
95% KM Percentile Lognormal (z)		1.853	95% KM USL (Lognormal)		2.916
Background DL/2 Statistics Assuming Lognormal Distribution					
Mean in Original Scale		0.813	Mean in Log Scale		-0.424
SD in Original Scale		0.534	SD in Log Scale		0.691
95% UTL95% Coverage		3.74	95% UPL (t)		2.28
90% Percentile (z)		1.586	95% Percentile (z)		2.038
99% Percentile (z)		3.263	95% USL		3.538

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	16	95% UTL with95% Coverage	1.7
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
Approximate Sample Size needed to achieve specified CC	59	95% UPL	1.7
95% USL	1.7	95% KM Chebyshev UPL	3.016
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
strontium			
General Statistics			
Total Number of Observations	16	Number of Distinct Observations	13
Minimum	14	First Quartile	16.6
Second Largest	29	Median	19
Maximum	46	Third Quartile	24.55
Mean	21.7	SD	7.877
Coefficient of Variation	0.363	Skewness	2.078
Mean of logged Data	3.029	SD of logged Data	0.307
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.524	d2max (for USL)	2.443
Normal GOF Test			
Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level	
Data appear Approximate Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	41.58	90% Percentile (z)	31.79
95% UPL (t)	35.93	95% Percentile (z)	34.66
95% USL	40.94	99% Percentile (z)	40.02
Gamma GOF Test			
A-D Test Statistic	0.604	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	10.41	k star (bias corrected MLE)	8.501
Theta hat (MLE)	2.084	Theta star (bias corrected MLE)	2.553
nu hat (MLE)	333.2	nu star (bias corrected)	272
MLE Mean (bias corrected)	21.7	MLE Sd (bias corrected)	7.443
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	35.79	90% Percentile	31.62
95% Hawkins Wixley (HW) Approx. Gamma UPL	35.82	95% Percentile	35.21
95% WH Approx. Gamma UTL with 95% Coverage	43.19	99% Percentile	42.64
95% HW Approx. Gamma UTL with 95% Coverage	43.54		
95% WH USL	42.31	95% HW USL	42.61
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	44.88	90% Percentile (z)	30.64
95% UPL (t)	36	95% Percentile (z)	34.25
95% USL	43.78	99% Percentile (z)	42.23
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	16	95% UTL with 95% Coverage	46
Approx, f used to compute achieved CC	0.842	Approximate Actual Confidence Coefficient achieved by UTL	0.56
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	46	95% BCA Bootstrap UTL with 95% Coverage	46
95% UPL	46	90% Percentile	27.05
90% Chebyshev UPL	46.06	95% Percentile	33.25
95% Chebyshev UPL	57.09	99% Percentile	43.45
95% USL	46		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
thallium			
General Statistics			
Total Number of Observations	10	Number of Missing Observations	6
Number of Distinct Observations	8		
Number of Detects	1	Number of Non-Detects	9

Number of Distinct Detects	1	Number of Distinct Non-Detects	7
Minimum Detect	2.3	Minimum Non-Detect	0.53
Maximum Detect	2.3	Maximum Non-Detect	0.65
Variance Detected	N/A	Percent Non-Detects	90%
Mean Detected	2.3	SD Detected	N/A
Mean of Detected Logged Data	0.833	SD of Detected Logged Data	N/A

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable thallium was not processed!

vanadium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	8
		Number of Missing Observations	6
Minimum	34	First Quartile	35.5
Second Largest	67	Median	38.5
Maximum	190	Third Quartile	52.5
Mean	57.9	SD	47.63
Coefficient of Variation	0.823	Skewness	2.884
Mean of logged Data	3.89	SD of logged Data	0.527

Critical Values for Background Threshold Values (BTVs)

Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176

Normal GOF Test

Shapiro Wilk Test Statistic	0.548	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.341	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Background Statistics Assuming Normal Distribution

95% UTL with 95% Coverage	196.6	90% Percentile (z)	118.9
95% UPL (t)	149.5	95% Percentile (z)	136.2
95% USL	161.5	99% Percentile (z)	168.7

Gamma GOF Test

A-D Test Statistic	1.459	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.285	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.123	k star (bias corrected MLE)	2.253
Theta hat (MLE)	18.54	Theta star (bias corrected MLE)	25.7

nu hat (MLE)	62.46	nu star (bias corrected)	45.06
MLE Mean (bias corrected)	57.9	MLE Sd (bias corrected)	38.58
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	139.3	90% Percentile	109.5
95% Hawkins Wixley (HW) Approx. Gamma UPL	138.1	95% Percentile	132.3
95% WH Approx. Gamma UTL with 95% Coverage	209.5	99% Percentile	182.5
95% HW Approx. Gamma UTL with 95% Coverage	212.7		
95% WH USL	155.5	95% HW USL	155
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.71	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	227	90% Percentile (z)	96.14
95% UPL (t)	134.8	95% Percentile (z)	116.4
95% USL	154.1	99% Percentile (z)	166.8
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Lognormal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	10	95% UTL with 95% Coverage	190
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	190	95% BCA Bootstrap UTL with 95% Coverage	190
95% UPL	190	90% Percentile	79.3
90% Chebyshev UPL	207.8	95% Percentile	134.7
95% Chebyshev UPL	275.7	99% Percentile	178.9
95% USL	190		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
zinc			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	6
Minimum	40	First Quartile	44.25
Second Largest	75	Median	46.5
Maximum	230	Third Quartile	49.75
Mean	66.9	SD	58.12

Coefficient of Variation	0.869	Skewness	3.01
Mean of logged Data	4.028	SD of logged Data	0.524
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	2.911	d2max (for USL)	2.176
Normal GOF Test			
Shapiro Wilk Test Statistic	0.485	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	236.1	90% Percentile (z)	141.4
95% UPL (t)	178.6	95% Percentile (z)	162.5
95% USL	193.4	99% Percentile (z)	202.1
Gamma GOF Test			
A-D Test Statistic	2.033	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.412	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.268	Data Not Gamma Distributed at 5% Significance Level	
Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	3.009	k star (bias corrected MLE)	2.173
Theta hat (MLE)	22.23	Theta star (bias corrected MLE)	30.79
nu hat (MLE)	60.18	nu star (bias corrected)	43.46
MLE Mean (bias corrected)	66.9	MLE Sd (bias corrected)	45.38
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	162.6	90% Percentile	127.6
95% Hawkins Wixley (HW) Approx. Gamma UPL	160.4	95% Percentile	154.6
95% WH Approx. Gamma UTL with 95% Coverage	245.8	99% Percentile	214.2
95% HW Approx. Gamma UTL with 95% Coverage	248.1		
95% WH USL	181.7	95% HW USL	180.2
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.608	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.388	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data Not Lognormal at 5% Significance Level	
Data Not Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	258	90% Percentile (z)	109.9
95% UPL (t)	153.7	95% Percentile (z)	132.9
95% USL	175.6	99% Percentile (z)	189.9

Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	10	95% UTL with 95% Coverage	230
Approx, f used to compute achieved CC	0.526	Approximate Actual Confidence Coefficient achieved by UTL	0.401
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	230	95% BCA Bootstrap UTL with 95% Coverage	230
95% UPL	230	90% Percentile	90.5
90% Chebyshev UPL	249.8	95% Percentile	160.3
95% Chebyshev UPL	332.6	99% Percentile	216.1
95% USL	230		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			

	Goodness-of-Fit Test Statistics for Data Sets with Non-Detects
User Selected Options	
Date/Time of Computation	ProUCL 5.18/17/2021 4:14:53 PM
From File	ProUCL Background Inputs.xls
Full Precision	OFF
Confidence Coefficient	0.95

antimony

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	6	10	0	10	100.00%

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable antimony was not processed!

arsenic

Raw Statistics	
Number of Valid Observations	16
Number of Distinct Observations	13
Minimum	1.4
Maximum	3.08
Mean of Raw Data	1.997
Standard Deviation of Raw Data	0.376
Khat	33.27
Theta hat	0.06
Kstar	27.08
Theta star	0.0737
Mean of Log Transformed Data	0.676
Standard Deviation of Log Transformed Data	0.176
Normal GOF Test Results	
Correlation Coefficient R	0.929
Shapiro Wilk Test Statistic	0.887
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.039
Lilliefors Test Statistic	0.147
Lilliefors Critical (0.05) Value	0.213
Data appear Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.948

A-D Test Statistic	0.399						
A-D Critical (0.05) Value	0.736						
K-S Test Statistic	0.124						
K-S Critical(0.05) Value	0.215						
Data appear Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.963						
Shapiro Wilk Test Statistic	0.948						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.368						
Lilliefors Test Statistic	0.125						
Lilliefors Critical (0.05) Value	0.213						
Data appear Lognormal at (0.05) Significance Level							
barium							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	15						
Minimum	36						
Maximum	77.9						
Mean of Raw Data	54.96						
Standard Deviation of Raw Data	11.56						
Khat	25.01						
Theta hat	2.197						
Kstar	20.36						
Theta star	2.699						
Mean of Log Transformed Data	3.986						
Standard Deviation of Log Transformed Data	0.206						
Normal GOF Test Results							
Correlation Coefficient R	0.971						
Shapiro Wilk Test Statistic	0.942						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.378						
Lilliefors Test Statistic	0.192						
Lilliefors Critical (0.05) Value	0.213						
Data appear Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.981						
A-D Test Statistic	0.321						
A-D Critical (0.05) Value	0.736						
K-S Test Statistic	0.17						
K-S Critical(0.05) Value	0.215						
Data appear Gamma Distributed at (0.05) Significance Level							

Lognormal GOF Test Results							
Correlation Coefficient R	0.984						
Shapiro Wilk Test Statistic	0.968						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.779						
Lilliefors Test Statistic	0.156						
Lilliefors Critical (0.05) Value	0.213						
Data appear Lognormal at (0.05) Significance Level							
beryllium							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	14						
Minimum	0.293						
Maximum	0.99						
Mean of Raw Data	0.507						
Standard Deviation of Raw Data	0.154						
Khat	14.04						
Theta hat	0.0361						
Kstar	11.45						
Theta star	0.0443						
Mean of Log Transformed Data	-0.715						
Standard Deviation of Log Transformed Data	0.268						
Normal GOF Test Results							
Correlation Coefficient R	0.886						
Shapiro Wilk Test Statistic	0.813						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.00264						
Lilliefors Test Statistic	0.228						
Lilliefors Critical (0.05) Value	0.213						
Data not Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.92						
A-D Test Statistic	0.558						
A-D Critical (0.05) Value	0.738						
K-S Test Statistic	0.185						
K-S Critical(0.05) Value	0.215						
Data appear Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.953						
Shapiro Wilk Test Statistic	0.933						

Shapiro Wilk Critical (0.05) Value	0.887							
Approximate Shapiro Wilk P Value	0.206							
Lilliefors Test Statistic	0.169							
Lilliefors Critical (0.05) Value	0.213							
Data appear Lognormal at (0.05) Significance Level								
cadmium								
	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
Raw Statistics	16	0	16	7	9	56.25%		
	Number	Minimum	Maximum	Mean	Median	SD		
Statistics (Non-Detects Only)	9	0.27	0.3	0.283	0.28	0.0122		
Statistics (Non-Detects Only)	7	0.0918	0.38	0.161	0.136	0.101		
Statistics (All: NDs treated as DL value)	16	0.0918	0.38	0.23	0.27	0.09		
Statistics (All: NDs treated as DL/2 value)	16	0.0918	0.38	0.15	0.14	0.0648		
Statistics (Normal ROS Imputed Data)	16	0.0772	0.38	0.147	0.136	0.0725		
Statistics (Gamma ROS Imputed Data)	16	0.0789	0.38	0.143	0.131	0.0718		
Statistics (Lognormal ROS Imputed Data)	16	0.0918	0.38	0.143	0.131	0.0693		
	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV		
Statistics (Non-Detects Only)	4.282	2.542	0.0376	-1.948	0.491	-0.252		
Statistics (NDs = DL)	5.628	4.614	0.0408	-1.562	0.47	-0.301		
Statistics (NDs = DL/2)	9.164	7.487	0.0164	-1.952	0.312	-0.16		
Statistics (Gamma ROS Estimates)	6.178	5.062	0.0231	-2.03	0.392	-0.193		
Statistics (Lognormal ROS Estimates)	--	--	--	-2.02	0.358	-0.177		
		Normal GOF Test Results						
	No NDs	NDs = DL	NDs = DL/2	Normal ROS				
Correlation Coefficient R	0.832	0.936	0.729	0.849				
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
Shapiro-Wilk (Detects Only)	0.712	0.803	Data Not Normal					
Shapiro-Wilk (NDs = DL)	0.866	0.887	Data Not Normal					
Shapiro-Wilk (NDs = DL/2)	0.566	0.887	Data Not Normal					
Shapiro-Wilk (Normal ROS Estimates)	0.742	0.887	Data Not Normal					
Lilliefors (Detects Only)	0.3	0.304	Data Appear Normal					
Lilliefors (NDs = DL)	0.297	0.213	Data Not Normal					
Lilliefors (NDs = DL/2)	0.376	0.213	Data Not Normal					
Lilliefors (Normal ROS Estimates)	0.215	0.213	Data Not Normal					
		Gamma GOF Test Results						
	No NDs	NDs = DL	NDs = DL/2	Gamma ROS				
Correlation Coefficient R	0.919	0.901	0.791	0.893				
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
Anderson-Darling (Detects Only)	0.646	0.71						
Kolmogorov-Smirnov (Detects Only)	0.267	0.313	Detected Data Appear Gamma Distributed					

Anderson-Darling (NDs = DL)	1.302	0.741						
Kolmogorov-Smirnov (NDs = DL)	0.328	0.216	Data Not Gamma Distributed					
Anderson-Darling (NDs = DL/2)	1.888	0.739						
Kolmogorov-Smirnov (NDs = DL/2)	0.332	0.215	Data Not Gamma Distributed					
Anderson-Darling (Gamma ROS Estimates)	0.81	0.741						
Kolmogorov-Smirnov (Gamma ROS Est.)	0.165	0.216	Detected Data appear Approximate Gamma Distr					
Lognormal GOF Test Results								
	No NDs	NDs = DL	NDs = DL/2	Log ROS				
Correlation Coefficient R	0.918	0.916	0.846	0.905				
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)					
Shapiro-Wilk (Detects Only)	0.851	0.803	Data Appear Lognormal					
Shapiro-Wilk (NDs = DL)	0.827	0.887	Data Not Lognormal					
Shapiro-Wilk (NDs = DL/2)	0.748	0.887	Data Not Lognormal					
Shapiro-Wilk (Lognormal ROS Estimates)	0.832	0.887	Data Not Lognormal					
Lilliefors (Detects Only)	0.235	0.304	Data Appear Lognormal					
Lilliefors (NDs = DL)	0.33	0.213	Data Not Lognormal					
Lilliefors (NDs = DL/2)	0.305	0.213	Data Not Lognormal					
Lilliefors (Lognormal ROS Estimates)	0.162	0.213	Data Appear Lognormal					
Note: Substitution methods such as DL or DL/2 are not recommended.								
hexavalent chromium								
	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs		
Raw Statistics	16	0	16	9	7	43.75%		
	Number	Minimum	Maximum	Mean	Median	SD		
Statistics (Non-Detects Only)	7	0.12	1.19	0.863	1.14	0.504		
Statistics (Non-Detects Only)	9	0.21	5.34	1.176	0.81	1.579		
Statistics (All: NDs treated as DL value)	16	0.12	5.34	1.039	0.855	1.207		
Statistics (All: NDs treated as DL/2 value)	16	0.06	5.34	0.85	0.58	1.225		
Statistics (Normal ROS Imputed Data)	16	-1.631	5.34	0.589	0.6	1.524		
Statistics (Gamma ROS Imputed Data)	16	0.01	5.34	0.791	0.6	1.263		
Statistics (Lognormal ROS Imputed Data)	16	0.13	5.34	0.836	0.6	1.23		
	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV		
Statistics (Non-Detects Only)	1.299	0.94	0.905	-0.27	0.867	-3.21		
Statistics (NDs = DL)	1.38	1.163	0.753	-0.366	0.941	-2.571		
Statistics (NDs = DL/2)	1.124	0.955	0.756	-0.669	1.045	-1.561		
Statistics (Gamma ROS Estimates)	0.541	0.482	1.46	-1.394	2.029	-1.456		
Statistics (Lognormal ROS Estimates)	--	--	--	-0.641	0.893	-1.394		
Normal GOF Test Results								
	No NDs	NDs = DL	NDs = DL/2	Normal ROS				
Correlation Coefficient R	0.705	0.73	0.659	0.853				

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.531	0.829	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.564	0.887	Data Not Normal
Shapiro-Wilk (NDs = DL/2)	0.467	0.887	Data Not Normal
Shapiro-Wilk (Normal ROS Estimates)	0.759	0.887	Data Not Normal
Lilliefors (Detects Only)	0.463	0.274	Data Not Normal
Lilliefors (NDs = DL)	0.388	0.213	Data Not Normal
Lilliefors (NDs = DL/2)	0.428	0.213	Data Not Normal
Lilliefors (Normal ROS Estimates)	0.308	0.213	Data Not Normal

Gamma GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Gamma ROS
Correlation Coefficient R	0.864	0.856	0.822	0.884

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.129	0.738	
Kolmogorov-Smirnov (Detects Only)	0.394	0.285	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	0.894	0.757	
Kolmogorov-Smirnov (NDs = DL)	0.265	0.219	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.404	0.761	
Kolmogorov-Smirnov (NDs = DL/2)	0.299	0.221	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	1.083	0.793	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.234	0.227	Data Not Gamma Distributed

Lognormal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Log ROS
Correlation Coefficient R	0.904	0.938	0.904	0.942

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.852	0.829	Data Appear Lognormal
Shapiro-Wilk (NDs = DL)	0.893	0.887	Data Appear Lognormal
Shapiro-Wilk (NDs = DL/2)	0.839	0.887	Data Not Lognormal
Shapiro-Wilk (Lognormal ROS Estimates)	0.902	0.887	Data Appear Lognormal
Lilliefors (Detects Only)	0.324	0.274	Data Not Lognormal
Lilliefors (NDs = DL)	0.221	0.213	Data Not Lognormal
Lilliefors (NDs = DL/2)	0.246	0.213	Data Not Lognormal
Lilliefors (Lognormal ROS Estimates)	0.22	0.213	Data Not Lognormal

Note: Substitution methods such as DL or DL/2 are not recommended.

trivalent chromium

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	14
Minimum	16.16
Maximum	70.2
Mean of Raw Data	26.43

Standard Deviation of Raw Data	13.43						
Khat	6.387						
Theta hat	4.139						
Kstar	5.231						
Theta star	5.053						
Mean of Log Transformed Data	3.194						
Standard Deviation of Log Transformed Data	0.377						
Normal GOF Test Results							
Correlation Coefficient R	0.804						
Shapiro Wilk Test Statistic	0.668						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	3.1044E-5						
Lilliefors Test Statistic	0.307						
Lilliefors Critical (0.05) Value	0.213						
Data not Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.883						
A-D Test Statistic	1.306						
A-D Critical (0.05) Value	0.741						
K-S Test Statistic	0.272						
K-S Critical(0.05) Value	0.216						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.905						
Shapiro Wilk Test Statistic	0.831						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.00584						
Lilliefors Test Statistic	0.245						
Lilliefors Critical (0.05) Value	0.213						
Data not Lognormal at (0.05) Significance Level							
Non-parametric GOF Test Results							
Data do not follow a discernible distribution at (0.05) Level of Significan							
total chromium							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	14						
Minimum	16						
Maximum	70.2						
Mean of Raw Data	26.63						
Standard Deviation of Raw Data	13.98						

Khat	5.828						
Theta hat	4.568						
Kstar	4.777						
Theta star	5.573						
Mean of Log Transformed Data	3.194						
Standard Deviation of Log Transformed Data	0.397						
Normal GOF Test Results							
Correlation Coefficient R	0.819						
Shapiro Wilk Test Statistic	0.689						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	5.8616E-5						
Lilliefors Test Statistic	0.31						
Lilliefors Critical (0.05) Value	0.213						
Data not Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.901						
A-D Test Statistic	1.323						
A-D Critical (0.05) Value	0.741						
K-S Test Statistic	0.273						
K-S Critical(0.05) Value	0.216						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.909						
Shapiro Wilk Test Statistic	0.833						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.00674						
Lilliefors Test Statistic	0.245						
Lilliefors Critical (0.05) Value	0.213						
Data not Lognormal at (0.05) Significance Level							
Non-parametric GOF Test Results							
Data do not follow a discernible distribution at (0.05) Level of Significan							
cobalt							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	14						
Minimum	6.3						
Maximum	27						
Mean of Raw Data	13.73						
Standard Deviation of Raw Data	6.721						
Khat	4.558						

Theta hat	3.011						
Kstar	3.745						
Theta star	3.665						
Mean of Log Transformed Data	2.506						
Standard Deviation of Log Transformed Data	0.494						
Normal GOF Test Results							
Correlation Coefficient R	0.952						
Shapiro Wilk Test Statistic	0.891						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.0725						
Lilliefors Test Statistic	0.198						
Lilliefors Critical (0.05) Value	0.213						
Data appear Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.974						
A-D Test Statistic	0.69						
A-D Critical (0.05) Value	0.742						
K-S Test Statistic	0.218						
K-S Critical(0.05) Value	0.216						
Data appear Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.959						
Shapiro Wilk Test Statistic	0.9						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.108						
Lilliefors Test Statistic	0.215						
Lilliefors Critical (0.05) Value	0.213						
Data appear Approximate_Lognormal at (0.05) Significance Level							
copper							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	12						
Minimum	15						
Maximum	62.8						
Mean of Raw Data	28.85						
Standard Deviation of Raw Data	15.78						
Khat	4.383						
Theta hat	6.582						
Kstar	3.603						
Theta star	8.007						
Mean of Log Transformed Data	3.244						
Standard Deviation of Log Transformed Data	0.482						

Normal GOF Test Results	
Correlation Coefficient R	0.9
Shapiro Wilk Test Statistic	0.801
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.00266
Lilliefors Test Statistic	0.213
Lilliefors Critical (0.05) Value	0.213
Data appear Approximate Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.957
A-D Test Statistic	0.943
A-D Critical (0.05) Value	0.742
K-S Test Statistic	0.212
K-S Critical(0.05) Value	0.216
Data follow Appr. Gamma Distribution at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.945
Shapiro Wilk Test Statistic	0.876
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.0423
Lilliefors Test Statistic	0.206
Lilliefors Critical (0.05) Value	0.213
Data appear Approximate_Lognormal at (0.05) Significance Level	
lead	
Raw Statistics	
Number of Valid Observations	10
Number of Missing Observations	6
Number of Distinct Observations	9
Minimum	0.55
Maximum	43
Mean of Raw Data	22.76
Standard Deviation of Raw Data	12.49
Khat	1.383
Theta hat	16.46
Kstar	1.034
Theta star	22
Mean of Log Transformed Data	2.721
Standard Deviation of Log Transformed Data	1.328
Normal GOF Test Results	
Correlation Coefficient R	0.95

Shapiro Wilk Test Statistic	0.912						
Shapiro Wilk Critical (0.05) Value	0.842						
Approximate Shapiro Wilk P Value	0.242						
Lilliefors Test Statistic	0.244						
Lilliefors Critical (0.05) Value	0.262						
Data appear Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.86						
A-D Test Statistic	1.256						
A-D Critical (0.05) Value	0.741						
K-S Test Statistic	0.377						
K-S Critical(0.05) Value	0.272						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.809						
Shapiro Wilk Test Statistic	0.676						
Shapiro Wilk Critical (0.05) Value	0.842						
Approximate Shapiro Wilk P Value	4.1142E-4						
Lilliefors Test Statistic	0.396						
Lilliefors Critical (0.05) Value	0.262						
Data not Lognormal at (0.05) Significance Level							
manganese							
Raw Statistics							
Number of Valid Observations	16						
Number of Distinct Observations	13						
Minimum	310						
Maximum	940						
Mean of Raw Data	547.3						
Standard Deviation of Raw Data	182.1						
Khat	10.67						
Theta hat	51.31						
Kstar	8.708						
Theta star	62.85						
Mean of Log Transformed Data	6.257						
Standard Deviation of Log Transformed Data	0.313						
Normal GOF Test Results							
Correlation Coefficient R	0.925						
Shapiro Wilk Test Statistic	0.854						
Shapiro Wilk Critical (0.05) Value	0.887						
Approximate Shapiro Wilk P Value	0.0161						
Lilliefors Test Statistic	0.295						
Lilliefors Critical (0.05) Value	0.213						

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.953
A-D Test Statistic	1.03
A-D Critical (0.05) Value	0.739
K-S Test Statistic	0.281
K-S Critical(0.05) Value	0.215

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.948
Shapiro Wilk Test Statistic	0.896
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.075
Lilliefors Test Statistic	0.264
Lilliefors Critical (0.05) Value	0.213

Data appear Approximate_Lognormal at (0.05) Significance Level

mercury

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	13	3	18.75%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	3	0.0067	0.023	0.0166	0.02	0.00868
Statistics (Non-Detects Only)	13	0.0072	0.28	0.0499	0.032	0.0701
Statistics (All: NDs treated as DL value)	16	0.0067	0.28	0.0437	0.0255	0.0642
Statistics (All: NDs treated as DL/2 value)	16	0.00335	0.28	0.0421	0.0255	0.065
Statistics (Normal ROS Imputed Data)	16	-0.0704	0.28	0.0312	0.0255	0.0749
Statistics (Gamma ROS Imputed Data)	16	0.0072	0.28	0.0425	0.0255	0.0648
Statistics (Lognormal ROS Imputed Data)	16	0.00522	0.28	0.0419	0.0255	0.065

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	1.377	1.111	0.0363	-3.402	0.807	-0.237
Statistics (NDs = DL)	1.314	1.11	0.0332	-3.557	0.833	-0.234
Statistics (NDs = DL/2)	1.098	0.934	0.0384	-3.687	0.979	-0.265
Statistics (Gamma ROS Estimates)	1.207	1.023	0.0352	-3.628	0.87	-0.24
Statistics (Lognormal ROS Estimates)	--	--	--	-3.691	0.958	-0.26

Normal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Normal ROS
Correlation Coefficient R	0.661	0.647	0.666	0.806

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.471	0.866	Data Not Normal
Shapiro-Wilk (NDs = DL)	0.451	0.887	Data Not Normal

Shapiro-Wilk (NDs = DL/2)	0.475	0.887	Data Not Normal	
Shapiro-Wilk (Normal ROS Estimates)	0.686	0.887	Data Not Normal	
Lilliefors (Detects Only)	0.4	0.234	Data Not Normal	
Lilliefors (NDs = DL)	0.374	0.213	Data Not Normal	
Lilliefors (NDs = DL/2)	0.365	0.213	Data Not Normal	
Lilliefors (Normal ROS Estimates)	0.318	0.213	Data Not Normal	

Gamma GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Gamma ROS
Correlation Coefficient R	0.829	0.817	0.84	0.832

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Anderson-Darling (Detects Only)	1.525	0.752	
Kolmogorov-Smirnov (Detects Only)	0.279	0.241	Data Not Gamma Distributed
Anderson-Darling (NDs = DL)	1.554	0.758	
Kolmogorov-Smirnov (NDs = DL)	0.247	0.22	Data Not Gamma Distributed
Anderson-Darling (NDs = DL/2)	1.06	0.762	
Kolmogorov-Smirnov (NDs = DL/2)	0.223	0.221	Data Not Gamma Distributed
Anderson-Darling (Gamma ROS Estimates)	1.267	0.76	
Kolmogorov-Smirnov (Gamma ROS Est.)	0.231	0.22	Data Not Gamma Distributed

Lognormal GOF Test Results

	No NDs	NDs = DL	NDs = DL/2	Log ROS
Correlation Coefficient R	0.897	0.915	0.952	0.948

	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)
Shapiro-Wilk (Detects Only)	0.844	0.866	Data Not Lognormal
Shapiro-Wilk (NDs = DL)	0.864	0.887	Data Not Lognormal
Shapiro-Wilk (NDs = DL/2)	0.93	0.887	Data Appear Lognormal
Shapiro-Wilk (Lognormal ROS Estimates)	0.912	0.887	Data Appear Lognormal
Lilliefors (Detects Only)	0.227	0.234	Data Appear Lognormal
Lilliefors (NDs = DL)	0.21	0.213	Data Appear Lognormal
Lilliefors (NDs = DL/2)	0.197	0.213	Data Appear Lognormal
Lilliefors (Lognormal ROS Estimates)	0.198	0.213	Data Appear Lognormal

Note: Substitution methods such as DL or DL/2 are not recommended.

nickel

Raw Statistics

Number of Valid Observations	16
Number of Distinct Observations	14
Minimum	4.9
Maximum	20
Mean of Raw Data	8.168
Standard Deviation of Raw Data	4.026
Khat	5.949
Theta hat	1.373

Kstar	4.876
Theta star	1.675
Mean of Log Transformed Data	2.014
Standard Deviation of Log Transformed Data	0.404

Normal GOF Test Results

Correlation Coefficient R	0.87
Shapiro Wilk Test Statistic	0.767
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	6.9828E-4
Lilliefors Test Statistic	0.227
Lilliefors Critical (0.05) Value	0.213

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.938
A-D Test Statistic	0.845
A-D Critical (0.05) Value	0.741
K-S Test Statistic	0.192
K-S Critical(0.05) Value	0.216

Data follow Appr. Gamma Distribution at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.942
Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.0484
Lilliefors Test Statistic	0.18
Lilliefors Critical (0.05) Value	0.213

Data appear Approximate_Lognormal at (0.05) Significance Level

selenium

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs
Raw Statistics	16	0	16	12	4	25.00%

	Number	Minimum	Maximum	Mean	Median	SD
Statistics (Non-Detects Only)	4	0.53	0.65	0.59	0.59	0.049
Statistics (Non-Detects Only)	12	0.306	1.7	0.986	0.964	0.508
Statistics (All: NDs treated as DL value)	16	0.306	1.7	0.887	0.62	0.47
Statistics (All: NDs treated as DL/2 value)	16	0.265	1.7	0.813	0.553	0.534
Statistics (Normal ROS Imputed Data)	16	0.306	1.7	0.859	0.617	0.495
Statistics (Gamma ROS Imputed Data)	16	0.306	1.7	0.859	0.594	0.493
Statistics (Lognormal ROS Imputed Data)	16	0.306	1.7	0.859	0.578	0.492

	K hat	K Star	Theta hat	Log Mean	Log Stdv	Log CV
Statistics (Non-Detects Only)	3.662	2.802	0.269	-0.157	0.582	-3.698

Statistics (NDs = DL)	3.999	3.291	0.222	-0.251	0.527	-2.102
Statistics (NDs = DL/2)	2.462	2.042	0.33	-0.424	0.691	-1.629
Statistics (Gamma ROS Estimates)	3.391	2.797	0.253	-0.307	0.574	-1.874
Statistics (Lognormal ROS Estimates)	--	--	--	-0.305	0.569	-1.868
Normal GOF Test Results						
	No NDs	NDs = DL	NDs = DL/2	Normal ROS		
Correlation Coefficient R	0.958	0.931	0.933	0.939		
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
Shapiro-Wilk (Detects Only)	0.895	0.859	Data Appear Normal			
Shapiro-Wilk (NDs = DL)	0.852	0.887	Data Not Normal			
Shapiro-Wilk (NDs = DL/2)	0.848	0.887	Data Not Normal			
Shapiro-Wilk (Normal ROS Estimates)	0.862	0.887	Data Not Normal			
Lilliefors (Detects Only)	0.214	0.243	Data Appear Normal			
Lilliefors (NDs = DL)	0.255	0.213	Data Not Normal			
Lilliefors (NDs = DL/2)	0.243	0.213	Data Not Normal			
Lilliefors (Normal ROS Estimates)	0.226	0.213	Data Not Normal			
Gamma GOF Test Results						
	No NDs	NDs = DL	NDs = DL/2	Gamma ROS		
Correlation Coefficient R	0.941	0.952	0.948	0.953		
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
Anderson-Darling (Detects Only)	0.53	0.737				
Kolmogorov-Smirnov (Detects Only)	0.205	0.247	Detected Data Appear Gamma Distributed			
Anderson-Darling (NDs = DL)	0.833	0.742				
Kolmogorov-Smirnov (NDs = DL)	0.225	0.216	Data Not Gamma Distributed			
Anderson-Darling (NDs = DL/2)	0.755	0.748				
Kolmogorov-Smirnov (NDs = DL/2)	0.19	0.217	Detected Data appear Approximate Gamma Distr			
Anderson-Darling (Gamma ROS Estimates)	0.759	0.743				
Kolmogorov-Smirnov (Gamma ROS Est.)	0.206	0.216	Detected Data appear Approximate Gamma Distr			
Lognormal GOF Test Results						
	No NDs	NDs = DL	NDs = DL/2	Log ROS		
Correlation Coefficient R	0.961	0.959	0.955	0.959		
	Test value	Crit. (0.05)	Conclusion with Alpha(0.05)			
Shapiro-Wilk (Detects Only)	0.906	0.859	Data Appear Lognormal			
Shapiro-Wilk (NDs = DL)	0.909	0.887	Data Appear Lognormal			
Shapiro-Wilk (NDs = DL/2)	0.887	0.887	Data Not Lognormal			
Shapiro-Wilk (Lognormal ROS Estimates)	0.901	0.887	Data Appear Lognormal			
Lilliefors (Detects Only)	0.181	0.243	Data Appear Lognormal			
Lilliefors (NDs = DL)	0.201	0.213	Data Appear Lognormal			
Lilliefors (NDs = DL/2)	0.157	0.213	Data Appear Lognormal			
Lilliefors (Lognormal ROS Estimates)	0.211	0.213	Data Appear Lognormal			

Note: Substitution methods such as DL or DL/2 are not recommended.	
strontium	
Raw Statistics	
Number of Valid Observations	16
Number of Distinct Observations	13
Minimum	14
Maximum	46
Mean of Raw Data	21.7
Standard Deviation of Raw Data	7.877
Khat	10.41
Theta hat	2.084
Kstar	8.501
Theta star	2.553
Mean of Log Transformed Data	3.029
Standard Deviation of Log Transformed Data	0.307
Normal GOF Test Results	
Correlation Coefficient R	0.879
Shapiro Wilk Test Statistic	0.791
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.00141
Lilliefors Test Statistic	0.208
Lilliefors Critical (0.05) Value	0.213
Data appear Approximate Normal at (0.05) Significance Level	
Gamma GOF Test Results	
Correlation Coefficient R	0.926
A-D Test Statistic	0.604
A-D Critical (0.05) Value	0.739
K-S Test Statistic	0.186
K-S Critical(0.05) Value	0.215
Data appear Gamma Distributed at (0.05) Significance Level	
Lognormal GOF Test Results	
Correlation Coefficient R	0.951
Shapiro Wilk Test Statistic	0.91
Shapiro Wilk Critical (0.05) Value	0.887
Approximate Shapiro Wilk P Value	0.112
Lilliefors Test Statistic	0.17
Lilliefors Critical (0.05) Value	0.213
Data appear Lognormal at (0.05) Significance Level	
thallium	

	Num Obs	Num Miss	Num Valid	Detects	NDs	% NDs

Raw Statistics	16	6	10	1	9	90.00%	

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!

It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable thallium was not processed!

vanadium

Raw Statistics

Number of Valid Observations	10
Number of Missing Observations	6
Number of Distinct Observations	8
Minimum	34
Maximum	190
Mean of Raw Data	57.9
Standard Deviation of Raw Data	47.63
Khat	3.123
Theta hat	18.54
Kstar	2.253
Theta star	25.7
Mean of Log Transformed Data	3.89
Standard Deviation of Log Transformed Data	0.527

Normal GOF Test Results

Correlation Coefficient R	0.721
Shapiro Wilk Test Statistic	0.548
Shapiro Wilk Critical (0.05) Value	0.842
Approximate Shapiro Wilk P Value	1.7634E-5
Lilliefors Test Statistic	0.341
Lilliefors Critical (0.05) Value	0.262

Data not Normal at (0.05) Significance Level

Gamma GOF Test Results

Correlation Coefficient R	0.847
A-D Test Statistic	1.459
A-D Critical (0.05) Value	0.732
K-S Test Statistic	0.285
K-S Critical(0.05) Value	0.268

Data not Gamma Distributed at (0.05) Significance Level

Lognormal GOF Test Results

Correlation Coefficient R	0.832
Shapiro Wilk Test Statistic	0.71
Shapiro Wilk Critical (0.05) Value	0.842

Approximate Shapiro Wilk P Value	0.00103						
Lilliefors Test Statistic	0.249						
Lilliefors Critical (0.05) Value	0.262						
Data appear Approximate_Lognormal at (0.05) Significance Level							
zinc							
Raw Statistics							
Number of Valid Observations	10						
Number of Missing Observations	6						
Number of Distinct Observations	10						
Minimum	40						
Maximum	230						
Mean of Raw Data	66.9						
Standard Deviation of Raw Data	58.12						
Khat	3.009						
Theta hat	22.23						
Kstar	2.173						
Theta star	30.79						
Mean of Log Transformed Data	4.028						
Standard Deviation of Log Transformed Data	0.524						
Normal GOF Test Results							
Correlation Coefficient R	0.674						
Shapiro Wilk Test Statistic	0.485						
Shapiro Wilk Critical (0.05) Value	0.842						
Approximate Shapiro Wilk P Value	4.0927E-6						
Lilliefors Test Statistic	0.414						
Lilliefors Critical (0.05) Value	0.262						
Data not Normal at (0.05) Significance Level							
Gamma GOF Test Results							
Correlation Coefficient R	0.809						
A-D Test Statistic	2.033						
A-D Critical (0.05) Value	0.732						
K-S Test Statistic	0.412						
K-S Critical(0.05) Value	0.268						
Data not Gamma Distributed at (0.05) Significance Level							
Lognormal GOF Test Results							
Correlation Coefficient R	0.762						
Shapiro Wilk Test Statistic	0.608						
Shapiro Wilk Critical (0.05) Value	0.842						
Approximate Shapiro Wilk P Value	7.2387E-5						
Lilliefors Test Statistic	0.388						
Lilliefors Critical (0.05) Value	0.262						
Data not Lognormal at (0.05) Significance Level							

Non-parametric GOF Test Results						
Data do not follow a discernible distribution at (0.05) Level of Significanc						

	Outlier Tests for Selected Variables excluding nondetects
User Selected Options	
Date/Time of Computation	ProUCL 5.19/2/2021 1:32:32 PM
From File	ProUCL Background Inputs.xls
Full Precision	OFF

No Outlier Test for antimony

Dixon's Outlier Test for arsenic

Total N = 16
Number NDs = 0
Number Detects = 16
10% critical value: 0.454
5% critical value: 0.507
1% critical value: 0.595
Note: NDs excluded from Outlier Test

1. Data Value 3.08 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.572

For 10% significance level, 3.08 is an outlier.
For 5% significance level, 3.08 is an outlier.
For 1% significance level, 3.08 is not an outlier.

2. Data Value 1.4 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.337

For 10% significance level, 1.4 is not an outlier.
For 5% significance level, 1.4 is not an outlier.
For 1% significance level, 1.4 is not an outlier.

Dixon's Outlier Test for barium

Total N = 16
Number NDs = 0
Number Detects = 16
10% critical value: 0.454
5% critical value: 0.507
1% critical value: 0.595
Note: NDs excluded from Outlier Test

1. Data Value 77.9 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.353

For 10% significance level, 77.9 is not an outlier.							
For 5% significance level, 77.9 is not an outlier.							
For 1% significance level, 77.9 is not an outlier.							
2. Data Value 36 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.297							
For 10% significance level, 36 is not an outlier.							
For 5% significance level, 36 is not an outlier.							
For 1% significance level, 36 is not an outlier.							
Dixon's Outlier Test for beryllium							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 0.99 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.650							
For 10% significance level, 0.99 is an outlier.							
For 5% significance level, 0.99 is an outlier.							
For 1% significance level, 0.99 is an outlier.							
2. Data Value 0.293 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.316							
For 10% significance level, 0.293 is not an outlier.							
For 5% significance level, 0.293 is not an outlier.							
For 1% significance level, 0.293 is not an outlier.							
Dixon's Outlier Test for cadmium							
Total N = 16							
Number NDs = 9							
Number Detects = 7							
10% critical value: 0.434							
5% critical value: 0.507							
1% critical value: 0.637							
Note: NDs excluded from Outlier Test							

1. Data Value 0.38 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.704							
For 10% significance level, 0.38 is an outlier.							
For 5% significance level, 0.38 is an outlier.							
For 1% significance level, 0.38 is an outlier.							
2. Data Value 0.0918 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.011							
For 10% significance level, 0.0918 is not an outlier.							
For 5% significance level, 0.0918 is not an outlier.							
For 1% significance level, 0.0918 is not an outlier.							
Dixon's Outlier Test for hexavalent chromium							
Total N = 16							
Number NDs = 7							
Number Detects = 9							
10% critical value: 0.441							
5% critical value: 0.512							
1% critical value: 0.635							
Note: NDs excluded from Outlier Test							
1. Data Value 5.34 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.908							
For 10% significance level, 5.34 is an outlier.							
For 5% significance level, 5.34 is an outlier.							
For 1% significance level, 5.34 is an outlier.							
2. Data Value 0.21 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.328							
For 10% significance level, 0.21 is not an outlier.							
For 5% significance level, 0.21 is not an outlier.							
For 1% significance level, 0.21 is not an outlier.							
Dixon's Outlier Test for trivalent chromium							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 70.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.608

For 10% significance level, 70.2 is an outlier.

For 5% significance level, 70.2 is an outlier.

For 1% significance level, 70.2 is an outlier.

2. Data Value 16.16 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.064

For 10% significance level, 16.16 is not an outlier.

For 5% significance level, 16.16 is not an outlier.

For 1% significance level, 16.16 is not an outlier.

Dixon's Outlier Test for total chromium

Total N = 16

Number NDs = 0

Number Detects = 16

10% critical value: 0.454

5% critical value: 0.507

1% critical value: 0.595

Note: NDs excluded from Outlier Test

1. Data Value 70.2 is a Potential Outlier (Upper Tail)?

Test Statistic: 0.598

For 10% significance level, 70.2 is an outlier.

For 5% significance level, 70.2 is an outlier.

For 1% significance level, 70.2 is an outlier.

2. Data Value 16 is a Potential Outlier (Lower Tail)?

Test Statistic: 0.087

For 10% significance level, 16 is not an outlier.

For 5% significance level, 16 is not an outlier.

For 1% significance level, 16 is not an outlier.

Dixon's Outlier Test for cobalt

Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 27 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.265							
For 10% significance level, 27 is not an outlier.							
For 5% significance level, 27 is not an outlier.							
For 1% significance level, 27 is not an outlier.							
2. Data Value 6.3 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.071							
For 10% significance level, 6.3 is not an outlier.							
For 5% significance level, 6.3 is not an outlier.							
For 1% significance level, 6.3 is not an outlier.							
Dixon's Outlier Test for copper							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 62.8 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.295							
For 10% significance level, 62.8 is not an outlier.							
For 5% significance level, 62.8 is not an outlier.							
For 1% significance level, 62.8 is not an outlier.							
2. Data Value 15 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.029							
For 10% significance level, 15 is not an outlier.							
For 5% significance level, 15 is not an outlier.							
For 1% significance level, 15 is not an outlier.							

Dixon's Outlier Test for lead							
Total N = 10							
Number NDs = 0							
Number Detects = 10							
10% critical value: 0.409							
5% critical value: 0.477							
1% critical value: 0.597							
Note: NDs excluded from Outlier Test							
1. Data Value 43 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.282							
For 10% significance level, 43 is not an outlier.							
For 5% significance level, 43 is not an outlier.							
For 1% significance level, 43 is not an outlier.							
2. Data Value 0.55 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.110							
For 10% significance level, 0.55 is not an outlier.							
For 5% significance level, 0.55 is not an outlier.							
For 1% significance level, 0.55 is not an outlier.							
Dixon's Outlier Test for manganese							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 940 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.342							
For 10% significance level, 940 is not an outlier.							
For 5% significance level, 940 is not an outlier.							
For 1% significance level, 940 is not an outlier.							
2. Data Value 310 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.223							

For 10% significance level, 310 is not an outlier.							
For 5% significance level, 310 is not an outlier.							
For 1% significance level, 310 is not an outlier.							
Dixon's Outlier Test for mercury							
Total N = 16							
Number NDs = 3							
Number Detects = 13							
10% critical value: 0.467							
5% critical value: 0.521							
1% critical value: 0.615							
Note: NDs excluded from Outlier Test							
1. Data Value 0.28 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.911							
For 10% significance level, 0.28 is an outlier.							
For 5% significance level, 0.28 is an outlier.							
For 1% significance level, 0.28 is an outlier.							
2. Data Value 0.0072 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.338							
For 10% significance level, 0.0072 is not an outlier.							
For 5% significance level, 0.0072 is not an outlier.							
For 1% significance level, 0.0072 is not an outlier.							
Dixon's Outlier Test for nickel							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 20 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.483							
For 10% significance level, 20 is an outlier.							
For 5% significance level, 20 is not an outlier.							
For 1% significance level, 20 is not an outlier.							

2. Data Value 4.9 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.025							
For 10% significance level, 4.9 is not an outlier.							
For 5% significance level, 4.9 is not an outlier.							
For 1% significance level, 4.9 is not an outlier.							
Dixon's Outlier Test for selenium							
Total N = 16							
Number NDs = 4							
Number Detects = 12							
10% critical value: 0.49							
5% critical value: 0.546							
1% critical value: 0.642							
Note: NDs excluded from Outlier Test							
1. Data Value 1.7 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.082							
For 10% significance level, 1.7 is not an outlier.							
For 5% significance level, 1.7 is not an outlier.							
For 1% significance level, 1.7 is not an outlier.							
2. Data Value 0.306 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.151							
For 10% significance level, 0.306 is not an outlier.							
For 5% significance level, 0.306 is not an outlier.							
For 1% significance level, 0.306 is not an outlier.							
Dixon's Outlier Test for strontium							
Total N = 16							
Number NDs = 0							
Number Detects = 16							
10% critical value: 0.454							
5% critical value: 0.507							
1% critical value: 0.595							
Note: NDs excluded from Outlier Test							
1. Data Value 46 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.674							

For 10% significance level, 46 is an outlier.							
For 5% significance level, 46 is an outlier.							
For 1% significance level, 46 is an outlier.							
2. Data Value 14 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.090							
For 10% significance level, 14 is not an outlier.							
For 5% significance level, 14 is not an outlier.							
For 1% significance level, 14 is not an outlier.							
No Outlier Test for thallium							
Dixon's Outlier Test for vanadium							
Total N = 10							
Number NDs = 0							
Number Detects = 10							
10% critical value: 0.409							
5% critical value: 0.477							
1% critical value: 0.597							
Note: NDs excluded from Outlier Test							
1. Data Value 190 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.794							
For 10% significance level, 190 is an outlier.							
For 5% significance level, 190 is an outlier.							
For 1% significance level, 190 is an outlier.							
2. Data Value 34 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.030							
For 10% significance level, 34 is not an outlier.							
For 5% significance level, 34 is not an outlier.							
For 1% significance level, 34 is not an outlier.							
Dixon's Outlier Test for zinc							
Total N = 10							
Number NDs = 0							
Number Detects = 10							
10% critical value: 0.409							
5% critical value: 0.477							

1% critical value: 0.597							
Note: NDs excluded from Outlier Test							
1. Data Value 230 is a Potential Outlier (Upper Tail)?							
Test Statistic: 0.829							
For 10% significance level, 230 is an outlier.							
For 5% significance level, 230 is an outlier.							
For 1% significance level, 230 is an outlier.							
2. Data Value 40 is a Potential Outlier (Lower Tail)?							
Test Statistic: 0.086							
For 10% significance level, 40 is not an outlier.							
For 5% significance level, 40 is not an outlier.							
For 1% significance level, 40 is not an outlier.							

