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 ACTION PLAN

FOR SOIL ONLY

UNC-CH COGENERATION FACILITY

CHAPEL HILL, NORTH CAROLINA

SITE ID# NCR000010272

Prepared by

engineers | scientists | innovators

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April 2023

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.

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.

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1. INTRODUCTION

On behalf of The University of North Carolina at Chapel Hill (UNC-CH), Geosyntec Consultants of NC, PC (Geosyntec) has prepared this Remedial Action Plan 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 notification was prompted when soils suspected of containing coal combustion by-products (CCBs) were encountered 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. Within 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 complete a Remedial Investigation (RI). 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.

The RI assessed fill areas in the southern portion of the Facility, the section of McCauley Street constructed of fill material and the creek or stream floodplain bisecting one of the two UNC-CH owned lots south of McCauley Street.

The *Remedial Investigation Report* (RIR) was submitted on May 27, 2016. The RIR concluded that concentrations of some contaminants of concern (COCs) exceeded their respective Remedial Goals (RGs) in soil (within the Facility property and in isolated pockets south of McCauley Street) and in a limited area of groundwater. The RIR recommended "No Further Action" for in-stream sediment and surface water.

This RAP for soil contains all required components as described by REC rule 15A NCAC 13C. For ease of review each component is referenced by specific paragraphs of 15A NCAC 3C .0306(l). The purpose of this RAP is to establish the objectives of the remediation, evaluate remedial options, document the selected remedy, and dictate how the selected remedy will be implemented.

This RAP for soil is a revised resubmittal of the initial *Proposal for a Containment Remedy* (Proposal) submitted February 2021. Since submitting the Proposal, UNC-CH has elected to remove two small, isolated pockets of impacted soil located south of McCauley Street, outside the facility's fence. Although the impacted soil meets human health and ecological risk thresholds, low level exceedances of soil to groundwater (leachability) screening levels exist. The proposed change in plan to remove these pockets is detailed in Section 3.4 of this soil RAP.

2. SOIL REMEDIAL INVESTIGATION SUMMARY .0306(N)(1)

2.1 Background

In early June 2010, a construction contractor was removing a portion of a sheet-pile wall to facilitate construction of a new warehouse at the University's Cogeneration Facility and exposed soils in the excavation, which contained suspected material. UNC-CH's previous consultant described the suspect material as fine grained, dark grey to black material with some coal fragments. The previous consultant suspected the material to be ash or coal dust. The suspect material was later confirmed to be CCBs. Soil samples were collected by two environmental consultants in June and July 2010 for initial characterization and submitted for laboratory analysis. The soil sample results indicated polycyclic aromatic hydrocarbons (PAHs), metals, and dioxins elevated above the IHSBs PSRGs.

Excavation and offsite disposal of soil impacted with CCBs was conducted from late 2010 to early 2011. Approximately 4,200 tons of impacted soil was removed from the area proximate to the Cogen facility new warehouse and disposed of offsite as non-hazardous waste at the Republic Services Incorporated Uwharrie Landfill in Uwharrie, North Carolina. CCB-impacted soil remained visible within the excavation sidewalls upon completion of the excavation activities.

One temporary groundwater monitoring well was installed in late 2010 proximate to the excavation where the CCBs were observed. Groundwater samples contained elevated concentrations of chromium, iron, and manganese that the previous consultant attributed to high turbidity. In addition, the total toxic equivalency (TEQ) for dioxins / furans in groundwater was above North Carolina's Title 15A 2L Groundwater Quality Standards. The TEQ is defined as the summed products of the dioxin and furan congener concentrations multiplied by their respective toxic equivalency factors. The temporary well was decommissioned before it could be resampled.

Extensive, additional background information can be found in the *Work Plan for Remedial Investigation* (Geosyntec, 2013), the *Work Plan Addendum for Remedial Investigation* (Geosyntec, 2014) and the *Remedial Investigation Report* (Geosyntec, 2016).

2.2 Site History

The Site has been owned by UNC-CH since 1921. The original coal-fired steam plant on this parcel became operational onsite in 1940. 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 original plant's use. No records were reviewed that suggest when the fly ash basin was decommissioned, but it is likely that it was immediately before the former above ground fuel oil tanks were added around 1960. Over the years, the Site has undergone notable changes involving soil grading, excavations with backfill, utility installations and other construction-related enhancements within the "area of concern" to accommodate Facility improvements. Prior to construction of the warehouse in 2010 / 2011, the last major renovation of the Site was completed in 1992 when the current Cogeneration Facility was commissioned. Since 1992, the topography of the southern portion of the Site has remained relatively unchanged.

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

2.3 Site Geology and Hydrogeology

As part of the RI, Geosyntec advanced 57 soil borings ranging from one (1) to 39 feet below ground surface (bgs). **Figure 3** shows the location of each soil boring. The investigated subsurface within the confines of the Facility's fence line was summarized as overlaying "fill or disturbed substrate" consisting of interbedded layers of clay and silt with sand. Isolated pockets of suspected CCBs were encountered sporadically within the "fill or disturbed substrate". These isolated pockets vary in size or significance, presumably because of the disturbances during past construction. Residual CCBs remain within the former fly ash basin between 17 and 27 feet bgs. The approximate outline of the former fly ash basin, based on historic maps, is depicted in **Figure 3.** Native soils below the "fill or disturbed substrate" consist of clayey sand to sandy clay soils.

On one of two University owned lots south of McCauley Street, two isolated pockets of subsurface ash were encountered. One of the pockets was encountered in the floodplain of the creek at a depth of 1-3 ft bgs. The second pocket was encountered within the banks of the creek within a depositional feature at approximately 1 ft bgs. Ash from these pockets has not been analyzed by microscopy techniques to definitively determine if the ash is of CCB-origin or not.

Geosyntec encountered suspected bedrock in only one of the 57 borings advanced; however, in 1977, the Heater Well Company installed two water supply wells in a different area of the Facility and encountered bedrock at 80 and 83 feet bgs. The two well construction logs describe the underlying bedrock as granite. Bradley, Phillips, Gay and Fuemmeler (2004) described the underlying bedrock as granite with green amphiboles and biotite.

Five monitoring wells were installed during the RI and were screened in the soil overburden. **Figure 3** documents the locations of the wells on the Site in relation to current and historical Site Features. Monitoring wells MW-2 and MW-3 serve as source area wells with MW-4 being a side gradient well. MW-1 and MW-5 are up gradient and downgradient wells, respectively. The predominant groundwater direction is southerly towards McCauley Street. An unnamed creek bisects the Site as shown in **Figure 3**. It is assumed the creek bisecting the Site is a hydraulic barrier to shallow groundwater flowing southerly through the "fill or disturbed substrate" and that shallow groundwater discharges as base flow in the creek.

2.4 Soil Characterization

Due to current and anticipated future uses, the soil investigation was subdivided into two distinct areas: (i) within the Facility's fence line, and (ii) outside the fence line encompassing McCauley Street and the two University owned lots south of McCauley Street.

Geosyntec used a tiered visual assessment method to delineate the limits of suspected CCB impacts. The assessment targeted the former fly ash basin, warehouse excavation area, and former silt basins and proceeded in the four cardinal directions on a boring-by-boring basis as described in the *Work Plan for Remedial Investigation* (Geosyntec, 2013). Boring locations were limited by Facility buildings and underground utilities.

Geosyntec observed each boring using the tiered visual assessment method along the entire length of the boring. **Table 1** summarizes observations and interpretations for each boring. Analytical samples were collected from select borings to characterize impacted soils or for "clean" confirmation during delineation.

Notable findings of the soil investigation include the following:

1. No soil contaminants of potential concern (COPCs) were encountered along McCauley Street.
2. Two isolated pockets of ash were encountered on one of the two lots south of McCauley Street.
3. Two suspected CCB impacted samples were analyzed by the Synthetic Precipitation Leaching Procedure (SPLP). The SPLP results suggest benzo(a)pyrene and eight metals have the potential to leach to groundwater (**Table 2**).
4. Dioxins / furans and PAHs were detected in surface soil samples exceeding their respective screening levels (**Table 3**).
5. A Site-specific background metals evaluation was performed to evaluate naturally occurring levels of metals in Site soils. Background samples were collected in areas where there was no evidence of CCB impacts. Background concentrations for aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, iron, lead, manganese, nickel, selenium, vanadium, and zinc were established using ProUCL software developed by the US Environmental Protection Agency (USEPA). Background concentrations were not calculated for antimony, cadmium, silver, or thallium given insufficient detections in the background samples.

The RI concluded remedial action was required for soils both within the delineated area inside the Facility's fence line and for the two pockets of ash impacted soil on the referenced lot south of McCauley Street. Unrestricted use Remedial Goals (RGs) for soil were established for select dioxins / furans, PAHs, and 13 metals.

2.5 Soil Delineation

Tables 3 and 4 compare analytical results from the RI to the final, Unrestricted Use soil RGs. **Figure 4** depicts the horizontal extents of impacted soil. Geosyntec interpreted the vertical extents of soil impacts as presented in the cross sections in **Figures 5-8**. Due to the disturbed nature (e.g., filled and graded multiple times since ~ 1960) within the Facility's fence line, the vertical limits of impacts are at or above the native soil and imported fill interface.

2.6 Conceptual Site Model

The presence of subsurface, residual CCBs and ash is historical. The residual, subsurface CCBs likely date back to between 1940's to 1960's when CCB management practices were not regulated as they are today. Since 1992 when the current, modern Cogeneration Facility was commissioned, the topography of the investigated area of the Site has remained unchanged. Modern, automated, and controlled processes and improvements of the Cogeneration Facility greatly reduce or essentially eliminate the probability of a new release of CCBs. Since 1992, CCBs from the boilers is transported by a controlled system of conveyors (a dry process) to the onsite, above ground enclosed silo for storage prior to transport and disposal. The University's hauling contractor transports and disposes of the CCBs as a non-RCRA regulated waste on a regular basis. Disposal reports are submitted annually to NCDEQ. Supporting management processes include but are not limited to Facility Response, Spill Prevention and Countermeasures, and Stormwater Pollution Prevention planning and implementation or operations / maintenance activities for each. Annual training is required for Facility employees

Neither ash pocket encountered south of McCauley Street has been analyzed by microscopy techniques to definitively determine if the ash is of CCB-origin or not. Observed ash may originate from other sources, however, soil impacts above unrestricted use, remedial goals necessitate remedial action.

2.7 Potential Receptors

Consistent with the RI, two distinct exposure units were established for assessing risk to receptors from site soils. The delineated area within the Facility's fence line was defined as exposure unit #1, (EU-1). The second exposure unit, EU-2, consisted of the investigated portion of the two lots south of McCauley Street. The soil data collected below McCauley Street was not included in the risk screening as it is located below the roadway, removing hypothetical exposure pathways.

The area within the Facility Property (i.e., EU1) operates entirely as an industrial facility. It is bounded by perimeter fencing and is operational and secured 24 hours per day; a hypothetical recurring trespasser scenario is therefore unlikely. Long-term soil excavation/construction projects are not anticipated given the current infrastructure within the property; however, the hypothetical construction worker scenario was considered for conservativism. For EU1, cancer and non-cancer risks were evaluated for hypothetical industrial / commercial worker and construction worker receptor scenarios.

The two lots south of McCauley Street (i.e., EU2) consist of a forested, undeveloped lots with steep topography on either side (approximately a 15-feet vertical drop from McCauley Street). A creek bifurcates the eastern-most lot. UNC owns both lots and redevelopment is unlikely. For EU2, industrial/commercial workers, construction workers, and a hypothetical adolescent trespasser were considered.

Note, sampling of in-stream sediment and surface water was conducted during the RI to determine the potential for human health or ecological risk associated with the creek bisecting one of the two UNC-CH owned lots south of McCauley Street. From this sampling and data evaluation, "No Further Action" was recommended for the in-stream sediments and surface water. NCDEQ concurred with this recommendation. A copy of the email is attached as **Appendix A.** Furthermore, no apparent ecological receptors are associated with soils within the Facility parcel (EU1) or on the lots south of McCauley Street (EU2).

3. SOIL REMEDIAL ACTION

3.1 Remedial Action Objectives .0306(n)(2)

Remedial action objectives for soils include:

- Prevent human exposure to soil containing COCs at concentrations above acceptable risk levels (carcinogenic and non-carcinogenic);
- Prevent migration of soil containing COCs at concentrations above acceptable risk levels (carcinogenic and non-carcinogenic); and

No remedial action objectives have been established to protect surface water, sediment, or ecological receptors. As previously discussed, the screening level risk assessment (Geosyntec, 2015) for in-stream sediment and surface water has achieved “No Further Action” status.

3.2 Feasibility Study .0306(n)(3)

A *Feasibility Study* (FS) was conducted for both Site soil and groundwater in December 2017 to (i) define remedial action objectives, (ii) screen candidate technologies for potential effectiveness at the Site given Site-specific conditions, (iii) assemble and evaluate potential remedial alternatives and (iv) recommend preferred alternatives. The FS qualitatively compared seven remedial alternatives for soil against eight evaluation criteria and identified a preferred remedial action. The FS is attached as **Appendix B**.

3.3 Description and Justification of Remedial Action with NCDEQ Concurrence .0306(k) & (n)(5) & (6)

For delineated impacts inside the Facility’s fence line (EU1), a soil containment remedy is proposed. The area will be subjected to land use restrictions allowing the impacted soil to remain per the FS.

The two pockets of soil impacts encountered south of McCauley Street (EU2), however, will be excavated and removed. UNC-CH has determined land use restrictions on the lot are not desirable. Because the pockets of impacted soil are small and shallow, UNC-CH will conduct two small, localized, shallow excavations to remove the soil impacts. Excavated soil will be disposed of consistent with waste characterizations results.

3.3.1 Protection of Human Health

A human health risk assessment was performed and presented in Geosyntec’s February 2021 *Proposal for Containment Remedy*. Since the two pockets of soil impacts on the lot south of McCauley Street (EU2) will be excavated and removed, results of the human health risk assessment related to these two pockets are not discussed or summarized herein.

For delineated impacts inside the Facility’s fence line (EU1), cancer and non-cancer risks were evaluated for hypothetical industrial / commercial worker and construction worker receptor scenarios. Both receptor scenarios were subjected to an appropriate subset of the RI soil data consistent with NCDEQ's risk-based technical guidance.

The NCDEQ *Technical Guidance for Risk-Based Environmental Remediation of Sites* (NCDEQ, 2020) recognizes a generally acceptable cumulative cancer risk of 1.0E-4 and a cumulative hazard index of less than 1.0 for non-carcinogens affecting the same target organ or system. The results for each receptor scenario units are summarized below.

For EU1 (within the Facility's fence line), the initial risk evaluation results are summarized below:

Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**	**Risk Exceeded?**
Commercial/Indstrial Worker	Soil Combined Pathways	1.8E-05	0.38	No
Construction/Excvation Worker	Soil Combined Pathways	1.2E-05	5.2	Yes

For the construction/excavation worker, the cumulative cancer risk is below the threshold and therefore acceptable, however, the non-cancer hazards are greater than the allowable threshold. The primary constituents driving the construction worker, non-cancer hazard exceedance are aluminum, arsenic, manganese, and vanadium. The *Risk-Based Guidance* indicates that the results of a construction worker risk screening "should not drive a cleanup level", but rather provide guidance in handling safety concerns. This is due to the inherently conservative nature of the construction worker intake/exposure parameters, that are not necessarily representative of typical construction activities.

The initial risk calculations set exposure point concentrations for constituents of concern at the maximum detected concentration. In cases where the initial risk calculations exceed acceptable levels, the *Risk-Based Guidance* allows for the use of alternative, more representative concentrations. Furthermore, REC program guidance specifies remediation of metals that are within naturally concentrations is not warranted. Therefore, to refine the Construction/Excavation Worker scenario risk calculations, exposure point concentrations for metal constituents with concentrations below their background values were set to zero. Using the June 2021 version of NCDEQ's Risk Calculator, the Construction/Excavation Worker scenario risk calculations were revised. The revised results are summarized below.

Receptor	**Pathway**	**Carcinogenic Risk**	**Hazard Index**
Constructon/Excavation Worker	Soil Combined Pathways	1.1E-06	0.27

The cumulative risks and hazards for the hypothetical Construction/Excavation worker including metals concentrations above background are acceptable. It is important to recognize the inherent conservativism applied to the risk calculator estimates since the hypothetical Construction/Excavation worker is the most sensitive receptor. Regulatory guidance does not recommend remedial cleanup levels based upon construction worker exposures. Geosyntec will consult with UNC to safeguard construction workers if they encounter potentially impacted soil (within the Facility's fence line or EU1) in the future.

3.3.2 Protection of Groundwater

Table 2 presents analytical results of two soil samples analyzed by the Synthetic Precipitation Leaching Procedure (SPLP). One of the SPLP samples was collected at SB-14 (**Figure 3**) within the footprint of a historical "fly ash basin". The results imply Antimony and Vanadium may leach to groundwater at concentrations above their respective Groundwater Quality Standards. After completing the first phase of the RI in October 2013 and consistent with the conceptual site model at that time, monitoring wells were installed to confirm the shallow groundwater flow direction and assess groundwater quality. MW-3 is installed downgradient of SB-14 at the edge of the historical "fly ash basin" source area. Groundwater flows from northwest to southeast through the historical "fly ash" basin towards the creek south of McCauley Street. **Table 5** presents groundwater monitoring results since monitoring well installation. Note, Antimony is non-detect and Vanadium fluctuates at or near the detection limit at MW-3.

The second SPLP sample was collected at SB-25 (**Figure 3**) within the footprint of one of the pockets of soil impacts south of McCauley Street. As previously discussed, the two pockets of soil impacts encountered south of McCauley Street (EU2), will be excavated, and removed. Once removed, leachability as a potential exposure pathway will be mitigated.

