UNC
ENVIRONMENT,
HEALTH & SAFETY

The University of North Carolina at Chapel Hill
Department of Environment, Health & Safety
1120 Estes Drive Ext., CB# 1650
Chapel Hill, North Carolina 27599-1650

May 27, 2016

Ms. Janet K. Macdonald
NC DEQ Division of Waste Management
Inactive Hazardous Sites Branch
217 West Jones Street
Raleigh, North Carolina 27603

Subject: **Remedial Investigation Report**
UNC Cogeneration Facility
Chapel Hill, Orange County, NC
Site ID No. NCR000010272

Dear Ms. Macdonald:

Attached for your review is the Remedial Investigation Report for the subject site. Geosyntec Consultants of NC, PC, the Registered Environmental Consultant for the site, prepared the document.

Please contact me at (919) 843-5913 if you have any questions. Thank you.

Sincerely,

Mary Beth Koza
Director, Environment, Health and Safety

Attachment

Cc: Larry Daw, UNC-CH
Daniel Elliott, Geosyntec
Eric Nesbit, Geosyntec

REC PROGRAM DOCUMENT CERTIFICATION FORM - PAGE 1 OF 2
IHSB SITE NAME UNC Cogeneration Facility. Site ID No. NCR000010272
DATE & NAME OF DOCUMENT May 2016
TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

REMEDIATING PARTY DOCUMENT CERTIFICATION STATEMENT (.0306(B)(2))

"I certify under penalty of law that I have personally examined and am familiar with the information contained in this submittal, including any and all documents accompanying this certification, and that, based on my inquiry of those individuals immediately responsible for obtaining the information, the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

Mary Beth Koza
Name of Remediating Party

Mary Beth Koza
Signature of Remediating Party

24 May 2016
Date

NOTARIZATION

North Carolina (Enter State)

Alamance **COUNTY**

I, Amy Butler, a Notary Public of said County and State, do hereby certify that Mary Beth Koza did personally appear and sign before me this day, produced proper identification in the form of NCDL, was duly sworn or affirmed, and declared that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 24th day of May 2016.

Amy Butler
Notary Public (signature)

(OFFICIAL SEAL)

Amy Butler
Notary Public
Alamance County
North Carolina

My commission expires: May 28, 2017

Document Certification Form No. DC - I
(Revised 8/11)

REC PROGRAM DOCUMENT CERTIFICATION FORM - PAGE 2 OF 2
IHSB SITE NAME _UNC Cogeneration Facility, Site ID No. NCR000010272_____
DATE & NAME OF DOCUMENT May 2016
TYPE OF SUBMITTAL (circle all that apply): Report, Work plan, Work Phase Comp. Statement, Schedule Change

REGISTERED SITE MANAGER CERTIFICATION OF SIGNATURES

As the Registered Environmental Consultant for the Site for which this filing is made, I certify that the signatures included herewith are genuine and authentic original handwritten signatures and/or true, accurate, and complete copies of the genuine and authentic original handwritten signatures of the persons who purport to sign for this filing. I further certify that I have collected through reliable means the originals and/or copies of said signatures from the persons authorized to sign for this filing who, in fact, signed the originals thereof. Those persons and I understand and agree that any copies of signatures have the same legally binding effect as original handwritten signatures, and I certify that any person for whom I am submitting a copy of their signature has provided me with their express consent to submit said copy. Additionally, I certify that I am authorized to attest to the genuineness and authenticity of the signatures, both originals and any copies, being submitted herewith and that by signing below, I do in fact attest to the genuineness and authenticity of all the signatures, both originals and copies, being submitted for this filing.

__Eric Nesbit_____
Name of Registered Site Manager

Signature of Registered Site Manager

27 MAY 2016
Date

REGISTERED SITE MANAGER DOCUMENT CERTIFICATION STATEMENT (.0306(b)(1))

"I certify under penalty of law that I am personally familiar with the information contained in this submittal, including any and all supporting documents accompanying this certification, and that the material and information contained herein is, to the best of my knowledge and belief, true, accurate and complete and complies with the Inactive Hazardous Sites Response Act N.C.G.S. 130A-310, et seq, and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information."

__Eric Nesbit_____
Name of Registered Site Manager

Signature of Registered Site Manager

27 May 2016
Date

NOTARIZATION

NC (Enter State)

WAKE COUNTY

I, MICHELLE MADLALA, a Notary Public of said County and State, do hereby certify that ERIC NESBIT did personally appear and sign before me this day, produced proper identification in the form of NCDL, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certifications is true and accurate, and he or she then signed these Certifications in my presence.

WITNESS my hand and official seal this 27th day of _May__, 2016.

Michelle M. Madlala
Notary Public (signature)

(OFFICIAL SEAL)

MICHELLE M. MADLALA
Notary Public
Wake County
My Commission Expires
09/17/2020
NORTH CAROLINA

My commission expires: 09/17/2020

Document Certification Form No. DC - II
(Revised 8/11)

REMEDIAL INVESTIGATION COMPLETION CERTIFICATION
15A NCAC 13C.0306(b)(5)(B)

Media (check all that apply): ☒ All Media ☐ Soil ☐ Ground water ☐ Surface water ☐ Sediment

REC is in compliance with both 15A NCAC 13C .0305(b)(2) and .0305(b)(3): [check] ☒

Site Name	UNC Cogeneration Facility	Street Address	575 West Cameron Ave
County	Orange County		Chapel Hill, NC
Site ID No.	NCR000010272		

The remedial investigation, which is the subject of this certification has, to the best of my knowledge, been completed in compliance with the Inactive Hazardous Sites Response Act N.C.G.S. 130A-310, et seq. and the remedial action program Rules 15A NCAC 13C .0300. I am aware that there are significant penalties for willfully submitting false, inaccurate or incomplete information.

RSM Signature

27 May 2016
Date

Eric Nesbit
RSM Name

Geosyntec Consultants of NC, PC
REC Name

00128
REC No.

2501 Blue Ridge Rd, Ste 430
Mailing Address

Raleigh, NC 27607
City, State, ZIP

NOTARIZATION

NC (Enter State)

WAKE **COUNTY**

I, MICHELLE MADLALA, a Notary Public of said County and State, do hereby certify that Eric Nesbit did personally appear and sign before me this day, produced proper identification in the form of NC DRIVERS LICENSE, was duly sworn or affirmed, and declared that, he or she is the duly authorized environmental consultant of the remediating party of the property referenced above and that, to the best of his or her knowledge and belief, after thorough investigation, the information contained in the above certification is true and accurate, and he or she then signed this Certification in my presence.

WITNESS my hand and official seal this 27th day of May, 2016.

Michelle Madlala
Notary Public (signature)

(OFFICIAL SEAL)

MICHELLE M. MADLALA
Notary Public
Wake County
My Commission Expires
09/17/2020
NORTH CAROLINA

My commission expires: 09/17/2020

Work Phase Completion Form No. WPC – II
(Revised 12/13)

Prepared for

The University of North Carolina at Chapel Hill
Department of Environment, Health and Safety
1120 Estes Drive Extension, CB# 1650
Chapel Hill, North Carolina 27599-1650

REMEDIAL INVESTIGATION REPORT

COGENERATION FACILITY
THE UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL
CHAPEL HILL, NORTH CAROLINA
SITE ID# NCR000010272

Prepared by

Geosyntec consultants

engineers | scientists | innovators

Geosyntec Consultants of NC, PC
2501 Blue Ridge Road, Suite 430
Raleigh, NC 27607

Project Number GN5219

May 2016

Geosyntec
consultants

I, Eric Nesbit, a Professional Engineer for Geosyntec Consultants of NC, PC do certify that the information in this report is correct and accurate to the best of my knowledge.

NORTH CAROLINA PROFESSIONAL SEAL 022217 ENGINEER ERIC C. NESBIT

27 MAY 2016

Geosyntec Consultants of NC, PC is licensed to practice engineering in North Carolina. The certification number (Firm's License Number) is C-3500.

Geosyntec Consultants of NC, PC is licensed to practice geology in North Carolina. The certification number (Firm's License Number) is C-295.

Geosyntec consultants

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1. INTRODUCTION

On behalf of The University of North Carolina at Chapel Hill (UNC-CH or University), Geosyntec Consultants of NC, PC (Geosyntec) has prepared this Remedial Investigation Report (RIR) for UNC-CH's Cogeneration Facility located at 575 West Cameron Avenue, Chapel Hill, North Carolina. On September 3, 2010, UNC-CH submitted a *Notification of an Inactive Hazardous Substance or Waste Disposal Site* to the North Carolina Department of Environmental Quality's (NCDEQ) Inactive Hazardous Waste Sites Branch (IHSB). The University submitted this notification after it encountered soils suspected of containing coal combustion by-products (CCBs) during excavation activities associated with the construction of a new warehouse building for the UNC-CH Cogeneration Facility (the Facility or Site). **Figure 1** depicts the Facility or Site location in a mixed residential / light commercial area just west of the main UNC-CH campus.

UNC-CH entered into an Administrative Agreement (AA) dated May 29, 2013 with NCDEQ to enroll the Site into the Registered Environmental Consultant (REC) program, the voluntary cleanup program in the IHSB. Pursuant to the REC program, the remediating party contracts with an IHSB-approved environmental consulting firm to direct, implement, regulate, and certify that all investigation and remediation work is performed in compliance with the program regulations found under Title 15A of the North Carolina Administrative Code, Subchapter 13C .0300 (15A NCAC 13C .0300).

UNC-CH contracted with Geosyntec, an approved REC consultant, to conduct a remedial investigation. The objectives of the remedial investigation were to: (i) identify all releases of hazardous substances to the environment, (ii) identify potential exposure pathways, (iii) characterize the chemical nature of such releases and collect sufficient sampling data to support a cleanup-level determination, (iv) delineate the areal and vertical extent of contamination, and (v) characterize site conditions sufficiently to conduct a feasibility study of remedial alternatives and to support a proposed remedy.

This Remedial Investigation Report documents the findings of the investigation. The remainder of this Introduction presents the background on the discovery of CCBs in Site soils and provides an overview of the organization of this RIR.

1.1 Background

In early June 2010, a construction contractor was removing a portion of a sheet-pile wall to facilitate construction of a new warehouse and exposed soils in the excavation containing suspect material. UNC-CH's previous environmental consultant described the suspect material as fine grained, dark grey to black material with some coal fragments. At the time, Piedmont Geologic, UNC-CH's environmental consultant, believed the material to be ash or coal dust or a combination of the two. The suspect material was later confirmed to be CCBs. Mactec Engineering & Consulting and Piedmont Geologic, UNC-CH's environmental consultants, collected characterization samples in June and July 2010 and submitted the samples for laboratory analysis. The sample results included polycyclic aromatic hydrocarbons (PAHs), metals, and dioxins in soils elevated above the IHSBs Preliminary Soil Remediation Goals (PSRGs).

Excavation and offsite disposal of CCB-impacted soils was conducted by Mid Atlantic Associates and its remedial subcontractor from late 2010 to early 2011. Approximately 4,200 tons of impacted soil was removed during this excavation and disposed of offsite in accordance with applicable state and federal requirements as non-hazardous waste at the Republic Services Incorporated Uwharrie Landfill in Uwharrie, North Carolina. CCB-impacted soil was still visible along excavation sidewalls following the termination of excavation activities.

Piedmont Geologic installed one temporary groundwater monitoring well in late 2010 proximate to the excavation where the CCBs were observed. Groundwater samples contained elevated concentrations of some metals that Piedmont Geologic attributed to high turbidity. Piedmont Geologic collected these groundwater samples using the traditional three volume purge method, as opposed to the preferred low-flow technique, which could have contributed to elevated turbidity. In addition, the total toxic equivalency (TEQ) for dioxins/furans in groundwater was above the NCAC 2L Groundwater Standards. According to NCDEQ's *Registered Environmental Consultant Program Implementation Guidance,* the TEQ is defined as summed products of the dioxin and furan congener concentrations multiplied by their respective toxic equivalency factors (TEF). Piedmont Geologic decommissioned the temporary well after resampling. The well was not purged prior to resampling.

In the summer of 2012, UNC-CH contracted with Geosyntec to complete the Remedial Investigation (RI) within the regulatory framework of the REC program.

Extensive supplemental background information can be found in the previously certified and submitted *Work Plan for Remedial Investigation* and the *Work Plan Addendum for Remedial Investigation*. These two documents further frame and provide context for the nature and extent of the RI. These two documents can be accessed via NCDEQ's CARA[3] internet portal. The reference ID for this project is "NCR000010272".

Figure 2 provides a representative current layout of the Facility or Site. Certain relevant historical features (e.g., former fly ash basin and silt basin locations) are shown as well.

1.2 Site Setting

The Site is located within the piedmont physiographic province. The topography of the piedmont is generally characterized by gently rolling hills. Historical topographic maps of the Site show a natural depression or ravine in the southern portion of the Site. By 1940, a dam was constructed across the ravine to create a fly ash basin for the predecessor plant's use. No records were reviewed that suggested when the fly ash basin was decommissioned and filled in, but it is likely that this occurred just before the former above ground fuel oil tanks were added around 1960. Over the years, change (i.e., excavating, filling and grading) has occurred at the Facility specifically in the southern portion within the area of concern to accommodate Facility improvements (e.g., replacement of the predecessor plant by the current Cogeneration facility, etc.). Prior to construction of the warehouse in 2010 / 2011, the University completed the last major renovation of the Site in 1992, which involved commissioning of the current Cogeneration facility. Since then, the topography of the southern portion of the site has remained relatively unchanged.

Cunningham and Daniel (2001) describe the soil to bedrock relationship conceptually as a series of layers from the ground surface down to bedrock. Cunningham and Daniel suggest the soil generally can be partitioned into an unsaturated zone above the shallow groundwater table, a saturated zone below the groundwater table, a transition zone between saprolite and bedrock, and finally fractured crystalline bedrock. From the ground surface, soil is often a thin layer of unconsolidated material above saprolite. Saprolite is derived from in-place weathering bedrock and is typically rich in clay. The transition zone consists of partially weathered bedrock and decreasing amounts of saprolite lying just above competent bedrock.

1.3 Report Organization

This report is organized into the following sections:

- **Section 2** – Field Methodology: This section summarizes the methodologies and procedures (including any variances from the work plan and work plan addendum) employed during the investigation;

- **Section 3** – Investigation Results and Findings: The results of the investigation of assessed media are summarized in this section;

- **Section 4** – Potential Receptors: In this section, information about potential receptors is discussed;

- **Section 5 –** Identification of Contaminants of Concern and Derivation of Remediation Goals: In this section, a summary of the Contaminants of Concern (COCs) based on the screening conducted as part of the RI and derivation of Remediation Goals for all media are presented;

- **Section 6 –** Conclusions: This section provides conclusions for the evaluated media based on the results of the RI and established remedial goals; and;

- **Section 7 –** References.

2. FIELD METHODOLOGY

Geosyntec conducted RI field activities in 2013 (October), 2014 (February, March, August, September, October, and November), and 2015 (January, April and November). The methodologies employed are described in further detail below by topic. A photographic log of the various phases and aspects of the investigation is presented in **Appendix A.**

Geosyntec conducted activities in general accordance with the project and community Health and Safety Plan submitted with the *Work Plan for Remedial Investigation*.

Process or procedural variations from the *Work Plan for Remedial Investigation* and the *Work Plan Addendum for Remedial Investigation* include:

- Incremental Sampling Methodology (ISM) was not used to assess surface soils outside of the Facility's property boundary due to the minimal amount of CCBs encountered outside of the Facility's boundary. The discrete sampling and conformational borings adequately characterized the CCBs encountered outside of the Facility's boundary.

- The "decision unit" sampled by ISM was only one foot thick (as opposed to two feet thick) to match the U. S. Environmental Protection Agency (USEPA) Region IV's definition of surface soil as from ground surface to one foot below grade.

- *De minimis* to trace amounts of CCBs encountered during the Tiered Visual Assessment dictated the interpretation of the absence of CCBs.

- Tentatively identified compounds (TICs) are not applicable to the analytical methods used.

- Only monitoring wells where CCBs were located (MW-3) were double cased.

2.1 Soil Investigation

Geosyntec assessed the surface and subsurface soils independently due to the inherently unique exposure scenarios between surface and subsurface soil. For this investigation surface soil was defined as 0 to 1 foot below grade (consistent with USEPA Region IV's definition of surface soil). Subsurface soil was defined as all soil deeper than 1 foot below

grade. Geosyntec assessed the accessible, shallow surface soil within the Facility's property using ISM as described in the *Work Plan.* The Interstate Technology & Regulatory Council (ITRC) developed the ISM (a structured sampling approach designed to increase sample representativeness while reducing data variability). Geosyntec assessed subsurface soil by employing a tiered visual assessment method paired with grab samples for characterization or confirmation. Soil boring locations for subsurface soil samples and the "decision unit" area for surface soil sampling are shown in **Figure 3** for reference. The methodologies used are presented below.

2.1.1 Tiered Visual Assessment

Geosyntec performed a three-tiered visual inspection in the field to determine the presence or absence of CCBs. The specifics of each tier are discussed below.

Tier 1 - Initial Inspection

Along with photographing and recording the lithology, Geosyntec observed the entire soil core for the presence of CCBs. Geosyntec assessed evidence of CCBs by comparing the texture or grain size distribution, color and evidence of an "ash-like" smear when applied to paper. Geosyntec compared the soil to reference samples of CCB-containing material. The reference sample of CCB containing material was collected from CCB containing soil left in place during the warehouse excavation. A reference sample of fly ash was also obtained from the current Cogeneration plant. If Geosyntec determined that CCBs were present during the Tier I inspection, additional visual assessment was not required. Instead, Geosyntec collected representative samples for analytical testing. If Geosyntec did not determine CCBs were present, then Geosyntec collected samples from locations along the soil core where the Tier 1 inspection was inconclusive. These samples were subjected to the Tier 2 inspection.

Tier 2 - Hand Lens Inspection

Geosyntec inspected samples under an 8 or 10 times magnification hand lens in Tier 2. Each Tier 2 sample that Geosyntec collected was first dried under a heat lamp and disaggregated. Geosyntec removed large pieces of organic matter. Geosyntec then processed the sample by placing it on a white sheet of paper for inspection under the hand lens. Geosyntec inspected the samples and visually compared them to the reference samples. Comparison of the samples to these reference materials or "baseline standards"

facilitated the determination of CCB impacts. If Geosyntec concluded that CCBs were present, additional visual assessment was not required. Rather, Geosyntec collected representative samples for analytical analysis. If the samples were still inconclusive, then the sample was further assessed by the Tier 3 analysis.

Tier 3 Stereoscopic Inspection

Geosyntec assessed subsamples that were inconclusive during the Tier 2 inspection under an estimated 40 times magnification stereo-microscope. Again, comparison of the subsamples to reference samples under the stereo-microscope facilitated the determination of CCB impacts. If Geosyntec concluded that CCBs were present, characterization samples were collected. If Geosyntec determined that CCBs were not present, Geosyntec collected representative samples for analytical confirmation.

Verification Samples

Geosyntec collected verification samples at key stages to assess the reliability of the tiered visual assessment method. Geosyntec collected a total of four verification samples that were representative of the following conditions: (1) soil grossly impacted with CCBs and clearly visible during Tier 1; (2) soil with CCBs identified by the hand lens during Tier 2; (3) soil with CCBs identified only by the stereo-microscope during Tier 3; and (4) soil determined to be free of CCBs during Tier 3 under the stereo-microscope.

Geosyntec sent one sample of each of the four above conditions to MicroVision Laboratories (Chelmsford, MA) overnight under chain of custody procedures. MicroVision analyzed the verification samples using their "Coal / Coal Ash Analysis" standard operating procedure. MicroVision's analysis uses a combination of microscopy techniques to determine if coal, coal ash, wood ash, asphalt, tar and fly ash are present in soil samples. MicroVision's analysis is a tiered assessment and was the basis for Geosyntec's field scale tiered visual assessment. MicroVision's analysis has been used by environmental professionals in the north eastern United States since 1999 and includes a preliminary inspection, stereoscopic examination, polarized light microscopy, scanning electron microscope examination, and energy dispersive spectroscopy.

2.1.2 Subsurface Soil Assessment

The subsurface soil assessment had three primary focus areas: the area within the fenced property boundary of the facility, along McCauley Street south of the facility, and two

undeveloped lots owned by UNC-CH to the south of McCauley Street. The section of McCauley Street located south of the Cogeneration Plant is unpaved and has been constructed using fill materials.

The subsurface soil assessment within the Site's property boundary followed USEPA's Triad sampling methodology as described in the *Work Plan*. The Triad methodology emphasizes systematic project planning, dynamic work strategies, and rapid sampling and analytical approaches to enhance efficiency, compress investigation timeframes, and reduce costs. Within the Facility's property boundary, Geosyntec advanced soil borings by either a direct push technology (DPT) rig or by hand auger. Geosyntec advanced each boring until native soil was observed or refusal was reached. Geosyntec conducted continuous soil core retrieval at each location so that the entire soil core could be observed prior to collecting samples. Geosyntec recorded the soil lithology, and the boring was observed for the presence of CCBs along its entire length. Geosyntec used a tiered visual assessment to determine the presence of CCBs. The results of the tiered visual assessment are discussed further below. If Geosyntec determined that CCBs were present, delineation continued by "stepping out" from the impacted location until soil with *de minimis* to trace amounts or free of CCBs was located. If CCBs were absent or *de minimis* to trace amounts were found, Geosyntec continued delineation by "stepping in" towards impacted locations to further refine or delineate the horizontal and vertical limits of CCBs in the subsurface.

The subsurface soil assessment along McCauley Street was limited to the portion of roadway constructed of fill (i.e., the portion directly behind and bordering the Site). Geosyntec advanced five evenly spaced borings using a sonic rig in the east-bound lane of McCauley Street. Geosyntec advanced the borings until native soil was observed or refusal was reached. Geosyntec retrieved continuous soil cores at each location. Geosyntec recorded the soil lithology and observed the boring for the presence of CCBs along its entire length. Geosyntec used the tiered visual assessment to determine the presence or absence of CCBs.

The subsurface soil assessment on the two UNC-CH owned lots south of McCauley Street focused on the creek transecting the lots (see **Figure 3**). Recognizing that historical Site operations and maintenance processes including storm water management had the potential to transport CCBs downstream via the creek, the subsurface soil assessment targeted the floodplain of the creek. Geosyntec advanced these borings with a hand auger until either the water table or refusal was reached. Geosyntec retrieved continuous soil

cores at each location. Geosyntec recorded the soil lithology and observed the boring for the presence or absence of CCBs along its entire length using tiered visual assessment. The soil boring logs are presented in **Appendix B**.

Geosyntec decontaminated sampling equipment prior to re-using at the next borehole. Equipment was either decontaminated with an environmental grade detergent (Liquinox™) and water or in the case of the McCauley Street borings (due to the unique sonic drilling process) were wiped clean and rinsed with water.

2.1.3 Subsurface Analytical Samples

Geosyntec analyzed a subset of the samples (based on professional judgement) collected during delineation for chemical characterization purposes. Geosyntec collected discrete samples following the completion of the tiered visual assessment for select borings. Generally, Geosyntec collected these samples along the depth interval with the highest apparent CCB impacts as interpreted during the tiered visual assessment.

Representative borings that Geosyntec interpreted to be absent of CCBs based on the tiered visual assessment were sampled for confirmation. Geosyntec collected samples of these borings at a depth interval consistent with the deepest apparent impact of CCBs observed in the nearest impacted boring.

Geosyntec sent both the characterization and confirmation samples to Test America Laboratories in laboratory supplied and preserved containers, on ice, overnight under chain of custody procedures. Test America Laboratories analyzed the samples for the following:

- USEPA Method 6010C (select metals);
- USEPA Method 7470A (mercury);
- USEPA Method 8270D SIM (PAHs); and
- USEPA Method 8290 (dioxins / furans)

To assess site-specific leachability, Test America Laboratories analyzed two visually impacted samples using USEPA's Synthetic Precipitation Leaching Procedure (SPLP),

Method 1312. Once subjected to the SPLP protocol, Test Laboratories America analyzed the supernatant for the following:

- USEPA Method 6010C (select metals);
- USEPA Method 7470A (mercury); and
- USEPA Method 8270D SIM (PAHs)

2.1.4 Determination of Background Soil Concentrations

The initial soil investigation dataset contained exceedances for certain metals [aluminum (Al), arsenic (As), barium (Ba), cobalt (Co), iron (Fe), manganese (Mn), mercury (Hg), selenium (Se), thallium (Tl), vanadium (V)] when screened against the REC program's Preliminary Soil remediation Goals (PSRGs). A statistical evaluation of these results suggested that many of the exceedances may be within natural background levels. The REC program allows for the evaluation of natural background concentrations to establish final soil Remediation Goals for metals. Therefore, Geosyntec collected additional soil samples to establish site-specific background concentrations.

Geosyntec advanced ten additional soil borings by DPT in locations outside of the initial "area of concern" at locations presumed to be absent of CCBs, and which would be representative of Site background conditions. **Figure 4** documents the locations of these background boring locations. Geosyntec advanced borings to the point where the field engineer / geologist was certain that the boring was in native soil (not fill). Geosyntec conducted continuous soil core retrieval at each location. Geosyntec recorded the soil lithology and observed the boring for the presence of CCBs along its entire length. Then, Geosyntec collected one grab sample per boring from an interval of native soil.

Geosyntec decontaminated sampling equipment prior to re-using at the next borehole with an environmental grade detergent (Liquinox™) and water bath.

Geosyntec sent the background soil samples to Test America Laboratories on ice, overnight under chain of custody procedures, and Test America Laboratories analyzed the samples using USEPA Method 6010C.

2.1.5 Surface Soil Assessment

ITRC defines a "decision unit" as a volume of soil for which a decision will be made based on the soil sampling results. Based on the observations of the preceding subsurface soil assessment, Geosyntec selected the boundaries of a "decision unit" to coincide with the horizontal limits of the subsurface CCB impacts within the facility's property boundary. Geosyntec did not use ISM to characterize the shallow soil on the two UNC-CH owned lots south of McCauley Street because the small isolated pockets of CCB impacts found were adequately characterized by discrete borings and analytical samples.

The horizontal limits of the "decision unit" were laid out to sample the accessible shallow soil within the impacted area (as determined by the preceding subsurface soil assessment). Geosyntec did not include areas covered by asphalt or concrete or other obstructions and areas determined to be absent of subsurface CCBs in the "decision unit." The "decision unit" as sampled is depicted in **Figure 3**.