	Background Statistics for Data Sets with Non-Detects		
User Selected Options			
Date/Time of Computation	ProUCL 5.18/20/2021 9:53:58 AM		
From File	ProUCL Background Inputs_b.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Coverage	95%		
Different or Future K Observations	1		
Number of Bootstrap Operations	2000		
antimony			
General Statistics			
Total Number of Observations	2	Number of Missing Observations	2
Number of Distinct Observations	2		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	2
Minimum Detect	N/A	Minimum Non-Detect	0.32
Maximum Detect	N/A	Maximum Non-Detect	0.325
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable antimony was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
arsenic			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	1.2	First Quartile	1.763
Second Largest	2.3	Median	2.125
Maximum	2.38	Third Quartile	2.32
Mean	1.958	SD	0.538
Coefficient of Variation	0.275	Skewness	-1.363
Mean of logged Data	0.638	SD of logged Data	0.316
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.87	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.244	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	

Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	4.727	90% Percentile (z)	2.648
95% UPL (t)	3.374	95% Percentile (z)	2.843
95% USL	2.745	99% Percentile (z)	3.21
Gamma GOF Test			
A-D Test Statistic	0.468	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.279	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	14.82	k star (bias corrected MLE)	3.871
Theta hat (MLE)	0.132	Theta star (bias corrected MLE)	0.506
nu hat (MLE)	118.5	nu star (bias corrected)	30.96
MLE Mean (bias corrected)	1.958	MLE Sd (bias corrected)	0.995
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	3.878	90% Percentile	3.291
95% Hawkins Wixley (HW) Approx. Gamma UPL	3.973	95% Percentile	3.828
95% WH Approx. Gamma UTL with 95% Coverage	6.703	99% Percentile	4.976
95% HW Approx. Gamma UTL with 95% Coverage	7.191		
95% WH USL	2.892	95% HW USL	2.917
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.288	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	9.598	90% Percentile (z)	2.835
95% UPL (t)	4.341	95% Percentile (z)	3.18
95% USL	3.002	99% Percentile (z)	3.943
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	2.38
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	2.38	90% Percentile	2.356
90% Chebyshev UPL	3.763	95% Percentile	2.368
95% Chebyshev UPL	4.581	99% Percentile	2.378

95% USL	2.38		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
barium			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	12	First Quartile	16.88
Second Largest	23.5	Median	21
Maximum	38.4	Third Quartile	27.23
Mean	23.1	SD	11.23
Coefficient of Variation	0.486	Skewness	0.995
Mean of logged Data	3.052	SD of logged Data	0.485
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	80.89	90% Percentile (z)	37.5
95% UPL (t)	52.66	95% Percentile (z)	41.58
95% USL	39.53	99% Percentile (z)	49.23
Gamma GOF Test			
A-D Test Statistic	0.212	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.85	k star (bias corrected MLE)	1.629
Theta hat (MLE)	3.949	Theta star (bias corrected MLE)	14.18
nu hat (MLE)	46.8	nu star (bias corrected)	13.03
MLE Mean (bias corrected)	23.1	MLE Sd (bias corrected)	18.1
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	63.39	90% Percentile	47.18
95% Hawkins Wixley (HW) Approx. Gamma UPL	65.74	95% Percentile	58.55

95% WH Approx. Gamma UTL with 95% Coverage	134.8	99% Percentile	84.07
95% HW Approx. Gamma UTL with 95% Coverage	151.3		
95% WH USL	41.31	95% HW USL	41.66
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.998	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	256.5	90% Percentile (z)	39.39
95% UPL (t)	75.81	95% Percentile (z)	46.98
95% USL	43.01	99% Percentile (z)	65.39
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	38.4
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	38.4	90% Percentile	33.93
90% Chebyshev UPL	60.78	95% Percentile	36.17
95% Chebyshev UPL	77.85	99% Percentile	37.95
95% USL	38.4		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
beryllium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	3	Number of Non-Detects	1
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.249	Minimum Non-Detect	0.32
Maximum Detect	0.465	Maximum Non-Detect	0.32
Variance Detected	0.0146	Percent Non-Detects	25%
Mean Detected	0.326	SD Detected	0.121
Mean of Detected Logged Data	-1.163	SD of Detected Logged Data	0.345
Warning: Data set has only 3 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.308	KM SD	0.0906
95% UTL95% Coverage	0.775	95% KM UPL (t)	0.547
90% KM Percentile (z)	0.425	95% KM Percentile (z)	0.457
99% KM Percentile (z)	0.519	95% KM USL	0.441
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.284	SD	0.129
95% UTL95% Coverage	0.947	95% UPL (t)	0.623
90% Percentile (z)	0.449	95% Percentile (z)	0.496
99% Percentile (z)	0.584	95% USL	0.473
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	12.11	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0269	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	72.63	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.249	Mean	0.31
Maximum	0.465	Median	0.263
SD	0.103	CV	0.334
k hat (MLE)	14.23	k star (bias corrected MLE)	3.725
Theta hat (MLE)	0.0218	Theta star (bias corrected MLE)	0.0833
nu hat (MLE)	113.9	nu star (bias corrected)	29.8
MLE Mean (bias corrected)	0.31	MLE Sd (bias corrected)	0.161
95% Percentile of Chisquare (2kstar)	14.72	90% Percentile	0.526
95% Percentile	0.613	99% Percentile	0.8

The following statistics are computed using Gamma ROS Statistics on Imputed Data					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1.083	1.135	95% Approx. Gamma UPL	0.621	0.628
95% Gamma USL	0.461	0.461			
Estimates of Gamma Parameters using KM Estimates					
Mean (KM)	0.308		SD (KM)		0.0906
Variance (KM)	0.00821		SE of Mean (KM)		0.0556
k hat (KM)	11.59		k star (KM)		3.064
nu hat (KM)	92.7		nu star (KM)		24.51
theta hat (KM)	0.0266		theta star (KM)		0.101
80% gamma percentile (KM)	0.439		90% gamma percentile (KM)		0.545
95% gamma percentile (KM)	0.643		99% gamma percentile (KM)		0.857
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.947	0.983	95% Approx. Gamma UPL	0.571	0.575
95% KM Gamma Percentile	0.456	0.456	95% Gamma USL	0.437	0.436
Lognormal GOF Test on Detected Observations Only					
Shapiro Wilk Test Statistic	0.817		Shapiro Wilk GOF Test		
5% Shapiro Wilk Critical Value	0.767		Detected Data appear Lognormal at 5% Significance Level		
Lilliefors Test Statistic	0.356		Lilliefors GOF Test		
5% Lilliefors Critical Value	0.425		Detected Data appear Lognormal at 5% Significance Level		
Detected Data appear Lognormal at 5% Significance Level					
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					
Mean in Original Scale	0.31		Mean in Log Scale		-1.206
SD in Original Scale	0.103		SD in Log Scale		0.295
95% UTL95% Coverage	1.364		95% BCA UTL95% Coverage		N/A
95% Bootstrap (%) UTL95% Coverage	N/A		95% UPL (t)		0.65
90% Percentile (z)	0.437		95% Percentile (z)		0.486
99% Percentile (z)	0.594		95% USL		0.461
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
KM Mean of Logged Data	-1.213		95% KM UTL (Lognormal)95% Coverage		1.129
KM SD of Logged Data	0.259		95% KM UPL (Lognormal)		0.588
95% KM Percentile Lognormal (z)	0.456		95% KM USL (Lognormal)		0.434
Background DL/2 Statistics Assuming Lognormal Distribution					
Mean in Original Scale	0.284		Mean in Log Scale		-1.331
SD in Original Scale	0.129		SD in Log Scale		0.438
95% UTL95% Coverage	2.511		95% UPL (t)		0.836
90% Percentile (z)	0.463		95% Percentile (z)		0.543
99% Percentile (z)	0.732		95% USL		0.501
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.					
Nonparametric Distribution Free Background Statistics					

Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	0.465
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.465
95% USL	0.465	95% KM Chebyshev UPL	0.75
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
cadmium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	0	Number of Non-Detects	4
Number of Distinct Detects	0	Number of Distinct Non-Detects	4
Minimum Detect	N/A	Minimum Non-Detect	0.32
Maximum Detect	N/A	Maximum Non-Detect	0.636
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!			
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!			
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).			
The data set for variable cadmium was not processed!			
hexavalent chromium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	3	Number of Non-Detects	1
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.24	Minimum Non-Detect	0.4
Maximum Detect	0.671	Maximum Non-Detect	0.4
Variance Detected	0.0467	Percent Non-Detects	25%
Mean Detected	0.446	SD Detected	0.216
Mean of Detected Logged Data	-0.892	SD of Detected Logged Data	0.515
Warning: Data set has only 3 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.395	KM SD	0.177
95% UTL95% Coverage	1.305	95% KM UPL (t)	0.86
90% KM Percentile (z)	0.622	95% KM Percentile (z)	0.686
99% KM Percentile (z)	0.807	95% KM USL	0.654
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.385	SD	0.215
95% UTL95% Coverage	1.492	95% UPL (t)	0.951
90% Percentile (z)	0.661	95% Percentile (z)	0.739
99% Percentile (z)	0.885	95% USL	0.699
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	6.052	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0738	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	36.31	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.22	Mean	0.39
Maximum	0.671	Median	0.334
SD	0.21	CV	0.538
k hat (MLE)	4.927	k star (bias corrected MLE)	1.398
Theta hat (MLE)	0.0791	Theta star (bias corrected MLE)	0.279
nu hat (MLE)	39.42	nu star (bias corrected)	11.19
MLE Mean (bias corrected)	0.39	MLE Sd (bias corrected)	0.33
95% Percentile of Chisquare (2kstar)	7.459	90% Percentile	0.826
95% Percentile	1.04	99% Percentile	1.523
The following statistics are computed using Gamma ROS Statistics on Imputed Data			

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.552	2.894	95% Approx. Gamma UPL	1.15	1.195
95% Gamma USL	0.727	0.733			

Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.395	SD (KM)	0.177
Variance (KM)	0.0313	SE of Mean (KM)	0.108
k hat (KM)	4.974	k star (KM)	1.41
nu hat (KM)	39.79	nu star (KM)	11.28
theta hat (KM)	0.0794	theta star (KM)	0.28
80% gamma percentile (KM)	0.615	90% gamma percentile (KM)	0.835
95% gamma percentile (KM)	1.05	99% gamma percentile (KM)	1.537

The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	2.009	2.205	95% Approx. Gamma UPL	0.989	1.014
95% KM Gamma Percentile	0.709	0.714	95% Gamma USL	0.664	0.667

Lognormal GOF Test on Detected Observations Only		
Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level
Detected Data appear Lognormal at 5% Significance Level		

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	0.393	Mean in Log Scale	-1.031
SD in Original Scale	0.206	SD in Log Scale	0.505
95% UTL95% Coverage	4.796	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	1.347
90% Percentile (z)	0.681	95% Percentile (z)	0.818
99% Percentile (z)	1.155	95% USL	0.746

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	-1.025	95% KM UTL (Lognormal)95% Coverage	3.309
KM SD of Logged Data	0.432	95% KM UPL (Lognormal)	1.118
95% KM Percentile Lognormal (z)	0.73	95% KM USL (Lognormal)	0.675

Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	0.385	Mean in Log Scale	-1.071
SD in Original Scale	0.215	SD in Log Scale	0.553
95% UTL95% Coverage	5.895	95% UPL (t)	1.469
90% Percentile (z)	0.696	95% Percentile (z)	0.851
99% Percentile (z)	1.241	95% USL	0.769
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			

Nonparametric Distribution Free Background Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	0.671
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.671
95% USL	0.671	95% KM Chebyshev UPL	1.257
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
trivalent chromium			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	22.76	First Quartile	37.57
Second Largest	62.88	Median	52.69
Maximum	64.97	Third Quartile	63.4
Mean	48.28	SD	19.8
Coefficient of Variation	0.41	Skewness	-0.776
Mean of logged Data	3.797	SD of logged Data	0.488
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	150.1	90% Percentile (z)	73.66
95% UPL (t)	100.4	95% Percentile (z)	80.85
95% USL	77.24	99% Percentile (z)	94.35
Gamma GOF Test			
A-D Test Statistic	0.401	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.658	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.297	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	6.447	k star (bias corrected MLE)	1.778
Theta hat (MLE)	7.488	Theta star (bias corrected MLE)	27.15
nu hat (MLE)	51.58	nu star (bias corrected)	14.23

MLE Mean (bias corrected)	48.28	MLE Sd (bias corrected)	36.2
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	127.5	90% Percentile	96.54
95% Hawkins Wixley (HW) Approx. Gamma UPL	133.7	95% Percentile	118.9
95% WH Approx. Gamma UTL with 95% Coverage	264.9	99% Percentile	168.8
95% HW Approx. Gamma UTL with 95% Coverage	301.4		
95% WH USL	84.49	95% HW USL	85.86
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	548.8	90% Percentile (z)	83.33
95% UPL (t)	161	95% Percentile (z)	99.49
95% USL	91.02	99% Percentile (z)	138.7
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	64.97
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	64.97	90% Percentile	64.34
90% Chebyshev UPL	114.7	95% Percentile	64.66
95% Chebyshev UPL	144.8	99% Percentile	64.91
95% USL	64.97		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
total chromium			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	23	First Quartile	37.63
Second Largest	63.55	Median	53.03
Maximum	65.4	Third Quartile	64.01
Mean	48.61	SD	19.99
Coefficient of Variation	0.411	Skewness	-0.749
Mean of logged Data	3.804	SD of logged Data	0.487

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.891	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.273	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	151.4	90% Percentile (z)	74.23
95% UPL (t)	101.2	95% Percentile (z)	81.49
95% USL	77.84	99% Percentile (z)	95.11
Gamma GOF Test			
A-D Test Statistic	0.403	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.658	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.3	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	6.448	k star (bias corrected MLE)	1.779
Theta hat (MLE)	7.539	Theta star (bias corrected MLE)	27.33
nu hat (MLE)	51.58	nu star (bias corrected)	14.23
MLE Mean (bias corrected)	48.61	MLE Sd (bias corrected)	36.45
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	128.4	90% Percentile	97.21
95% Hawkins Wixley (HW) Approx. Gamma UPL	134.6	95% Percentile	119.7
95% WH Approx. Gamma UTL with 95% Coverage	266.7	99% Percentile	170
95% HW Approx. Gamma UTL with 95% Coverage	303.3		
95% WH USL	85.08	95% HW USL	86.44
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.866	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.262	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	550.8	90% Percentile (z)	83.84
95% UPL (t)	161.9	95% Percentile (z)	100.1
95% USL	91.57	99% Percentile (z)	139.5
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			

Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	65.4
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	65.4	90% Percentile	64.85
90% Chebyshev UPL	115.6	95% Percentile	65.12
95% Chebyshev UPL	146	99% Percentile	65.34
95% USL	65.4		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

cobalt

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
Minimum	3.9	First Quartile	6.338
Second Largest	7.63	Median	7.39
Maximum	14.1	Third Quartile	9.246
Mean	8.194	SD	4.269
Coefficient of Variation	0.521	Skewness	1.072
Mean of logged Data	2.001	SD of logged Data	0.525

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462

Normal GOF Test		
Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level
Data appear Normal at 5% Significance Level		

Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	30.15	90% Percentile (z)	13.66
95% UPL (t)	19.43	95% Percentile (z)	15.22
95% USL	14.44	99% Percentile (z)	18.12

Gamma GOF Test		
A-D Test Statistic	0.29	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level
Detected data appear Gamma Distributed at 5% Significance Level		

Gamma Statistics			
k hat (MLE)	5.069	k star (bias corrected MLE)	1.434
Theta hat (MLE)	1.616	Theta star (bias corrected MLE)	5.714
nu hat (MLE)	40.55	nu star (bias corrected)	11.47
MLE Mean (bias corrected)	8.194	MLE Sd (bias corrected)	6.843
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	23.87	90% Percentile	17.26
95% Hawkins Wixley (HW) Approx. Gamma UPL	24.89	95% Percentile	21.67
95% WH Approx. Gamma UTL with 95% Coverage	52.57	99% Percentile	31.65
95% HW Approx. Gamma UTL with 95% Coverage	59.85		
95% WH USL	15.18	95% HW USL	15.33
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	110.3	90% Percentile (z)	14.51
95% UPL (t)	29.47	95% Percentile (z)	17.56
95% USL	15.95	99% Percentile (z)	25.11
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	14.1
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	14.1	90% Percentile	12.16
90% Chebyshev UPL	22.51	95% Percentile	13.13
95% Chebyshev UPL	29	99% Percentile	13.9
95% USL	14.1		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
copper			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	4.2	First Quartile	7.365
Second Largest	8.55	Median	8.485

Maximum	10.3	Third Quartile	8.986
Mean	7.866	SD	2.589
Coefficient of Variation	0.329	Skewness	-1.323
Mean of logged Data	2.011	SD of logged Data	0.395
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	21.19	90% Percentile (z)	11.18
95% UPL (t)	14.68	95% Percentile (z)	12.13
95% USL	11.65	99% Percentile (z)	13.89
Gamma GOF Test			
A-D Test Statistic	0.517	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.376	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	9.824	k star (bias corrected MLE)	2.623
Theta hat (MLE)	0.801	Theta star (bias corrected MLE)	2.999
nu hat (MLE)	78.59	nu star (bias corrected)	20.98
MLE Mean (bias corrected)	7.866	MLE Sd (bias corrected)	4.857
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	17.78	90% Percentile	14.38
95% Hawkins Wixley (HW) Approx. Gamma UPL	18.42	95% Percentile	17.17
95% WH Approx. Gamma UTL with 95% Coverage	33.5	99% Percentile	23.27
95% HW Approx. Gamma UTL with 95% Coverage	36.97		
95% WH USL	12.56	95% HW USL	12.72
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.369	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	56.85	90% Percentile (z)	12.38
95% UPL (t)	21.09	95% Percentile (z)	14.29

95% USL	13.3	99% Percentile (z)	18.7
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	10.3
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	10.3	90% Percentile	9.772
90% Chebyshev UPL	16.55	95% Percentile	10.03
95% Chebyshev UPL	20.49	99% Percentile	10.24
95% USL	10.3		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
lead			
General Statistics			
Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	2
Minimum	4	First Quartile	4.725
Second Largest	4	Median	5.45
Maximum	6.9	Third Quartile	6.175
Mean	5.45	SD	2.051
Coefficient of Variation	0.376	Skewness	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable lead was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
manganese			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	180	First Quartile	277.5
Second Largest	449	Median	379.5
Maximum	579	Third Quartile	481.5
Mean	379.5	SD	172.5
Coefficient of Variation	0.455	Skewness	0
Mean of logged Data	5.849	SD of logged Data	0.507

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.992	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.156	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	1267	90% Percentile (z)	600.6
95% UPL (t)	833.4	95% Percentile (z)	663.2
95% USL	631.8	99% Percentile (z)	780.8
Gamma GOF Test			
A-D Test Statistic	0.22	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.21	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	5.755	k star (bias corrected MLE)	1.605
Theta hat (MLE)	65.94	Theta star (bias corrected MLE)	236.4
nu hat (MLE)	46.04	nu star (bias corrected)	12.84
MLE Mean (bias corrected)	379.5	MLE Sd (bias corrected)	299.5
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	1049	90% Percentile	777.9
95% Hawkins Wixley (HW) Approx. Gamma UPL	1099	95% Percentile	966.5
95% WH Approx. Gamma UTL with 95% Coverage	2240	99% Percentile	1391
95% HW Approx. Gamma UTL with 95% Coverage	2554		
95% WH USL	682.1	95% HW USL	691.8
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.969	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	4717	90% Percentile (z)	664.9
95% UPL (t)	1318	95% Percentile (z)	799.4
95% USL	728.8	99% Percentile (z)	1130
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			

Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	579
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	579	90% Percentile	540
90% Chebyshev UPL	958.1	95% Percentile	559.5
95% Chebyshev UPL	1220	99% Percentile	575.1
95% USL	579		

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers
and consists of observations collected from clean unimpacted locations.
The use of USL tends to provide a balance between false positives and false negatives provided the data
represents a background data set and when many onsite observations need to be compared with the BTV.

mercury

General Statistics			
Total Number of Observations	4	Number of Missing Observations	0
Number of Distinct Observations	4		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	0.0052	Minimum Non-Detect	0.0255
Maximum Detect	0.0078	Maximum Non-Detect	0.026
Variance Detected	3.3800E-6	Percent Non-Detects	50%
Mean Detected	0.0065	SD Detected	0.00184
Mean of Detected Logged Data	-5.056	SD of Detected Logged Data	0.287

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.0065	KM SD	0.0013
95% UTL95% Coverage	0.0132	95% KM UPL (t)	0.00992
90% KM Percentile (z)	0.00817	95% KM Percentile (z)	0.00864
99% KM Percentile (z)	0.00952	95% KM USL	0.0084

DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.00969	SD	0.00383
95% UTL95% Coverage	0.0294	95% UPL (t)	0.0198
90% Percentile (z)	0.0146	95% Percentile (z)	0.016

99% Percentile (z)		0.0186		95% USL	0.0153
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons					
Gamma GOF Tests on Detected Observations Only					
Not Enough Data to Perform GOF Test					
Gamma Statistics on Detected Data Only					
k hat (MLE)		24.66		k star (bias corrected MLE)	N/A
Theta hat (MLE)		2.6356E-4		Theta star (bias corrected MLE)	N/A
nu hat (MLE)		98.65		nu star (bias corrected)	N/A
MLE Mean (bias corrected)		N/A			
MLE Sd (bias corrected)		N/A		95% Percentile of Chisquare (2kstar)	N/A
Estimates of Gamma Parameters using KM Estimates					
Mean (KM)		0.0065		SD (KM)	0.0013
Variance (KM)		1.6900E-6		SE of Mean (KM)	0.0013
k hat (KM)		25		k star (KM)	6.417
nu hat (KM)		200		nu star (KM)	51.33
theta hat (KM)		2.6000E-4		theta star (KM)	0.00101
80% gamma percentile (KM)		0.0085		90% gamma percentile (KM)	0.00993
95% gamma percentile (KM)		0.0112		99% gamma percentile (KM)	0.0139
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.0157	0.0162	95% Approx. Gamma UPL	0.0105	0.0106
95% KM Gamma Percentile	0.00879	0.00882	95% Gamma USL	0.0085	0.00852
Lognormal GOF Test on Detected Observations Only					
Not Enough Data to Perform GOF Test					
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					
Mean in Original Scale		0.00643		Mean in Log Scale	-5.056
SD in Original Scale		0.00106		SD in Log Scale	0.166
95% UTL95% Coverage		0.0149		95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage		N/A		95% UPL (t)	0.00984
90% Percentile (z)		0.00787		95% Percentile (z)	0.00836
99% Percentile (z)		0.00936		95% USL	0.00811
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
KM Mean of Logged Data		-5.056		95% KM UTL (Lognormal)95% Coverage	0.0181
KM SD of Logged Data		0.203		95% KM UPL (Lognormal)	0.0109
95% KM Percentile Lognormal (z)		0.00889		95% KM USL (Lognormal)	0.00857
Background DL/2 Statistics Assuming Lognormal Distribution					
Mean in Original Scale		0.00969		Mean in Log Scale	-4.704
SD in Original Scale		0.00383		SD in Log Scale	0.439
95% UTL95% Coverage		0.0866		95% UPL (t)	0.0287
90% Percentile (z)		0.0159		95% Percentile (z)	0.0186
99% Percentile (z)		0.0251		95% USL	0.0172

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	0.026
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.026
95% USL	0.026	95% KM Chebyshev UPL	0.0128
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
nickel			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	4
Minimum	3.8	First Quartile	5.9
Second Largest	7.1	Median	6.85
Maximum	9.54	Third Quartile	7.71
Mean	6.76	SD	2.355
Coefficient of Variation	0.348	Skewness	-0.225
Mean of logged Data	1.859	SD of logged Data	0.384
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	18.87	90% Percentile (z)	9.777
95% UPL (t)	12.96	95% Percentile (z)	10.63
95% USL	10.2	99% Percentile (z)	12.24
Gamma GOF Test			
A-D Test Statistic	0.289	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.263	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			

Gamma Statistics			
k hat (MLE)	9.852	k star (bias corrected MLE)	2.63
Theta hat (MLE)	0.686	Theta star (bias corrected MLE)	2.571
nu hat (MLE)	78.82	nu star (bias corrected)	21.04
MLE Mean (bias corrected)	6.76	MLE Sd (bias corrected)	4.169
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	15.26	90% Percentile	12.35
95% Hawkins Wixley (HW) Approx. Gamma UPL	15.73	95% Percentile	14.74
95% WH Approx. Gamma UTL with 95% Coverage	28.74	99% Percentile	19.97
95% HW Approx. Gamma UTL with 95% Coverage	31.44		
95% WH USL	10.78	95% HW USL	10.88
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	46.32	90% Percentile (z)	10.5
95% UPL (t)	17.64	95% Percentile (z)	12.08
95% USL	11.26	99% Percentile (z)	15.69
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	9.54
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	9.54	90% Percentile	8.808
90% Chebyshev UPL	14.66	95% Percentile	9.174
95% Chebyshev UPL	18.23	99% Percentile	9.467
95% USL	9.54		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
selenium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	0
Number of Distinct Observations	3		
Number of Detects	2	Number of Non-Detects	2

Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.272	Minimum Non-Detect	0.64
Maximum Detect	0.409	Maximum Non-Detect	0.64
Variance Detected	0.00945	Percent Non-Detects	50%
Mean Detected	0.34	SD Detected	0.0972
Mean of Detected Logged Data	-1.099	SD of Detected Logged Data	0.29
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.34	KM SD	0.0688
95% UTL95% Coverage	0.694	95% KM UPL (t)	0.521
90% KM Percentile (z)	0.428	95% KM Percentile (z)	0.453
99% KM Percentile (z)	0.5	95% KM USL	0.441
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	0.33	SD	0.0573
95% UTL95% Coverage	0.625	95% UPL (t)	0.481
90% Percentile (z)	0.404	95% Percentile (z)	0.424
99% Percentile (z)	0.464	95% USL	0.414
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	24.16	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0141	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	96.62	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.34	SD (KM)	0.0688
Variance (KM)	0.00473	SE of Mean (KM)	0.0688
k hat (KM)	24.49	k star (KM)	6.29
nu hat (KM)	195.9	nu star (KM)	50.32
theta hat (KM)	0.0139	theta star (KM)	0.0541
80% gamma percentile (KM)	0.446	90% gamma percentile (KM)	0.522
95% gamma percentile (KM)	0.59	99% gamma percentile (KM)	0.732
The following statistics are computed using gamma distribution and KM estimates			

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.827	0.853	95% Approx. Gamma UPL	0.551	0.555
95% KM Gamma Percentile	0.462	0.463	95% Gamma USL	0.446	0.447

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	0.34	Mean in Log Scale	-1.099
SD in Original Scale	0.0794	SD in Log Scale	0.237
95% UTL95% Coverage	1.125	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	0.621
90% Percentile (z)	0.451	95% Percentile (z)	0.492
99% Percentile (z)	0.578	95% USL	0.471

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	-1.099	95% KM UTL (Lognormal)95% Coverage	0.956
KM SD of Logged Data	0.205	95% KM UPL (Lognormal)	0.571
95% KM Percentile Lognormal (z)	0.467	95% KM USL (Lognormal)	0.45

Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	0.33	Mean in Log Scale	-1.119
SD in Original Scale	0.0573	SD in Log Scale	0.169
95% UTL95% Coverage	0.779	95% UPL (t)	0.509
90% Percentile (z)	0.405	95% Percentile (z)	0.431
99% Percentile (z)	0.484	95% USL	0.418

DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.

Nonparametric Distribution Free Background Statistics

Data do not follow a Discernible Distribution (0.05)

Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	0.64
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	0.64
95% USL	0.64	95% KM Chebyshev UPL	0.675

Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers

and consists of observations collected from clean unimpacted locations.

The use of USL tends to provide a balance between false positives and false negatives provided the data

represents a background data set and when many onsite observations need to be compared with the BTV.

strontium

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
Minimum	6.9	First Quartile	8.025
Second Largest	11.5	Median	9.95

Maximum	12.85	Third Quartile	11.84
Mean	9.913	SD	2.739
Coefficient of Variation	0.276	Skewness	-0.0471
Mean of logged Data	2.264	SD of logged Data	0.285
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	24	90% Percentile (z)	13.42
95% UPL (t)	17.12	95% Percentile (z)	14.42
95% USL	13.92	99% Percentile (z)	16.29
Gamma GOF Test			
A-D Test Statistic	0.296	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.26	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	16.87	k star (bias corrected MLE)	4.384
Theta hat (MLE)	0.588	Theta star (bias corrected MLE)	2.261
nu hat (MLE)	134.9	nu star (bias corrected)	35.07
MLE Mean (bias corrected)	9.913	MLE Sd (bias corrected)	4.734
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	18.91	90% Percentile	16.26
95% Hawkins Wixley (HW) Approx. Gamma UPL	19.23	95% Percentile	18.76
95% WH Approx. Gamma UTL with 95% Coverage	31.87	99% Percentile	24.09
95% HW Approx. Gamma UTL with 95% Coverage	33.66		
95% WH USL	14.33	95% HW USL	14.39
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.234	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	41.78	90% Percentile (z)	13.87
95% UPL (t)	20.39	95% Percentile (z)	15.39

95% USL	14.61	99% Percentile (z)	18.69
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	12.85
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	12.85	90% Percentile	12.45
90% Chebyshev UPL	19.1	95% Percentile	12.65
95% Chebyshev UPL	23.26	99% Percentile	12.81
95% USL	12.85		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
thallium			
General Statistics			
Total Number of Observations	2	Number of Missing Observations	2
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.64
Maximum Detect	N/A	Maximum Non-Detect	0.64
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable thallium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
vanadium			
General Statistics			
Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	2
Minimum	19	First Quartile	23.25
Second Largest	19	Median	27.5
Maximum	36	Third Quartile	31.75

Mean	27.5	SD	12.02
Coefficient of Variation	0.437	Skewness	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable vanadium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
zinc			
General Statistics			
Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	2
Minimum	19	First Quartile	22.38
Second Largest	19	Median	25.75
Maximum	32.5	Third Quartile	29.13
Mean	25.75	SD	9.546
Coefficient of Variation	0.371	Skewness	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable zinc was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			

	Background Statistics for Data Sets with Non-Detects
User Selected Options	
Date/Time of Computation	ProUCL 5.18/20/2021 9:47:02 AM
From File	ProUCL Background Inputs_a.xls
Full Precision	OFF
Confidence Coefficient	95%
Coverage	95%
Different or Future K Observations	1
Number of Bootstrap Operations	2000

aluminum

General Statistics

Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A

Warning: This data set only has 0 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable aluminum was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

antimony

General Statistics

Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	5
Maximum Detect	N/A	Maximum Non-Detect	5
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable antimony was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

arsenic			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	3		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.42	Minimum Non-Detect	10
Maximum Detect	0.44	Maximum Non-Detect	10
Variance Detected	2.0000E-4	Percent Non-Detects	50%
Mean Detected	0.43	SD Detected	0.0141
Mean of Detected Logged Data	-0.844	SD of Detected Logged Data	0.0329
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.43	KM SD	0.01
95% UTL95% Coverage	0.481	95% KM UPL (t)	0.456
90% KM Percentile (z)	0.443	95% KM Percentile (z)	0.446
99% KM Percentile (z)	0.453	95% KM USL	0.445
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	2.715	SD	2.639
95% UTL95% Coverage	16.29	95% UPL (t)	9.657
90% Percentile (z)	6.096	95% Percentile (z)	7.055
99% Percentile (z)	8.853	95% USL	6.574
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	1849	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.3260E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	7395	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.43	SD (KM)	0.01
Variance (KM)	1.0000E-4	SE of Mean (KM)	0.01
k hat (KM)	1849	k star (KM)	462.4

nu hat (KM)	14792		nu star (KM)	3699	
theta hat (KM)	2.3256E-4		theta star (KM)	9.2990E-4	
80% gamma percentile (KM)	0.447		90% gamma percentile (KM)	0.456	
95% gamma percentile (KM)	0.463		99% gamma percentile (KM)	0.478	
The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.483	0.484	95% Approx. Gamma UPL	0.457	0.457
95% KM Gamma Percentile	0.447	0.447	95% Gamma USL	0.445	0.445
Lognormal GOF Test on Detected Observations Only					
Not Enough Data to Perform GOF Test					
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects					
Mean in Original Scale	0.43		Mean in Log Scale	-0.844	
SD in Original Scale	0.0115		SD in Log Scale	0.0269	
95% UTL95% Coverage	0.494		95% BCA UTL95% Coverage	N/A	
95% Bootstrap (%) UTL95% Coverage	N/A		95% UPL (t)	0.461	
90% Percentile (z)	0.445		95% Percentile (z)	0.449	
99% Percentile (z)	0.458		95% USL	0.447	
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution					
KM Mean of Logged Data	-0.844		95% KM UTL (Lognormal)95% Coverage	0.485	
KM SD of Logged Data	0.0233		95% KM UPL (Lognormal)	0.457	
95% KM Percentile Lognormal (z)	0.447		95% KM USL (Lognormal)	0.445	
Background DL/2 Statistics Assuming Lognormal Distribution					
Mean in Original Scale	2.715		Mean in Log Scale	0.383	
SD in Original Scale	2.639		SD in Log Scale	1.417	
95% UTL95% Coverage	2144		95% UPL (t)	60.96	
90% Percentile (z)	9.009		95% Percentile (z)	15.07	
99% Percentile (z)	39.59		95% USL	11.64	
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.					
Nonparametric Distribution Free Background Statistics					
Data do not follow a Discernible Distribution (0.05)					
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)					
Order of Statistic, r	4		95% UTL with95% Coverage	10	
Approx, f used to compute achieved CC	0.211		Approximate Actual Confidence Coefficient achieved by UTL	0.185	
Approximate Sample Size needed to achieve specified CC	59		95% UPL	10	
95% USL	10		95% KM Chebyshev UPL	0.479	
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.					
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers					
and consists of observations collected from clean unimpacted locations.					
The use of USL tends to provide a balance between false positives and false negatives provided the data					
represents a background data set and when many onsite observations need to be compared with the BTV.					

barium			
General Statistics			
Total Number of Observations	5	Number of Distinct Observations	4
Minimum	23.1	First Quartile	23.2
Second Largest	27	Median	24
Maximum	27	Third Quartile	27
Mean	24.86	SD	1.984
Coefficient of Variation	0.0798	Skewness	0.477
Mean of logged Data	3.211	SD of logged Data	0.0791
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	4.203	d2max (for USL)	1.671
Normal GOF Test			
Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level	
Data appear Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	33.2	90% Percentile (z)	27.4
95% UPL (t)	29.49	95% Percentile (z)	28.12
95% USL	28.18	99% Percentile (z)	29.48
Gamma GOF Test			
A-D Test Statistic	0.647	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.286	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	198.8	k star (bias corrected MLE)	79.64
Theta hat (MLE)	0.125	Theta star (bias corrected MLE)	0.312
nu hat (MLE)	1988	nu star (bias corrected)	796.4
MLE Mean (bias corrected)	24.86	MLE Sd (bias corrected)	2.786
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	29.71	90% Percentile	28.49
95% Hawkins Wixley (HW) Approx. Gamma UPL	29.74	95% Percentile	29.61
95% WH Approx. Gamma UTL with 95% Coverage	34.05	99% Percentile	31.8
95% HW Approx. Gamma UTL with 95% Coverage	34.17		
95% WH USL	28.26	95% HW USL	28.27
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.26	**Lilliefors Lognormal GOF Test**	

5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	34.57	90% Percentile (z)	27.44
95% UPL (t)	29.83	95% Percentile (z)	28.24
95% USL	28.3	99% Percentile (z)	29.81
Nonparametric Distribution Free Background Statistics			
Data appear Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	5	95% UTL with 95% Coverage	27
Approx, f used to compute achieved CC	0.263	Approximate Actual Confidence Coefficient achieved by UTL	0.226
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	27	95% BCA Bootstrap UTL with 95% Coverage	27
95% UPL	27	90% Percentile	27
90% Chebyshev UPL	31.38	95% Percentile	27
95% Chebyshev UPL	34.34	99% Percentile	27
95% USL	27		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
beryllium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	2		
Number of Detects	0	Number of Non-Detects	4
Number of Distinct Detects	0	Number of Distinct Non-Detects	2
Minimum Detect	N/A	Minimum Non-Detect	0.1
Maximum Detect	N/A	Maximum Non-Detect	2
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!			
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!			
The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).			
The data set for variable beryllium was not processed!			
cadmium			
General Statistics			

Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	2		
Number of Detects	0	Number of Non-Detects	4
Number of Distinct Detects	0	Number of Distinct Non-Detects	2
Minimum Detect	N/A	Minimum Non-Detect	0.08
Maximum Detect	N/A	Maximum Non-Detect	1
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!

Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable cadmium was not processed!

calcium

General Statistics

Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A

Warning: This data set only has 0 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable calcium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

hexavalent chromium

General Statistics

Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.74
Maximum Detect	N/A	Maximum Non-Detect	0.74
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable hexavalent chromium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
trivalent chromium			
General Statistics			
Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A
Warning: This data set only has 0 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable trivalent chromium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
total chromium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	3		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.45	Minimum Non-Detect	5
Maximum Detect	0.53	Maximum Non-Detect	5
Variance Detected	0.0032	Percent Non-Detects	50%
Mean Detected	0.49	SD Detected	0.0566
Mean of Detected Logged Data	-0.717	SD of Detected Logged Data	0.116
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			

KM Mean	0.49	KM SD	0.04
95% UTL95% Coverage	0.696	95% KM UPL (t)	0.595
90% KM Percentile (z)	0.541	95% KM Percentile (z)	0.556
99% KM Percentile (z)	0.583	95% KM USL	0.548

DL/2 Substitution Background Statistics Assuming Normal Distribution

Mean	1.495	SD	1.161
95% UTL95% Coverage	7.467	95% UPL (t)	4.55
90% Percentile (z)	2.983	95% Percentile (z)	3.405
99% Percentile (z)	4.196	95% USL	3.193

DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	149.7	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00327	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	598.9	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.49	SD (KM)	0.04
Variance (KM)	0.0016	SE of Mean (KM)	0.04
k hat (KM)	150.1	k star (KM)	37.68
nu hat (KM)	1201	nu star (KM)	301.5
theta hat (KM)	0.00327	theta star (KM)	0.013
80% gamma percentile (KM)	0.556	90% gamma percentile (KM)	0.595
95% gamma percentile (KM)	0.628	99% gamma percentile (KM)	0.695

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.725	0.729	95% Approx. Gamma UPL	0.602	0.603
95% KM Gamma Percentile	0.558	0.558	95% Gamma USL	0.55	0.55

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	0.49	Mean in Log Scale	-0.717
SD in Original Scale	0.0462	SD in Log Scale	0.0945
95% UTL95% Coverage	0.794	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	0.626
90% Percentile (z)	0.551	95% Percentile (z)	0.57
99% Percentile (z)	0.608	95% USL	0.561

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean of Logged Data	-0.717	95% KM UTL (Lognormal)95% Coverage	0.744

KM SD of Logged Data	0.0818	95% KM UPL (Lognormal)	0.606
95% KM Percentile Lognormal (z)	0.559	95% KM USL (Lognormal)	0.55
Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	1.495	Mean in Log Scale	0.0998
SD in Original Scale	1.161	SD in Log Scale	0.945
95% UTL95% Coverage	142.8	95% UPL (t)	13.29
90% Percentile (z)	3.71	95% Percentile (z)	5.23
99% Percentile (z)	9.96	95% USL	4.402
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	5
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	5
95% USL	5	95% KM Chebyshev UPL	0.685
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
cobalt			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	2		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	1	Number of Distinct Non-Detects	1
Minimum Detect	0.16	Minimum Non-Detect	5
Maximum Detect	0.16	Maximum Non-Detect	5
Variance Detected	0	Percent Non-Detects	50%
Mean Detected	0.16	SD Detected	0
Mean of Detected Logged Data	-1.833	SD of Detected Logged Data	0
Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!			
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).			
The data set for variable cobalt was not processed!			
copper			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	3		

Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	1.1	Minimum Non-Detect	10
Maximum Detect	1.2	Maximum Non-Detect	10
Variance Detected	0.005	Percent Non-Detects	50%
Mean Detected	1.15	SD Detected	0.0707
Mean of Detected Logged Data	0.139	SD of Detected Logged Data	0.0615
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	1.15	KM SD	0.05
95% UTL95% Coverage	1.407	95% KM UPL (t)	1.282
90% KM Percentile (z)	1.214	95% KM Percentile (z)	1.232
99% KM Percentile (z)	1.266	95% KM USL	1.223
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	3.075	SD	2.223
95% UTL95% Coverage	14.51	95% UPL (t)	8.924
90% Percentile (z)	5.924	95% Percentile (z)	6.732
99% Percentile (z)	8.247	95% USL	6.326
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	528.7	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00218	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2115	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	1.15	SD (KM)	0.05
Variance (KM)	0.0025	SE of Mean (KM)	0.05
k hat (KM)	529	k star (KM)	132.4
nu hat (KM)	4232	nu star (KM)	1059
theta hat (KM)	0.00217	theta star (KM)	0.00868
80% gamma percentile (KM)	1.233	90% gamma percentile (KM)	1.28
95% gamma percentile (KM)	1.319	99% gamma percentile (KM)	1.395

The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	1.426	1.429	95% Approx. Gamma UPL	1.286	1.286
95% KM Gamma Percentile	1.233	1.234	95% Gamma USL	1.224	1.224

Lognormal GOF Test on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	1.15	Mean in Log Scale	0.139
SD in Original Scale	0.0577	SD in Log Scale	0.0502
95% UTL95% Coverage	1.488	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	1.311
90% Percentile (z)	1.225	95% Percentile (z)	1.248
99% Percentile (z)	1.291	95% USL	1.237
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	0.139	95% KM UTL (Lognormal)95% Coverage	1.437
KM SD of Logged Data	0.0435	95% KM UPL (Lognormal)	1.288
95% KM Percentile Lognormal (z)	1.234	95% KM USL (Lognormal)	1.224
Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	3.075	Mean in Log Scale	0.874
SD in Original Scale	2.223	SD in Log Scale	0.85
95% UTL95% Coverage	189.7	95% UPL (t)	22.42
90% Percentile (z)	7.122	95% Percentile (z)	9.698
99% Percentile (z)	17.31	95% USL	8.306
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	10
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	10
95% USL	10	95% KM Chebyshev UPL	1.394
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
iron			
General Statistics			
Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		

Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.2
Maximum Detect	N/A	Maximum Non-Detect	0.2
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable iron was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
lead			
General Statistics			
Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	5
Maximum Detect	N/A	Maximum Non-Detect	5
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable lead was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
magnesium			
General Statistics			
Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A
Warning: This data set only has 0 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			

The data set for variable magnesium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
manganese			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	4		
Number of Detects	3	Number of Non-Detects	1
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	11	Minimum Non-Detect	10
Maximum Detect	22.2	Maximum Non-Detect	10
Variance Detected	38.41	Percent Non-Detects	25%
Mean Detected	18.13	SD Detected	6.198
Mean of Detected Logged Data	2.851	SD of Detected Logged Data	0.393
Warning: Data set has only 3 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.816	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.356	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	16.1	KM SD	5.622
95% UTL95% Coverage	45.02	95% KM UPL (t)	30.89
90% KM Percentile (z)	23.31	95% KM Percentile (z)	25.35
99% KM Percentile (z)	29.18	95% KM USL	24.32
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	14.85	SD	8.29
95% UTL95% Coverage	57.5	95% UPL (t)	36.66
90% Percentile (z)	25.47	95% Percentile (z)	28.49
99% Percentile (z)	34.14	95% USL	26.97
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			

k hat (MLE)	10.78	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.682	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	64.69	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	4.816	Mean	14.8
Maximum	22.2	Median	16.1
SD	8.363	CV	0.565
k hat (MLE)	3.208	k star (bias corrected MLE)	0.969
Theta hat (MLE)	4.615	Theta star (bias corrected MLE)	15.28
nu hat (MLE)	25.66	nu star (bias corrected)	7.748
MLE Mean (bias corrected)	14.8	MLE Sd (bias corrected)	15.04
95% Percentile of Chisquare (2kstar)	5.869	90% Percentile	34.36
95% Percentile	44.85	99% Percentile	69.28

The following statistics are computed using Gamma ROS Statistics on Imputed Data

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	131.9	162.7	95% Approx. Gamma UPL	53.28	57.8
95% Gamma USL	31.12	32.01			

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	16.1	SD (KM)	5.622
Variance (KM)	31.61	SE of Mean (KM)	3.443
k hat (KM)	8.2	k star (KM)	2.217
nu hat (KM)	65.6	nu star (KM)	17.73
theta hat (KM)	1.963	theta star (KM)	7.263
80% gamma percentile (KM)	23.81	90% gamma percentile (KM)	30.57
95% gamma percentile (KM)	36.98	99% gamma percentile (KM)	51.11

The following statistics are computed using gamma distribution and KM estimates

Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods

	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	65.9	71.26	95% Approx. Gamma UPL	35.35	36.2
95% KM Gamma Percentile	26.59	26.8	95% Gamma USL	25.15	25.28

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects

Mean in Original Scale	15.22	Mean in Log Scale	2.606
SD in Original Scale	7.712	SD in Log Scale	0.586
95% UTL95% Coverage	275.3	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	63.21
90% Percentile (z)	28.68	95% Percentile (z)	35.48
99% Percentile (z)	52.88	95% USL	31.88
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	2.714	95% KM UTL (Lognormal)95% Coverage	98.78
KM SD of Logged Data	0.365	95% KM UPL (Lognormal)	39.44
95% KM Percentile Lognormal (z)	27.51	95% KM USL (Lognormal)	25.74
Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	14.85	Mean in Log Scale	2.54
SD in Original Scale	8.29	SD in Log Scale	0.699
95% UTL95% Coverage	461.2	95% UPL (t)	79.71
90% Percentile (z)	31.05	95% Percentile (z)	40.02
99% Percentile (z)	64.42	95% USL	35.23
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	22.2
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	22.2
95% USL	22.2	95% KM Chebyshev UPL	43.5
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
mercury			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	4
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	0.2
Maximum Detect	N/A	Maximum Non-Detect	0.2
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A
Warning: All observations are Non-Detects (NDs), therefore all statistics and estimates should also be NDs!			
Specifically, sample mean, UCLs, UPLs, and other statistics are also NDs lying below the largest detection limit!			