3.3.3 Supporting Justifications

Supporting justifications include:

1. The presence of subsurface, residual CCBs within the Facility's fence line (EU1) is historical. The residual, subsurface CCBs likely date back to between 1940's to 1960's when CCB management practices were not regulated as they are today.
2. The Facility property is zoned and used for industrial purposes. The Facility has been used for the generation of steam and / or power since the 1940's and will continue to be for the foreseeable future. Also, the University has owned the two undeveloped lots south of McCauley Street (EU2) since 2007 and 2008. UNC-CH does not have plans to sell either in the foreseeable future. The undeveloped lots provide an open-space or buffer between nearby residences and the Cogeneration Facility.
3. CCBs remain underneath Facility buildings, utilities, and other Site improvements (EU1) making it impracticable to actively remediate all CCB impacted soil. Land use restrictions represent the most efficacious path forward to deal with this legacy environmental issue at the Cogen facility.
4. Groundwater is not being used at the Cogeneration Facility (EU1) or the two University owned, undeveloped lots south of McCauley Street (EU2).
5. On three occasions readily available records were reviewed, and field surveys conducted to identify water supply wells offsite in the surrounding community. The most recent

record review and survey occurred in June 2019. No Wellhead Protection Areas were noted. Orange County's Environmental Health Department provided records of two irrigation wells (located at 322 West University Drive and 400 Ransom Street). Both wells are located on the opposite side of the creek (the presumed groundwater discharge feature) from the Cogeneration Facility, and both are approximately level or up gradient from the CCB impacted subsurface soils topographically. A visual survey of the residential neighborhood south of the Cogeneration Facility was performed. No water supply wells were observed.

6. The Site and surrounding community are within the Orange Water and Sewer Authority's (OWASA) service area. OWASA supplies potable water via three surface water impoundments. All the OWASA surface impoundments are greater than one mile away from the Site.

3.3.4 Description of Soil Remedial Action

A soil containment remedy is proposed for the delineated soils within the Facility's fence line (EU1). No additional intrusive construction or operations and maintenance activities will be required. The containment remedy will be implemented consistent with REC Program Guidance. Both a *Declaration of Perpetual Land Use Restrictions* (DPLUR) and a *Notice of an Inactive Hazardous Substance or Waste Disposal Site* (Notice) will be prepared and recorded in the Orange County Register of Deeds Office.

For the two pockets of impacted soil south of McCauley Street (EU2), excavation and disposal are planned. Generally accepted methods for the remediation industry will be used to excavate and remove the two pockets south of McCauley Street. Waste excavation spoils will be containerized and characterized for proper disposal. Waste characterization spoils will be disposed of according to their characterization results.

3.4 Remedial Action Implementation .0306(n)(7)

Upon submission of this soil RAP, a soil containment remedy will be finalized. No intrusive remedial activities will be implemented within EU1. The containment remedy will be implemented consistent with REC Program Guidance. Both a *Declaration of Perpetual Land Use Restrictions* (DPLUR) and a *Notice of an Inactive Hazardous Substance or Waste Disposal Site* (Notice) will be prepared and recorded in the Orange County Register of Deeds Office.

For the two pockets of impacted soil south of McCauley Street (EU2), activities and the excavation process required to remove the impacted soil are described below.

3.4.1 Permitting

Geosyntec performed a wetlands delineation and stream assessment to determine if the two pockets of impacted soil south of McCauley Street are regulated under Section 401 and Section 404 of the Clean Water Act and / or NCDEQ's Jordan Water Supply Nutrient Strategy. Both pockets of impacted soil are outside regulated wetland and stream boundaries. Therefore, Sections 401 and 404 permitting is not required. UNC-CH is coordinating with NCDEQ concerning any Jordan

Water Supply Nutrient Strategy permits and / or further requirements. A memorandum summarizing the methodology and findings of the Section 401 and 404 delineation and assessment is attached as **Appendix C**.

3.4.2 Soil Excavation Implementation

Once any required permits related to NCDEQ's Jordan Water Supply Nutrient Strategy are secured, implementation can begin. Clearing or trimming of vegetation and debris may be necessary to facilitate compact equipment. If used, the path will avoid large trees and care will be taken to avoid up-rooting vegetation. Any cut vegetation will be placed on the path after soil removal is complete to minimize erosion.

To minimize disturbance to sensitive environments, these pockets will be excavated by hand tools. Starting at SB-24, SB-25, SB-26, and SB-35, easily and accessible soil impacts will be excavated laterally and vertically until either ash is no longer visible, the groundwater table is reached, refusal is achieved or previously determined clean boring locations (SB-32, SB-33, SB-34, and SB-36) are reached. Excavation areas and any spoils stockpiles will be cordoned off at the end of each day with orange construction fencing. Stockpiles will be covered with plastic sheeting. Excavation spoils will be transported to and containerized in drums or a lined and tarped roll off container located within the back gate of the Facility. Spoils will either be transported manually in buckets or by compact equipment. Compact equipment (if used to transport excavated spoils) will remain on the western side of the creek bed. Erosion control best management practices may be required.

If dewatering of excavated spoils is required or recommended, then the excavation spoils will be stockpiled on plastic immediately adjacent to the excavation area. Water drained from the excavation spoils will be routed to drain into the excavation.

Soils will be transported under waste manifest or bill of lading to an approved disposal facility following all excavation activities.

3.4.4 Site Restoration

Once excavation is complete, any sidewalls of the excavation areas will be gently sloped and stabilized with bales of pine straw. Afterwards, Geosyntec anticipates the excavation areas will be allowed to re-stabilize via natural process. Permit terms and conditions may affect site restoration requirements. All trash and debris generated during the excavation will be disposed of appropriately.

3.4.5 Pilot or Treatability Studies .0306(n)(4)

No additional site characterization, pre-design pilot or treatability studies are required.

3.4.6 Decontamination Procedures .0306(n)10

Decontamination of excavation tools, equipment and sample collection tools will be in general accordance with the U.S. Environmental Protection Agency's, Region IV, Laboratory Services and Applied Science Division's (LSASD) *Field Equipment Cleaning and Decontamination* dated June 22, 2020.

3.4.7 Waste Management 0306(s)

Excavation spoils will be stored in labeled, 55-gallon, steel drums or lined and tarped roll-off boxes. Samples will be collected for characterization, profiling, transportation and treatment or disposal at an approved facility. Composite soil samples will be collected and analyzed for waste characterization by analyses required by the disposal facility.

Transportation, treatment and or disposal will be consistent with the waste determination. Based on prior project waste disposal efforts, the wastes are expected to be characterized as non-hazardous.

Any spent gloves, plastic sheeting, disposable sampling equipment etcetera will be disposed of as non-hazardous municipal solid waste via the Facility's dumpster.

Decontamination water will be treated via the Facility's process water treatment system.

3.4.8 Community Health and Safety .0306(n)(9)

The health and safety of persons, including the surrounding community, will be protected during this RA implementation. During field activities, Geosyntec will coordinate and communicate daily with applicable UNC-CH personnel. Geosyntec and UNC-CH will coordinate to keep employees, vendors, visitors of members of the public free from exposure to the inherent physical and chemical hazards associated with the work. It is the Field Team Leader's responsibility to maintain the safety of all. Hazard management practices may change over time if the Field Team Leader deems it necessary. The field team leader will continuously adjust safety procedures and requirements in the field depending on site conditions.

Protection of the public and the surrounding community focuses on two primary tasks: maintaining security of the work area, and isolation of RA derived wastes from the public. Excavation areas and spoils stockpiles will require cordoning off and covering with plastic sheeting daily to mitigate potential contact with the public. Cordoning will be accomplished by using orange construction fencing. Geosyntec personnel will monitor each active work area daily while work is in progress. Erosion control and stormwater best management practices will be implemented and monitored daily to protect the creek from sediment loading.

Waste generated as part of this RA will be moved to a secure area within the fence enclosure of the Facility and properly labeled in secure containers.

3.5 Criteria for Remedial Action Completion .0306(n)(8)

Both the DPLUR and Notice for EU1 (within the Facility's fence line) will be recorded in the Orange County Register of Deeds office to the satisfaction of the IHSB. Once complete, annual verification and certification must be submitted to NCDEQ, as directed. Geosyntec will prepare a guidance document or specification for the UNC Cogeneration Facility's use dictating how to proceed with any future excavation, trenching or otherwise subsurface construction within the delineated area consistent with the DPLUR and Notice.

One composite, confirmation sample will be collected from each of the two removal areas (EU2) south of McCauley Street. The excavation sidewalls and (if the excavation is terminated above the groundwater table) floor or base will be sampled as a composite sample. The samples will be analyzed for the following:

- SPLP for USEPA Method 8290 (dioxins / furans);
- SPLP for USEPA Method 8270 SIM (SVOCs / PAHs);
- SPLP for USEPA Methods 6010 / 7470 (select metals);
- SPLP for SM 2540 (TDS), and;
- SPLP for USEPA Method 9056 (sulfate).

Confirmation sample results will be screened against the Final RGs for groundwater. Exceedance of a Final RG will require additional excavation and removal.

4. REFERENCES

Email correspondence between Janet Macdonald (NCDEQ) and Eric Nesbit (Geosyntec) dated November 20, 2015 concerning the Sediment / Surface Water Screening Report.

Geosyntec Consultants of NC, PC, 2016. *Remedial Investigation Report, UNC-Chapel Hill Cogeneration Facility*.

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Inactive Hazardous Sites Branch, North Carolina Department of Environmental Quality, 2022. *Guidelines for Assessment and Cleanup of Contaminated Sites.*

North Carolina Department of Environmental Quality, 2020. *Revised Technical Guidance for Risk-Based Environmental Remediation of Sites.*

North Carolina Department of Environmental Quality, 2021. *Risk Calculator.*

TABLES

Table 1
Soil Delineation Summary
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Bring	(Field) Visual Asseent Observations	Initial Fie Interpretaion	Analytical Sample Notes (interval sampled, field notes for interval sampld)	Screening Level Exceedences [1]	ash lens CCBs Impated Determination
			19-20' bgs, ash	As, Se	
2	ash lens	CCBs Impated	13-14' bgs, trace to no CCBs… maybe mineral	None	
3	ash lens	CCBs Impated	not sampled	-	
4	trace to little CCBs oberved	CCBs Impated	not sampled	-	
5	trace to little CCBs oberved	Clean	6-7' bgs, Approx. 5 suspect grains, little to no impats	None	
6	trace to little CCBs oberved	CCBs Impated	not sampled	-	
7	trace to little CCBs oberved	CCBs Impated	not sampled	-	
8	ash lens	CCBs Impated	2-3' bgs, mostly ash	As, D/Fs, PAHs	
9	no to trace CCBs obsrved	Clean	8-9' bgs, trace coal fragments, interpreted to be natie soil starting at 8' bgs	D/Fs	
	no to trace CCBs obsrved	Clean	3-4' bgs, trace coal… likely mineral	D/Fs, PAHs	
11	no to trace CCBs obsrved	Clean	3-4' bgs, trace to no coal… maybe mineral	D/Fs, PAHs	
12	No ash observed	Clean	2-3' bgs, No ash observed… maybe mineral	D/Fs	No ash observed… exceedence is not related to ash
13	ash lens	CCBs Impated	7-8' bgs, ash 9-10'bgs, no ash	As, D/Fs	
14	ash lens	CCBs Impated	19-23'bgs, ash from 17-27	As, Ba, Hg, Se, PAHs, D/F	
15	ash lens	CCBs Impated	not sampled	-	
16	trace to few CCBs obsved	Clean	11-12' bgs, small flecks visible but may be minerals	None	
17	trace to little CCBs oberved	CCBs Impated	11-12' bgs, coal fragments with trace ash	None	
18	trace to little CCBs oberved	CCBs Impated	4-5' bgs, ash visible with coal fragments	As, D/Fs, PAHs	
19	ash lens	CCBs Impated	16-17' bgs, coal fragment with trace ash	D/Fs	
20	ash lens	CCBs Impated	not sampled	-	
21	ash lens	CCBs Impated	12-13' bgs, no CCBs visible, most likely minerals	None	
22	trace to few CCBs obsved	CCBs Impated	not sampled	-	
23	no to trace CCBs obsrved	Clean	12-13' bgs, no coal or ash visible	D/Fs	
24	trace ash observ	Ash Imped	not sampled	-	
25	ash lens	Ash Imped	1-2' bgs, ash	As, D/Fs, PAHs	
26	no to trace ash obsered	Clean	2-3' bgs, no to trace ash	As, D/Fs, PAHs	
27	No ash observed	Clean	2-3' bgs, no ash observed	D/F	No ash observed… exceedence is not related to ash
28	no CCBs	Clean	3-4' bgs, no CCBs observed	None	
29	no CCBs	Clean	3-4' bgs, no CCBs observed	As, D/Fs	
30	no CCBs	Clean	4-5' bgs, no CCBs observed	PAHs	No CCBs… exceedence is not related to CCBs
31	no CCBs	Clean	7-8' bgs, no CCBs observed	None	
32	no ash observed	Clean	2.7-2.9' bgs, no ash observed	None	
33	no ash observed	Clean	1.5-2.5' bgs, no ash observed	None	
34	no ash observed	Clean	1.5-2.5' bgs, no ash observed	None	
35	ash observed	Ash Imped	0.5-1' bGS, ash present	PAHs	
36	No ash observed	Clean	0.7-2' bgs, no ash observed	None	
37	no CCBs	Clean	2.0-2.5' bgs, no CCBs observed	None	
38	no CCBs	Clean	19.5-20' bgs, no ash/coal particles, possible organic	PAHs	No CCBs… exceedence is not related to CCBs
39	no to trace CCBs obsrved	Clean	18-18.5' bgs, no to trace CCBs	None	
40	no to trace CCBs obsrved	Clean	9-9.5' bgs, CCBs 12-12.5' bgs, no CCBs	None	
41	no to trace CCBs obsrved	Clean	11.5-12' bgs, possible CCBs	PAHs	No CCBs… exceedence is not related to CCBs
42	no CCBs	Clean	not sampled	-	

Notes:
1. Observed ash impacts at boring locations south of McCauley Street have not been confirmed as CCBs via microscopy.

Table 2

Subsurface Soil SPLP Results
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Metd Ty	Anayte	Uts	Prelimina Groundwat Remediation Gs (2Ls and IM	Locion	SB-14	SB-25
				DepthGS)	19 -	1-2
				Sampleate	10/25/	10/30/2013
SVOs	1-Methylnaphtlene	µg/	1		<0.	0.031J
	2-methylnaphtlene	µg/	30		<0.	0.0077J
	Acenaphthene	µg/	80		<0.	0.024J
	Acenaphthyle	µg/	200		<0.	0.016J
	Anthracene	mgL	2		0.0000056U	0.000011J
	Benz(a)anthre	µg/	0.05		0.0042U	0.0098J
	Benzo(a) pyre	µg/	0.005		0.0069U	0.0082J
	Benzo(b)fluornthene	µg/	0.05		0.0031U	0.011J
	Benzo(g,h,i)rylene	µg/	200		0.0062U	0.0082J
	Benzo(k)fluornthene	µg/	0.5		0.0063U	<0.0063U
	Chrysene	µg/	5		0.0033U	0.014J
	Dibenz(a,h)anhracene	µg/	0.005		0.0041U	<0.0041U
	Fluoranthene	µg/	300		006J	0.027J
	Fluorene	µg/	300		0.0055U	0.015J
	Indeno(1,2,3-,d)pyrene	µg/	0.05		0.0045U	0.007J
	Naphthalene	µg/	6		014J	0.023J
	Phenanthrene	µg/	200		017J	0.06J
	Pyrene	µg/	200		<0.	0.032J
Meals	Aluminium	mgL	-		0.	5.7
	Antimony	mgL	0.001		0.	<0.0031U
	Arsenic	ug/	10		4.	21
	Barium	ug/	700			110
	Beryllium	mgL	0.004		<0.	0.00095J
	Cadmium	ug/	2		0.45U	<0.45U
	Calcium	mgL	-			-
	ChromiumVI)	ug/	10		0.66U	23
	Cobalt	mgL	0.001		0.00012U	0.0028J
	Copper	mgL	1		0053J	0.11
	Iron	ug/	300			5600
	Lead	µg/	15		2.6U	74
	Magnesium	mgL	-			-
	Manganese	ug/	50			53
	Mercury	ug/	1		0.03U	0.04J
	Nickel	ug/	100		1.3U	7J
	Potassium	mgL	-			-
	Selenium	ug/	20		6J	<4.9U
	Silver	ug/	20		0.93U	<0.93U
	Sodium	mgL	-			-
	Thallium	mgL	0.0002		0.0049U	<0.0049U
	Vanadium	mgL	0.0003		017	0.027
	Zinc	mg/L	1		0.01J	0.059

Note

1. m/L indicates milligram per liter.
2. µg indicates microgram per liter.
3. Udicates result was below the method detection limit.
4. Jdicates results is an estimate.
5. Goundwater remediation goals reference NCDENRs 2L and IMAC standards from April 1, 2013.
6. SVOC indicates semi-volatile organic compound.