Prior to mobilizing to the field, Geosyntec divided the "decision unit" into at least 30 areas (grids) of equal size. Geosyntec then selected random locations within each grid for collection of a soil increment or subsample. In the field, Geosyntec mapped each soil increment location and collected a soil increment (i.e., a sample). Geosyntec used a manual coring device to collect an increment. Geosyntec collected a minimum of 30 soil increments across the "decision unit" and composited them together into one ISM sample. Consistent with ITRC guidance, Geosyntec laid out a new grid network across the "decision unit" and incrementally sampled again. In total, Geosyntec conducted three replicate ISM samples.

Geosyntec decontaminated the sampling equipment with an environmental grade detergent (Liquinox™) and water in between replicate samples.

Geosyntec sent the ISM samples to Test America Laboratories (Denver, CO) with minimal handling, on ice, overnight under chain of custody procedures.

Prior to analyzing, Test America Laboratories performed predetermined, prescribed ISM specific processing laboratory procedures applicable to the project COCs. After completing the laboratory ISM processing procedures, Test America Laboratories analyzed the samples for the following:

- USEPA Method 6010C (select metals);

- USEPA Method 7470A (mercury);
- USEPA Method 8270D SIM (select semi-volatile organic compounds); and
- USEPA Method 8290 (dioxins / furans)

2.2 Groundwater Investigation

The initial soil investigation dataset confirmed the presence of CCBs in the "area of concern." Initially, Geosyntec assumed the groundwater flow direction to be generally from the north to the south towards a creek cutting across the south east corner of the Facility and onto the two University-owned lots south of McCauley Street. Geosyntec installed four monitoring wells to assess groundwater quality based on the presumptive groundwater flow direction as well as the initial results of the soil investigation. Geosyntec installed one up-gradient monitoring well (MW-1), one side-gradient monitoring well (MW-4) and two source area monitoring wells (MW-2 and MW-3) as shown on **Figure 3**. Later, Geosyntec installed a down-gradient well (MW-5) on one of the University-owned lots south of McCauley Street. The methodology for installation of the wells, well development and groundwater sampling is presented in the following subsections.

2.2.1 Monitoring Well Installation and Development

A certified North Carolina well contractor under the direct supervision of Geosyntec's field engineer / geologist installed monitoring wells in the overburden by hollow stem auger (HSA) and/or air rotary methods. Geosyntec used DPT or split spoon sampling in advance of HSA or air rotary methods to record the lithology and inspect for CCBs. The borings at MW-1 and MW 4 did not contain CCBs; therefore, Geosyntec constructed the wells as single cased wells. At MW-2, the amount of CCBs Geosyntec encountered was *de minimis*; Geosyntec therefore constructed the well as a single cased well. MW-3 contained CCBs, so Geosyntec installed a 6-inch outer permanent PVC surface casing to 22 feet below ground surface (bgs) to seal off the overburden and mitigate potential cross-contamination or migration of contaminants. Geosyntec allowed the outer casing at MW-3 to cure for more than 24 hours before completing the well. Geosyntec constructed all wells of two-inch PVC casing and screen (0.01 inch slot). Geosyntec allowed the bentonite seals to hydrate for approximately one hour prior to grouting.

Geosyntec installed MW-5 during a second mobilization by HSA methods as well. Because Geosyntec observed no CCBs during installation, Geosyntec also installed MW-5 as a single cased, two inch diameter PVC well. Geosyntec used DPT initially to record the lithology and inspect for the presence of CCBs.

Construction logs for the wells are presented in **Appendix C**.

Geosyntec decontaminated the auger flights and other equipment with a pressure washer and hot soapy water and rinse prior to re-using at the next borehole.

Geosyntec developed the wells after allowing the newly installed wells to settle at least overnight following grouting. Geosyntec performed well development by either pumping alone or alternating the use of a surge block with pumping depending upon well yield and degree of turbidity. The well development logs for the five wells are presented in **Appendix D**.

2.2.2 Groundwater Assessment

Prior to initiating groundwater sampling, Geosyntec gauged the monitoring wells to measure the depth to groundwater and determine the shallow groundwater flow direction across the "area of concern".

Geosyntec then purged and sampled each well using a "low flow" method. If Geosyntec considered drawdown in the well excessive during purging, Geosyntec used the traditional multiple well volume method. Geosyntec used a bladder pump to purge and sample MW-1 and MW-4 (due to the water depth in the well casing) while using a peristaltic pump to purge and sample MW-2, MW-3 and MW-5. Following stabilization of field parameters including turbidity, pH, conductivity, oxidation-reduction potential (ORP), and dissolved oxygen, Geosyntec collected unfiltered groundwater samples for analysis. The purge logs at each well for four separate sampling events are presented in **Appendix E**.

Geosyntec used dedicated tubing (and bladders where necessary) for each monitoring well consistently since the first groundwater sampling event. Geosyntec disassembled the bladder pump between each well and decontaminated the pump with soapy water and water bath between wells.

Geosyntec sent groundwater samples to Test America Laboratories in laboratory supplied and preserved containers, on ice, overnight under chain of custody procedures. Test America Laboratories analyzed the samples for the following:

- USEPA Method 6010C (select metals);
- USEPA Method 7470A (mercury);
- USEPA Method 8270D SIM (select semi-volatile organic compounds);
- USEPA Method 8290 (dioxins / furans);
- USEPA Method 9034 (sulfide);
- USEPA Method 9056A (sulfate);
- SM 2320 (alkalinity);
- SM 2540C (total dissolved solids), and;
- SM 2540D (total suspended solids).

2.3 Sediment and Surface Water Investigation

The REC program requires in-stream sediment concentrations to be protective of human health and potential ecological receptors. Sediment may not leach constituents to groundwater and / or surface water above their applicable standards. If initial sediment concentrations exceed any of the above screening criteria, the REC program requires a written request to be submitted to the NCDEQ for direction. In response, NCDEQ may require an ecological risk assessment and / or allowable adjustments to the preliminary remediation goals. Ultimately, NCDEQ will assist in establishing site specific, final Remediation Goals for sediment and surface water.

Because Geosyntec observed CCBs in soil boring SB-24 and detected CCB-related constituents (e.g. metals, polycyclic aromatic hydrocarbons (PAHs), etc.) in soil borings SB-25 and SB-26, Geosyntec sampled surface water and sediments in the creek to assess the extent of potential CCB impacts in these media. Geosyntec sampled only portions of the creek on University- owned property. Sediment (denoted “SED”) and co-located

surface water (denoted "SW") sample locations are shown in **Figure 3**. Geosyntec collected "SED-1 / SW-1" upstream of the area of concern to establish natural or anthropogenic conditions prior to entering the Site. Geosyntec collected "SED-2 / SW-2" to establish sediment and surface water conditions being transported onto University-owned property. Geosyntec collected"SED-3 / SW-3" to establish sediment and surface water quality potentially being transported off University-owned property.

Geosyntec later re-sampled the most down gradient location "SED-3 / SW-3" (labeled as "SED-3R / SW-3R"), as close as possible to the original location and in the same manner, to confirm the presence of CCB related constituents.

Geosyntec collected samples from downstream to upstream so as not influence subsequent downstream sample results from disturbance of the creek bed upstream.

Geosyntec collected surface water samples prior to sediment samples. Prior to surface water sampling, Geosyntec collected standard water quality parameters with a calibrated water quality instrument and a turbidity meter at locations SW-2 and SW-3. Geosyntec collected surface water samples with a peristaltic pump and with new disposable tubing at each of the three surface water locations. Geosyntec collected surface water samples directly into laboratory supplied and preserved sample containers.

Geosyntec sent surface water samples to Test America Laboratories in laboratory supplied and preserved containers, on ice, overnight under chain of custody procedures. Test America Laboratories analyzed the samples for the following:

- USEPA Method 6010C (select metals);
- USEPA Method 7470A (mercury);
- USEPA Method 8270D SIM (select semi-volatile organic compounds);
- USEPA Method 8290 (dioxins / furans), and;
- USEPA Method 9056A (sulfate);

Geosyntec collected sediment samples with a decontaminated stainless steel scoop. Geosyntec collected samples from the base of the creek bed to approximately six inches below the stream bottom in locations of depositional features. These locations would be

expected to exhibit a greater likelihood of sediment deposition in the stream course. Geosyntec then homogenized the samples in a decontaminated stainless steel bowl prior to placing the sample in laboratory supplied and preserved containers.

Geosyntec sent sediment samples to Test America Laboratories on ice, overnight under chain of custody procedures. Test America Laboratories analyzed the samples for the following:

- USEPA Method 6010C (select metals);
- USEPA Method 7470A (mercury);
- USEPA Method 8270D SIM (select semi-volatile organic compounds), and;
- USEPA Method 8290 (dioxins / furans)

2.4 Quality Assurance / Quality Control

Geosyntec prepared a Quality Assurance Project Plan (QAPP) as an appendix to the *Work Plan* and *Work Plan Addendum.* Geosyntec prepared the QAPP using USEPA's Guidance for QAPPs in advance of initiating any fieldwork. The investigation of all media generally followed the REC Program Implementation Guidance; USEPA Region IV Science and Ecosystem Support Division's (SESD) applicable operating procedures, Geosyntec's *Work Plan* and Geosyntec's *Work Plan Addendum* and the project QAPP. Variations have been recorded herein.

Geosyntec collected field quality assurance / quality control (QA /QC) samples throughout the RI. In general, the QA / QC samples included blind duplicate samples, equipment rinseate samples, matrix spike and matrix spike duplicate samples. Geosyntec submitted the field QA / QC blind duplicate and rinseate samples with their corresponding primary samples for analysis of the same analytical parameters. Laboratory QA / QC samples included method blanks, laboratory controls, matrix spike and matrix spike duplicates.

Geosyntec personnel performed Stage 2A data validation on the majority of groundwater, sediment and surface water samples. Data validation refers to USEPA directed processes and procedures to evaluate the laboratory data received for completeness and usability

with respect to project goals and objectives. Data validation processes and procedures are analyte and sample specific.

2.5 Surveying

In preparation for the *Work Plan*, a North Carolina-licensed professional surveyor prepared a site survey plat. The horizontal coordinates were tied to the North American Datum of 1983 consistent with other UNC-CH projects at the Facility.

Geosyntec flagged individual soil borings and sediment / surface water sample locations in the field following each field event and/or located with a global positioning system (GPS) unit to capture their horizontal coordinates. Geosyntec incorporated the coordinates for each soil, sediment and surface water sample into the project's geographic information system (GIS) database.

The project surveyor surveyed the monitoring well locations for horizontal and vertical control. The surveyor tied the top of casing for each well to the North American Vertical Datum of 1988. An updated version of site survey plat is presented in **Appendix F**.

2.6 Investigation Derived Waste

Geosyntec stored soil investigation derived waste (IDW) in one-cubic yard cardboard boxes or 55-gallon, steel drums and labeled pending waste profiling and ultimately transportation and disposal. EVO Corporation in Winston-Salem, NC disposed of soil IDW as non-hazardous. EVO picked up five boxes on October 22, 2014, and on June 24, 2015, two more drums for disposal. Copies of both manifests are provided in **Appendix G**.

Geosyntec incorporated all IDW water generated (during decontamination processes, well development or purging prior to sampling) into the UNC-CH Cogeneration facility's onsite waste water treatment unit prior to being disposed of via Orange Water and Sewer Authority's sanitary sewer.

3. INVESTIGATION RESULTS

The following sections document the findings of the RI based on the investigations conducted pursuant to the procedures and methodologies described in Section 2. They include descriptions of the Site geology, hydrogeology, and a summary of the results from sampling environmental media including soils, groundwater, sediments, and surface water on Site and the University-owned parcels below McCauley Street.

Neither the community nor project personnel reported any health and safety incidents leading to an unacceptable exposure during the course of the investigation.

3.1 Geologic Conditions

Geosyntec advanced 57 soil borings ranging in total depth from 1 to 39 feet bgs. During the course of the soil investigation on the Facility property, interbedded layers of clays / silt and sand with isolated pockets or layers of CCBs were present above generally clayey sand to sandy clay media. Geosyntec interpreted the layers of clay / silt and sand with CCBs present to be imported fill areas. Geosyntec interpreted the clayey sand to sand clay media below the fill as native soils.

On one of the University-owned lots south of McCauley Street, Geosyntec encountered two isolated, subsurface CCBs deposits in areas of the creek's floodplain where deposition during high water events likely occurs.

Geosyntec did not encounter bedrock during the assessment. Bedrock at the Site is described as granite with dark green amphiboles and biotite according to Bradley, Phillips, Gay and Fuemmeler (2004). Well construction records from two onsite water supply wells installed in 1977 document bedrock at 80 and 83 feet below ground surface. The bedrock was described as brown, red and blue granite (Heater Well Company, 1977).

Figures 5 through **8** are conceptual cross sectional views of the assessed areas.

3.2 Hydrogeological Conditions

Geosyntec installed five monitoring wells screened in the soil overburden. Geosyntec collected groundwater elevation data four times during the course of the remedial investigation to evaluate groundwater flow direction. **Table 1** documents well construction details, the recorded depth to water level measurements, and the

corresponding water table elevations. The shallow groundwater table over the majority of the Site ranges from 15 to 32 feet bgs. **Figures 9 -12** are the resulting potentiometric surface maps for each event. Each event confirms the assumed hydraulic gradient (from north to south toward the creek). The average horizontal hydraulic gradient is 0.06 feet of drop or reduction in elevation per foot of horizontal distance from MW-1 to MW-5.

3.3 Analytical Results

The table below summarizes the individual assessments and applicable screening criteria. The soil criteria are divided into two separate categories: (1) within the facility property, and (2) outside of the fenced property (McCauley St. and two southern lots) due to current and anticipated future use.

Samples	Screening Criteria / Notes
Verification	MicroVision Lab's "Coal Ash / Wood Ash Analysis"
Soil (Within Facility Property)	Lowest of the Residential (health based) and Protection of Groundwater PSRG. Background Conc. (metals only)
Soil (McCauley St and 2 Lots futher South)	Lowest of the Residential (health based) and Protection of Groundwater PSRG. Background Conc. (metals only)
Site Specific Background Concentrations of Metals in Soil	Statistical Approach using EPA's ProUCL 5.0 Software to Calculate Background Concentrations
Groundwater	15A NCAC 2L and IMACS (Groundwater Quality Standards). Background Conc. (metals only)
Surface Water	15A NCAC 2B (Surface Water Quality Standards)
Sediment	Lowest of the Residential (health based), Protective of Groundwater PSRG and USEPA Region III Ecological Screening Benchmarks. Background Conc. (metals only). Exceedance of GW Standards. Exceedance of Surface Water Standards.

The analytical methods Geosyntec chose were selected to achieve reporting limits at or below applicable NCDEQ standards or requirements, to the degree practical. In some cases, reporting limits (RLs) were higher than the standards when, in the opinion of the laboratory, the RLs represent the lowest practically achievable.

Total equivalent (TEQ) values for both dioxins /furans and PAHs are discussed throughout the subsequent sections of this report. To clarify, TEQ values are calculated

for a group or class of compounds (either dioxins and furans combined or PAHs). In the case of dioxins and furans, many distinct compounds may exist together with similar chemical structures, physio-chemical properties and toxic responses. When dioxins and furans are detected in analytical samples, a TEQ can be calculated to determine the toxicity of the mixture in the sample relative to a reference congener or compound, namely 2,3,7,8-TCDD. The process is similar for PAHs, where benzo(a)pyrene is the reference compound.

3.3.1 Subsurface Soil Assessment

The results of the subsurface investigation are presented in **Table 2** and **Figures 13** and **14**. **Figure 13** presents the analytical data from boring locations within the Facility's property boundary and **Figure 14** presents the data from boring locations in McCauley Street and the two University-owned lots further south.

3.3.1.1 Verification Samples

Geosyntec submitted four verification samples to MicroVision Laboratories for validation of the tiered visual assessment used in the field as described in Section 2.1.1. The four samples were indicative of the four possible outcomes of the field assessment method: impacted by CCBs at Tier 1 (unaided visual), impacted by CCBs at Tier 2 (hand lens), impacted by CCBs at Tier 3 (microscopy), and absence of CCBs.

The results of each verification sample confirmed the field level determination of the presence or absence of CCBs within the samples. MicroVision Laboratories "Coal Ash / Wood Ash Analysis" report is presented in **Appendix H**.

3.3.1.2 Determination of Background Soil Concentrations

The USEPA recommends using ProUCL version 5.0 software for analysis of environmental data sets with and without non-detect values. Geosyntec used ProUCL to calculate Upper Threshold Limits (UTL) for metals in soil. Geosyntec established an UTL based on the 95% confidence limit of the 95th percentile (i.e. 95% of naturally occurring background samples would fall below this value 95% of the time). Geosyntec then designated the calculated UTL as the site-specific background concentration for screening purposes and establishing final remedial goals.

To determine background soil concentrations for the metals, Geosyntec initially screened analytical results for outlier data using a combination of statistical tools including box plots, QQ plots, histograms and Dixon's outlier tests. The purpose of this screening process was to assess the potential distribution of metals in soil, e.g., normal distribution, lognormal distribution, etc. Sample BKG-8 did not exhibit common distribution characteristics and is considered an outlier (beryllium, cobalt, iron, manganese, selenium and vanadium) at a 1% significance level. As such, Geosyntec excluded BKG-8 from the data set when calculating the UTL of the metals in background soil. Further, Geosyntec could not calculate background concentrations for antimony, cadmium, silver or thallium due to greater than 50 % of the values being below the laboratory RLs in each dataset. Geosyntec calculated the most appropriate UTL for the remaining metals in the dataset. Geosyntec finalized calculated background UTL concentrations for aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, vanadium and zinc as shown in **Table 3**. The laboratory reports are presented in **Appendix I.**

3.3.1.3 Subsurface Assessment within the Facility's Property Boundary

Geosyntec used the tiered visual assessment method to delineate the limits of CCB impacts within the fence line of the southern portion of the Facility parcel. The assessment targeted the former fly ash basin, warehouse excavation area and former silt basins and was conducted on a boring by boring basis as described in the *Work Plan for Remedial Investigation.* Boring locations were limited by Facility buildings and underground utilities. Geosyntec assessed the borings by the tiered visual assessment method along the entire length of the boring. Geosyntec collected analytical samples for characterization of impacted soils or confirmation of "clean" soils for delineation purposes.

Results of the subsurface soil assessment within the Facility's property boundary are summarized below. The summary table below presents potential contaminants of concern and the range of concentrations Geosyntec encountered during the subsurface assessment.

Analyte	Units	Screening Criteria	Concentration Range
2,3,7,8 TCDD	ng/kg	1.1	2.1

D /F TEQ	ng/kg	1.1	1.5 - 125
HxCDD Mix	ng/kg	100	396
1-methylnapthalene	ug/kg	55	55
benzo(a)pyrene	ug/kg	16	25 - 140
benzo(b)fluoranthene	ug/kg	160	180
dibenz(a,h)anthracene	ug/kg	16	36
PAH TEQ	ug/kg	16	22 – 216
arsenic	mg/kg	3.2	3.5 – 21
barium	mg/kg	580	710
mercury	mg/kg	1	1.3
selenium	mg/kg	2.1	2.7 – 4.9

Laboratory reports are presented in **Appendix J.** Calculations for total equivalent (TEQ) values for dioxins / furans and PAHs are documented in **Appendix K.**

3.3.1.4 McCauley Street and Two Lots Further South

Geosyntec also used the tiered visual assessment to delineate the limits of CCB impacts along McCauley Street and within the two University owned lots south of McCauley Street. The assessment targeted the eastbound lane of McCauley Street and the floodplain of the creek in areas where suspended solids including CCBs may likely settle out and be deposited during high water events. Geosyntec assessed the borings using the tiered visual assessment method along the entire length of the boring. Geosyntec collected analytical samples for characterization of impacted soils or confirmation of “clean” soils for delineation purposes.

Results of the off-site assessment are summarized below. The summary table below presents the range of concentrations Geosyntec encountered during the assessment.

Analyte	Units	PSRG	Concentration
2,3,7,8 TCDD	ng/kg	1.1	1.3 – 8.5
D /F TEQ	ng/kg	1.1	3.5 – 418

HxCDD Mix	ng/kg	100	1,700
1-methylnapthalene	ug/kg	55	76 – 760
benz(a)anthracene	ug/kg	160	360 – 2,700
benzo(a)pyrene	ug/kg	16	52 – 2,400
benzo(b)fluoranthene	ug/kg	160	150 – 2,700
dibenz(a,h)anthracene	ug/kg	16	22 – 460
naphthalene	ug/kg	210	400
indeno(1,2,3-c,d)pyrene	ug/kg	160	190 – 1,200
PAH TEQ	ug/kg	16	20 – 3,533
arsenic	mg/kg	3.2	4.1 – 15

Laboratory reports are presented in **Appendix J.** Calculations for total equivalent (TEQ) values for dioxins / furans and PAHs are documented in **Appendix K.**

COCs in soil above the final Unrestricted Use Remedial Goals are not present along McCauley Street. On one of the lots south of McCauley Street, Geosyntec located two isolated pockets of CCBs adjacent to the creek, within the floodplain. Both pockets of CCBs are delineated horizontally by confirmation borings, the creek channel bed itself and topographical features. Geosyntec interpreted the vertical extents of CCB impacts to be at or above the elevation of the creek channel bed.

Samples at both soil borings SB-12 and SB-27 exceed the final Unrestricted Use Remedial Goals for the dioxins / furans TEQ. At both borings, Geosyntec observed no CCBs during the tiered visual assessment and interpreted both borings to be “clean.” Both borings are delineated to the residential (health based) PSRG, but slightly exceed the Protective of Groundwater PSRG. Only once during the groundwater assessment has the dioxins / furans TEQ exceeded its groundwater standard, suggesting limited leachability under site specific conditions. Geosyntec recommends repeating groundwater monitoring for dioxins / furans TEQ..

3.3.1.5 SPLP Samples

The SPLP procedure is designed to determine the potential for constituents to leach from soil under typical environmental conditions. Geosyntec performed the SPLP analysis on two CCB impacted samples prior to installing any monitoring wells and conducting groundwater sampling.

The SPLP results suggest benzo(a)pyrene and eight metals (i.e. Sb, As, Cr, Co, Fe, Pb, Mn and V) may leach to groundwater. When compared to the groundwater assessment results, Geosyntec detected benzo(a)pyrene only once in a groundwater sample above its groundwater standard. This suggests a limited leaching potential for benzo(a)pyrene under site specific conditions. Of the metals determined to potentially leach by the SPLP analysis, only chromium, cobalt, iron, manganese and vanadium are of concern based on the groundwater assessment. Further discussion on the groundwater quality is presented on Section 3.3.3.

3.3.2 Surface Soil Assessment

Geosyntec completed the initial phase of the subsurface investigation to determine the area of impact from historical CCB operations, Geosyntec conducted additional assessment of surface soils to evaluate the potential exposure pathway from impacts in the more accessible shallow soils. To assess representative exposure potential of surface soils the incremental sampling methodology, described in section 2, was conducted within the decision unit of CCB impact. The results of the surface investigation are presented in **Table 4.**

Both the dioxins / furans TEQ and the PAHs TEQ exceeded the residential and protection of groundwater PSRGs. Individual PAH constituents including 1-methylnaphthalene, benzo(a)pyrene and dibenz(a,h)anthracene exceeded both of their respective PSRGs as well. Four other PAH constituents exceeded at least one of their respective PSRGs in one of the three samples.

Of these constituents and TEQs, 1-methylnapthalene did not exceed its corresponding standard during the groundwater assessment. The dioxins furans TEQ, PAH TEQ, benzo(a)pyrene and dibenz(a,h)anthracene exceeded their respective groundwater quality standards only once during the groundwater assessment. This suggests a limited capacity for these constituents to affect groundwater under site specific conditions.

Laboratory reports are presented in **Appendix L.** Calculations for TEQ values for dioxins / furans and PAHs are documented in **Appendix K.**

3.3.3 Groundwater Assessment

Following the initial phase of the subsurface soil investigation, Geosyntec constructed monitoring wells to confirm the assumed groundwater flow direction and assess groundwater quality as it flows through the "area of concern".

Results of the assessment are summarized in the table below.

Up Gradient (MW-1)	
	Establishes background groundwater concentrations
Source Area (MW-2 & MW-3)	
	1 slight exceedance of D /F TEQ. A duplicate sample was below the Standard
	No exceedances of PAHs
	Sulfate and TDS exceed Standard
	Co exceeds Standard by 1 or 2 orders of magnitude
	Mn exceeds Standard by 1 or 2 orders of magnitude
	As and Tl exceeded standard intermittently
	Exceedances of Fe and V appear to be background
Side Gradient (MW-4)	
	Cr exceeds Standard
	One detection of Tl (estimated) above its Standard
Down Gradient (MW-5)	
	Slight exceedances of Co (estimated). The Co exceedances area orders of magnitude lower than at Source Area
	1 exceedance of Tl
	1 exceedance of benzo(a)pyrene, diben(a,h)anthracene, indeno(1,2,3cd)pyrene and PAH TEQ

Groundwater analytical results for all four monitoring events are presented in **Table 5**. Exceedances of groundwater standards are shown on **Figure 11**. Laboratory reports are presented in **Appendix M.** Calculations for TEQs for dioxins / furans and PAHs are documented in **Appendix K.**

Geosyntec determined background groundwater quality based on the results at monitoring well MW-1. Iron, manganese and vanadium have exceeded their respective preliminary remediation goals as determined by Title 15A North Carolina Administrative Code Subchapter 2L (15A NCAC 2L) on at least one occasion at MW-1. Naturally occurring metals dissolved in groundwater are common in this area of North Carolina.

The groundwater signature or fingerprint emanating from the source areas includes elevated sulfate, total dissolved solids (TDS) with cobalt and manganese elevated about 1 to 2 orders of magnitude above their respective standards. Of equal importance, the signature lacks PAHs and dioxins / furans are rare.

The groundwater signature / fingerprint appears to be delineated by MW-4 and the assessed reach of the creek (presumably a local discharge point for groundwater) on the two University owned lots. As discussed below in Section 3.3.4, the surface water when sampled poses minimal risk and hazard to human health and ecological receptors. At MW-4, the typical CCB groundwater signature does not appear to be present, however, chromium is elevated. At monitoring well MW-5, the typical CCB groundwater signature is lacking as well. Monitoring well MW-5 was sampled twice prior to November 2015 when the PAH exceedances were detected. Each of the previous events had no detections of PAHs in monitoring well MW-5. The November 2015 PAHs were low level detections with estimated concentrations (i.e. "J" flagged by the analytical laboratory). The low level PAH detections are inconsistent with the groundwater signature repeatedly seen at monitoring wells MW-2 and MW-3 (i.e. the source area monitoring wells).

3.3.4 Sediment and Surface Water Assessment

Geosyntec summarized the data from the sediment and surface water investigation in accordance with the REC program guidance and submitted it under a separate cover to NCDEQ in October 2015 for review and direction. The *Sediment / Surface Water Screening Report* addressed potential human health and ecological exposures and risks related to the in-stream sediment and surface water. The full report is presented in **Appendix N**.