The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).			
The data set for variable mercury was not processed!			
nickel			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	3		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.29	Minimum Non-Detect	10
Maximum Detect	0.33	Maximum Non-Detect	10
Variance Detected	8.0000E-4	Percent Non-Detects	50%
Mean Detected	0.31	SD Detected	0.0283
Mean of Detected Logged Data	-1.173	SD of Detected Logged Data	0.0914
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.31	KM SD	0.02
95% UTL95% Coverage	0.413	95% KM UPL (t)	0.363
90% KM Percentile (z)	0.336	95% KM Percentile (z)	0.343
99% KM Percentile (z)	0.357	95% KM USL	0.339
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	2.655	SD	2.708
95% UTL95% Coverage	16.58	95% UPL (t)	9.78
90% Percentile (z)	6.125	95% Percentile (z)	7.109
99% Percentile (z)	8.954	95% USL	6.615
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	239.9	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00129	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	959.7	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A

Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.31	SD (KM)	0.02
Variance (KM)	4.0000E-4	SE of Mean (KM)	0.02
k hat (KM)	240.3	k star (KM)	60.23
nu hat (KM)	1922	nu star (KM)	481.8
theta hat (KM)	0.00129	theta star (KM)	0.00515
80% gamma percentile (KM)	0.343	90% gamma percentile (KM)	0.362
95% gamma percentile (KM)	0.378	99% gamma percentile (KM)	0.41

The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.424	0.426	95% Approx. Gamma UPL	0.365	0.366
95% KM Gamma Percentile	0.344	0.344	95% Gamma USL	0.34	0.34

Lognormal GOF Test on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	0.31	Mean in Log Scale	-1.173
SD in Original Scale	0.0231	SD in Log Scale	0.0746
95% UTL95% Coverage	0.454	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	0.376
90% Percentile (z)	0.34	95% Percentile (z)	0.35
99% Percentile (z)	0.368	95% USL	0.345
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	-1.173	95% KM UTL (Lognormal)95% Coverage	0.431
KM SD of Logged Data	0.0646	95% KM UPL (Lognormal)	0.367
95% KM Percentile Lognormal (z)	0.344	95% KM USL (Lognormal)	0.34
Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	2.655	Mean in Log Scale	0.218
SD in Original Scale	2.708	SD in Log Scale	1.607
95% UTL95% Coverage	4851	95% UPL (t)	85.42
90% Percentile (z)	9.758	95% Percentile (z)	17.5
99% Percentile (z)	52.33	95% USL	13.05
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	10
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	10
95% USL	10	95% KM Chebyshev UPL	0.407
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			

Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
potassium			
General Statistics			
Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A
Warning: This data set only has 0 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable potassium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
selenium			
General Statistics			
Total Number of Observations	4	Number of Missing Observations	1
Number of Distinct Observations	3		
Number of Detects	2	Number of Non-Detects	2
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.096	Minimum Non-Detect	20
Maximum Detect	0.11	Maximum Non-Detect	20
Variance Detected	9.8000E-5	Percent Non-Detects	50%
Mean Detected	0.103	SD Detected	0.0099
Mean of Detected Logged Data	-2.275	SD of Detected Logged Data	0.0963
Warning: Data set has only 2 Detected Values.			
This is not enough to compute meaningful or reliable statistics and estimates.			
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test on Detects Only			
Not Enough Data to Perform GOF Test			
Kaplan Meier (KM) Background Statistics Assuming Normal Distribution			
KM Mean	0.103	KM SD	0.007
95% UTL95% Coverage	0.139	95% KM UPL (t)	0.121

90% KM Percentile (z)	0.112	95% KM Percentile (z)	0.115
99% KM Percentile (z)	0.119	95% KM USL	0.113
DL/2 Substitution Background Statistics Assuming Normal Distribution			
Mean	5.052	SD	5.714
95% UTL95% Coverage	34.44	95% UPL (t)	20.09
90% Percentile (z)	12.37	95% Percentile (z)	14.45
99% Percentile (z)	18.34	95% USL	13.41
DL/2 is not a recommended method. DL/2 provided for comparisons and historical reasons			
Gamma GOF Tests on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Gamma Statistics on Detected Data Only			
k hat (MLE)	216.2	k star (bias corrected MLE)	N/A
Theta hat (MLE)	4.7646E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	864.7	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A		
MLE Sd (bias corrected)	N/A	95% Percentile of Chisquare (2kstar)	N/A
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.103	SD (KM)	0.007
Variance (KM)	4.9000E-5	SE of Mean (KM)	0.007
k hat (KM)	216.5	k star (KM)	54.29
nu hat (KM)	1732	nu star (KM)	434.4
theta hat (KM)	4.7573E-4	theta star (KM)	0.0019
80% gamma percentile (KM)	0.115	90% gamma percentile (KM)	0.121
95% gamma percentile (KM)	0.127	99% gamma percentile (KM)	0.138

The following statistics are computed using gamma distribution and KM estimates					
Upper Limits using Wilson Hilferty (WH) and Hawkins Wixley (HW) Methods					
	WH	HW		WH	HW
95% Approx. Gamma UTL with 95% Coverage	0.143	0.144	95% Approx. Gamma UPL	0.122	0.123
95% KM Gamma Percentile	0.115	0.115	95% Gamma USL	0.113	0.113

Lognormal GOF Test on Detected Observations Only			
Not Enough Data to Perform GOF Test			
Background Lognormal ROS Statistics Assuming Lognormal Distribution Using Imputed Non-Detects			
Mean in Original Scale	0.103	Mean in Log Scale	-2.275
SD in Original Scale	0.00808	SD in Log Scale	0.0786
95% UTL95% Coverage	0.154	95% BCA UTL95% Coverage	N/A
95% Bootstrap (%) UTL95% Coverage	N/A	95% UPL (t)	0.126
90% Percentile (z)	0.114	95% Percentile (z)	0.117
99% Percentile (z)	0.123	95% USL	0.115
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean of Logged Data	-2.275	95% KM UTL (Lognormal)95% Coverage	0.146
KM SD of Logged Data	0.0681	95% KM UPL (Lognormal)	0.123
95% KM Percentile Lognormal (z)	0.115	95% KM USL (Lognormal)	0.114

Background DL/2 Statistics Assuming Lognormal Distribution			
Mean in Original Scale	5.052	Mean in Log Scale	0.0136
SD in Original Scale	5.714	SD in Log Scale	2.644
95% UTL95% Coverage	816321	95% UPL (t)	1064
90% Percentile (z)	30.01	95% Percentile (z)	78.42
99% Percentile (z)	475.2	95% USL	48.42
DL/2 is not a Recommended Method. DL/2 provided for comparisons and historical reasons.			
Nonparametric Distribution Free Background Statistics			
Data do not follow a Discernible Distribution (0.05)			
Nonparametric Upper Limits for BTVs(no distinction made between detects and nondetects)			
Order of Statistic, r	4	95% UTL with95% Coverage	20
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
Approximate Sample Size needed to achieve specified CC	59	95% UPL	20
95% USL	20	95% KM Chebyshev UPL	0.137
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			
represents a background data set and when many onsite observations need to be compared with the BTV.			
strontium			
General Statistics			
Total Number of Observations	4	Number of Distinct Observations	3
		Number of Missing Observations	1
Minimum	85.3	First Quartile	85.45
Second Largest	100	Median	92.75
Maximum	100	Third Quartile	100
Mean	92.7	SD	8.43
Coefficient of Variation	0.0909	Skewness	-4.875E-4
Mean of logged Data	4.526	SD of logged Data	0.0911
Critical Values for Background Threshold Values (BTVs)			
Tolerance Factor K (For UTL)	5.144	d2max (for USL)	1.462
Normal GOF Test			
Shapiro Wilk Test Statistic	0.737	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Normal at 5% Significance Level	
Data appear Approximate Normal at 5% Significance Level			
Background Statistics Assuming Normal Distribution			
95% UTL with 95% Coverage	136.1	90% Percentile (z)	103.5
95% UPL (t)	114.9	95% Percentile (z)	106.6
95% USL	105	99% Percentile (z)	112.3

Gamma GOF Test			
A-D Test Statistic	0.706	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.657	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.341	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	160.9	k star (bias corrected MLE)	40.39
Theta hat (MLE)	0.576	Theta star (bias corrected MLE)	2.295
nu hat (MLE)	1287	nu star (bias corrected)	323.1
MLE Mean (bias corrected)	92.7	MLE Sd (bias corrected)	14.59
Background Statistics Assuming Gamma Distribution			
95% Wilson Hilferty (WH) Approx. Gamma UPL	116.5	90% Percentile	111.8
95% Hawkins Wixley (HW) Approx. Gamma UPL	116.7	95% Percentile	117.9
95% WH Approx. Gamma UTL with 95% Coverage	143	99% Percentile	130
95% HW Approx. Gamma UTL with 95% Coverage	144.1		
95% WH USL	105.4	95% HW USL	105.4
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.737	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.307	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			
Background Statistics assuming Lognormal Distribution			
95% UTL with 95% Coverage	147.7	90% Percentile (z)	103.9
95% UPL (t)	117.5	95% Percentile (z)	107.4
95% USL	105.6	99% Percentile (z)	114.2
Nonparametric Distribution Free Background Statistics			
Data appear Approximate Normal at 5% Significance Level			
Nonparametric Upper Limits for Background Threshold Values			
Order of Statistic, r	4	95% UTL with 95% Coverage	100
Approx, f used to compute achieved CC	0.211	Approximate Actual Confidence Coefficient achieved by UTL	0.185
		Approximate Sample Size needed to achieve specified CC	59
95% Percentile Bootstrap UTL with 95% Coverage	N/A	95% BCA Bootstrap UTL with 95% Coverage	N/A
95% UPL	100	90% Percentile	100
90% Chebyshev UPL	121	95% Percentile	100
95% Chebyshev UPL	133.8	99% Percentile	100
95% USL	100		
Note: The use of USL tends to yield a conservative estimate of BTV, especially when the sample size starts exceeding 20.			
Therefore, one may use USL to estimate a BTV only when the data set represents a background data set free of outliers			
and consists of observations collected from clean unimpacted locations.			
The use of USL tends to provide a balance between false positives and false negatives provided the data			

represents a background data set and when many onsite observations need to be compared with the BTV.			
silver			
General Statistics			
Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A
Warning: This data set only has 0 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable silver was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
sodium			
General Statistics			
Total Number of Observations	0	Number of Distinct Observations	0
		Number of Missing Observations	5
Minimum	N/A	First Quartile	N/A
Second Largest	N/A	Median	N/A
Maximum	N/A	Third Quartile	N/A
Mean	N/A	SD	N/A
Coefficient of Variation	N/A	Skewness	N/A
Warning: This data set only has 0 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable sodium was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
thallium			
General Statistics			
Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	10
Maximum Detect	N/A	Maximum Non-Detect	10
Variance Detected	N/A	Percent Non-Detects	100%

Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable thallium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

vanadium

General Statistics

Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	5
Maximum Detect	N/A	Maximum Non-Detect	5
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable vanadium was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

zinc

General Statistics

Total Number of Observations	2	Number of Missing Observations	3
Number of Distinct Observations	1		
Number of Detects	0	Number of Non-Detects	2
Number of Distinct Detects	0	Number of Distinct Non-Detects	1
Minimum Detect	N/A	Minimum Non-Detect	30
Maximum Detect	N/A	Maximum Non-Detect	30
Variance Detected	N/A	Percent Non-Detects	100%
Mean Detected	N/A	SD Detected	N/A
Mean of Detected Logged Data	N/A	SD of Detected Logged Data	N/A

Warning: This data set only has 2 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable zinc was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			
Hardness			
General Statistics			
Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	3
Minimum	53600	First Quartile	53700
Second Largest	53600	Median	53800
Maximum	54000	Third Quartile	53900
Mean	53800	SD	282.8
Coefficient of Variation	0.00526	Skewness	N/A
Warning: This data set only has 2 observations!			
Data set is too small to compute reliable and meaningful statistics and estimates!			
The data set for variable Hardness was not processed!			
It is suggested to collect at least 8 to 10 observations before using these statistical methods!			
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.			

Appendix C - DEQ Risk Calculator Documentation

Appendix C-1
Exposure Point Concentration Tables

Appendix C-2
Exposure Unit #1 – Resident and Non-Residential Worker
(0-2 ft bgs soil samples, background concentrations included)

Appendix C-3
Exposure Unit #1 – Construction Worker
(0-10 ft bgs soil samples, background concentrations included)

Appendix C-4
Exposure Unit #2 Trail – Greenway User and Construction Worker
(soil samples, background concentrations included)

Appendix C-5
Exposure Unit #2 Creek – Greenway User
(sediment and surface water samples, background concentrations included)

Appendix C-6
Exposure Unit #3 – Resident, Non-Residential Worker, and Greenway User
(0-2 ft bgs soil samples, background concentrations included)

Appendix C-7
Exposure Unit #3 - Construction Worker
(0-10 ft bgs soil samples, background concentrations included)

Appendix C-8
Exposure Unit #1 – Resident and Non-Residential Worker
(0-2 ft bgs soil samples, background concentrations excluded)

Appendix C-9
Exposure Unit #1 – Construction Worker
(0-10 ft bgs soil samples, background concentrations excluded)

Appendix C-10
Exposure Unit #2 Trail – Greenway User and Construction Worker
(soil samples, background concentrations excluded)

Appendix C-11
Exposure Unit #2 Creek – Greenway User
(sediment and surface water samples, background concentrations excluded)

Appendix C-12
Exposure Unit #3 – Resident, Non-Residential Worker, and Greenway User
(0-2 ft bgs soil samples, background concentrations excluded)

Appendix C-13
Exposure Unit #3 - Construction Worker
(0-10 ft bgs soil samples, background concentrations excluded)

Appendix C-1 Exposure Point Concentration Tables
Exposure Unit #1
Direct Contact to Soil Pathway
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job. No. TCH-009

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	cobalt	copper	lead	manganese	mercury	nickel	selenium	strontium	thallium	vanadium	zinc
Site-Specific BSV				3.015	87.86	0.929	0.313	5.725	70.2	36.31	77.3	59.11	1,149	0.256	19.49	2.503	43.19	0.981	227	230
S-4	04/29/13	CCP	1 ft	14	24	ND	1.5	NA	NA	30	65	20	1,500	0.011	43	ND	NA	ND	21	120
S-5*	01/31/14	CCP	0-4 ft	37	2,800	NA	ND	1.3	19.7	NA	NA	10	NA	0.30	NA	3.2	NA	NA	NA	NA
S-6*	01/31/14	CCP	0-4 ft	43	3,200	NA	ND	2.7	19.3	NA	NA	12	NA	0.42	NA	6.1	NA	NA	NA	NA
GP-1	02/03/14	CCP	8-12 ft	3.5	86	NA	ND	ND	8.8	NA	NA	26	NA	0.083	NA	ND	NA	NA	NA	NA
GP-2	02/03/14	CCP	26-28 ft	41	1,100	NA	ND	ND	19	NA	NA	11	NA	0.24	NA	4.0	NA	NA	NA	NA
GP-3	02/03/14	CCP	10-12 ft	48	1,200	NA	ND	0.53	22.47	NA	NA	39	NA	0.42	NA	ND	NA	NA	NA	NA
GP-4	02/04/14	CCP	10-12 ft	59	2,900	NA	ND	ND	20	NA	NA	11	NA	0.51	NA	5.8	NA	NA	NA	NA
GP-5	02/04/14	CCP	4-6 ft	72	2,800	NA	ND	ND	19	NA	NA	9.5	NA	0.33	NA	2.6	NA	NA	NA	NA
	04/03/19	CCP	4-6 ft	95.9	2,350	5.46	<0.956	0.836 J	12.3	7.05	50.9	NA	34.7	1.2	11.1	12	325	NA	NA	NA
	04/03/19[1]	CCP	4-6 ft	95.9	2,630	6.99	<0.931	0.712 J	16.2	10.3	62.5	NA	53.4	0.39	17.1	13	308	NA	NA	NA
GP-6	02/04/14	CCP	9-11 ft	65	850	NA	ND	ND	19	NA	NA	27	NA	11	NA	4.1	NA	NA	NA	NA
	04/04/19	CCP	9-10 ft	6.73	178	0.758	0.118 J	<1.11	10.0	5.18	11	NA	687	0.05	6.24	0.88	21.7	NA	NA	NA
GP-7	02/04/14	CCP	10-12 ft	55	1,700	NA	ND	ND	19	NA	NA	11	NA	0.26	NA	4.3	NA	NA	NA	NA
GP-8	02/04/14	CCP	11-15 ft	54	4,100	NA	ND	ND	20	NA	NA	9.2	NA	0.29	NA	4.5	NA	NA	NA	NA
GP-11	02/04/14	CCP	4-6 ft	16	450	NA	ND	ND	16	NA	NA	23	NA	0.35	NA	ND	NA	NA	NA	NA
GP-12	02/04/14	CCP	2-4 ft	52	2,000	NA	ND	ND	19	NA	NA	14	NA	0.28	NA	2.1	NA	NA	NA	NA
HH-1	11/03/16	Soil	0-1 ft	5.9	120	1.00	<0.29	0.45	20.55	7.9	25	27	350	0.052	8.8	0.69	31	<0.58	48	50
	11/03/16[1]	Soil	0-1 ft	3.4	110	0.79	<0.35	0.54	19.46	8.4	17	18	360 BH	0.067	12	<0.71	30	<0.71	41	35
HH-2	11/03/16	Soil	0-1 ft	4.9	140	0.93	<0.29	0.43	13.57	12	21	30	260	0.085	5.9	1.0	25	<0.58	48	43
HH-3	11/03/16	Soil	0-1 ft	9.9	200	1.30	<0.33	0.46 J	17.54	7.8	31	24	350	0.076	8.9	2.4	36	<0.65	53	100
HH-4	11/03/16	Soil	0-1 ft	2.4	72	1.00	<0.28	0.50	44.5	16	37	2.3	630	<0.023	33	<0.56	42	0.60	73	70
HH-5	11/03/16	Soil	0-1 ft	2.4	73	0.75	<0.30	<0.14	23	8.4	19	9.3	410	<0.025	14	1.2	23	<0.60	39	51
MW-7	11/01/16	Soil	0-1 ft	2.6	67	0.87	<0.30	0.89	9.11	3.9	180	7.6	100	0.030	2.9	<0.59	6.7	<0.59	61	46
Maximum Concentrations - All Samples				95.9	4,100	6.99	1.5	2.7	44.5	30	180	39	1,500	11	43	13	325	0.60	73	120
Maximum Concentrations - Shallow (0-2') Interval				14	200	1.30	1.5	0.89	44.5	30	180	30	1,500	0.085	43	2.4	42	0.60	73	120
Maximum Concentrations - Construction Worker (0-10') Interval				95.9	3,200	6.99	1.5	2.7	44.5	30	180	30	1,500	11	43	13	325	0.60	73	120

Notes:
Red indicates concentration is below recommended site-specific background screening value (BSV).
Orange shading indicates maximum concentration in all samples.
Blue shading indicated maximum concentrations in samples that include the shallow (0-2 ft) interval.
Purple shading indicates maximum concentrations in samples that include the 0-10 ft interval.
Grey shading indicates concentration is maximum concentration in all use scenarios.
[1] Duplicate sample taken.
CCP = Coal Combustion Product; ND = Not Detected; NA = Not Analyzed.
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
BH = Method blank greater than one-half laboratory reporting limit, but sample concentration greater than 10x the method blank.
*Location resampled at 0-1 ft interval (HH-2 and HH-5); 0-1 ft sample considered more representative of shallow interval.

Appendix C-1 Exposure Point Concentration Tables
Exposure Unit #2
Direct Contact to Soil Pathway
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job. No. TCH-009

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	cobalt	copper	lead	manganese	mercury	nickel	selenium	strontium	thallium	vanadium	zinc
Site-Specific BSV				3.015	87.86	0.929	0.313	5.725	70.2	36.31	77.3	59.11	1,149	0.256	19.49	2.503	43.19	0.981	227	230
SS-7	02/18/16	Soil	2-12 in	3.1	84	0.60	ND	NA	NA	6.9	15	13	500	0.038	5.9	ND	31	ND	37	37
HH-8	10/27/16	Soil	0-1 ft	3.6	100	1.00	<0.30	<0.35	19	12	29	18	570	0.036	9.0	<0.60	28	<0.60	52	54
MW-6	11/02/16	Soil	0-1 ft	2.9	38	0.61	<0.26	0.21 J	9.79	9.5	23	12	570	0.082	8.2	1.0	22	0.81	31	77
SED-3A	04/05/19	Soil	0-1 ft	3.45	33.9	0.418 J	<0.582	<1.16	17.4	16.5	6.97	NA	560	<0.0054	5.82	0.237 J	9.6	NA	NA	NA
SED-5A	04/04/19	Soil	0-1 ft	1.25	13.5	0.156 J	<0.571	0.352 J	13.2	5.95	39.1	NA	243	0.0071	4.38	<0.571	10.9	NA	NA	NA
SED-8	04/05/19	Drainage Pathway Soil	2-6 in	2.41	49.1	0.313 J	0.122 J	<1.25	12.0	7.01	14.3	NA	423	0.063	4.66	1.01	15.2	NA	NA	NA
SED-9	04/05/19	Drainage Pathway Soil	2-6 in	1.16	33.8	0.199 J	<0.660	0.461 J	21.6	9.11	10.1	NA	431	0.013	6.68	<0.660	16.7	NA	NA	NA
SED-10	04/05/19	Drainage Pathway Soil	2-6 in	1.29	24.4	0.118 J	0.221 J	0.418 J	12.0	4.43	10.8	NA	195	0.037	4.03	0.273 J	8.1	NA	NA	NA
SED-12	08/27/19	Drainage Pathway Soil	0-2 in	4.73	102	0.765 J	0.214 J	<1.68	27.6	6.17	23.1	NA	341	0.042	7.69	0.961	25.4	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	3.97	122	0.499 J	0.204 J	<1.74	9.45	6.04	19.7	NA	319	0.077	4.95	1.36	32.8	NA	NA	NA
SED-13	08/27/19	Drainage Pathway Soil	0-2 in	12.4	958	1.56	0.284 J	<2.03	29.4	13.9	38.9	NA	538	0.12	19.2	3.07	125	NA	NA	NA
	04/05/19	Drainage Pathway Soil	2-6 in	14.5	724	1.1	0.171 J	<1.58	14.0	7.58	27.1	NA	563	0.075	8.73	1.69	70.5	NA	NA	NA
SED-18	04/05/19	Drainage Pathway Soil	2-6 in	4.53	137	0.534 J	<0.689	<1.38	18.7	11.1	28.2	NA	464	0.051	9	1.85	32.6	NA	NA	NA
SED-19	04/05/19	Drainage Pathway Soil	2-6 in	1.55	20	0.161 J	<0.588	0.435 J	21.7	7.98	8.38	NA	266	0.0073	4.94	0.334 J	15	NA	NA	NA
SED-20	04/05/19	Drainage Pathway Soil	2-6 in	0.792	31.4	0.152 J	<0.687	<1.37	5.76	4.5	9.1	NA	360	0.012	2.19	0.263 J	11.5	NA	NA	NA
SED-21	04/05/19	Drainage Pathway Soil	2-6 in	1.12	25.9	0.149 J	<0.591	<1.18	20.9	4.44	6.58	NA	221	0.011	2.7	0.286 J	12.8	NA	NA	NA
Excavation G-1	04/16/20	Soil	2-3 ft	3.68	58.8	<3.08	<1.23	0.478 J	20.0	5.73	14.5	NA	193	0.052	6.94	<3.08	6.2	NA	NA	NA
Excavation H-3	05/11/20	Soil	1-2 ft	2.41	71.0	<3.28	<1.31	0.410 J	40.2	14.1	43.4	NA	251	0.0485 J	12.5	1.46 J	58.1	NA	NA	NA
Excavation H-5	05/11/20	Soil	1-2 ft	1.10 J	74.5	<3.04	<1.22	0.497 J	21.1	8.25	16.9	NA	558	<0.0486	6.77	<3.04	32.2	NA	NA	NA
Excavation H-6	05/11/20	Soil	1-2 ft	1.02 J	96.0	<2.97	<1.19	<1.19	14.9	7.57	10.7	NA	557	0.0222 J	4.03	<2.97	20.5	NA	NA	NA
Excavation H-7	11/09/20	Soil	0-1 ft	1.10 J	73.7	0.767 J	<1.22	<1.22	8.04	3.68	15.0	NA	233	0.022	4.63	0.479 J	9.6	NA	NA	NA
Excavation I-1	04/08/20	Soil	1-2 ft	2.91	67.2	<2.77	<1.11	0.457 J	26.2	13.0	18.3	NA	594	0.042	8.25	<2.77	26.3	NA	NA	NA
Excavation I-2	04/08/20	Soil	1-2 ft	3.65	74.1	<2.85	<1.14	0.313 J	23.3	12.0	21.4	NA	544	0.022	8.70	<2.85	17.2	NA	NA	NA
Excavation I-3	04/08/20	Soil	1-2 ft	2.18	61.5	<2.88	<1.15	0.387 J	13.1	9.23	19.5	NA	419	0.019	6.02	<2.88	13.3	NA	NA	NA
Maximum Concentrations*				14.5	958	1.56	0.284	0.497	40.2	16.5	43.4	18	594	0.12	19.2	3.07	125	0.81	52	77

Notes:
Red indicates concentration is below recommended site-specific background screening value (BSV).
Orange shading indicates maximum exposure unit concentration.
CCP = Coal Combustion Product; ND = Not Detected; NA = Not Analyzed.
J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.
Site-Specific Background Screening Value (BSV) represents 95% upper threshold level (UTL) with 95% coverage calculated using EPA ProUCL 5.1.
*Maximum concentration for samples collected in shallow (0-2 ft) soil interval are the same as maximum concentrations.

Appendix C-1 Exposure Point Concentration Tables
Exposure Unit #2
Direct Contact to Sediment Pathway
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job. No. TCH-009

Sediment Sampling Point ID	Sample Date	arsenic	barium	beryllium	hexavalent chromium	trivalent chromium	cobalt	copper	manganese	mercury	nickel	selenium	strontium
Recommended Site-Specific BSV		2.74	38.4	0.48	0.79	69.5	16.388	13.8	759	0.0078	9.92	0.409	16.9
SED-3 (Adjacent)	04/05/19	1.36	16.4	0.111 J	0.670 J	13.5	5.18	20.2	225	0.0054 J	4.81	<0.607	9.2
SED-4 (Adjacent)	04/05/19	2.35	20.3	0.191 J	0.456 J	63.8	7.26	8.39	293	0.0080	10.5	0.344 J	30.7
SED-5 (Downstream)	04/04/19	1.82	24.3	0.233 J	0.595 J	16.8	5.9	8.86	399	<0.0035	4.86	<0.617	6.2
Maximum Concentrations		2.35	24.3	0.233	0.670	63.8	7.26	20.2	399	0.0080	10.5	0.344	30.7

Notes:

Red indicates concentration is below recommended site-specific background screening value (BSV).

Orange shading indicates maximum exposure unit concentration.

J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.

Appendix C-1 Exposure Point Concentration Tables
Exposure Unit #2
Direct Contact to Surface Water Pathway
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job. No. TCH-009

Surface Water Sampling Point ID	Sample Date	arsenic	barium	total chromium	cobalt	copper[2]	manganese	nickel[2]	selenium	strontium
Recommended Site-Specific BSV		0.44	27	0.53	0.16	1.2	22.2	0.33	0.11	100
SW-3 (Adjacent)	11/03/16	<10	27	<5.0	<5.0	<10	34	<10	<20	100
	11/03/16[1]	<10	27	<5.0	<5.0	<10	33	<10	<20	110
	04/05/19	0.45	25.7	0.62	0.26	2.8	37.4	0.50	0.11 J	88.8
SW-4 (Adjacent)	11/03/16	<10	27	<5.0	<5.0	<10	25	<10	<20	110
	04/05/19	0.42	23.6	<0.50	0.14	1.0	24.6	0.26 J	0.10 J	89.1
	04/05/19[1]	0.41	23.7	<0.50	0.14	0.98	24.8	0.26 J	0.088 J	87.7
SW-5 (Downstream)	11/03/16	<10	26	<5.0	<5.0	<10	24	<10	<20	100
	04/04/19	0.40	16.9	<0.50	0.14	0.88	19.5	0.21 J	0.12 J	81.8
SW-21 (Drainage Pathway)	04/05/19	0.40	32.1	0.73	0.36	3.2	29.5	0.62	0.11 J	69.9
	04/05/19[2]	0.15	18.3	<0.50	0.094 J	3.1	9.3	0.43 J	<0.50	43.5
Maximum Concentrations		0.45	32.1	0.73	0.36	3.2	37.4	0.62	0.12	110

Notes:

Red indicates concentration is below recommended site-specific background screening value (BSV).

Orange shading indicates maximum exposure unit concentration.

[1] Duplicate sample taken.

[2] Sample was field filtered.

J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.

Appendix C-1 Exposure Point Concentration Tables
Exposure Unit #3
Direct Contact to Soil Pathway
828 Martin Luther King, Jr. Blvd.
Chapel Hill, North Carolina
H&H Job. No. TCH-009

Sample ID	Sample Date	Material Sampled (Soil or CCP)	Sample Depth	arsenic	barium	beryllium	cadmium	hexavalent chromium	trivalent chromium	cobalt	copper	manganese	mercury	nickel	selenium	strontium
Recommended Site-Specific BSV				3.015	87.86	0.929	0.313	5.725	70.2	36.31	77.3	1,149	0.256	19.49	2.503	43.19
HH-9	04/03/19	CCP	0-1 ft	3.37	131	0.398 J	0.178 J	<1.29	12.7	5.97	14.5	260	0.31	3.59	0.722	33.2
HH-10	04/03/19	CCP	0-1 ft	60.3	2,970	5.14	0.162 J	<1.60	13.8	9.84	51.3	73.3	0.22	17.1	5.04	269
HH-11	04/03/19	CCP	0-1 ft	42.5	3,260	5.9	0.220 J	0.467 J	18.7	13.4	55.3	113	0.43	23.5	9.05	234
S-7	01/31/14	CCP	0-4 ft	44	2,500	NA	ND	1.4	27.6	NA	NA	11	NA	0.44	NA	4.5
Excavation H-1	05/11/20	Soil	1-2 ft	1.16	37.2	<2.76	<1.10	<1.10	20.1	10.7	15.3	412	<0.0442	5.80	<2.76	29.3
Excavation H-2	05/11/20	Soil	1-2 ft	1.93	100	<3.25	<1.30	0.578 J	43.8	19.1	59.2	265	0.0494 J	16.2	1.58 J	56.8
Excavation H-4	05/11/20	Soil	2-3 ft	2.03	67.1	<3.04	<1.22	0.388 J	25.8	20.8	24.0	1,480	0.0237 J	7.81	<3.04	38.1
Maximum Concentrations				60.3	3,260	5.9	0.220	1.4	43.8	20.8	59.2	1,480	0.43	23.5	9.05	269
Maximum Concentrations - Shallow Interval Only				60.3	3,260	5.9	0.220	1.4	43.8	19.1	59.2	412	0.43	23.5	9.05	269

Notes:

Red indicates concentration is below recommended site-specific background screening value (BSV).

Orange shading indicates maximum exposure unit concentration.

CCP = Coal Combustion Product.

J = Detected above method detection limit but below laboratory reporting limit; therefore, result is an estimated concentration.

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #1 Resident & Non-Residential Worker
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Basis: May 2021 EPA RSL Table		
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Exposure Unit ID: EU #1 Resident & Non-Residential Worker		
Form No.	**Description**	**Check box if included**
	DATA INPUT SHEETS	
	Input Section 1 - Exposure Pathways & Parameters	
Input Form 1A	Complete Exposure Pathways	☑
Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
	Input Section 2 - Exposure Point Concentrations	
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
	DATA OUTPUT SHEETS	
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Output Form 1A	Risk for Individual Pathways	☑
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	Output Section 2 - Direct Contact Soil and Groundwater Calculators	
Output Form 2A	Resident Soil	☑
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☑
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☐
Output Form 2F	Recreator/Trespasser Soil	☐
Output Form 2G	Recreator/Trespasser Surface Water	☐
	Output Section 3 - Vapor Intrusion Calculators	
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
	Output Section 4 - Contaminant Migration Worksheets	
Output Form 4A	Soil to Groundwater - Forward Mode	☐
Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021 **Basis: May 2021 EPA RSL Table**		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #1 Resident & Non-Residential Worker		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☑
	Groundwater Use	☐
Non-Residential Worker	Soil	☑
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Resident & Non-Residential Worker

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Resident & Non-Residential Worker

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	195	
Exposure Time (ET) (hr)	2	NA	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	195	
Exposure Time (ET) (hr)	2	2	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Resident & Non-Residential Worker

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from shallow samples (0-2 ft) collected within the exposure unit.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
14	S-4	7440-38-2	Arsenic, Inorganic			mg/kg										
200	HH-3	7440-39-3	Barium			mg/kg										
1.3	HH-3	7440-41-7	Beryllium and compounds			mg/kg										
1.5	S-4	7440-43-9	Cadmium (Diet)			mg/kg										
44.5	HH-4	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
0.89	MW-7	18540-29-9	Chromium(VI)			mg/kg										
30	S-4	7440-48-4	Cobalt			mg/kg										
180	MW-7	7440-50-8	Copper			mg/kg										
30	HH-2	7439-92-1	~Lead and Compounds			mg/kg										
1500	S-4	7439-96-5	Manganese (Non-diet)			mg/kg										
0.085	HH-2	7439-97-6	~Mercury (elemental)			mg/kg										
43	S-4	7440-02-0	Nickel Soluble Salts			mg/kg										
2.4	HH-3	7782-49-2	Selenium			mg/kg										
42	HH-4	7440-24-6	Strontium, Stable			mg/kg										
0.6	HH-4	7440-28-0	Thallium (Soluble Salts)			mg/kg										
73	HH-4	7440-62-2	Vanadium and Compounds			mg/kg										
120	S-4	7440-66-6	Zinc and Compounds			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #1 Resident & Non-Residential Worker				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	2.4E-05	3.6E+00	YES
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	4.8E-06	2.4E-01	NO
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Resident Soil **Output Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU #1 Resident & Non-Residential Worker

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk*	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient*	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14	14	14	**1.8E-05**	**2.5E-06**	3.6E-10	2.1E-05	**3.6E-01**	4.2E-02	1.5E-05	**4.0E-01**
7440-39-3	Barium	200	200	200					1.3E-02		6.5E-06	1.3E-02
7440-41-7	Beryllium and compounds	1.3	1.3	1.3			1.9E-11	1.9E-11	8.3E-03		1.1E-06	8.3E-03
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			1.6E-11	1.6E-11	1.9E-02	1.8E-03	2.4E-06	2.1E-02
16065-83-1	Chromium(III), Insoluble Salts	44.5	44.5	44.5					3.8E-04			3.8E-04
18540-29-9	Chromium(VI)	0.89	0.89	0.89	**2.9E-06**		1.2E-09	2.9E-06	3.8E-03		1.4E-07	3.8E-03
7440-48-4	Cobalt	30	30	30			1.6E-09	1.6E-09	**1.3E+00**		8.1E-05	**1.3E+00**
7440-50-8	Copper	180	180	180					5.8E-02			5.8E-02
7439-92-1	~Lead and Compounds	30	30	30					**<SL****	**<SL****	**<SL****	
7439-96-5	Manganese (Non-diet)	1500	1500	1500					**8.0E-01**		4.8E-04	**8.0E-01**
7439-97-6	~Mercury (elemental)	0.085	0.085	0.085							7.3E-03	7.3E-03
7440-02-0	Nickel Soluble Salts	43	43	43			6.7E-11	6.7E-11	2.7E-02		7.7E-06	2.7E-02
7782-49-2	Selenium	2.4	2.4	2.4					6.1E-03		1.9E-09	6.1E-03
7440-24-6	Strontium, Stable	42	42	42					8.9E-04			8.9E-04
7440-28-0	Thallium (Soluble Salts)	0.6	0.6	0.6					**7.7E-01**			**7.7E-01**
7440-62-2	Vanadium and Compounds	73	73	73					1.9E-01		1.2E-05	1.9E-01
7440-66-6	Zinc and Compounds	120	120	120					5.1E-03			5.1E-03
						Cumulative:		2.4E-05				**3.6E+00**

DEQ Risk Calculator - Direct Contact - Non-Residential Worker Soil **Output Form 2C**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Resident & Non-Residential Worker

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14	14	14	**3.9E-06**	8.2E-07	8.3E-11	**4.7E-06**	2.4E-02	5.1E-03	3.6E-06	2.9E-02
7440-39-3	Barium	200	200	200					8.6E-04		1.5E-06	8.6E-04
7440-41-7	Beryllium and compounds	1.3	1.3	1.3			4.3E-12	4.3E-12	5.6E-04		2.5E-07	5.6E-04
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			3.7E-12	3.7E-12	1.3E-03	2.2E-04	5.8E-07	1.5E-03
16065-83-1	Chromium(III), Insoluble Salts	44.5	44.5	44.5					2.5E-05			2.5E-05
18540-29-9	Chromium(VI)	0.89	0.89	0.89	1.4E-07		1.0E-10	1.4E-07	2.5E-04		3.4E-08	2.5E-04
7440-48-4	Cobalt	30	30	30			3.7E-10	3.7E-10	8.6E-02		1.9E-05	8.6E-02
7440-50-8	Copper	180	180	180					3.9E-03			3.9E-03
7439-92-1	~Lead and Compounds	30	30	30					**<SL****	**<SL****	**<SL****	
7439-96-5	Manganese (Non-diet)	1500	1500	1500					5.4E-02		1.2E-04	5.4E-02
7439-97-6	~Mercury (elemental)	0.085	0.085	0.085							1.7E-03	1.7E-03
7440-02-0	Nickel Soluble Salts	43	43	43			1.5E-11	1.5E-11	1.8E-03		1.8E-06	1.8E-03
7782-49-2	Selenium	2.4	2.4	2.4					4.1E-04		4.6E-10	4.1E-04
7440-24-6	Strontium, Stable	42	42	42					6.0E-05			6.0E-05
7440-28-0	Thallium (Soluble Salts)	0.6	0.6	0.6					5.1E-02			5.1E-02
7440-62-2	Vanadium and Compounds	73	73	73					1.3E-02		2.8E-06	1.3E-02
7440-66-6	Zinc and Compounds	120	120	120					3.4E-04			3.4E-04
						Cumulative:		4.8E-06				2.4E-01

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #1 Construction Worker
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Exposure Unit ID: EU #1 Construction Worker		
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Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
Input Section 2 - Exposure Point Concentrations		
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
DATA OUTPUT SHEETS		
Output Section 1 - Summary Output for All Calculators		
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
Output Section 2 - Direct Contact Soil and Groundwater Calculators		
Output Form 2A	Resident Soil	☐
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☐
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☑
Output Form 2F	Recreator/Trespasser Soil	☐
Output Form 2G	Recreator/Trespasser Surface Water	☐
Output Section 3 - Vapor Intrusion Calculators		
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
Output Section 4 - Contaminant Migration Worksheets		
Output Form 4A	Soil to Groundwater - Forward Mode	☐
Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
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Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021 **Basis:** May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #1 Construction Worker		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Construction Worker

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Construction Worker

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	195	
Exposure Time (ET) (hr)	2	NA	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	195	
Exposure Time (ET) (hr)	2	2	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations | **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Construction Worker

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from samples collected between 0 to 10 ft within the exposure unit.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
95.9	GP-5	7440-38-2	Arsenic, Inorganic			mg/kg										
3200	S-6	7440-39-3	Barium			mg/kg										
6.99	GP-5	7440-41-7	Beryllium and compounds			mg/kg										
1.5	S-4	7440-43-9	Cadmium (Diet)			mg/kg										
44.5	HH-4	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
2.7	S-6	18540-29-9	Chromium(VI)			mg/kg										
30	S-4	7440-48-4	Cobalt			mg/kg										
180	MW-7	7440-50-8	Copper			mg/kg										
30	HH-2	7439-92-1	~Lead and Compounds			mg/kg										
1500	S-4	7439-96-5	Manganese (Non-diet)			mg/kg										
11	GP-6	7439-97-6	~Mercury (elemental)			mg/kg										
43	S-4	7440-02-0	Nickel Soluble Salts			mg/kg										
13	GP-5	7782-49-2	Selenium			mg/kg										
325	GP-5	7440-24-6	Strontium, Stable			mg/kg										
0.6	HH-4	7440-28-0	Thallium (Soluble Salts)			mg/kg										
73	HH-4	7440-62-2	Vanadium and Compounds			mg/kg										
120	S-4	7440-66-6	Zinc and Compounds			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #1 Construction Worker				

DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	7.0E-06	1.1E+01	YES
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC

VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC

CONTAMINANT MIGRATION CALCULATORS			
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**	
Groundwater	Source Soil	Exceedence of 2L at Receptor?	NC
	Source Groundwater	Exceedence of 2L at Receptor?	NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?	NC
	Source Groundwater	Exceedence of 2B at Receptor?	NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil **Output Form 2E**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 Construction Worker

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	95.9	95.9	95.9	**3.5E-06**	5.6E-07	**1.3E-06**	**5.3E-06**	**5.7E-01**	9.1E-02	**1.4E+00**	**2.1E+00**
7440-39-3	Barium	3200	3200	3200					4.7E-02		1.4E-01	1.9E-01
7440-41-7	Beryllium and compounds	6.99	6.99	6.99			5.2E-08	5.2E-08	4.1E-03		7.9E-02	8.3E-02
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			8.3E-09	8.3E-09	8.8E-03	1.1E-03	3.4E-02	4.4E-02
16065-83-1	Chromium(III), Insoluble Salts	44.5	44.5	44.5					8.7E-05		2.0E-03	2.1E-03
18540-29-9	Chromium(VI)	2.7	2.7	2.7	5.4E-08		7.0E-07	7.5E-07	1.6E-03		2.0E-03	3.6E-03
7440-48-4	Cobalt	30	30	30			8.3E-07	8.3E-07	2.9E-02		**3.4E-01**	**3.7E-01**
7440-50-8	Copper	180	180	180					5.3E-02			5.3E-02
7439-92-1	~Lead and Compounds	30	30	30					**<SL****	**<SL****	**<SL****	
7439-96-5	Manganese (Non-diet)	1500	1500	1500					1.8E-01		**6.7E+00**	**6.9E+00**
7439-97-6	~Mercury (elemental)	11	11	11							**1.1E+00**	**1.1E+00**
7440-02-0	Nickel Soluble Salts	43	43	43			3.4E-08	3.4E-08	6.3E-03		4.8E-02	5.5E-02
7782-49-2	Selenium	13	13	13					7.7E-03		1.5E-04	7.8E-03
7440-24-6	Strontium, Stable	325	325	325					4.8E-04			4.8E-04
7440-28-0	Thallium (Soluble Salts)	0.6	0.6	0.6					4.4E-02			4.4E-02
7440-62-2	Vanadium and Compounds	73	73	73					2.2E-02		1.6E-01	1.9E-01
7440-66-6	Zinc and Compounds	120	120	120					1.2E-03			1.2E-03
						Cumulative:		7.0E-06				**1.1E+01**

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #2 Lower Level Trail - Greenway User and Construction Worker
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Basis: May 2021 EPA RSL Table		
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Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker		
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	Input Section 1 - Exposure Pathways & Parameters	
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Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
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Input Form 2B	Groundwater Exposure Point Concentration Table	☐
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Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
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	DATA OUTPUT SHEETS	
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Output Form 2A	Resident Soil	☐
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☐
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Output Form 4C	Soil to Surface Water - Forward Mode	☐
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Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Wor		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☑
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	98th percentile based on trail use polling data
Exposure Time (ET) (hr)	2	NA	0.5	98th percentile based on trail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	98th percentile based on trail use polling data
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	98th percentile based on trail use polling data
Exposure Time (ET) (hr)	2	2	1	98th percentile based on trail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	98th percentile based on trail use polling data
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from all samples collected within the exposure unit. Note that all maximum concentrations were within the 0-2 ft bgs interval; therefore, both the construction worker and greenway user receptor were evaluated.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
14.5	SED-13	7440-38-2	Arsenic, Inorganic			mg/kg										
958	SED-13	7440-39-3	Barium			mg/kg										
1.56	SED-13	7440-41-7	Beryllium and compounds			mg/kg										
0.284	SED-13	7440-43-9	Cadmium (Diet)			mg/kg										
40.2	Excavation H-3	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
0.497	Excavation H-5	18540-29-9	Chromium(VI)			mg/kg										
16.5	SED-3A	7440-48-4	Cobalt			mg/kg										
43.4	Excavation H-3	7440-50-8	Copper			mg/kg										
18	HH-8	7439-92-1	~Lead and Compounds			mg/kg										
594	Excavation I-1	7439-96-5	Manganese (Non-diet)			mg/kg										
0.12	SED-13	7439-97-6	~Mercury (elemental)			mg/kg										
19.2	SED-13	7440-02-0	Nickel Soluble Salts			mg/kg										
3.07	SED-13	7782-49-2	Selenium			mg/kg										
125	SED-13	7440-24-6	Strontium, Stable			mg/kg										
0.81	MW-6	7440-28-0	Thallium (Soluble Salts)			mg/kg										
52	HH-8	7440-62-2	Vanadium and Compounds			mg/kg										
77	MW-6	7440-66-6	Zinc and Compounds			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	1.4E-06	3.6E+00	YES
Recreator/Trespasser	Soil	8.4E-06	4.1E-01	NO
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil	Output Form 2E
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker	

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14.5	14.5	14.5	5.3E-07	8.4E-08	1.9E-07	8.0E-07	8.5E-02	1.4E-02	**2.2E-01**	**3.2E-01**
7440-39-3	Barium	958	958	958					1.4E-02		4.3E-02	5.7E-02
7440-41-7	Beryllium and compounds	1.56	1.56	1.56			1.2E-08	1.2E-08	9.2E-04		1.8E-02	1.8E-02
7440-43-9	Cadmium (Diet)	0.284	0.284	0.284			1.6E-09	1.6E-09	1.7E-03	2.1E-04	6.4E-03	8.3E-03
16065-83-1	Chromium(III), Insoluble Salts	40.2	40.2	40.2					7.9E-05		1.8E-03	1.9E-03
18540-29-9	Chromium(VI)	0.497	0.497	0.497	1.0E-08		1.3E-07	1.4E-07	2.9E-04		3.7E-04	6.6E-04
7440-48-4	Cobalt	16.5	16.5	16.5			4.6E-07	4.6E-07	1.6E-02		1.9E-01	**2.0E-01**
7440-50-8	Copper	43.4	43.4	43.4					1.3E-02			1.3E-02
7439-92-1	~Lead and Compounds	18	18	18					**<SL****	**<SL****	**<SL****	
7439-96-5	Manganese (Non-diet)	594	594	594					7.3E-02		**2.7E+00**	**2.7E+00**
7439-97-6	~Mercury (elemental)	0.12	0.12	0.12							1.2E-02	1.2E-02
7440-02-0	Nickel Soluble Salts	19.2	19.2	19.2			1.5E-08	1.5E-08	2.8E-03		2.2E-02	2.4E-02
7782-49-2	Selenium	3.07	3.07	3.07					1.8E-03		3.4E-05	1.8E-03
7440-24-6	Strontium, Stable	125	125	125					1.8E-04			1.8E-04
7440-28-0	Thallium (Soluble Salts)	0.81	0.81	0.81					6.0E-02			6.0E-02
7440-62-2	Vanadium and Compounds	52	52	52					1.5E-02		1.2E-01	1.3E-01
7440-66-6	Zinc and Compounds	77	77	77					7.6E-04			7.6E-04
						Cumulative:		1.4E-06				**3.6E+00**

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU #2 Lower Level Trail - Greenway User and Construction Worker

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14.5	14.5	14.5	**6.8E-06**	**1.2E-06**	1.6E-11	**8.0E-06**	5.5E-02	7.6E-03	6.8E-07	6.3E-02
7440-39-3	Barium	958	958	958					9.1E-03		1.3E-06	9.1E-03
7440-41-7	Beryllium and compounds	1.56	1.56	1.56			9.7E-13	9.7E-13	1.5E-03		5.5E-08	1.5E-03
7440-43-9	Cadmium (Diet)	0.284	0.284	0.284			1.3E-13	1.3E-13	5.4E-04	6.0E-05	2.0E-08	6.0E-04
16065-83-1	Chromium(III), Insoluble Salts	40.2	40.2	40.2					5.1E-05			5.1E-05
18540-29-9	Chromium(VI)	0.497	0.497	0.497	3.9E-07		3.0E-11	3.9E-07	3.1E-04		3.5E-09	3.1E-04
7440-48-4	Cobalt	16.5	16.5	16.5			3.9E-11	3.9E-11	1.0E-01		1.9E-06	1.0E-01
7440-50-8	Copper	43.4	43.4	43.4					2.1E-03			2.1E-03
7439-92-1	~Lead and Compounds	18	18	18					**<SL****	**<SL****	**<SL****	
7439-96-5	Manganese (Non-diet)	594	594	594					4.7E-02		8.3E-06	4.7E-02
7439-97-6	~Mercury (elemental)	0.12	0.12	0.12							4.5E-04	4.5E-04
7440-02-0	Nickel Soluble Salts	19.2	19.2	19.2			1.3E-12	1.3E-12	1.8E-03		1.5E-07	1.8E-03
7782-49-2	Selenium	3.07	3.07	3.07					1.2E-03		1.1E-10	1.2E-03
7440-24-6	Strontium, Stable	125	125	125					4.0E-04			4.0E-04
7440-28-0	Thallium (Soluble Salts)	0.81	0.81	0.81					1.5E-01			1.5E-01
7440-62-2	Vanadium and Compounds	52	52	52					2.0E-02		3.6E-07	2.0E-02
7440-66-6	Zinc and Compounds	77	77	77					4.9E-04			4.9E-04
						Cumulative:		8.4E-06				4.1E-01

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #2 Lower Level Creek - Greenway User
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Complete Exposure Pathways		Input Form 1A
Version Date: June 2021 **Basis: May 2021 EPA RSL Table**		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #2 Lower Level Creek - Greenway User		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☑
	Surface Water	☑
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: **June 2021**
Basis: **May 2021 EPA RSL Table**
Site ID: **BPN 21061-17-060**

Exposure Unit ID: **EU #2 Lower Level Creek - Greenway User**

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	98th percentile based on trail polling data
Exposure Time (ET) (hr)	2	NA	0.5	98th percentile based on trail polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	98th percentile based on trail polling data
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	98th percentile based on trail polling data
Exposure Time (ET) (hr)	2	2	1	98th percentile based on trail polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	98th percentile based on trail polling data
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from sediment samples collected at the site during the most recent sampling event.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
2.35	SED-4	7440-38-2	Arsenic, Inorganic			mg/kg										
24.3	SED-5	7440-39-3	Barium			mg/kg										
0.233	SED-5	7440-41-7	Beryllium and compounds			mg/kg										
63.8	SED-4	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
0.67	SED-3	18540-29-9	Chromium(VI)			mg/kg										
7.26	SED-4	7440-48-4	Cobalt			mg/kg										
20.2	SED-3	7440-50-8	Copper			mg/kg										
399	SED-5	7439-96-5	Manganese (Non-diet)			mg/kg										
0.008	SED-4	7439-97-6	~Mercury (elemental)			mg/kg										
10.5	SED-4	7440-02-0	Nickel Soluble Salts			mg/kg										
0.344	SED-4	7782-49-2	Selenium			mg/kg										
30.7	SED-4	7440-24-6	Strontium, Stable			mg/kg										

Exposure Point Concentrations **Input Form 2C**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

Surface Water Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations detected in surface water samples over the last 5 years of sampling.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (ug/L)	Notes:	CAS Number	Chemical	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
0.45	SW-3	7440-38-2	Arsenic, Inorganic			ug/L										
32.1	SW-21	7440-39-3	Barium			ug/L										
0.73	SW-21	16065-83-1	Chromium(III), Insoluble Salts			ug/L										
0.36	SW-21	7440-48-4	Cobalt			ug/L										
3.2	SW-21	7440-50-8	Copper			ug/L										
37.4	SW-3	7439-96-5	Manganese (Non-diet)			ug/L										
0.62	SW-21	7440-02-0	Nickel Soluble Salts			ug/L										
0.12	SW-5	7782-49-2	Selenium			ug/L										
110	SW-3 and SW-4	7440-24-6	Strontium, Stable			ug/L										

Risk for Individual Pathways **Output Form 1A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

DIRECT CONTACT SOIL AND WATER CALCULATORS

Receptor	Pathway	Carcinogenic Risk	Hazard Index	Risk exceeded?
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	1.8E-06	9.1E-02	NO
	Surface Water*	3.2E-07	1.7E-02	NO

VAPOR INTRUSION CALCULATORS

Receptor	Pathway	Carcinogenic Risk	Hazard Index	Risk exceeded?
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC

CONTAMINANT MIGRATION CALCULATORS

Pathway	Source	Target Receptor Concentrations Exceeded?	
Groundwater	Source Soil	Exceedence of 2L at Receptor?	NC
	Source Groundwater	Exceedence of 2L at Receptor?	NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?	NC
	Source Groundwater	Exceedence of 2B at Receptor?	NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.