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

Mthod Type	Analyte	its	Final Unresricted Use Remeial Goal	Location	DU01		
				Depth (ft BGS)	0	0	0-1
				Sample Date	2/26/2014	2/27/	2/27/2014
Dioxins and Fuans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HDD)	ng/kg	-		470	290	250
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HDF)	ng/kg	-		91	53	48
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HDF)	ng/kg	-		9.4	5.1	4.2J
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCD)	ng/kg	-		8.7	4.4J	4.6J
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCF)	ng/kg	-		4.3J	2.2J	1.8J
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCD)	ng/kg	-		18	12	9.7
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCF)	ng/kg	-		5.7	3.8J	2.9J
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCD)	ng/kg	-		5.7	3.6J	4J
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCF)	ng/kg	-		0.18J	0.096J	0.12J
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8		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 (PeCD)	ng/kg	-		<0.045U		0.15J
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCF)	ng/kg	-		0.97J	0.68J	0.65J
	2,3,4,7,8-Pentachlorodibenzofuran (PeCD)	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 (OCD)	ng/kg	-		5800	4200	3500
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (CDF)	ng/kg	-		290	170	150
	Calculated Dioxin/Furan TEQ	ng/kg	1.1		13.0148	8.6925	7.6531
	Calculated Hexachlorodibenzo-p-dioxin, M: ure	ng/kg	625		3.2	2	1.8
SCs	1-Methylnaphthalene*	µg/kg	112,500		95J / 350J	260J 280J	240J / 150J
	2-methylnaphthalene*	µg/kg	-		110J 410J	250J 290J	260J / 170J
	Acenaphthene*	µg/kg	-		17 / 89J	21 /	11J / 12
	Acenaphthylene*	µg/kg	-		120 / 300	130 /	65J / 64
	Anthracene	µg/kg	-		460	70	66
	Benz(a)anthracene	µg/kg	1,000		710	130	120
	Benzo(a) pyrene	µg/kg	100		360	69	97
	Benzo(b)fluoranthene	µg/kg	1,000		780	170	140
	Benzo(g,h,i)perylene	µg/kg	-		370	110	84
	Benzo(k)fluoranthene	µg/kg	10,000		270	56	41
	Chrysene	µg/kg	100,000		760	190	150
	Dibenz(a,h)anthracene	µg/kg	100		110J	27	22
	Fluoranthene	µg/kg	-		1,800	300	220
	Fluorene	µg/kg	-		390	33	33
	Indeno(1,2,3-c,d)pyrene	µg/kg	1,000		380	76	67
	Naphthalene*	µg/kg	7,647		64 / 310	150 /	160 / 100
	Phenanthrene	µg/kg	-		2,100	350	270
	Pyrene	µg/kg	-		1,500	340	270
	PAH TEQ	µg/kg	100		660	134	152
Mtals	Aluminium	mg/kg	42,996		13000J		12,000
	Antimony	mg/kg	-		<J	<	<0.38U
	Arsenic	mg/kg	3.2		2.5J	3	2.6
	Barium	mg/kg	3000		59J	61	58
	Beryllium	mg/kg	32		0.37J	0.33J	0.27J
	Cadmium	mg/kg	-		0.11J	0.13J	0.13J
	Chromium (III+VI)	mg/kg	-		19J	28	33
	Cobalt	mg/kg	30.9		7J	9	8.5
	Copper	mg/kg	620		22J	25	26
	Iron	mg/kg	59,291		17,000J	19,000	19,000
	Lead	mg/kg	400		13J-		11
	Magnesium	mg/kg	-		3000J	4,100	4,800
	Manganese	mg/kg	1,542		380J	450	470
	Mercury	mg/kg	1.9		0.03	0.036	0.03
	Nickel	mg/kg	-		12	18	19
	Selenium	mg/kg	78		<J	<	<0.86U
	Silver	mg/kg	-		< 0.16U	<	<0.16U
	Thallium	mg/kg	0.16		<J	<	<0.65U
	Vanadium	mg/kg	96.2		33J	36	34
	Zinc	mg/kg	-		58J	67	66

Notes:

1. Results / concentrations may be revised from those reported in the Remedial Investigation Report based on subsequent data validation performed in October 2019.
2. Final Unrestricted Use Remedial Goals as established in the Remedial Investigation Report dated May 2016.
3. Highlighted concentrations are exceedences of the Final Unrestricted Use Remedial Goal.
4. ft BGS indicates feet below ground surface.
5. PAH indicates polyaromatic hydrocarbon.
6. SVOC indicates semi-volatile organic compound.
7. TEQ indicates total equivalents.
8. ng/kg indicates nanogram per kilogram.
9. mg/kg indicates milligram per kilogram.
10. µg/kg indicates microgram per kilogram.
11. J indicates results is an estimate.
12. U indicates result was below the method detection limit.
13. * 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.

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

Method Type	Analyte	its	Final Un Use Remedoal	Location	SB-1	SB-2	SB-5	SB-8	SB-9	SB-10	SB-11	SB-12	SB-12	SB-13	SB-13
				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
				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
	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	n/kg	-		2.2J	2.2J	1.	4100	64	120	580	40	44	1100	32
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	n/kg	-		<6.9U	<8U	<0.	420	9.1	14	91	2.3J	1.6J	230	2.3J
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	n/kg	-		0.2J	<0.	<0.	44	1.5J	1.3J	8.3	<0.1U	<0.	23	<0.
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	n/kg	-		<018U	0.	<0.	230	0.	1.1J	12	0.71J	0.93J	16	0.23J
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	n/kg	-		0.027J	0.	0.	24J	1J	0.66J	3.6J	0.11J	0.23J	12	<0.
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	n/kg	-		0.065J	0.	<0.	130	1.5J	2.6J	20	1.1J	0.62J	42	<0.
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	n/kg	-		0.074J	0.	<0.	71J	1.1J	1.4J	8.6	0.84J	0.69J	28	0.
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	n/kg	-		0.044J	0.14J	0.	36J	0.	2.1J	5.4J	0.53J	1.2J	12	0.62J
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	n/kg	-		0.049J	<0.0067U	<0.	<36U	<0.	0.36J	<14U	<08U	<0.	0.49J	<0.
Dioxins and Furans	2,3,7,8-Tetrachlorooxanthrene (TCDD)	n/kg	4.8		<0.	<0.	<0.	2.1J	<0.	<021U	<043J	1.3	0.38J	0.5J	<0.
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	n/kg	-		0.062J	0.	<0.	11J	<0.	0.3J	0.87J	0.91J	1.2J	0.79J	<02U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	n/kg	-		<015U	<0.0037U	<0.	0.37J	0.	<046U	<0.	0.12J	<0.	0.17J	<0.
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	n/kg	-		0.043J	<0.0028U	0.	5.7J	0.	0.33J	1.6J	0.22J	0.17J	2.2J	<0.
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	n/kg	-		<014U	<0.0027U	<0.	0.31J	<0.	<042U	<0.	0.073J	<0.	0.4J	<01U
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	n/kg	-		<0.	<0.0026U	<0.	0.13J	<0.	<02U	<0.	<066U	<04U	0.19J	<0.
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	n/kg	-		360	150	280	56000J	1500	4500	8900	1800	1900	15,000	2800
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	n/kg	-		0.29J	<	<	710J	21	53	230	6.6J	6.5J	670	11J
	Calculated Dioxin/Furan TEQ	n/kg	1.1		0.	0.	0.	125.5401	1.	3.8739	15.565	3.	2.	30.9341	1.
	Calculated Hexachlorodibenzo-p-dioxin,	n/kg	625		0.01	0.02	0.	39.6	0.3	0.6	3.74	0.23	0.28	7	0.09
	1-Methylnaphthalene	µ/kg	112,		20J	<0.	<0.	55J	<0.	3.3J	17	3.8J	3.4J	15	<31U
	2-methylnaphthalene	µ/kg	-		19J	<0.	<0.	69J	<0.	2.5J	21	4.9J	4.3J	19	<37U
	Acenaphthene	µ/kg	-		3.4J	<17U	<0.	16	<16U	1.5J	5J	0.49J	1.1J	2.1J	<19U
	Acenaphthylene	µ/kg	-		2.2J	<18U	<0.	130	1.2J	14	6.3	2J	1.2J	2.8J	<2U
	Anthracene	µ/kg	-		1.6J	<78U	<0.	99	<74U	11	14	1.9J	2.6J	3.6J	<85U
	Benz(a)anthracene	µ/kg	1,		<1.2U	<97U	<0.	120	1.1J	23	34	3.6J	4.4J	6.9	<1U
	Benzo(a) pyrene	µ/kg	100		<98U	<8U	<0.	140	<76U	25	35	3.6J	4.3J	6.6	<87U
	Benzo(b)fluoranthene	µ/kg	1,		<1.6U	<3U	<3U	180	1.7J	30	51	5.9J	7.2	10	<4U
	Benzo(g,h,i)perylene	µ/kg	-		<1.5U	<2U	<1U	130	1.7J	19	25	2.9J	3.3J	4.6J	<3U
SVOCs	Benzo(k)fluoranthene	µ/kg	10,		<1.3U	<1U	<1	69	1.6J	11	18	1.9J	2J	3.3J	<2U
	Chrysene	µ/kg	100,		<1.3U	<1U	<1	150	1.6J	30	41	5.8J	6.7	9.9	<2U
	Dibenz(a,h)anthracene	µ/kg	100		<1.7U	<4U	<4U	36	1.9J	5.4J	7.6	<1.5U	<4U	<1.7U	<5U
	Fluoranthene	µ/kg	-		3.4J	<1U	<1	190	<1U	41	74	9.6	11	14	<2U
	Fluorene	µ/kg	-		4.4J	<51U	<0.	30	<48U	4.3J	4.9J	1.3J	1.3J	2.5J	<56U
	Indeno(1,2,3-c,d)pyrene	µ/kg	1,		<1.5U	<2U	<1U	96	1.8J	15	21	2.4J	2.7J	3.7J	<3U
	Naphthalene	µ/kg	7,		21	<35U	<0.	39	<33U	1.9J	17	2.7J	2.3J	14	0.45J
	Phenanthrene	µ/kg	-		8.1	<2U	<1U	170	<1U	38	63	11	12	19	<3U
	Pyrene	µ/kg	-		4J	<2U	<1U	190	<1U	50	61	8.3	9.5	14	<3U
	PAH TEQ	µ/kg	100		ND	ND	ND	216.44	2.	37.34	53.421	4.8148	5.	8.7029	ND
	Aluminum	m/kg	42,		14000B	16,	9,	16,000B	14,000	22,000	13,000	6,800	8,600	15,000	16,
	Antimony	m/kg	-		<44U	<39U	<0.	<48U	<42U	<42U	<38U	<39U	<39U	<47U	<41U
	Arsenic	m/kg	3.2		14	1.5J	1.	21	0.	2.5	2.9	1.7J	2.2	3.5	1J
	Barium	m/kg	3,		68	17	14	440	18	43	48	86	120	42	14
	Beryllium	m/kg	32		1.1	0.33J	0.	1.6	0.	0.48J	0.57	0.4J	0.52	0.42J	0.17J
	Cadmium	m/kg	-		<047U	<0.	<0.	0.14J	<0.	<045U	<0.	<042U	<0.	<051U	<0.
	Chromium (III+VI)	m/kg	-		14J	7.4	9.8	29	8.3	9.5	9.2	7.1	9.4	8.7	7.7
	Cobalt	m/kg	30.9		6.6	4.9	1	6.7	7.3	2.8	5.2	1.4	1.9	2.4	1.6
	Copper	m/kg	620		24	8.4	11	49	6.9	14	21	8.5	12	16	13
Metals	Iron	m/kg	59,		28,000B	17,	11,	19,000B	14,	21,000	15,000	5,200	6,600	13,000	6500
	Lead	m/kg	400		17	9.9	6.6	22	13	31	14	9.1	12	15	8.5
	Manganese	m/kg	1,		530	90	31	220	410	250	240	46	54	69	45
	Mercury	m/kg	1.9		0.22	0.	0.	0.14	0.	0.02J	0.02J	0.034	0.035	0.064	0.
	Nickel	m/kg	-		7.1	2.6J	1.	11	2.7J	3.1J	4.2	2.2J	3J	2.7J	2J
	Selenium	m/kg	78		2.7	<89U	<0.	<1U	<95U	<94U	<86U	<88U	0.96J	<1.1U	<94U
	Silver	m/kg	-		<18U	<17U	<0.	<2U	<18U	<18U	<16U	<16U	<17U	<0.2U	<17U
	Thallium	m/kg	0.		<75U	<67U	<0.	<82U	<71U	<71U	<65U	<66U	<67U	<81U	<71U
	Vanadium	m/kg	96.2		32J	27	28	47	30	43	30	15	19	41	24
	Zinc	mg/kg	-		72J	19	8.1	70 B	36	29	44	14	17	31	19

Analyte	SB-14	SB-16	S	SB-18	S	S	S	S	SB-26	S	SB-28	SB-29	S	SB-31	SB-32
Depth (ft BGS)	19-23	11-12	11-12	4-5	16-17	12-13	12-13	1-2	2-3	2-3	3-4	3-4	4-5	7-8	2.9
Sample Date	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	10/30/2013	10/14/2014	10/14/2014	10/14/2014	10/14/2014	11/13/2014
1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	18	2.6J	6.4	310	32	3.7J	29	15,000	480	65	<5.9U	62	<8U	<5U	-
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	5.4J	0.19J	<0.	69	0.	<0.	<0.	950	100	0.19J	<5.9U	12	<8U	<5U	-
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	<095U	<051U	<0.	7.4	<0.	<0.	<U	130	10	<9U	<039U	<6.8U	<0.	<5U	-
1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	0.26J	0.2J	<0.	0.99J	<0.	<0.	0.	410	7.5	0.17J	<037U	1.7J	<0.	<0.	-
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	2.3J	<048U	<0.	2.5J	<01U	<0.	<0.	36J	5.7J	0.	0.074J	0.7J	<0.	<0.	-
1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	1.2J	<057U	<0.	14	0.23J	<0.	0.	640	22	0.22J	0.16J	2.5J	<0.	0.	-
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.98J	<053U	<0.	3.5J	<0.	<0.	<0.	55J	9.5J	0.	0.12J	1.1J	0.	<0.	-
1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	1.4J	0.18J	0.	2.5J	0.19J	<0.	0.	650	8	0.38J	<5.9U	<6.8U	<0.	<0.	-
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	<096U	<066U	<0.	<099U	<0.	<0.	<0.	13J	0.35J	0.	<029U	<063U	<0.	<0.	-
2,3,7,8-Tetrachlorooxanthrene (TCDD)	0.13J	<025U	<0.	0.15J	<0.	<0.	<0.	8.5J	<086U	<01U	<12U	<21U	<12U	<0.	-
1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	0.57J	<011J	<0.	0.23J	<0.	<0.	<0.	60J	0.34J	<0.	0.099J	0.36J	<0.	0.	-
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.54J	<048U	<0.	<11U	<0.	<0.	<0.	4.4J	0.2J	<0.	<042U	<049U	<0.	<0.	-
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	<069J	<048U	<0.	0.97J	<01U	<0.	<0.	7.6J	1.3J	0.03J	<5.9U	<5.9U	<0.	<0.	-
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.39J	<047U	<0.	<12U	<0.	<0.	<0.	<65U	0.26J	<0.	<04U	<043U	<0.	<0.	-
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.3J	<042U	<0.	0.35J	<0.0067U	<0.	<0.	1.9J	0.37J	<0.	<035U	0.1J	<0.	<0.	-
1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	490	150	1300	4500	6300J	520	4000	24,000	6100J	11000J	330	750	83	1,	-
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	9.6J	0.83J	0.	150	<03U	<	<	2,	280	<	<12U	36	<	<	-
Calculated Dioxin/Furan TEQ	1.96798	0.	0.	8.12	2.	0.	1.	418.672	13.718	4.	0.2334	1.	0.	0.	-
Calculated Hexachlorodibenzo-p-dioxin,	0.29	0.04	0.02	1.7	0.04	ND	0.	170	3.8	0.08	0.02	0.4	ND	0.	-
1-Methylnaphthalene	11	<28U	<3U	44	<3UJ	<0.	<0.	0.	76J	0.45J	0.89J	17J	6.7J	<0.	2.7J
2-methylnaphthalene	11	<34U	<36U	51	<35UJ	<0.	0.	<1UJ	56J	0.51J	0.69J	21J	7.4J	<0.	2J
Acenaphthene	0.79J	<17U	<18U	5.6	<18U	<0.	<0.	<1U	36	<18U	<17U	<0.2U	0.	<2U	<17U
Acenaphthylene	0.83J	<19U	<2U	19	<19U	<0.	0.	2,	290	0.57J	2.5J	3.4J	6	<0.	2.4J
Anthracene	<1.1U	<79U	<83U	31	<83U	<0.	<0.	1,	190	<8U	1.4J	3.5J	4.9J	<0.	2.1J
Benz(a)anthracene	<1.4U	<98U	<U	58	<1U	<0.	<1.	2,	360	<1U	2.8J	8.1	15	<1U	6
Benzo(a) pyrene	<1.1U	<81U	<85U	56	<85U	<0.	<0.	2,	360	<82U	2.9J	7.3	15	<0.	5.4
Benzo(b)fluoranthene	<1.9U	<1.3U	<4U	96	<4U	<3U	<1.	2,	420	<3U	3.8J	12	25	<5U	6.6
Benzo(g,h,i)perylene	<1.7U	<1.2U	<3U	41	<3U	<2U	<1.	1,	250	<2U	2.1J	4.9J	8.3	<3U	<2U
Benzo(k)fluoranthene	<1.5U	<1.1U	<2U	35	<1U	<1U	<1.	950	150	<1U	1.3J	3.6J	8.2	<2U	1.8J
Chrysene	<1.5U	<1.1U	<2U	75	<1U	<1U	<1.	3,	550	1.1J	4.6J	12	22	<2U	8.7
Dibenz(a,h)anthracene	<2U	<1.4U	<5U	13	<5U	<4U	<1.	460	76	<4U	<1.4U	<1.6U	2.7J	<6U	1.7J
Fluoranthene	1.9J	<1.1U	<2U	100	<1U	<1U	<1.	6,	880	1.7J	5.5	15	22	<2U	10
Fluorene	1J	<51U	<54U	8.1	<54U	<0.	<0.	1,	110	<52U	0.72J	1.4J	1.1J	<0.	1.8J
Indeno(1,2,3-c,d)pyrene	<1.7U	<1.2U	<3U	35	<3U	<2U	<1.	1,	190	<2U	1.9J	5J	9.5	<3U	<2U
Naphthalene	9.5	<36U	<38U	33	<37U	<0.	<0.	<1U	41	0.64J	0.53J	15	4.3J	<4U	<34U
Phenanthrene	2.7J	<1.2U	<3U	91	<3U	<2U	<1.	<1U	1,000	1.5J	6.5	19	16	<3U	16
Pyrene	<1.7U	<1.2U	<3U	100	<3U	<2U	<1.	8,	1,200	1.4J	8.1	16	23	<3U	14
PAH TEQ	0	ND	ND	88.325	ND	ND	ND	3,	535	0.	3.7676	9.858	22.754	ND	8.4
Aluminum	31,000	11,000	20,	11,000	12,000	10,	19,	8500J	6,400	18,000	9,600	23,000	14,000	27,	4,200
Antimony	<0.53U	<38U	<43U	<37U	<38U	<0.	<0.	<55U	<0.4U	<44U	<36U	<2.4U	<44U	<0.	<41U
Arsenic	28	0.9J	1.4J	3.6	1.1J	1.6J	2J	15	4.1	1.6J	1.2J	5.9J	1.6J	0.	<71U
Barium	710	34	23	43	22	18	17	160	52	48	31	82	56	34	30B
Beryllium	5.9	0.75	0.	0.65	0.17J	0.	0.	1.4	0.43J	1.2	0.26J	1.2J	0.64	0.	0.21J
Cadmium	0.27J	0.11J	<0.	<04U	<0.	<0.	<0.	0.	<043U	<0.	<043U	<26U	<0.	<0.	<0.
Chromium (III+VI)	20	12	10	7.9	11	6.2	15	25	7.1	29	5.9	8J	9	7.3	9.0B
Cobalt	9.4	11	12	3.7	1.5	4.5	3.	6.9	3.2	3.5	2	14	6	1	1.0J
Copper	200	23	22	12	14	16	26	200	12	40	8.5	28	23	13	3.4
Iron	26,000	13,000	18,	12,000	13,000	8,	27,	8,	6,100B	27,	5,100	31,000	17,000	8,	1700
Lead	26	13	21	15	8.4	15	9.	73	18	11	7.1	18	21	5.5	4.6
Manganese	600	680	320	200	52	240	110	86	120	130	33	570	230	47	53J
Mercury	1.3	<0.	0.	0.042	0.	0.	0.	0.	0.046	0.023	0.03	0.16	0.	0.	0.
Nickel	15	3.5J	3.8J	2.8J	1.9J	1.7J	2.	10	3.4J	5.6	1.8J	5.4J	3.1J	2.	3.4J
Selenium	4.9	<86U	<98U	<83U	<86U	<0.	<0.	<3U	<91U	<99U	<82U	<5.4U	1.1J	1.	<92U
Silver	<0.22U	<16U	<18U	<15U	<16U	<0.	<0.	<23U	<17U	<18U	<15U	<1U	<18U	<0.	<17U
Thallium	<0.9U	<65U	<74U	<63U	<65U	<0.	<0.	<95U	<69U	<75U	<62U	<4.1U	<75U	<0.	<70U
Vanadium	54	30	34	25	35	16	93	26	13	68	9.6	84	39	24	5.6
Zinc	130	52	72	37	11	34	16	85	30	57	11	73	58	20	8.7