Ms. Hanna Assefa, NCDEQ Toxicologist, reviewed the *Sediment / Surface Water Screening Report* and agreed with the report's conclusions recommending "No Further Action." Ms. Assefa stated "[t]he contaminant concentrations in sediment and water are not likely to pose risk and hazard to humans above allowable limits" and "[f]or ecological risk the benchmarks used for comparison are appropriate." NCDEQ's toxicologist did not address leaching concerns with the sediment samples results.

Results relevant to leaching are discussed below.

- The creek is a presumed local groundwater discharge point. The creek has been flowing each time it has been observed during the course of this RI and so is determined to be a perennial stream. With an upwelling of groundwater into the creek as baseflow, no threat to groundwater exists.

- As discussed in the *Sediment / Surface Water Screening Report*, surface water detections for dioxin / furans TEQ, aluminum, barium and pyrene exceeded their respective benchmarks, but ultimately NCDEQ concluded (email communication from Janet Macdonald, NCDEQ, to Eric Nesbit, Geosyntec) that the surface water quality posed an acceptable risk to human health and ecological receptors.

- The creek is primarily fed by urban runoff which has been suggested as an important pathway of PAHs into sediment. The upstream samples have greater concentrations of PAHs than the midstream or downstream samples indicating that the source of these impacts originates from runoff from the urban area upstream of the Site and are not the result of the former CCB management practices.

3.3.5 Quality Assurance / Quality Control Results

Geosyntec performed stage 2A data validation on most groundwater, sediment and surface water samples. Overall, the data as qualified was determined usable for meeting the project objectives. All data validation reports are presented in **Appendix O**.

3.4 Vapor Intrusion Potential Evaluation

Geosyntec did not perform a vapor intrusion potential evaluation. Of the COCs encountered in soil, only three of the PAHS (e.g., 1-methylnaphthalene, benz(a)anthracene, and naphthalene) are considered to be volatile. Of these, only benz(a)anthracene was encountered at a concentration exceeding its Unrestricted Use Final Remediation Goal. This detection was on the University owned (undeveloped) lot located south of McCauley Street.

4. POTENTIAL RECEPTORS

Aside from the potential human and ecological exposures and /or risks presented in the *Sediment / Surface Water Screening Report*, this section documents the search for receptors potentially exposed to Site source areas or CCBs potentially originating from the Site.

4.1 Within the Facilities' Property Boundary

The Facility is zoned and used for industrial purposes. The Facility property has been used for the generation of steam and / or power since the 1940's and will continue to be for the foreseeable future. The property boundary is access controlled, manned 24 hours per day and enclosed in a fence to reduce the potential for trespassing.

4.2 McCauley Street and Two University-owned Lots Further South

The University has owned the two undeveloped lots south of McCauley Street since 2007 and 2008. UNC-CH does not have any plans to sell either in the foreseeable future. The lot boundaries are not fenced in or otherwise access controlled. The lots are well vegetated and the creek highlighted in the *Sediment / Surface Water Screening Report* bisects one of the two lots.

The filled but unpaved segment of McCauley Street (adjacent to the Facilities' property southern boundary) is maintained by the Town of Chapel Hill and surfaced with gravel. This segment of McCauley Street provides the only access to approximately ten residential units. Pedestrians, bicyclists and vehicles use this segment frequently.

4.3 Groundwater Use

Groundwater is not used at the Facility. To the east, south and west of the Site, the surrounding community is mostly residential with some office and/or industrial use. The Site and surrounding community are within the Orange Water and Sewer Authority's (OWASA) service area. OWASA supplies water via three surface water impoundments: University Lake, Cane Creek Reservoir, and Stone Quarry Reservoir, all of which are greater than one mile away from the Site and with a low potential to be impacted by Site source areas or CCBs potentially emanating from the Site. According to NCDEQ's Division of Water Resources, no Wellhead Protection Areas are within one mile of the Site.

Previously in the *Work Plan*, Geosyntec identified a potential water supply well associated with 410 Westwood Drive, south of the Site on the opposite side of the creek. At that time, OWASA was able to confirm that the property was on municipal water and sewer service. A search (29 February 2016) of the Orange County Department of Health's online well permit and inspection inquiry system and GIS system did not provide any record of a permit and / or well. Furthermore, Geosyntec did not locate records of any wells south of the Site within one mile.

On 18 March 2016, Geosyntec performed a visual survey of the area south of the Site. Geosyntec identified six structures as potential well houses and/or storage sheds during the survey. None of the addresses were listed in the Orange County Department of Health's online well permit and inspection inquiry system. Geosyntec confirmed that all of the addresses have active or current potable water service from OWASA.

5. IDENTIFICATION OF CONTAMINANTS OF CONCERN AND DERIVATION OF REMEDIATION GOALS

Geosyntec developed and adjusted Final Remediation Goals for soil and groundwater COCs in accordance with Appendix D and E of the *REC Program Implementation Guidance* (October 2015).

Geosyntec did not develop Final Remediation Goals for sediment due to the fact that the recorded concentrations of PAHs do not pose a threat to potential receptors, as noted in the *Sediment / Surface Water Screening Report* and confirmed by NCDEQ's toxicologist, Ms. Hanna Assefa. Furthermore, Geosyntec observed that the concentrations within the in-stream sediment generally decline with increasing distance downstream. Remediation to less than upstream, background concentrations in sediment is not required.

5.1 Soil

A listing of the COCs in soil and their respective Final (unrestricted use) Remediation Goal are presented in **Table 6**. Geosyntec considered all soil COCs that exceed their respective health based PSRG in surface and subsurface soil samples. Geosyntec considered additional constituents detected at concentrations within one order of magnitude of their health based PSRG. Geosyntec adjusted health based PSRGs depending on the associated cancer causing effects, non-cancer causing effects, or whether the COC has both cancer and non-cancer causing effects as allowed by Appendix E of the REC Guidance.

Ultimately, the final soil Remediation Goals must be protective of both human health and groundwater. Because the CCB impacts have been present for more than 15 years (prior to 1992), NCDEQ considers that the protection of groundwater requirement has been achieved for constituents either not detected or detected at concentrations below their relative groundwater standard in source area monitoring wells MW-2 and MW-3 (per paragraph D.2.1.2, exceptions 2(a)). For all other soil COCs, Geosyntec compared the initial protective of groundwater PSRG against twenty times the COCs groundwater standard. NCDEQ allows for soil (in mg/kg) less than twenty times its corresponding groundwater Remediation Goal (in mg/L) to remain in place. Geosyntec attempted comparisons of total COC concentrations to their respective SPLP leachable concentrations for arsenic, manganese and vanadium. But with only two data points, illogical trends for all three constituents resulted. Therefore, Geosyntec disregarded these

comparisons for each of the three constituents. Finally, Geosyntec considered the background concentrations for metal COCs.

Geosyntec determined the final Remediation Goal for each COC considered to be the lesser of the final health based criterion and final protective of groundwater Remedial Goal (when applicable). In the case of metal COCs, the final Remediation Goal is set at the background concentration if the lesser of the final health based criteria and final protective of groundwater remedial goal is below the background concentration. For metal COCs, remediation below background is not required pursuant to NCDEQ Voluntary Cleanup Program rules.

Application of these final soil Remediation Goals to the analytical results along with observations recorded during the tiered visual assessments of each boring reveals the horizontal extents of impacted soil. **Figure 16** depicts the horizontal extents of impacted soil within the fenced boundaries of the Site. **Figure 17** depicts the horizontal extents of impacted soil south of the fence on McCauley Street and the two southern parcels

Geosyntec interpreted the vertical extents of CCB impacts as depicted in the cross sections (**Figures 5-8**). Due to the disturbed nature of the assessed area (e.g., filled and graded multiple times since ~ 1960), the vertical limits of CCB impacts are at or above the native soil and imported fill interface.

5.2 Groundwater

A listing of the COCs in groundwater and their respective final Remediation Goals are presented in **Table 7**. The final Remediation Goals for COCs in groundwater are the North Carolina Administrative Code 2L Groundwater Standards and the Interim Maximum Allowable Concentrations (IMAC). Remediation below practical quantitation limits is not required. Remediation below site specific natural background concentrations for metals only is not required. Geosyntec calculated background groundwater concentrations by taking the average concentrations of iron and manganese from the four monitoring events from the up gradient monitoring well, MW-1. Geosyntec could not calculate background groundwater concentrations for chromium, cobalt and vanadium due to the absence of detections above the reporting limit and the presence of estimated concentrations. For chromium, cobalt and vanadium, the NCAC 2L Groundwater Standard or IMAC became the final Remediation Goal.

6. CONCLUSION

Geosyntec has completed the Remedial Investigation in accordance with the REC rules codified at 15A North Carolina Administrative Code 13C .300 and the *REC program Implementation Guidance* (latest version October 2015).

The table below summarizes Geosyntec's conclusions regarding the media specific assessments.

Samples / Media	Conclusions
Verification	Confirmed the Tiered Visual Assessment was viable
Background Concentrations of Metals in Soil	Used to Determine Final Unrestricted Use RGs for Soil
Soil (Within Facility Property)	Requires a remedy for D/F TEQ, PAH TEQs, select PAHs and As
Soil (McCauley St and Lots further South)	a). For McCauley St., No Further Action Proposed b). 2 Pockets of CCBs in one of the Lots South of McCauley St. requires a remedy for 2,3,7,8-TCDD, D/F TEQ, PAH TEQ, select PAHs and As
Groundwater	Requires a remedy for Sulfate, TDS, Co and Mn
Surface Water	No Further Action Proposed
Sediment	No Further Action Proposed

The risk to human health and ecological receptors posed by exposure to potential Site-related constituents in surface water and in-stream sediment is both low and acceptable, as supported by NCDEQ's toxicologist. The concentrations reported for the in-stream sediment and surface water are likely attributable to runoff from the local urban area rather than historic CCB management practices associated with the Site. COC concentrations in sediment from the most upstream sediment sample are generally the highest reported of the three samples. Sediment COC concentrations further downstream are generally lower than in the most upstream sample. Remediation to less than the upstream background concentrations is not required by NCDEQ Voluntary Cleanup

Program requirements. No significant contribution from sediment leaching into surface water is apparent. Geosyntec proposes a "No Further Action" status for the in-stream sediment and surface water in the assessed reach of the creek.

Site groundwater has consistently been shown to flow north to south through the "area of concern" towards the creek. It is reasonably anticipated that groundwater within the near vicinity of the assessed areas discharges into the creek as baseflow. The groundwater plume emanating from the source area wells MW-2 and MW-3 is defined by elevated concentrations of sulfate, TDS, cobalt and manganese. The groundwater plume appears to be delineated by MW-1 (up gradient), MW-4 (side gradient), the creek (side gradient and down gradient) and MW-5 (down gradient). The chromium exceedances at MW-4 are inconsistent with the defining signature or fingerprint of the plume as determined at MW-2 and MW-3. Site groundwater contains constituents (e.g., sulfate, TDS, cobalt, and manganese) at concentrations exceeding their respective final Remedial Goals which must be addressed by a Remedial Action Plan.

Based on the borings advanced within McCauley Street, the segment comprised of fill material is absent of COCs above the final Unrestricted Use Remedial Goal. Geosyntec proposes a "No Further Action" status for the soils / fill below McCauley Street.

Geosyntec located two isolated pockets of CCB-impacted soils within the floodplain of the creek. One of the pockets is centered on SB-24 and SB-35. The second pocket is centered on SB-25 and SB-26. CCB impacts and soils with COCs exceeding the final Unrestricted Use Remedial Goals are present in both the surface and subsurface within the Facilities' property boundary. These impacts are delineated horizontally to the final Unrestricted Use Remedial Goals. The vertical limits of impacts do not exceed the depth of the disturbance or fill material. A Feasibility Study and subsequent Remedial Action Plan is required to monitor, manage and address impacted media appropriately.

7. REFERENCES

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TABLES

Table 1
Monitoring Well Construction Details and Groundwater Elevations
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

							3/10/2014		9/9/2014		4/20/2015		11/18/2015	
Monitoring Well ID	**Installation Date**	**Northing (ft)**	**Easting (ft)**	**Total Depth (ft BGS)**	**Screen Interval (ft BGS)**	**TOC Elevation (ft NAVD88)**	**DTW (ft BTOC)**	**GW Elevation (ft NAVD88)**	**DTW (ft BTOC)**	**GW Elevation (ft NAVD88)**	**DTW (ft BTOC)**	**GW Elevation (ft NAVD88)**	**DTW (ft BTOC)**	**GW Elevation (ft NAVD88)**
MW-1	2/24/2014	784789.1573	1981527.4957	39.5	29.5-39.5	477.05	31.38	445.67	32.31	444.74	30.68	446.37	28.02	449.03
MW-2	2/25/2014	784592.8914	1981808.1606	29.5	19.5-29.5	447.53	15.15	432.38	15.59	431.94	15.62	431.91	14.84	432.69
MW-3	2/28/2014	784567.3372	1981745.7245	29	24-29	447.15	15.44	431.71	16.26	430.89	16.23	430.92	14.16	432.99
MW-4/PZ-4	2/27/2014	784501.8497	1981597.5918	38	28-38	458.42	27.02	431.4	27.55	430.87	26.44	431.98	25.7	432.72
MW-5	8/22/2014	784484.338	1981852.2958	20	5-20	426.07	-	-	8.14	417.93	6.3	419.77	6.8	419.27

Notes:
1. ft indicates feet.
2. BGS indicates below ground surface.
3. NAVD88 indicates North America Vertical Datum 1988.
4. BTOC indicates below top of casing.

Table 2
Subsurface Soil Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Method Type	Analyte	Units	Residential PSRG	Protection of Groundwater PSRG	Background Concentration	Location	SB-1	SB-2	SB-5	SB-8	SB-9	SB-10	SB-11	SB-12		SB-13		SB-14	SB-16	SB-17	SB-18	SB-19	SB-21	SB-23	SB-25	SB-26
						Depth (ft BGS)	19-20	13-14	6-7	2-3	8-9	3-4	3-4	2-3	2-3	7-8	9-10	19-23	11-12	11-12	4-5	16-17	12-13	12-13	1-2	2-3
						Sample Date	10/23/2013	10/23/2013	10/24/2013	10/24/2013	10/24/2013	10/25/2013	10/25/2013	10/25/2013	10/25/2013 (Dup)	10/25/2013	10/25/2013	10/25/2013	10/28/2013	10/28/2013	10/28/2013	10/29/2013	10/29/2013	10/29/2013	10/30/2013	10/30/2013
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/kg	-	-	-		2.2J	2.2J	1.1J	4100	64	120	580	40	44	1100	32	18	2.6J	6.4	310	32	3.7J	29	15,000	480
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		0.18J	0.11J	<0.015U	420	9.1	14	91	2.3J	1.6J	230	2.3J	5.4J	0.19J	<0.046U	69	0.025J	<0.01U	<0.0084U	950	100
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		0.2J	<0.012U	<0.021U	44	1.5J	1.3J	8.3	<0.1U	<0.042U	23	<0.084U	<0.095U	<0.051U	<0.065U	7.4	<0.012U	<0.017U	0.054J	130	10
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		<0.018U	0.032J	<0.014U	230	0.87J	1.1J	12	0.71J	0.93J	16	0.23J	0.26J	0.2J	<0.067U	0.99J	<0.033U	<0.0087U	0.064J	410	7.5
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.027J	0.0064J	0.05J	24J	1J	0.66J	3.6J	0.11J	0.23J	12	<0.033U	2.3J	<0.048U	<0.056U	2.5J	<0.01U	<0.0099U	<0.0094U	36J	5.7J
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		0.065J	0.028J	<0.016U	130	1.5J	2.6J	20	1.1J	0.62J	42	<0.046U	1.2J	<0.057U	<0.057U	14	0.23J	<0.0089U	0.082J	640	22
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.074J	0.019J	<0.011U	71	1.1J	1.4J	8.6	0.84J	0.69J	28	0.097J	0.98J	<0.053U	<0.056U	3.5J	<0.011U	<0.0097U	<0.0092U	55J	9.5
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		0.044J	0.14J	0.049J	36	0.78J	2.1J	5.4J	0.53J	1.2J	12	0.62J	1.4J	0.18J	0.12J	2.5J	0.19J	<0.008U	0.33J	650	8
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.049J	<0.0067U	<0.016U	<0.36U	<0.055U	0.36J	<0.14U	<0.08U	<0.045U	0.49J	<0.045U	<0.096U	<0.066U	<0.073U	<0.099U	<0.015U	<0.014U	<0.012U	13J	0.35J
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8	1.1	-		<0.0067U	<0.004U	<0.0086U	2.1JQ	<0.016U	<0.021U	<0.043J	1.3	0.38J	0.5J	<0.015U	0.13J	<0.025U	<0.035U	0.15J	<0.012U	<0.011U	<0.0062U	8.5J	<0.086U
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/kg	-	-	-		0.062J	0.0065J	<0.0055U	11J	<0.023U	0.3J	0.87J	0.91J	1.2J	0.79J	<0.02U	0.57J	<0.011J	<0.017U	0.23J	<0.016U	<0.0097U	<0.015U	60J	0.34J
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		<0.015U	<0.0037U	<0.007U	0.37J	0.091J	<0.046U	<0.081U	0.12J	<0.035U	0.17J	<0.013U	0.54J	<0.048U	<0.054U	<0.11U	<0.017U	<0.012U	<0.011U	4.4J	0.2J
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.043J	<0.0028U	0.031J	5.7J	0.22J	0.33J	1.6J	0.22J	0.17J	2.2J	<0.029U	<0.069J	<0.048U	<0.054U	0.97J	<0.01U	<0.0098U	<0.0099U	7.6J	1.3J
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		<0.014U	<0.0027U	<0.0059U	0.31J	<0.025U	<0.042U	<0.099U	0.073J	<0.033U	0.4J	<0.01U	0.39J	<0.047U	<0.055U	<0.12U	<0.018U	<0.011U	<0.011U	<0.65U	0.26J
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	-	-	-		<0.0084U	<0.0026U	<0.0057U	0.13J	<0.011U	<0.02U	<0.034U	<0.066U	<0.04U	0.19J	<0.0065U	1.3J	<0.042U	<0.046U	0.35J	<0.0067U	<0.0089U	<0.0078U	1.9J	0.37J
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/kg	-	-	-		360	150	280	56,000	1500	4500	8900	1800	1900	15,000	2800	490	150	1300	4500	6300	520	4000	24,000	6,100
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	-	-	-		0.29J	0.26J	0.071J	710	21	53	230	6.6J	6.5J	670	11J	9.6J	0.83J	0.93J	150	<0.03U	0.068J	0.21J	2,300	280
	Calculated Dioxin/Furan TEQ	ng/kg	4.8	1.1	-		0.226087	0.097218	0.1080213	125.5401	1.75203	3.8739	15.565	3.55148	2.99195	30.9341	1.281	1.96798	0.122149	0.490439	8.12	2.25225	0.1930204	1.538203	418.672	13.718
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/kg	100	-	-		0.109	0.2	0.049	396	3.15	5.8	37.4	2.34	2.75	70	0.85	2.86	0.38	0.187	17.49	0.42	ND	0.476	1,700	37.5
SVOCs	1-Methylnaphthalene	µg/kg	180,000	55	-		20	<0.28U	<0.27U	55	<0.27U	3.3J	17	3.8J	3.4J	15	<0.31U	11	<0.28U	<0.3U	44	<0.3U	<0.28U	<0.31U	760	76
	2-methylnaphthalene	µg/kg	48,000	1,600	-		19	<0.33U	<0.32U	69	<0.32U	2.5J	21	4.9J	4.3J	19	<0.37U	11	<0.34U	<0.36U	51	<0.35U	<0.34U	0.43J	430	56
	Acenaphthene	µg/kg	720,000	8,400	-		3.4J	<0.17U	<0.17U	16	<0.16U	1.5J	5J	0.49J	1.1J	2.1J	<0.19U	0.79J	<0.17U	<0.18U	5.6	<0.18U	<0.17U	<0.19U	420	36
	Acenaphthylene	µg/kg	-	21,000	-		2.2J	<0.18U	<0.18U	130	1.2J	14	6.3	2J	1.2J	2.8J	<0.2U	0.83J	<0.19U	<0.2U	19	<0.19U	<0.19U	0.38J	2,000	290
	Anthracene	µg/kg	3,600,000	660,000	-		1.6J	<0.78U	<0.75U	99	<0.74U	11	14	1.9J	2.6J	3.6J	<0.85U	<1.1U	<0.79U	<0.83U	31	<0.83U	<0.78U	<0.86U	1,600	190
	Benz(a)anthracene	µg/kg	160	180	-		<1.2U	<0.97U	<0.94U	120	1.1J	23	34	3.6J	4.4J	6.9	<1.1U	<1.4U	<0.98U	<1U	58	<1U	<0.98U	<1.1U	2,700	360
	Benzo(a) pyrene	µg/kg	16	59	-		<0.98U	<0.8U	<0.77U	140	<0.76U	25	35	3.6J	4.3J	6.6	<0.87U	<1.1U	<0.81U	<0.85U	56	<0.85U	<0.81U	<0.88U	2,400	360
	Benzo(b)fluoranthene	µg/kg	160	600	-		<1.6U	<1.3U	<1.3U	180	1.7J	30	51	5.9J	7.2	10	<1.4U	<1.9U	<1.3U	<1.4U	96	<1.4U	<1.3U	<1.4U	2,700	420
	Benzo(g,h,i)perylene	µg/kg	-	7,800,000	-		<1.5U	<1.2U	<1.1U	130	1.7J	19	25	2.9J	3.3J	4.6J	<1.3U	<1.7U	<1.2U	<1.3U	41	<1.3U	<1.2U	<1.3U	1,600	250
	Benzo(k)fluoranthene	µg/kg	1,600	5,900	-		<1.3U	<1.1U	<1U	69	1.6J	11	18	1.9J	2J	3.3J	<1.2U	<1.5U	<1.1U	<1.2U	35	<1.1U	<1.1U	<1.2U	950	150
	Chrysene	µg/kg	16,000	18,000	-		<1.3U	<1.1U	<1U	150	1.6J	30	41	5.8J	6.7	9.9	<1.2U	<1.5U	<1.1U	<1.2U	75	<1.1U	<1.1U	<1.2U	3,800	550
	Dibenz(a,h)anthracene	µg/kg	16	190	-		<1.7U	<1.4U	<1.4U	36	1.9J	5.4J	7.6	<1.5U	<1.4U	<1.7U	<1.5U	<2U	<1.4U	<1.5U	13	<1.5U	<1.4U	<1.6U	460	76
	Fluoranthene	µg/kg	480,000	330,000	-		3.4J	<1.1U	<1U	190	<1U	41	74	9.6	11	14	<1.2U	1.9J	<1.1U	<1.2U	100	<1.1U	<1.1U	<1.2U	6,600	880
	Fluorene	µg/kg	480,000	56,000	-		4.4J	<0.51U	<0.49U	30	<0.48U	4.3J	4.9J	1.3J	1.3J	2.5J	<0.56U	1J	<0.51U	<0.54U	8.1	<0.54U	<0.51U	<0.56U	1,100	110
	Indeno(1,2,3-c,d)pyrene	µg/kg	160	2,000	-		<1.5U	<1.2U	<1.1U	96	1.8J	15	21	2.4J	2.7J	3.7J	<1.3U	<1.7U	<1.2U	<1.3U	35	<1.3U	<1.2U	<1.3U	1,200	190
	Naphthalene	µg/kg	3,800	210	-		21	<0.35U	<0.34U	39	<0.33U	1.9J	17	2.7J	2.3J	14	0.45J	9.5	<0.36U	<0.38U	33	<0.37U	<0.36U	<0.39U	400	41
	Phenanthrene	µg/kg	-	68,000	-		8.1	<1.2U	<1.1U	170	<1.1U	38	63	11	12	19	<1.3U	2.7J	<1.2U	<1.3U	91	<1.3U	<1.2U	<1.3U	8,600	1,000
	Pyrene	µg/kg	360,000	220,000	-		4J	<1.2U	<1.1U	190	<1.1U	50	61	8.3	9.5	14	<1.3U	<1.7U	<1.2U	<1.3U	100	<1.3U	<1.2U	<1.3U	8,800	1,200
	PAH TEQ	µg/kg	16	59	-		ND	ND	ND	216.44	2.3776	37.34	53.421	4.8148	5.7567	8.7029	ND	0	ND	ND	88.325	ND	ND	ND	3,533	535
Metals	Aluminium	mg/kg	15,000	-	42,996		14000B	16,000B	9,300	16,000B	14,000	22,000	13,000	6,800	8,600	15,000	16,000	31,000	11,000	20,000	11,000	12,000	10,000	19,000B	8,500	6,400
	Antimony	mg/kg	6.2	0.9	-		<0.44U	<0.39U	<0.39U	<0.48U	<0.42U	<0.42U	<0.38U	<0.39U	<0.39U	<0.47U	<0.41U	<0.53U	<0.38U	<0.43U	<0.37U	<0.38U	<0.39U	<0.4U	<0.55U	<0.4U
	Arsenic	mg/kg	0.68	5.8	3.2		14	1.5J	1.4J	21	0.73J	2.5	2.9	1.7J	2.2	3.5	1J	28	0.9J	1.4J	3.6	1.1J	1.6J	2J	15	4.1
	Barium	mg/kg	3,000	580	58.4		68	17	14	440	18	43	48	86	120	42	14	710	34	23	43	22	18	17	160	52
	Beryllium	mg/kg	32	63	1.4		1.1	0.33J	0.13J	1.6	0.45J	0.48J	0.57	0.4J	0.52	0.42J	0.17J	5.9	0.75	0.46J	0.65	0.17J	0.57	0.45J	1.4	0.43J
	Cadmium	mg/kg	14	3	-		<0.047U	<0.043U	<0.042U	0.14J	<0.045U	<0.045U	<0.041U	<0.042U	<0.042U	<0.051U	<0.045U	0.27J	0.11J	<0.047U	<0.04U	<0.041U	<0.043U	<0.043U	0.25J	<0.043U
	Chromium (III+VI)	mg/kg	24,000	360,000	52.2		14	7.4	9.8	29	8.3	9.5	9.2	7.1	9.4	8.7	7.7	20	12	10	7.9	11	6.2	15	25	7.1
	Cobalt	mg/kg	4.6	0.9	30.9		6.6	4.9	1	6.7	7.3	2.8	5.2	1.4	1.9	2.4	1.6	9.4	11	12	3.7	1.5	4.5	3.4	6.9	3.2
	Copper	mg/kg	620	700	67.3		24	8.4	11	49	6.9	14	21	8.5	12	16	13	200	23	22	12	14	16	26	200	12
	Iron	mg/kg	11,000	150	59,291		28,000B	17,000B	11,000B	19,000B	14,000B	21,000	15,000	5,200	6,600	13,000	6500	26,000	13,000	18,000	12,000	13,000	8,400B	27,000B	8,600	6,100B
	Lead	mg/kg	400	270	35.0		17	9.9	6.6	22	13	31	14	9.1	12	15	8.5	26	13	21	15	8.4	15	9.6	73	18
	Manganese	mg/kg	360	65	1,542		530	90	31	220	410	250	240	46	54	69	45	600	680	320	200	52	240	110	86	120
	Mercury	mg/kg	1.9	1	-		0.22	0.013J	0.021	0.14	0.032	0.02J	0.02J	0.034	0.035	0.064	0.014J	1.3	<0.0075U	0.027	0.042	0.011J	0.0083J	0.039	0.072	0.046
	Nickel	mg/kg	300	130	7.6		7.1	2.6J	1.1J	11	2.7J	3.1J	4.2	2.2J	3J	2.7J	2J	15	3.5J	3.8J	2.8J	1.9J	1.7J	2.3J	10	3.4J
	Selenium	mg/kg	78	2.1	1.9		2.7	<0.89U	<0.88U	<1.1U	<0.95U	<0.94U	<0.86U	<0.88U	0.96J	<1.1U	<0.94U	4.9	<0.86U	<0.98U	<0.83U	<0.86U	<0.89U	<0.9U	<1.3U	<0.91U
	Silver	mg/kg	78	3.4	-		<0.18U	<0.17U	<0.16U	<0.2U	<0.18U	<0.18U	<0.16U	<0.16U	<0.17U	<0.2U	<0.17U	<0.22U	<0.16U	<0.18U	<0.15U	<0.16U	<0.17U	<0.17U	<0.23U	<0.17U
	Thallium	mg/kg	0.16	0.28	-		<0.75U	<0.67U	<0.67U	<0.82U	<0.71U	<0.71U	<0.65U	<0.66U	<0.67U	<0.81U	<0.71U	<0.9U	<0.65U	<0.74U	<0.63U	<0.65U	<0.67U	<0.68U	<0.95U	<0.69U
	Vanadium	mg/kg	78	6	96.2		32	27	28	47	30	43	30	15	19	41	24	54	30	34	25	35	16	93	26	13
	Zinc	mg/kg	4,600	1,200	257.2		72	19	8.1	70 B	36	29	44	14	17	31	19	130	52	72	37	11	34	16	85	30

Notes:
1. ng/kg indicates nanogram per kilogram.
2. mg/kg indicates milligram per kilogram.
3. µg/kg indicates microgram per kilogram.
4. TEQ indicates total equivalents.
5. ft BGS indicates feet below ground surface.
6. U indicates result was below the method detection limit.
7. J indicates results is an estimate.
8. PSRG indicates preliminary soil remediation goals and reference NCDENR's Inactive Hazardous Sites Branch's tables from September 2015.
9. SVOC indicates semi-volatile organic compound.
10. PAH indicates polyaromatic hydrocarbon.
11. ND indicates all of the input parameters into the caculated parameter were non-detect.
12. Highlighted concentrations are exceedences of the screening criteria.