3. NM = Not Modeled

4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	2.35	2.35	2.35	**1.1E-06**	2.0E-07	2.6E-12	**1.3E-06**	8.9E-03	1.2E-03	1.1E-07	1.0E-02
7440-39-3	Barium	24.3	24.3	24.3					2.3E-04		3.4E-08	2.3E-04
7440-41-7	Beryllium and compounds	0.233	0.233	0.233			1.5E-13	1.5E-13	2.2E-04		8.2E-09	2.2E-04
16065-83-1	Chromium(III), Insoluble Salts	63.8	63.8	63.8					8.1E-05			8.1E-05
18540-29-9	Chromium(VI)	0.67	0.67	0.67	5.3E-07		4.1E-11	5.3E-07	4.2E-04		4.7E-09	4.2E-04
7440-48-4	Cobalt	7.26	7.26	7.26			1.7E-11	1.7E-11	4.6E-02		8.5E-07	4.6E-02
7440-50-8	Copper	20.2	20.2	20.2					9.6E-04			9.6E-04
7439-96-5	Manganese (Non-diet)	399	399	399					3.2E-02		5.6E-06	3.2E-02
7439-97-6	~Mercury (elemental)	0.008	0.008	0.008							3.0E-05	3.0E-05
7440-02-0	Nickel Soluble Salts	10.5	10.5	10.5			7.1E-13	7.1E-13	1.0E-03		8.2E-08	1.0E-03
7782-49-2	Selenium	0.344	0.344	0.344					1.3E-04		1.2E-11	1.3E-04
7440-24-6	Strontium, Stable	30.7	30.7	30.7					9.7E-05			9.7E-05
						Cumulative:		1.8E-06				9.1E-02

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Surface Water **Output Form 2G**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #2 Lower Level Creek - Greenway User

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (ug/L)	Dermal Concentration (ug/L)	Ingestion Carcinogenic Risk	Dermal Contact Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Contact Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	0.45	0.45	2.7E-07	4.5E-08	3.2E-07	1.8E-03	3.7E-04	2.2E-03
7440-39-3	Barium	32.1	32.1				2.0E-04	5.6E-04	7.6E-04
16065-83-1	Chromium(III), Insoluble Salts	0.73	0.73				6.0E-07	9.2E-06	9.8E-06
7440-48-4	Cobalt	0.36	0.36				1.5E-03	1.2E-04	1.6E-03
7440-50-8	Copper	3.2	3.2				9.8E-05	2.0E-05	1.2E-04
7439-96-5	Manganese (Non-diet)	37.4	37.4				1.9E-03	9.5E-03	1.1E-02
7440-02-0	Nickel Soluble Salts	0.62	0.62				3.8E-05	3.8E-05	7.6E-05
7782-49-2	Selenium	0.12	0.12				2.9E-05	5.9E-06	3.5E-05
7440-24-6	Strontium, Stable	110	110				2.3E-04	4.5E-05	2.7E-04
					Cumulative:	3.2E-07			1.7E-02

North Carolina Department of Environmental Quality Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #3 Embankment - Resident, Non-Residential Worker, and Greenway
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User		
Form No.	**Description**	**Check box if included**
DATA INPUT SHEETS		
Input Section 1 - Exposure Pathways & Parameters		
Input Form 1A	Complete Exposure Pathways	☑
Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
Input Section 2 - Exposure Point Concentrations		
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
DATA OUTPUT SHEETS		
Output Section 1 - Summary Output for All Calculators		
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
Output Section 2 - Direct Contact Soil and Groundwater Calculators		
Output Form 2A	Resident Soil	☑
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☑
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☐
Output Form 2F	Recreator/Trespasser Soil	☑
Output Form 2G	Recreator/Trespasser Surface Water	☐
Output Section 3 - Vapor Intrusion Calculators		
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
Output Section 4 - Contaminant Migration Worksheets		
Output Form 4A	Soil to Groundwater - Forward Mode	☐
Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Gr		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☑
	Groundwater Use	☐
Non-Residential Worker	Soil	☑
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☑
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks | **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: **June 2021**
Basis: **May 2021 EPA RSL Table**
Site ID: **BPN 21061-17-060**

Exposure Unit ID: **EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User**

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	2	1	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from samples collected from shallow (0-2 ft) soil within the exposure unit.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
60.3	HH-10	7440-38-2	Arsenic, Inorganic			mg/kg										
3260	HH-11	7440-39-3	Barium			mg/kg										
5.9	HH-11	7440-41-7	Beryllium and compounds			mg/kg										
0.22	HH-11	7440-43-9	Cadmium (Diet)			mg/kg										
43.8	Excavation H-2	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
1.4	S-7	18540-29-9	Chromium(VI)			mg/kg										
19.1	Excavation H-2	7440-48-4	Cobalt			mg/kg										
59.2	Excavation H-2	7440-50-8	Copper			mg/kg										
412	Excavation H-1	7439-96-5	Manganese (Non-diet)			mg/kg										
0.43	HH-11	7439-97-6	~Mercury (elemental)			mg/kg										
23.5	HH-11	7440-02-0	Nickel Soluble Salts			mg/kg										
9.05	HH-11	7782-49-2	Selenium			mg/kg										
269	HH-10	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User				

DIRECT CONTACT SOIL AND WATER CALCULATORS

Receptor	Pathway	Carcinogenic Risk	Hazard Index	Risk exceeded?
Resident	Soil	9.4E-05	3.1E+00	YES
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	2.0E-05	2.2E-01	NO
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	3.4E-05	4.6E-01	NO
	Surface Water*	NC	NC	NC

VAPOR INTRUSION CALCULATORS

Receptor	Pathway	Carcinogenic Risk	Hazard Index	Risk exceeded?
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC

CONTAMINANT MIGRATION CALCULATORS

Pathway	Source	Target Receptor Concentrations Exceeded?	
Groundwater	Source Soil	Exceedence of 2L at Receptor?	NC
	Source Groundwater	Exceedence of 2L at Receptor?	NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?	NC
	Source Groundwater	Exceedence of 2B at Receptor?	NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Resident Soil **Output Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk*	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient*	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**7.8E-05**	**1.1E-05**	1.6E-09	8.9E-05	**1.5E+00**	1.8E-01	6.5E-05	**1.7E+00**
7440-39-3	Barium	3260	3260	3260					**2.1E-01**		1.1E-04	**2.1E-01**
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			8.5E-11	8.5E-11	3.8E-02		4.8E-06	3.8E-02
7440-43-9	Cadmium (Diet)	0.22	0.22	0.22			2.4E-12	2.4E-12	2.8E-03	2.7E-04	3.6E-07	3.1E-03
16065-83-1	Chromium(III), Insoluble Salts	43.8	43.8	43.8					3.7E-04			3.7E-04
18540-29-9	Chromium(VI)	1.4	1.4	1.4	**4.6E-06**		2.0E-09	4.6E-06	6.0E-03		2.3E-07	6.0E-03
7440-48-4	Cobalt	19.1	19.1	19.1			1.0E-09	1.0E-09	**8.1E-01**		5.1E-05	**8.1E-01**
7440-50-8	Copper	59.2	59.2	59.2					1.9E-02			1.9E-02
7439-96-5	Manganese (Non-diet)	412	412	412					**2.2E-01**		1.3E-04	**2.2E-01**
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							3.7E-02	3.7E-02
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			3.7E-11	3.7E-11	1.5E-02		4.2E-06	1.5E-02
7782-49-2	Selenium	9.05	9.05	9.05					2.3E-02		7.3E-09	2.3E-02
7440-24-6	Strontium, Stable	269	269	269					5.7E-03			5.7E-03
						Cumulative:		9.4E-05				**3.1E+00**

DEQ Risk Calculator - Direct Contact - Non-Residential Worker Soil **Output Form 2C**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**1.7E-05**	**3.5E-06**	3.6E-10	**2.0E-05**	1.0E-01	2.2E-02	1.5E-05	1.3E-01
7440-39-3	Barium	3260	3260	3260					1.4E-02		2.5E-05	1.4E-02
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			1.9E-11	1.9E-11	2.5E-03		1.1E-06	2.5E-03
7440-43-9	Cadmium (Diet)	0.22	0.22	0.22			5.4E-13	5.4E-13	1.9E-04	3.2E-05	8.5E-08	2.2E-04
16065-83-1	Chromium(III), Insoluble Salts	43.8	43.8	43.8					2.5E-05			2.5E-05
18540-29-9	Chromium(VI)	1.4	1.4	1.4	2.1E-07		1.6E-10	2.1E-07	4.0E-04		5.4E-08	4.0E-04
7440-48-4	Cobalt	19.1	19.1	19.1			2.4E-10	2.4E-10	5.5E-02		1.2E-05	5.5E-02
7440-50-8	Copper	59.2	59.2	59.2					1.3E-03			1.3E-03
7439-96-5	Manganese (Non-diet)	412	412	412					1.5E-02		3.2E-05	1.5E-02
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							8.9E-03	8.9E-03
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			8.4E-12	8.4E-12	1.0E-03		1.0E-06	1.0E-03
7782-49-2	Selenium	9.05	9.05	9.05					1.5E-03		1.7E-09	1.5E-03
7440-24-6	Strontium, Stable	269	269	269					3.8E-04			3.8E-04
						Cumulative:		2.0E-05				2.2E-01

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Resident, Non-Residential Worker, and Greenway User

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway User

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**2.8E-05**	**5.1E-06**	6.7E-11	**3.3E-05**	**2.3E-01**	3.2E-02	2.8E-06	**2.6E-01**
7440-39-3	Barium	3260	3260	3260					3.1E-02		4.6E-06	3.1E-02
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			3.7E-12	3.7E-12	5.6E-03		2.1E-07	5.6E-03
7440-43-9	Cadmium (Diet)	0.22	0.22	0.22			1.0E-13	1.0E-13	4.2E-04	4.6E-05	1.5E-08	4.6E-04
16065-83-1	Chromium(III), Insoluble Salts	43.8	43.8	43.8					5.5E-05			5.5E-05
18540-29-9	Chromium(VI)	1.4	1.4	1.4	**1.1E-06**		8.5E-11	**1.1E-06**	8.9E-04		9.8E-09	8.9E-04
7440-48-4	Cobalt	19.1	19.1	19.1			4.5E-11	4.5E-11	1.2E-01		2.2E-06	1.2E-01
7440-50-8	Copper	59.2	59.2	59.2					2.8E-03			2.8E-03
7439-96-5	Manganese (Non-diet)	412	412	412					3.3E-02		5.8E-06	3.3E-02
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							1.6E-03	1.6E-03
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			1.6E-12	1.6E-12	2.2E-03		1.8E-07	2.2E-03
7782-49-2	Selenium	9.05	9.05	9.05					3.4E-03		3.2E-10	3.4E-03
7440-24-6	Strontium, Stable	269	269	269					8.5E-04			8.5E-04
						Cumulative:		3.4E-05				4.6E-01

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #3 Embankment - Construction Worker
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
	Input Section 2 - Exposure Point Concentrations	
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
	DATA OUTPUT SHEETS	
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Output Form 1B	Sitewide Risk	☐
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Output Form 3F	Non-Residential Worker Indoor Air	☐
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Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021 **Basis: May 2021 EPA RSL Table**		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #3 Embankment - Construction Worker		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Construction Worker

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Construction Worker

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	2	1	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations — **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Construction Worker

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from all samples collected within the exposure unit.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
60.3	HH-10	7440-38-2	Arsenic, Inorganic			mg/kg										
3260	HH-11	7440-39-3	Barium			mg/kg										
5.9	HH-11	7440-41-7	Beryllium and compounds			mg/kg										
0.22	HH-11	7440-43-9	Cadmium (Diet)			mg/kg										
43.8	Excavation H-2	16065-83-1	Chromium(III), Insoluble Salts			mg/kg										
1.4	S-7	18540-29-9	Chromium(VI)			mg/kg										
20.8	Excavation H-4	7440-48-4	Cobalt			mg/kg										
59.2	Excavation H-2	7440-50-8	Copper			mg/kg										
1480	Excavation H-4	7439-96-5	Manganese (Non-diet)			mg/kg										
0.43	HH-11	7439-97-6	~Mercury (elemental)			mg/kg										
23.5	HH-11	7440-02-0	Nickel Soluble Salts			mg/kg										
9.05	HH-11	7782-49-2	Selenium			mg/kg										
269	HH-10	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #3 Embankment - Construction Worker				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	4.4E-06	8.8E+00	YES
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.

3. NM = Not Modeled

4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil **Output Form 2E**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #3 Embankment - Construction Worker

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**2.2E-06**	3.5E-07	8.0E-07	**3.3E-06**	**3.6E-01**	5.7E-02	**9.0E-01**	**1.3E+00**
7440-39-3	Barium	3260	3260	3260					4.8E-02		1.5E-01	1.9E-01
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			4.4E-08	4.4E-08	3.5E-03		6.6E-02	7.0E-02
7440-43-9	Cadmium (Diet)	0.22	0.22	0.22			1.2E-09	1.2E-09	1.3E-03	1.7E-04	4.9E-03	6.4E-03
16065-83-1	Chromium(III), Insoluble Salts	43.8	43.8	43.8					8.6E-05		2.0E-03	2.1E-03
18540-29-9	Chromium(VI)	1.4	1.4	1.4	2.8E-08		3.6E-07	3.9E-07	8.3E-04		1.0E-03	1.9E-03
7440-48-4	Cobalt	20.8	20.8	20.8			5.8E-07	5.8E-07	2.0E-02		**2.3E-01**	**2.5E-01**
7440-50-8	Copper	59.2	59.2	59.2					1.7E-02			1.7E-02
7439-96-5	Manganese (Non-diet)	1480	1480	1480					1.8E-01		**6.6E+00**	**6.8E+00**
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							4.4E-02	4.4E-02
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			1.9E-08	1.9E-08	3.5E-03		2.6E-02	3.0E-02
7782-49-2	Selenium	9.05	9.05	9.05					5.3E-03		1.0E-04	5.4E-03
7440-24-6	Strontium, Stable	269	269	269					4.0E-04			4.0E-04
						Cumulative:		4.4E-06				**8.8E+00**

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU#1 - Resident & Non-Residential Worker excluding Background
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
Input Section 2 - Exposure Point Concentrations		
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
DATA OUTPUT SHEETS		
Output Section 1 - Summary Output for All Calculators		
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
Output Section 2 - Direct Contact Soil and Groundwater Calculators		
Output Form 2A	Resident Soil	☑
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☑
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☐
Output Form 2F	Recreator/Trespasser Soil	☐
Output Form 2G	Recreator/Trespasser Surface Water	☐
Output Section 3 - Vapor Intrusion Calculators		
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Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
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Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Backgrou		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☑
	Groundwater Use	☐
Non-Residential Worker	Soil	☑
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	195	
Exposure Time (ET) (hr)	2	NA	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	195	
Exposure Time (ET) (hr)	2	2	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from shallow samples (0-2 ft) collected within the exposure unit with background concentrations removed.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
14	S-4	7440-38-2	Arsenic, Inorganic			mg/kg										
200	HH-3	7440-39-3	Barium			mg/kg										
1.3	HH-3	7440-41-7	Beryllium and compounds			mg/kg										
1.5	S-4	7440-43-9	Cadmium (Diet)			mg/kg										
180	MW-7	7440-50-8	Copper			mg/kg										
1500	S-4	7439-96-5	Manganese (Non-diet)			mg/kg										
43	S-4	7440-02-0	Nickel Soluble Salts			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	2.1E-05	1.3E+00	YES
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	4.7E-06	9.1E-02	NO
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Resident Soil **Output Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk*	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient*	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14	14	14	**1.8E-05**	**2.5E-06**	3.6E-10	2.1E-05	**3.6E-01**	4.2E-02	1.5E-05	**4.0E-01**
7440-39-3	Barium	200	200	200					1.3E-02		6.5E-06	1.3E-02
7440-41-7	Beryllium and compounds	1.3	1.3	1.3			1.9E-11	1.9E-11	8.3E-03		1.1E-06	8.3E-03
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			1.6E-11	1.6E-11	1.9E-02	1.8E-03	2.4E-06	2.1E-02
7440-50-8	Copper	180	180	180					5.8E-02			5.8E-02
7439-96-5	Manganese (Non-diet)	1500	1500	1500					**8.0E-01**		4.8E-04	**8.0E-01**
7440-02-0	Nickel Soluble Salts	43	43	43			6.7E-11	6.7E-11	2.7E-02		7.7E-06	2.7E-02
						Cumulative:		2.1E-05				**1.3E+00**

DEQ Risk Calculator - Direct Contact - Non-Residential Worker Soil	Output Form 2C
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU#1 - Resident & Non-Residential Worker excluding Background	

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14	14	14	**3.9E-06**	8.2E-07	8.3E-11	**4.7E-06**	2.4E-02	5.1E-03	3.6E-06	2.9E-02
7440-39-3	Barium	200	200	200					8.6E-04		1.5E-06	8.6E-04
7440-41-7	Beryllium and compounds	1.3	1.3	1.3			4.3E-12	4.3E-12	5.6E-04		2.5E-07	5.6E-04
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			3.7E-12	3.7E-12	1.3E-03	2.2E-04	5.8E-07	1.5E-03
7440-50-8	Copper	180	180	180					3.9E-03			3.9E-03
7439-96-5	Manganese (Non-diet)	1500	1500	1500					5.4E-02		1.2E-04	5.4E-02
7440-02-0	Nickel Soluble Salts	43	43	43			1.5E-11	1.5E-11	1.8E-03		1.8E-06	1.8E-03
						Cumulative:		4.7E-06				9.1E-02

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU #1 - Construction Worker excluding Background
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

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Complete Exposure Pathways		Input Form 1A
Version Date: June 2021 **Basis:** May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU #1 - Construction Worker excluding Background		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 - Construction Worker excluding Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 - Construction Worker excluding Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	195	
Exposure Time (ET) (hr)	2	NA	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	2	
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	195	
Exposure Time (ET) (hr)	2	2	2	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	2	
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU #1 - Construction Worker excluding Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from samples collected between 0 to 10 ft within the exposure unit, excluding background levels.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
95.9	GP-5	7440-38-2	Arsenic, Inorganic			mg/kg										
3200	S-6	7440-39-3	Barium			mg/kg										
6.99	GP-5	7440-41-7	Beryllium and compounds			mg/kg										
1.5	S-4	7440-43-9	Cadmium (Diet)			mg/kg										
180	MW-7	7440-50-8	Copper			mg/kg										
1500	S-4	7439-96-5	Manganese (Non-diet)			mg/kg										
11	GP-6	7439-97-6	~Mercury (elemental)			mg/kg										
43	S-4	7440-02-0	Nickel Soluble Salts			mg/kg										
13	GP-5	7782-49-2	Selenium			mg/kg										
325	GP-5	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU #1 - Construction Worker excluding Background				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	5.4E-06	1.1E+01	YES
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil **Output Form 2E**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU #1 - Construction Worker excluding Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	95.9	95.9	95.9	**3.5E-06**	5.6E-07	**1.3E-06**	**5.3E-06**	**5.7E-01**	9.1E-02	**1.4E+00**	**2.1E+00**
7440-39-3	Barium	3200	3200	3200					4.7E-02		1.4E-01	1.9E-01
7440-41-7	Beryllium and compounds	6.99	6.99	6.99			5.2E-08	5.2E-08	4.1E-03		7.9E-02	8.3E-02
7440-43-9	Cadmium (Diet)	1.5	1.5	1.5			8.3E-09	8.3E-09	8.8E-03	1.1E-03	3.4E-02	4.4E-02
7440-50-8	Copper	180	180	180					5.3E-02			5.3E-02
7439-96-5	Manganese (Non-diet)	1500	1500	1500					1.8E-01		**6.7E+00**	**6.9E+00**
7439-97-6	~Mercury (elemental)	11	11	11							**1.1E+00**	**1.1E+00**
7440-02-0	Nickel Soluble Salts	43	43	43			3.4E-08	3.4E-08	6.3E-03		4.8E-02	5.5E-02
7782-49-2	Selenium	13	13	13					7.7E-03		1.5E-04	7.8E-03
7440-24-6	Strontium, Stable	325	325	325					4.8E-04			4.8E-04
						Cumulative:		5.4E-06				**1.1E+01**

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU#2 Trail - Greenway User & Construction Worker excluding Backgro
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Input Form 1B	Exposure Factors and Target Risks	☑
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	Input Section 2 - Exposure Point Concentrations	
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Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
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Output Form 4C	Soil to Surface Water - Forward Mode	☐
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Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding E		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☑
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98th pecrentile of trail user polling data
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98th pecrentile of trail user polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	Based on 98th pecrentile of trail user polling data
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98th pecrentile of trail user polling data
Exposure Time (ET) (hr)	2	2	1	Based on 98th pecrentile of trail user polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	Based on 98th pecrentile of trail user polling data
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from all soil samples collected within the exposure unit, exlcuding background concentrations

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
14.5	SED-13	7440-38-2	Arsenic, Inorganic			mg/kg										
958	SED-13	7440-39-3	Barium			mg/kg										
1.56	SED-13	7440-41-7	Beryllium and compounds			mg/kg										
3.07	SED-13	7782-49-2	Selenium			mg/kg										
125	SED-13	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	8.1E-07	3.9E-01	NO
Recreator/Trespasser	Soil	8.0E-06	7.5E-02	NO
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil **Output Form 2E**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14.5	14.5	14.5	5.3E-07	8.4E-08	1.9E-07	8.0E-07	8.5E-02	1.4E-02	**2.2E-01**	**3.2E-01**
7440-39-3	Barium	958	958	958					1.4E-02		4.3E-02	5.7E-02
7440-41-7	Beryllium and compounds	1.56	1.56	1.56			1.2E-08	1.2E-08	9.2E-04		1.8E-02	1.8E-02
7782-49-2	Selenium	3.07	3.07	3.07					1.8E-03		3.4E-05	1.8E-03
7440-24-6	Strontium, Stable	125	125	125					1.8E-04			1.8E-04
						Cumulative:		8.1E-07				3.9E-01

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#2 Trail - Greenway User & Construction Worker excluding Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	14.5	14.5	14.5	**6.8E-06**	**1.2E-06**	1.6E-11	**8.0E-06**	5.5E-02	7.6E-03	6.8E-07	6.3E-02
7440-39-3	Barium	958	958	958					9.1E-03		1.3E-06	9.1E-03
7440-41-7	Beryllium and compounds	1.56	1.56	1.56			9.7E-13	9.7E-13	1.5E-03		5.5E-08	1.5E-03
7782-49-2	Selenium	3.07	3.07	3.07					1.2E-03		1.1E-10	1.2E-03
7440-24-6	Strontium, Stable	125	125	125					4.0E-04			4.0E-04
						Cumulative:		8.0E-06				7.5E-02

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU#2 Creek - Greenway User exlcuding Background
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Input Form 1D	Sample Statistics	☐
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Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☑
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
DATA OUTPUT SHEETS		
Output Section 1 - Summary Output for All Calculators		
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
Output Section 2 - Direct Contact Soil and Groundwater Calculators		
Output Form 2A	Resident Soil	☐
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☐
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☐
Output Form 2F	Recreator/Trespasser Soil	☑
Output Form 2G	Recreator/Trespasser Surface Water	☑
Output Section 3 - Vapor Intrusion Calculators		
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
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Output Form 3F	Non-Residential Worker Indoor Air	☐
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Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☑
	Surface Water	☑
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98th percentile tail use polling data
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98th percentile tail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	Based on 98th percentile tail use polling data
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98th percentile tail use polling data
Exposure Time (ET) (hr)	2	2	1	Based on 98th percentile tail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	Based on 98th percentile tail use polling data
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from sediment samples collected at the site during the most recent sampling event, excluding background levels.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
20.2	SED-3	7440-50-8	Copper			mg/kg										
0.008	SED-4	7439-97-6	~Mercury (elemental)			mg/kg										
10.5	SED-4	7440-02-0	Nickel Soluble Salts			mg/kg										
30.7	SED-4	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background				

DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	7.1E-13	2.1E-03	NO
	Surface Water*	3.2E-07	1.7E-02	NO

VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC

CONTAMINANT MIGRATION CALCULATORS			
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**	
Groundwater	Source Soil	Exceedence of 2L at Receptor?	NC
	Source Groundwater	Exceedence of 2L at Receptor?	NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?	NC
	Source Groundwater	Exceedence of 2B at Receptor?	NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.
3. NM = Not Modeled
4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-50-8	Copper	20.2	20.2	20.2					9.6E-04			9.6E-04
7439-97-6	~Mercury (elemental)	0.008	0.008	0.008							3.0E-05	3.0E-05
7440-02-0	Nickel Soluble Salts	10.5	10.5	10.5			7.1E-13	7.1E-13	1.0E-03		8.2E-08	1.0E-03
7440-24-6	Strontium, Stable	30.7	30.7	30.7					9.7E-05			9.7E-05
						Cumulative:		7.1E-13				2.1E-03

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Surface Water	Output Form 2G
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU#2 Creek - Greenway User exlcuding Background	

Receptor Type: Greenway user

CAS #	Chemical Name:	Ingestion Concentration (ug/L)	Dermal Concentration (ug/L)	Ingestion Carcinogenic Risk	Dermal Contact Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Contact Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	0.45	0.45	2.7E-07	4.5E-08	3.2E-07	1.8E-03	3.7E-04	2.2E-03
7440-39-3	Barium	32.1	32.1				2.0E-04	5.6E-04	7.6E-04
16065-83-1	Chromium(III), Insoluble Salts	0.73	0.73				6.0E-07	9.2E-06	9.8E-06
7440-48-4	Cobalt	0.36	0.36				1.5E-03	1.2E-04	1.6E-03
7440-50-8	Copper	3.2	3.2				9.8E-05	2.0E-05	1.2E-04
7439-96-5	Manganese (Non-diet)	37.4	37.4				1.9E-03	9.5E-03	1.1E-02
7440-02-0	Nickel Soluble Salts	0.62	0.62				3.8E-05	3.8E-05	7.6E-05
7782-49-2	Selenium	0.12	0.12				2.9E-05	5.9E-06	3.5E-05
7440-24-6	Strontium, Stable	110	110				2.3E-04	4.5E-05	2.7E-04
					Cumulative:	3.2E-07			1.7E-02

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU#3 - Resident, Non-Residential Worker, & Greenway User excludign
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

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Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background		
Form No.	**Description**	**Check box if included**
	DATA INPUT SHEETS	
	Input Section 1 - Exposure Pathways & Parameters	
Input Form 1A	Complete Exposure Pathways	☑
Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
	Input Section 2 - Exposure Point Concentrations	
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
	DATA OUTPUT SHEETS	
	Output Section 1 - Summary Output for All Calculators	
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
	Output Section 2 - Direct Contact Soil and Groundwater Calculators	
Output Form 2A	Resident Soil	☑
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☑
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☐
Output Form 2F	Recreator/Trespasser Soil	☑
Output Form 2G	Recreator/Trespasser Surface Water	☐
	Output Section 3 - Vapor Intrusion Calculators	
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
	Output Section 4 - Contaminant Migration Worksheets	
Output Form 4A	Soil to Groundwater - Forward Mode	☐
Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User exc		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☑
	Groundwater Use	☐
Non-Residential Worker	Soil	☑
	Groundwater Use	☐
Construction Worker	Soil	☐
Recreator/Trespasser	Soil	☑
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks | **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	Based on 98% percentile of trail users
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98% percentile of trail users
Exposure Time (ET) (hr)	2	2	1	Based on 98% percentile of trail users
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	Based on 98% percentile of trail users
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from samples collected from shallow (0-2 ft) soil within the exposure unit, excluding background levels.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
60.3	HH-10	7440-38-2	Arsenic, Inorganic			mg/kg										
3260	HH-11	7440-39-3	Barium			mg/kg										
5.9	HH-11	7440-41-7	Beryllium and compounds			mg/kg										
0.43	HH-11	7439-97-6	~Mercury (elemental)			mg/kg										
23.5	HH-11	7440-02-0	Nickel Soluble Salts			mg/kg										
9.05	HH-11	7782-49-2	Selenium			mg/kg										
269	HH-10	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background				
DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	8.9E-05	2.1E+00	YES
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	2.0E-05	1.5E-01	NO
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	NC	NC	NC
Recreator/Trespasser	Soil	3.3E-05	3.1E-01	NO
	Surface Water*	NC	NC	NC
VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
CONTAMINANT MIGRATION CALCULATORS				
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**		
Groundwater	Source Soil	Exceedence of 2L at Receptor?		NC
	Source Groundwater	Exceedence of 2L at Receptor?		NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?		NC
	Source Groundwater	Exceedence of 2B at Receptor?		NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.

3. NM = Not Modeled

4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Resident Soil	Output Form 2A
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background	

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk*	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient*	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**7.8E-05**	**1.1E-05**	1.6E-09	8.9E-05	**1.5E+00**	1.8E-01	6.5E-05	**1.7E+00**
7440-39-3	Barium	3260	3260	3260					**2.1E-01**		1.1E-04	**2.1E-01**
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			8.5E-11	8.5E-11	3.8E-02		4.8E-06	3.8E-02
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							3.7E-02	3.7E-02
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			3.7E-11	3.7E-11	1.5E-02		4.2E-06	1.5E-02
7782-49-2	Selenium	9.05	9.05	9.05					2.3E-02		7.3E-09	2.3E-02
7440-24-6	Strontium, Stable	269	269	269					5.7E-03			5.7E-03
						Cumulative:		8.9E-05				**2.1E+00**

DEQ Risk Calculator - Direct Contact - Non-Residential Worker Soil	Output Form 2C
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background	

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**1.7E-05**	**3.5E-06**	3.6E-10	**2.0E-05**	1.0E-01	2.2E-02	1.5E-05	1.3E-01
7440-39-3	Barium	3260	3260	3260					1.4E-02		2.5E-05	1.4E-02
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			1.9E-11	1.9E-11	2.5E-03		1.1E-06	2.5E-03
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							8.9E-03	8.9E-03
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			8.4E-12	8.4E-12	1.0E-03		1.0E-06	1.0E-03
7782-49-2	Selenium	9.05	9.05	9.05					1.5E-03		1.7E-09	1.5E-03
7440-24-6	Strontium, Stable	269	269	269					3.8E-04			3.8E-04
						Cumulative:		2.0E-05				1.5E-01

DEQ Risk Calculator - Direct Contact - Recreator/Trespasser Soil **Output Form 2F**
Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060
Exposure Unit ID: EU#3 - Resident, Non-Residential Worker, & Greenway User excludign Background

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*
*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 400 mg/kg for residential soil.*

Receptor Type: Greenway User

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**2.8E-05**	**5.1E-06**	6.7E-11	**3.3E-05**	**2.3E-01**	3.2E-02	2.8E-06	**2.6E-01**
7440-39-3	Barium	3260	3260	3260					3.1E-02		4.6E-06	3.1E-02
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			3.7E-12	3.7E-12	5.6E-03		2.1E-07	5.6E-03
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							1.6E-03	1.6E-03
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			1.6E-12	1.6E-12	2.2E-03		1.8E-07	2.2E-03
7782-49-2	Selenium	9.05	9.05	9.05					3.4E-03		3.2E-10	3.4E-03
7440-24-6	Strontium, Stable	269	269	269					8.5E-04			8.5E-04
						Cumulative:		3.3E-05				3.1E-01

North Carolina Department of Environmental Quality
Risk Calculator

Version Date:	June 2021
Basis:	May 2021 EPA RSL Table
Site Name:	828 MLK Jr. Blvd Property
Site Address:	828 MLK Jr Blvd, Chapel Hill, Orange County, North Carolina
DEQ Section:	Brownfields Program
Site ID:	BPN 21061-17-060
Exposure Unit ID:	EU#3 - Construction Worker excluding Background
Submittal Date:	
Prepared By:	Hart & Hickman, PC
	3921 Sunset Ridge Rd, Suite 301, Raleigh, North Carolina
Reviewed By:	

Table of Contents		TOC
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#3 - Construction Worker excluding Background		
Form No.	**Description**	**Check box if included**
	DATA INPUT SHEETS	
	Input Section 1 - Exposure Pathways & Parameters	
Input Form 1A	Complete Exposure Pathways	☑
Input Form 1B	Exposure Factors and Target Risks	☑
Input Form 1C	Contaminant Migration Parameters	☐
Input Form 1D	Sample Statistics	☐
	Input Section 2 - Exposure Point Concentrations	
Input Form 2A	Soil Exposure Point Concentration Table	☑
Input Form 2B	Groundwater Exposure Point Concentration Table	☐
Input Form 2C	Surface Water Exposure Point Concentration Table	☐
Input Form 2D	Soil Gas Exposure Point Concentration Table	☐
Input Form 2E	Indoor Air Exposure Point Concentration Table	☐
	DATA OUTPUT SHEETS	
	Output Section 1 - Summary Output for All Calculators	
Output Form 1A	Risk for Individual Pathways	☑
Output Form 1B	Sitewide Risk	☐
	Output Section 2 - Direct Contact Soil and Groundwater Calculators	
Output Form 2A	Resident Soil	☐
Output Form 2B	Resident Groundwater Use	☐
Output Form 2C	Non-Residential Worker Soil	☐
Output Form 2D	Non-Residential Worker Groundwater Use	☐
Output Form 2E	Construction Worker Soil	☑
Output Form 2F	Recreator/Trespasser Soil	☐
Output Form 2G	Recreator/Trespasser Surface Water	☐
	Output Section 3 - Vapor Intrusion Calculators	
Output Form 3A	Resident Groundwater to Indoor Air	☐
Output Form 3B	Resident Soil Gas to Indoor Air	☐
Output Form 3C	Resident Indoor Air	☐
Output Form 3D	Non-Residential Worker Groundwater to Indoor Air	☐
Output Form 3E	Non-Residential Worker Soil Gas to Indoor Air	☐
Output Form 3F	Non-Residential Worker Indoor Air	☐
	Output Section 4 - Contaminant Migration Worksheets	
Output Form 4A	Soil to Groundwater - Forward Mode	☐
Output Form 4B	Groundwater to Groundwater - Forward Mode	☐
Output Form 4C	Soil to Surface Water - Forward Mode	☐
Output Form 4D	Groundwater to Surface Water - Forward Mode	☐
Output Form 4E	Soil to Groundwater - Backward Mode	☐
Output Form 4F	Groundwater to Groundwater - Backward Mode	☐
Output Form 4G	Soil to Surface Water - Backward Mode	☐
Output Form 4H	Groundwater to Surface Water - Backward Mode	☐

Complete Exposure Pathways		Input Form 1A
Version Date: June 2021		
Basis: May 2021 EPA RSL Table		
Site ID: BPN 21061-17-060		
Exposure Unit ID: EU#3 - Construction Worker excluding Background		
Note: Risk output will only be calculated for complete exposure pathways.		
Receptor	**Pathway**	**Check box if pathway complete**
DIRECT CONTACT SOIL AND WATER PATHWAYS		
Resident	Soil	☐
	Groundwater Use	☐
Non-Residential Worker	Soil	☐
	Groundwater Use	☐
Construction Worker	Soil	☑
Recreator/Trespasser	Soil	☐
	Surface Water	☐
VAPOR INTRUSION PATHWAYS		
Resident	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
Non-Residential Worker	Groundwater to Indoor Air	☐
	Soil Gas to Indoor Air	☐
	Indoor Air	☐
CONTAMINANT MIGRATION PATHWAYS		
Groundwater	Source Soil	☐
	Source Groundwater	☐
Surface Water	Source Soil	☐
	Source Groundwater	☐

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Construction Worker excluding Background

Exposure Parameter	Default Value	Site Specific Value	Justification
General			
Target Cancer Risk (individual)	1.0E-06	1.0E-06	
Target Cancer Risk (cumulative)	1.0E-04	1.0E-04	
Target Hazard Index (individual)	2.0E-01	2.0E-01	
Target Hazard Index (cumulative)	1.0E+00	1.0E+00	
Residential Child			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	15	15	
Exposure Duration (ED) (yr)	6	6	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm2)	2373	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	200	
Skin Surface Area - Water Exposure (SA_w) (cm2)	6365	6365	
Water Ingestion Rate (IRW) (L/d)	0.78	0.78	
Water Exposure Time (ET_{event}) (hr/event)	0.54	0.54	
Water Event Frequency (EV) (events/day)	1	1	
Residential Adult			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	20	20	
Exposure Frequency (EF) (d/yr)	350	350	
Exposure Time (ET) (hr)	24	24	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	2.5	2.5	
Water Exposure Time (ET_{event}) (hr/event)	0.71	0.71	
Water Event Frequency (EV) (events/day)	1	1	
Non-Residential Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Exposure Duration (ED) (yr)	25	25	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.12	0.12	
Soil Ingestion Rate (IR) (mg/day)	100	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	
Water Ingestion Rate (IRW) (L/d)	0.83	0.83	
Water Exposure Time (ET_{event}) (hr/event)	0.67	0.67	
Water Event Frequency (EV) (events/day)	1	1	
Construction Worker			
Lifetime (LT) (years)	70	70	
Body Weight (BW) (kg)	80	80	
Working Weeks (EW) (wk/yr)	50	50	
Exposure Duration (ED) (yr)	1	1	
Exposure Frequency (EF) (d/yr)	250	250	
Exposure Time (ET) (hr)	8	8	
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	3527	3527	
Soil Adherence Factor (AF) (mg/cm^2)	0.3	0.3	
Soil Ingestion Rate (IR) (mg/day)	330	330	

Exposure Factors and Target Risks **Input Form 1B**

Version Date: June 2021
Basis: May 2021 EPA RSL Table
Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Construction Worker excluding Background

Exposure Parameter	Default Value		Site Specific Value	Justification
User Defined Child				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	NA	70	
Averaging Time (AT) (days/yr)	365	NA	365	
Body Weight (BW) (kg)	15	NA	15	
Exposure Duration 0-2 (ED) (yr)	2	NA	2	
Exposure Duration 2-6 (ED) (yr)	4	NA	4	
Exposure Frequency (EF) (d/yr)	195	NA	52	Based on 98th percentile of trail use polling data
Exposure Time (ET) (hr)	2	NA	0.5	Based on 98th percentile of trail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	2373	NA	2373	
Soil Adherence Factor (AF) (mg/cm^2)	0.2	NA	0.2	
Soil Ingestion Rate (IRS) (mg/day)	200	NA	200	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	6365	NA	6365	
Water Ingestion Rate (IRW) (L/hr)	0.124	NA	0.124	
Water Exposure Time (ET_{event}) (hr/event)	2	NA	0.5	Based on 98th percentile of trail use polling data
Water Event Frequency (EV) (events/day)	1	NA	1	
User Defined Adult				
	Recreator	Trespasser		
Lifetime (LT) (years)	70	70	70	
Body Weight (BW) (kg)	80	45	80	
Exposure Duration 6-16 (ED) (yr)	10	10	10	
Exposure Duration 16-26 (ED) (yr)	10	0	10	
Exposure Frequency (EF) (d/yr)	195	90	364	Based on 98th percentile of trail use polling data
Exposure Time (ET) (hr)	2	2	1	Based on 98th percentile of trail use polling data
Skin Surface Area - Soil Exposure (SA_s) (cm^2)	6032	6032	6032	
Soil Adherence Factor (AF) (mg/cm^2)	0.07	0.2	0.07	
Soil Ingestion Rate (IRS) (mg/day)	100	200	100	
Skin Surface Area - Water Exposure (SA_w) (cm^2)	19652	19652	19652	
Water Ingestion Rate (IRW) (L/hr)	0.0985	0.071	0.0985	
Water Exposure Time (ET_{event}) (hr/event)	2	2	1	Based on 98th percentile of trail use polling data
Water Event Frequency (EV) (events/day)	1	1	1	

Exposure Point Concentrations **Input Form 2A**

Version Date: June 2021

Basis: May 2021 EPA RSL Table

Site ID: BPN 21061-17-060

Exposure Unit ID: EU#3 - Construction Worker excluding Background

Soil Exposure Point Concentration Table

Description of Exposure Point Concentration Selection:

Maximum detected constituent concentrations from all samples collected within the exposure unit, excluding background levels.