Notes:

1. Results / concentrations may be revised from those reported in the Remedial Investigation Report based on subsequent data validation performed in October 2019.
2. Final Unrestricted Use Remedial Goals as established in the Remedial Investigation Report dated May 2016.
3. Highlighted concentrations are exceedences of the Final Unrestricted Use Remedial Goal.
4. ft BGS indicates feet below ground surface.
5. PAH indicates polyaromatic hydrocarbon.
6. SVOC indicates semi-volatile organic compound.
7. TEQ indicates total equivalents.
8. ng/kg indicates nanogram per kilogram.
9. mg/kg indicates milligram per kilogram.
10. µg/kg indicates microgram per kilogram.
11. J indicates results is an estimate.
12. ND indicates all of the input parameters into the calculated result or concentration were "non-detect".
13. U indicates result was below the method detection limit.

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

Method Type	Analyte	its	Final Un Use Remedoal	Location	S	S	SB-35	SB-36	SB-37	S	S	SB-40			SB-41
				Depth (ft BGS)	1.5	1.5	0.0	0.75-2	2-2.5	5-20	18-18.5	9-9.		12-12.5	11.5-12
				Sample Date	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	-		-	-	-	-	-	<058U	11	5.4	5.3	8.3	18
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	-		-	-	-	-	-	<0.	0.J	<015U	<0.0062	<0.	<0.0069
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	-		-	-	-	-	-	<0.	<0.	<0.	<0083U	<0.	<0.0091U
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-		-	-	-	-	-	<015U	<0.	0.22J	0.17J	<0.	0.16J
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF	ng/kg	-		-	-	-	-	-	<010U	<0.	<0.	<0078U	<0.	<0.023U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/kg	-		-	-	-	-	-	<016U	0.19J	0.	0.22J	0.	0.25J
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF	ng/kg	-		-	-	-	-	-	<0.	<0.	<0.	<0077U	<0.	<0.0058U
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/kg	-		-	-	-	-	-	<015U	<0.	<0099	<017U	<0.	<0.024U
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF	ng/kg	-		-	-	-	-	-	<014U	<0.	<0.	<0096U	<0.	<0.0073U
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/kg	4.8		-	-	-	-	-	<076U	<0.	<061U	<079U	<0.	0.12J
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/kg	-		-	-	-	-	-	<021U	<0.	<0.	<018U	<0.	<0.0065U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-		-	-	-	-	-	<0.	<0.	0.	<0.01U	<0.	0.080J
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF	ng/kg	-		-	-	-	-	-	<011U	<0.	<0.	<0077U	<0.	<0.0058U
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	-		-	-	-	-	-	<0.	<0.	0.	0.058Q,J	<0.	0.25J
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	-		-	-	-	-	-	<0.	<0.	0.	0.063J	<0.	0.077J
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/kg	-		-	-	-	-	-	570	990	250	280	1,	2,100
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	-		-	-	-	-	-	<0.	<0.	<0.	<0035U	<0.	<0.0053U
	Calculated Dioxin/Furan TEQ	ng/kg	1.1		-	-	-	-	-	0.171	0.426	0.	0.1845	0.	1.0781
	Calculated Hexachlorodibenzo-p-dioxin,	ng/kg	625		-	-	-	-	-	ND	0.02	0.030	0.02	0.01	0.04
SVOCs	1-Methylnaphthalene	µg/kg	112,		<27U	<0.	81	4.8J	-	3.1J	<27U	1.7J	2.7J	<0.	11
	2-methylnaphthalene	µg/kg	-		<32U	<0.	87	5.2J	-	7.4	0.55J	1.5J	2.3J	<0.	8.8
	Acenaphthene	µg/kg	-		<16U	<0.	11	<0.18U	-	56	0.53J	0.67J	<0.16U	<0.	2.4J
	Acenaphthylene	µg/kg	-		<17U	<2U	41	2.1J	-	11	3.1J	1.3J	1.6J	1.6J	7.6
	Anthracene	µg/kg	-		<74U	<0.	57	1.7J	-	200	2.5J	2.2J	1.6J	1.4J	7.8
	Benz(a)anthracene	µg/kg	1,000		<92U	<1U	120	3.9J	-	97	3.6J	4J	3.3J	2.5J	14
	Benzo(a) pyrene	µg/kg	100		<76U	1.4J	110	3.8J	-	52	4.1J	3.5J	3.2J	2.1J	13
	Benzo(b)fluoranthene	µg/kg	1,000		2J	2J	150	4.8J	-	65	4J	5.5	5.3	2.8J	22
	Benzo(g,h,i)perylene	µg/kg	-		<1U	<3U	78	2.8J	-	25	3.2J	2.7J	2.6J	1.7J	9.4
	Benzo(k)fluoranthene	µg/kg	10,		<0U	<2U	43	1.2J	-	23	1.4J	1.7J	1.7J	<1U	6.3
	Chrysene	µg/kg	100,		<0U	<2U	160	5.9	-	96	4.1J	6.2	6.6	2.9J	27
	Dibenz(a,h)anthracene	µg/kg	100		<3U	<6U	22	<1.4U	-	6.3J	<4U	<3U	<1.3U	<5U	2.4J
	Fluoranthene	µg/kg	-		<0U	<2U	280	7.4	-	530	3.6J	9.9	9.3	4J	39
	Fluorene	µg/kg	-		<48U	<0.	32	1.1J	-	200	0.57J	1.1J	1J	0.	4.4J
	Indeno(1,2,3-c,d)pyrene	µg/kg	1,000		<1U	<3U	63	2.2J	-	30	2.9J	2.4J	2.4J	1.7J	9.7
	Naphthalene	µg/kg	7,647		<33U	<0.	76	<0.36U	-	24	0.51J	1.1J	1.5J	0.	6.5
	Phenanthrene	µg/kg	-		<1U	<3U	280	11	-	49	1.6J	10	9.9	2.9J	43
	Pyrene	µg/kg	-		2.4J	2J	300	9.6	-	410	6.2	8.8	8.3	4.9J	37
	PAH TEQ	g/kg	100		0.2	1.6	165.9	4.9	-	77.826	5.	4.	4.3236	2.	20.06
Metals	Aluminum	mg/kg	42,		5,700	4,	6,300	5,900	-	16,000	8,200	5,300	4,700	11,000	7,400
	Antimony	mg/kg	-		<36U	<0.	<47U	<0.43U	-	<46U	<41U	<39U	<0.34U	<0.	<0.39U
	Arsenic	mg/kg	3.2		<62U	<0.	2.1J	1.1J	1.9J	1.3J	1.4J	1.4J	0.83J	0.	0.69J
	Barium	mg/kg	3,000		41B	33B	34	39B	-	59B	22B	35B	31B	16B	32B
	Beryllium	mg/kg	32		0.34J	0.	0.23J	0.63	-	0.57J	0.27J	0.2J	0.19J	0.	0.29J
	Cadmium	mg/kg	-		<0.	<0.	0.25J	0.12J	-	<05U	<0.	<042U	<036U	<0.	<0.042U
	Chromium (III+VI)	mg/kg	-		8.6B	5.	10B	6.6B	-	3.9	6.8	7.4	5	11	7.2
	Cobalt	mg/kg	30.9		1.2	1.5	4.3	3.1	-	1.9	4.7	2.2	2	4.1	1.7
	Copper	mg/kg	620		5.1	4.4	75J	18	-	5.9	6.5	7.4	6.6	68	25
	Iron	mg/kg	59,		1200	1900	7400	5400	-	23,000	5,900	5,400	4,900	13,000	6,600
	Lead	mg/kg	400		5.1	5.4	30	56	-	9.2	11	9	7.9	11	7.8
	Manganese	mg/kg	1,542		38	32	81J	240	-	160	150	100	89	210	38
	Mercury	mg/kg	1.9		0.	0.	0.055	0.0098J	-	0.024	0.	0.	0.016J	<0.	0.025
	Nickel	mg/kg	-		2.9J	2.0J	5.1	3.0J	-	1.9J	1.9J	1.3J	1.1J	3.5J	1.4J
	Selenium	mg/kg	78		<81U	<0.	1.3J	<0.96U	-	<1U	<93U	<88U	<0.76U	<0.	<0.88U
	Silver	mg/kg	-		<15U	<0.	<20U	<0.18U	-	<19U	<17U	<16U	<0.14U	<0.	<0.16U
	Thallium	mg/kg	0.16		<61U	<0.	<81U	<0.73U	-	<79U	<71U	<66U	<0.58U	<0.	<0.66U
	Vanadium	mg/kg	96.2		6.9	6.9	21	11	-	21	16	13	11	21	17
	Zinc	mg/kg	-		9	8.5	58	24	-	48	12	8.5	8.5	32	11

Notes:

1. Results / concentrations may be revised from those reported in the Remedial Investigation Report based o
2. Final Unrestricted Use Remedial Goals as established in the Remedial Investigation Report dated May 20
3. Highlighted concentrations are exceedences of the Final Unrestricted Use Remedial Goal.
4. ft BGS indicates feet below ground surface.
5. PAH indicates polyaromatic hydrocarbon.
6. SVOC indicates semi-volatile organic compound.
7. TEQ indicates total equivalents.
8. ng/kg indicates nanogram per kilogram.
9. mg/kg indicates milligram per kilogram.
10. µg/kg indicates microgram per kilogram.
11. J indicates results is an estimate.
12. ND indicates all of the input parameters into the calculated result or concentration were "non-detect".
13. U indicates result was below the method detection limit.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-1											
					3/2014		9/2014		4/2015		11/2015		5/2016		6/2018	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.	J	0.	U	0.	J	0.	U	0.00041	
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.00016	
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.00019	
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	J	0.	U	0.	U	0.	U	0.	U	0.00066	
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.00078	
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.0000056	
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.00066	
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.00054	
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	J	0.00074	
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.0000056	
	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	J	0.	J	0.00068	
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	J	0.	U	0.	U	0.	U	0.	J	0.	F2
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	U	0.	J	0.	J	0.	J	0.0035	U	0.00029	J
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	J	0.	J	0.	U	0.00058	U	0.0013	U
	Calculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	0.	U	0.		0.		0.		0.		0.	
	Calculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	0.	U	0.		ND				ND		ND	
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2-methylnaphthalene	µg/L	30	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Acenaphthene	µg/L	80	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Acenaphthylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Anthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Benz(a)anthracene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Benzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Benzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	J	0.	U	0.	U
	Benzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Benzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	U	0.	J	0.	U	0.	U
	Chrysene	µg/L	5	-	0.	U	0.	U	0.	U	0.	J	0.	U	0.	U
	Dibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Fluoranthene	µg/L	300	-	0.	U	0.	U	0.	U	0.	J	0.	U	0.	U
	Fluorene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Indeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	Naphthalene	µg/L	6	-	0.	U	0.	U	0.	U	0.	U	0.	J	0.	J
	Phenanthrene	µg/L	200	-	0.	U	0.	U	0.	U	0.024	J	0.0094	U	0.014	J
	Pyrene	µg/L	200	-	0.	U	0.	U	0.	U	0.041	J	0.0078	U	0.0098	U
	PAH TEQ	µg/L	0.005	0.005	ND				ND		00418		ND		ND	
General Chemistry	Bromide	mg/L	-	-	-				-				-		0.11	U
	Bicarbonate as CaCO3	mg/L	-	-	76				-				-		-	
	Total Inorganic Carbon	mg/L	-	-	-				-				-		3.7J	J+
	Dissolved Organic Carbon	mg/L	-	-	-				-				-		0.38	J
	Chloride	mg/L	250	-	27				-				-		16	B
	Fluoride	mg/L	2	-	-				-				-		0.06	U
	Nitrate	mg/L	10	-	-				-				-		1.4	
	Nitrite	mg/L	1	-	-				-				-		049	U
	Orthophosphate	mg/L	-	-	-				-				-		0.19	F1
	Sulfate	mg/L	250	250	69				71		71B		62	B	55	B
	Sulphide	mg/L	-	-	0.	U	-		-				-		-	
	TDS	mg/L	500	500	260				180				150		140	
	TSS	mg/L	-	-			-		-				-		-	
Metals	luminium	mg/L	-	-	0.		1		0.		0.		0.	J	-	
	ntimony	mg/L	0.001	-	0.	U	0.	U	0.	U	0.	U	0.0031	U	-	
	Arsenic	ug/L	10	-	4	U	8	J	4	U	4	U	4	U	-	
	arium	ug/L	700	-	42				37		38		35		-	
	Beryllium	mg/L	0.004	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	oron	ug/L	700	-	-				-				-		-	
	Cadmium	ug/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	alcium	mg/L	-	-	24				13				9.2		6.2	
	Chromium (III+VI)	ug/L	10	10	0.	J	2.	J	1	J	5	J	1	J	3.5	
	Hexavalent Chromium (VI)	ug/L	-	-	-				-				-		-	
	obalt	mg/L	0.001	0.001	0.	U	0.	U	0.	U	0.	U	0.0012	U	0.049	U
	Copper	mg/L	1	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.	
	Iron	ug/L	300	578	140		1,		430				100	U	22	U
	Lead	µg/L	15	-	2	U	2	U	2	U	2.6	U	2.6	U	-	
	Lithium	µg/L	-	-	-				-				-		-	
	Magnesium	mg/L	-	-	5		3		2		2		2		1.4	
	anganese	ug/L	50	70	190				22				10	U	10	U
	Mercury	ug/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	olybdenum	ug/L	-	-	-				-				-			
	Nickel	ug/L	100	-	1	U	1	U	2	J	1	J	1	U	-	
	Potassium	mg/L	-	-	3		2.		2	J	2	J	3	U	1.5	
	Selenium	ug/L	20	-	4	U	4	U	5	J	13	J	5.6J		-	
	Silver	ug/L	20	-	0.	U	0.	U	0.	U	0.93	U	0.93	U	-	
	Sodium	mg/L	-	-	57				41			B	34	B	34	
	trontium	ug/L	-	-	-				-				-		-	
	hallium	mg/L	0.0002	-	0.	U	0.	U	0.	U	0.	J	0.	U	-	
	anadium	mg/L	0.0003	0.0003	0.	U	0.	J	0.	U	0.	J	0.	U	0.	U
	Zinc	mg/L	1	-	0.02	U	0.013	J	0.0082	J	0.011	J	0.009	J	-	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	M-1 continued							
					12/12/2018		11/14/2019		12/2020		12/14/2021	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.0006	U	-		-		-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	-		-		-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	-		-		-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.12	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.12	U	-		-		-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	ND		-		-		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	ND		-		-		-	
SVOCs	Methylnaphthalene	µg/L	1	-	0.0062	U	-		-		-	
	methylnaphthalene	µg/L	30	-	0.0056	U	-		-		-	
	cenaphthene	µg/L	80	-	0.012	U	-		-		-	
	cenaphthylene	µg/L	200	-	0.011	U	-		-		-	
	nthracene	mg/L	2	-	0.	U	-		-		-	
	enz(a)anthracene	µg/L	0.05	-	0.0035	U	-		-		-	
	enzo(a) pyrene	µg/L	0.005	0.005	0.0056	U	-		-		-	
	enzo(b)fluoranthene	µg/L	0.05	-	0.0038	U	-		-		-	
	enzo(g,h,i)perylene	µg/L	200	-	0.0039	U	-		-		-	
	enzo(k)fluoranthene	µg/L	0.5	-	0.0055	U	-		-		-	
	hrysene	µg/L	5	-	0.0035	U	-		-		-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.0053	U	-		-		-	
	luoranthene	µg/L	300	-	0.005	U	-		-		-	
	luorene	µg/L	300	-	0.021	U	-		-		-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.016	U	-		-		-	
	aphthalene	µg/L	6	-	0.012	J	-		-		-	
	henanthrene	µg/L	200	-	0.013	J	-		-		-	
	yrene	µg/L	200	-	0.0089	U	-		-		-	
	AH TEQ	µg/L	0.005	0.005	ND		-		-		-	
General Chemistry	romide	mg/L	-	-	0.11	U	0.23	U	0.23	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-		-	
	otal Inorganic Carbon	mg/L	-	-	6.9		6		5.4	J	3.7	J+
	issolved Organic Carbon	mg/L	-	-	1	U	0.58	J	1	U	0.	J
	hloride	mg/L	250	-	16		10		10		12	
	luoride	mg/L	2	-	0.06	U	0.19		0.17	U	0.17	U
	itrate	mg/L	10	-	1.6		0.85		-		0.	
	itrite	mg/L	1	-	0.049		0.	J	-		0.049	U
	rthophosphate	mg/L	-	-	0.19	F1	0.47	UF1	-		0.47	U
	ulfate	mg/L	250	250	60	J+	62		54		63	
	ulphide	mg/L	-	-	-		-		-		-	
	DS	mg/L	500	500	150		150		150	J	140	
	SS	mg/L	-	-	-		-		-		-	
Metals	luminium	mg/L	-	-	-		-		-		-	
	ntimony	mg/L	0.001	-	-		-		-		-	
	senic	ug/L	10	-	-		-		4.4	U	4.4	U
	arium	ug/L	700	-	-		-		-		-	
	eryllium	mg/L	0.004	-	-		-		-		-	
	oron	ug/L	700	-	-		-		42	J	32	J
	admium	ug/L	2	-	-		-		-		-	
	alcium	mg/L	-	-	6.7		8.6		6.2		4.4	
	hromium (III+VI)	ug/L	10	10	10	U	10	U	1.5	J	1.7	J
	exavalent Chromium (VI)	ug/L	-	-	-		-		-		-	
	obalt	mg/L	0.001	0.001	0.0012	U	0.	U	0.	U	0.0012	U
	opper	mg/L	1	-	-		-		-		-	
	on	ug/L	300	578	180		170		22	U	37	J
	ead	µg/L	15	-	-		-		-		-	
	ithium	µg/L	-	-	-		-		9.1	U	9.1	U
	agnesium	mg/L	-	-	1.3		1.9		1.1		0.8	
	Manganese	ug/L	50	70	10	U	5	J	1.9	U	1.9	U
	ercury	ug/L	1	-	-		-		-		-	
	olybdenum	ug/L	-	-	-		-		1.0	U	1.0	U
	ickel	ug/L	100	-	-		-		-		-	
	otassium	mg/L	-	-	1.9	J	3	U	1.9	J	1.6	J
	elenium	ug/L	20	-	-		-		-		-	
	ilver	ug/L	20	-	-		-		-		-	
	odium	mg/L	-	-	42		33		34		36	
	trontium	ug/L	-	-	-		-		88		65	^6+
	hallium	mg/L	0.0002	-	-		-		0.0049	U	0.0049	U
	anadium	mg/L	0.0003	0.0003	0.0011	U	0.	U	0.0011	U	0.0011	U
	nc	mg/L	1	-	-		-		-		-	