Table 2
Subsurface Soil Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Method Type	Analyte	Units	Residential PSRG	Protection of Groundwater PSRG	Background Concentration	Location	SB-27	SB-28	SB-29	SB-30	SB-31	SB-32	SB-33	SB-34	SB-35	SB-36	SB-37	SB-38	SB-39	SB-40			SB-41
						Depth (ft BGS)	2-3	3-4	3-4	4-5	7-8	2.7-2.9	1.5-2.5	1.5-2.5	0.5-1.0	0.75-2	2-2.5	19.5-20	18-18.5	9-9.5		12-12.5	11.5-12
						Sample Date	10/30/2013	10/14/2014	10/14/2014	10/14/2014	10/14/2014	11/13/2014	11/13/2014	11/13/2014	11/13/2014	11/13/2014	1/29/2015	4/22/2015	4/23/2015	4/23/2015	4/23/2015 (Dup)	4/23/2015	4/23/2015
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/kg	-	-	-		65	5.6J	62	1.9J	6.2J	-	-	-	-	-	-	<0.058U	11	5.4	5.3	8.3	18
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		0.19J	1.5J	12	2J	0.099J	-	-	-	-	-	-	<0.0057U	0.14B,J	<0.015U	<0.0062	<0.0051U	<0.0069
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		0.043J	<0.039U	1.2J	<0.038U	0.17J	-	-	-	-	-	-	<0.0079U	<0.0072U	<0.0054U	<0.0083U	<0.0075U	<0.0091U
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		0.17J	<0.037U	1.7J	<0.033U	<0.049U	-	-	-	-	-	-	<0.015U	<0.015U	0.22J	0.17J	<0.015U	0.16J
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.035J	0.074J	0.7J	<0.026U	<0.03U	-	-	-	-	-	-	<0.010U	<0.006U	<0.0061U	<0.0078U	<0.0073U	<0.023U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		0.22J	0.16J	2.5J	<0.035U	0.15J	-	-	-	-	-	-	<0.016U	0.19J	0.098J	0.22J	0.12J	0.25J
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.033J	0.12J	1.1J	0.11J	<0.03U	-	-	-	-	-	-	<0.0098U	<0.0057U	<0.0057U	<0.0077U	<0.0069U	<0.0058U
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		0.38J	0.077J	1J	<0.032U	<0.047U	-	-	-	-	-	-	<0.015U	<0.014U	<0.0099	<0.017U	<0.014U	<0.024U
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		<0.022J	<0.029U	<0.063U	<0.034U	<0.047U	-	-	-	-	-	-	<0.014U	<0.0077U	<0.0076U	<0.0096U	<0.0091U	<0.0073U
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8	1.1	-		<0.01U	<0.12U	<0.21U	<0.12U	<0.18U	-	-	-	-	-	-	<0.076U	<0.063U	<0.061U	<0.079U	<0.062U	0.12J
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/kg	-	-	-		<0.011U	0.099J	0.36J	<0.034U	0.28J	-	-	-	-	-	-	<0.021U	<0.016U	<0.0039U	<0.018U	<0.021U	<0.0065U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		<0.021U	<0.042U	<0.049U	<0.035U	<0.048U	-	-	-	-	-	-	<0.0096U	<0.0049U	0.025J	<0.01U	<0.0073U	0.080J
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.03J	0.14J	0.14J	<0.025U	<0.034U	-	-	-	-	-	-	<0.011U	<0.0060U	<0.0065U	<0.0077U	<0.0076U	<0.0058U
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		<0.021U	<0.04U	<0.043U	<0.036U	<0.046U	-	-	-	-	-	-	<0.0095U	<0.0052U	0.050J	0.058Q,J	<0.0071U	0.25J
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	-	-	-		<0.023U	<0.035U	0.1J	<0.039U	<0.041U	-	-	-	-	-	-	<0.0059U	<0.005U	0.051J	0.063J	<0.0049U	0.077J
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/kg	-	-	-		11,000	330	750	83	1,100	-	-	-	-	-	-	570	990	250	280	1,200	2,100
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	-	-	-		0.41J	2.4J	36	2.2J	0.5J	-	-	-	-	-	-	<0.0080U	<0.0059U	<0.0043U	<0.0035U	<0.010U	<0.0053U
	Calculated Dioxin/Furan TEQ	ng/kg	4.8	1.1	-		4.041453	0.32682	2.0718	0.07556	0.68984	-	-	-	-	-	-	0.171	0.426	0.18165	0.1845	0.455	1.0781
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/kg	100	-	-		0.77	0.237	5.2	ND	0.15	-	-	-	-	-	-	ND	0.19	0.318	0.24	0.12	0.41
SVOCs	1-Methylnaphthalene	µg/kg	180,000	55	-		0.45J	0.89J	17	6.7	<0.32U	2.7J	<0.27U	<0.31U	81	4.8J	-	3.1J	<0.27U	1.7J	2.7J	<0.29U	11
	2-methylnaphthalene	µg/kg	48,000	1,600	-		0.51J	0.69J	21	7.4	<0.38U	2J	<0.32U	<0.37U	87	5.2J	-	7.4	0.55J	1.5J	2.3J	<0.35U	8.8
	Acenaphthene	µg/kg	720,000	8,400	-		<0.18U	<0.17U	<0.2U	0.72J	<0.2U	<0.17U	<0.16U	<0.19U	11	<0.18U	-	56	0.53J	0.67J	<0.16U	<0.18U	2.4J
	Acenaphthylene	µg/kg	-	21,000	-		0.57J	2.5J	3.4J	6	<0.21U	2.4J	<0.17U	<0.2U	41	2.1J	-	11	3.1J	1.3J	1.6J	1.6J	7.6
	Anthracene	µg/kg	3,600,000	660,000	-		<0.8U	1.4J	3.5J	4.9J	<0.88U	2.1J	<0.74U	<0.87U	57	1.7J	-	200	2.5J	2.2J	1.6J	1.4J	7.8
	Benz(a)anthracene	µg/kg	160	180	-		<1U	2.8J	8.1	15	<1.1U	6	<0.92U	<1.1U	120	3.9J	-	97	3.6J	4J	3.3J	2.5J	14
	Benzo(a) pyrene	µg/kg	16	59	-		<0.82U	2.9J	7.3	15	<0.91U	5.4	<0.76U	1.4J	110	3.8J	-	52	4.1J	3.5J	3.2J	2.1J	13
	Benzo(b)fluoranthene	µg/kg	160	600	-		<1.3U	3.8J	12	25	<1.5U	6.6	2J	2J	150	4.8J	-	65	4J	5.5	5.3	2.8J	22
	Benzo(g,h,i)perylene	µg/kg	-	7,800,000	-		<1.2U	2.1J	4.9J	8.3	<1.3U	<1.2U	<1.1U	<1.3U	78	2.8J	-	25	3.2J	2.7J	2.6J	1.7J	9.4
	Benzo(k)fluoranthene	µg/kg	1,600	5,900	-		<1.1U	1.3J	3.6J	8.2	<1.2U	1.8J	<1.0U	<1.2U	43	1.2J	-	23	1.4J	1.7J	1.7J	<1.1U	6.3J
	Chrysene	µg/kg	16,000	18,000	-		1.1J	4.6J	12	22	<1.2U	8.7	<1.0U	<1.2U	160	5.9	-	96	4.1J	6.2	6.6	2.9J	27
	Dibenz(a,h)anthracene	µg/kg	16	190	-		<1.4U	<1.4U	<1.6U	2.7J	<1.6U	1.7J	<1.3U	<1.6U	22	<1.4U	-	6.3J	<1.4U	<1.3U	<1.3U	<1.5U	2.4J
	Fluoranthene	µg/kg	480,000	330,000	-		1.7J	5.5	15	22	<1.2U	10	<1.0U	<1.2U	280	7.4	-	530	3.6J	9.9	9.3	4J	39
	Fluorene	µg/kg	480,000	56,000	-		<0.52U	0.72J	1.4J	1.1J	<0.58U	1.8J	<0.48U	<0.57U	32	1.1J	-	200	0.57J	1.1J	1J	0.53J	4.4J
	Indeno(1,2,3-c,d)pyrene	µg/kg	160	2,000	-		<1.2U	1.9J	5J	9.5	<1.3U	<1.2U	<1.1U	<1.3U	63	2.2J	-	30	2.9J	2.4J	2.4J	1.7J	9.7
	Naphthalene	µg/kg	3,800	210	-		0.64J	0.53J	15	4.3J	<0.4U	<0.34U	<0.33U	<0.39U	76	<0.36U	-	24	0.51J	1.1J	1.5J	0.48J	6.5
	Phenanthrene	µg/kg	-	68,000	-		1.5J	6.5	19	16	<1.3U	16	<1.1U	<1.3U	280	11	-	49	1.6J	10	9.9	2.9J	43
	Pyrene	µg/kg	360,000	220,000	-		1.4J	8.1	16	23	<1.3U	14	2.4J	2J	300	9.6	-	410	6.2	8.8	8.3	4.9J	37
	PAH TEQ	µg/kg	16	59	-		0.0011	3.7676	9.858	22.754	ND	8.4	0.2	1.6	165.9	4.9	-	77.826	5.1681	4.7132	4.3236	2.8029	20.06
Metals	Aluminium	mg/kg	15,000	-	42,996		18,000	9,600	23,000	14,000	27,000	4,200	5,700	4,800	6,300	5,900	-	16,000	8,200	5,300	4,700	11,000	7,400
	Antimony	mg/kg	6.2	0.9	-		<0.44U	<0.36U	<2.4U	<0.44U	<0.42U	<0.41U	<0.36U	<0.42U	<0.47U	<0.43U	-	<0.46U	<0.41U	<0.39U	<0.34U	<0.38U	<0.39U
	Arsenic	mg/kg	0.68	5.8	3.2		1.6J	1.2J	5.9J	1.6J	0.8J	<0.71U	<0.62U	<0.73U	2.1J	1.1J	1.9J	1.3J	1.4J	1.4J	0.83J	0.93J	0.69J
	Barium	mg/kg	3,000	580	58.4		48	31	82	56	34	30B	41B	33B	34	39B	-	59B	22B	35B	31B	16B	32B
	Beryllium	mg/kg	32	63	1.4		1.2	0.26J	1.2J	0.64	0.31J	0.21J	0.34J	0.31J	0.23J	0.63	-	0.57J	0.27J	0.2J	0.19J	0.29J	0.29J
	Cadmium	mg/kg	14	3	-		<0.047U	<0.043U	<0.26U	<0.046U	<0.044U	<0.044U	<0.039U	<0.045U	0.25J	0.12J	-	<0.05U	<0.045U	<0.042U	<0.036U	<0.042U	<0.042U
	Chromium (III+VI)	mg/kg	24,000	360,000	52.2		29	5.9	8J	9	7.3	9.0B	8.6B	5.4B	10B	6.6B	-	3.9	6.8	7.4	5	11	7.2
	Cobalt	mg/kg	4.6	0.9	30.9		3.5	2	14	6	1	1.0J	1.2	1.5	4.3	3.1	-	1.9	4.7	2.2	2	4.1	1.7
	Copper	mg/kg	620	700	67.3		40	8.5	28	23	13	3.4	5.1	4.4	75	18	-	5.9	6.5	7.4	6.6	68	25
	Iron	mg/kg	11,000	150	59,291		27,000B	5,100	31,000	17,000	8,400	1700	1200	1900	7400	5400	-	23,000	5,900	5,400	4,900	13,000	6,600
	Lead	mg/kg	400	270	35.0		11	7.1	18	21	5.5	4.6	5.1	5.4	30	56	-	9.2	11	9	7.9	11	7.8
	Manganese	mg/kg	360	65	1,542		130	33	570	230	47	53	38	32	81	240	-	160	150	100	89	210	38
	Mercury	mg/kg	1.9	1	-		0.023	0.03	0.16	0.036	0.026	0.013J	0.012J	0.015J	0.055	0.0098J	-	0.024	0.013J	0.013J	0.016J	<0.0072U	0.025
	Nickel	mg/kg	300	130	7.6		5.6	1.8J	5.4J	3.1J	2.9J	3.4J	2.9J	2.0J	5.1	3.0J	-	1.9J	1.9J	1.3J	1.1J	3.5J	1.4J
	Selenium	mg/kg	78	2.1	1.9		<0.99U	<0.82U	<5.4U	1.1J	1.1J	<0.92U	<0.81U	<0.95U	1.3J	<0.96U	-	<1U	<0.93U	<0.88U	<0.76U	<0.87U	<0.88U
	Silver	mg/kg	78	3.4	-		<0.18U	<0.15U	<1U	<0.18U	<0.18U	<0.17U	<0.15U	<0.18U	<0.20U	<0.18U	-	<0.19U	<0.17U	<0.16U	<0.14U	<0.16U	<0.16U
	Thallium	mg/kg	0.16	0.28	-		<0.75U	<0.62U	<4.1U	<0.75U	<0.72U	<0.70U	<0.61U	<0.72U	<0.81U	<0.73U	-	<0.79U	<0.71U	<0.66U	<0.58U	<0.66U	<0.66U
	Vanadium	mg/kg	78	6	96.2		68	9.6	84	39	24	5.6	6.9	6.9	21	11	-	21	16	13	11	21	17
	Zinc	mg/kg	4,600	1,200	257.2		57	11	73	58	20	8.7	9	8.5	58	24	-	48	12	8.5	8.5	32	11

Notes:
1. ng/kg indicates nanogram per kilogram.
2. mg/kg indicates milligram per kilogram.
3. µg/kg indicates microgram per kilogram.
4. TEQ indicates total equivalents.
5. ft BGS indicates feet below ground surface.
6. U indicates result was below the method detection limit.
7. J indicates results is an estimate.
8. PSRG indicates preliminary soil remediation goals and reference NCDENR's Inactive Hazardous Sites Branch's tables from Septemb
9. SVOC indicates semi-volatile organic compound.
10. PAH indicates polyaromatic hydrocarbon.
11. ND indicates all of the input parameters into the caculated parameter were non-detect.
12. Highlighted concentrations are exceedences of the screening criteria.

Table 3
Background Soil Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Analyte	Units	Location	BKG-1	BKG-2	BKG-3	BKG-4	BKG-5	BKG-6	BKG-7	BKG-8	BKG-9	BKG-10	Final Background Concentration
		Sample Depth (ft BGS)	9-10	NR	7-8	9-10	9-10	9-10	9-10	9-10	9-10	NR	
		Sample Date	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	10/13/2014	
Aluminium	mg/kg		16,000	22,000	35,000	23,000	24,000	21,000	29,000	30,000	14,000	15,000	42,996
Antimony	mg/kg		<0.44U	<0.37U	<0.4U	<0.45U	<0.39U	<0.39U	<0.45U	<0.36U	<0.36U	<0.44U	-
Arsenic	mg/kg		1.3J	1.6J	1.2J	1.9J	1.5J	0.69J	2.5	2.3	1.4J	1.8J	3.2
Barium	mg/kg		45	34	24	18	22	29	28	46	21	18	58.4
Beryllium	mg/kg		0.57J	0.51	0.37J	0.77	0.57	0.22J	0.39J	1.8	0.34J	0.3J	1.4
Cadmium	mg/kg		<0.045U	<0.041U	<0.044U	<0.049U	<0.042U	0.053J	<0.046U	0.2J	<0.042U	<0.22U	-
Chromium (III+VI)	mg/kg		5.6	4.8	8.6	20	12	21	10	13	20	14	52.2
Cobalt	mg/kg		1.9	1.5	1.6	5	11	7.6	2.1	78	3.1	1.2	30.9
Copper	mg/kg		28	21	11	14	22	41	14	50	45	19	67.3
Iron	mg/kg		13,000	14,000	16,000	29,000	15,000	16,000	17,000	56,000	16,000	12,000	59,291
Lead	mg/kg		13	11	9.3	20	35	14	12	33	3.8	5.9	35.0
Manganese	mg/kg		130	64	65	160	150	330	48	1700	560	66	1,542
Nickel	mg/kg		2.4J	2.8J	3.4J	5	4J	7.5	3.8J	4.2	3.2J	2.2J	7.6
Selenium	mg/kg		<1U	<0.83U	0.99J	1.1J	1.2J	<0.87U	1.3J	1.8	<0.81U	<0.99U	1.9
Silver	mg/kg		<0.19U	<0.15U	<0.17U	<0.19U	<0.16U	<0.16U	<0.19U	<0.15U	<0.15U	<0.18U	-
Thallium	mg/kg		<0.76U	<0.63U	<0.69U	<0.78U	<0.67U	<0.66U	<0.77U	<0.62U	<0.61U	<0.75U	-
Vanadium	mg/kg		28	32	31	66	44	28	50	190	45	28	96.2
Zinc	mg/kg		22	33	18	27	45	110	27	84	14	11	257.2

Notes:
1. mg/kg indicates milligram per kilogram.
2. ft BGS indicates feet below ground surface.
3. U indicates result was below the method detection limit.
4. J indicates results is an estimate.
5. NR indicates not recorded.

Table 4
ISM Soil Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Method Type	Analyte	Units	Residential PSRG	Protection of Groundwater PSRG	Background Concentration	Location	DU01		
						Depth (ft BGS)	0-1	0-1	0-1
						Sample Date	2/26/2014	2/27/2014	2/27/2014
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/kg	-	-	-		470	290	250
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		91	53	48
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	-	-	-		9.4	5.1	4.2J
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		8.7	4.4J	4.6J
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		4.3J	2.2J	1.8J
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		18	12	9.7
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		5.7	3.8J	2.9J
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/kg	-	-	-		5.7	3.6J	4J
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.18J	0.096J	0.12J
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8	1.1	-		0.11J	0.39J	0.31J
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/kg	-	-	-		0.91J	0.74J	0.78J
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		<0.045U	0.13J	0.15J
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	-	-	-		0.97J	0.68J	0.65J
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-	-	-		0.33J	0.2J	0.19J
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	-	-	-		0.098J	0.29J	0.076J
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/kg	-	-	-		5800	4200	3500
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	-	-	-		290	170	150
	Calculated Dioxin/Furan TEQ	ng/kg	4.8	1.1	-		13.0148	8.6925	7.6531
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/kg	100	-	-		32.4	20	18.3
SVOCs	1-Methylnaphthalene*	µg/kg	18,000	55	-		95 / 350	260 / 280	240 / 150
	2-methylnaphthalene*	µg/kg	48,000	1,600	-		110 / 410	250 / 290	260 / 170
	Acenaphthene*	µg/kg	720,000	8,400	-		17 / 89	21 / 14	11 / 12
	Acenaphthylene*	µg/kg	-	21,000	-		120 / 300	130 / 64	65 / 64
	Anthracene	µg/kg	3,600,000	660,000	-		460	70	66
	Benz(a)anthracene	µg/kg	160	180	-		710	130	120
	Benzo(a) pyrene	µg/kg	16	59	-		360	69	97
	Benzo(b)fluoranthene	µg/kg	160	600	-		780	170	140
	Benzo(g,h,i)perylene	µg/kg	-	7,800,000	-		370	110	84
	Benzo(k)fluoranthene	µg/kg	1,600	5,900	-		270	56	41
	Chrysene	µg/kg	16,000	18,000	-		760	190	150
	Dibenz(a,h)anthracene	µg/kg	16	190	-		110	27	22
	Fluoranthene	µg/kg	480,000	330,000	-		1,800	300	220
	Fluorene	µg/kg	480,000	56,000	-		390	33	33
	Indeno(1,2,3-c,d)pyrene	µg/kg	160	2,000	-		380	76	67
	Naphthalene*	µg/kg	3,800	210	-		64 / 310	150 / 180	160 / 100
	Phenanthrene	µg/kg	-	68,000	-		2,100	350	270
	Pyrene	µg/kg	360,000	220,000	-		1,500	340	270
	PAH TEQ	µg/kg	16	59	-		660	134	152
Metals	Aluminium	mg/kg	15,000	-	42,996		13,000	13,000	12,000
	Antimony	mg/kg	6.2	0.9	-		<0.37U	<0.36U	<0.38U
	Arsenic	mg/kg	0.68	5.8	3.2		2.5	3	2.6
	Barium	mg/kg	3,000	580	58.4		59	61	58
	Beryllium	mg/kg	32	63	1.4		0.37J	0.33J	0.27J
	Cadmium	mg/kg	14	3	-		0.11J	0.13J	0.13J
	Chromium (III+VI)	mg/kg	24,000	360,000	52.2		19	28	33
	Cobalt	mg/kg	4.6	0.9	30.9		7	9	8.5
	Copper	mg/kg	620	700	67.3		22	25	26
	Iron	mg/kg	11,000	150	59,291		17,000	19,000	19,000
	Lead	mg/kg	400	270	35.0		13	11	11
	Magnesium	mg/kg	-	-	-		3,000	4,100	4,800
	Manganese	mg/kg	360	65	1,542		380	450	470
	Mercury	mg/kg	1.9	1	-		0.03	0.036	0.03
	Nickel	mg/kg	300	130	7.6		12	18	19
	Selenium	mg/kg	78	2.1	1.9		<0.84U	<0.82U	<0.86U
	Silver	mg/kg	78	3.4	-		<0.16U	<0.15U	<0.16U
	Thallium	mg/kg	0.16	0.28	-		<0.63U	<0.62U	<0.65U
	Vanadium	mg/kg	78	6	96.2		33	36	34
	Zinc	mg/kg	4,600	1,200	257.2		58	67	66

Notes:
1. * indicates analysis was performed both before and after ISM sample processing in the laboratory.
   Results are reported as "X / Y" where X is the result before processing and Y is the result after processing.
2. ng/kg indicates nanogram per kilogram.
3. mg/kg indicates milligram per kilogram.
4. µg/kg indicates microgram per kilogram.
5. TEQ indicates total equivalents.
6. ft BGS indicates feet below ground surface.
7. U indicates result was below the method detection limit.
8. J indicates results is an estimate.
9. PSRG indicates preliminary soil remediation goals and reference NCDENR's Inactive Hazardous Sites Branch's tables from September 2015.
10. SVOC indicates semi-volatile organic compound.
11. PAH indicates polyaromatic hydrocarbon.
12. Highlighted concentrations are exceedences of the screening criteria.