NOTE: If the chemical list is changed from a prior calculator run, remember to select "See All Chemicals" on the data output sheet or newly added chemicals will not be included in risk calculations

Exposure Point Concentration (mg/kg)	Notes:	CAS Number	Chemical **For the chemicals highlighted in blue, data entry notes are provided in the PSRG Table link on the Main Menu**	Minimum Concentration (Qualifier)	Maximum Concentration (Qualifier)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening	Background Value	Screening Toxicity Value (Screening Level) (n/c)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion
60.3	HH-10	7440-38-2	Arsenic, Inorganic			mg/kg										
3260	HH-11	7440-39-3	Barium			mg/kg										
5.9	HH-11	7440-41-7	Beryllium and compounds			mg/kg										
1480	Excavation H-4	7439-96-5	Manganese (Non-diet)			mg/kg										
0.43	HH-11	7439-97-6	~Mercury (elemental)			mg/kg										
23.5	HH-11	7440-02-0	Nickel Soluble Salts			mg/kg										
9.05	HH-11	7782-49-2	Selenium			mg/kg										
269	HH-10	7440-24-6	Strontium, Stable			mg/kg										

Risk for Individual Pathways				Output Form 1A
Version Date: June 2021				
Basis: May 2021 EPA RSL Table				
Site ID: BPN 21061-17-060				
Exposure Unit ID: EU#3 - Construction Worker excluding Background				

DIRECT CONTACT SOIL AND WATER CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Non-Residential Worker	Soil	NC	NC	NC
	Groundwater Use*	NC	NC	NC
Construction Worker	Soil	3.4E-06	8.5E+00	YES
Recreator/Trespasser	Soil	NC	NC	NC
	Surface Water*	NC	NC	NC

VAPOR INTRUSION CALCULATORS				
Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk exceeded?**
Resident	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC
Non-Residential Worker	Groundwater to Indoor Air	NC	NC	NC
	Soil Gas to Indoor Air	NC	NC	NC
	Indoor Air	NC	NC	NC

CONTAMINANT MIGRATION CALCULATORS			
Pathway	**Source**	**Target Receptor Concentrations Exceeded?**	
Groundwater	Source Soil	Exceedence of 2L at Receptor?	NC
	Source Groundwater	Exceedence of 2L at Receptor?	NC
Surface Water	Source Soil	Exceedence of 2B at Receptor?	NC
	Source Groundwater	Exceedence of 2B at Receptor?	NC

Notes:

1. If lead concentrations were entered in the exposure point concentration tables, see the individual calculator sheets for lead concentrations in comparison to screening levels. Note that lead is not included in cumulative risk calculations.

2. * = If concentrations in groundwater exceed the NC 2L Standards or IMAC, or concentrations in surface water exceed the NC 2B Standards, appropriate remediation and/or institutional control measures will be necessary to be eligible for a risk-based closure.

3. NM = Not Modeled

4. NC = Pathway not calculated

DEQ Risk Calculator - Direct Contact - Construction Worker Soil	**Output Form 2E**
Version Date: June 2021	
Basis: May 2021 EPA RSL Table	
Site ID: BPN 21061-17-060	
Exposure Unit ID: EU#3 - Construction Worker excluding Background	

** - Note that inhalation on this calculator refers to outdoor inhalation of volatiles and particulates, not indoor inhalation associated with vapor intrusion.*

*** - Note that the EPA has no consensus on reference dose or cancer slope factor values for lead, therefore it is not possible to calculate cancer risk or hazard quotient. Lead concentrations are compared to the EPA screening level of 800 mg/kg for commercial/industrial soil.*

CAS #	Chemical Name:	Ingestion Concentration (mg/kg)	Dermal Concentration (mg/kg)	Inhalation Concentration (mg/kg)*	Ingestion Carcinogenic Risk	Dermal Carcinogenic Risk	Inhalation Carcinogenic Risk	Calculated Carcinogenic Risk	Ingestion Hazard Quotient	Dermal Hazard Quotient	Inhalation Hazard Quotient	Calculated Non-Carcinogenic Hazard Quotient
7440-38-2	Arsenic, Inorganic	60.3	60.3	60.3	**2.2E-06**	3.5E-07	8.0E-07	**3.3E-06**	**3.6E-01**	5.7E-02	**9.0E-01**	**1.3E+00**
7440-39-3	Barium	3260	3260	3260					4.8E-02		1.5E-01	1.9E-01
7440-41-7	Beryllium and compounds	5.9	5.9	5.9			4.4E-08	4.4E-08	3.5E-03		6.6E-02	7.0E-02
7439-96-5	Manganese (Non-diet)	1480	1480	1480					1.8E-01		**6.6E+00**	**6.8E+00**
7439-97-6	~Mercury (elemental)	0.43	0.43	0.43							4.4E-02	4.4E-02
7440-02-0	Nickel Soluble Salts	23.5	23.5	23.5			1.9E-08	1.9E-08	3.5E-03		2.6E-02	3.0E-02
7782-49-2	Selenium	9.05	9.05	9.05					5.3E-03		1.0E-04	5.4E-03
7440-24-6	Strontium, Stable	269	269	269					4.0E-04			4.0E-04
						Cumulative:		3.4E-06				**8.5E+00**

TOWN OF CHAPEL HILL

Town Hall
405 Martin Luther King Jr. Boulevard
Chapel Hill, NC 27514

Item Overview

Item #: 12., **File #:** [21-0770], **Version:** 1 **Meeting Date:** 10/13/2021

Receive the Fiscal Year (FY) 2021 Affordable Housing Annual Report.

Staff:	**Department:**
Sarah Osmer Viñas, Interim Director	Housing and Community
Faith Brodie, Director	Public Housing
Nate Broman-Fulks, Affordable Housing Manager	Housing and Community
Stacey Todd, Public Housing Management Analyst	Public Housing

Overview: This annual report on affordable housing activities for Fiscal Year 2021 tracks:
- Community indicators related to the housing market and affordable housing,
- The Town's progress toward affordable housing targets,
- The status of projects funded with Town resources,
- General housing conditions in Chapel Hill, and
- Public Housing highlights

☆ **Recommendation(s):**

That the Council receive this Fiscal Year 2021 Annual Report.

Report Highlights:

Community Indicators

- The median household income in Chapel Hill rose to $90,400, which is an increase of $6,000 (or 7%) from 2019 to 2020 HUD Data.
- The median home value rose to $410,105, which is an increase of $26,000 (or 6%) from August 2019 to August 2020.
- The percentage of cost-burdened renters has continued to rise with 58% of renters currently spending more than 30% of their income on housing expenses.

Affordable Housing Results

- Housing and Community continues to focus on COVID-19 response efforts
- Town affordable housing partnership with DHIC wins state's highest honor in affordable housing, the 2020 Housing North Carolina Award
- The Town provided emergency housing assistance payments to 535 households. This assistance is reflected in the total units preserved.
- Council approved 198 affordable homes
- The Town awarded $1.8 million to community partners for affordable housing projects
- The Town awarded funding to 130 new development units
- The 2200 Homestead Road affordable housing development project received rezoning approval
- Selected development partners and completed Concept Planning process for Jay Street

affordable housing development project

Public Housing Operations

Highlights of the fourth quarter, including a recap from the first three quarters, include:

- Continued COVID-related efforts, such as responding to Emergency Work Orders only and managing a record of needed routine repairs and managing a "new normal" for Public Housing tenants by continuing socially distanced weekly food distributions, screening all maintenance services calls before entering apartments and conducting household annual income updates via mail and telephone instead of in person
- Tracking financial metrics such as liquidity ratio, adequacy of reserves and our timeliness in paying vendors to ensure scheduled property restorations, such as appliance replacements, are not delayed,
- Information on the 2021 Habitability Inspections conducted by HUD in July
- Continued implementation of the Public Housing Master Plan including progress with the redevelopment of Trinity Court
- Efforts to increase tenant engagement and programming.

Attachments:

- Draft Staff Presentation
- Affordable Housing Annual Report - Fiscal Year 2021
- Public Housing Annual Report - Fiscal Year 2021

The Agenda will reflect the text below and/or the motion text will be used during the meeting.

PRESENTER: Sarah Osmer Viñas, Interim Housing and Community Director
Faith Brodie, Public Housing Director
Nate Broman-Fulks, Affordable Housing Manager
Stacey Todd, Public Housing Management Analyst

RECOMMENDATION: That the Council receive the Fiscal Year 2021 Affordable Housing Annual Report.

Affordable Housing Annual Report

Fiscal Year 2021

Council Meeting Presentation
October 13, 2021

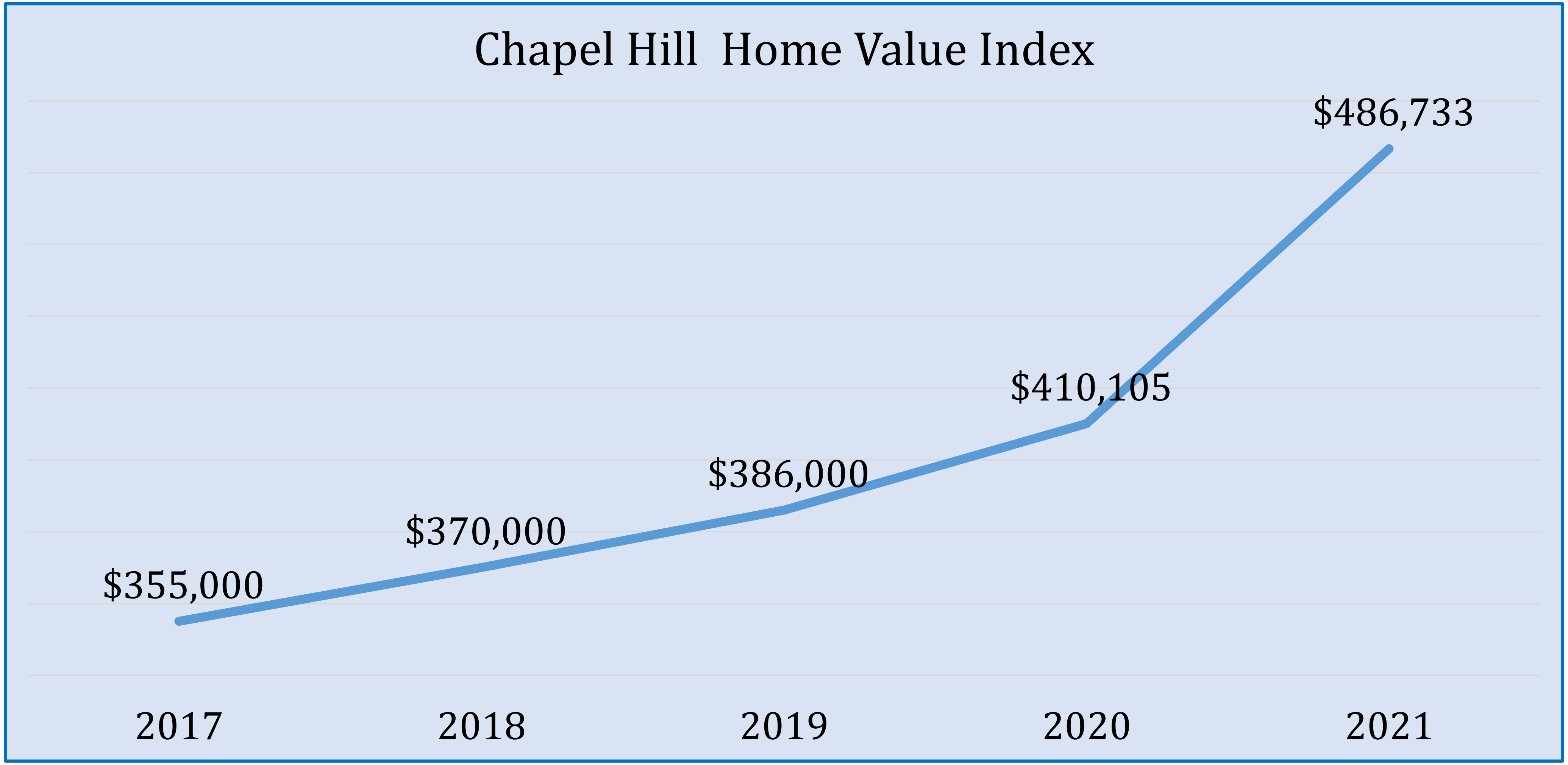
Agenda

1. 2021 Annual Results
2. Project Highlights
3. Next Steps

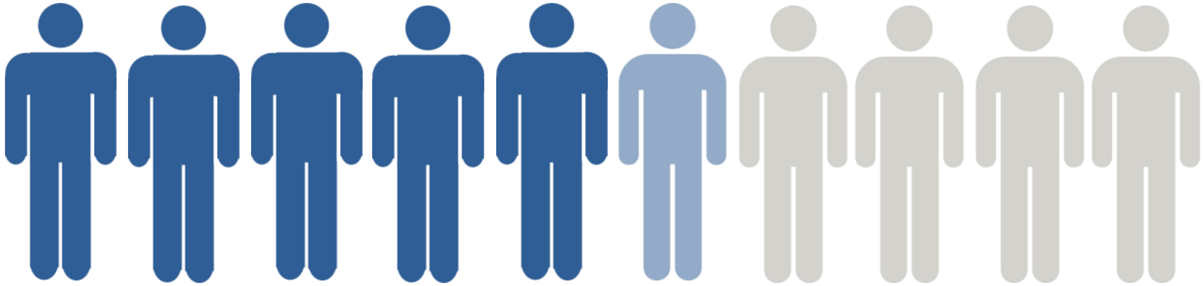
Summary of Progress in FY21

- Town and DHIC Awarded the 2020 Housing North Carolina Award
- 535 households provided emergency Housing Assistance
- 198 affordable homes approved by Council
- **<u>$1.8</u>** million awarded to community partners for affordable housing projects
- 130 new development units awarded funding from the Town
- Selected development partners for Jay St and Trinity Court

Substantial Increase in Home Values



Cost-Burdened Renters in Chapel Hill

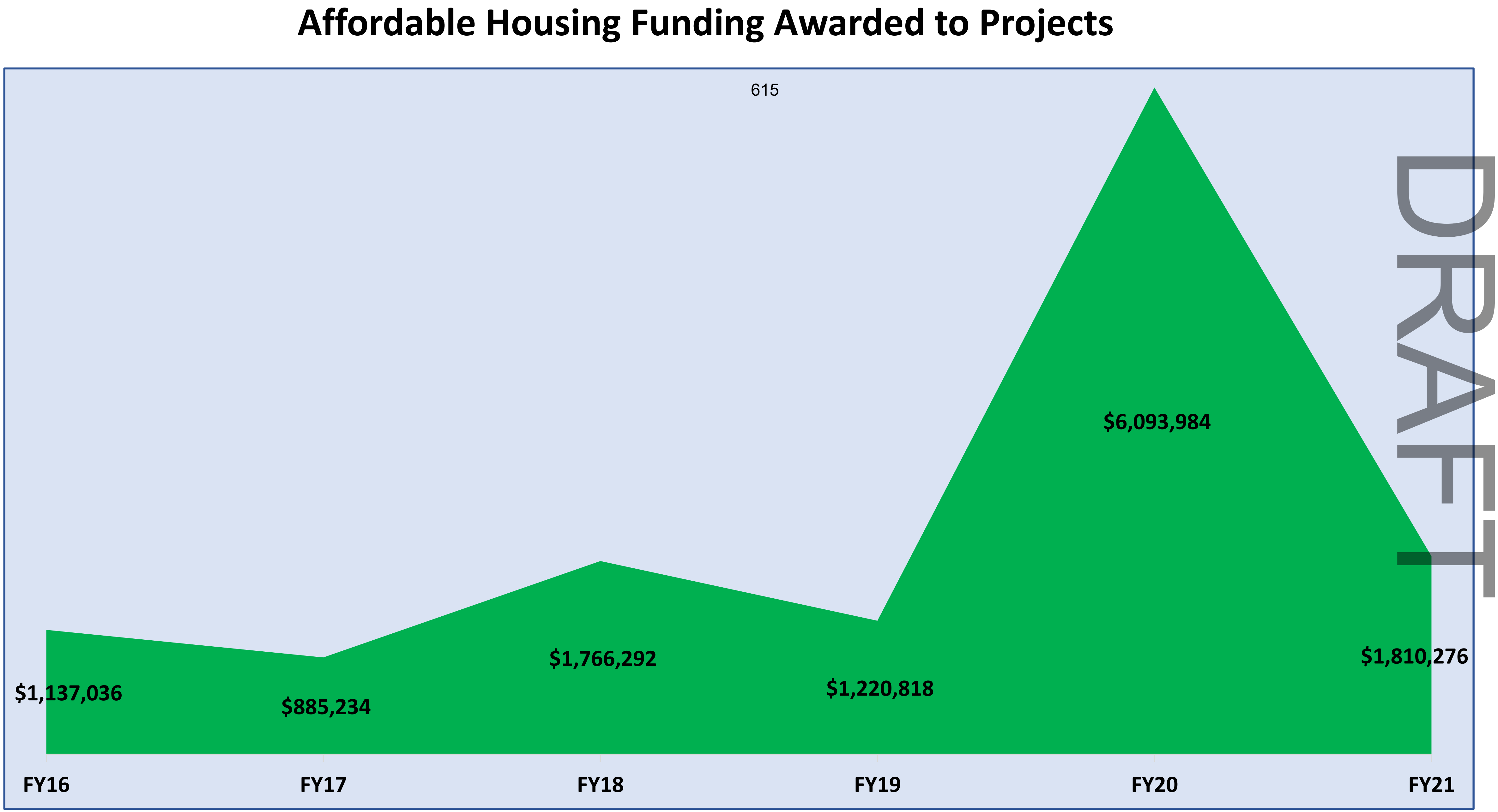


57% of Renters

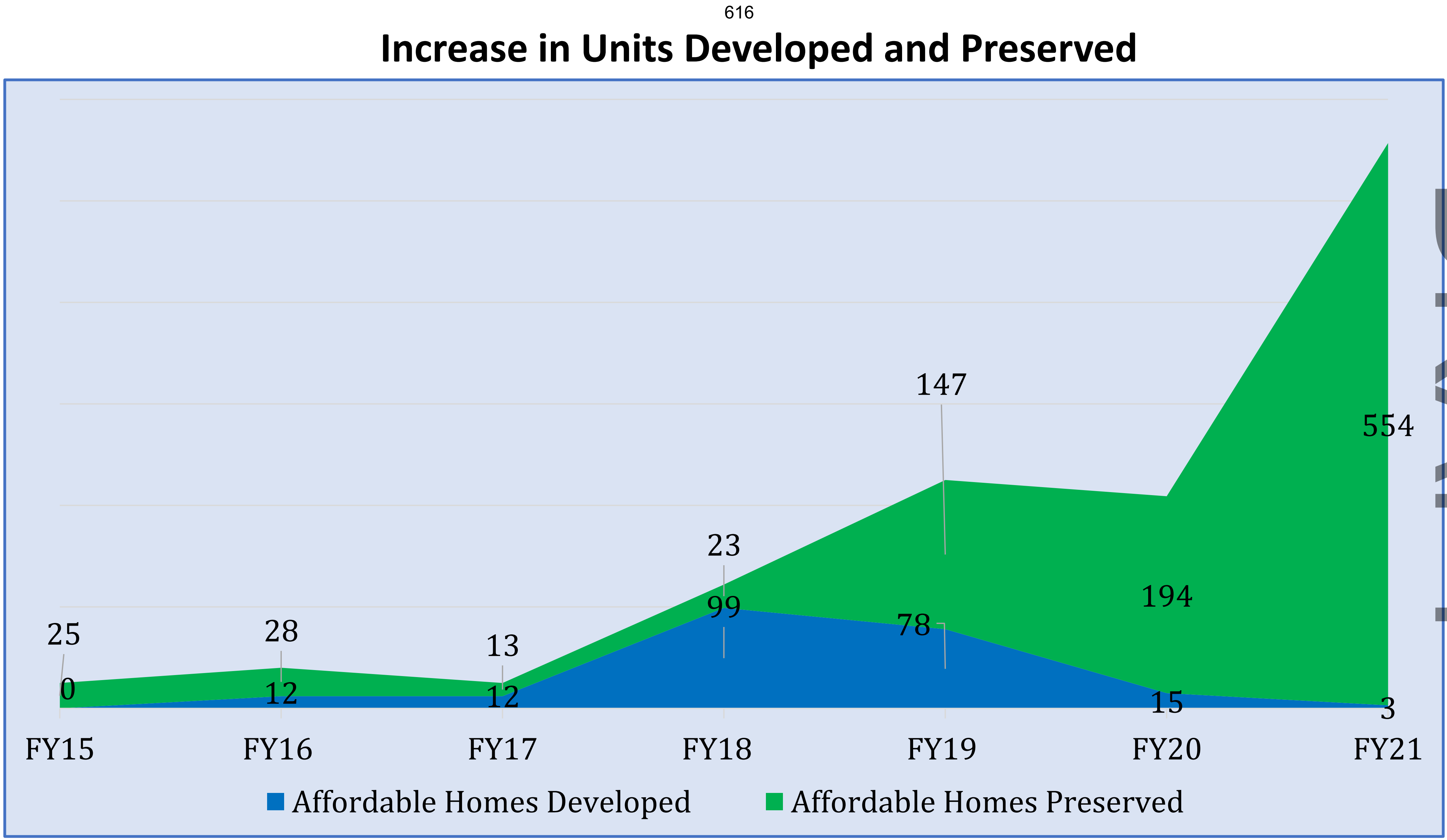
Rental Units Affordable for 60% AMI

16%

The Town has increased its support for affordable housing:



Increased support has increased our impact:



Five Year Targets – 2023

400

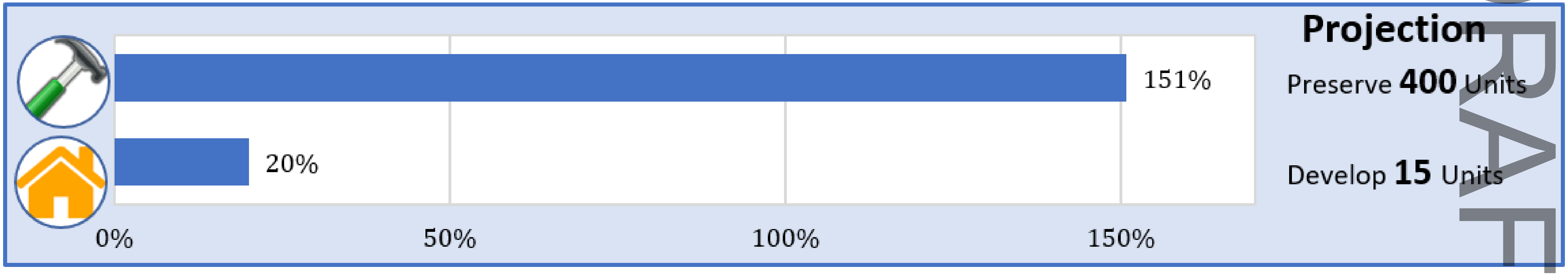
Development

300

Preservation

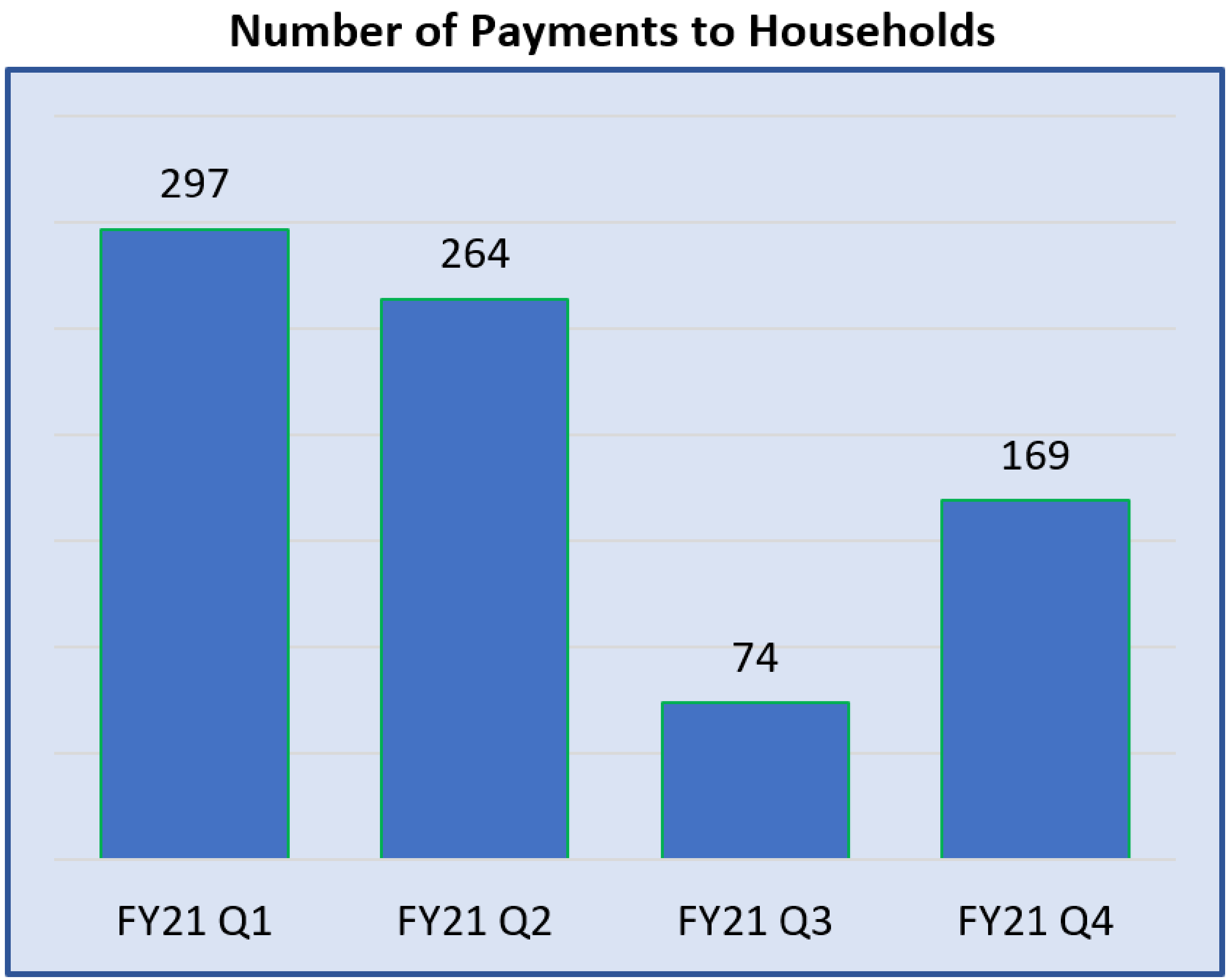
FY21 Key Results

Progress Towards FY21 Projection



Emergency Housing Assistance Program

- 535 unique households assisted
- Serving very low-income households
- $ 1.3 million in Town investment



Awarded Excellence in Affordable Housing

- Town and DHIC awarded the 2020 Housing North Carolina Award for excellence in affordable housing for Greenfield
- North Carolina's top honor for excellence in affordable housing

Affordable Homes Approved

- 200 affordable homes received development approvals
  - ~75 through the Town's Inclusionary Housing program
- 130 affordable homes receive funding support from the Town

Development on Town-Owned Land

- Homestead Gardens - 2200 Homestead
  - Received rezoning approval to develop ~120 affordable homes
  - Planning to break ground in spring/summer 2022
- Jay Street
  - Concept Plan process completed
  - Conducting community engagement to refine draft site plan before submit conditional zoning application

FY21 Projection

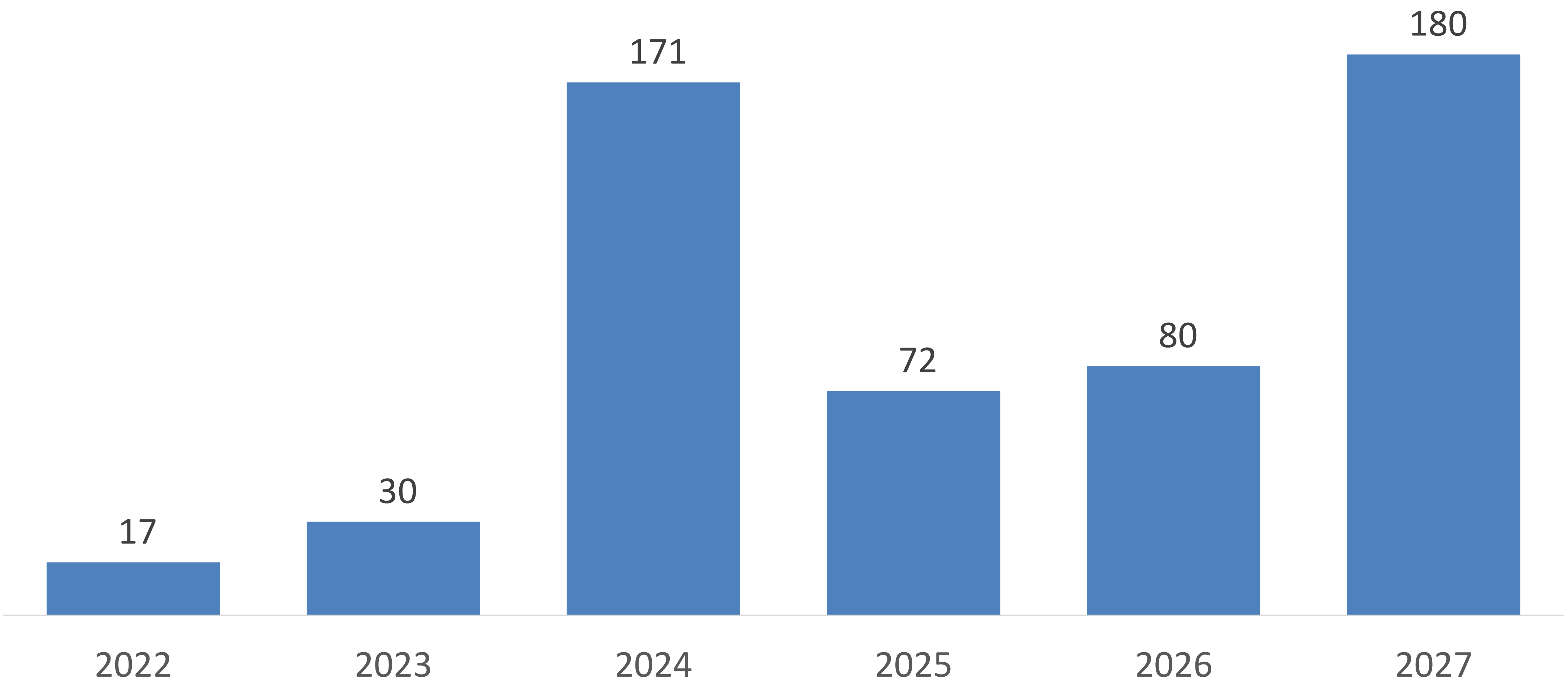
15

Development

350

Preservation

Affordable Housing Development Pipeline



DRAFT

On the Horizon

1. Break ground at Homestead Gardens, Weavers Grove, and Perry Place
2. Submit Trinity Court Concept Plan and Jay St Application
3. Review AHDR Funding Plan in October and allocate the remaining $5 million in bond funding
4. Continue providing Emergency Housing Assistance and adjusting programs based on impact from Covid-19
5. Community Development Block Grant Initial Public Forum in November

Public Housing

FY 2021 Annual Report

Metrics

To track our progress and success, Public Housing will mirror HUD's metrics in the Public Housing Assessment System (PHAS) score. These metrics are:

- Physical Condition
- Financial Condition
- Management Operations
- Capital Fund
- Community Engagement

Operations during COVID-19

- No graded PHAS inspection this fiscal year
- Habitability Inspection in Q4
- Emergency Work Orders only
- Continued pre-screening process for tenants
- Continued Annual Recertifications via mail
- Continued weekly food distribution

Physical Condition

HUD evaluates site, building exterior, interior, and general condition of neighborhood

- Habitability Inspection
- Completion of Oakwood units!
- Plumbing repairs

128 Emergency Work Orders

92% closed within 24 hours

Financial Condition

Operating Fund

HUD evaluates whether the Housing Agency has sufficient financial resources and is managing those resources effectively

	Liquidity	Adequacy of Reserves	Adjusted Operated Income	Money owed to vendors
2021	**19.09%**	**22.75%**	**$488,991**	**0.51**
2020	**12.83%**	**26.63%**	**$474,541**	**1.26**

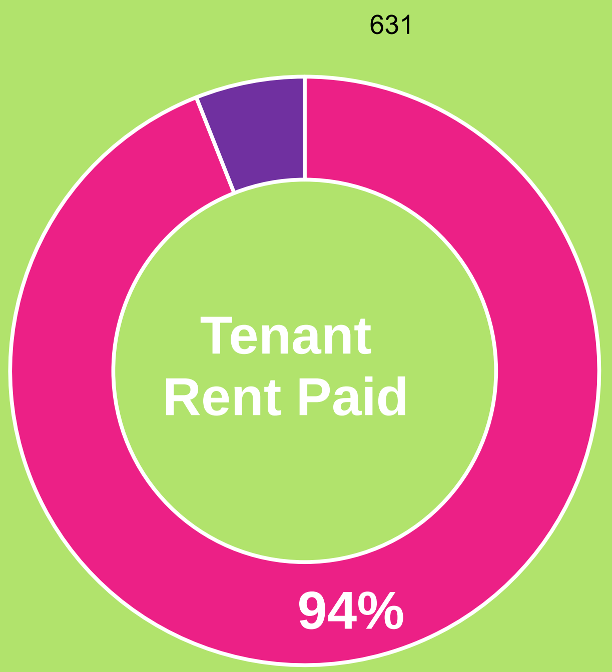
**No debt service either year

Data represents values from Annual Financial Data Schedule collected at FY end (6/30/21)

Improvements were made in Liquidity from 6/30/20 to 6/30/21

Management Operations

HUD is assessing the effectiveness of the Housing Agency's Management in terms of Occupancy, Tenant Account Receivables, and Accounts Payable



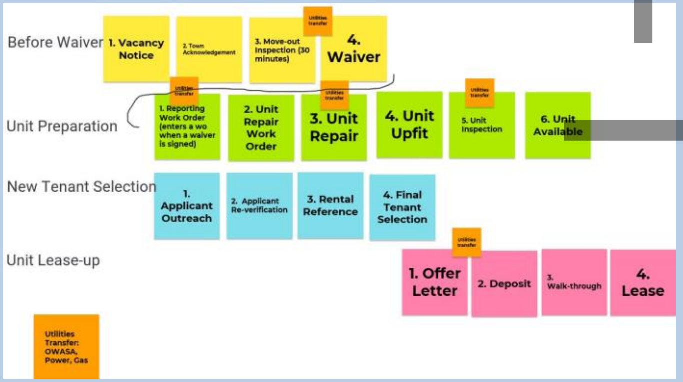
98% Occupancy;
5 vacant units:

2 vacant units due to Fire damage

3 vacant units currently in Leasing

- **Community Housing Partners community engagement for Trinity Re-Imagined**

- **67% of tenants = COVID vaccine**



- **Unit Turnaround Process Improvement team created**

Capital Fund

HUD evaluates the time it takes to use the funds designated for Building Improvements. All Grant Funds must be spent within 4 years of receipt.

4th Quarter balance does not reflect FY22 grant.

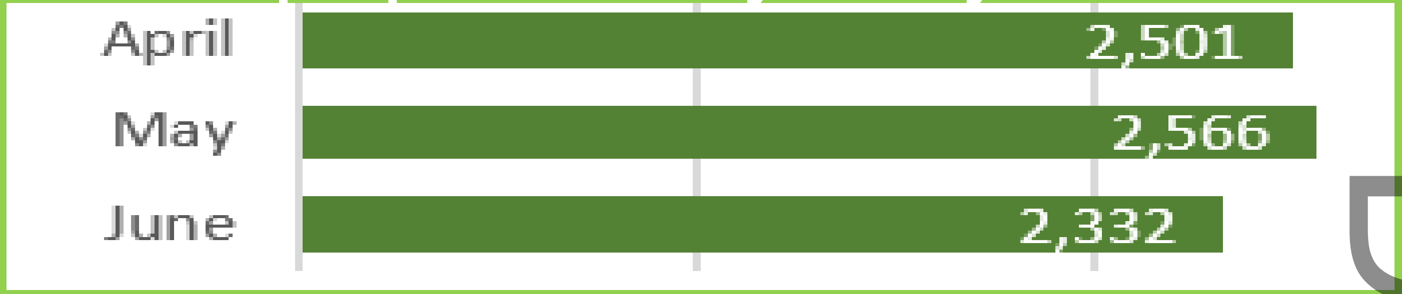
Quarter	Current Encumbrances	Available Balance
4	$270,457.89	$2,058,460.59
3	$260,031.55	$2,137,648.83
2	$333,313.41	$2,182,249.84
1	$304,688.85	$2,363,794.71

Grant Funds used for:

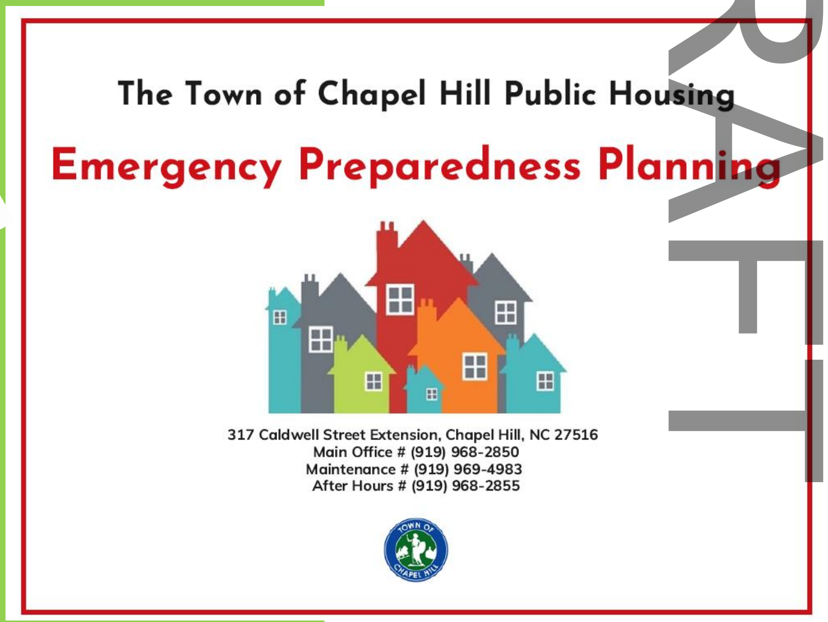
1. Development
2. Financing
3. Modernization
4. Management Improvement

Community Engagement

Number of people served by weekly Food Distribution



National Night Out event held in THREE neighborhoods



Resident Council Members increases

What's Ahead for Public Housing?

- Implementation of the Public Housing Master Plan
- Filling staff vacancies: Maintenance Programs Supervisor, Administration Assistant, two Maintenance Mechanics, and Housing Officer II
- Grow and develop our Resident Council
- Move forward with Trinity Re-Imagined

THANK YOU

from Public Housing

AFFORDABLE HOUSING ANNUAL REPORT

FISCAL YEAR 2021

JULY 1, 2020 - JUNE 30, 2021

FY21 Key Results

535 households provided Emergency Housing Assistance

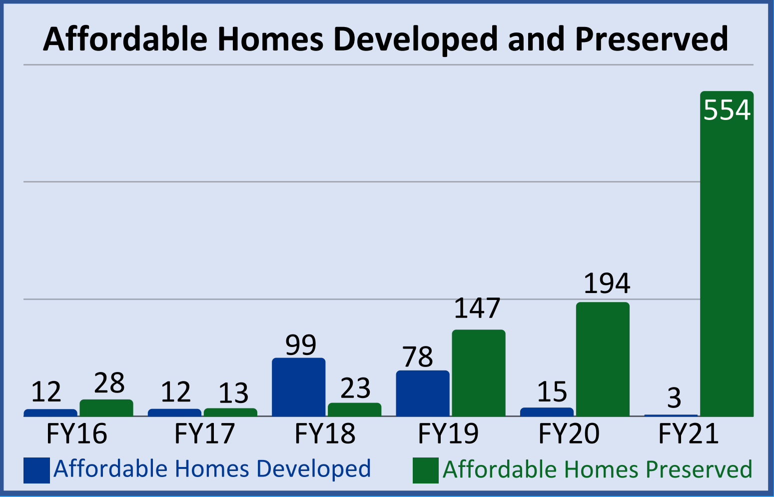
$6.3 million Town Budget for affordable housing strategies

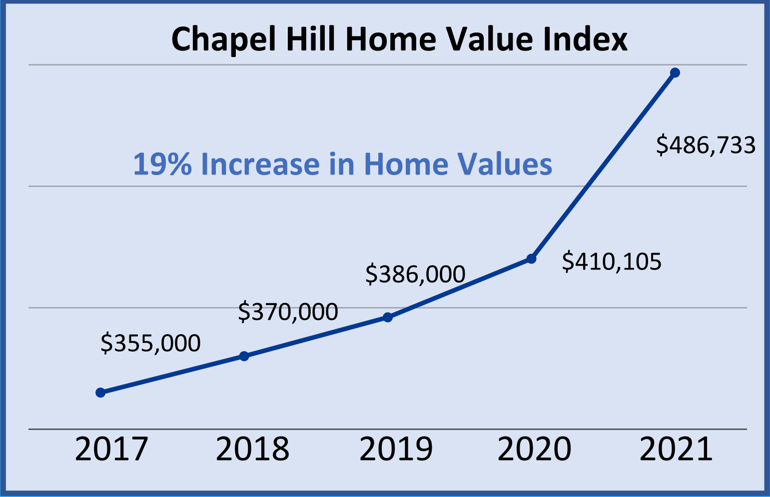
198 affordable housing units approved by Council

Approval of the 2200 Homestead Road Affordable Housing Development Project

Making significant progress on development projects including Jay Street and Trinity Court

Awarded the 2020 Housing North Carolina Award for the Greenfield Project





Community Indicators

$6,226,205
Town Budget for Affordable Housing Strategies

$90,900
Median Household Income

58%
of Renters spend more than 30% of income on Housing

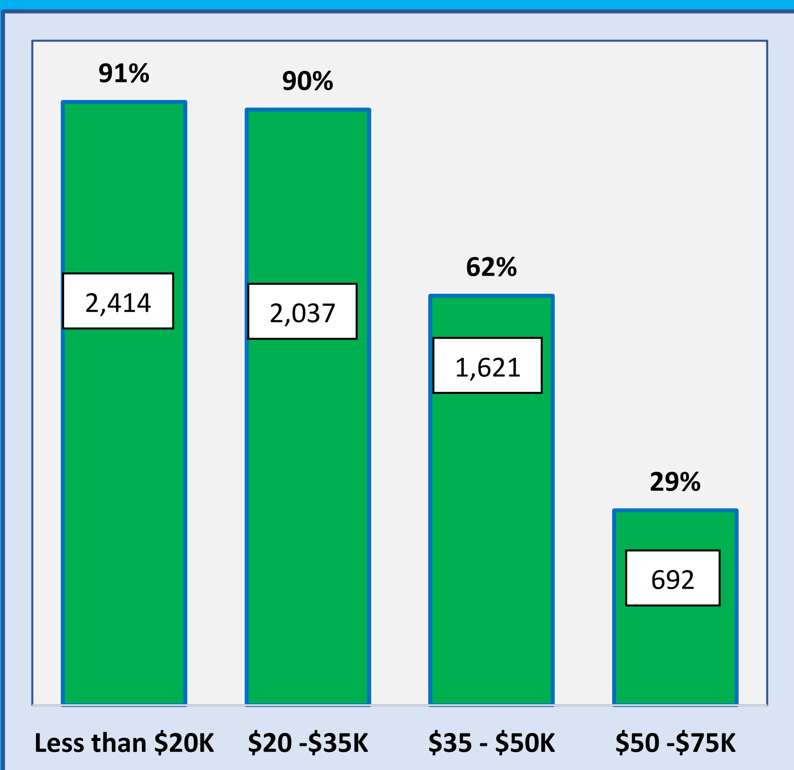
40%
of Housing Units (7,459) affordable to households with income at 80% AMI

$410,105
Median Home Value

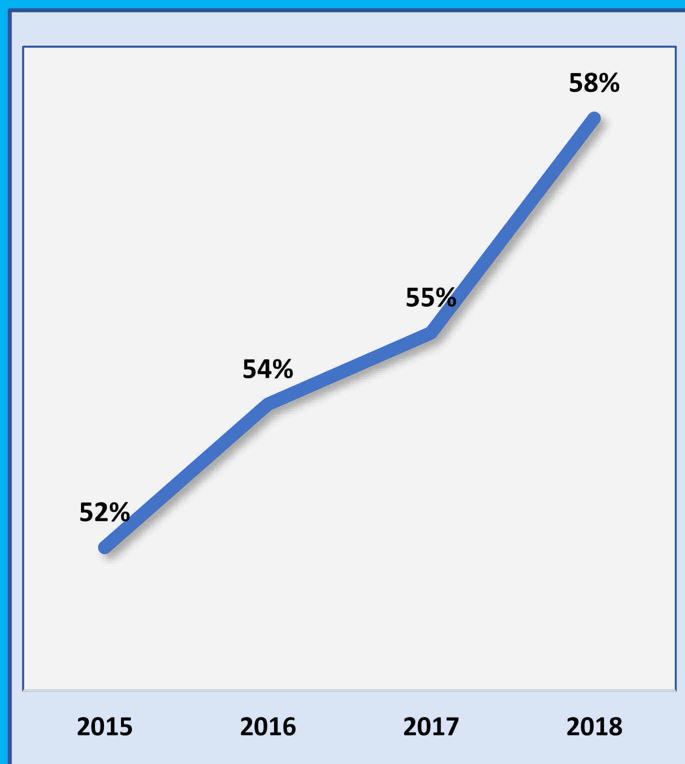
22.5%
of Homeowners spend more than 30% of income on Housing

21,708
Total housing units in town

Number and Percent of Households that are Cost-Burdened by Income Level



Percentage of Renters Cost-Burdened by Year



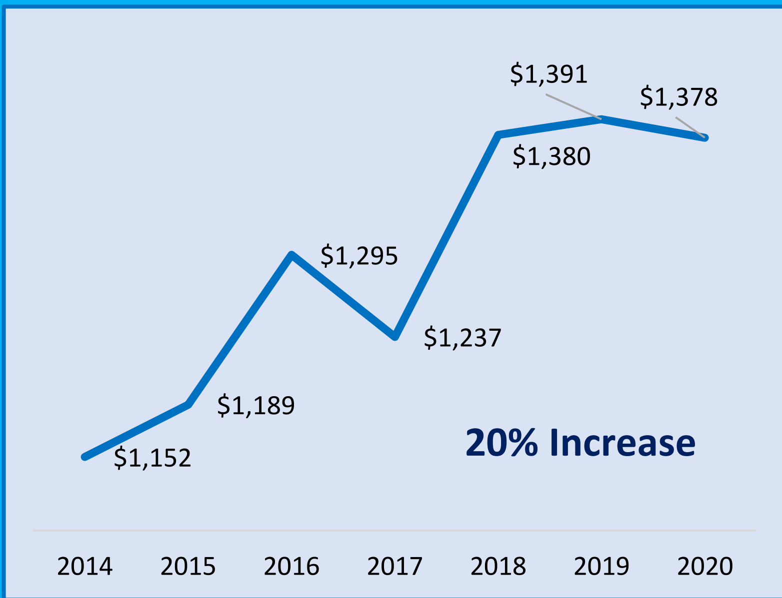
To learn more:

HTTP://WWW.CHAPELHILLAFFORDABLEHOUSING.ORG

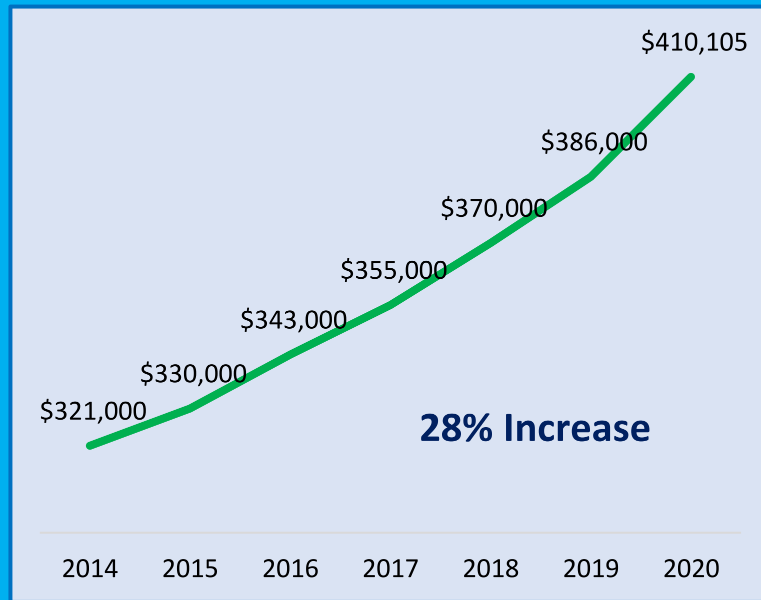
Housing costs have been rising in Chapel Hill since 2014:

638

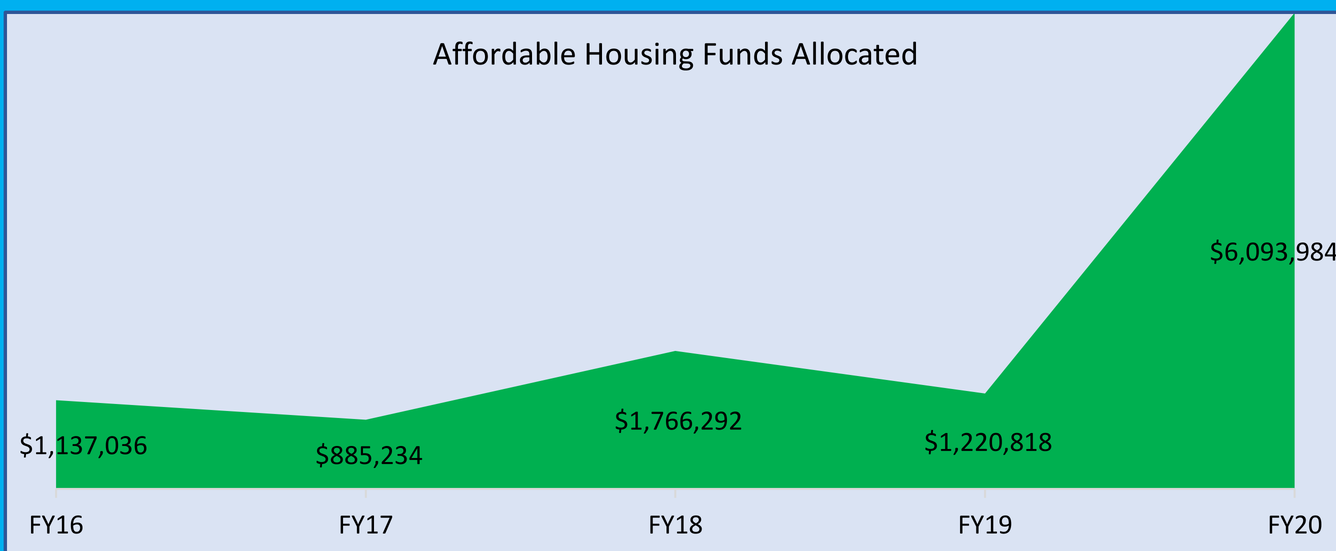
Rise in Rental Rates



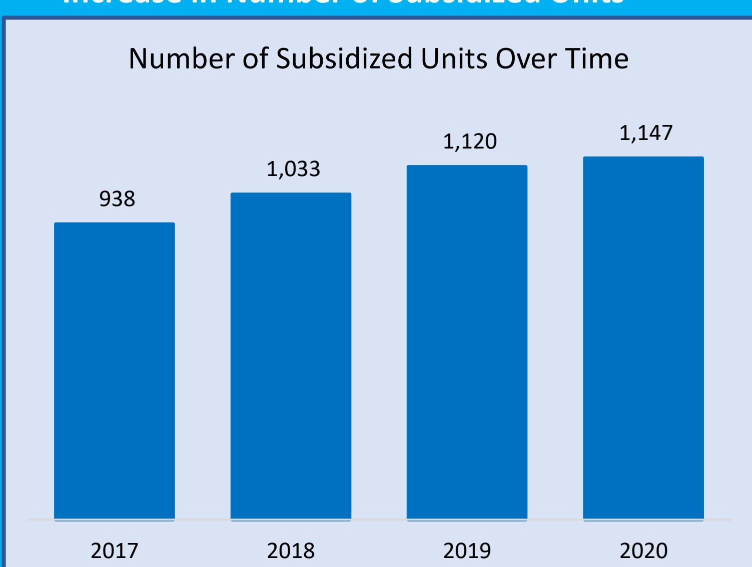
Rise in Home Values



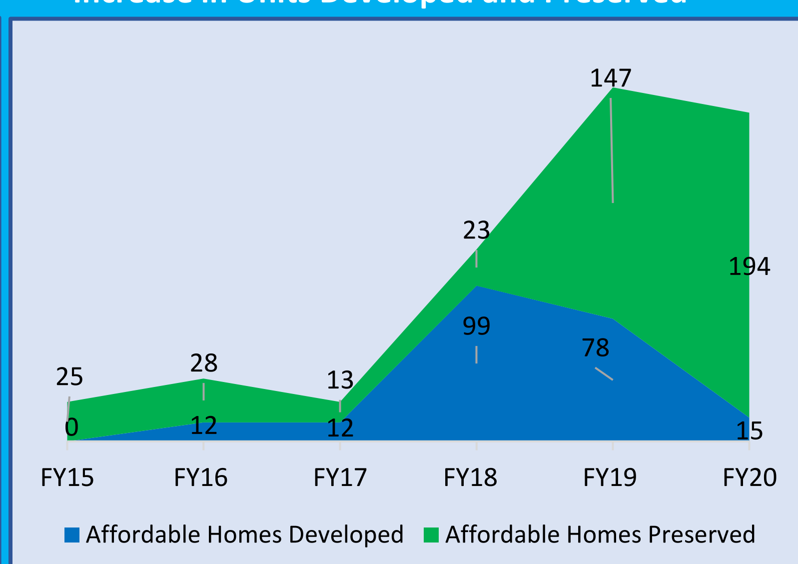
The Town has increased its support for affordable housing to address housing needs:



Increase in Number of Subsidized Units

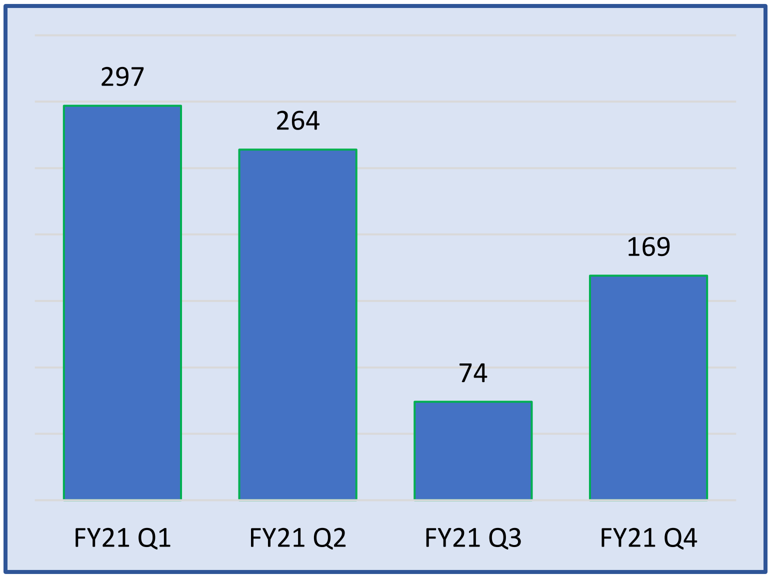


Increase in Units Developed and Preserved

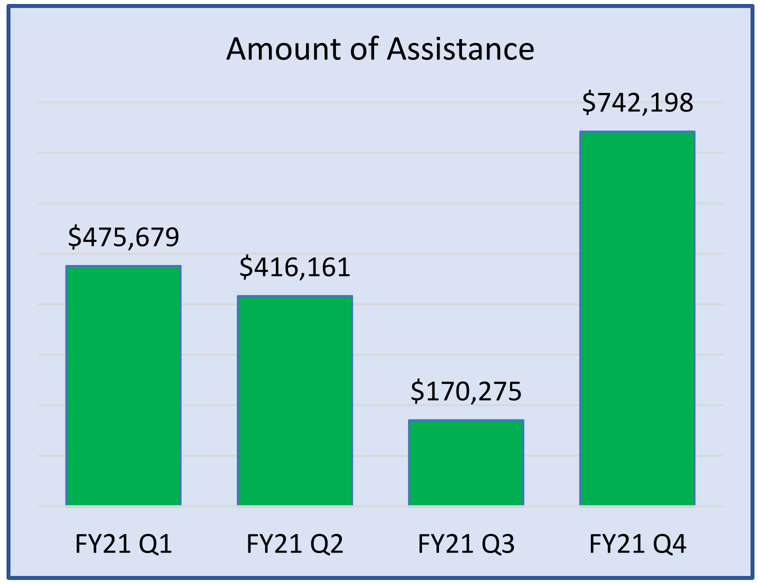


Emergency Housing Assistance

Number of Rental Payments Made

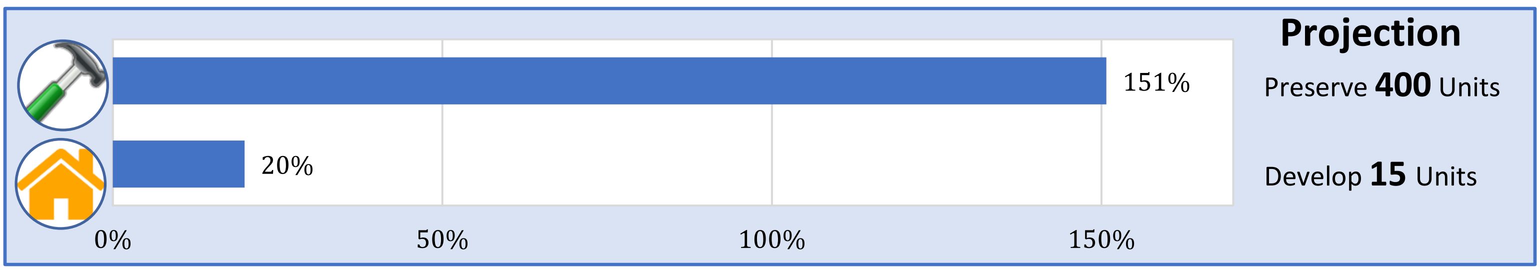


Amount of Assistance Provided

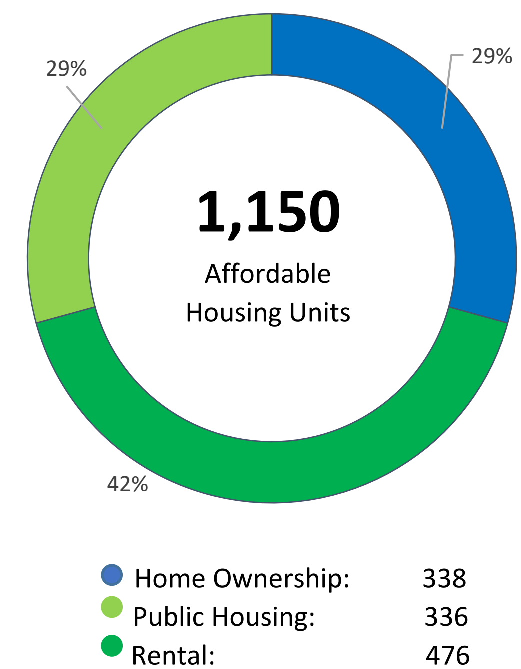


FY21 Town Performance-to-Date

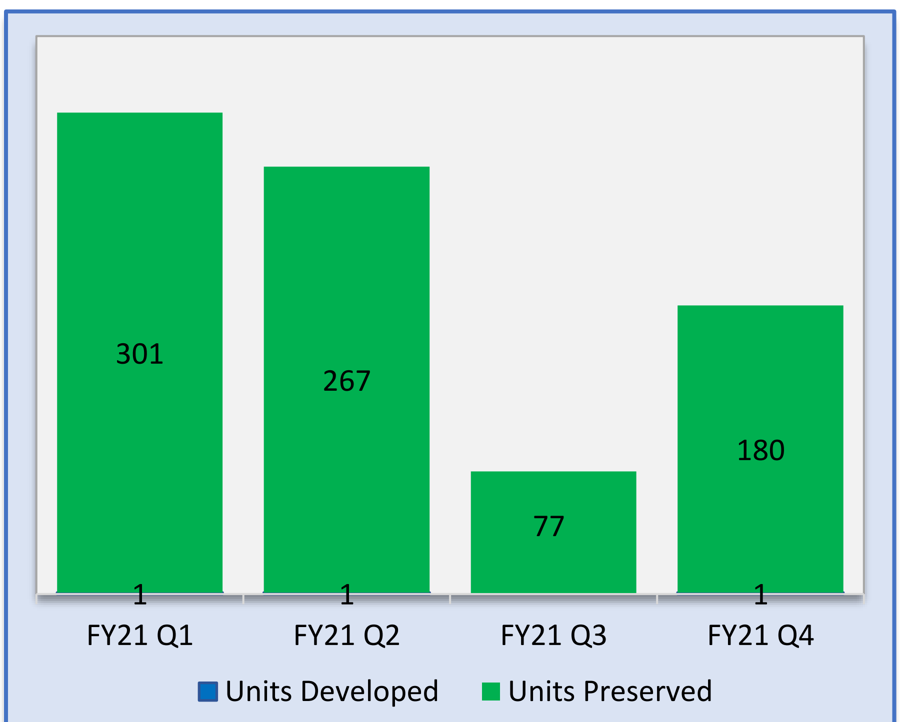
Progress Towards FY21 Projection



Number of Subsidized Units in Town



Units Developed and Preserved by Quarter



Affordable Housing Projects Underway Supported by the Town

Project Type	Provider	Project Name	Number of Units	Projected Completion	Status
🏠	Community Home Trust	Culbreth Park Acquisition	1	FY21 Q1	✓
🏠	Community Home Trust	Graham Street Acquisition	1	FY21 Q2	✓
🔨	Town of Chapel Hill Public Housing	Church Street Renovation	1	FY21 Q2	✓
🔨	Town of Chapel Hill Transitional Housing	Sykes Street Renovation	1	FY21 Q4	✓
🔨	Orange County	Emergency Housing Assistance	400	FY21 Q4	✓
🔨	Self-Help	Northside Neighborhood Initiative Housing Rehabilitation	7	FY21 Q4	✓
🏠	Habitat for Humanity	Sunset Drive Home Construction	1	FY21 Q4	✓
🔨	Community Home Trust	Homebuyer Subsidy	1	FY21 Q4	✓
🏠	Self-Help	Grisham Cottages	2	FY22 Q2	🟡
🔨	Town of Chapel Hill Public Housing	Oak Avenue Furnace Replacement and Fire Repair	3	FY22 Q2	🟡
🔨	Orange County Preservation Coalition	Homeowner Rehab	3	FY22 Q2	🟡
🔨	Town of Chapel Hill Transitional Housing	Ashley Forest Renovation	1	FY22 Q2	🟡
🏠	Town of Chapel Hill	Employee and Transitional Housing Program Master Leasing	5	FY22 Q2	🟡
🏠	Pee Wee Homes	Mitchell Lane Tiny-plex	2	FY22 Q3	🟡
🏠	CASA	Merritt Mill Road Multi-Family Development	24	FY23 Q4	🟡
🔨	Town of Chapel Hill	Transitional Housing at Umstead Road	1	FY22 Q4	🟢
🏠	Town of Chapel Hill	2200 Homestead Road	120	FY24 Q2	🟢
🏠	EmPOWERment, Inc.	PEACH Apartments	10	FY24 Q2	🟢
🏠	Town of Chapel Hill	Jay Street	48	FY25 Q2	🟢
🏠	Town of Chapel Hill	Trinity Court	54	FY25 Q2	🟢
🏠	Habitat for Humanity	Weavers Grove	100	FY28 Q2	🟢

Legend:

✓: The project has been completed

🟢 : The project is on track to meet its project scope and schedule

🟡 : The project has been delayed in meeting its previous quarter project scope and schedule

🔴 : The project has stalled and may not be completed

🏠 : Development Project

🔨 : Preservation Project

Affordable Housing Work Plan Highlights

Project	Progress Update
DEVELOPMENT	
2200 Homestead	• Draft development contract between the Town and Homestead Collaborative scheduled for Council review October 13. • Development team plans to break ground in spring/summer of 2022. • Hosted Rep. David Price for a site visit in August as part of a Community Project Funding request in the FY22 federal budget.
Jay Street	• Development team received feedback on a preliminary concept plan from the Community Design Commission, Housing Advisory Board, and Town Council in the spring. • Development team is working with the Jackson Center and Town staff for Phase 2 of its community engagement activities, with focus on gathering input to inform final site plan. • Development team is anticipating a conditional zoning application submission in late fall.
Trinity Court	• In June, the Town executed a memorandum of understanding (MOU) with the recommended development partner, Community Housing Partners (CHP). • Staff are working with CHP to conduct project due diligence and assemble a concept plan application for submission by October 2021. Advisory Boards and Town Council will review the concept in October and November. • CHP and its partners are finalizing a community engagement plan.
Bennett Road	• Staff are finalizing a proposed visioning process designed to engage the Council and community, assess development options, and create a concept plan for the site.
PRESERVATION	
Implement Manufactured Home Communities Strategy	• Staff updated the draft County-wide Manufactured Home Action Plan (MHAP) and shared the latest version with the elected representatives of the Local Government Affordable Housing Collaborative. • Each jurisdiction has shared the draft County-wide MHAP with their housing advisory boards, the OCAHC, and Preservation Coalition in September for review and input. • Staff continuing to explore options for applying the Resident Owned Community model to MH communities in Orange County.
Affordable Housing Preservation Strategy	• The Town continues to support the County-wide Emergency Housing Assistance (EHA) program. • The EHA partnership was selected by ChangeLabSolutions[1] to participate in their Housing Solutions Collaborative peer learning cohort to evaluate EHA program success and sustainability. Staff from each jurisdiction and Empowerment are serving on that team. • Staff is conducting additional research on implementation options for the Preservation Strategy based on Council's feedback.
POLICY	
Implement Employee Housing Program	• Staff have completed an evaluation of program. • Staff plan to provide Housing Advisory Board and Council with update on findings in October.
FUNDING	
Implement Investment Plan for Affordable Housing – Affordable Housing Bond	• Staff planning for next Bond RFP process in winter for remaining $5 million. • Staff exploring eligible uses of American Rescue Plan Act funds and how other communities are using ARPA to support affordable housing efforts.
Manage Funding Programs ▪ **Affordable Housing Fund (AHF)** ▪ **Development Reserve (AHDR)** ▪ **CDBG**	• Staff released RFP for the Affordable Housing Development Reserve on August 30, with applications due Oct. 1st. The town received 5 applications requesting a total of $751,000 in funding.Town Council is scheduled to review in October 27th. • CDBG Annual Action Plan submitted to HUD in May and Comprehensive Annual Performance and Evaluation Report (CAPER) submitted in early October
MANAGING TOWN-OWNED HOUSING	
Transitional Housing Program	• Renovations of Ashley Forest units underway. • Households moving into the Union units within the next month

[1] https://www.changelabsolutions.org/

Notes & Citations

- The percentage of renters and homeowners that pay more than 30% of their income on Housing, the number and percentage of cost-burdened housing, and total occupied housing units in town data source is U.S. Census Bureau, 2014-2018 American Community Survey 5-Year Estimates
- HUD defines cost-burdened families as those who pay more than 30% of their income for all housing-related expenses and may have difficulty affording necessities such as food, clothing, transportation, and medical care.
- The median household income data source is the HUD 2020 Median Family Income Estimates based on American Community Survey data for the Durham-Chapel Hill Metropolitan Statistical Area.
- The median home value data source is Zillow.com and average rent rate is RentJungle.com
- The total budget this fiscal year for affordable housing strategies captures all Town expenditures for affordable housing. This includes the Affordable Housing Fund, CDBG Funds, the affordable housing bond, and operating funds, among others.
- The percentage of housing units that are affordable to households with income under 80% AMI includes naturally occurring affordable housing and units subsidized by the Town. The data source for this metric and corresponding chart is the commercial real-estate research firm Co-Star and the County-wide data inventory created through the Orange County Affordable Housing Coalition.
- The percent-of-budget allocated metric displays the percentage of the Town budget for affordable housing projects allocated as of the date of the quarterly report.
- The data source for the number of units subsidized by the Town is the County-wide Data Inventory created through the Orange County Affordable Housing Coalition.
- The data source for subsidized housing unit development projections is the County-wide data inventory created through the Orange County Affordable Housing Coalition.
- The number of subsidized units listed in this report has decreased by 35 units from the FY20 Q4 Report as an error in the jurisdictional classification of some units was discovered and corrected.

PUBLIC HOUSING ANNUAL REPORT
Including FY21 Q4: April- June

Our quarterly reports are designed to provide an overview of the Town's Public Housing Department. Consistent with the United States Housing & Urban Development (HUD)'s rating, we also include information as it pertains to the Public Housing Assessment System **(PHAS).**

PHAS was created by **HUD** to evaluate the overall condition of each housing agency to obtain results that are objective, uniform, and verifiable.

Chapel Hill's listed PHAS score is based on the Oct. 2019 Real Estate Assessment Center (**REAC**) inspection. Due to the COVID conditions, there has not been a graded assessment since that time. HUD conducted a 2021 **Habitability Inspection** on July 27 and 29, but that did not affect the existing PHAS score.

Our October 2019 scores: ………………………… -Management: 5 (out of 25)
-Capital Fund: 5 (out of 10)
-Physical Condition: 19 (out of 40)

Total Score: ………………………………………………… 54 out of 100
Status: ……………………………………………………….. **Troubled Status**

Graded as a Troubled Status resulted in a requirement for us to design and fulfill a **Recovery Agreement** with HUD. Our Recovery Agreement contained the following corrective actions:

-All Elected Officials and Senior Leadership Staff participating in HUD's "Lead the Way" training;
-Increasing the quantity and quality of external contractors;
-Improving the expenditure of our capital funds;
-Evaluating maintenance staffing and performance; and
-Evaluating previous REAC reports for strategies to improve Capital Fund and maintenance costs.

These are our evaluation tools referred to as **PHAS Indicators**. Public Housing leadership added a fifth indicator, Community Engagement, to identify opportunities for further connections with tenants. The five indicators are listed below, as well as their evaluation measures and steps taken to positively influence those measures.

INDICATOR	HUD EVALUTION MEASURES	ACTIONS TAKEN TO IMPROVE SCORE
Physical Condition	▪ Physical inspections	▪ Building improvements ▪ Repairs
Financial Condition	▪ Management of funds	▪ Monitor and process all invoices to ensure they are paid within 30 days

Management	▪ Tenant Accounts Receivable ▪ Occupancy Rate ▪ Accounts Payable	▪ Account for reductions in rent due to loss of income during pandemic ▪ Offer timely rent payment incentives ▪ Maintain all payable accounts within current status; paid within 90 days
Capital Fund	▪ Obligation of HUD funds ▪ Occupancy Rate	▪Obligate funds to specific projects – Create timeline to show exactly which properties will be improved ▪ Decrease time units are vacant
Community Engagement*	▪ Created indicators to develop and analyze community engagement efforts.	▪ Continue Monthly newsletter ▪ Coordinate weekly Food Bank ▪ Facilitate Resident's Council ▪ Survey residents reference programming interest

*added by Public Housing leadership to maintain and improve connections with tenants.

OUR "NEW NORMAL" DEALING WITH COVID PANDEMIC

- Continued pre-screening process (employees, tenants, and applicants)
- Distributed face guards to Public Housing staff
- Continued abbreviated monthly safety inspections
- Responded to Emergency Work Orders only (maintained record of Routine Work Order Request)
- Staggered staffing at Administrative Office

PHYSICAL CONDITION

QUARTER 1: JULY to SEPTEMBER 2020

- Responded to 184 Emergency Work Orders; 167 (90%) closed within 24 hours.
- Responded to Pest Control as needed; halted regular inspections for safety of residents and staff.
- New contract with landscape company for Public Housing properties
- Repair contracts completed or in progress:
  - Rebuilding of fire damaged units at Oakwood (E1 and E2)

QUARTER 2: OCTOBER to DECEMBER 2020

- Responded to 179 Emergency Work Orders; 173 (98%) closed within 24 hours.
- Responded to monthly Pest Control and air conditioner filter changes.
- Continued residential entry level inspections.
- Repair contracts completed or in progress:
  - Repair of brick wall at Sykes St. playground
  - Reroofing of Craig/ Gomains and Lindsay St. (19 buildings)
  - Continued rebuilding of fire damaged units at Oakwood (E1 and E2)

QUARTER 3: JANUARY to MARCH 2021

- Responded to 152 Emergency Work Orders; 148 (96%) closed within 24 hours.
- Responded to monthly Pest Control and air filter changes.
- Repair contracts completed or in progress: Oakwood burn units, sidewalk repairs

- Continued rebuilding of fire damaged units at Oakwood (E1 and E2)
- New sidewalk at Oakwood (D unit)
- 4 abandoned units reclaimed and repaired for leasing.
- Replaced flooring and completed asbestos remediation in 509C at Craig/Gomains
- Resurfaced bathtubs at Airport Gardens (21 bathtubs)

QUARTER 4: APRIL TO JUNE 2021

- Resolved 128 Emergency Work Orders, closing 92% within 24 hours.
- Maintained ledger of needed routine repairs.
- Completed safety inspections for all AMP II neighborhoods in preparation for the HUD Habitability Inspections; including smoke alarm checks, light bulb replacements, air filter changes and minor repairs.
- 30 Unit Turnovers completed
- Repair contracts completed or in progress: fencing around playground at S. Estes, renovation of units with fire damage at Oakwood.

FINANCIAL CONDITION/ OPERATING FUND

- Liquidity Rate and Money Owed to Vendors have improved;
- However, Adequacy of Reserves rate decreased

Quarter 1	10%
Quarter 2	52%
Quarter 3	26%
Quarter 4	117%

MANAGEMENT

QUARTER 1: JULY to SEPTEMBER 2020

- Tenant Account Receivable: 94% of accounts receivable paid
- Occupancy Rates: 6 vacant units at the end of the quarter, all being prepared to lease.

QUARTER 2: OCTOBER to DECEMBER 2020

- Tenant Account Receivable: 98% of accounts receivable paid
- Occupancy Rates: 7 vacant units at the end of the quarter
  - 2 units under repair due to fire damage, 5 being prepared to lease

QUARTER 3: JANUARY to MARCH 2021

- **Tenant Account Receivable: 99% of accounts receivable paid**
- **Occupancy Rates: 8 vacant units at the end of the quarter**
  - **2 units under repair due to fire damage, 6 being prepared to lease.**

QUARTER 4: APRIL TO JUNE 2021

- **Tenant Account Receivable:** 94% of accounts receivable paid

- **<u>Occupancy Rates</u>:** 5 vacant units at the end of the quarter
  - 2 units being completed from fire damage, 3 being prepared to lease
- Transfer of 3 households to appropriate bedroom-sized unit based on deconcentration plan's findings
- Unit Turnaround Process Improvement team created; held 4 meetings and collected data on last 15 unit turnarounds to analyze.

CAPITAL FUND

- Funds used for development, preservation, financing, modernization, and management improvements.
- 100% allocation of funds to identified projects.
- Summary of Capital Fund Grant balances per quarter*.
  - *4th Quarter balance does not reflect acceptance of FY22 grant. We report those funds in FY22Q1:

Quarter	Current Encumbrances	Available Balance
4	$270,457.89	$2,058,460.59
3	$260,031.55	$2,137,648.83
2	$333,313.41	$2,182,249.84
1	$304,688.85	$2,363,794.71

- Quarter 3 Projects: Virtual Staff Retreat, Ballentine Associates-Affordable Housing Development analysis, Re-glazing bathtubs, asbestos testing, and abatement, reroofing at Craig Gomains.
- **Quarter 4 Projects: Asphalt and pavement evaluation in collaboration with Public Works. Replaced fencing around playground area in South Estes neighborhood.**

COMMUNITY ENGAGEMENT

QUARTER 1: JULY to SEPTEMBER 2020

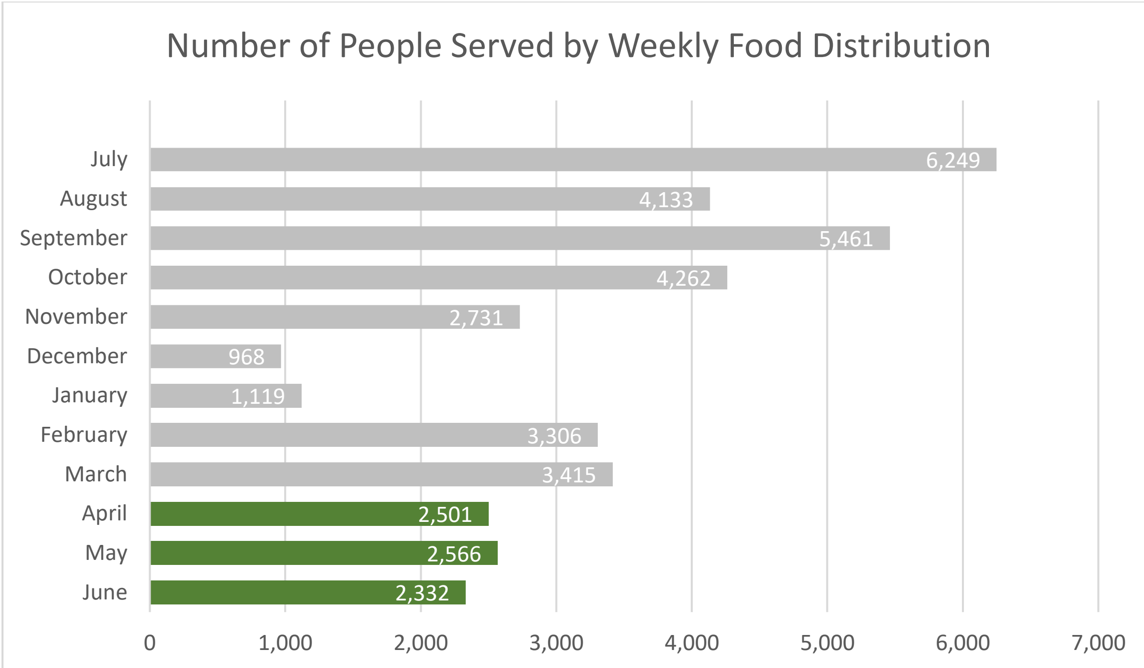
- Mailed monthly newsletter to tenants.
- Continued operation of weekly food distribution.

QUARTER 2: OCTOBER to DECEMBER 2020

- Mailed monthly newsletter to tenants.
- Mailed 2021 Calendars to tenants including information on community resources.
- Mailed invitations to the new Resident Council to residents
- Partnered with Piedmont Health Services to administer COVID tests and flu shots.
- Distributed over 2,500 masks to tenants.
- Continued operation of weekly food distribution.

QUARTER 3: JANUARY to MARCH 2021

- Mailed monthly newsletter to tenants.
- Held monthly Resident Council Meetings in January, February, and March
- Continued re-certification of Tenant's employment and family size.
- Continued operation of weekly food distribution.



Quarter 4: Community Engagement

- 296 Newsletters mailed each month
- 25 Newsletters sent electronically to community partners
- Resident Council convened each month
- Over 7,000 people served at weekly Food Bank Distribution
- 204 income and family size recertifications completed
- Wellness Committee information shared with tenants
- Office Assistant met regularly with Everbridge, a public communication platform created to allow for communication with tenants via automated calls and alerts.
- COVID Vaccination & Testing information sponsored by Piedmont Health shared with all tenants
- National Night Out event held in 3 Public Housing neighborhoods, staff, police and fire department present
- Distribution of Emergency Preparedness bags to ¼ of Public Housing households (other ¾ distributed in FY22 Q1)
- Two community engagement meetings held with Community Housing Partners for Trinity Re-Imagined project; a third is scheduled for December 2021.

** NOTES AND DEFINITIONS

HUD- U.S. Department of Housing and Urban Development

PHAS- Public Housing Assessment System- An assessment tool used by HUD to measure Public Housing Agencies uniformly and consistently.

PHAS Indicators - Four areas of Public Housing Agency operations that are inspected and rated; they are physical condition, financial condition, management, and capital fund.

Habitability Inspection: HUD conducted inspections; does not result in “grade” but does allow PHA to make corrections to any identified needs.

Liquidity- The ratio between cash and current liabilities.

- The higher the ratio, the better the score.

Adequacy of Reserves-the ratio between unrestricted resources and average monthly operating expenses

- The higher the ratio, the better the score.

Unrestricted Resources- Access to anything that can be turned into cash (unrestricted cash, tenant’s security deposits, unrestricted investments)

Monthly Operating Expenses- dwelling rent expense, operating expense, and extraordinary maintenance (divided by 12 for a monthly average)

Adjusted Operated Income-the ratio between operating income and annual debt service.

Accounts Payable-the ratio between total vendor accounts payable and monthly operating expense.

- The lower the ratio, the higher the score
- Accounts payable-(both > and < than 90 days)/Monthly operating expenses

TOWN OF CHAPEL HILL

Town Hall
405 Martin Luther King Jr. Boulevard
Chapel Hill, NC 27514

Item Overview

Item #: 13., **File #:** [21-0771], **Version:** 2 **Meeting Date:** 10/13/2021

Authorize the Town Manager to Execute a Site Development Agreement with Self-Help Ventures Fund for the 2200 Homestead Road Mixed-Income Affordable Housing Development.

Staff:
Sarah Osmer Viñas, Interim Director
Nate Broman-Fulks, Affordable Housing Manager
Emily Holt, Affordable Housing Development Officer

Department:
Housing and Community

Overview: This agreement authorizes the Town to temporarily convey land to Self-Help Ventures Fund while they perform and manage site development. The agreement describes the roles and responsibilities of Self-Help and the Town during site development.

Recommendation(s):

That the Council authorize the Town Manager to execute a site development agreement with Self-Help Ventures Fund to prepare the land and infrastructure for the development of mixed income affordable housing at 2200 Homestead Road.

Background: The Town and its outside legal counsel at Sanford Holshouser Law Group have worked with Self-Help Ventures Fund to draft a site development agreement that confirms the roles and responsibilities of Self-Help and the Town in carrying out the site development scope for the 2200 Homestead Road project. This agreement is for the land and infrastructure preparation. Separate agreements with the housing developers - CASA, Community Home Trust, and Habitat for Humanity of Orange County - to develop the housing portions of the project will come to Council for approval in the winter/spring 2022.

The Town Council consistently reviewed and authorized the steps leading to consideration of this agreement.

- In September 2017 <http://chapelhill.granicus.com/MinutesViewer.php?view_id=21&clip_id=3233&doc_id=2307f58a-9404-11e7-8661-00505691bffa>, the Town Council designated a 14-acre parcel of Town-owned land at 2200 Homestead Road for mixed-income affordable housing and authorized the Town Manager to continue to pursue development on this site and to engage potential partners.
- In June 2018 <https://chapelhill.legistar.com/LegislationDetail.aspx?ID=3531765&GUID=2AAB0753-D883-4117-BBFE-, the Town Council reviewed a concept plan for the development of 2200 Homestead Road.
- In November 2018 <https://chapelhill.legistar.com/LegislationDetail.aspx?ID=3760315&GUID=212CC318-56AD-416C-A079-, the Town Council authorized the Town Manager to issue a Request for Qualifications to identify potential development partners and to begin negotiations with potential developers.
- In February 2020, the Town executed a Memorandum of Understanding with Self-Help Ventures Fund laying out the terms of negotiation for the drafting of a development agreement.
- In June 2020 <https://chapelhill.legistar.com/LegislationDetail.aspx?ID=4563690&GUID=ADE08ABC-2155-4427-A7A8-

, Council approved $3.3M in Affordable Housing Bond funds to pay for site construction costs.

- In November 2020 <https://chapelhill.legistar.com/LegislationDetail.aspx?ID=4682752&GUID=67E829EC-E6E4-4117-849B-09126332CFA0>, Council approved $173,395 in Affordable Housing Development Reserve funding for predevelopment and site construction costs.
- On May 19, 2021 <https://chapelhill.legistar.com/LegislationDetail.aspx?GUID=3FF66E07-2362-4A7A-A8E7-F0E3EC81F28B&ID=4955855&Options=&Search=>, Council approved a conditional zoning application for the parcel, thereby approving the development of 117 mixed-income affordable housing units on the site.

Key components of the agreement:

- *The temporary conveyance of the 2200 Homestead Road parcel to Self-Help:* Once site development is complete, Self-Help will reconvey the land back to the Town and the Town will draft separate land conveyance and development agreements with each of the three housing developers. If the agreements between the Town and housing developers are approved by Council and executed prior to completion of site development, Self-Help could instead convey the land directly to the partner(s) in a separate land conveyance agreement.

- *The responsibilities of Self-Help in conducting site development for the project*: This includes management of the site development budget and oversight of the site development contract with the general contractor.

- *The Town's funding commitment*: The agreement references the related funding agreement between Self-Help and the Town outlining the requirements for accessing the Town approved funding for the project.

- *Coordination between the Town and Self-Help to draft development agreements with the housing developers (CASA, Community Home Trust, and Habitat for Humanity Orange County):* These agreements will provide, a project financing plan, and the land use restrictions and covenants required to provide a 99-year affordability period, among other things. Each vertical development agreement will be reviewed by Council prior to execution.

Fiscal Impact/Resources: The Town Council approved a $3.3 million funding award from the Town's Affordable Housing Bond in June 2020. The Council also approved $173,395 in Affordable Housing Development Reserve funding in November 2020 to fund predevelopment activities and site development costs for the project. This Site Development Agreement does not allocate any additional Town funds toward the project.

Attachments:

- Resolution
- Draft Staff Presentation
- 2200 Homestead Project Milestones
- 2200 Homestead Road Site Development Agreement

A RESOLUTION AUTHORIZING THE TOWN MANAGER TO EXECUTE A SITE DEVELOPMENT AGREEMENT FOR THE 2200 HOMESTEAD ROAD MIXED INCOME AFFORDABLE HOUSING DEVELOPMENT (2021-10-13/R-18)

WHEREAS, on September 6, 2017, the Council designated 2200 Homestead Road as a mixed-income affordable housing site and authorized the Town Manager to continue to pursue development of mixed-income affordable housing on this site and to engage potential partners in the discussions; and

WHEREAS, on June 20, 2018 the Council gave feedback on a Concept Plan for the development of 2200 Homestead Road where the exploration of development partners was identified as a key next step; and

WHEREAS, on November 28, 2018 the Council authorized the Town Manager to issue a Request for Qualifications to identify potential development partners for 2200 Homestead and to begin negotiations with potential developers; and

WHEREAS, on February 27, 2019 the Town executed a Memorandum of Understanding with Self-Help Ventures Fund to establish the terms and conditions for negotiating an agreement for 2200 Homestead Road site development; and

WHEREAS, on June 17, 2020 the Council approved $3.3M in Affordable Housing Bond funding for the 2200 Homestead Road project; and

WHEREAS, on November 4, 2020 the Council approved $173,395 in Affordable Housing Development Reserve funding for the 2200 Homestead Road project; and

WHEREAS, the Council approved the Conditional Zoning of the 2200 Homestead Rd project on May 19, 2021.

NOW, THEREFORE, BE IT RESOLVED by the Council of the Town of Chapel Hill that the Council authorizes the Town Manager to execute a site development agreement with Self-Help Ventures Fund for the 2200 Homestead Rd site, as described in the October 13, 2021 meeting materials.

This the 13th day of October, 2021.

The Agenda will reflect the text below and/or the motion text will be used during the meeting.

PRESENTER: Nate Broman-Fulks, Affordable Housing Manager
Emily Holt, Affordable Housing Development Officer

RECOMMENDATION: That the Council authorize the Town Manager to execute a site development agreement with Self-Help Ventures Fund to prepare the land and infrastructure for the development of mixed income affordable housing at 2200 Homestead Road.

2200 Homestead Site Development Agreement

Council Presentation
October 13, 2021

Agenda

1. Project History and Context

2. Site Development Agreement Summary

3. Discussion and Next Steps

Council Consideration

- Authorize the Town Manager to execute a site development agreement with Self-Help for the 2200 Homestead Road affordable housing development.

Project History

Summer 2017
Council Dedicates Land for Mixed Income Aff Housing

Spring 2018
Council Review of Concept Plan

Spring 2020
Council Approves AH Bond funding

2017 — 2021

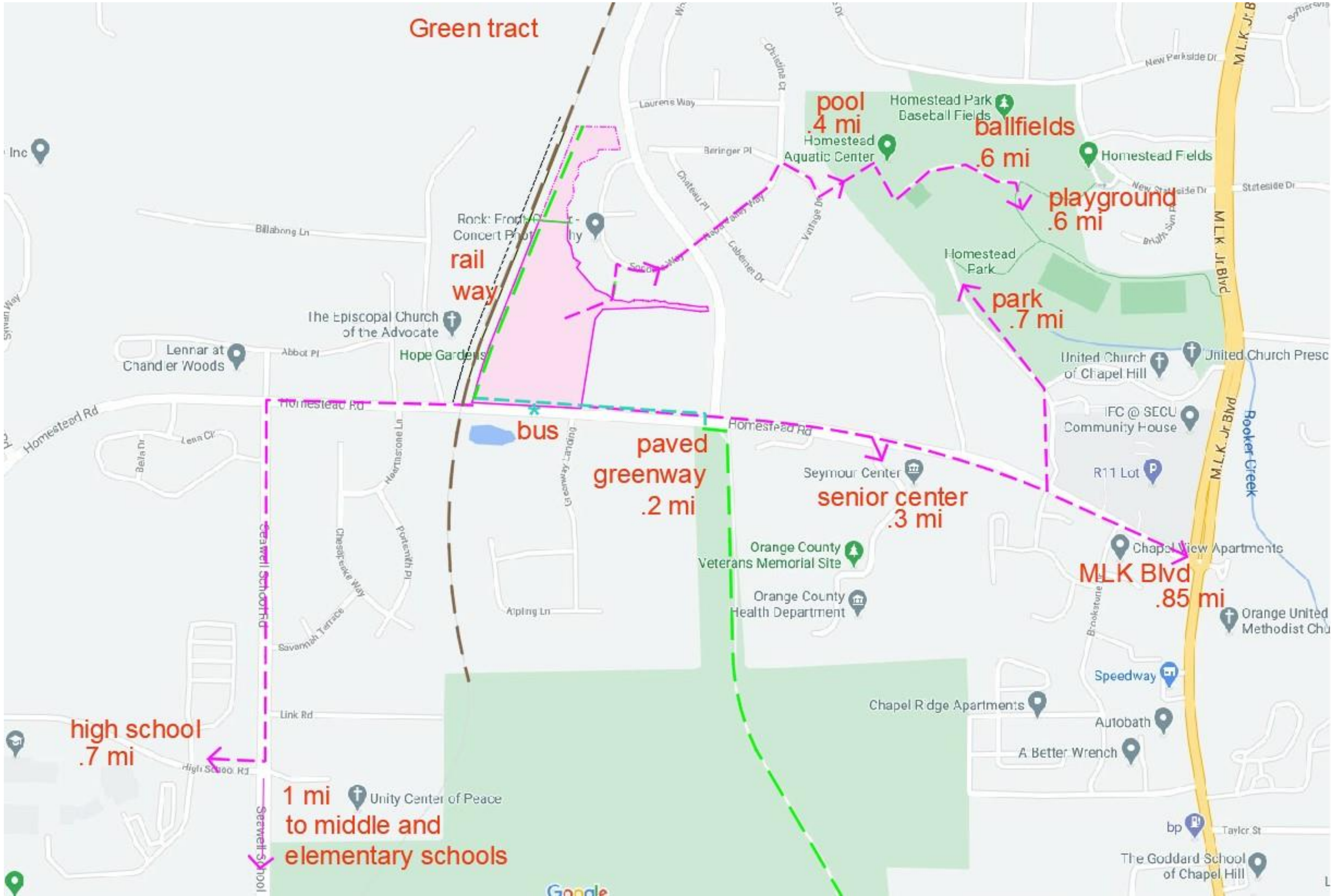
Fall 2017-Winter 2018
Project Visioning

Fall 2018-Winter 2020
Identify Development Partner, Execute MOU

Self-Help
Habitat for Humanity of Orange County
Community Home Trust
CASA

Fall 2020-Spring 2021
CZ Application Submission and Review, Council Approves CZD

Site Context



Approved Site Plan

- Site – 13 acres

- Residential Units – 115-126
  - 72 apartments
  - 27-35 townhomes
  - 18 duplexes

- Amenities include:
  - greenway trail
  - nature trails
  - central green with playground, shelter, grills
  - basketball court
  - community garden

Site Development Agreement Summary

1. Town will temporarily convey property to Self-Help
2. Self-Help will prepare land for development of affordable units by Collaborative Developers
3. Self-Help and Town will work together to draft development agreements with Collaborative Partners for construction of affordable units

1. Town conveyance to Self-Help

- Conveyance to occur after contract executed with general contractor
- Once site development complete, Self-Help will reconvey site to the Town within 60 days

- If appropriate, Self-Help could convey land directly to partners

2. Self-Help will develop site on behalf of Town

- Manage contract with general contractor for site construction
- Scope includes preparation of land for vertical construction and new community garden

3. Development agreements with housing developers

- Self-Help will assist housing developers to prepare development agreements
- Contracts will include:
  - Financing Plan
  - Affordability Plan
  - Land use restrictions and covenants required, including 99-year affordability period

Next Steps

Fall 2021

- Execute Site Development Agreement
- Apply for final permits

Spring 2022

- Execute contract w/ general contractor
- Convey land to Self-Help
- Obtain final approvals

★ Council considers agreements w/ housing developers

Summer 2022

- Site construction
- Execute agreements with housing developers
- Convey land to housing developers

Fall 2022 – Summer 2024

- Housing construction

Council Consideration

- Adopt R-# authorizing the Town Manager to execute a site development agreement with Self-Help Ventures Fund for the 2200 Homestead Road affordable housing development.