Notes:

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4. TEQ indicates total equivalents.
5. U indicates result was below the method detection limit.
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   However, the method detection limit is an approximation.
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   sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-2 3/2014		MW-2 9/2014		MW-2 4/2015		MW-2 11/2015		MW-2 5/2016		MW-2 6/2018	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.00062		0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	J	0.00079		0.	U	0.	J	0.	U	0.	U
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.00039		0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.00011		0.	J	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.00011		0.	U	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.00012		0.	J	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.00011		0.	U	0.	J	0.	U	0.	U
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	J	0.00011		0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	J	0.00012		0.	U	0.	U	0.	U	0.	U
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.00011		0.	U	0.	U	0.	U	0.	U
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.00021		0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	J	0.	J	0.	U	0.0024	J	0.0024	U	0.00029	U
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.0016	J	0.0017	U	0.00086	U
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	0.		0.00012427		0.		0.		ND			
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	0.		ND		0.		ND		ND			
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	methylnaphthalene	µg/L	30	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthene	µg/L	80	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enz(a)anthracene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	hrysene	µg/L	5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	luoranthene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0	U
	luorene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	aphthalene	µg/L	6	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.	J
	henanthrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0094	U	0.0092	U	0.01	U
	yrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0078	U	0.0077	U	0.00083	U
	AH TEQ	µg/L	0.005	0.005	ND		ND				ND		ND		ND	
General Chemistry	romide	mg/L	-	-	-		-				-		-			U
	icarbonate as CaCO3	mg/L	-	-	140		-				-		-		-	
	otal Inorganic Carbon	mg/L	-	-	-		-				-		-		1.5	
	issolved Organic Carbon	mg/L	-	-	-		-				-		-		1.5	
	hloride	mg/L	250	-	19		-				11	B	-		17	
	luoride	mg/L	2	-	-		-				-				0.4J	
	itrate	mg/L	10	-	-		-				-				0.051J	
	itrite	mg/L	1	-	-		-				-				0.049	U
	rthophosphate	mg/L	-	-	-		-				-				0.19	U
	ulfate	mg/L	250	250	170		140			B	90	B	85		99	
	ulphide	mg/L	-	-	0.	U	-				-				-	
	DS	mg/L	500	500	400		320				250		530			
	SS	mg/L	-	-	1	U	-				-		-			
Metals	luminium	mg/L	-	-	0.	U	0.	U	0.	U	0.		0.	U	-	
	ntimony	mg/L	0.001	-	0.	U	0.	U	0.	U	0.		0.0031	U	-	
	senic	ug/L	10	-	4	U	6.5		4	U	5		4	U	-	
	arium	ug/L	700	-	87		53			B	39	J	50		-	
	eryllium	mg/L	0.004	-	0.	U	0.00047		0.	U	0.		0.	U	-	
	oron	ug/L	700	-	-		-				-		-		-	
	admium	ug/L	2	-	0.	U	0.45		0.	U	0.		0.	U	-	
	alcium	mg/L	-	-	31		24				15		17		16	
	hromium (III+VI)	ug/L	10	10	0.	U	0.66		0.	U	2.7	J	0.66	U	0.66	U
	exavalent Chromium (VI)	ug/L	-	-	-		-				-		-			
	obalt	mg/L	0.001	0.001	0.		0.		0.		0.		0.029		0.03	
	opper	mg/L	1	-	0.	U	0.	J	0.	U	0.		0.	U	-	
	on	ug/L	300	578	22	U	340				140			J	630	
	ead	µg/L	15	-	2	U	2.6		2	U	2		2.6	U	-	
	ithium	µg/L	-	-	9	U	-				-				-	
	agnesium	mg/L	-	-	7		5.9		5		3		3		3.7	B
	Manganese	ug/L	50	70	6,		5,		6,		3,800	B	4,400	B	4,600	
	ercury	ug/L	1	-	0.	U	0.	U	0.	U	0.		-			
	olybdenum	ug/L	-	-	-		-				-		-			
	ickel	ug/L	100	-	5	J	4.1		5	J	2	J	3	J	-	
	otassium	mg/L	-	-	3		3		3		2	J	3	B	2.8	J
	elenium	ug/L	20	-	4	U	4.9		4	U	4		4	U	-	
	ilver	ug/L	20	-	1	J	2.3		0.	U	0.93		0.93	U	-	
	odium	mg/L	-	-	99	J	69				62	B	66		75	B
	trontium	ug/L	-	-	-		-				-		-			
	hallium	mg/L	0.0002	-	0.	U	0.	U	0.	U	0.	J	0.	U	-	
	anadium	mg/L	0.0003	0.0003	0.	U	0.	U	0.	U	0.	J	0.	U	0.0017	J
	nc	mg/L	1	-	0.02		0.0062	J	0.093		0.005	J	0.0096	J	-	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the
   sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-2 continued 12/17/2018		11/2019		12/2020		12/13/2021	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	-		-		-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	-		-		-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	-		-		-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	-		-		-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	-		-		-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.11	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	-		-		-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	ND		-		-		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	ND		-		-		-	
SVOCs	Methylnaphthalene	µg/L	1	-	R		-		-		-	
	methylnaphthalene	µg/L	30	-	R		-		-		-	
	cenaphthene	µg/L	80	-	R		-		-		-	
	cenaphthylene	µg/L	200	-	R		-		-		-	
	nthracene	mg/L	2	-	R		-		-		-	
	enz(a)anthracene	µg/L	0.05	-	0.11	U	-		-		-	
	enzo(a) pyrene	µg/L	0.005	0.005	0.11	U	-		-		-	
	enzo(b)fluoranthene	µg/L	0.05	-	0.11	U	-		-		-	
	enzo(g,h,i)perylene	µg/L	200	-	0.11	U	-		-		-	
	enzo(k)fluoranthene	µg/L	0.5	-	0.0057	J	-		-		-	
	hrysene	µg/L	5	-	0.11	U	-		-		-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	R		-		-		-	
	luoranthene	µg/L	300	-	0.11	U	-		-		-	
	luorene	µg/L	300	-	R		-		-		-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	R		-		-		-	
	aphthalene	µg/L	6	-	0.0067	J	-		-		-	
	henanthrene	µg/L	200	-	R		-		-		-	
	yrene	µg/L	200	-	0.11	U	-		-		-	
	AH TEQ	µg/L	0.005	0.005	0.		-		-		-	
General Chemistry	romide	mg/L	-	-	0.11	U	0.	U	0.23	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-		-	
	otal Inorganic Carbon	mg/L	-	-	22		24		22	J	26	
	issolved Organic Carbon	mg/L	-	-	1.7	B	1.4		1		1.7	
	hloride	mg/L	250	-	11	B	8.4		21		18	
	luoride	mg/L	2	-	0.47	J	0.	J	0.		0.69	
	itrate	mg/L	10	-	0.12	J	0.	U	0.	J	0.19	J
	itrite	mg/L	1	-	0.049	U	0.	U	-		0.049	U
	rthophosphate	mg/L	-	-	0.19	U	0.	U	-		0.47	U
	ulfate	mg/L	250	250	96	B	51		100		89	
	ulphide	mg/L	-	-	-		-		-		-	
	DS	mg/L	500	500	260		210		270		270	
	SS	mg/L	-	-	-		-		-		-	
Metals	luminium	mg/L	-	-	-		-		-		-	
	ntimony	mg/L	0.001	-	-		-		-		-	
	senic	ug/L	10	-	-		-		4.4	U	4.4	U
	arium	ug/L	700	-	-		-		-		-	
	eryllium	mg/L	0.004	-	-		-		-		-	
	oron	ug/L	700	-	-		-		42	J	50	J
	admium	ug/L	2	-	-		-		-		-	
	alcium	mg/L	-	-	15		14		30		29	
	hromium (III+VI)	ug/L	10	10	0.74	J	10	U	0.66	U	0.66	U
	exavalent Chromium (VI)	ug/L	-	-	-		-		-		-	
	obalt	mg/L	0.001	0.001	0.024		0.		0.043		0.04	
	opper	mg/L	1	-	-		-		-		-	
	on	ug/L	300	578	100		400		130		110	
	ead	µg/L	15	-	-		-		-		-	
	ithium	µg/L	-	-	-		-		9	U	9.1	U
	agnesium	mg/L	-	-	3.7		3.7		8.6		8.9	
	Manganese	ug/L	50	70	3,900	B	3,		7,		6,600	
	ercury	ug/L	1	-	-		-		-		-	
	olybdenum	ug/L	-	-	-		-		1	U	2.3	J
	ickel	ug/L	100	-	-		-		-		-	
	otassium	mg/L	-	-	2.6	J	3	U	3.5		3.7	
	elenium	ug/L	20	-	-		-		-		-	
	ilver	ug/L	20	-	-		-		-		-	
	odium	mg/L	-	-	61		44		37		38	
	trontium	ug/L	-	-	-		-		550		550	^6+
	hallium	mg/L	0.0002	-	-		-		0.0049	U	0.0056	J
	anadium	mg/L	0.0003	0.0003	0.0011	U	0.	U	0.0011	U	0.0011	U
	nc	mg/L	1	-	-		-		-		-	

Notes:

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3. µg/L indicates microgram per liter.
4. TEQ indicates total equivalents.
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9. R indicates the results are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-3											
					3/2014		3/10/D)		9/2014		9/10/D)		4/2015		4/24/Dup)	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.00035		0.	U	0.	U	0.	U
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.00012		0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.		0.	J, U	0.	U	0.	U
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.00013		0.	U	0.	J	0.	J,U
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.00012		0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	J	0.	U
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	J	0.	U,J	0.	J, U	0.	J	0.	U	0.	U
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.0025	U	0.0037	U	0.007	U
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.0015	U	0.0081	U	0.0062	U
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	0.		ND		0.		0.		0.		0.	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	ND		ND		ND		ND		0.		ND	
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	methylnaphthalene	µg/L	30	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthene	µg/L	80	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enz(a)anthracene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	hrysene	µg/L	5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	luoranthene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	luorene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	aphthalene	µg/L	6	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	henanthrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0093	U	0.0094	U	0.0096	U
	yrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0077	U	0.0078	U	0.008	U
	AH TEQ	µg/L	0.005	0.005	ND		ND		ND				ND		ND	
General Chemistry	romide	mg/L	-	-	-		-		-				-		-	
	icarbonate as CaCO3	mg/L	-	-	55		-		-				-		-	
	otal Inorganic Carbon	mg/L	-	-	-		-		-				-		-	
	issolved Organic Carbon	mg/L	-	-	-		-		-				-		-	
	hloride	mg/L	250	-	45		-		-				-		-	
	luoride	mg/L	2	-	-		-		-				-		-	
	itrate	mg/L	10	-	-		-		-				-		-	
	itrite	mg/L	1	-	-		-		-				-		-	
	rthophosphate	mg/L	-	-	-		-		-		-				-	
	ulfate	mg/L	250	250	330		-		290				330		350	
	ulphide	mg/L	-	-	0.79	U	-		-		-				-	
	DS	mg/L	500	500	600		-		650		640		670		670	
	SS	mg/L	-	-	.1	U	-		-		-		-		-	
Metals	luminium	mg/L	-	-	12		0.	U,J	0.	U	0.	U	0.	U	0.	U
	ntimony	mg/L	0.001	-	0.	U	0.	U	0.	U	0.0031	U	0.0031	U	0.0031	U
	senic	ug/L	10	-	4.4	U	4	U	4	U	4	U	4	UJ	5	J
	arium	ug/L	700	-	22		21		18				19		19	
	eryllium	mg/L	0.004	-	0.	J	0.		0.00051		0.	J	0.	J	0.	J
	oron	ug/L	700	-	-		-		-				-		-	
	admium	ug/L	2	-	0.67	J	0.		0.	U	0.	U	0	J	0.	J
	alcium	mg/L	-	-	61		-		65				78		77	
	hromium (III+VI)	ug/L	10	10	0.66	U	0.	U	0.	U	0.66	U	0.66	U		U
	exavalent Chromium (VI)	ug/L	-	-	-		-		-		-		-			
	obalt	mg/L	0.001	0.001	0.15		0.		0.		0.12		0.13		0.12	
	opper	mg/L	1	-	0.	J	0.	U,J	0.		0.	J	0.	U		U
	on	ug/L	300	578	200		67J		460				370		340	
	ead	µg/L	15	-	2.6	U	2	U	2	U	2.6	U	2.6	U	2.6	U
	ithium	µg/L	-	-	-		-		-				-		-	
	agnesium	mg/L	-	-	16		-		19		18		20		20	
	Manganese	ug/L	50	70	8,		8,		7,		7,600		8,500		8,200	
	ercury	ug/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	olybdenum	ug/L	-	-	-		-		-				-		-	
	ickel	ug/L	100	-	31	J	32J		27		27		26		25	J
	otassium	mg/L	-	-	9.2		-		8		8		8		8	
	elenium	ug/L	20	-	4.9	U	4	U	4	U	4.9		4.9	U	4.9	U
	ilver	ug/L	20	-	0.93	U	0.	U	2	J	1.8	J	2.1	J	2.7	J
	odium	mg/L	-	-	100		-		99		97		110		100	
	trontium	ug/L	-	-			-		-		-		-		-	
	hallium	mg/L	0.0002	-	0.	U	0.	U	0.	U	0.0049		0.0049	U	0.0049	U
	anadium	mg/L	0.0003	0.0003	0.	U	0.	U	0.	J	0.0014	J	0.0011	U	0.0011	U
	nc	mg/L	1	-	0.052		0.052		0.038		0.037		0.038		0.035	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the
sample and meet quality control criteria. The presence of the analyte cannot be verified.