Table 5
Groundwater Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Method Type	Analyte	Units	Preliminary Groundwater Remediation Goals (2Ls and	Location	MW-1				MW-2				MW-3							
				Sample Date	3/10/2014	9/9/2014	4/21/2015	11/19/2015	3/11/2014	9/9/2014	4/21/2015	11/21/2015	3/10/2014	3/10/2014 (Dup)	9/10/2014	9/10/2014 (Dup)	4/24/2015	4/24/2015 (Dup)	11/21/2015	11/21/2015 (Dup)
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-		<0.00029U	0.00093J	0.00078U	0.0015J	<0.00028U	0.00062J	0.00066U	<0.00054U	<0.00038U	<0.000098U	<0.0022U	<0.00045U	<0.00075U	<0.00024U	<0.00069U	<0.00029U
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-		<0.00032U	0.00048J	0.0012U	<0.0005U	0.0012J	0.00079J	0.00047U	0.00058J	<0.00037U	<0.00036U	<0.00035UJ	<0.000094U	<0.00017U	<0.0008U	<0.000088UJ	0.00038J
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-		<0.00033U	0.00082J	0.00026U	<0.00041U	<0.00011U	0.00039J	<0.00014U	<0.00014U	<0.00033U	<0.00011U	<0.000071U	<0.000046U	<0.00021U	<0.00094U	<0.00041U	<0.00012U
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-		0.00047J	<0.000079U	<0.00013U	<0.00011U	<0.00034U	<0.00011U	0.00072J	<0.00036U	<0.000087U	<0.00011U	<0.00012U	<0.000086U	<0.00011U	<0.00013U	<0.00024U	<0.00013U
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00038U	<0.000096U	<0.000075U	<0.000079U	<0.00036U	<0.00011U	<0.00005U	<0.00026U	<0.00022U	<0.000044U	0.00035J	<0.000086UJ	<0.00006U	<0.000075U	<0.0003U	<0.00018U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-		<0.00012U	<0.000081U	<0.00013U	<0.00012U	<0.00032U	<0.00012U	0.00039J	<0.00036U	<0.000095U	<0.00028U	<0.00013U	<0.000087U	0.00072J	<0.00015UJ	<0.00028U	<0.00012U
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00023U	<0.000096U	0.00024U	<0.000077U	<0.00034U	<0.00011U	0.00015U	0.00057J	<0.00022U	<0.000055U	<0.000081U	<0.000082U	<0.000058U	<0.000039U	<0.00029U	<0.00018U
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-		<0.00045U	0.00028J	<0.00012U	<0.00011U	0.0011J	<0.00011U	<0.000064U	<0.00034U	<0.00042U	<0.00011U	<0.00012U	<0.00033U	<0.000099U	<0.00013U	<0.00024U	<0.00012U
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00053U	0.00048J	<0.000087U	<0.0001U	<0.00035U	0.0004J	<0.000059U	<0.00031U	<0.00019U	<0.00017U	<0.000093U	<0.0001U	<0.000072U	<0.000089U	<0.00035U	<0.00021U
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002		<0.000059U	<0.000044U	<0.000013U	<0.000089U	<0.00017U	<0.000041U	<0.000013U	<0.00019U	<0.000055U	<0.000043U	<0.000059U	<0.000027U	<0.000013U	<0.000018U	<0.00011U	<0.000072U
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-		<0.00036U	<0.000057U	<0.00032U	<0.00031U	<0.00012U	<0.000051U	0.00045U	<0.00086U	<0.000041U	<0.00011U	<0.000062U	<0.00004U	0.00063J	<0.0004U	<0.00013U	<0.00082U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-		<0.00033U	<0.0001U	<0.000057U	<0.00037U	0.001J	<0.00012U	<0.000025U	<0.00018U	0.00058J	<0.000069UJ	<0.000066UJ	0.00028J	<0.000068U	<0.00012U	<0.00021U	<0.00093U
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00033U	0.00034J	0.00043U	<0.000086U	<0.00034U	<0.00011U	<0.000054U	<0.00027U	<0.000035U	<0.000046U	<0.000084U	<0.000089U	<0.000066U	0.00048J	<0.0003U	<0.0002U
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-		<0.00028U	<0.000095U	<0.000054U	0.0003J	<0.00033U	0.00021J	<0.000025U	<0.00016U	<0.00034U	<0.00018U	<0.000059U	<0.000077U	<0.000063U	<0.000061U	<0.00018U	<0.000094U
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-		0.000093J	<0.00005U	<0.000037U	<0.000099U	<0.0001U	<0.000065U	<0.000027U	<0.0001U	<0.000038U	<0.000025U	<0.000046U	<0.000062U	<0.000046U	<0.000039U	<0.00017U	<0.00006U
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-		<0.0024U	0.0078J	0.011J	0.014J	0.0082J	0.007J	0.0033U	0.0024J	<0.00051U	<0.00052U	<0.013U	<0.0025U	<0.0037U	<0.007U	<0.0015U	0.0031J
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-		<0.00044U	0.0044J	0.017J	<0.0016U	<0.00023U	0.0039J	0.0092U	0.0016J	<0.00013U	<0.00032U	<0.0014U	<0.0015U	<0.0081U	<0.0062U	<0.00016U	<0.00093U
	Calculated Dioxin/Furan TEQ	ng/L	0.0002		0.0000563	0.00013596	0.0000084	0.0001092	0.00015446	0.00012427	0.000111	0.000064	0.0000174	ND	0.000035	0.0000084	0.000702	0.000048	ND	0.000005
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-		0.000047	0.000028	ND	ND	0.00011	ND	0.00011	ND	ND	ND	ND	ND	0.000072	ND	ND	ND
SVOCs	1-Methylnaphthalene	µg/L	1		<0.0055U	<0.0058U	<0.0056U	<0.0054U	<0.0054U	<0.0056U	<0.0054U	<0.0054U	<0.0055U	<0.0054U	<0.0054U	<0.0054U	<0.0055U	<0.0056U	<0.0055U	<0.0054U
	2-methylnaphthalene	µg/L	30		<0.005U	<0.0052U	<0.0051U	<0.0049U	<0.0049U	<0.0051U	<0.0049U	<0.0049U	<0.005U	<0.0049U	<0.0049U	<0.0049U	<0.005U	<0.0051U	<0.005U	<0.0049U
	Acenaphthene	µg/L	80		<0.01U	<0.011U	<0.011U	<0.01U	<0.01U	<0.011U	<0.01U	<0.01U	<0.011U	<0.01U	<0.01U	<0.01U	<0.01U	<0.011U	<0.01U	<0.01U
	Acenaphthylene	µg/L	200		<0.0097U	<0.01U	<0.0098U	<0.0095U	<0.0095U	<0.0099U	<0.0095U	<0.0096U	<0.0097U	<0.0095U	<0.0095U	<0.0095U	<0.0096U	<0.0098U	<0.0096U	<0.0098U
	Anthracene	mg/L	2		<0.000014U	<0.000014U	<0.000014U	<0.000014U	<0.000013U	<0.000014U	<0.000014U	<0.000014U	<0.000014U	<0.000013U	<0.000014U	<0.000014U	<0.000014U	<0.000014U	<0.000014U	<0.000014U
	Benz(a)anthracene	µg/L	0.05		<0.0031U	<0.0033U	<0.0032U	<0.0031U	<0.003U	<0.0032U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0032U	<0.0031U	<0.0031U
	Benzo(a) pyrene	µg/L	0.005		<0.005U	<0.0052U	<0.0051U	<0.0049U	<0.0049U	<0.0051U	<0.0049U	<0.0049U	<0.005U	<0.0049U	<0.0049U	<0.0049U	<0.005U	<0.0051U	<0.005U	<0.0049U
	Benzo(b)fluoranthene	µg/L	0.05		<0.0033U	<0.0035U	<0.0034U	0.04J	<0.0033U	<0.0034U	<0.0033U	<0.0033U	<0.0033U	<0.0033U	<0.0033U	<0.0033U	<0.0033U	<0.0034U	<0.0033U	<0.0033U
	Benzo(g,h,i)perylene	µg/L	200		<0.0034U	<0.0036U	<0.0035U	<0.0034U	<0.0034U	<0.0035U	<0.0034U	<0.0034U	<0.0035U	<0.0034U	<0.0034U	<0.0034U	<0.0034U	<0.0035U	<0.0034U	<0.0034U
	Benzo(k)fluoranthene	µg/L	0.5		<0.0049U	<0.0051U	<0.005U	0.013J	<0.0048U	<0.005U	<0.0048U	<0.0048U	<0.0049U	<0.0048U	<0.0048U	<0.0048U	<0.0049U	<0.005U	<0.0049U	<0.0048U
	Chrysene	µg/L	5		<0.0031U	<0.0032U	<0.0032U	0.049J	<0.003U	<0.0032U	<0.003U	<0.0031U	<0.0031U	<0.003U	<0.003U	<0.003U	<0.0031U	<0.0031U	<0.0031U	<0.0031U
	Dibenz(a,h)anthracene	µg/L	0.005		<0.0047U	<0.0049U	<0.0048U	<0.0046U	<0.0046U	<0.0048U	<0.0046U	<0.0046U	<0.0047U	<0.0046U	<0.0046U	<0.0046U	<0.0047U	<0.0048U	<0.0047U	<0.0046U
	Fluoranthene	µg/L	300		<0.0044U	<0.0046U	<0.0045U	0.066J	<0.0043U	<0.0045U	<0.0043U	<0.0043U	<0.0044U	<0.0043U	<0.0043U	<0.0043U	<0.0044U	<0.0045U	<0.0044U	<0.0043U
	Fluorene	µg/L	300		<0.018U	<0.019U	<0.019U	<0.018U	<0.018U	<0.019U	<0.018U	<0.018U	<0.018U	<0.018U	<0.018U	<0.018U	<0.018U	<0.019U	<0.018U	<0.018U
	Indeno(1,2,3-c,d)pyrene	µg/L	0.05		<0.014U	<0.015U	<0.015U	<0.014U	<0.014U	<0.015U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U	<0.014U
	Naphthalene	µg/L	6		<0.0052U	<0.0054U	<0.0053U	<0.0051U	<0.0051U	0.031J	<0.0051U	<0.0051U	<0.0052U	<0.0051U	<0.0051U	<0.0051U	<0.0051U	<0.0053U	<0.0052U	<0.0051U
	Phenanthrene	µg/L	200		<0.0095U	<0.0099U	<0.0096U	0.024J	<0.0093U	<0.0096U	<0.0093U	<0.0094U	<0.0095U	<0.0093U	<0.0093U	<0.0093U	<0.0094U	<0.0096U	<0.0094U	<0.0094U
	Pyrene	µg/L	200		<0.0078U	<0.0082U	<0.008U	0.041J	<0.0077U	<0.008U	<0.0077U	<0.0078U	<0.0079U	<0.0077U	<0.0077U	<0.0077U	<0.0078U	<0.008U	<0.0078U	<0.0078U
	PAH TEQ	µg/L	0.005		ND	ND	ND	0.00418	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
General Chemistry	Bicarbonate as CaCO3	mg/L	-		76	-	-	-	140	-	-	-	55	-	-	-	-	-	-	-
	Chloride	mg/L	250		27	-	-	-	19	-	-	11B	45	-	-	-	-	-	54B	53B
	Sulfate	mg/L	250		69	77	71B	71B	170	140	120B	90B	330	-	290	280	330	350	340B	340B
	Sulphide	mg/L	-		<0.79U	-	-	-	<0.79U	-	-	-	<0.79U	-	-	-	-	-	-	-
	TDS	mg/L	500		260	200	180	180	400	320	300	250	600	-	650	640	670	670	680	680
	TSS	mg/L	-		6	-	-	-	<1.1U	-	-	-	<1.1U	-	-	-	-	-	-	-
Metals	Aluminium	mg/L	-		0.13	1.2	0.46	0.75	<0.018U	<0.018U	<0.018U	<0.018U	0.12	<0.018UJ	<0.018U	<0.018U	<0.018U	<0.018U	<0.018U	<0.018U
	Antimony	mg/L	0.001		<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U
	Arsenic	ug/L	10		<4.4U	8.3J	<4.4U	<4.4U	<4.4U	6.5J	<4.4U	5J	<4.4U	<4.4U	<4.4U	<4.4U	<4.4UJ	5.3J	12J	12J
	Barium	ug/L	700		42	36	37B	38	87	53	57B	39J	22	21	18	19	19	19	19	19
	Beryllium	mg/L	0.004		<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U	0.00053J	0.00055J	0.00051J	0.00069J	0.00061J	0.00055J	0.00052J	0.00048J
	Cadmium	ug/L	2		<0.45U	<0.45U	<0.45U	<0.45U	<0.45U	<0.45U	<0.45U	<0.45U	0.67J	0.91J	<0.45U	<0.45U	0.5J	0.58J	<0.45U	<0.45U
	Calcium	mg/L	-		24	15	13	10	31	24	22	15	61	-	65	63	78	77	73	74
	Chromium (III+VI)	ug/L	10		0.74J	2.8J	1.9J	5.5J	<0.66U	<0.66U	<0.66U	2.7J	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	<0.66U	2.0J	1.8J
	Cobalt	mg/L	0.001		<0.0012U	<0.0012U	<0.0012U	<0.0012U	0.032	0.028	0.033	0.023	0.15	0.15	0.13	0.12	0.13	0.12	0.12	0.12
	Copper	mg/L	1		<0.0014U	0.0024J	<0.0014U	<0.0014U	<0.0014U	0.0014J	<0.0014U	<0.0014U	0.0015J	<0.0014UJ	0.0028J	0.0025J	<0.0014U	<0.0014U	<0.0014U	<0.0014U
	Iron	ug/L	300		140	1,200	430	540	<22U	340	190	140	200	67J	460	450	370	340	360	330
	Lead	µg/L	15		<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U
	Magnesium	mg/L	-		5.7	3.3	2.8	2.3	7	5.9	5.6	3.7	16	-	19	18	20	20	20	20
	Manganese	ug/L	50		190	50	22	17	6,400	5700	6,000	3,800B	8,500	8,500	7,700	7,600	8,500	8,200	7,800B	7,900B
	Mercury	ug/L	1		<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.027U
	Nickel	ug/L	100		<1.3U	<1.3U	2.1J	<1.3U	5.5J	4.1J	5.9J	2.9J	31J	32J	27J	27J	26J	25J	25J	25J
	Potassium	mg/L	-		3.4	2.8J	2.7J	2.8J	3.5	3	3.6	2.7J	9.2	-	8.5	8.3	8.8	8.7	9.5	10
	Selenium	ug/L	20		<4.9U	<4.9U	5.3J	13J	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	<4.9U	16J	14J
	Silver	ug/L	20		<0.93U	<0.93U	<0.93U	<0.93U	1.2J	2.3J	<0.93U	<0.93U	<0.93U	<0.93U	2.4J	1.8J	2.1J	2.7J	<0.93U	<0.93U
	Sodium	mg/L	-		57	42	41	40B	99J	69	75	62B	100	-	99	97	110	100	97B	97B
	Thallium	mg/L	0.0002		<0.0049U	<0.0049U	<0.0049U	0.0052J	<0.0049U	<0.0049U	<0.0049U	0.0072J	<0.0049U	<0.0049U	<0.0049U	<0.0049U	<0.0049U	<0.0049U	0.018	0.021
	Vanadium	mg/L	0.0003		<0.0011U	0.003J	<0.0011U	0.0023J	<0.0011U	<0.0011U	<0.0011U	0.0017J	<0.0011U	<0.0011U	0.0011J	0.0014J	<0.0011U	<0.0011U	<0.0011UJ	0.0014J
	Zinc	mg/L	1		0.02U	0.013J	0.0082J	0.011J	<0.02U	0.0062J	0.093	0.005J	0.052	0.052	0.038	0.037	0.038	0.035	0.088J	0.22J

Notes:
1. ng/L indicates nanogram per liter.
2. mg/L indicates milligram per liter.
3. µg/L indicates microgram per liter.
4. TEQ indicates total equivalents.
5. U indicates result was below the method detection limit.
6. J indicates results is an estimate.
7. UJ indicates the analyte was not detected above the method detection limit. However, the method detection limit is an approximation.
8. B is a laboratory flag indicating compound was detected in both the method blank and sample
9. Groundwater remediation goals reference NCDENRs 2L and IMAC standards from April 1, 2013.
10. TDS indicates total dissolved solids.
11. TSS indicates total suspended solids.
12. PAH indicates polyaromatic hydrocarbon.
13. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
14. Highlighted concentrations are exceedences of screening criteria.

Table 5
Groundwater Analytical Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Method Type	Analyte	Units	Preliminary Groundwater Remediation Goals (2Ls and	Location	PZ/MW-4			MW-5		
				Sample Date	9/10/2014	4/21/2015	11/19/2015	9/10/2014	4/20/2015	11/19/2015
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-		<0.00013U	0.00056U	<0.00017U	<0.00026U	0.00065U	<0.00013U
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-		<0.000053U	0.001U	<0.00005U	<0.00022U	0.00016U	<0.00022U
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-		<0.00019U	<0.00016U	<0.00069U	<0.00029U	<0.00021U	<0.000066U
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-		<0.00011U	<0.00013U	<0.00011U	<0.000055U	<0.00013U	<0.00012U
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00011U	<0.00007U	<0.00011U	<0.00005U	0.0003J	<0.000081U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-		<0.00011U	0.00033J	<0.00011U	<0.000057U	<0.00014U	<0.00013U
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.0001U	<0.000071U	<0.0001U	<0.000048U	<0.000063U	<0.000078U
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-		<0.0001U	<0.00012U	<0.00041U	<0.00022U	<0.00013U	<0.00012U
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00038U	<0.000088U	<0.00013U	<0.000059U	0.00016U	<0.0001U
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002		<0.000095U	<0.000035U	<0.00012U	<0.000026U	<0.00001U	<0.00014U
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-		<0.000026U	<0.00028U	<0.0001U	<0.000022U	<0.00024U	<0.000084U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-		<0.000087U	<0.000047U	<0.000086U	<0.00006U	<0.000062U	<0.000093U
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-		<0.00026U	0.00034U	<0.00011U	<0.00005U	0.00041U	<0.000082U
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-		<0.00008U	<0.00005U	<0.00008U	<0.000052U	<0.00006U	<0.000089U
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-		<0.000041U	<0.000028U	<0.000095U	<0.000028U	<0.00003U	<0.00011U
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-		<0.0054U	<0.0036U	<0.0021U	<0.0026U	<0.0058U	<0.002U
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-		<0.002U	<0.0072U	<0.00036U	<0.0011U	<0.007U	<0.00085U
	Calculated Dioxin/Furan TEQ	ng/L	0.0002		ND	0.000033	ND	0.00002278	0.00003	ND
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-		ND	0.00033	ND	0.000022	ND	ND
SVOCs	1-Methylnaphthalene	µg/L	1		<0.0054U	<0.0056U	<0.0054U	<0.0054U	<0.006U	<0.0054U
	2-methylnaphthalene	µg/L	30		<0.0049U	<0.0051U	<0.0049U	<0.0049U	<0.0055U	<0.0049U
	Acenaphthene	µg/L	80		<0.01U	<0.011U	<0.01U	<0.01U	<0.011U	<0.01U
	Acenaphthylene	µg/L	200		<0.0095U	<0.0098U	<0.0096U	<0.0095U	<0.011U	<0.0096U
	Anthracene	mg/L	2		<0.000014U	<0.000014U	<0.000014U	<0.000013U	<0.000015U	<0.000014U
	Benz(a)anthracene	µg/L	0.05		<0.0031U	<0.0032U	<0.0031U	<0.003U	<0.0034U	0.043J
	Benzo(a) pyrene	µg/L	0.005		<0.0049U	<0.0051U	<0.0049U	<0.0049U	<0.0055U	0.036J
	Benzo(b)fluoranthene	µg/L	0.05		<0.0033U	<0.0034U	<0.0033U	<0.0033U	<0.0037U	0.049J
	Benzo(g,h,i)perylene	µg/L	200		<0.0034U	<0.0035U	<0.0034U	<0.0034U	<0.0038U	0.067J
	Benzo(k)fluoranthene	µg/L	0.5		<0.0048U	<0.005U	<0.0048U	<0.0048U	<0.0054U	0.049J
	Chrysene	µg/L	5		<0.0031U	<0.0031U	<0.0031U	<0.003U	<0.0034U	0.048J
	Dibenz(a,h)anthracene	µg/L	0.005		<0.0046U	<0.0048U	<0.0046U	<0.0046U	<0.0051U	0.07J
	Fluoranthene	µg/L	300		<0.0043U	<0.0045U	<0.0043U	<0.0043U	<0.0048U	<0.0043U
	Fluorene	µg/L	300		<0.018U	<0.019U	<0.018U	<0.018U	<0.02U	<0.018U
	Indeno(1,2,3-c,d)pyrene	µg/L	0.05		<0.014U	<0.014U	<0.014U	<0.014U	<0.016U	0.061J
	Naphthalene	µg/L	6		<0.0051U	<0.0053U	<0.0051U	<0.0051U	<0.0057U	<0.0051U
	Phenanthrene	µg/L	200		<0.0093U	<0.0096U	<0.0094U	<0.0093U	<0.01U	<0.0094U
	Pyrene	µg/L	200		<0.0077U	<0.008U	<0.0078U	<0.0077U	<0.0086U	0.027J
	PAH TEQ	µg/L	0.005		ND	ND	ND	ND	ND	0.122
General Chemistry	Bicarbonate as CaCO3	mg/L	-		-	-	-	-	-	-
	Chloride	mg/L	250		-	-	-	-	-	-
	Sulfate	mg/L	250		53	62B	73B	170	200B	200J
	Sulphide	mg/L	-		-	-	-	-	-	-
	TDS	mg/L	500		140	140	170	420	390	410
	TSS	mg/L	-		-	-	-	-	-	-
Metals	Aluminium	mg/L	-		0.022J	0.046J	0.046J	<0.018U	0.054J	0.12
	Antimony	mg/L	0.001		<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U	<0.0031U
	Arsenic	ug/L	10		<4.4U	<4.4U	7.1J	<4.4U	<4.4U	5.1J
	Barium	ug/L	700		34	32B	41	18	23B	21
	Beryllium	mg/L	0.004		<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U	<0.00047U
	Cadmium	ug/L	2		<0.45U	<0.45U	<0.45U	<0.45U	<0.45U	<0.45U
	Calcium	mg/L	-		14	15	20	42	37	40
	Chromium (III+VI)	ug/L	10		19	26	29	<0.66U	0.69J	4.4J
	Cobalt	mg/L	0.001		<0.0012U	<0.0012U	<0.0012U	0.0018J	0.0021J	0.0015J
	Copper	mg/L	1		0.0017J	<0.0014U	<0.0014U	0.0018J	<0.0014U	<0.0014U
	Iron	ug/L	300		<22U	35J	70J	<22U	36J	67J
	Lead	µg/L	15		<2.6U	<2.6U	<2.6U	<2.6U	<2.6U	<2.6U
	Magnesium	mg/L	-		4.1	4.5	5.5	14	13	13
	Manganese	ug/L	50		7.7J	4.3J	4U	28	38	22B
	Mercury	ug/L	1		<0.027U	<0.027U	<0.027U	<0.027U	<0.027U	<0.0027U
	Nickel	ug/L	100		1.8J	2.3J	<1.3U	5.7J	7.6J	3.5J
	Potassium	mg/L	-		3.6	3.8	3.8	2.4J	2.7J	2.8J
	Selenium	ug/L	20		<4.9U	5J	<4.9U	<4.9U	<4.9U	11J
	Silver	ug/L	20		<0.93U	<0.93U	<0.93U	<0.93U	<0.93U	<0.93U
	Sodium	mg/L	-		15	15	14B	61	61	63B
	Thallium	mg/L	0.0002		<0.0049U	<0.0049U	0.0067J	<0.0049U	<0.0049U	0.0077J
	Vanadium	mg/L	0.0003		<0.0011U	<0.0011U	<0.0011U	<0.0011U	<0.0011U	<0.0011U
	Zinc	mg/L	1		0.0088J	0.0076J	0.0075J	<0.0045U	0.0046J	<0.0045U

Notes:
1. ng/L indicates nanogram per liter.
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3. µg/L indicates microgram per liter.
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13. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
14. Highlighted concentrations are exceedences of screening criteria.