2200 HOMESTEAD SITE DEVELOPMENT AGREEMENT

Council Presentation
October 13, 2021

DRAFT

Next Steps

2200 Homestead Road Project Milestones	FY2018				FY2019				FY2020				FY2021				FY2022				FY2023				FY2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
DEVELOPMENT																												
Council approves site development contract with Self-Help																		★										
Land conveyance to Self-Help																			X									
Council approves vertical development agreement(s) with vertical Collaborative partners																				★								
Project receives final approvals and permits																				X								
Project Groundbreaking - site construction begins																				X								
Land conveyance to Vertical Partners																					X							
Vertical construction begins																					X							
Construction Complete																											X	

★ Council Item Scheduled
★ Council Item Heard and/or Action Taken

Project Budget (to be populated from SHVF)

Sources	Tentative amount ($)
Town	3,500,000
Orange County	
[new State funding allocation]	2,000,000
[more to come]	
TOTAL	

Uses	Tentative amount ($)
Site Development Contract, total	
SHVF fee	
[more to come]	
TOTAL	

2200 Homestead Road Project Milestones	FY2018				FY2019				FY2020				FY2021				FY2022				FY2023				FY2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
DEVELOPMENT																												
Council designated land for mixed-income affordable housing	★																											
Council reviewed concept plan				★																								
Council authorized issuance of RFQ for development partners and negotiations with potential developers						★																						
Town executes MOU w/ Self-Help as leader of the Homestead Housing Collaborative development team											✓																	
Council approved $3.3M in AH bond funding to site construction costs												★																
Council approved $173,395 in AHDR funding for predevelopment and site construction costs														★														
Council approved Conditional Zoning District																★												
Council approves site development agreement with Self-Help																		☆										
Self-Help executes contract w/ site construction contractor																												
Land conveyance to Self-Help																			X									
Council approves development agreement(s) with housing partners																				☆								
Project receives final approvals and permits																				X								
Groundbreaking - site construction begins																				X								
Land conveyance to vertical partners																					X							
Vertical construction begins																					X							
Construction complete																											X	

☆ **Council Item Scheduled**
★ **Council Item Heard and/or Action Taken**

Last updated 10-7-2021 by Emily Holt, Town of Chapel Hill

Prepared by and return after recording to:

Brian L. Crawford
Robert M. Jessup Jr.
Sanford Holshouser LLP
209 Lloyd St., Suite 350
Carrboro, NC 27510

PINs – 9870912947

Brief description – 2200 Homestead Road, Chapel Hill

Agreement for
<u>2200 Homestead Road Site Development</u>

THIS AGREEMENT is dated as of __________, 2021, and is between the Town of Chapel Hill, a North Carolina municipal corporation (the "Town"), and Self-Help Ventures Fund ("SHVF"), a North Carolina nonprofit corporation.

Introduction and Purpose

The Town owns a parcel of approximately 14 acres at 2200 Homestead Road, Chapel Hill, as more specifically described in Attachment A (the "Site"). In September 2017, the Town dedicated the Site for mixed-income affordable housing, with a focus on providing affordable homes, and requested staff to pursue development. In 2019, the Town accepted a proposal from SHVF, as part of the development team they assembled and refer to as the Homestead Housing Collaborative, to develop the Site as a residential community serving a range of incomes and providing a variety of housing types for homeownership and rental.

This Agreement states the Parties' definitive and binding agreement with respect to SHVF's role in the undertaking to manage Site construction on behalf of the Town.

Unless the context clearly requires otherwise, capitalized terms used in this Agreement and not otherwise defined have the meanings set forth in Attachment B.

NOW, THEREFORE, for and in consideration of the mutual promises and covenants contained in this Agreement, the Parties agree as follows:

1. The Town will convey the Site to SHVF.

A. <u>Conveyance and acceptance</u>. The Town will convey the Site to SHVF, for valuable consideration the receipt of which is hereby acknowledged, and SHVF agrees to accept the conveyance under the terms and conditions of this Agreement. The Town is making this conveyance under its statutory authority North Carolina General Statute 160A-279 to convey property to nonprofit organizations carrying out a public purpose and its authority to enter into agreements with private entities to provide housing for persons of low and moderate income.

B. <u>Termination prior to Closing</u>. The Town will have no further obligation to convey the Site if the Town has not approved the Site Development Contract by July 1, 2022, with time being of the essence for this purpose. SHVF can terminate this Agreement at any time before the Closing Date for any reason. If under this Section either this Agreement expires or SHVF terminates this Agreement, then neither Party will have any further rights or obligations under this Agreement.

C. <u>Closing; Special Warranty Deed</u>. The Town will convey the Site to SHVF by a special warranty deed in form and substance acceptable to both Parties (the "Deed"). The Town will deliver the Deed to SHVF at such time and place within Orange or Durham Counties, North Carolina as SHVF may designate, but SHVF must give the Town five Business Days' notice of the time and place for delivery. In no event will the Town be required to deliver the Deed less than 30 days after the Town's approval of the Site Development Contract. The delivery and acceptance of the Deed are referred to in this Agreement as the "Closing," and the date and time of acceptance are referred to as the "Closing Date."

D. **Conditions for closing.** The Town must receive the following items, in form and substance reasonably acceptable to the Town, at or prior to the Closing, as conditions to the Town's obligation to complete the Closing.

1. The Site Development Contract in a form previously approved by the Town, signed by both SHVF and the Site Contractor.

2. The payment and performance bonds called for in Section 2A.2 d.

3. The final Budget referenced in Section 2B.2.

4. The executed Funding Agreement referenced in Section 2B.

5. An agreement by SHVF to reconvey the Site to the Town for no additional consideration at either Party's request (A) within 60 days after the Completion Date or (B) any time on or after the date which is twelve (12) months after the issuance of building permits for the Site Development Contract Work (the "Deadline") if the Completion Date has not previously occurred. The Parties agree that time is of the essence with respect to the dates and timelines specified in this subsection. This agreement to reconvey may be included in the Deed or in a separate agreement as the Parties may agree.

6. The recording of any land use restrictions or covenants related to the overall Site development plan that the Town deems desirable to be in place prior to Closing. These restrictions or covenants will be designed to provide for long-term use of the Site for affordable housing without regard to any specific requirements or obligations of the Collaborative Developers.

E. **Delivery of information.** Within ten Business Days after the Effective Date, the Town will deliver to SHVF at the address set forth in Section 6(a) (or make available for SHVF's convenient examination and copying) copies of all the following materials relating to the Site in the Town's possession:

1. Any policies of title insurance issued in favor of the Town or the Town's predecessors in title for any portion of the Site.

2. Any land surveys of any portion of the Site.

3. Any permits, zoning stipulations, agreements, or requirements that affect or that are proposed to affect any portion of the Site.

In addition, the Town will provide to SHVF any information or materials relating to the Site of the same or similar nature to the foregoing coming into the Town's possession or control throughout the term of this Agreement. The Town represents that all such deliveries are being made in good faith, but the Town makes no further representation or warranty, expressed or implied, as to the accuracy or completeness of those documents.

F. **Risk of loss.** The Town will bear the risk of loss or damage to the Site until the Closing, except as otherwise provided for in this Agreement.

G. **No brokers.** The Town and SHVF represent, one to the other, that it has not dealt with any broker, finder, or other agent in connection with the transaction contemplated by this Agreement. To the extent permitted by law, each party will indemnify, defend, protect, and hold the other harmless from and against any and all claims incurred by the other party by reason of any breach or inaccuracy of the representation contained in this Section.

H. **Closing costs.** The Town will pay for the preparation of the Deed, and for all other documents necessary to perform the Town's obligations under this Agreement. SHVF will pay for any title insurance, recording fees for the Deed and any other recordable documents described by this Agreement. Each party is responsible for its own legal fees and costs. As the Site is currently exempt from real estate taxes, there will be no pro-ration payment for real estate taxes.

I. **Post-closing obligations.** After Closing, the Town and SHVF will cooperate with one another, at reasonable times and on reasonable conditions, to prepare, execute and deliver documents necessary to fully carry out the intent and purposes of this Agreement. Except for such instruments as the Parties were originally obligated to deliver by the terms of this Agreement, such cooperation will be without additional cost or liability to the Party from which such cooperation is sought.

2. SHVF will develop the Site on behalf of the Town for the purpose of passing it to other Collaborative Developers

A. Site development contract

SHVF will plan, design, build and otherwise carry out the Project. SHVF will act in consultation with the Town and under the terms and conditions of this Agreement, but SHVF has the right and responsibility to manage the Project. SHVF's responsibilities will include the following:

1. SHVF has selected, and the Town hereby approves, WeaverCooke to be the site contractor (the "Site Contractor").

2. SHVF will provide for the preparation of the Site Development Contract, and then will enter into the Site Development Contract with the Site Contractor. The Site Development Contract will be subject to the Town's reasonable approval, but the Site Development Contract must in any event include the following terms and conditions:

    a. For the Site Development Contract to be a guaranteed maximum price contract and may allow for change orders to the scope of work.

    b. For the scope of work for Site Development to be consistent with the Zoning Compliance Permit issued by the Town. The scope for preparing the new site for relocation of Hope Gardens includes: mobilization, erosion control, clearing and grubbing, grading, fine grading, driveway apron, and laying gravel in the parking lot for up to six regular parking spaces (the "Hope Gardens Work"). Notwithstanding the foregoing, the Parties acknowledge and agree that SHVF shall have no obligation to include the Hope Gardens Work in the Site Development Contract if (a) the cost of such work exceeds $95,000; or (b) the final Budget does not include sufficient resources for completing such work.

c. For the Project to be complete not later than the Deadline. SHVF shall notify Town as far in advance as is possible of any anticipated delays beyond the Deadline.

d. For the Site Contractor to provide payment and performance bonds in favor of the Town as would apply if the Town were contracting for work on a public contract covered by Chapter 143 of the North Carolina General Statutes.

e. For the Site Contractor to proceed in a good and workmanlike manner, and to keep the Project free of defects and the Site free of mechanics', materialmen's, and similar liens.

f. For the Site Contractor to maintain general liability, workers compensation, builders' risk and other insurance as the Town may reasonably require, and for those coverages to be subject to such terms and conditions, and extensions of coverage to the Town, as the Town may reasonably specify.

g. For contractors' warranties to be assigned to the Town upon the completion of the Site Contractor's work.

4. SHVF will on its own apply and obtain all permits, entitlements and planning approvals required according to municipal and county ordinances. SHVF will present to the Town the finished contractor documents when the Project is complete. SHVF will at all times carry and maintain, or cause the Contractor to carry and maintain, with responsible carriers general liability insurance in amounts reasonably acceptable to the Town from time to time, with the Town as an additional insured with respect to occurrences at the Site. SHVF will promptly notify the Town of the Completion Date.

B. <u>Project Budget; Change Orders.</u>

1. The Town and SHVF will agree on a Project budget (the "Budget"). The Budget will show in reasonable detail (a) all primary categories of Project Costs, except that all amounts to be paid under the Site Development Contract may be shown

as a single entry, and (b) all sources of Project funding. Either Party may request additional information concerning items of funding or expense.

2. Attachment D shows a tentative Budget, but the Parties are not bound by this Exhibit in completing the final Budget. SHVF acknowledges that the Town intends to contribute not more than $3,500,000 toward Project Costs. SHVF has no obligation to fund Project Costs beyond sources identified in the Project Budget.

3. SHVF has primary responsibility to manage the Project and the Budget to secure completion of the Project within the Budget, in accordance with the agreed-upon scope of work, and by the Deadline.

4, If the Site Contractor requests a change to the Site Development Contract (a) that does not modify the original scope of such contract and (b) the cost of which does not exceed remaining contingency (a requested “Change Order”), SHVF shall either (a) deny the Change Order or (b) approve the Change Order and provide notice to the Town of the requested Change Order. If the Change Order requires an increase in Project funding, SHVF must also notify the Town of the sources of funding to be made available to resolve that increase.

5. If the Site Contractor requests a change to the Site Development Contract (a) that modifies the original scope of such contract or (b) the costs of which exceeds remaining contingency (a requested “Scope Change Order”), SHVF shall either (a) deny the Scope Change Order or (b) notify the Town of the requested Scope Change Order and SHVF’s recommendation that it be approved. If the Scope Change Order requires an increase in Project funding, SHVF must also notify the Town of the sources of funding to be made available to resolve that increase. Within five Business Days of its receipt of the notice and recommendation of a Scope Change Order, the Town Manager (or the Manager’s designee) must notify SHVF of either (a) the Town’s approval of the Scope Change Order or (b) the Town’s reasons, in brief and general terms, for not approving the Scope Change Order or for referring the Scope Change Order for consideration by the Town Council at the next Council meeting for which the agenda has not yet been distributed. If the Town fails to deliver a notice as contemplated under (b), then the Town will be deemed to have approved the Scope Change Order, except that no Scope Change Order that increases the Town Maximum Contribution will be effective without the Town’s express consent.

6. The Town grants the Town Manager (or the Manager's designee) full authority to provide approval, or not, under this Section. The Town Manager, in the Manager's discretion, may refer any Scope Change Order to the Town Council for the Town Council's consideration.

7. If conditions require amendments to the Site Development Contract or the Budget, beyond approved Change Orders, the Parties shall negotiate in good faith to amend the Site Development Contract, the Town Maximum Contribution or other aspects of the Budget as possible. Either Party may invoke the provisions of Section 5D for the consideration of any required amendments.

C. **Disbursement of Town Payments.** The Town will make payments toward Project Costs pursuant to a separate Funding Agreement between the Town and SHVF. This agreement will be based on a form commonly used by the Town for similar project payments.

3. SHVF and the Town will work together on Development Contracts.

SHVF and the Town expect that when the Project is complete, SHVF and the Town will provide for portions of the Site to be conveyed in separate transactions to the Collaborative Developers. The Site will be conveyed to the Town. If appropriate the Site may be conveyed directly in portions to the Collaborative Developers, as the Town and SHVF may agree as the Project nears its conclusion.

SHVF is the lead member of the Homestead Housing Collaborative and will have primary responsibility for coordination and leadership of its members. As lead member, SHVF will assist each Collaborative Developer to work with the Town to prepare and deliver a Collaborative Development Contract in form and substance reasonably acceptable to both parties. Each Collaborative Development Contract will include at least the information contemplated in Attachment C. The Parties acknowledge that land conveyance to a Collaborative Developer shall not occur until the Town's Collaborative Development Contract with such Developer is effective and includes at least the terms set forth in Attachment C. Once the Collaborative Development Contract are executed and SHVF delivers the Site, the Collaborative Developers will be solely responsible for their vertical construction commitments made in their agreements with the Town. SHVF has no responsibility or obligation with respect to the performance by any Collaborative Developer of its respective Collaborative Development Contract.

4. Representations and warranties of the Parties

A. By SHVF

SHVF makes the following statements of fact, with the understanding and intent that the Town will rely on these statements in making its decision to enter into this Agreement:

(a) SHVF is duly organized, validly existing, and in good standing under the laws of North Carolina.

(b) SHVF has full power and authority to execute and deliver this Agreement and to perform its obligations under this Agreement.

(c) SHVF has duly executed and delivered this Agreement. Assuming due authorization, execution and delivery of this Agreement by the Town, this Agreement constitutes a valid, legal and binding obligations of SHVF, enforceable in accordance with its terms, subject to bankruptcy, insolvency and other similar laws affecting the enforcement of creditors' rights generally and such principals of equity as a court having jurisdiction may impose.

(d) SHVF is solvent, is able to pay its ordinary debts and expenses as they become due, and is not currently the defendant in any bankruptcy, insolvency or similar proceeding under federal or state law.

(e) SHVF has not been barred from participation in any program of federal, state or local assistance for projects or undertakings of the sort contemplated by this Agreement.

(f) Neither the execution and delivery of this Agreement, nor the fulfillment of or compliance with its terms and conditions, nor the consummation of the transactions contemplated by this Agreement, results in any material breach of the terms, conditions and provisions of any agreement or instrument to which SHVF is now a party or by which either is bound, or constitutes a default under any of the foregoing.

(g) There is no litigation or other court or administrative proceeding pending or threatened against SHVF (or against any SHVF official in an official capacity) affecting SHVF's rights to execute or deliver this Agreement or to comply with its obligations under this Agreement.

(h) SHVF hereby agrees to indemnify, protect and save the Town (including its affiliates), any Council member, member, director, officer, agent or employee thereof, harmless from all liability, obligations, losses, claims, damages, actions, suits, proceedings, costs and expenses, including reasonable attorneys' fees, actually incurred, arising out of, connected with, or resulting, directly or indirectly, from SHVF's acts or omissions in completion of the Project, including, without limitation, the possession, condition, construction or use of the Site or the actions of any Site Contractor or its agents, employees and contractors. The indemnification arising under this paragraph shall continue in full force and effect notwithstanding the termination of this Agreement, or any other agreement, document or instrument related to the Project to which SHVF and the Town are Parties. SHVF is not required to indemnify the Town under this paragraph for claims that arise solely from the Town's gross negligence or willful misconduct.

(i) No SHVF representation, covenant or warranty in this Agreement is false or misleading in any material respect.

(j) SHVF will promptly notify the Town of any matter that affects the accuracy of any representation and warranty under this Section, including any change in conditions or any receipt of any notice, action, or other information SHVF receives relating to any representation or warranty under this Section.

(k) SHVF will not cause or knowingly permit any action to be taken that will cause any of the foregoing representations or warranties to be untrue on or prior to

Closing, and all of SHVF's representations and warranties under this Agreement will be as of the Closing as though those representations or warranties were made then.

B. By the Town

The Town makes the following statements of fact, with the understanding and intent that SHVF will rely on these statements in making its decision to enter into this Agreement:

Generally –

(a) The Town is a duly organized and validly existing municipal corporation of the State of North Carolina. The Town will take no action that would adversely affect its existence as a municipal corporation in good standing in the State of North Carolina.

(b) The Town has all powers necessary to enter into the transactions contemplated by this Agreement and to carry out its obligations under this Agreement.

(c) The Town has duly and validly authorized, executed and delivered this Agreement. Assuming due authorization, execution and delivery of this Agreement by SHVF, this Agreement constitutes a valid, legal and binding obligation of the Town, enforceable in accordance with its terms, subject to bankruptcy, insolvency and other similar laws affecting the enforcement of creditors' rights generally and such principals of equity as a court having jurisdiction may impose.

(d) The Town requires no further approval or consent from any governmental authority with respect to the Town's entering into or performing under this Agreement.

(e) Neither the execution and delivery of this Agreement, nor the fulfillment of or compliance with its terms and conditions, nor the consummation of the transactions contemplated by this Agreement, results in any material breach of the terms, conditions and provisions of any agreement or instrument to which the Town is now a party or by which either is bound, or constitutes a default under any of the foregoing.

(f) There is no litigation or other court or administrative proceeding pending or threatened against the Town (or against any Town official in an official capacity) affecting the Town's rights to execute or deliver this Agreement or to comply with its obligations under this Agreement.

(g) No Town representation, covenant or warranty in this Agreement is false or misleading in any material respect.

With respect to the Site and its title --

1. The Town holds fee simple title to the Site, free and clear of any and all easements, covenants, conditions, or other encumbrances.

2. The Town is in sole and exclusive possession of the entire Site, and no other person or entity claims any right to possess all or any portion of the Site.

3. No options, rights of first refusal, or other agreements are in effect to purchase or to lease any interest in the Site or any part thereof.

4. The Site is currently exempt from *ad valorem* taxes and is expected to remain tax exempt provided it is developed for affordable housing as planned.

5. The Town is not a "foreign person" within the meaning of the Internal Revenue Code, as amended, Sections 1445 and 7701 or the regulations promulgated thereunder.

6. The Town is not a person with whom U.S. persons or entities are restricted from doing business under regulations of the Office of Foreign Asset Control (the "OFAC"), of the Department of the Treasury (including those named on OFAC's Specially Designated and Blocked Persons List) or under any statute, executive order (including the September 24, 2001, Executive Order Blocking Site and Prohibiting Transactions with Persons Who Commit, Threaten to Commit, or Support Terrorism)

7. The Town has no knowledge of any violation of Environmental Laws (as defined below) related to the Site or the presence or release of Hazardous Materials (as defined below) on or from the Site except as previously disclosed to SHVF in the following reports:

[List by date, title, and contractor; will include existing asbestos report]

The term “Environmental Laws” includes without limitation the Resource Conservation and Recovery Act and the Comprehensive Environmental Response Compensation and Liability Act and other federal laws governing their implementing regulations and guidelines as of the Effective Date, and all state, regional, county, municipal, and other local laws, regulations and ordinances that are equivalent or similar to the federal laws recited above or that purport to regulate Hazardous Materials. The term “Hazardous Materials” includes petroleum, including crude oil or any fraction thereof, natural gas, natural gas liquids, liquified natural gas, or synthetic gas usable for fuel (or mixtures of natural gas or such synthetic gas), asbestos and asbestos containing materials and any substance, material waste, pollutant or contaminant listed or defined as hazardous or toxic under any Environmental Law. The representations and warranties contained in this paragraph will survive Closing for so long as is permitted by applicable law.

***In addition* --**

The Town will promptly notify SHVF of any matter that affects the accuracy of any representation and warranty under this Section, including any change in conditions or any receipt of any notice, action, or other information the Town receives relating to any representation or warranty under this Section.

The Town will not cause or knowingly permit any action to be taken that will cause any of the foregoing representations or warranties to be untrue on or prior to the Closing, and all of the Town’s representations and warranties under this Agreement will be true as of the Closing as though those representations or warranties were made then.

5. Defaults and Remedies; Dispute Resolution

A. <u>Defaults</u>. A Party is in default under this Agreement if it fails to (i) complete the Project, (ii) make required payments, (iii) perform any other obligation under this Agreement, or if it (iii) dissolves, or is subject to a declaration of involuntary or voluntary bankruptcy, or if (v) any warranty, representation or statement in this Agreement or in any other document executed or delivered in connection herewith is found to be incorrect or misleading in any material respect on the date made.

B. **<u>Remedies</u>.** Whenever any Event of Default has occurred and has not been remedied within fifteen (15) days of receipt of written notice describing such default, the non-defaulting Party may take either or both of the following remedial steps:

i. At its option, cure the default by paying money or taking any other appropriate action, in which case the defaulting Party must reimburse the non-defaulting Party for all costs and expenses reasonably incurred in curing the default.

ii. Take whatever action at law or in equity may appear necessary or desirable to collect the amounts then due and thereafter to become due, to enforce performance and observance of any obligation, agreement or covenant of a Party under this Agreement, and to recover legal fees and other expenses incurred in pursuing and enforcing any remedy

iii. Any amounts owed to a non-defaulting Party under this Section will bear interest payable by the defaulting Party, from the date of the non-defaulting Party's payment, at the annual rate of 4.00%, calculated based on a 360-day year consisting of twelve 30-day months.

C. **<u>No remedy exclusive; other provisions.</u>** No remedy conferred or reserved in this Agreement is intended to be exclusive, but the remedies are instead intended to be cumulative. No delay or omission to exercise any right or power accruing upon any default constitutes a waiver of that right or power. A waiver of any default is limited to the default so waived and does not waive any other default.

D. **<u>Dispute resolution</u>.** In the event of a dispute between the Parties concerning the terms or performance of this Agreement, the Parties will take the following steps prior to commencing any proceeding before a court or administrative body:

1. <u>Exchange of positions</u>. Any Party noting a dispute under this Agreement will notify the other Party of the nature of the dispute and the first Party's pro-

posed resolution. Within ten days after the notice date, the other Party must respond in writing as to its view of the dispute and its position on the proposed resolution.

2. Meet and confer. If the Parties are unable to reach an agreement on the dispute and upon notice from any Party, the Parties will promptly hold a meeting attended by representatives with appropriate authority to resolve the dispute. At this meeting, the Parties will attempt in good faith to negotiate a resolution of the dispute.

3. Mediation. If the dispute remains unsettled by negotiation, the Parties will engage the services of a professional mediator certified by the Dispute Resolution Commission as a Superior Court mediator and agreed upon by the Parties. The Parties will then attempt in good faith to resolve the dispute through mediation. The Town and SHVF will each pay one-half of the mediator's fees and expenses, and each Party will pay all its own legal fees and other expenses related to the mediation. Each Party must be represented at the mediation by a representative with appropriate authority to resolve the matters in dispute. Only after mediation may a Party initiate legal or administrative proceedings.

6. Additional Provisions

a. **Notices.** (i) Any communication provided for in this Agreement must be in English and must be in writing. Under this Agreement, "writing" includes facsimile transmission and electronic mail.

(ii) For the purposes of this Agreement, any communication sent by facsimile transmission or electronic mail will be deemed to have been given on the date the communication is similarly acknowledged by the Town Manager or the director of the Town's office of Housing and Community, (in the case of the Town), or other authorized representative (in the case of SHVF). No such communication will be deemed given or effective without such an acknowledgment.

(iii) Any other communication under this Agreement will be deemed given on the delivery date shown on a United States Postal Service certified mail receipt, or a delivery receipt (or similar evidence) from a national commercial package delivery service, if addressed as follows:

A) If to the Town, to the Town of Chapel Hill Manager, Re: Notice under 2021 2200 Homestead Road Agreement, 405 Martin Luther King Jr. Blvd., Chapel Hill, NC 27514

B) If to SHVF, to Self-Help Ventures Fund, Attn: Real Estate Team Leader, 301 W. Main Street, Durham NC 27701

(iv) The Town will send a copy of any notice sent to SHVF to Self-Help Ventures Fund, Attn: General Counsel, 301 W. Main Street, Durham NC 27701, but no failure or defect in this second notice affects the validity of a notice otherwise deemed given to the address shown in (iii)(B) (or any successor address designated under (iv) below).

(v) Any addressee may designate additional or different addresses for communications by notice given under this Section to each of the others, but in no event is a Party required to give notice to more than one addressee for the notice to be otherwise effective under this Section.

(vi) Whenever this Agreement requires the giving of a notice, the person entitled to receive the notice may waive the notice, in writing. The giving or receipt of the notice will then not be a condition to the validity of any action taken in reliance upon the waiver.

b. **Each Party will bear its own costs.** Each Party will bear its own costs of the fees and expenses of its counsel and consultants, and of the studies or surveys required under this Agreement or that it otherwise commissions or obtains for its use under this Agreement.

c. **Limitation on liability of officers and agents.** No officer, agent or employee of the Town will be subject to any personal liability or accountability because of the execution of this Agreement, or any other documents related to the transactions contemplated by this Agreement. Those officers, agents or employees will be deemed to execute documents in their official capacities only, and not in their individual capacities. This provision does not relieve any officer, agent or employee from the performance of any official duty provided by law.

d. **<u>No assignment.</u>** Neither Party may assign any of its rights or obligations under this Agreement without the express consent of the other.

e. **<u>Amendments.</u>** Neither this Agreement, nor any provision hereof may be changed, waived, discharged, modified or terminated orally, but only by an instrument in writing signed by the Party against whom enforcement is sought.

f. **<u>Further instruments.</u>** Upon a Party's request, the other Party will execute, acknowledge and deliver any further instruments reasonably necessary or desired to carry out more effectively the purposes of this Agreement or any other document related to the transactions contemplated by this Agreement.

g. **<u>Governing law</u>.** The Parties intend that North Carolina law will govern this Agreement and all matters of its interpretation. To the extent permitted by law, the Parties agree that any action brought with respect to this Agreement must be brought in the North Carolina General Court of Justice in Orange County, North Carolina.

h. **<u>Time not of the essence</u>**. The Parties agree that time is not of the essence with respect to the deadlines and other limits of this Agreement, except where expressly stated.

i. **<u>Not a partnership</u>**. This Agreement describes and defines an arm's-length contract between the Town and SHVF. The Town and SHVF are not partners or otherwise participants in a joint venture.

j. **<u>Entire agreement</u>.** This Agreement constitutes the entire agreement between the Town and SHVF with respect to its general subject matter.

k. **<u>No third-party beneficiaries</u>.** There are no persons or entities intended as third-party beneficiaries of this Agreement. No person or entity, including the Collaborative Developers, is intended to have any rights to enforce any rights or obligations under this Agreement, other than the Town, SHVF and their respective successors and assigns.

l. **Counterparts.** This Agreement may be executed in several counterparts, including separate counterparts. Each will be an original, but all of them together constitute the same instrument.

m. **Recording allowed**. Either Party may provide for this Agreement to be recorded in the office of the Register of Deeds of Orange County, North Carolina.

n. **Execution; Effective date.** This Agreement will become effective as of the last date and time indicated on the signature page for a signature (the "Effective Date"). If the Agreement has not become effective, however, prior to ___________, 2021, then any offer represented by the first Party's signature is automatically revoked, and no Party has any further rights or obligations under this Agreement. Each Party must promptly give notice of its execution to the other Party.

Attachments –

A – Site description
B – Definitions; rules of interpretation
C – Development Contract components
D – Tentative Project Budget

[The remainder of this page has been left blank intentionally.]

IN WITNESS WHEREOF, the Town and SHVF have caused this Agreement to be executed and delivered by duly authorized officers.

(SEAL)

TOWN OF CHAPEL HILL,
NORTH CAROLINA

ATTEST:

____
Sabrina Oliver
Town Clerk

By: __________________________
Maurice Jones
Town Manager

Date and time: _______________

STATE OF NORTH CAROLINA;
ORANGE COUNTY

I,____________________________, a Notary Public of such Town and State, certify that Sabrina Oliver and Maurice Jones personally came before me this day and acknowledged that they are the Town Clerk and the Town Manager, respectively, of the Town of Chapel Hill, North Carolina, and that by authority duly given and as the act of such Town, the foregoing instrument was signed in the Town's name by such Town Manager, sealed with its corporate seal and attested by such Town Clerk.

WITNESS my hand and official stamp or seal, this _____ day of __________, 2021.

[SEAL]

____
Notary Public

My commission expires: ____________

[Agreement for 2200 Homestead Road Site Development, dated as of ___________, 2021]

IN WITNESS WHEREOF, the Town and SHVF have caused this Agreement to be executed and delivered by duly authorized officers.

(SEAL)
ATTEST:

____

Printed name: _____________________

Title: _____________________

SELF-HELP VENTURES FUND

By: ___________________________

Printed name: _____________________

Title: _____________________

Date and time: ______________

STATE OF NORTH CAROLINA;
ORANGE COUNTY

I, a Notary Public of such Town and State, certify that ___________ and ___________ personally came before me this day and acknowledged that they are the ___________ and the ___________, respectively, of Self Help Ventures Fund, a corporation, and that by authority duly given and as the act of such corporation, the foregoing instrument was signed in the corporation's name by such ___________, sealed with its corporate seal and attested by such ___________.

WITNESS my hand and official stamp or seal, this _____ day of _________, 2021.

[SEAL]

My commission expires: ___________

____
Notary Public

[Agreement for
2200 Homestead Road Site Development,
dated as of __________, 2021]

Attachment A – Legal description of Site

[To come]

Schedule B -- Definitions; Rules of Interpretation

Definitions. For all purposes of this Agreement, unless the context requires otherwise, the following terms have the following meanings.

"Budget" means the budget for the sources of uses of Project Funds referenced in Section 2B1.

"Business Day" means any day other than a day that Town offices have previously been scheduled to be closed.

"Closing" and "Closing Date" have the meanings assigned in Section 1C.

"Collaborative Developer" or "Developers" means the partners under the Memorandum of Understanding dated February 27, 2020 with the Town and SHVF, and specifically means CASA, Community Home Trust, and Habitat for Humanity of Orange County.

"Collaborative Development Contract" means an agreement between a Collaborative Developer and the Town for the vertical development of a portion of the Site as contemplated by Section 3.

"Completion Date" means the first date substantially all Project is complete.

"Deadline" means the deadline for Project completion as designated in Section 1D5.

"Deed" means the deed to convey the Site to SHVF referenced in Section 1C.

"Effective Date" has the meaning assigned in Section 6(n).

SHVF or the Town may be referred to individually as a "Party" and together as the "Parties."

“Hope Gardens” or “” Hope Gardens Work” means the specific work and site relocation that support the nonprofit and student run Hope Gardens.

“Project” means the preparation of the Site to make it suitable for the vertical development contemplated by the Introduction, including carrying out the work contemplated by Site Development Contract.

“Project Costs” means all costs of carrying-out of the Project, including the costs of the design, planning, constructing, acquiring, installing, equipping of improvements to the Project. “Project Costs” includes sums required to reimburse SHVF for advances made for any costs otherwise described in this definition, and all financing costs.

“Site”” means the parcel of approximately 14 acres located at 2200 Homestead Road, as more particularly described in Attachment A.

“Site Contractor” means any firm obligated to carry out any portion of the Project under the Site Development Contract.

“Site Development Contract” means any and all contracts between SHVF and one or more third party Site Contractors to carry out any portion of the Project.

“Town Maximum Contribution” means $3,500,000, as the maximum amount the Town intends to pay toward Project Costs.

Rules of Interpretation. Unless the context otherwise requires,

(a) An accounting term not otherwise defined has the meaning assigned to it in accordance with generally accepted accounting principles, and any accounting term should be understood to include any successor term or other new term with a substantially equivalent function.

(b) Unless otherwise indicated, references to Sections and Attachments are to the Sections and Attachments of this Agreement.

(c) Words importing the singular will include the plural and vice versa, and words importing any gender will include all other genders.

(d) The headings on sections and articles are solely for convenience of reference. They do not constitute a part of this Agreement, nor should they affect its meanings, construction or effect.

(e) Reference to any statute or regulation should be understood to include any successor provision.

(f) The use of the term "including" should in all cases be understood to mean "including, without limitation."

Attachment C – required contents of Collaborative Developer Agreements

Each Collaborative Developer Agreement will be between the Town and a Collaborative Developer. It will include at least the information specified in this Attachment, and such other provisions as the Town may require or accept.

1. Name of developer entity, relationship to Collaborative member, and organization chart

2. A list of all its project team members including architects, civil engineer and legal counsel that will be involved in the transactions. This section includes any knowledge of proposed management entities or agents working on the collaborative member's project. The Town may require additional information on the identity and qualifications of organizations or individuals.

3. Proposed development program for the Site, including schematic design, development timeline, and physical descriptions such as number and square footage of each dwelling unit, bedroom and bathroom count for each unit, footprints of all proposed buildings, description of amenities, number and location of parking stalls, pedestrian and vehicular circulation, and allowances for access roads, utilities, setbacks and other site plan elements required by the Town's development standards.

4. Project financing plan: The financing plan will illustrate the developer's plan for how to finance the approved development plan, including the sources, amounts and timing of different funding sources and the sources and uses of funds. Each financing plan must also specify the terms of any expected Town financial participation. The financing plan must disclose all fees and all amounts paid to entities under common control. The financing plan must also include a 30-year pro forma of the development's financial performance and show provisions for adequate reserves for routine maintenance and capital repairs.

5. An undertaking to provide the Town with an as-built Survey and other as-built construction documents.

6. Affordability plan, stating each Collaborative Developer's program to insure extended long-term affordability consistent with that Developer's expertise and role in the overall collaborative. For example:

   CASA will finance, construct, own, and manage affordable multifamily rental units targeting households between 0% and 80% of AMI. CASA is expected to partner with the UNC Horizons program to designate a portion (approximately 34 units in a single building) of the multifamily units for participants and/or graduates of the Horizons program. There are expected to be approximately 74 total multifamily rental units developed by CASA.

   Habitat for Humanity will finance, construct, market, and sell approximately 18 affordable duplex units (9 buildings, each with two units) targeted to households earning between 30% and 80% of AMI, with the majority of units targeted to households below 60% AMI.

   Community Home Trust will finance, construct, market, and find residents for approximately 26 affordable townhomes targeted to households earning between 65% and 115% of AMI. The vast majority of these units will be available for sale to first-time homebuyers; a small number of units may be used as affordable rentals serving households under 65% AMI.

7. Appropriate land use restrictions and covenants governing both the behavior of the Collaborative Developer and the land to provide for the Town's typical 99-year affordability period consistent with the affordability plan. The restrictions covenants will be in place prior to fee simple conveyance to the Collaborative Developer.

8. Appropriate representations and warranties from the Collaborative Developer as to such matters as existence and good standing, proper authorization, financial and technical capability, absence of litigation or conflict with other agreements, lack of debarment, and other customary matters.

9. Indemnification by the Developer of the Town with respect to all activities at the Developer's portion of the Site after conveyance.

10. Designation of appropriate project contact for decision making purposes. Additional provisions for notices, resolution of disputes and similar matters.

Attachment D – Draft Project Budget

Sources of funds
All sources are committed unless indicated otherwise.

Source	Tentative amount ($)
Town of Chapel Hill Affordable Housing Bond	3,300,000
Town of Chapel Hill AHDR	170,000
Orange County Affordable Housing Bond	1,500,000
Community Project Funding, Rep. Price *(anticipated)*	1,871,349
TOTAL	6,841,349

Uses of funds
Numbers shown are preliminary and subject to change based on construction cost escalations and other unforeseen project costs that may arise.

Use	Tentative amount ($)
Site Development Costs	4,943,236
Contribution to Hope Gardens Site Costs	95,000
Hard Cost Contingency	988,647
Design, Survey, & Geotech Testing	289,435
Other Soft Costs	203,776
Developer Fee	321,255
TOTAL	6,841,349

*Last updated October 1, 2021 by Self-Help Ventures Fund staff.

TOWN OF CHAPEL HILL

Town Hall
405 Martin Luther King Jr. Boulevard
Chapel Hill, NC 27514

Item Overview

Item #: 14., **File #:** [21-0772], **Version:** 1 **Meeting Date:** 10/13/2021

Concept Plan Review: 5500 and 5502 Old Chapel Hill Road.

See the Summary Report on the next page.

The Agenda will reflect the text below and/or the motion text will be used during the meeting.

PRESENTER: Corey Liles, Principal Planner

a. Review of process
b. Presentation by the applicant
c. Comments from the Community Design Commission
d. Comments from the public
e. Comments and questions from the Mayor and Town Council
f. Motion to adopt a resolution transmitting Council comments to the applicant.

RECOMMENDATION: That the Council adopt the resolution transmitting comments to the applicant.

CONCEPT PLAN REPORT

CONCEPT PLAN REVIEW: 5500 AND 5502 OLD CHAPEL HILL ROAD (PROJECT #21-055)

SUMMARY REPORT

TOWN OF CHAPEL HILL PLANNING DEPARTMENT
Colleen Willger, Director
Judy Johnson, Assistant Director

PROPERTY ADDRESS	MEETING DATE	APPLICANT
5500 and 5502 Old Chapel Hill Road	October 13, 2021	CJT, PA, on behalf of EB Capital Partners

STAFF RECOMMENDATION

That the Council adopt the resolution transmitting comments to the applicant regarding the proposed development.

PROCESS

- The Council will hear the applicant's presentation, receive comments from the Community Design Commission, Housing Advisory Board, and Stormwater Utility Management Advisory Board, hear public comments, and offer suggestions to the applicant.
- Because this review is a Concept Plan submittal, statements by individual Council members this evening do not represent an official position or commitment on the part of a Council member with respect to the position he or she may take when and if the Council considers a formal application.
- The Community Design Commission reviewed a concept plan for this site on September 28, 2021.
- The Housing Advisory Board reviewed a concept plan for this site on September 14, 2021.
- The Stormwater Utility Management Advisory Board reviewed a concept plan for this site on September 28, 2021.

DECISION POINTS

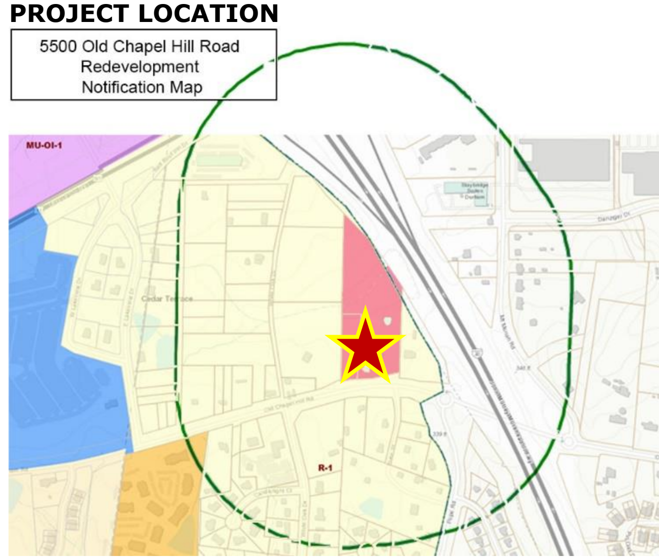
- The site is located in the North 15-501 Corridor Area of the Future Land Use Map (FLUM).
- The FLUM identifies multifamily residential as one of the primary land uses.

PROJECT OVERVIEW

This approximately 6.5-acre site is located on the north side of Old Chapel Hill Road, just to the west of Interstate 40 (I-40). The site is zoned Residential-1 (R-1). There are currently a single-family dwelling unit and several outbuildings on the property.

The applicant proposes to construct a 90-unit, four-to-five story apartment building and 126 parking spaces. The plan shows the portion of the parcel south of the stream being developed as part of this proposal. The proposal does not propose any encroachment into the stream buffer.

PROJECT LOCATION



ATTACHMENTS	
	1. Concept Plan Report 2. Draft Staff Presentation 3. Resolution A, transmitting comments to the applicant 4. Advisory Board recommendations (*to be attached*) 5. Applicant Materials

LONG-RANGE PLANS EVALUATION

5500 and 5502 Old Chapel Hill Road

The following report provides an evaluation by Planning Staff of the Concept Plan site, based on long-range planning considerations.

PROPERTY ADDRESS	APPLICANT	CURRENT ZONING DISTRICT
5500 and 5502 Old Chapel Hill Road	Wendi Ramsden CJT, PA	Residential-1 (R-1)

EXISTING LAND USE	PROPOSED LAND USE
Vacant / Undeveloped	Multifamily Residential

SURROUNDING PROPERTIES – EXISTING LAND USES
I-40 freeway (North/East), Single-family residence (East, West, and South)

FUTURE LAND USE MAP (FLUM) FOCUS AREA	FLUM SUB-AREA
North 15-501 Corridor	A

OTHER APPLICABLE ADOPTED PLANS

☒ Mobility and Connectivity Plan
☒ Parks Comprehensive Plan
☒ Greenways Master Plan
☒ Chapel Hill Bike Plan
☒ Cultural Arts Plan
☒ Stormwater Management Master Plan
☒ Climate Action and Response Plan ***(NEW)***
☐ West Rosemary Street Development Guide
☐ Central West Small Area Plan

SUMMARY OF PLAN CONSIDERATIONS AFFECTING SITE

Map excerpts on following pages demonstrate the Plan Considerations listed below. The location of 5500 Old Chapel Hill Road is marked with the ★ symbol.

Future Land Use Map (FLUM)

- The project is located in the North 15-501 Corridor Sub-Area A.
- Multifamily Residential is identified as one of the appropriate Primary land uses.
- Typical Height in the Sub-Area is 4-6 stories.
- Transitional Area is on the south side of the site.

Mobility and Connectivity Plan

- NC Department of Transportation is nearing completion of a project to upgrade Old Chapel Hill Road with pedestrian and bicycle facilities.

Parks Comprehensive Plan

- The site does not fall within a Community Park or Neighborhood Park Service Area.
- No additional Neighborhood Parks or Community Parks are proposed in the vicinity of the site.

Greenways Master Plan

- The applicant should **coordinate with Chapel Hill Parks & Recreation** for the latest information on trail alignment, design, and construction timing.

Chapel Hill Bike Plan

- Mapping of future bike facilities in the Bike Plan is superseded by the Mobility and Connectivity Plan. The Bike Plan provides some additional detail on facility design.

Cultural Arts Plan

- No opportunities for integrating public art are identified at locations that impact the site.

Stormwater Management Master Plan

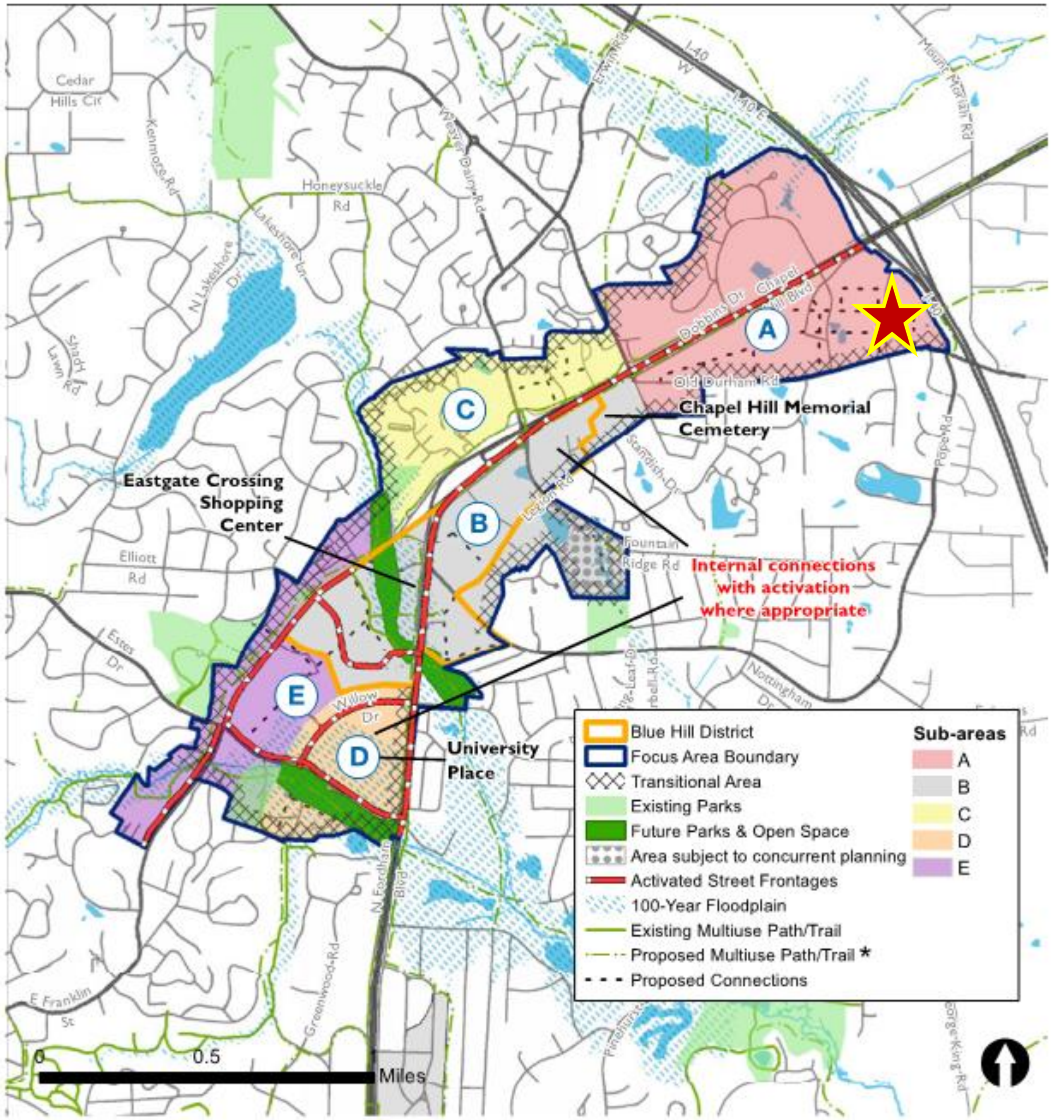
- The site is mostly located in the Clark Lake 1 (JL1) Basin. The applicant should **coordinate with Chapel Hill's Stormwater Management Division** to understand relevant stormwater considerations.