10. F1 & F2 are data qualifiers used by the laboratory.

11. TDS indicates total dissolved solids.

12. TSS indicates total suspended solids.

13. PAH indicates polyaromatic hydrocarbon.

14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.

15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.

16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-3 continued											
					11/21/2015		11/2015 (Dup)		5/6/2016		6/13/2018		12/17/2018		11/13/2019	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.00069	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	J,U	0.	J	0.	U	0.	U	0.	U	-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.00041	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.00024	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.0003	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.00028	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.00029	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.00024	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.00035	U	0.	U	0.	U	0.	U	0.	U	-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.00011	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.00013	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.00021	U	0.	U	0.	U	0.	U	0.	U	-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.0003	U	0.	U	0.	U	0.	U	0.	U	-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.00018	U	0.	U	0.	U	0.	U	0.	U	-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.00017	U	0.	U	0.	U	0.	U	0.	U	-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.0015	U	0.	J	0.	J	0.099	U	0.1	U	-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.00016	U	0.	U	0.	U	0.0016	U	0.00053	U	-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	ND		0.		0.		ND		ND		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	ND		ND		ND		ND		ND		-	
SVOCs	Methylnaphthalene	µg/L	1	-	0.0055	U	0.	U	0.	U	0.	U	0.	U	-	
	methylnaphthalene	µg/L	30	-	0.005	U	0.	U	0.	U	0.	U	0.	U	-	
	cenaphthene	µg/L	80	-	0.01	U	0.01	U	0.01	U	0.01	U	0.	U	-	
	cenaphthylene	µg/L	200	-	0.0096	U	0.	U	0.	U	0.	U	0.	U	-	
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	enz(a)anthracene	µg/L	0.05	-	0.0031	U	0.	U	0.	U	0.	J	0.11	U	-	
	enzo(a) pyrene	µg/L	0.005	0.005	0.005	U	0.	U	0.	U	0.	U	0.11	U	-	
	enzo(b)fluoranthene	µg/L	0.05	-	0.0033	U	0.	U	0.	U	0.	U	0.11	U	-	
	enzo(g,h,i)perylene	µg/L	200	-	0.0034	U	0.	U	0.	U	0.	U	0.	J	-	
	enzo(k)fluoranthene	µg/L	0.5	-	0.0049	U	0.	U	0.	U	0.	U	0.	J	-	
	hrysene	µg/L	5	-	0.0031	U	0.	U	0.003	U	0.	J	0.11	U	-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.0047	U	0.	U	0.	U	0.	U	0.	U	-	
	luoranthene	µg/L	300	-	0.0044	U	0.	U	0.	U	0.	U	0.11	U	-	
	luorene	µg/L	300	-	0.018	U	0.018	U	0.018	U	0.	U	0.	U	-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.014	U	0.014	U	0.014	U	0.	U	0.	U	-	
	aphthalene	µg/L	6	-	0.0052	U	0.	U	0.095	U	0.	U	0.	J	-	
	henanthrene	µg/L	200	-	0.0094	U	0.	U	0.	U	0.015	J	0.012	J	-	
	yrene	µg/L	200	-	0.0078	U	0.	U	0.	U	0.013	J	0.11	U	-	
	AH TEQ	µg/L	0.005	0.005	ND		ND		ND		0.000839		0.000075		-	
General Chemistry	romide	mg/L	-	-	-		-		-		0.14	J	0.11	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-		-		-		-	
	otal Inorganic Carbon	mg/L	-	-	-		-		-		Not Rported		39	J+	39	
	issolved Organic Carbon	mg/L	-	-	-		-		-		0.78	J	1.0	B	0.9	J
	hloride	mg/L	250	-	54	B	53	B	-		13	B	13	B	12	
	luoride	mg/L	2	-	-		-		-		0.16	J	0.14	J	0.17	U
	itrate	mg/L	10	-	-		-		-		0.	U	0.	U	0.09	R
	itrite	mg/L	1	-	-		-		-		0.	U	0.	U	0.049	R
	rthophosphate	mg/L	-	-	-		-		-		0.19	U	0.19	U	0.47	R
	ulfate	mg/L	250	250	340	B	340	B	330	B	250	B	300		210	
	ulphide	mg/L	-	-	-		-		-		-		-		-	
	DS	mg/L	500	500	680		680		630		540		560		480	
	SS	mg/L	-	-	-		-		-		-		-		-	
Metals	luminium	mg/L	-	-	0.018	U	0.018	U	0.31		-		-		-	
	ntimony	mg/L	0.001	-	0.0031	U	0.	U	0.	U	-		-		-	
	senic	ug/L	10	-	12	J	12	J	4.4	U	-		-		-	
	arium	ug/L	700	-	19		19		20		-		-		-	
	eryllium	mg/L	0.004	-	0.00052	J	0.	J	0.	J	-		-		-	
	oron	ug/L	700	-	-		-		-		-		-		-	
	admium	ug/L	2	-	0.45	U	0.45	U	0.88	J	-		-		-	
	alcium	mg/L	-	-	73		74		71		73		77		65	
	hromium (III+VI)	ug/L	10	10	2	J	1.8	J	0.99	J	0.66	U	0.66	U	10	U
	exavalent Chromium (VI)	ug/L	-	-	-		-		-		-		-		-	
	obalt	mg/L	0.001	0.001	0.12		0.12		0.11		0.06		0.073		0.055	
	opper	mg/L	1	-	0.0014	U	0.	U	0.	U	-		-		-	
	on	ug/L	300	578	360		330		940	J	110		170		480	
	ead	µg/L	15	-	2.6	U	2.6	U	2.6	U	-		-		-	
	ithium	µg/L	-	-	-		-		-		-		-		-	
	agnesium	mg/L	-	-	20		20		18		18		20		18	
	Manganese	ug/L	50	70	7,800	B	7,900	B	7,200		5,400		6,300	B	4,800	
	ercury	ug/L	1	-	0.027	U	0.027	U	0.027	U	-		-		-	
	olybdenum	ug/L	-	-	-		-		-		-		-		-	
	ickel	ug/L	100	-	25	J	25	J	22	J	-		-		-	
	otassium	mg/L	-	-	9.5		10		8.8	B	6.5		7.5		6.6	
	elenium	ug/L	20	-	16	J	14	J	4.9	U	-		-		-	
	ilver	ug/L	20	-	0.93	U	0.93	U	0.93	U	-		-		-	
	odium	mg/L	-	-	97B	B	97	B	88	B	56		63		44	
	trontium	ug/L	-	-	-		-		-		-		-		-	
	hallium	mg/L	0.0002	-	0.018		0.021		0.	U	-		-		-	
	anadium	mg/L	0.0003	0.0003	0.0011	UJ	0.	J	0.	J	0.	U	0.0011	U	0.0016	J
	nc	mg/L	1	-	0.088	J	0.22	J	0.078		-		-		-	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-3 continued			
					12/17/2020		13/2021	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	-		-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	-		-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	-		-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	-		-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	-		-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	-		-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	-		-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	-		-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	-		-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	-		-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	-		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	-		-	
SVOCs	Methylnaphthalene	µg/L	1	-	-		-	
	methylnaphthalene	µg/L	30	-	-		-	
	cenaphthene	µg/L	80	-	-		-	
	cenaphthylene	µg/L	200	-	-		-	
	nthracene	mg/L	2	-	-		-	
	enz(a)anthracene	µg/L	0.05	-	-		-	
	enzo(a) pyrene	µg/L	0.005	0.005	-		-	
	enzo(b)fluoranthene	µg/L	0.05	-	-		-	
	enzo(g,h,i)perylene	µg/L	200	-	-		-	
	enzo(k)fluoranthene	µg/L	0.5	-	-		-	
	hrysene	µg/L	5	-	-		-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	-		-	
	luoranthene	µg/L	300	-	-		-	
	luorene	µg/L	300	-	-		-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	-		-	
	aphthalene	µg/L	6	-	-		-	
	henanthrene	µg/L	200	-	-		-	
	yrene	µg/L	200	-	-		-	
	AH TEQ	µg/L	0.005	0.005	-		-	
General Chemistry	romide	mg/L	-	-	0.23	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-	
	otal Inorganic Carbon	mg/L	-	-	45	J	47	
	issolved Organic Carbon	mg/L	-	-	0.78	J	1.3	
	hloride	mg/L	250	-	19		19	
	luoride	mg/L	2	-	0.17	J	0.17	U^1-
	itrate	mg/L	10	-	0.09	U	0.09	U
	itrite	mg/L	1	-	-		0.049	U
	rthophosphate	mg/L	-	-	-		0.47	U
	ulfate	mg/L	250	250	280		270	
	ulphide	mg/L	-	-	-		-	
	DS	mg/L	500	500	560		580	
	SS	mg/L	-	-	-		-	
Metals	luminium	mg/L	-	-	-		-	
	ntimony	mg/L	0.001	-	-		-	
	senic	ug/L	10	-	4.4	U	4.4	U
	arium	ug/L	700	-	-		-	
	eryllium	mg/L	0.004	-	-		-	
	oron	ug/L	700	-	78	J	77	J
	admium	ug/L	2	-	-		-	
	alcium	mg/L	-	-	83		91	
	hromium (III+VI)	ug/L	10	10	0.66	U	0.66	U
	exavalent Chromium (VI)	ug/L	-	-	-		-	
	obalt	mg/L	0.001	0.001	0.061		0.051	
	opper	mg/L	1	-	-		-	
	on	ug/L	300	578	120		270	
	ead	µg/L	15	-	-		-	
	ithium	µg/L	-	-	9.1	U	9.1	U
	agnesium	mg/L	-	-	21		22	
	Manganese	ug/L	50	70	5,800		5,	
	ercury	ug/L	1	-	-		-	
	olybdenum	ug/L	-	-	1	U	1	U
	ickel	ug/L	100	-	-		-	
	otassium	mg/L	-	-	6.7		6.1	
	elenium	ug/L	20	-	-		-	
	ilver	ug/L	20	-	-		-	
	odium	mg/L	-	-	53		44	
	trontium	ug/L	-	-	1,100		1,	^6+
	hallium	mg/L	0.0002	-	0.0049	U	0.0052	J
	anadium	mg/L	0.0003	0.0003	0.0011	U	0.0013	J
	nc	mg/L	1	-	-		-	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the sample and meet quality control criteria. The presence of the analyte cannot be verified.

10. F1 & F2 are data qualifiers used by the laboratory.

11. TDS indicates total dissolved solids.

12. TSS indicates total suspended solids.

13. PAH indicates polyaromatic hydrocarbon.

14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.

15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.

16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	PZ/MW-4 9/2014		4/2015		11/2015		6/2016		6/2018		12/2018	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.005	j	0.00076	U	0.11	U
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.00092	U	0.0015	U	0.00055	U
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	ND		0.		ND		0.		ND		ND	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-			0.		ND				ND		ND	
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	methylnaphthalene	µg/L	30	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthene	µg/L	80	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enz(a)anthracene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	enzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	hrysene	µg/L	5	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	luoranthene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	luorene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	aphthalene	µg/L	6	-	0.	U	0.	U	0.	U	0.	U	0.	J	0.	U
	henanthrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0093	U	0.01	U	0.011	U
	yrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0077	U	0.0084	U	0.0093	U
	AH TEQ	µg/L	0.005	0.005	ND		ND		ND				ND		0.02145	
General Chemistry	romide	mg/L	-	-	-		-		-				0.11	U	0.11	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-				-		-	
	otal Inorganic Carbon	mg/L	-	-	-		-		-				6.7		13	J+
	issolved Organic Carbon	mg/L	-	-	-		-		-				0.28	J	1	U
	hloride	mg/L	250	-	-		-		-				3	U	3	U
	luoride	mg/L	2	-	-		-		-				0.06	U	0.06	U
	itrate	mg/L	10	-	-		-		-				1.3		1.1	
	itrite	mg/L	1	-	-		-		-				0.		0.049	U
	rthophosphate	mg/L	-	-	-		-		-				0.19	F1, U	0.81	J+
	ulfate	mg/L	250	250	53		62B	B	73		21		16	B	9.7	B
	ulphide	mg/L	-	-	-		-		-				-		-	
	DS	mg/L	500	500	140		140		170				62		70	
	SS	mg/L	-	-	-		-		-				-		-	
Metals	luminium	mg/L	-	-	0.	J	0.	J	0.	J	0.		-		-	
	ntimony	mg/L	0.001	-	0.	U	0.	U	0.	U	0.	U	-		-	
	senic	ug/L	10	-	4	U	4	U	7	J	4	U	-		-	
	arium	ug/L	700	-	34		32	B	41				-		-	
	eryllium	mg/L	0.004	-	0.	U	0.	U	0.	U	0.	U	-		-	
	oron	ug/L	700	-	-		-		-				-		-	
	admium	ug/L	2	-	0.	U	0.	U	0.	U	0.	U	-		-	
	alcium	mg/L	-	-	14		15		20				6.4		5.8	
	hromium (III+VI)	ug/L	10	10	19		26		29				8	J	8	J
	exavalent Chromium (VI)	ug/L	-	-	-		-		-				8	J	7.6	B
	obalt	mg/L	0.001	0.001	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	opper	mg/L	1	-	0.	J	0.	U	0.	U	0.	U	-		-	
	on	ug/L	300	578	22	U	35	J	70		680	J	22	U	22	U
	ead	µg/L	15	-	2	U	2	U	2	U	2.6	U	-		-	
	ithium	µg/L	-	-	-		-		-				-		-	
	agnesium	mg/L	-	-	4		4		5		2		1		1.5	
	Manganese	ug/L	50	70	7	J	4	J	4		22	B	1.4	J	1.1	J
	ercury	ug/L	1	-	0.	U	0.	U	0.	U	0.	U	-		-	
	olybdenum	ug/L	-	-	-		-		-				-		-	
	ickel	ug/L	100	-	1.		2	J	1	U	1	U	-		-	
	otassium	mg/L	-	-	3		3		3		3	B	2	J	2.8	J
	elenium	ug/L	20	-	4	U	5		4	U	4	U	-		-	
	ilver	ug/L	20	-	0.	U	0.	U	0.	U	0.93	U	-		-	
	odium	mg/L	-	-	15		15		14		11		6		6	
	trontium	ug/L	-	-	-		-		-				-		-	
	hallium	mg/L	0.0002	-	0.	U	0.	U	0.	J	0.	U	-		-	
	anadium	mg/L	0.0003	0.0003	0.	U	0.	U	0.	U	0.	J	0.	U	0.0011	U
	nc	mg/L	1	-	0.0088	J	0.0076	J	0.0075	J	0.0077	J	-		-	

Notes:

1. ng/L indicates nanogram per liter.
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3. µg/L indicates microgram per liter.
4. TEQ indicates total equivalents.
5. U indicates result was below the method detection limit.
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10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	PZ/M-4 continued 11/14/2019		12/2020		12/13/2021	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	-		-		-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	-		-		-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	-		-		-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-		-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-		-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-		-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-		-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	-		-		-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-		-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	-		-		-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	-		-		-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	-		-		-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	-		-		-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	-		-		-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	-		-		-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	-		-		-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	-		-		-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	-		-		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	-		-		-	
SVOCs	Methylnaphthalene	µg/L	1	-	-		-		-	
	methylnaphthalene	µg/L	30	-	-		-		-	
	cenaphthene	µg/L	80	-	-		-		-	
	cenaphthylene	µg/L	200	-	-		-		-	
	nthracene	mg/L	2	-	-		-		-	
	enz(a)anthracene	µg/L	0.05	-	-		-		-	
	enzo(a) pyrene	µg/L	0.005	0.005	-		-		-	
	enzo(b)fluoranthene	µg/L	0.05	-	-		-		-	
	enzo(g,h,i)perylene	µg/L	200	-	-		-		-	
	enzo(k)fluoranthene	µg/L	0.5	-	-		-		-	
	hrysene	µg/L	5	-	-		-		-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	-		-		-	
	luoranthene	µg/L	300	-	-		-		-	
	luorene	µg/L	300	-	-		-		-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	-		-		-	
	aphthalene	µg/L	6	-	-		-		-	
	henanthrene	µg/L	200	-	-		-		-	
	yrene	µg/L	200	-	-		-		-	
	AH TEQ	µg/L	0.005	0.005	-		-		-	
General Chemistry	romide	mg/L	-	-	0.23	U	1.2	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-	
	otal Inorganic Carbon	mg/L	-	-	6.7		7.7	J	5	
	issolved Organic Carbon	mg/L	-	-	0.35	U	0.35	U	0.	J
	hloride	mg/L	250	-	1.9 J	J	9.9	J	2.4	J
	luoride	mg/L	2	-	0.17	U	0.83	U	0.	^1
	itrate	mg/L	10	-	0.88		0.74	J	0.	
	itrite	mg/L	1	-	0.049	U	-		0.049	U
	rthophosphate	mg/L	-	-	0.47	U	-		0.47	U
	ulfate	mg/L	250	250	8.9		73		10	
	ulphide	mg/L	-	-	-		-		-	
	DS	mg/L	500	500	59		64		62	
	SS	mg/L	-	-	-		-		-	
Metals	luminium	mg/L	-	-	-		-		-	
	ntimony	mg/L	0.001	-	-		-		-	
	senic	ug/L	10	-	-		4.4	U	4.4	U
	arium	ug/L	700	-	-		-		-	
	eryllium	mg/L	0.004	-	-		-		-	
	oron	ug/L	700	-	-		11	J	13	J
	admium	ug/L	2	-	-		-		-	
	alcium	mg/L	-	-	4.9		5.3		5	
	hromium (III+VI)	ug/L	10	10	10	U	3.1	J	3	J
	exavalent Chromium (VI)	ug/L	-	-	4.7		3.2	J	2.6	
	obalt	mg/L	0.001	0.001	0.0012	U	0.	U	0.0012	U
	opper	mg/L	1	-	-		-		-	
	on	ug/L	300	578	350		22	U	520	
	ead	µg/L	15	-	-		-		-	
	ithium	µg/L	-	-	-		9.1	U	9.1	U
	agnesium	mg/L	-	-	1.5		1.4		1.4	
	Manganese	ug/L	50	70	14		1.9	U	16	
	ercury	ug/L	1	-	-		-		-	
	olybdenum	ug/L	-	-	-		1	U	1	U
	ickel	ug/L	100	-	-		-		-	
	otassium	mg/L	-	-	3	B	2.6	J	2.7	J
	elenium	ug/L	20	-	-		-		-	
	ilver	ug/L	20	-	-		-		-	
	odium	mg/L	-	-	5.1		4.9		5	
	trontium	ug/L	-	-	-		79		80	^6+
	hallium	mg/L	0.0002	-	-		0.	U	0.0049	U
	anadium	mg/L	0.0003	0.0003	0.0011	U	0.	U	0.0012	J
	nc	mg/L	1	-	-		-		-	