Table 6
Final Remediation Goals for Soil
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Soil COCs	Units	Final Health Based Remdial Goal	Final Protection of GW Remedial Goal	Background Concentration	Final Unrestricted Use Remedial Goal for Soil
2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8	-	-	4.8
Calculated Dioxin/Furan TEQ	ng/kg	4.8	1.1	-	1.1
Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/kg	625	-	-	625
1-Methylnaphthalene	ug/kg	112,500	-	-	112,500
Benz(a)anthracene	ug/kg	1,000	-	-	1,000
Benzo(a) pyrene	ug/kg	100	-	-	100
Benzo(b)fluoranthene	ug/kg	1,000	-	-	1,000
Benzo(k)flouranthene	ug/kg	10,000	-	-	10,000
Chrysene	ug/kg	100,000	-	-	100,000
Dibenz(a,h)anthracene	ug/kg	100	-	-	100
Indeno(1,2,3-c,d)pyrene	ug/kg	1,000	-	-	1,000
Naphthalene	ug/kg	7,647	-	-	7,647
PAH TEQ	ug/kg	100	-	-	100
Aluminium	mg/kg	15,000	-	42,996	42,996
Arsenic	mg/kg	2.1	5.8	3.2	3.2
Barium	mg/kg	3,000	-	58.4	3,000
Beryllium	mg/kg	32	-	1.4	32
Cobalt	mg/kg	4.6	0.9	30.9	30.9
Copper	mg/kg	620	-	67.3	620
Iron	mg/kg	11,000	150	59,291	59,291
Lead	mg/kg	400	-	35	400
Manganese	mg/kg	360	65	1,542	1,542
Mercury	mg/kg	1.9	-	-	1.9
Selenium	mg/kg	78	-	1.9	78.0
Thallium	mg/kg	0.16	0.28	-	0.16
Vanadium	mg/kg	78	6	96.2	96.2

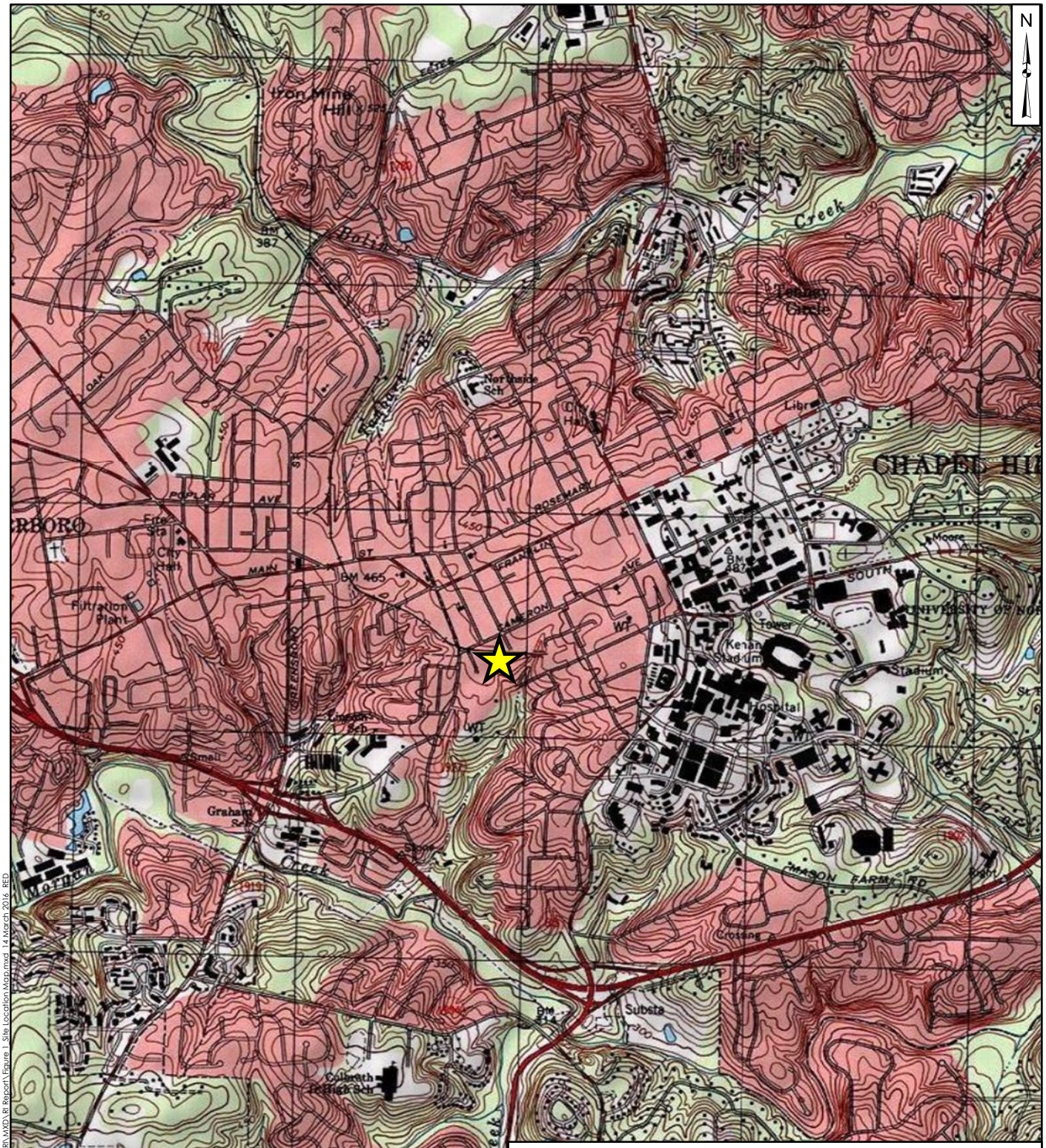
Table 7
Final Remediation Goals for Groundwater
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Groundwater COCs	Units	2L and IMACs	Background Concentration	Final Remedial Goal for Groundwater
Calculated Dioxin/Furan TEQ	ng/L	0.0002	-	0.0002
Benzo(a) pyrene	ug/L	0.005	-	0.005
Dibenz(a,h)anthracene	ug/L	0.005	-	0.005
Indeno(1,2,3-c,d)pyrene	ug/L	0.05	-	0.05
PAH TEQ	ug/L	0.005	-	0.005
Sulfate	mg/L	250	-	250
TDS	mg/L	500	-	500
Chromium (III+VI)	ug/L	10	-	10
Cobalt	mg/L	0.001	-	0.001
Iron	ug/L	300	578	578
Manganese	ug/L	50	70	70
Vanadium	mg/L	0.0003	-	0.0003

Notes:

1. Background concentration is the average concentration for the 4 monitoring events at MW-1.

FIGURES



Legend

Site Location

Notes:
1. Source: 2013 National Geographic Society, i-cubed

Site Location

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, North Carolina

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure 1

Path: \\Raleigh-01\Data1 M:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\RI Report\Figure 1_Site Location Map.mxd 14 March 2016 RED

Legend

- Site Boundary
- Flyash Basin
- Silt Basin
- Warehouse
- Piedmont Geologic Initial Excavation
- Drainage Feature
- Culverted Drainage Feature
- Parcels

Notes:
1. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Site Layout Map

UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec
Consultants of NC, PC
License No. C-3500

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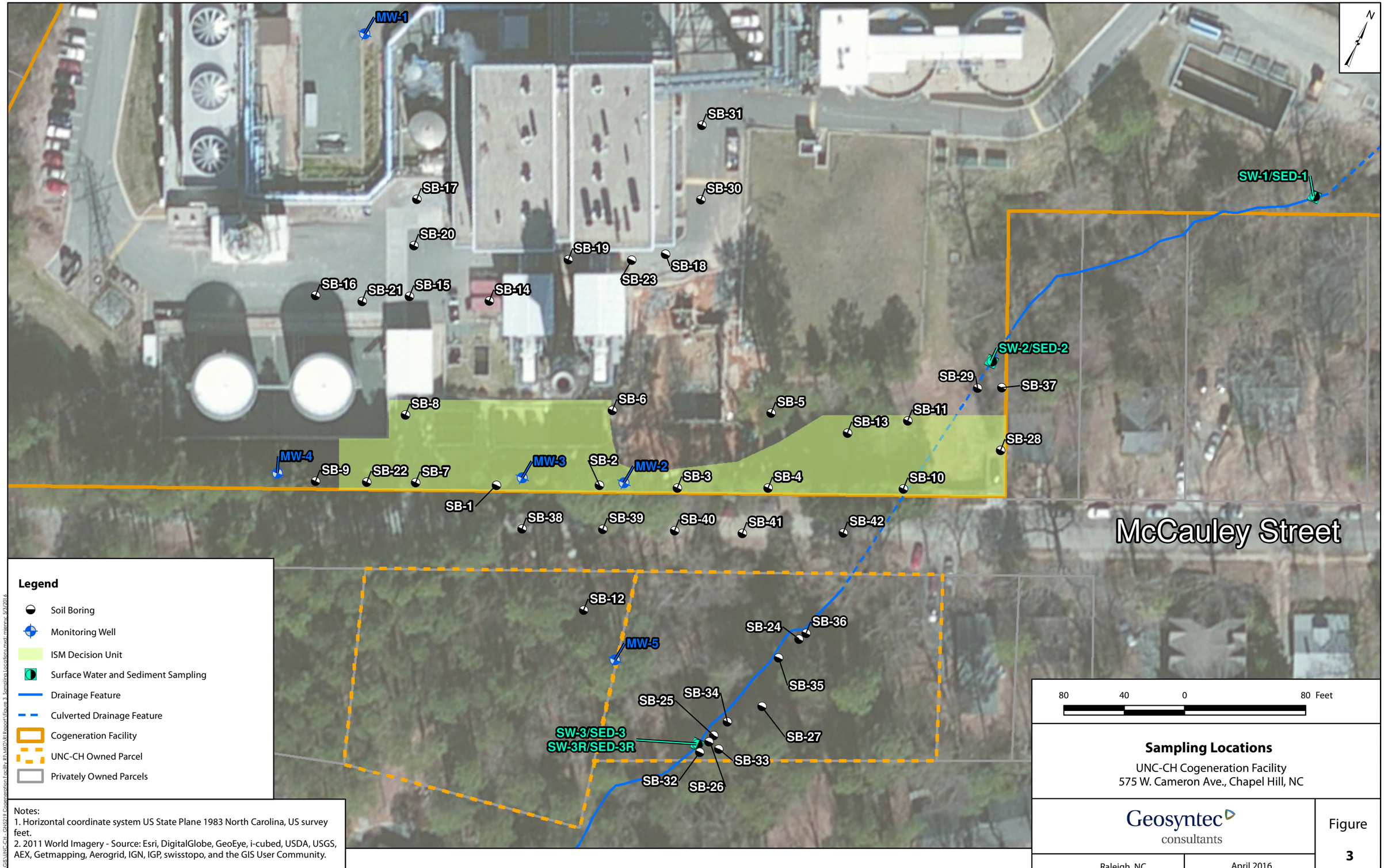
Figure 2

M:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\RI Report\Figure 2_Site Layout Map.mxd: mlenny: 5/3/2016



Legend

- Soil Boring
- Monitoring Well
- ISM Decision Unit
- Surface Water and Sediment Sampling
- Drainage Feature
- Culverted Drainage Feature
- Cogeneration Facility
- UNC-CH Owned Parcel
- Privately Owned Parcels

Notes:
1. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
2. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

M:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\RI Report\Figure 3_Sampling Locations.mxd; miannv; 5/3/2016

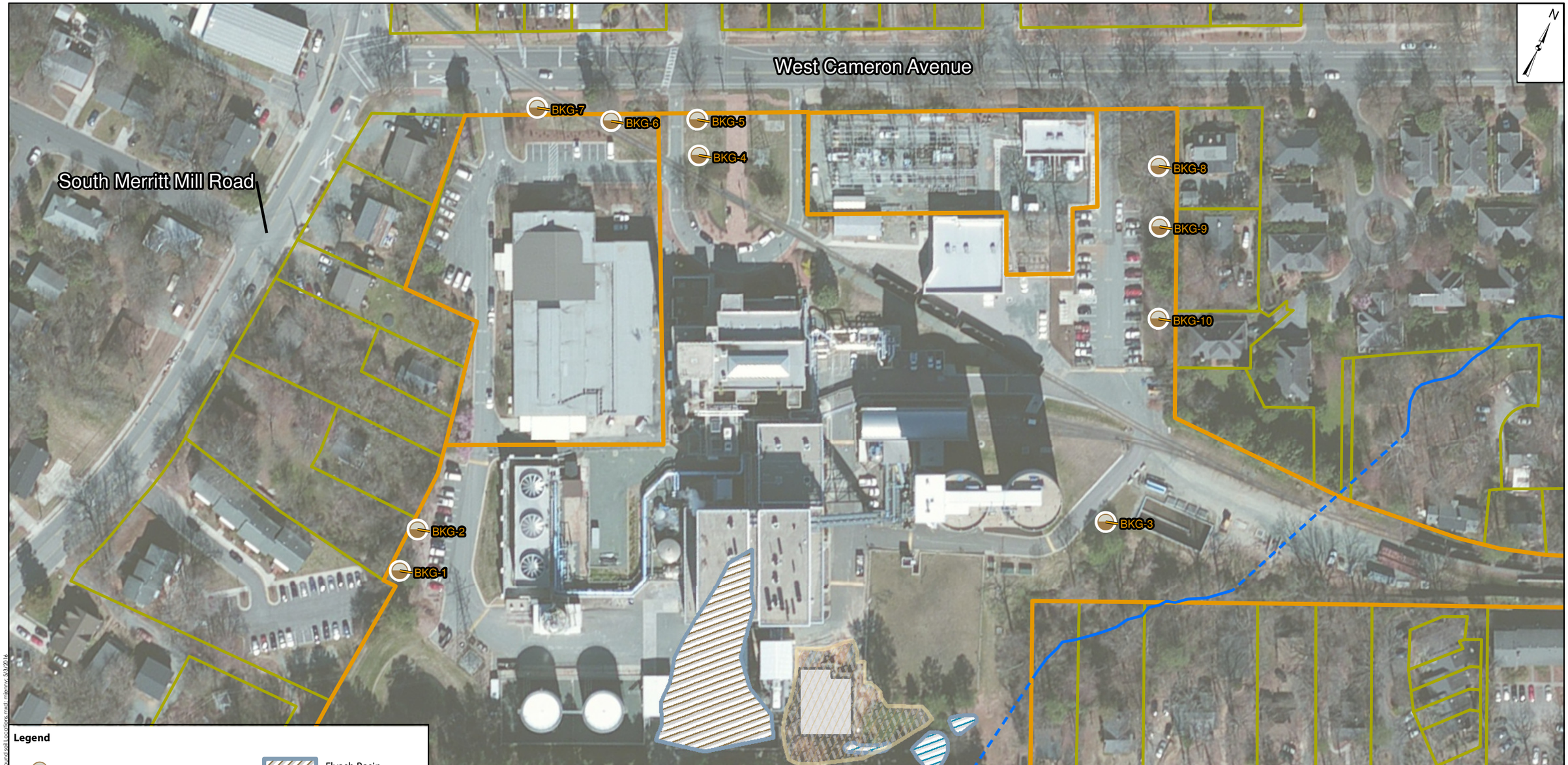
Sampling Locations

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

Geosyntec consultants

Raleigh, NC | April 2016

Figure 3



Legend

- Background Sampling Location
- Drainage Feature
- Culverted Drainage Feature
- Cogeneration Facility
- Privately Owned Parcels
- Piedmont Geologic Initial Investigation
- Flyash Basin
- Silt Basin
- Warehouse

Notes:
1. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
2. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Background Soil Sampling Locations

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

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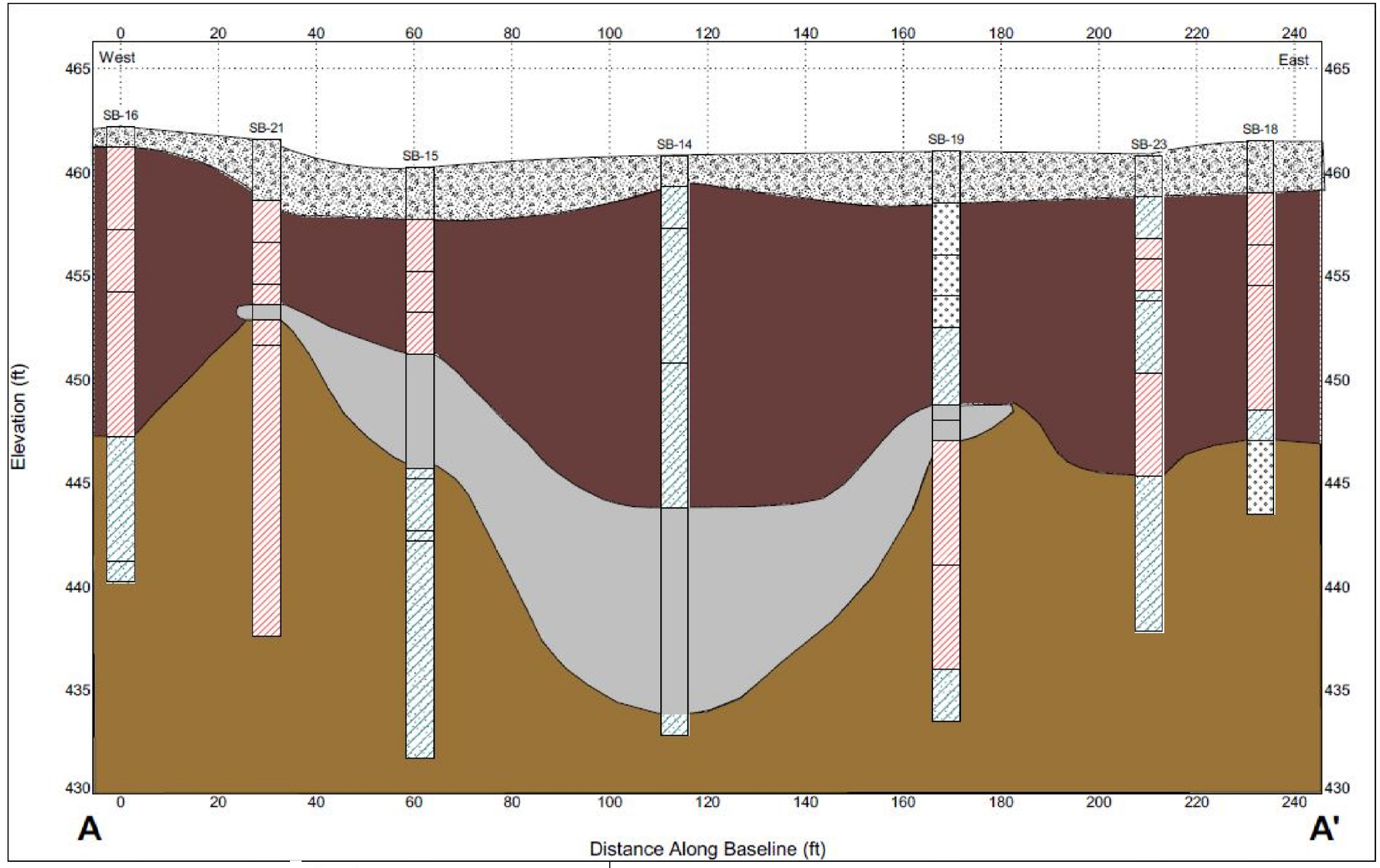
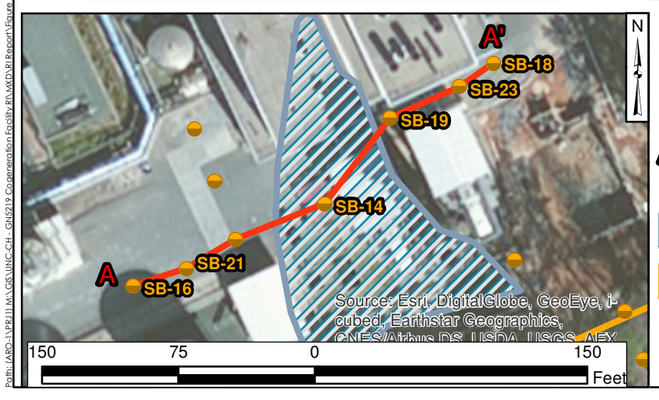
Figure 4

M:\GIS\UNC-CH - GH5219 Cogeneration Facility RI\MXD\RI Report\Figure 4 - Background soil Locations.mxd: mlenny: 5/3/2016

USCS Soil Boring Legend

- Asphalt
- Topsoil
- Fill Material
- CCBs
- Gravel/Concrete
- Poorly-graded GRAVEL (GP)
- Clayey SAND (SC)
- Low plasticity CLAY (CL)
- High plasticity CLAY (CH)
- Low plasticity silty CLAY (CL-ML)
- Well-graded SAND with clay (SW-SC)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Well-graded SAND (SW)





Site and Cross Section Legend

- Borings
- A — A' Transect A-A'
- Historic Fly Ash Basin
- Property Boundaries

- Asphalt
- Gravel/Concrete
- CCBs
- Fill - minor isolated pockets of CCBs are suspected within
- Native material - clayey SAND (SC) to sandy CLAY (CL)/ Saprolite

Notes:
1. CCB designates Coal Combustion Byproducts
2. Soil borings collected by Geosyntec Consultants from 23-28 October 2013.
3. USCS indicates Unified Soil Classification System
4. The USCS soil boring legend incorporates only the soils identified at the Site.
5. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

40 20 0 40 Feet

Vertical Exaggeration = 4

Lithologic Cross Section A to A'

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

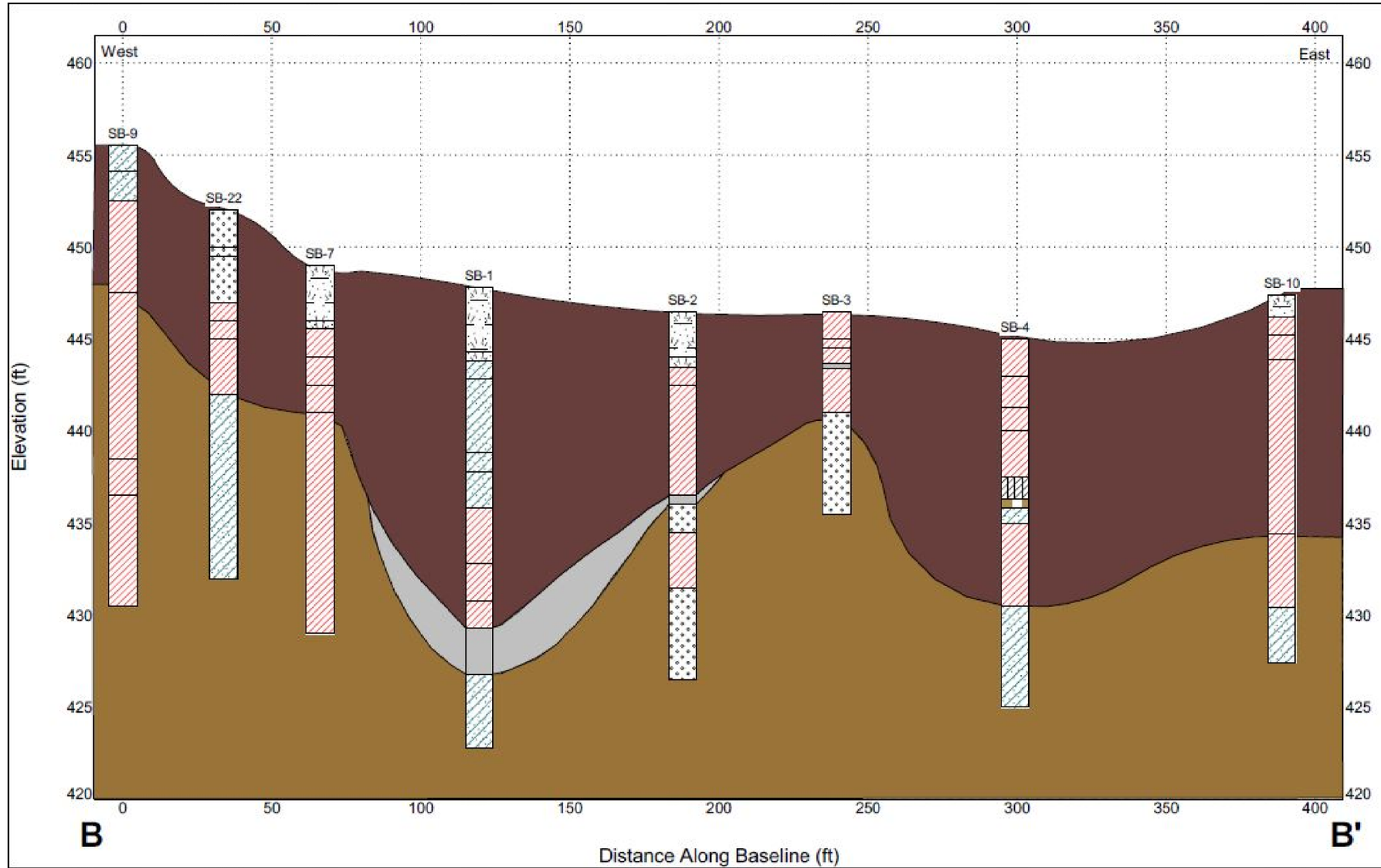
Raleigh, NC

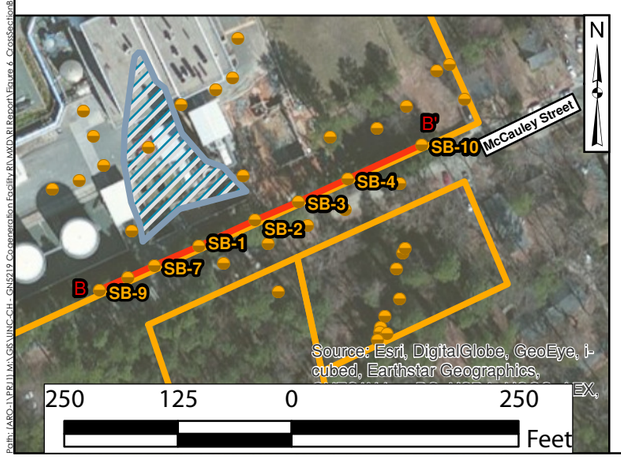
April 2016

Figure 5

USCS Soil Boring Legend

- Asphalt
- Topsoil
- Fill Material
- CCBs
- Gravel/Concrete
- Poorly-graded GRAVEL (GP)
- Clayey SAND (SC)
- Low plasticity CLAY (CL)
- High plasticity CLAY (CH)
- Low plasticity silty CLAY (CL-ML)
- Well-graded SAND with clay (SW-SC)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Well-graded SAND (SW)





Site and Cross Section Legend

- Borings
- Transect B-B'
- Historic Fly Ash Basin
- Property Boundaries

- Asphalt
- Gravel/Concrete
- CCBs
- Fill - minor isolated pockets of CCBs are suspected within
- Native material - clayey SAND (SC) to sandy CLAY (CL)/ Saprolite

Notes:
1. CCB designates Coal Combustion Byproducts
2. Soil borings collected by Geosyntec Consultants from 23-28 October 2013.
3. USCS indicates Unified Soil Classification System
4. The USCS Legend incorporates only the soils identified at the Site.
5. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

50 25 0 50 Feet

Vertical Exaggeration = 6

Lithologic Cross Section B to B'

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

Geosyntec Consultants of NC, PC
NC License No.: C-3500

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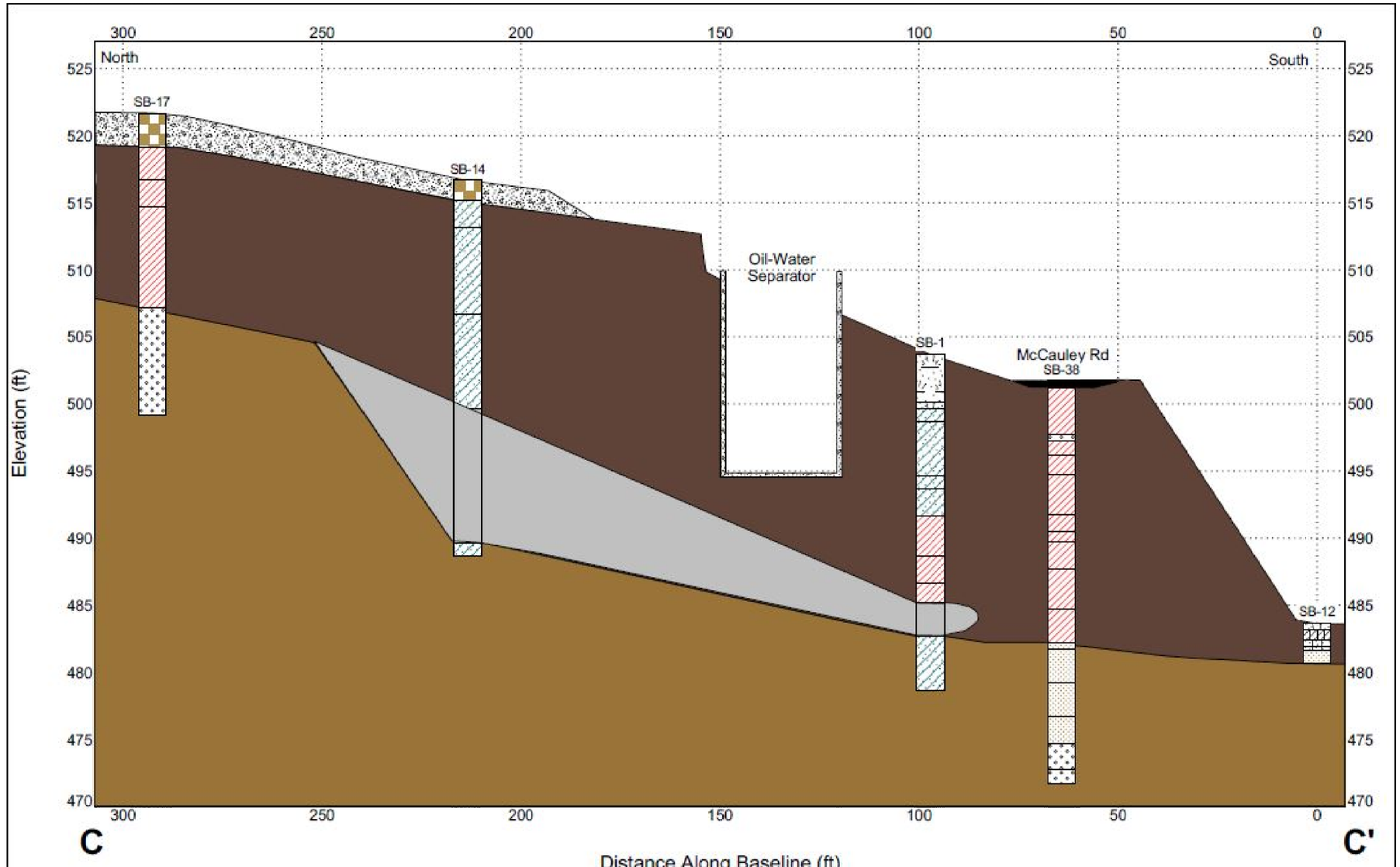
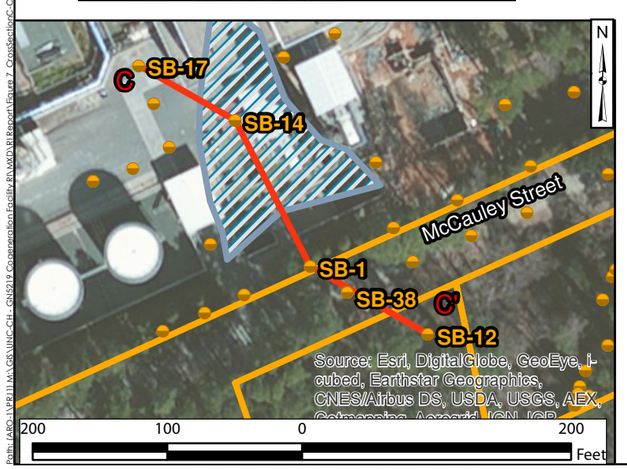
Figure 6