Climate Action and Response Plan *(NEW)*

(Note: no map excerpt provided, as the Plan is generally text-based)

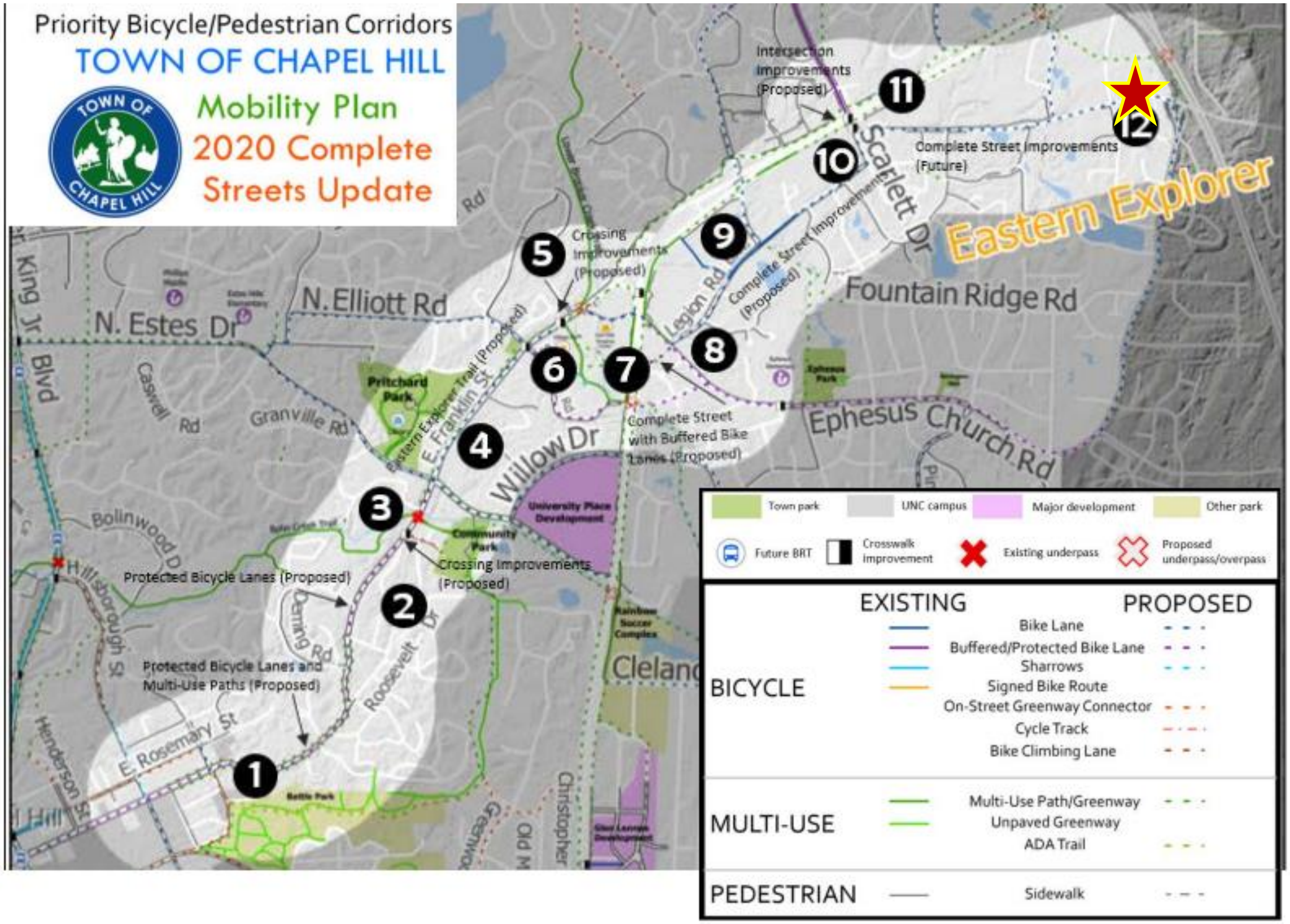
- Developing the site in accordance with the Future Land Use Map and Mobility Plan would contribute to the following Plan actions:
    - Create walkable, bikeable, transit-served neighborhoods
    - Increase bicycling, walking, and transit use
- Conditions for development could contribute to the other actions in the plan such as:
    - Net-zero emissions for new construction
    - Create a town-wide EV charging station network
    - Protect water quality, natural, and agricultural resources
    - Enhance green infrastructure

Future Land Use Map (Excerpt)



* See Mobility Plan for more information about proposed multi-modal improvements

Mobility and Connectivity Plan (Excerpt)



CONCEPT PLAN REPORT
5500 and 5502 Old Chapel Hill Road

Legend

- Neighborhood Park
- Service Radius ½ Mile
- Community Park Serving as Neighborhood Park
- Proposed Neighborhood Park ½ Mile radius
- Community Park
- Service Radius 1.5 Mile
- Proposed Community Park 1.5 Mile radius
- Chapel Hill Town Limits

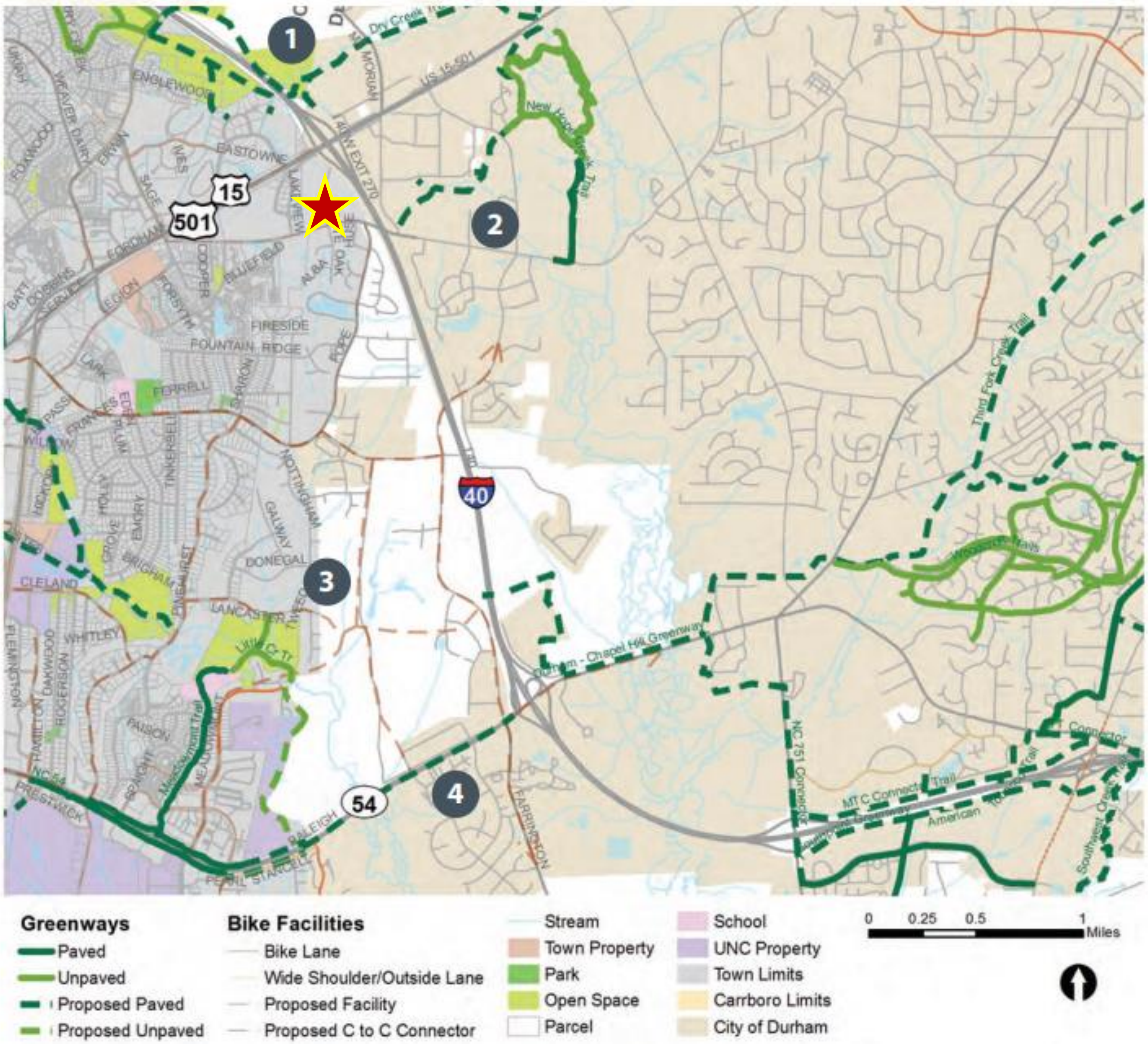
COMMUNITY PARK FACILITIES
(Community Park Serving as Neighborhood Park)

1 HOMESTEAD PARK
2 CEDAR FALLS PARK
3 COMMUNITY CENTER PARK
4 SOUTHERN COMMUNITY PARK

NEIGHBORHOOD PARK FACILITIES

5 NORTH FOREST HILLS PARK
6 PRITCHARD PARK
7 EPHESUS PARK
8 UMSTEAD PARK
9 HARGRAVES PARK
10 OAKWOOD PARK
11 MEADOWMONT PARK

Greenways Master Plan (Excerpt)



Cultural Arts Plan (Excerpt)

Stormwater Management Master Plan (Excerpt)

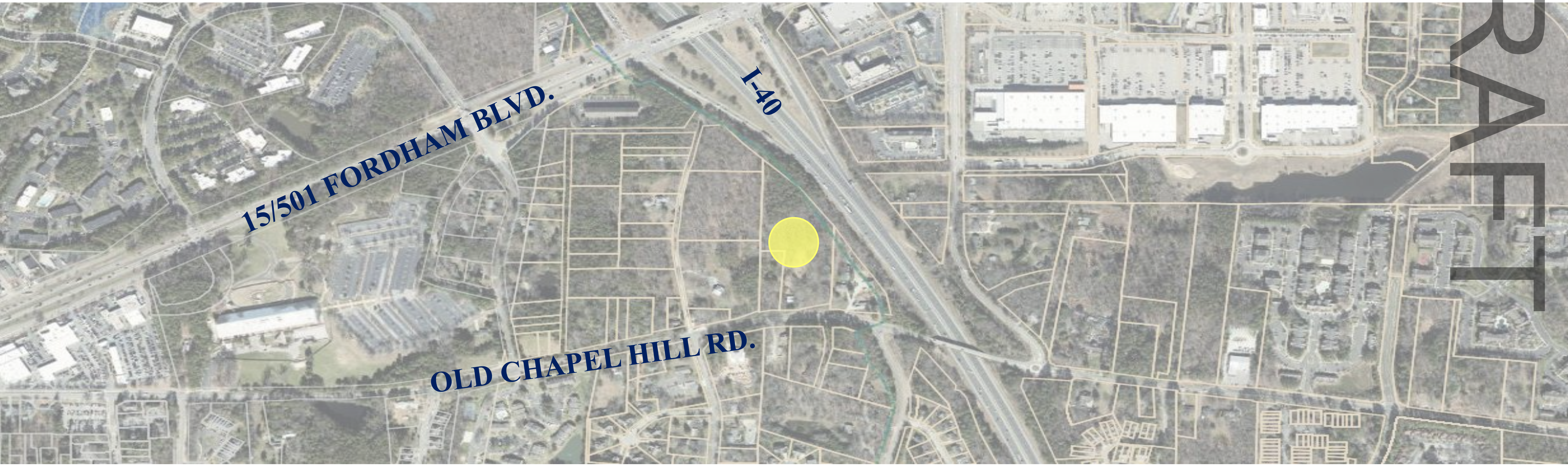
CONCEPT PLAN
10/13/2021

Council

DRAFT

5500 Old Chapel Hill Road

5500/5502 Old Chapel Hill Rd . Chapel Hill, NC . 27514



RECOMMENDATION

- Adopt Resolution, transmitting comments to the Applicant regarding the proposed development

DRAFT

CONCEPT PLANS

- No Decision; Feedback Only
- Applicant provides a rough sketch
- Staff does not conduct a formal review of concept plans
- Sketch is forwarded to advisory boards for preliminary feedback

DRAFT

PROCESS OVERVIEW

Concept Plans

- Special Use Permit
- Conditional Zoning
- Development Agreement

PROJECT SUMMARY

- Existing Zoning-R1
- Multi-Family Res.
- Approx. 90 Units
- Approx. 126 Parking
- Recreational Amenities

DRAFT

KEY POINTS-*Evaluation*

- 15/501 N. Future Focus Area

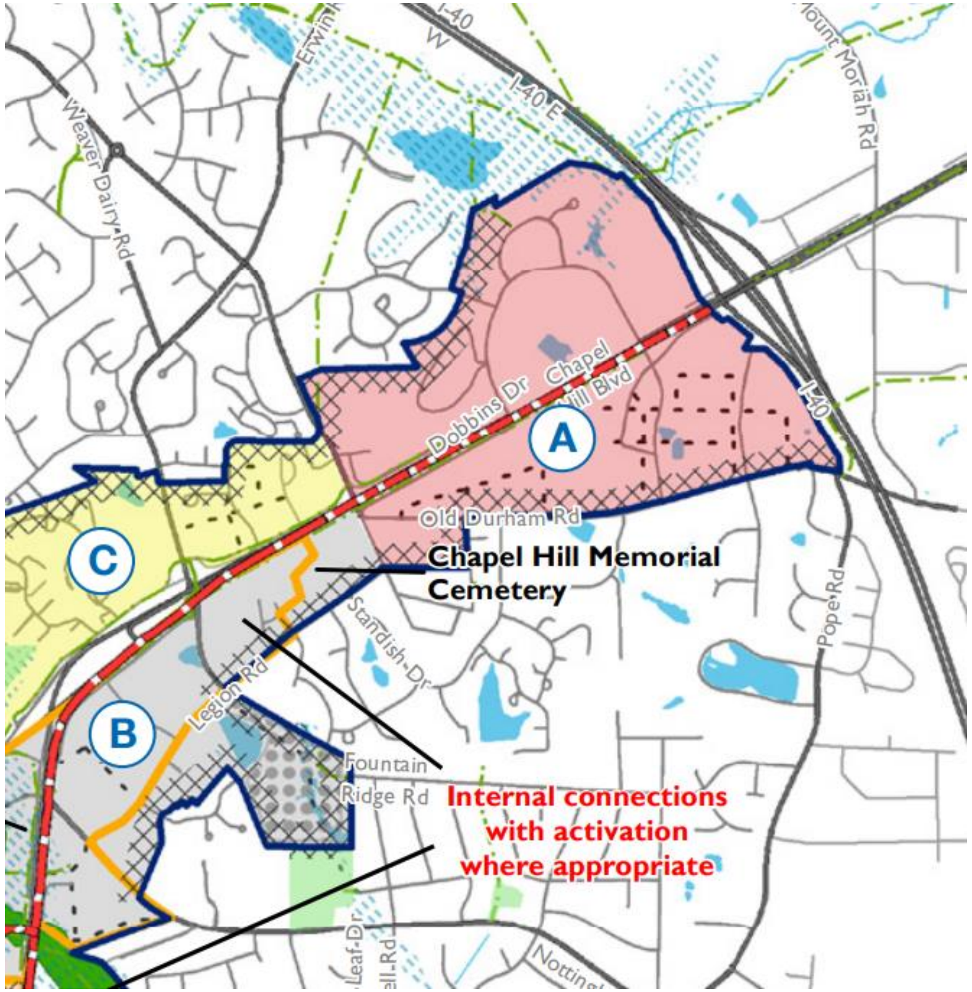
  -Sub Area A

  -Multifamily, shops, offices & commercial/office

  -Parks and Green/Gathering Spaces

  -Townhouse and Residences

  -Typical Height 4-6 stories



DRAFT

RECOMMENDATION

- Adopt Resolution, transmitting comments to the Applicant regarding the proposed development

DRAFT

A RESOLUTION TRANSMITTING COUNCIL COMMENTS ON A CONCEPT PLAN FOR 5500 AND 5502 OLD CHAPEL HILL ROAD (PROJECT #21-055) (2021-10-13/R-19)

WHEREAS, a Concept Plan has been submitted for review by the Council of the Town of Chapel Hill for 5500 and 5502 Old Chapel Hill Road, further identified by Durham County Parcel Identifier Numbers 0709-01-09-7325 and 0709-01-09-8651; and

WHEREAS, the Council has the opportunity tonight to hear this applicant's presentation, receive a set of comments from the Community Design Commission, the Stormwater Management Utility Advisory Board, and the Housing Advisory Board, hear public comments, and offer suggestions to the applicant; and

WHEREAS, the Council has heard presentations from the applicant and members of the public; and

WHEREAS, statements by individual Council members this evening are not an official position or commitment on the part of a Council member with respect to the position he or she may take when and if a formal application for development is subsequently submitted to the Council for formal consideration; and

WHEREAS, the Council has discussed the proposal, with Council members offering reactions and suggestions.

NOW, THEREFORE, BE IT RESOLVED by the Council of the Town of Chapel Hill that the Council transmits comments to the applicant regarding this proposal, as expressed by Council members during discussions on October 13, 2021 and reflected in minutes of that meeting.

This the 13th day of October, 2021.

CONCEPT PLAN APPLICATION

Parcel Identifier Number (PIN): 0709-01-097325 / 0709-01-09-8651

Date: 26 July 2021

Section A: Project Information

Project Name: 5500 Old Chapel Hill Road

Property Address: 5500 and 5502 Old Chapel Hill Road

Zip Code: 27707

Use Groups (A, B, and/or C): A

Existing Zoning District: R-1

Project Description: 90 unit apartment building with 126 parking spaces and recreational amenities

Section B: Applicant, Owner and/or Contract Purchaser Information

Applicant Information (to whom correspondence will be mailed)

Name: CJT, PA Attn: Wendi Ramsden

Address: 111 W Main Street

City: Durham State: NC Zip Code: 27701

Phone: 919-682-0368 Email: wramsden@cjtpa.com

The undersigned applicant hereby certifies that, to the best of his knowledge and belief, all information supplied with this application is true and accurate.

Signature: Wendi Ramsden Date: 7.26.2021

Owner/Contract Purchaser Information:

☐ **Owner** ☒ **Contract Purchaser**

Name: EB Capital Partners, Attn: Ernest Brown

Address: 100 Silers Fen Court

City: Chapel Hill State: NC Zip Code: 27517

Phone: 202-586-3062 Email: ebrown@ebcapitalpartners.com

The undersigned applicant hereby certifies that, to the best of his knowledge and belief, all information supplied with this application is true and accurate.

Signature: Date:

5500 Old Chapel Hill Road

Concept Plan Application 26 July 2021

Response to Project Summary Questions

1. Would this project demonstrate compliance with the Comprehensive Plan?
    - Small Area Plan – *N/A*
    - Overall Zone – *Yes* / NCD - *N/A*
    - Study Area – *N/A*
    - Land Use Plan – *Complies with the guidelines and design as characterized for the North 15 501 Corridor Focus Area as described in the Future Land Use Map / Charting Our Future report December 2020*

    The site is within Town limits.

2. Would the proposed project comply with the Land Use map?

    Yes, the project complies with the December 2020 Future Land Use report.

3. Would the proposed project require a rezoning?

    Yes.

4. What is the proposed zoning district?

    Existing zoning is R-1.
    Zoning to accommodate multi-family residential at a density of 14 units/ac and an FAR of .482 could be OI-3.

5. Would the proposed project require modifications to the existing regulations?

    It is expected that the applicant would ask for modifications to the street landscape buffer. There would also be modification request for disturbance of steep slopes. There is only 1,300 sf of steep slope on site broken up into 7 areas. The largest steep slope area is about 600 sf. The project would disturb 75% of the steep slopes.

6. If there is a residential component to the project, does the applicant propose to address affordable housing?

    The entire project will be residential. The developer is expected to offer some percentage of the units as affordable and workforce. The developer has reached out to the Town's housing staff, and expects to meet with them prior to the board presentations.

    a. Has the applicant presented its concept plan to the Housing Advisory Board?
    No. This will happen during the concept plan review process.

b. Has the applicant met with appropriate Town staff to discuss affordable housing policy, expectations, and options?
The developer has reached out to the Town housing department and has an appointment to meet with them about policy, expectations, and options prior to the Housing Advisory Board presentation.

c. Is the project for ownership or rental?
Rental.

7. Are there existing conditions that impact the site design (i.e. environmental features such as RCD, slopes, erosion and sedimentation, retention of trees and tree stands, stormwater drainage patterns, significant views into and out of the site)?

   Yes.

   There is an existing intermittent stream on site, running west to east. The associated RCD is 50' each side of the stream. This zone effectively divides the property in two, with the southern portion slightly larger than the northern portion.

   There are many utilities along the frontage – overhead power lines, underground stormwater lines, and water utilities, all with associated easements.

8. Has the applicant addressed traffic impact? Traffic and circulation issues?

   Traffic impacts will be assessed at the time of formal conditional zoning application. Recent improvements have been made to Old Chapel Hill Road with the addition of the round-about at Pope, widening of the street, and addition of sidewalks to the east.

9. How is the application compatible with he surrounding neighborhood and/or district?
   The project is compatible with the Town's initiatives for development in the North 15 501 Corridor focus area.

10. Has the applicant discussed the project with adjacent neighbors?

    The contract purchaser has not formally spoken with adjacent landowners.

5500 Old Chapel Hill Road

Concept Plan Application 26 July 2021

Developer's Program

The project includes a 90-unit 4-5 story apartment building with 126 parking spaces. The building will be an urban style apartment with access through a central lobby space and units accessed off interior corridors. The design will include a mix of materials such as brick and aluminum storefronts on the ground level, and a mix of fiber cement board and batten siding along with metal on the upper floors. The building will be 4 stories facing Old Chapel Hill Road and will take advantage of slope to add a lower level on the north side of the building. That lower level will be the location for the leasing office and indoor amenities. The project will also include exterior site amenities such as a pool, dog park, disc golf, and walking trails. The residential units will all be accessed from interior corridors on the top four floors.

The project is accessible to public transit and also close to I-40 for easy access for commuters. The service functions (for example trash collection) will be handled inside the lower level of the building.

The northeastern portion of the parcel fronts the highway (I-40) – that portion of the site is intended to remain undeveloped but will be used for recreation, and the full 100'wide landscape buffer will be satisfied with retained tree coverage. The development will be contained in the southern portion of the site, accessible from Old Chapel Hill Road. The site frontage is almost 360 lf, and two driveways are planned on that frontage.

The site is served by a Chapel Hill Transit route which will carry passengers into downtown Chapel Hill.

The property is a rectangular parcel approximately 6.5 acres in size with a stream and related buffer running west to east through the center.

The current concept includes plans for the development of the approximately 4 acres south of the stream and related buffer zone. There are no current plans to develop the 2.5 acres of buildable area north of the stream but that may be developed in the future in a compatible use, or as adjacent parcels develop and provide access. As part of the current development plan, nature trails or a disc golf course may be incorporated into the forest area north of the stream, and would be field located to avoid grading, large tree removal, and tree clearing in general. Pedestrian creek crossing would be made by stepping stones or by low flow crossing strategies.

A pond stormwater management facility will be constructed to handle runoff from the development and will meet the current storm management requirements.

The RCD zones will remain forested and the minimum requirement of 30% tree coverage will be exceeded by existing forest to remain. It is expected that approximately 35% of the site will remain forested, and additional canopy and understory trees will be added in the design. West, south and eastern required buffers would be 10'-20' wide and the project design includes constructed buffers to meet the internal buffer requirements. The buffer along the I-40 frontage would be 100' wide and is expected to remain in forest.

Statement of Compliance with Comprehensive Plan

The proposed residential project is being designed to comply with the Chapel Hill Comprehensive Plan, and with the Future Land Use Map (FLUM).

The main applicable concepts from the Comprehensive Plan are Community Choices, and Sustainability.

Community Choices:
The project will provide small apartments in an urban style building. This gives Town residents a choice of apartment style living which is not garden-style walk up, but a more urban framework. The building will be an urban style corridor loaded facility with interior amenities as well as site recreation facilities. This facility will be marketed to young professionals and empty nesters. Because the majority of units are 1-bedroom, it is unlikely to attract families or student populations.

Sustainability:
This apartment project will take advantage of dense development to concentrate site disturbance and allow for a greater amount of forest to remain, as well as staying out of RCD zones on site.

Charting Our Future Guiding Principals

The following principals are identified in the Town's Land Use Initiative published in December 2020.

1. Demonstrate the Town's commitment to effectively respond to the threats associated with climate change as well as environmental stewardship and resiliency.
2. Ensure equitable planning and development.
3. Encourage a diversity of housing types.
4. Promote distinctive, safe, and attractive neighborhoods.
5. Cultivate a vibrant and inclusive community.

6. Direct investment along key transportation corridors and promote construction of transit and multi-modal transportation options in concert with the Town's regional transportation partners.
7. Support and facilitate economic development, including the development of flexible and varied types of retail and offices spaces; job creation; innovation; and entrepreneurship, through redevelopment and infill development, in order to expand and diversify the Town's tax base to enable the Town's fiscal resiliency.
8. Provide appropriate transition between land uses and buildings of different scales.
9. Preserve and maintain Chapel Hill's appearance and create the quality of design and development the Town desires.
10. Cooperate and collaborate with all of the Town's regional partners especially the University of North Carolina at Chapel Hill and UNC Health.

The proposed multi-family project complies with the majority of these guidelines and does not contradict the others. Multi family use has been identified as a primary desired use in this zone (Sub Area A of the North 15-501 Corridor) in the Charting Our Future report. The 4-5 story height falls in the range of typical height and transitional height desired in this area.

The project will implement sustainable design measures to promote environmental sustainability. Many recreational amenities will involve low impact use of stream buffers and retained forest area. The stream buffer on site will be protected, and the retained forest on site will exceed Town codes. Additional plantings will be included in the design to provide parking lot shade, hardscape shade, building shade, as well as aesthetic benefit. Stormwater runoff from new impervious surfaces will be treated on site for both peak flow and for water quality improvement.

The project will offer urban style apartment living new to this part of town. Sidewalks will be added to the street frontage.

Statement of Compliance with Design Guidelines

The portion of the site to be developed is a rectangular 4-acre piece fronting Old Chapel Hill Road. Located in Durham County, the parcel is within the limits of the Town of Chapel Hill.

The Town has a Design Manual which provide guidance for the design of new projects, intended “to assure that new designs remain in continuity with the Town’s existing design ‘successes’ and at the same time inspire exciting and creative additions to the community’s blend of distinctive buildings from many eras” (p.1)

These guidelines regulate site design as it relates to services, utilities, and landscaping.

Stormwater Treatment - The project will meet stormwater quantity and quality controls at the time of final plan development and approval. A surface pond is anticipated which will treat for both water quality and peak flow. The approximate size of this facility has been accommodated on the proposed layout plan.

Landscaping and tree protection - The project will meet most parts of this guideline including but not limited to: total tree coverage, parking lot screening, perimeter landscape buffers, landscaping around the building, and storm pond plantings. Because of the multiple overhead and underground utilities along Old Chapel Hill Road, and due to the large and irregular distance of the property line from the street edge, the applicant would expect to ask for a modification to reduce the street buffer planting or modify the location of the plantings.

It is expected that the retained tree coverage on site will be about 35%, exceeding the minimum requirement.

There is no current plan for development of the site north of the stream buffer. Though it is possible that mulch trails and disc golf would be incorporated into the plan, these are uses which would be accommodated without tree removal or grading.

Access and circulation - The project will be designed to comply with Town standards for circulation, parking, emergency access, and access for services such as utility maintenance and trash collection. Street frontage is approximately 360 LF, and the applicant expects to have 2 driveway entries along this frontage. There is no current opportunity for connection to other public streets, but the project could accommodate a future connection to potential development on the parcel to the west. As the west portion of the site will include an access drive, and parking on site will exceed minimum requirements, it would be easy to accommodate off-street connections to future adjacent development.

Parking and loading - The LUMO calls for 1-1.25 parking spaces per 1 bedroom unit, and 1.4-1.75 spaces per 2-bedroom unit. Total required parking for this project would be a minimum of 100 spaces and maximum of 126 spaces. The concept plan accommodates 126 parking spaces total. Bicycle parking will meet Town codes, and the majority of bicycle parking will be located inside the building. Electric charging stations will be provided on site as well as bike storage and bike wash station to encourage alternative transportation usage.

Street lights, signs and markings – It is not anticipated that public street improvements will be required.

Utilities and easements - There is electric service along the parcel frontage. There is also water service along the frontage.

Sanitary sewer will involve some extension of a sanitary main, and possible a pump station within the project.

New easements will be recorded as necessary for utility mains and stormwater mitigation facilities on site, and also to recombine the two existing parcels.

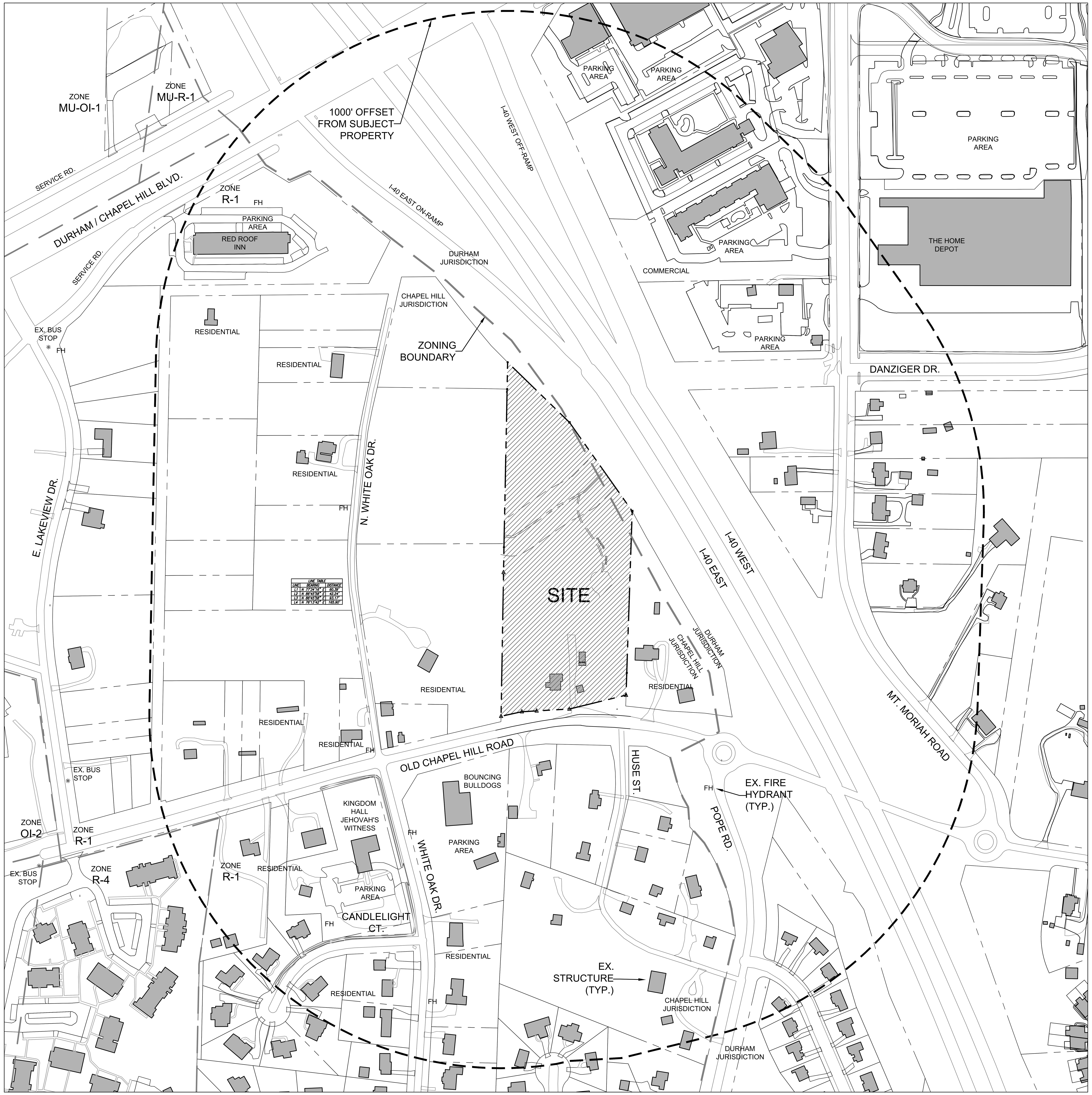
Solid waste management – A trash compactor will be located in the lower level of the building. A recycling and cardboard dumpster collection facility will be located at the end of the surface parking area. Access to the collection areas will meet Town and County requirements, or will accommodate private pickup.

Affordable Housing Plan

This concept plan proposes multi-family housing at the east edge of Town. Of the 90 proposed units, some portion will be offered for affordable housing. These units will be located within the main building and will be constructed and leased concurrent with the market rate units.

The developer is currently working with Town staff to formulate an affordable housing plan offering.

5500 OLD CHAPEL HILL ROAD APARTMENTS
CONCEPT PLAN APPLICATION
DURHAM, NC



1 / CP-1
AREA MAP
SCALE: 1" = 150'

CONTACT INFORMATION

OWNER
TERRI BENFORADFO
1026 NICKELBY ST, DURHAM NC 27703

CONTRACT PURCHASER / DEVELOPER
EB CAPITAL PARTNERS
100 SILERS FEN COURT
CHAPEL HILL NC 27517
CONTACT: Ernest Brown, 205-586-3062
ebrown@ebcapitalpartners.com

APPLICANT / LANDSCAPE ARCHITECT
CJT PA
111 WEST MAIN STREET,
DURHAM NC 27701
CONTACT: Wendi Ramsden, 919-682-0368
wramsden@cjtpa.com

SITE DATA

PIN	0709-01-09-7325 0709-01-09-8651
NET LAND AREA	283,682 SF / 6.51 AC NET
GROSS LAND AREA	293,519 SF / 6.74 AC GROSS
EXISTING ZONING:	R-1
PROPOSED ZONING:	CZ-OI-3
EXISTING USE:	RESIDENTIAL, WOODED
PROPOSED USES:	MULTI-FAMILY RESIDENTIAL

LIST OF SHEETS

CP-1 COVER & AREA MAP
CP-2 EXISTING CONDITIONS PLAN
CP-3 CONCEPT PLAN
RENDERED CONCEPT PLAN

ENGINEERING . PLANNING . LANDSCAPE ARCHITECTURE
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NC BOARD OF EXAMINERS FOR ENGINEERS AND SURVEYORS LIC # C-1209

NC BOARD OF LANDSCAPE ARCHITECTS LIC # C-104

NORTH CAROLINA 1302 WENDI L. RAMSDEN
7.26.2021

Project
5500/5502 OLD CHAPEL HILL RD APARTMENTS

5500 OLD CHAPEL HILL RD
DURHAM, NC 27707
DURHAM COUNTY NC

PLANNING JURISDICTION:
TOWN OF CHAPEL HILL

5500 OLD CHAPEL HILL RD
P.I.N. 0709-01-09-7325
5502 OLD CHAPEL HILL RD
P.I.N. 0709-01-09-8651

Job Number 2126

Drawn WLR, MTC
Checked WLR
Date 07.26.2021
Revisions

CONCEPT PLAN
PLANS NOT ISSUED
FOR CONSTRUCTION

Sheet Title
COVER & AREA MAP

Sheet Number
CP-1

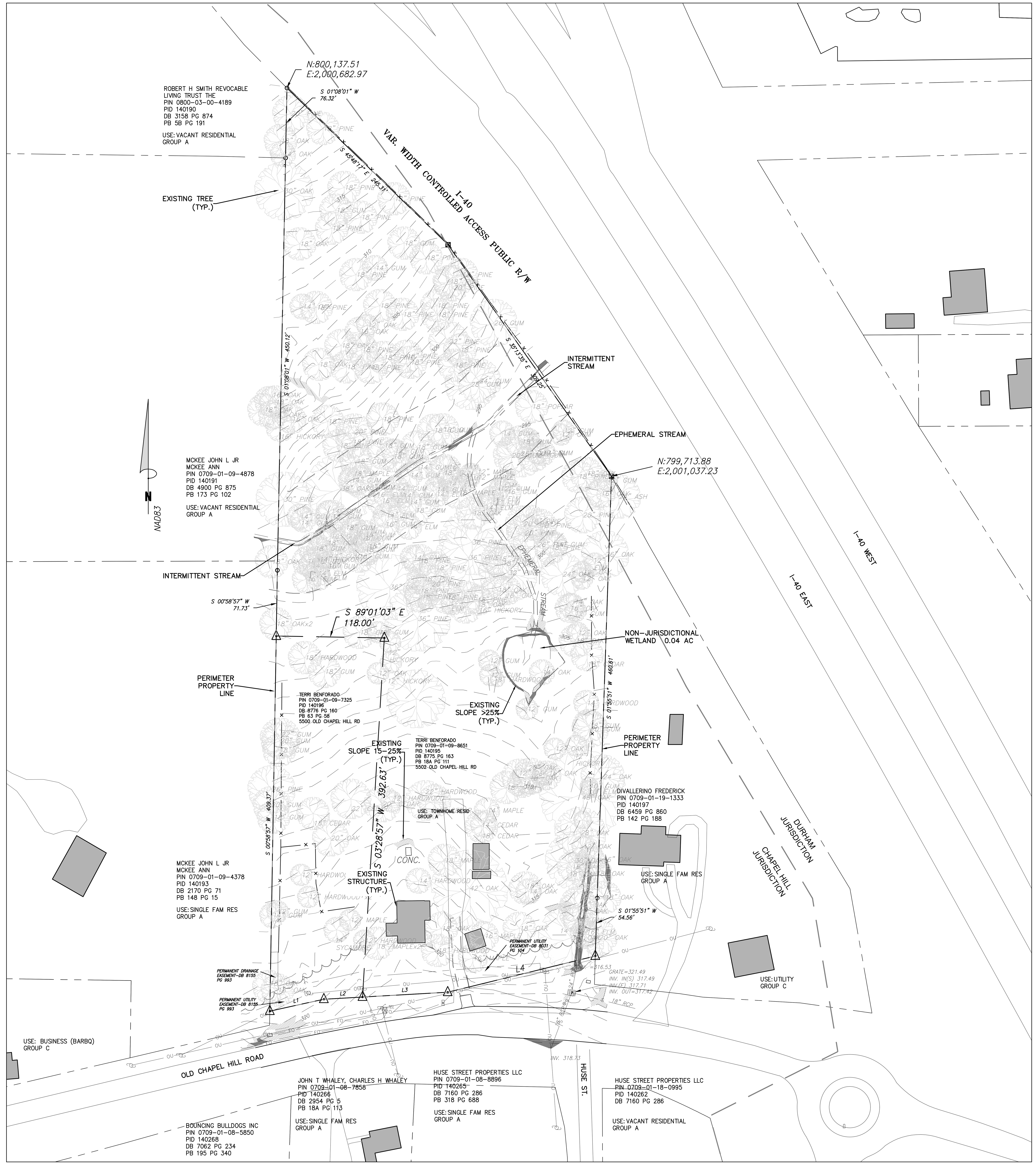
723

SITE DATA

ENVIRONMENTAL CONSTRAINTS	SLOPES > 25% ON SITE = 1,315 SF
	POTENTIAL WETLAND = 3,170 SF
	INTERMITTENT STREAM WITH 50' STREAMSIDE RCD & 50' BUFFER

SLOPES > 25%

SLOPES 15–25%



1 / CP-2
EXISTING CONDITIONS
SCALE: 1" = 60'

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NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1302 WENDI L. RAMSDEN
7.26.2021

Project
5500/5502 OLD CHAPEL HILL RD APARTMENTS

5500 OLD CHAPEL HILL RD
DURHAM, NC 27707
DURHAM COUNTY NC

PLANNING JURISDICTION: TOWN OF CHAPEL HILL

5500 OLD CHAPEL HILL RD P.I.N. 0709-01-09-7325
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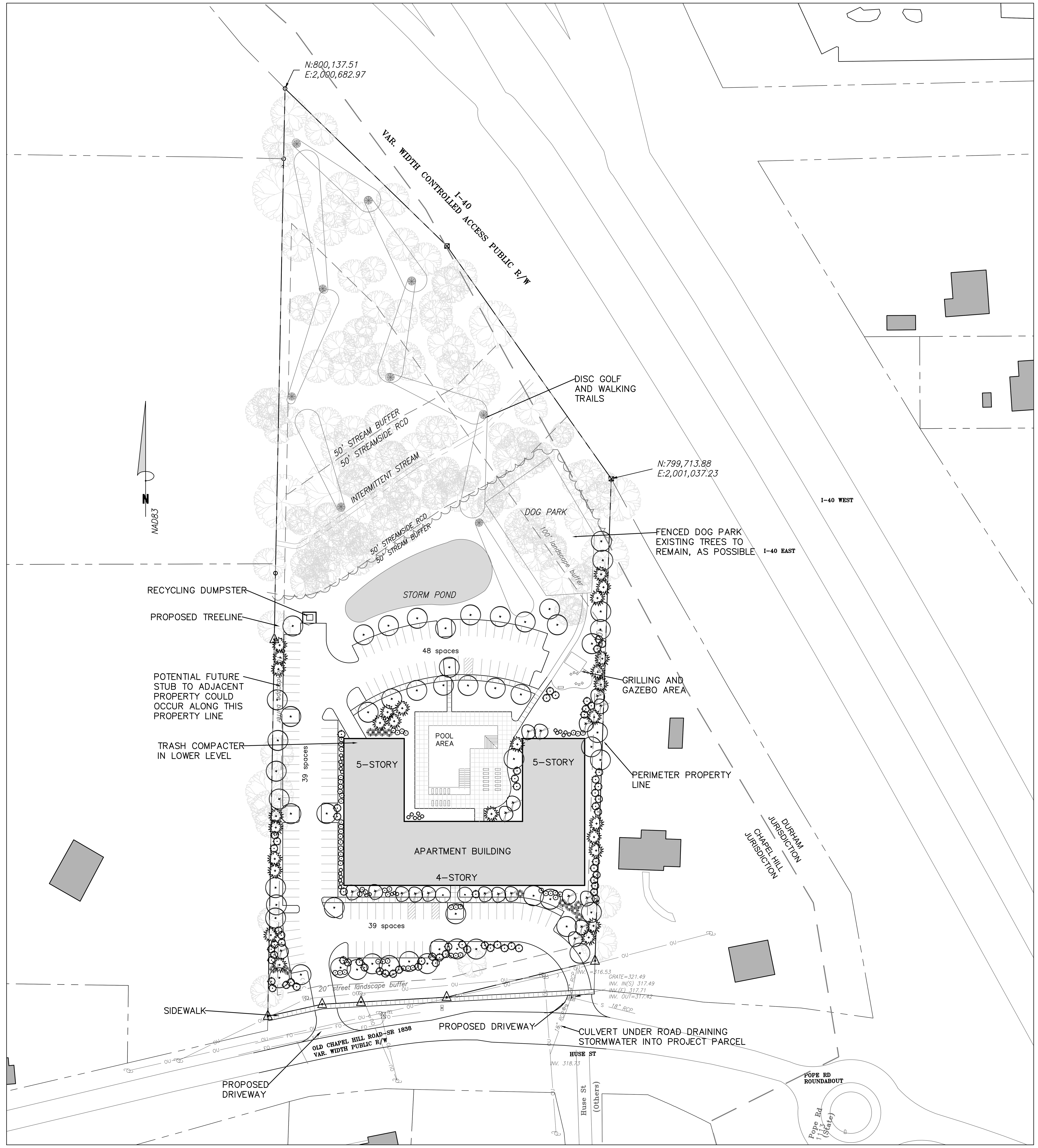
CP-2



1 / CP-3
CONCEPT LAYOUT
SCALE: 1" = 60'

60' 0 60' 120' 180'
Scale 1" = 60'

RESIDENTIAL OFFERING

90 APARTMENTS IN 4-5 STORY BUILDING
63 STUDIO/1-BDROM
27 2-BDRM

ANTICIPATED BUILDING SIZE: 141,500 SF

REQUIRED PARKING: 100 MIN, 126 MAX
STUDIO/1-BEDROOM: 63-78 SPACES
2-BEDROOM: 37-48
PARKING PROVIDED: 126 SPACES

RECREATION FACILITIES

- POOL
- COMMUNITY GAZEBO AND GRILLING AREA
- DISC GOLF
- DOG PARK
- WALKING TRAILS
- LOWER LEVEL BUILDING TO HAVE AMENITIES SUCH AS LEASING OFFICE, FITNESS ROOM, BIKE STORAGE, RESIDENT WORKSPACE

ENVIRONMENTAL CONSIDERATIONS

- PROTECTION OF STREAMSIDE RCD
- STORMWATER MITIGATION IN SURFACE POND
- MINIMAL STEEP SLOPES
- MULTIPLE UNDERGROUND AND ABOVE GROUND UTILITIES ALONG STREET FRONTAGE

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NORTH CAROLINA REGISTERED LANDSCAPE ARCHITECT 1302 WENDI L. RAMSDEN
7.26.2021

Project
5500/5502 OLD CHAPEL HILL RD APARTMENTS

5500 OLD CHAPEL HILL RD
DURHAM, NC 27707
DURHAM COUNTY NC

PLANNING JURISDICTION:
TOWN OF CHAPEL HILL

5500 OLD CHAPEL HILL RD
P.I.N. 0709-01-09-7325
5502 OLD CHAPEL HILL RD
P.I.N. 0709-01-09-8651

Job Number 2126
Drawn WLR, MTC
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Date 07.26.2021
Revisions

CONCEPT PLAN
PLANS NOT ISSUED
FOR CONSTRUCTION

Sheet Title
CONCEPT LAYOUT

Sheet Number
CP-3

CJTpa
SURVEYING / ENGINEERING / LANDSCAPE ARCHITECTURE

5500 Old Chapel Hill Road

Conceptual Site Plan - Chapel Hill, NC

1"=70' (11x17)