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16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	MW-5											
					9/2014		4/2015		11/2015		5/2016		5/5/D)		6/2018	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	J	0.	U	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	U	0.	U	0.	U	0.0015	U	0.00093	U	0.00017	U
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	U	0.	U	0.00076	U	0.0011	U	0.0012	U
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	0.		0.		ND				ND		ND	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	0.		ND		ND				ND		ND	
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	methylnaphthalene	µg/L	30	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthene	µg/L	80	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	cenaphthylene	µg/L	200	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	enz(a)anthracene	µg/L	0.05	-	0.	U	0.	U	0.	J	0.	U	0.	U	0.	J,U
	enzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	enzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	enzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	enzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	hrysene	µg/L	5	-	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	luoranthene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0	U
	luorene	µg/L	300	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.	U	0.	J	0.	U	0.	U	0.	U
	aphthalene	µg/L	6	-	0.	U	0.	U	0.	U	0.	U	0.	U	0.	J
	henanthrene	µg/L	200	-	0.	U	0.	U	0.	U	0.0095	U	0.0094	U	0.0097	U
	yrene	µg/L	200	-	0.	U	0.	U	0.	J	0.0078	U	0.0078	U	0.008	U
	AH TEQ	µg/L	0.005	0.005	ND		ND		0.		ND		ND		ND	
General Chemistry	romide	mg/L	-	-	-		-		-				-		0.14	J
	icarbonate as CaCO3	mg/L	-	-	-		-		-				-		-	
	otal Inorganic Carbon	mg/L	-	-	-		-		-				-		0.71	J
	issolved Organic Carbon	mg/L	-	-	-		-		-				-		0.77	J
	hloride	mg/L	250	-	-		-		-				-		20	
	luoride	mg/L	2	-	-		-		-				-		0.08	J
	itrate	mg/L	10	-	-		-		-				-		1.1	
	itrite	mg/L	1	-	-		-		-				-		049	U
	rthophosphate	mg/L	-	-	-		-		-				-		0.26	J
	ulfate	mg/L	250	250	170		200		200		210	B	210	B	210	
	ulphide	mg/L	-	-	-		-		-				-		-	
	DS	mg/L	500	500	420		390		410				400			
	SS	mg/L	-	-	-		-		-				-		-	
Metals	luminium	mg/L	-	-	0.	U	0.	J	0.		0.	U	0.	U	-	
	ntimony	mg/L	0.001	-	0.	U	0.	U	0.	U	0.	U	0.0031	U	-	
	senic	ug/L	10	-	4	U	4	U	5	J	5.	J	4	J,U	-	
	arium	ug/L	700	-			23	B	21				21		-	
	eryllium	mg/L	0.004	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	oron	ug/L	700	-			-		-				-		-	
	admium	ug/L	2	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	alcium	mg/L	-	-			37		40				44		43	
	hromium (III+VI)	ug/L	10	10	0.	U	0.	J	4	J	0.	J	0.	J	0.	U
	exavalent Chromium (VI)	ug/L	-	-	-		-		-				-		-	
	obalt	mg/L	0.001	0.001	0.	J	0.	J	0.	J	0.	J	0.		0.	J
	opper	mg/L	1	-	0.	J	0.	U	0.	U	0.	U	0.	U	-	
	on	ug/L	300	578		U		J	67		22	U	100	U	110	
	ead	µg/L	15	-	2	U	2	U	2	U	2	U	2.6	U	-	
	ithium	µg/L	-	-	-		-		-				-			
	agnesium	mg/L	-	-	14		13		13				14		14	
	Manganese	ug/L	50	70	28		38		22		17B	B	16	B	75	
	ercury	ug/L	1	-	0.	U	0.	U	0.	U	0.	U	0.	U	-	
	olybdenum	ug/L	-	-			-		-				-		-	
	ickel	ug/L	100	-	5	J	7	J	3	J	5.	J	5	U	-	
	otassium	mg/L	-	-	2	J	2	J	2	J	3B	B	3		2	J
	elenium	ug/L	20	-	4	U	4	U	11		4	U	4	U	-	
	ilver	ug/L	20	-	0.	U	0.	U	0.	U	0.93	U	0.93	U	-	
	odium	mg/L	-	-	61		61		63		63B	B	64		65	
	trontium	ug/L	-	-	-		-		-				-		-	
	hallium	mg/L	0.0002	-	0.	U	0.	U	0.	J	0.	J	0.	UJ	-	
	anadium	mg/L	0.0003	0.0003	0.	U	0.	U	0.	U	0.	U	0.	U	0.	U
	nc	mg/L	1	-	0.0045	U	0.0046	J	0.0045	U	0.0045	U	0.0045	U	-	

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. R indicates the results are rejected due to deficiencies in the ability to analyze the
   sample and meet quality control criteria. The presence of the analyte cannot be verified.
10. F1 & F2 are data qualifiers used by the laboratory.
11. TDS indicates total dissolved solids.
12. TSS indicates total suspended solids.
13. PAH indicates polyaromatic hydrocarbon.
14. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
15. Groundwater Final Remediation Goals reference Geosyntec's 2016 Remedial Investigation Report.
16. NCDENRs 2L and IMAC standards from April 1, 2013.

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

Method	Analyte	Unit	2Ls and IMACs	Final Remediation Goals for Groundwater	M-5 continued											
					6/14/Dup)		12/13/2018		12/13/D)		11/2019		12/17/2020		12/13/2021	
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCDD)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	J,U	0.	J	-		-		-	
	2,3,6,7,8-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorooxanthrene (HxCDD)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	3,7,8-Tetrachlorooxanthrene (TCDD)	ng/L	0.0002	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,7,8-Pentachlorooxanthrene (PeCDD)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorooxanthrene (OCDD)	ng/L	-	-	0.	U	0.11	U	0.	U	-		-		-	
	2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/L	-	-	0.	U	0.	U	0.	U	-		-		-	
	alculated Dioxin/Furan TEQ	ng/L	0.0002	0.0002	ND		ND		0.		-		-		-	
	alculated Hexachlorodibenzo-p-dioxin, Mixture	ng/L	-	-	ND		ND		ND		-		-		-	
SVOCs	Methylnaphthalene	µg/L	1	-	0.	U	0.	U	0.	U	-		-		-	
	methylnaphthalene	µg/L	30	-	0.	U	0.	J	0.	J,U	-		-		-	
	cenaphthene	µg/L	80	-	0.	U	0.012	U	0.	U	-		-		-	
	cenaphthylene	µg/L	200	-	0.01	U	0.011	U	0.	U	-		-		-	
	nthracene	mg/L	2	-	0.	U	0.	U	0.	U	-		-		-	
	enz(a)anthracene	µg/L	0.05	-	0.	J	0.11	U	0.	U	-		-		-	
	enzo(a) pyrene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	-		-		-	
	enzo(b)fluoranthene	µg/L	0.05	-	0.	U	0.11	U	0.	U	-		-		-	
	enzo(g,h,i)perylene	µg/L	200	-	0.	U	0.	U	0.	U	-		-		-	
	enzo(k)fluoranthene	µg/L	0.5	-	0.	U	0.	U	0.	U	-		-		-	
	hrysene	µg/L	5	-	0.	U	0.11	U	0.	J	-		-		-	
	ibenz(a,h)anthracene	µg/L	0.005	0.005	0.	U	0.	U	0.	U	-		-		-	
	luoranthene	µg/L	300	-	0.1	U	0.11	U	0.	U	-		-		-	
	luorene	µg/L	300	-	0.	U	0.02	U	0.	U	-		-		-	
	ndeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05	0.	U	0.016	U	0.	U	-		-		-	
	aphthalene	µg/L	6	-	0.	J	0.	J	0.	J,U	-		-		-	
	henanthrene	µg/L	200	-	0.01	U	0.01	U	0.	U	-		-		-	
	yrene	µg/L	200	-	0.	U	0.	U	0.	U	-		-		-	
	AH TEQ	µg/L	0.005	0.005	0.43		ND		0.		-		-		-	
General Chemistry	romide	mg/L	-	-	0.17	J	0.13	J	0.	J	0.23		0.23	U	0.23	U
	icarbonate as CaCO3	mg/L	-	-	-		-		-		-		-		-	
	otal Inorganic Carbon	mg/L	-	-	0.71	J	31		29		8		19	J	18	
	issolved Organic Carbon	mg/L	-	-	0.75	J	1		1	U	1		0.91	J	1.1	
	hloride	mg/L	250	-	20		19	B	19	J	20		25		30	
	luoride	mg/L	2	-	0.	J	0.12		0.	U	0.		0.17	U	0.17	U^1+
	itrate	mg/L	10	-	1.2		2.5	J	1.1	J	1.	J	0.92	J	1.1	
	itrite	mg/L	1	-	0.		0.049		0.	1F2,	0.	R	-		0.049	U
	rthophosphate	mg/L	-	-	0.19	J	0.98	J	0.19	J,U	0.47	R	-		0.47	U
	ulfate	mg/L	250	250	210		220		210		230		210	J	250	
	ulphide	mg/L	-	-	-		-		-		-		-		-	
	DS	mg/L	500	500	440		420		430		500		400		460	
	SS	mg/L	-	-	-		-		-		-		-		-	
Metals	luminium	mg/L	-	-	-		-		-		-		-		-	
	ntimony	mg/L	0.001	-	-		-		-		-		-		-	
	senic	ug/L	10	-	-		-		-		-		4.4	U	4.4	U
	arium	ug/L	700	-	-		-		-		-		-		-	
	eryllium	mg/L	0.004	-	-		-		-		-		-		-	
	oron	ug/L	700	-	-		-		-		-		32	J	35	J
	admium	ug/L	2	-	-		-		-		-		-		-	
	alcium	mg/L	-	-	42		41		43		41		38		46	
	hromium (III+VI)	ug/L	10	10	0.66	U	0.77	J	0.	J	10	U	0.68	J	0.66	U
	exavalent Chromium (VI)	ug/L	-	-	-		-		-		-		-		-	
	obalt	mg/L	0.001	0.001	0.	J	0.	J	0.	J	0.	J	0.002	J	0.0024	J
	opper	mg/L	1	-	-		-		-		-		-		-	
	on	ug/L	300	578	110		240	J	350	J	840		550		1,200	
	ead	µg/L	15	-	-		-		-		-		-		-	
	ithium	µg/L	-	-	-		-		-		-		9.1	U	0.0091	U
	agnesium	mg/L	-	-	14	B	13		13		14		12		14	
	Manganese	ug/L	50	70	79		73		90		480		78		76	
	ercury	ug/L	1	-	-		-		-		-		-		-	
	olybdenum	ug/L	-	-	-		-		-		-		1	U	1.0	U
	ickel	ug/L	100	-	-		-		-		-		-		-	
	otassium	mg/L	-	-	2.7	J	2.7	J	2.8	J	3.6	B	2.9	J	2.8	J
	elenium	ug/L	20	-	-		-		-		-		-		-	
	ilver	ug/L	20	-	-		-		-		-		-		-	
	odium	mg/L	-	-	66	B	68		71		77		65		68	
	trontium	ug/L	-	-	-		-		-		-		360		440	^6+
	hallium	mg/L	0.0002	-	-		-		-		-		0.0049	U	0.0049	U
	anadium	mg/L	0.0003	0.0003	0.	U	0.		0.	U	0.0011	U	0.0011	U	0.0011	U
	nc	mg/L	1	-	-		-		-		-		-		-	

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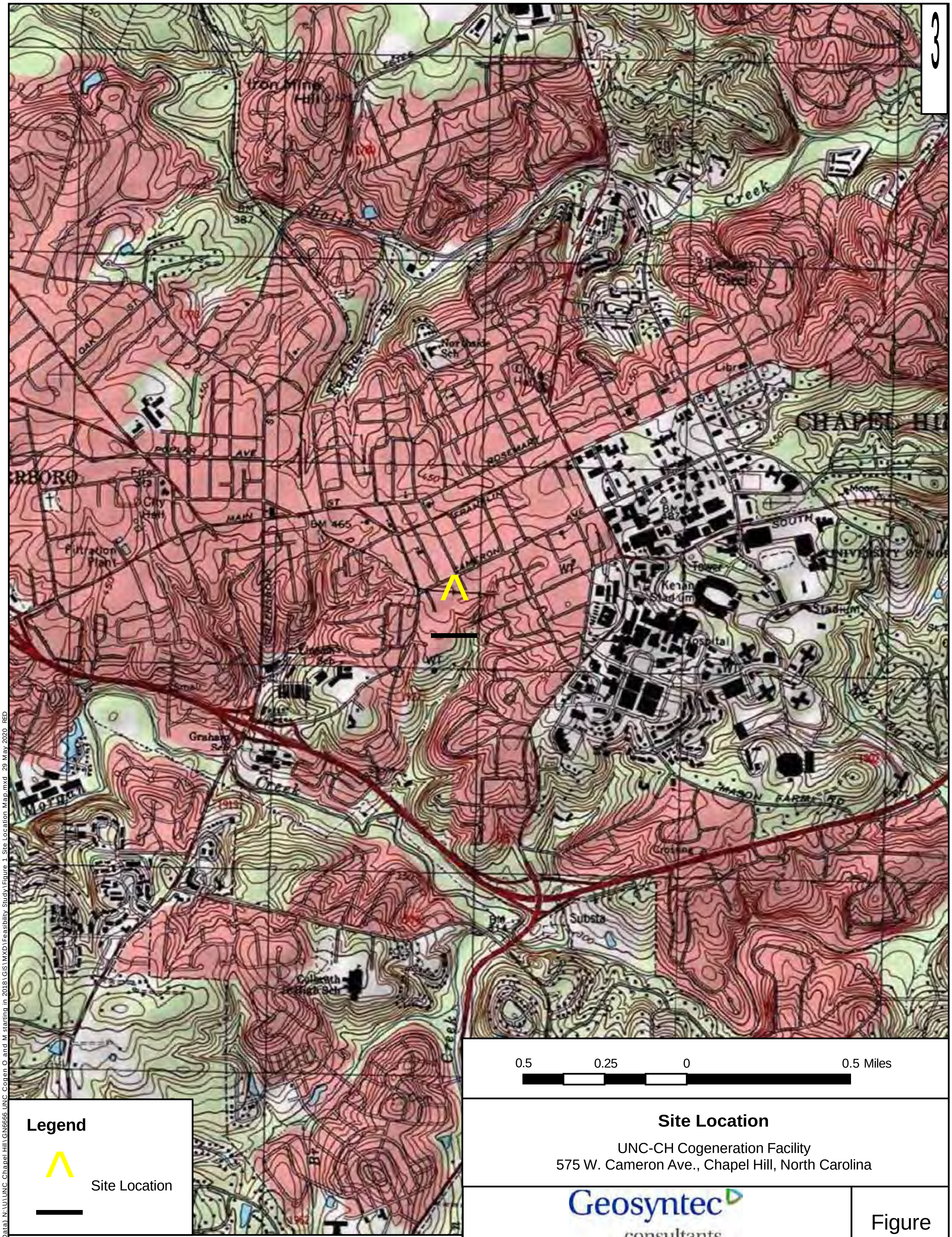
16. NCDENRs 2L and IMAC standards from April 1, 2013.

FIGURES



0.5 0.25 0 0.5 Miles

Legend

Site Location

Site Location

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

Geosyntec consultants
Geosyntec Consultants of NC, P.C.