USCS Soil Boring Legend

- Asphalt
- Topsoil
- Fill Material
- CCBs
- Gravel/Concrete
- Poorly-graded GRAVEL (GP)
- Clayey SAND (SC)
- Low plasticity CLAY (CL)
- High plasticity CLAY (CH)
- Low plasticity silty CLAY (CL-ML)
- Well-graded SAND with clay (SW-SC)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Well-graded SAND (SW)





Site and Cross Section Legend

- Borings
- Transect C-C'
- Historic Fly Ash Basin
- Property Boundaries

- Asphalt
- Gravel/Concrete
- CCBs
- Fill - minor isolated pockets of CCBs are suspected within
- Native material - clayey SAND (SC) to sandy CLAY (CL)/ Saprolite

Notes:
1. CCB designates Coal Combustion Byproducts
2. Soil borings collected by Geosyntec Consultants from 23-28 October 2013 and 22 April 2015.
3. USCS indicates Unified Soil Classification System.
4. The USCS soil boring legend incorporates only the soils identified at the Site.
5. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

50 25 0 50 Feet

Vertical Exaggeration = 3.3

Lithologic Cross Section C to C'

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

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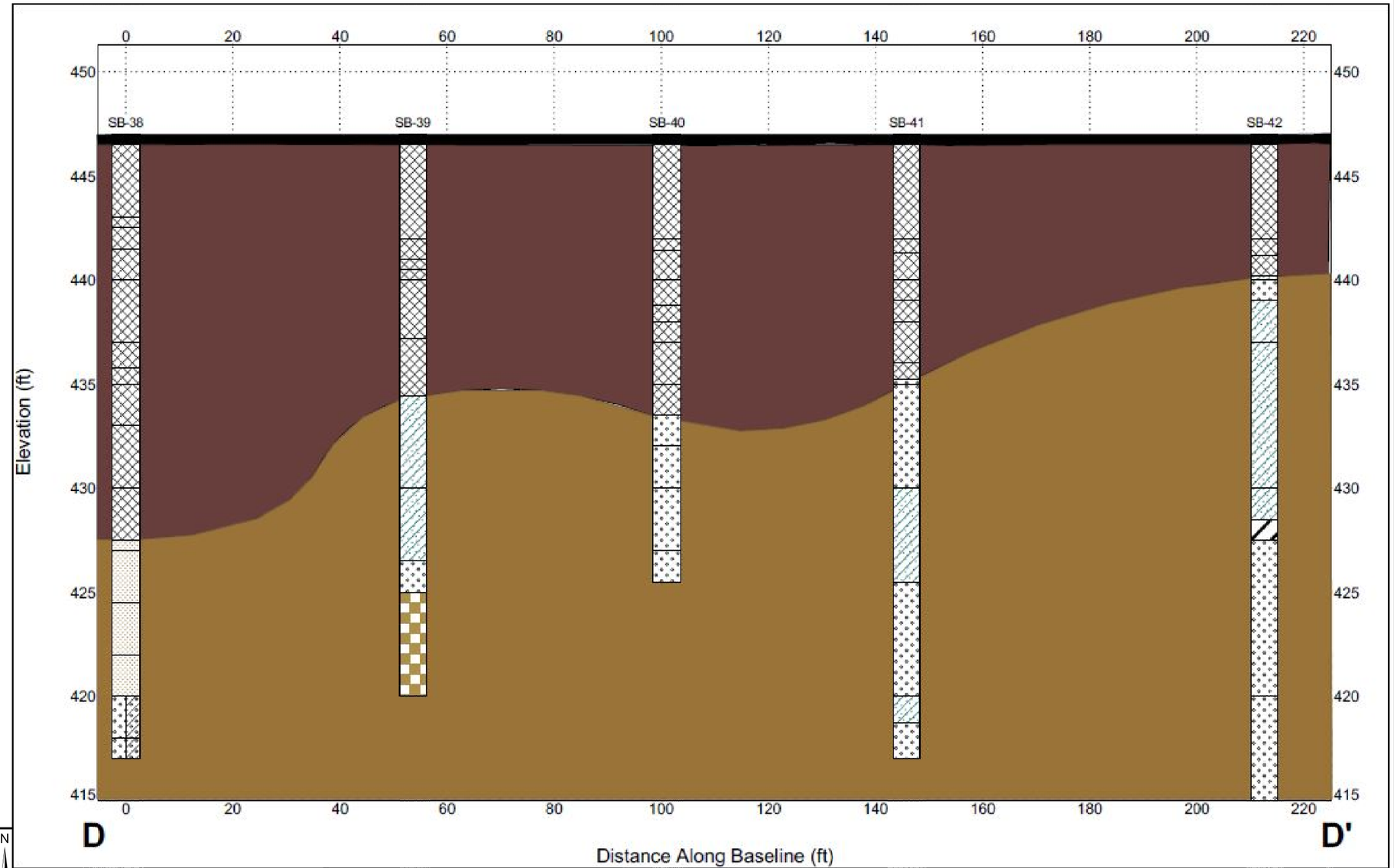
NC License No.: C-3500

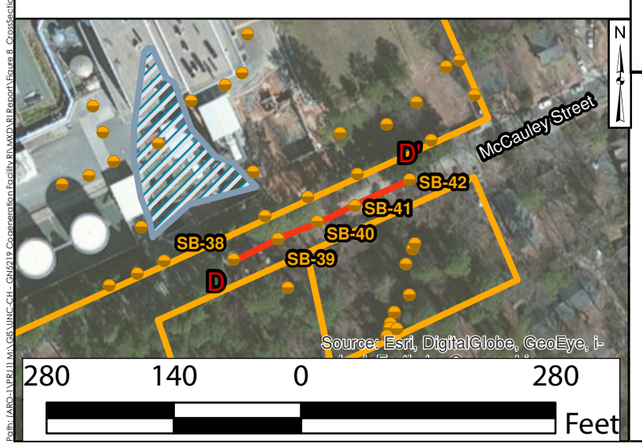
Raleigh, NC | April 2016

Figure 7

USCS Soil Boring Legend

- Asphalt
- Topsoil
- Fill Material
- CCBs
- Gravel/Concrete
- Poorly-graded GRAVEL (GP)
- Clayey SAND (SC)
- Low plasticity CLAY (CL)
- High plasticity CLAY (CH)
- Low plasticity silty CLAY (CL-ML)
- Well-graded SAND with clay (SW-SC)
- Poorly-graded SAND (SP)
- Silty SAND (SM)
- Well-graded SAND (SW)





Site and Cross Section Legend

- Borings
- Transect D-D'
- Historic Fly Ash Basin
- Property Boundaries

- Asphalt
- Gravel/Concrete
- CCBs
- Fill - minor isolated pockets of CCBs are suspected within
- Native material - clayey SAND (SC) to sandy CLAY (CL)/ Saprolite

Notes:
1. CCB designates Coal Combustion Byproducts.
2. Soil borings collected by Geosyntec Consultants from 22-23 April 2015.
3. USCS indicates Unified Soil Classification System.
4. The USCS soil boring legend incorporates only the soils identified at the Site.
5. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

40 20 0 40 Feet

Vertical Exaggeration = 4

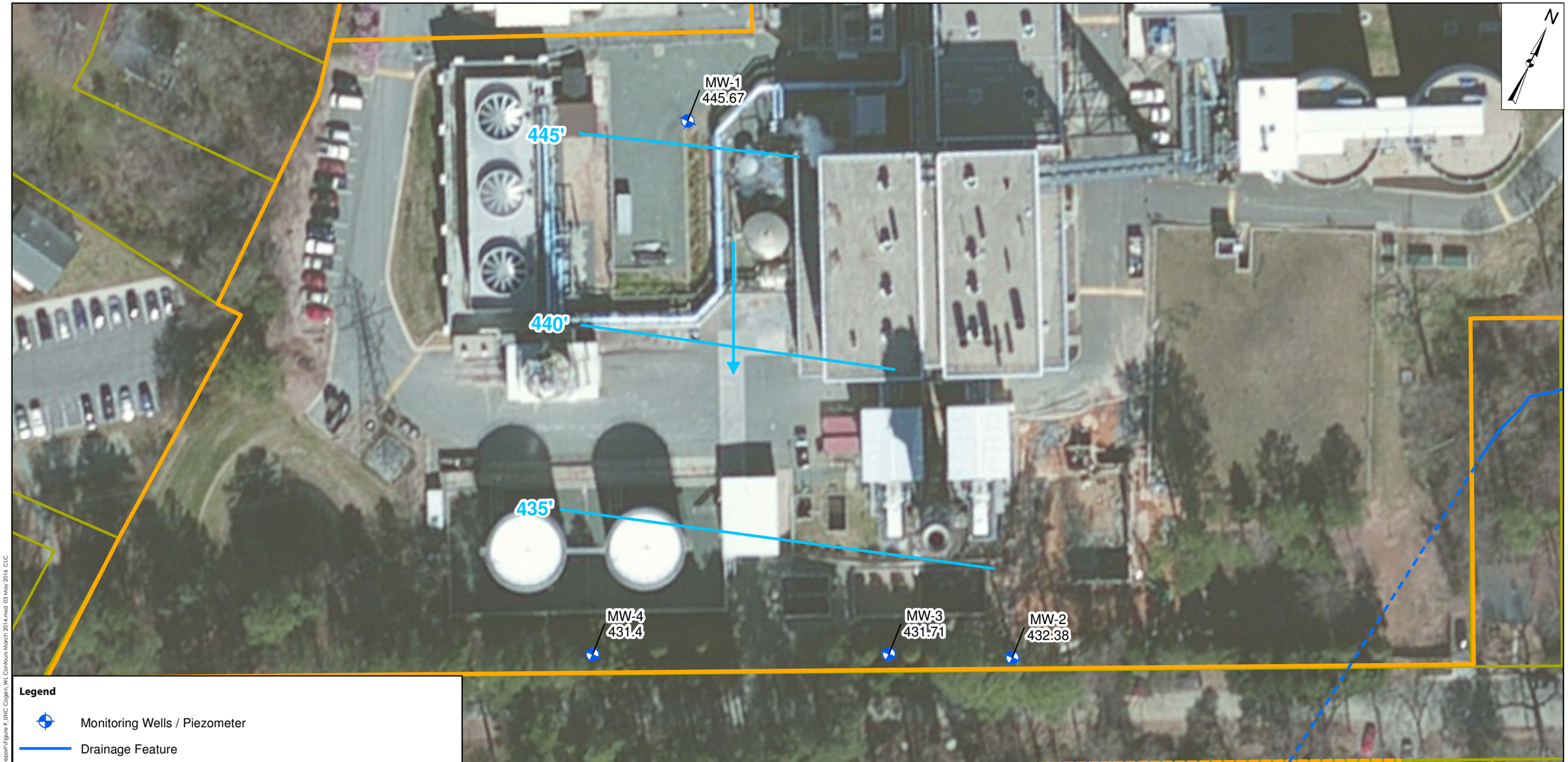
Lithologic Cross Section D to D'

UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

Geosyntec Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure 8



Legend

- Monitoring Wells / Piezometer
- Drainage Feature
- Culverted Drainage Feature
- Potentiometric Contours
- Cogeneration Facility Site
- UNC-Owned Parcels
- Privately Owned Parcels
- Groundwater flow direction

Notes:
1. NM indicates not measured - monitoring well installed in August 2014
2. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
3. Groundwater flow direction is approximate.
4. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

75 37.5 0 75 Feet

Potentiometric Surface Map
10 March 2014

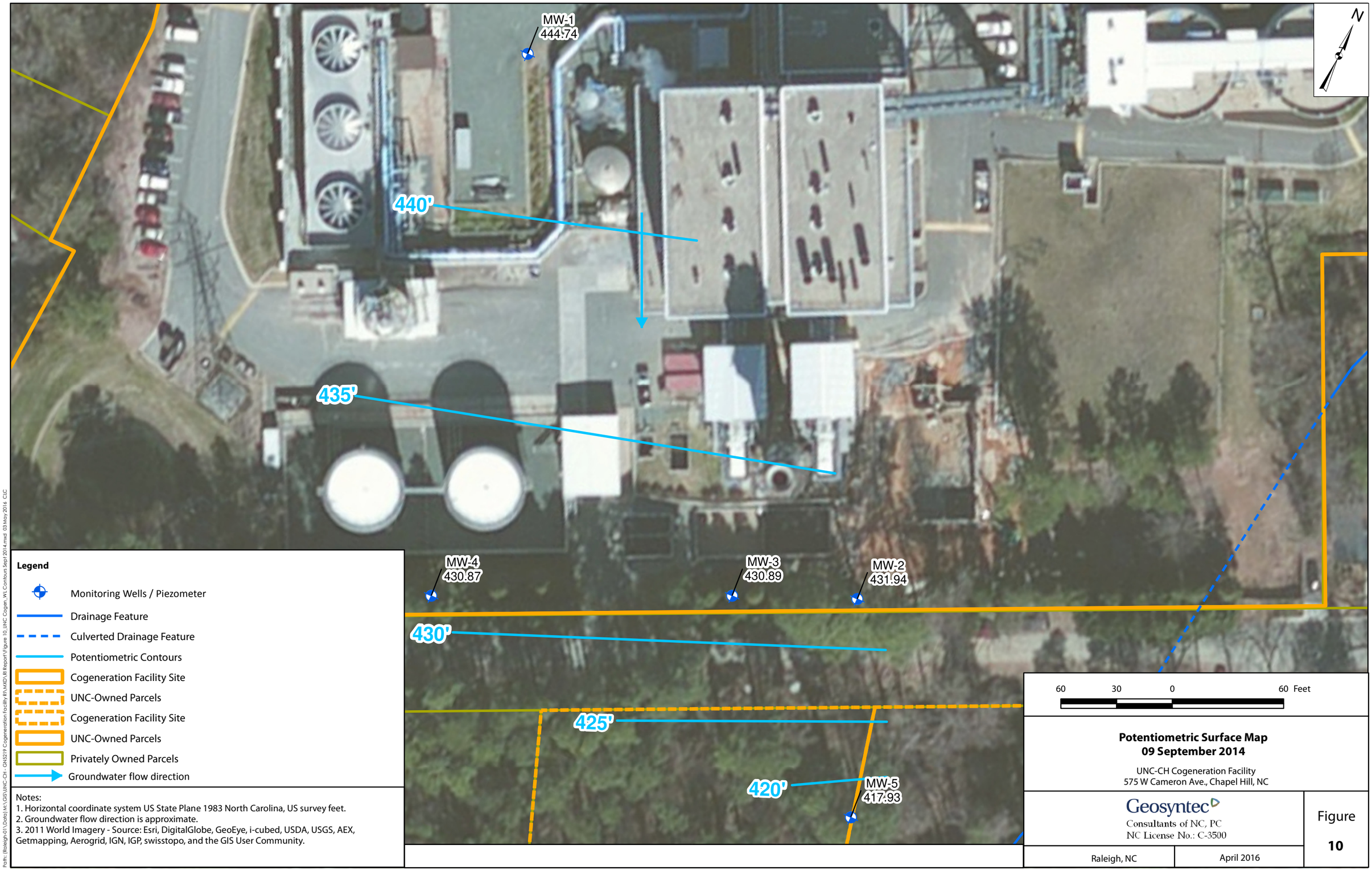
UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure
9

Path: (Raleigh-01\Data)M:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\RI Report\Figure 9_UNC Cogen_WL Contours March 2014.mxd 03 May 2016 CLC



Legend

- Monitoring Wells / Piezometer
- Drainage Feature
- Culverted Drainage Feature
- Potentiometric Contours
- Cogeneration Facility Site
- UNC-Owned Parcels
- Cogeneration Facility Site
- UNC-Owned Parcels
- Privately Owned Parcels
- Groundwater flow direction

Notes:
1. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
2. Groundwater flow direction is approximate.
3. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Potentiometric Surface Map
09 September 2014

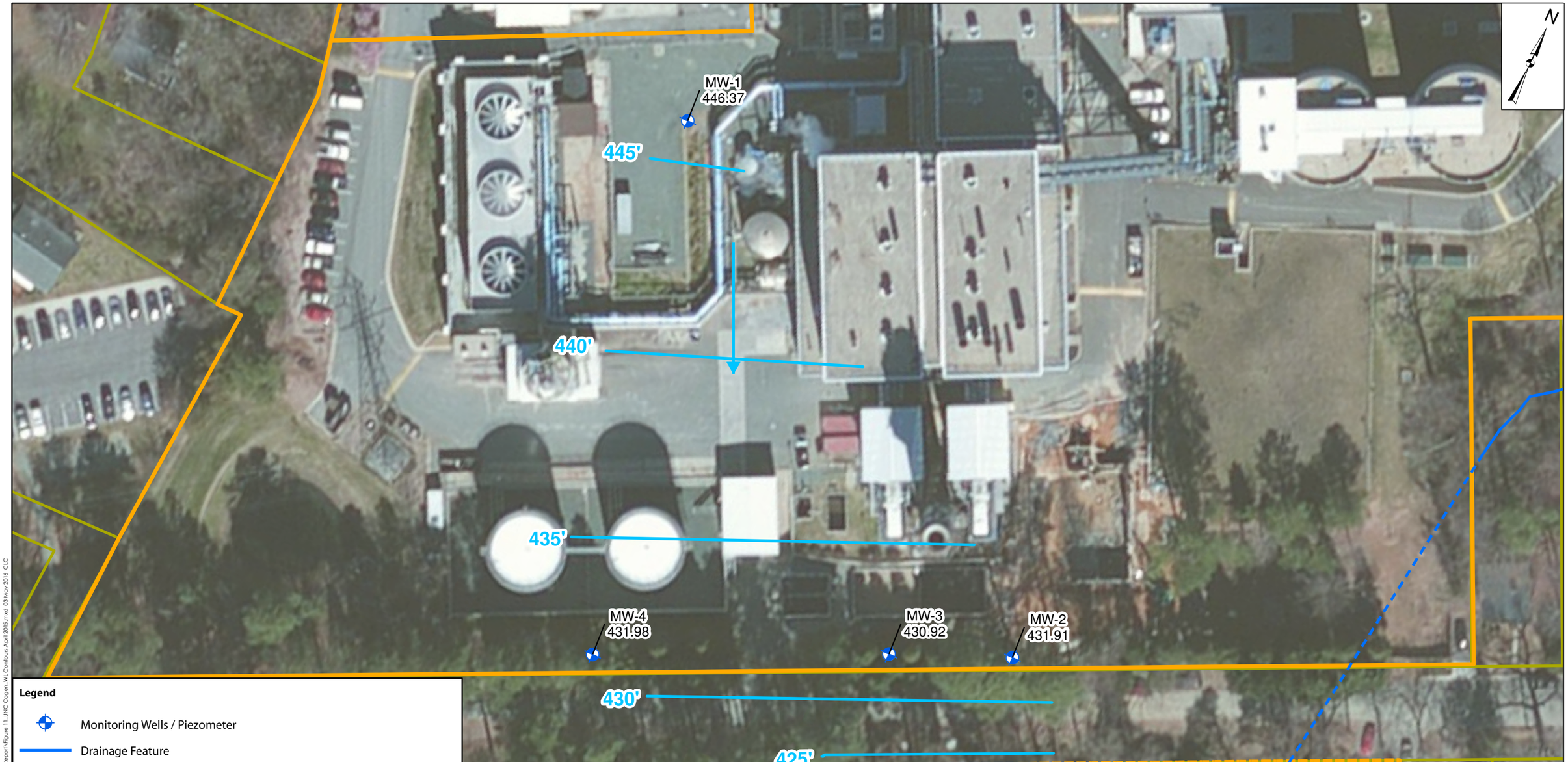
UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec
Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure
10

Path: (Raleigh-01\Data)M:\GIS\UNC-CH - GN5219 Cogeneration Facility R\MXD\R Report\Figure 10_UNC Cogen_WL Contours Sept 2014.mxd 03 May 2016 CIC



Legend

- Monitoring Wells / Piezometer
- Drainage Feature
- Culverted Drainage Feature
- Potentiometric Contours
- Cogeneration Facility Site
- UNC-Owned Parcels
- Privately Owned Parcels
- Groundwater flow direction

Notes:
1. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
2. Groundwater flow direction is approximate.
3. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

75 37.5 0 75 Feet

Potentiometric Surface Map
20 April 2015

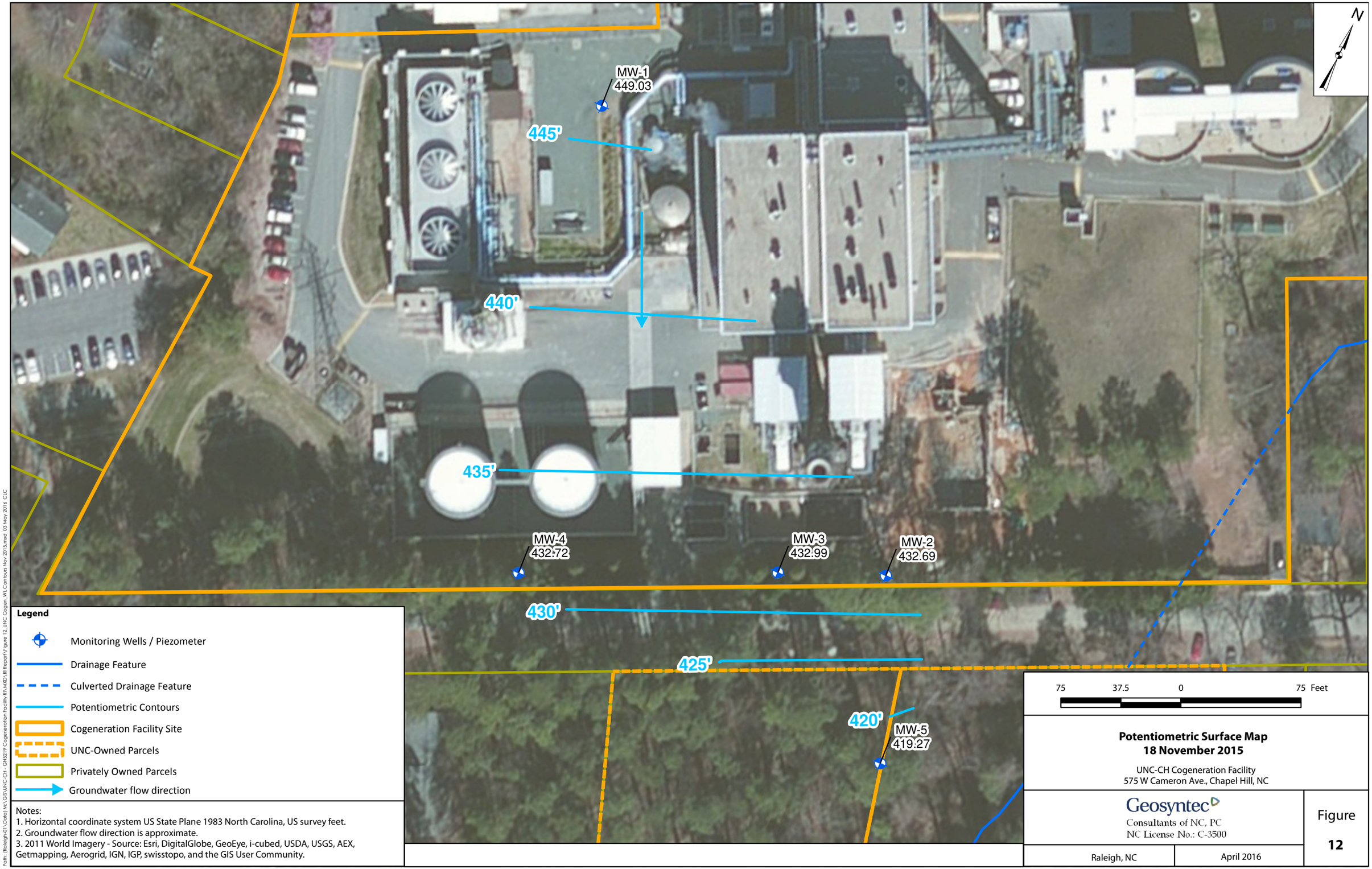
UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure 11

Path: [Raleigh-01\Data] M:\GIS\UNC-CH - GH5219 Cogeneration Facility RI\MXD\RI Report\Figure 11_UNC Cogen_WL Contours April 2015.mxd 03 May 2016 CLC



Legend

- Monitoring Wells / Piezometer
- Drainage Feature
- Culverted Drainage Feature
- Potentiometric Contours
- Cogeneration Facility Site
- UNC-Owned Parcels
- Privately Owned Parcels
- Groundwater flow direction

Notes:
1. Horizontal coordinate system US State Plane 1983 North Carolina, US survey feet.
2. Groundwater flow direction is approximate.
3. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Potentiometric Surface Map
18 November 2015

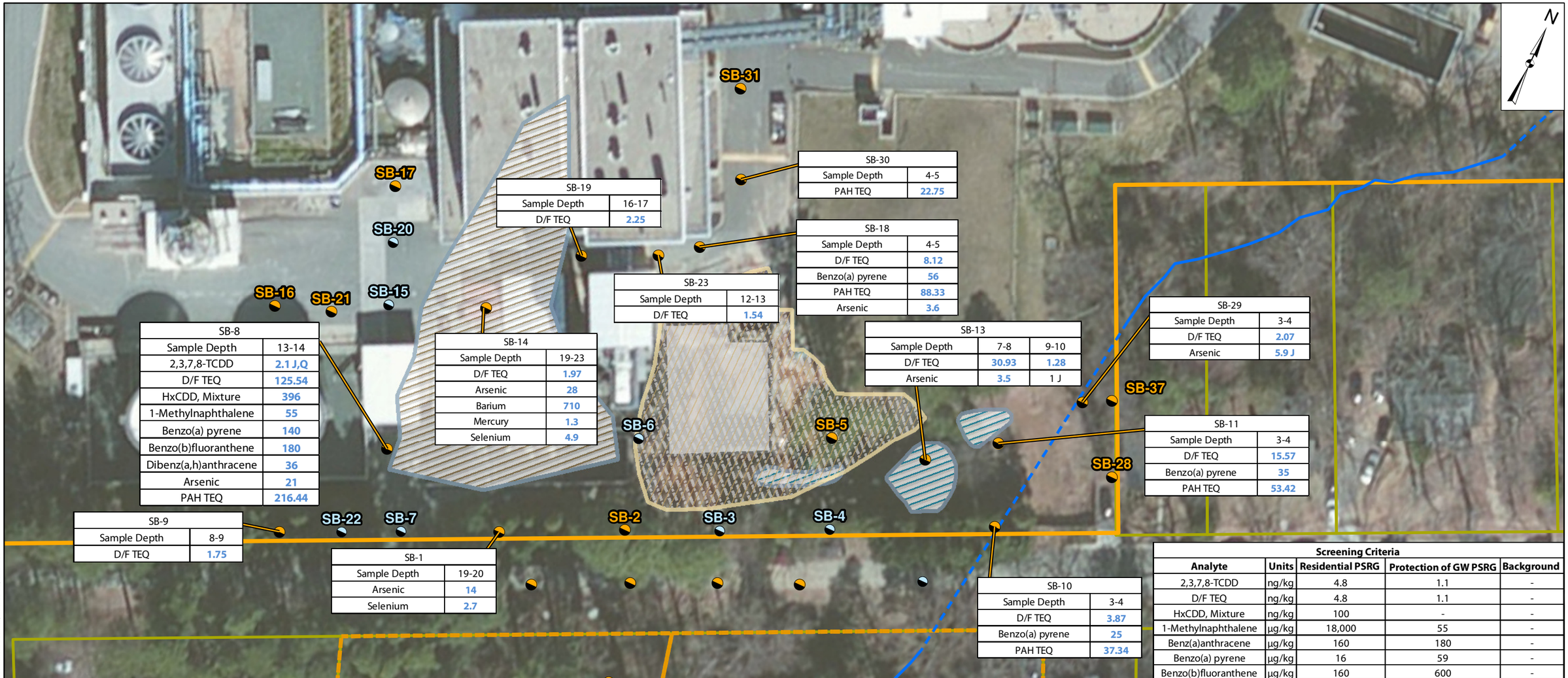
UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure
12

Path: [Raleigh-01\Data] M:\GIS\UNC-CH - GH5219 Cogeneration Facility RI\MXD\RI Report\Figure 12_UNC Cogen_WL Contours Nov 2015.mxd 03 May 2016 CLC



SB-30	
Sample Depth	4-5
PAH TEQ	22.75

SB-19	
Sample Depth	16-17
D/F TEQ	2.25

SB-18	
Sample Depth	4-5
D/F TEQ	8.12
Benzo(a) pyrene	56
PAH TEQ	88.33
Arsenic	3.6

SB-23	
Sample Depth	12-13
D/F TEQ	1.54

SB-29	
Sample Depth	3-4
D/F TEQ	2.07
Arsenic	5.9 J

SB-8	
Sample Depth	13-14
2,3,7,8-TCDD	2.1 J,Q
D/F TEQ	125.54
HxCDD, Mixture	396
1-Methylnaphthalene	55
Benzo(a) pyrene	140
Benzo(b)fluoranthene	180
Dibenz(a,h)anthracene	36
Arsenic	21
PAH TEQ	216.44

SB-14	
Sample Depth	19-23
D/F TEQ	1.97
Arsenic	28
Barium	710
Mercury	1.3
Selenium	4.9

SB-13		
Sample Depth	7-8	9-10
D/F TEQ	30.93	1.28
Arsenic	3.5	1 J

SB-11	
Sample Depth	3-4
D/F TEQ	15.57
Benzo(a) pyrene	35
PAH TEQ	53.42

SB-9	
Sample Depth	8-9
D/F TEQ	1.75

SB-1	
Sample Depth	19-20
Arsenic	14
Selenium	2.7

SB-10	
Sample Depth	3-4
D/F TEQ	3.87
Benzo(a) pyrene	25
PAH TEQ	37.34

Legend

- Soil Boring (Visually Assessed)
- Soil Boring (Visually Assessed and Analytical Sample Collected)
- University Owned Properties
- Cogeneration Facility Property Boundary
- Privately Owned Parcels
- Piedmont Geologic Initial Excavation
- Flyash Basin
- Silt Basin
- Warehouse
- Drainage Feature
- Culverted Drainage Feature

Notes:
1. Soil borings collected by Geosyntec Consultants on 23-28 October 2013, 13 November 2014, and 29 January 2015.
2. Blue text denotes exceedances
3. PSRGs are from the Inactive Hazardous Sites Branch Preliminary Soil Remediation Goals Table, September 2015.
4. "J" and "Q" indicate estimated concentration.
5. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Screening Criteria				
Analyte	Units	Residential PSRG	Protection of GW PSRG	Background
2,3,7,8-TCDD	ng/kg	4.8	1.1	-
D/F TEQ	ng/kg	4.8	1.1	-
HxCDD, Mixture	ng/kg	100	-	-
1-Methylnaphthalene	µg/kg	18,000	55	-
Benz(a)anthracene	µg/kg	160	180	-
Benzo(a) pyrene	µg/kg	16	59	-
Benzo(b)fluoranthene	µg/kg	160	600	-
Dibenz(a,h)anthracene	µg/kg	16	190	-
PAH TEQ	µg/kg	16	59	-
Arsenic	mg/kg	0.68	5.8	3.2
Barium	mg/kg	3000	580	58.4
Mercury	mg/kg	1.9	1	-
Selenium	mg/kg	78	2.1	1.9

75 37.5 0 75 Feet

Soil Analytical Data (Within the Site Boundary)

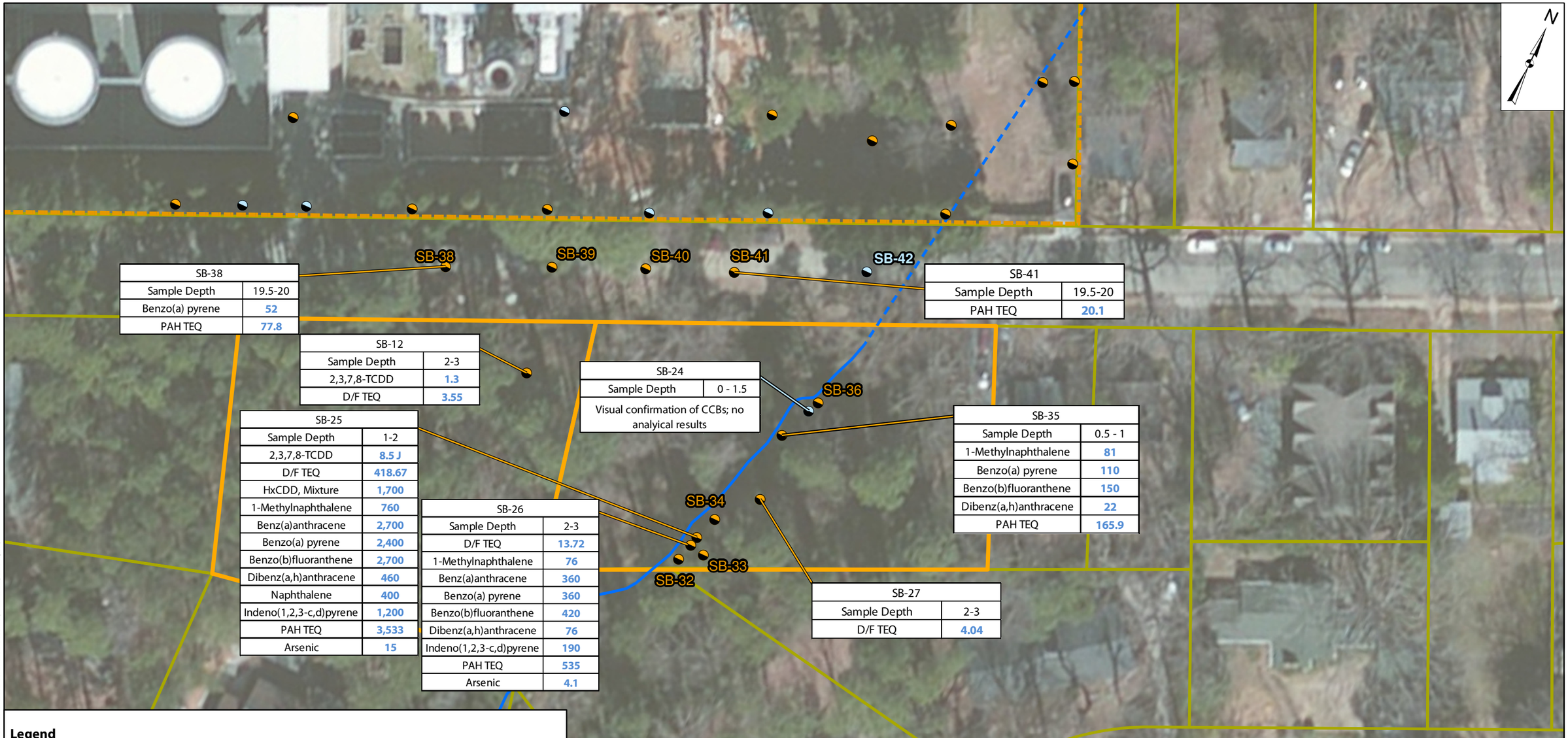
UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

Geosyntec Consultants of NC, PC
NC License No.: C-3500

Raleigh, NC | April 2016

Figure 13

Path: (Raleigh-01\Data)M:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\RI Report\Figure 13 - soil exceedances within Site boundary.mxd 03 May 2016 CLC



SB-38	
Sample Depth	19.5-20
Benzo(a) pyrene	52
PAH TEQ	77.8

SB-41	
Sample Depth	19.5-20
PAH TEQ	20.1

SB-12	
Sample Depth	2-3
2,3,7,8-TCDD	1.3
D/F TEQ	3.55

SB-24	
Sample Depth	0 - 1.5
Visual confirmation of CCBs; no analyical results	

SB-35	
Sample Depth	0.5 - 1
1-Methylnaphthalene	81
Benzo(a) pyrene	110
Benzo(b)fluoranthene	150
Dibenz(a,h)anthracene	22
PAH TEQ	165.9

SB-25	
Sample Depth	1-2
2,3,7,8-TCDD	8.5 J
D/F TEQ	418.67
HxCDD, Mixture	1,700
1-Methylnaphthalene	760
Benz(a)anthracene	2,700
Benzo(a) pyrene	2,400
Benzo(b)fluoranthene	2,700
Dibenz(a,h)anthracene	460
Naphthalene	400
Indeno(1,2,3-c,d)pyrene	1,200
PAH TEQ	3,533
Arsenic	15

SB-26	
Sample Depth	2-3
D/F TEQ	13.72
1-Methylnaphthalene	76
Benz(a)anthracene	360
Benzo(a) pyrene	360
Benzo(b)fluoranthene	420
Dibenz(a,h)anthracene	76
Indeno(1,2,3-c,d)pyrene	190
PAH TEQ	535
Arsenic	4.1

SB-27	
Sample Depth	2-3
D/F TEQ	4.04

Legend

- Soil Boring (Visually Assessed)
- Soil Boring (Visually Assessed and Analytical Sample Collected)
- Cogeneration Facility Property Boundary
- University Owned Parcels
- Privately Owned Parcels
- Drainage Feature
- Culverted Drainage Feature

Notes:
1. Soil borings were collected by Geosyntec Consultants from 23-28 October 2013, 12 November 2014, and 22-23 April 2015.
2. Blue text denotes exceedances.
3. A duplicate was collected at SB-12 and SB-40. The higher of the two results is reported.
4. PSRGs are from the Inactive Hazardous Sites Branch Prelminary Soil Remediation Goals Table, September 2015.
5. "J" indicates estimated concentration
6. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

		Screening Criteria		
Analyte	**Units**	**Residential PSRG**	**Protection of GW PSRG**	**Background**
2,3,7,8-TCDD	ng/kg	4.8	1.1	-
D/F TEQ	ng/kg	4.8	1.1	-
HxCDD, Mixture	ng/kg	100	-	-
1-Methylnaphthalene	µg/kg	18,000	55	-
Benz(a)anthracene	µg/kg	160	180	-
Benzo(a) pyrene	µg/kg	16	59	-
Benzo(b)fluoranthene	µg/kg	160	600	-
Dibenz(a,h)anthracene	µg/kg	16	190	-
Naphthalene	µg/kg	3800	210	-
Indeno(1,2,3-c,d)pyrene	µg/kg	160	2,000	-
PAH TEQ	µg/kg	16	59	-
Arsenic	mg/kg	0.68	5.8	3.2

80 40 0 80 Feet

Soil Analytical Data (Outside the Site Boundary)

UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

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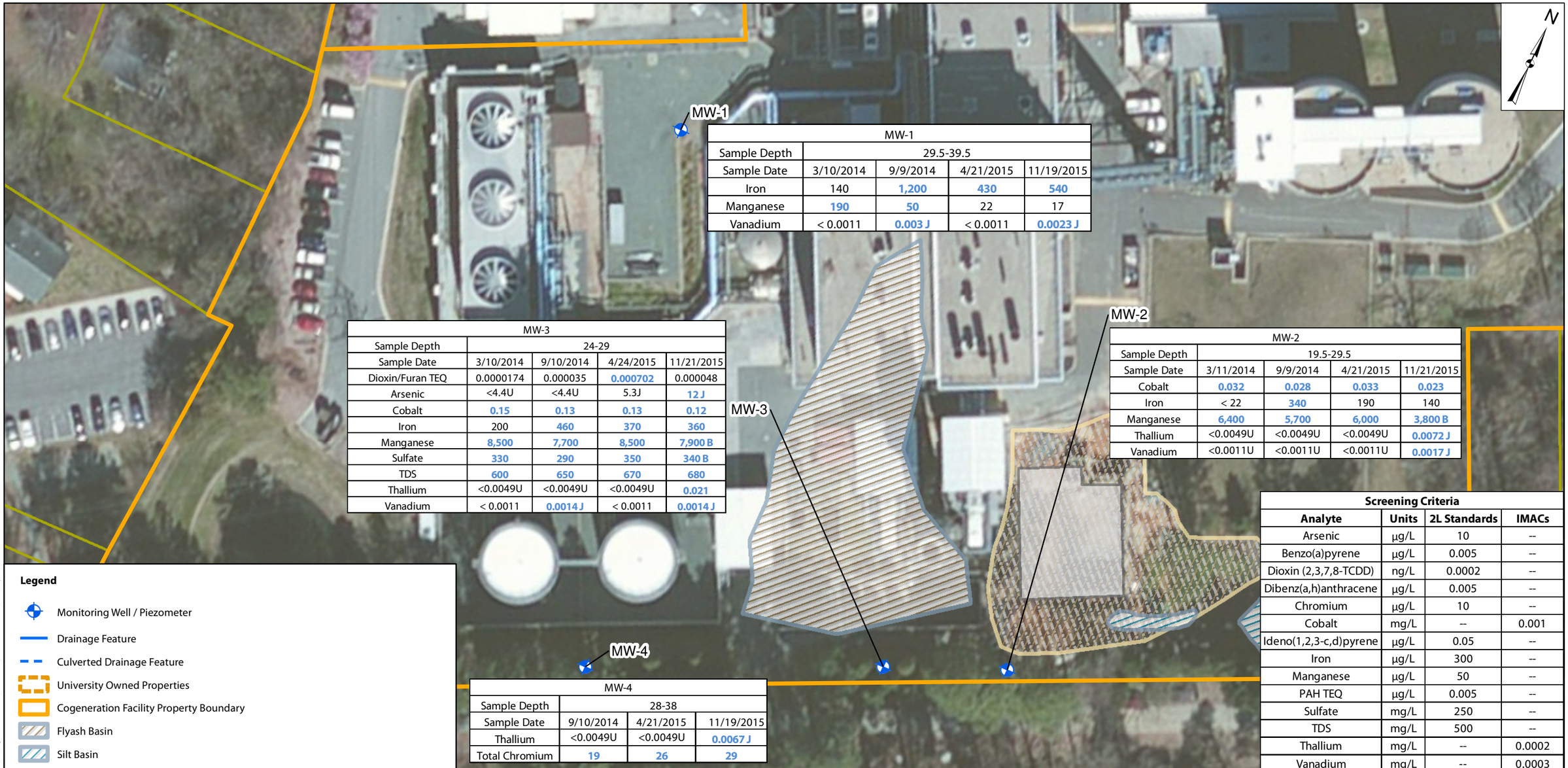
Figure
14

Path: [Raleigh-01\Data]M:\GIS\UNC-CH - GN5219 Cogeneration Facility\R\WD\R\Report\Figure 14 - soil exceedances outside Site Boundary.mxd 03 May 2016 : mjenny



MW-1				
Sample Depth	29.5-39.5			
Sample Date	3/10/2014	9/9/2014	4/21/2015	11/19/2015
Iron	140	1,200	430	540
Manganese	190	50	22	17
Vanadium	< 0.0011	0.003 J	< 0.0011	0.0023 J

MW-3				
Sample Depth	24-29			
Sample Date	3/10/2014	9/10/2014	4/24/2015	11/21/2015
Dioxin/Furan TEQ	0.0000174	0.000035	0.000702	0.000048
Arsenic	<4.4U	<4.4U	5.3J	12 J
Cobalt	0.15	0.13	0.13	0.12
Iron	200	460	370	360
Manganese	8,500	7,700	8,500	7,900 B
Sulfate	330	290	350	340 B
TDS	600	650	670	680
Thallium	<0.0049U	<0.0049U	<0.0049U	0.021
Vanadium	< 0.0011	0.0014 J	< 0.0011	0.0014 J

MW-2				
Sample Depth	19.5-29.5			
Sample Date	3/11/2014	9/9/2014	4/21/2015	11/21/2015
Cobalt	0.032	0.028	0.033	0.023
Iron	< 22	340	190	140
Manganese	6,400	5,700	6,000	3,800 B
Thallium	<0.0049U	<0.0049U	<0.0049U	0.0072 J
Vanadium	<0.0011U	<0.0011U	<0.0011U	0.0017 J

MW-4			
Sample Depth	28-38		
Sample Date	9/10/2014	4/21/2015	11/19/2015
Thallium	<0.0049U	<0.0049U	0.0067 J
Total Chromium	19	26	29

MW-5			
Sample Depth	5-20		
Sample Date	9/10/2014	4/20/2015	11/19/2015
Benzo(a)pyrene	<0.0049U	<0.0055U	0.036J
Dibenz(a,h)anthracene	<0.0046U	<0.0051U	0.07J
Ideno(1,2,3-c,d)pyrene	<0.014U	<0.016U	0.061J
PAH TEQ	ND	ND	0.122
Cobalt	0.0018 J	0.0021 J	0.0015 J
Thallium	<0.0049U	<0.0049U	0.0077 J

Screening Criteria			
Analyte	Units	2L Standards	IMACs
Arsenic	µg/L	10	--
Benzo(a)pyrene	µg/L	0.005	--
Dioxin (2,3,7,8-TCDD)	ng/L	0.0002	--
Dibenz(a,h)anthracene	µg/L	0.005	--
Chromium	µg/L	10	--
Cobalt	mg/L	--	0.001
Ideno(1,2,3-c,d)pyrene	µg/L	0.05	--
Iron	µg/L	300	--
Manganese	µg/L	50	--
PAH TEQ	µg/L	0.005	--
Sulfate	mg/L	250	--
TDS	mg/L	500	--
Thallium	mg/L	--	0.0002
Vanadium	mg/L	--	0.0003

Legend

- Monitoring Well / Piezometer
- Drainage Feature
- Culverted Drainage Feature
- University Owned Properties
- Cogeneration Facility Property Boundary
- Flyash Basin
- Silt Basin
- Warehouse
- Piedmont Geologic Initial Excavation
- Privately Owned Parcels

Notes:
1. Groundwater samples were collected by Geosyntec Consultants.
2. Screening criteria are from the NCDEQ 2L Standards Table, April 2013.
3. Blue text denotes exceedance.
4. "J" indicates estimated concentration.
5. A field duplicate was collected at MW-3 during all three sampling events. The highest result of the two samples is reported in this figure.
6. Sample depths are reported in feet below ground surface.
7. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

75 37.5 0 75 Feet

Groundwater Analytical Data

UNC-CH Cogeneration Facility
575 W Cameron Ave., Chapel Hill, NC

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Figure
15

Path: (Raleigh-01\Data) M:\GIS\UNC-CH - GN5219 Cogeneration Facility R1\MXD\BI Report\Figure 17 - GW Analytical Data April 2016.mxd 03 May 2016 mjenny

Legend

- Soil Boring (Interpreted to be clean)
- Soil Boring (Interpreted to be impacted)
- Monitoring Well
- University Owned Properties
- Cogeneration Facility Property Boundary
- Privately Owned Parcels
- Piedmont Geologic Initial Excavation
- Flyash Basin
- Silt Basin
- Warehouse
- Drainage Feature
- Culverted Drainage Feature

Notes:
1. Soil borings collected by Geosyntec Consultants on 23-28 October 2013, 13 November 2014, and 29 January 2015.
2. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

75 37.5 0 75 Feet

Horizontal Extents of Impacted Soil (Within the Site Boundary)

UNC-CH Cogeneration Facility
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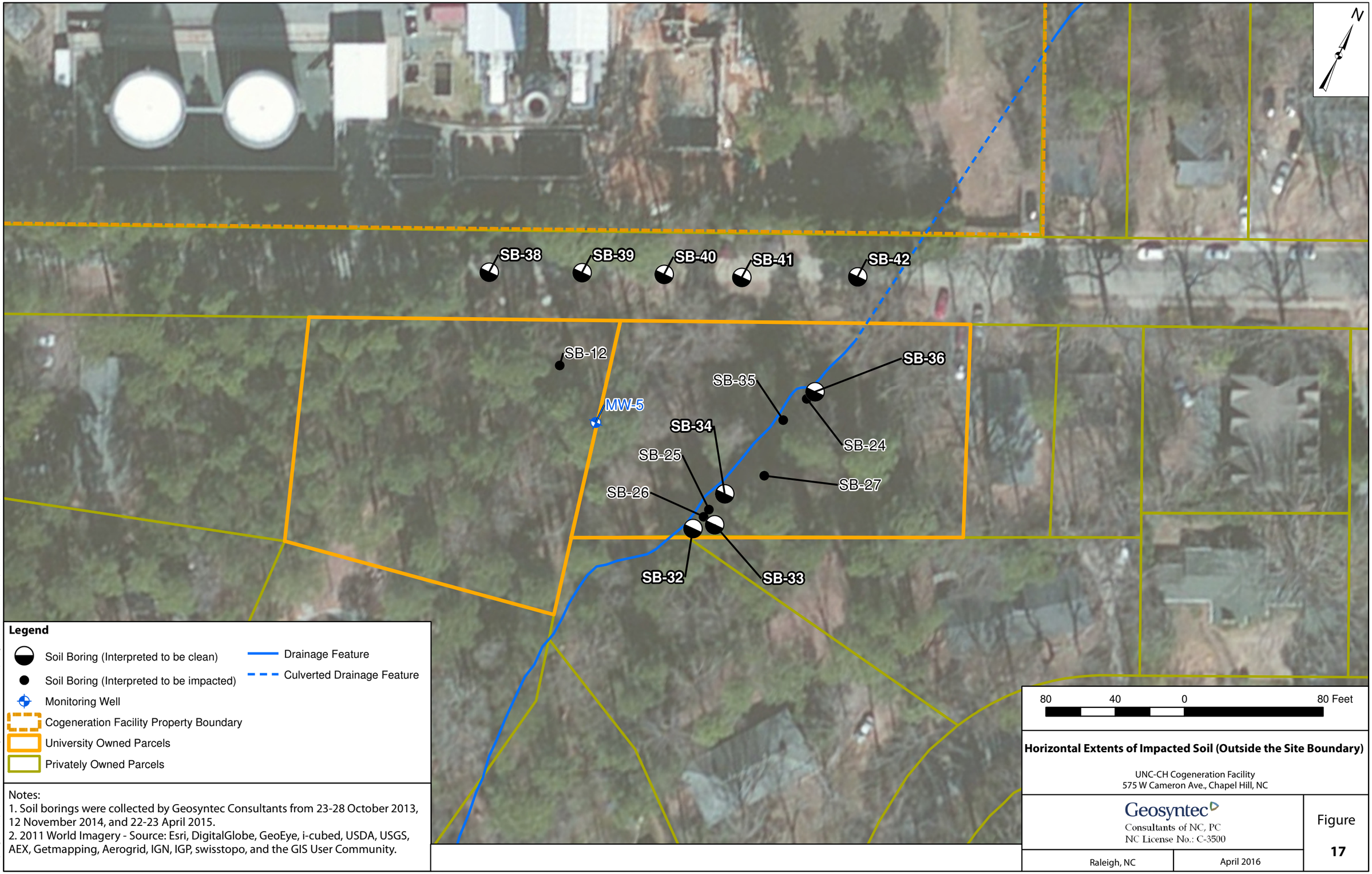
Figure 16

Path: (Raleigh-01\Data) M:\GIS\UNC-CH - GNS219 Cogeneration Facility RI\MXD\RI Report\Figure 15 - Horizontal Extents of Impacted Soil within Site boundary.mxd 03 May 2016 CJC



Legend

- Soil Boring (Interpreted to be clean)
- Soil Boring (Interpreted to be impacted)
- Monitoring Well
- Cogeneration Facility Property Boundary
- University Owned Parcels
- Privately Owned Parcels
- Drainage Feature
- Culverted Drainage Feature

Notes:
1. Soil borings were collected by Geosyntec Consultants from 23-28 October 2013, 12 November 2014, and 22-23 April 2015.
2. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Horizontal Extents of Impacted Soil (Outside the Site Boundary)

UNC-CH Cogeneration Facility
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Figure 17

Path: (Raleigh-01\Data) M:\GIS\UNC-CH - GNS219 Cogeneration Facility RI\MXD\RI Report\Figure 16 - Horizontal Extents of Impacted Soil outside Site Boundary.mxd 03 May 2016; mjenny