Figure
1

Raleigh, NC | May 2020

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

Path: (Raleigh-01\Data) N:\U\UNC Chapel Hill\GN6666 UNC Cogen O and M starting in 2018\GIS\MXD\Feasibility Study\Figure 1 Site Location Map.mxd 29 May 2020 RED

Legend

- Drainage Feature
- Culverted Drainage Feature
- Cogeneration Facility
- UNC-CH Owned Parcel
- Privately Owned Parcels
- Flyash Basin
- Silt Basin
- Warehouse
- Piedmont Geologic Initial Excavation

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

60 30 0 60 Feet

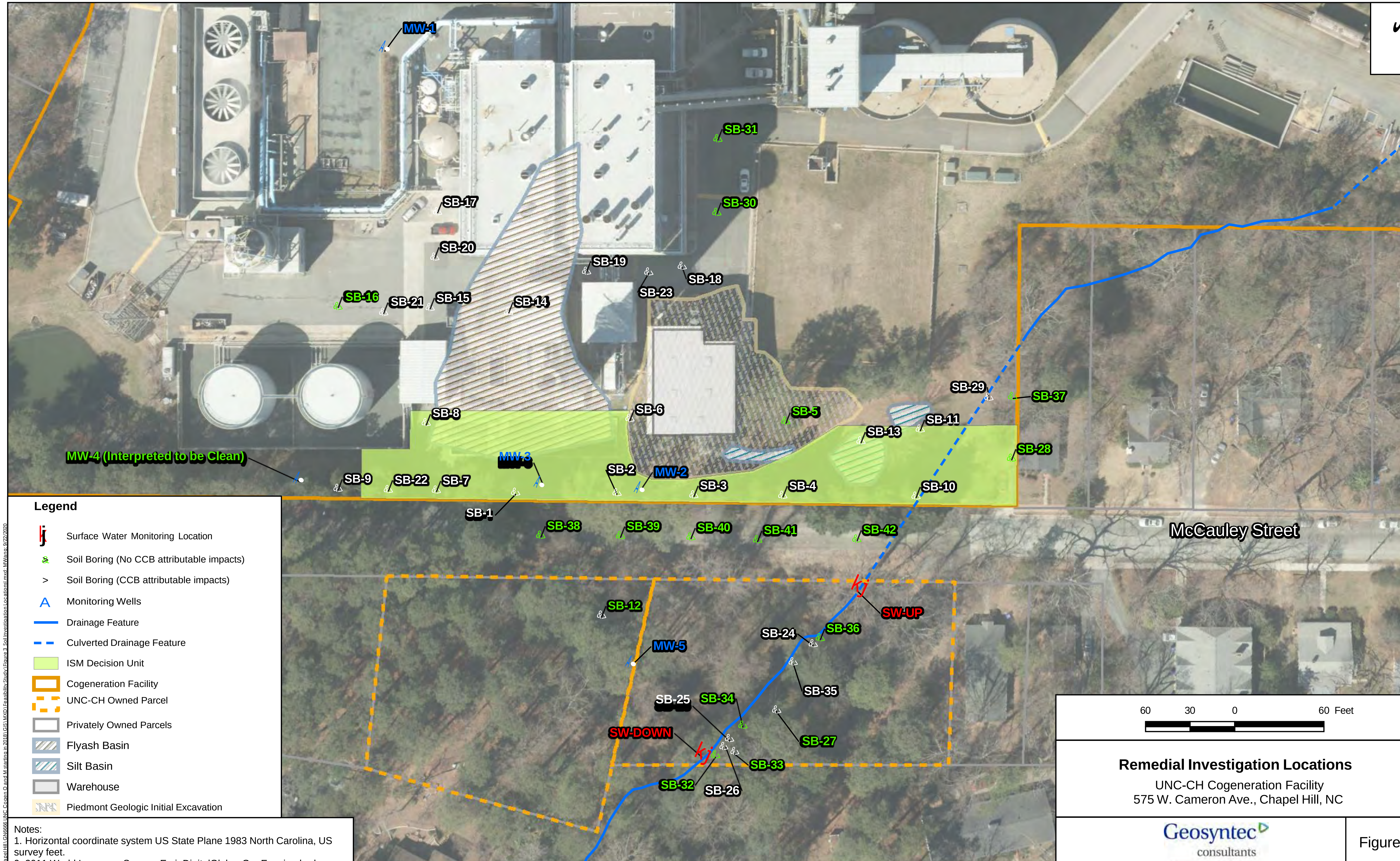
Site Layout

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

Geosyntec consultants
Geosyntec Consultants of NC, PC

Raleigh, NC | June 2020

Figure 2



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

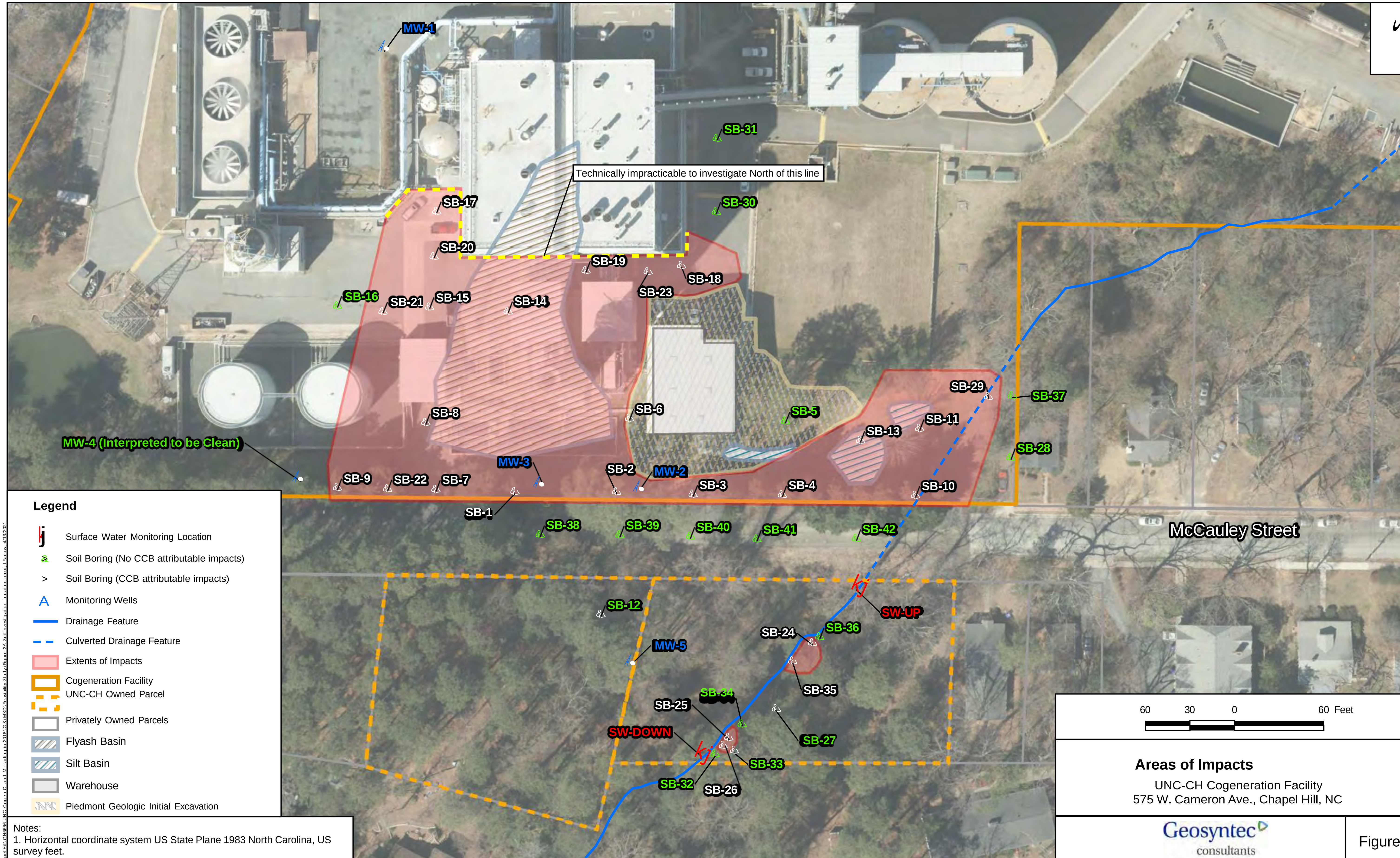
Remedial Investigation Locations

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

Geosyntec consultants
Geosyntec Consultants of NC, P.C.

Raleigh, NC | September 2020

Figure 3



Notes:
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2. 2011 World Imagery - Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the

Areas of Impacts

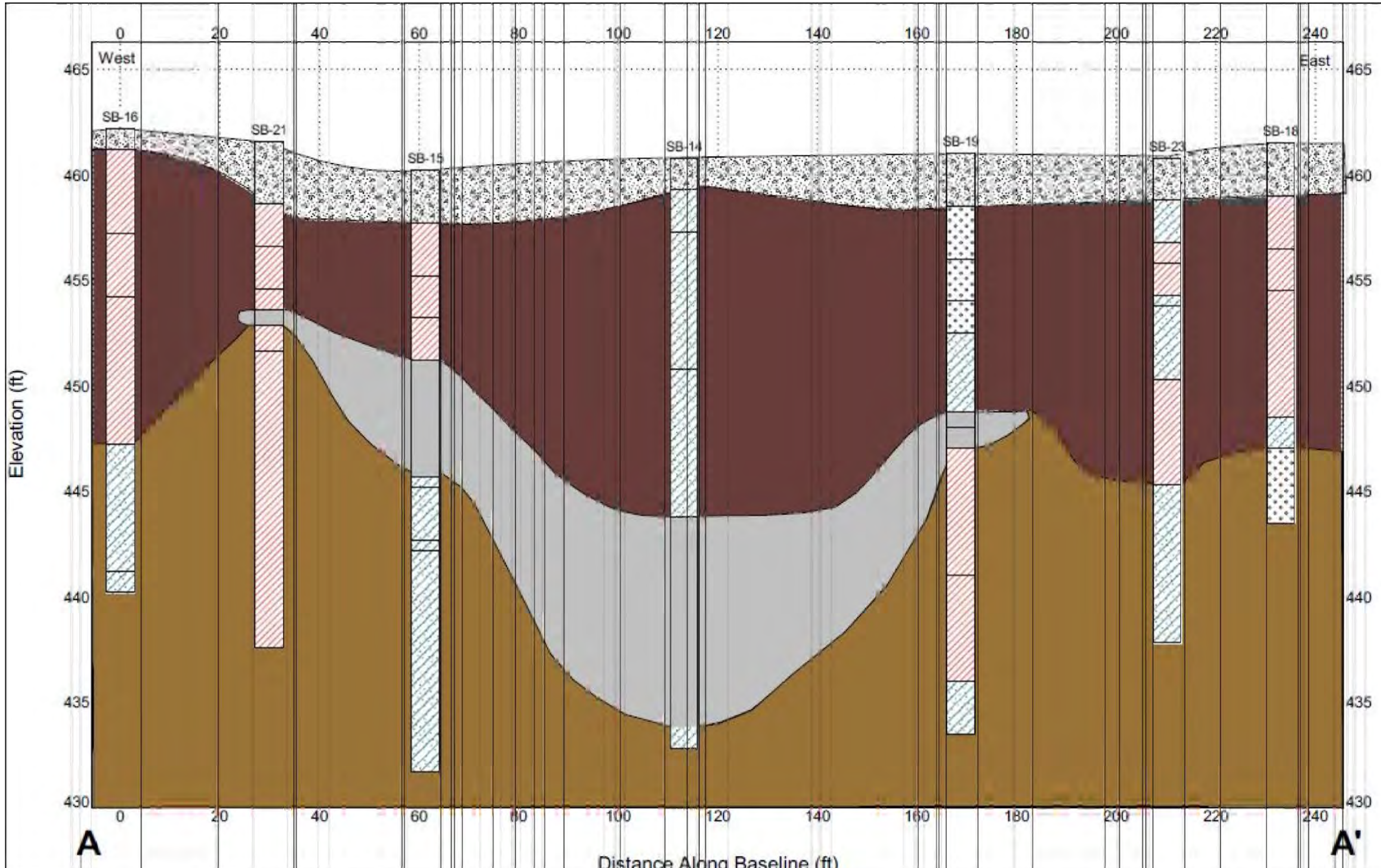
UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

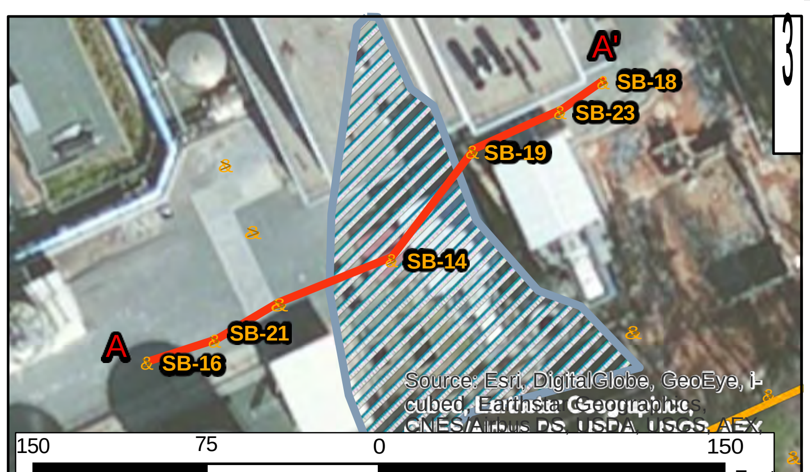
Geosyntec consultants
Geosyntec Consultants of NC, P.C.

Figure 4

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 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'

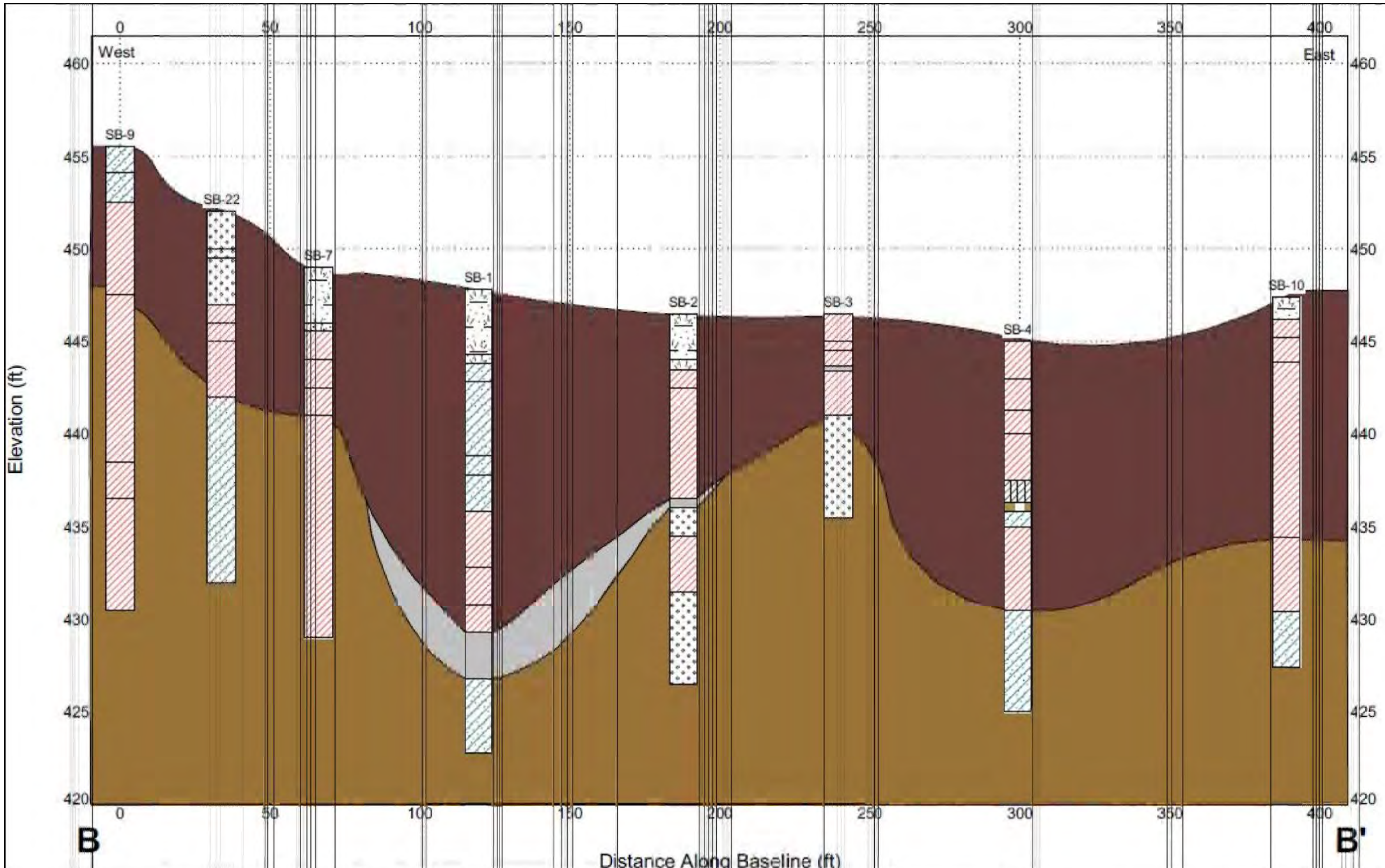
UNC-CH Cogeneration Facility
575 W. Cameron Ave., Chapel Hill, NC

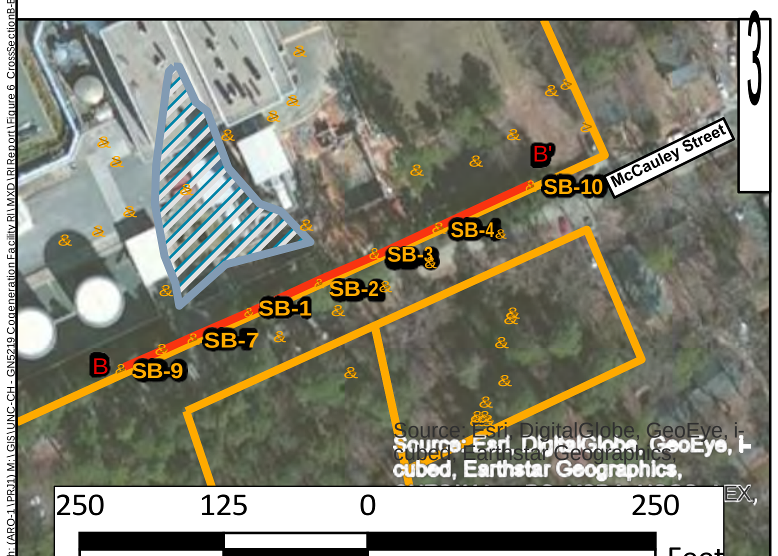
Geosyntec consultants

Raleigh, NC	June 2020	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

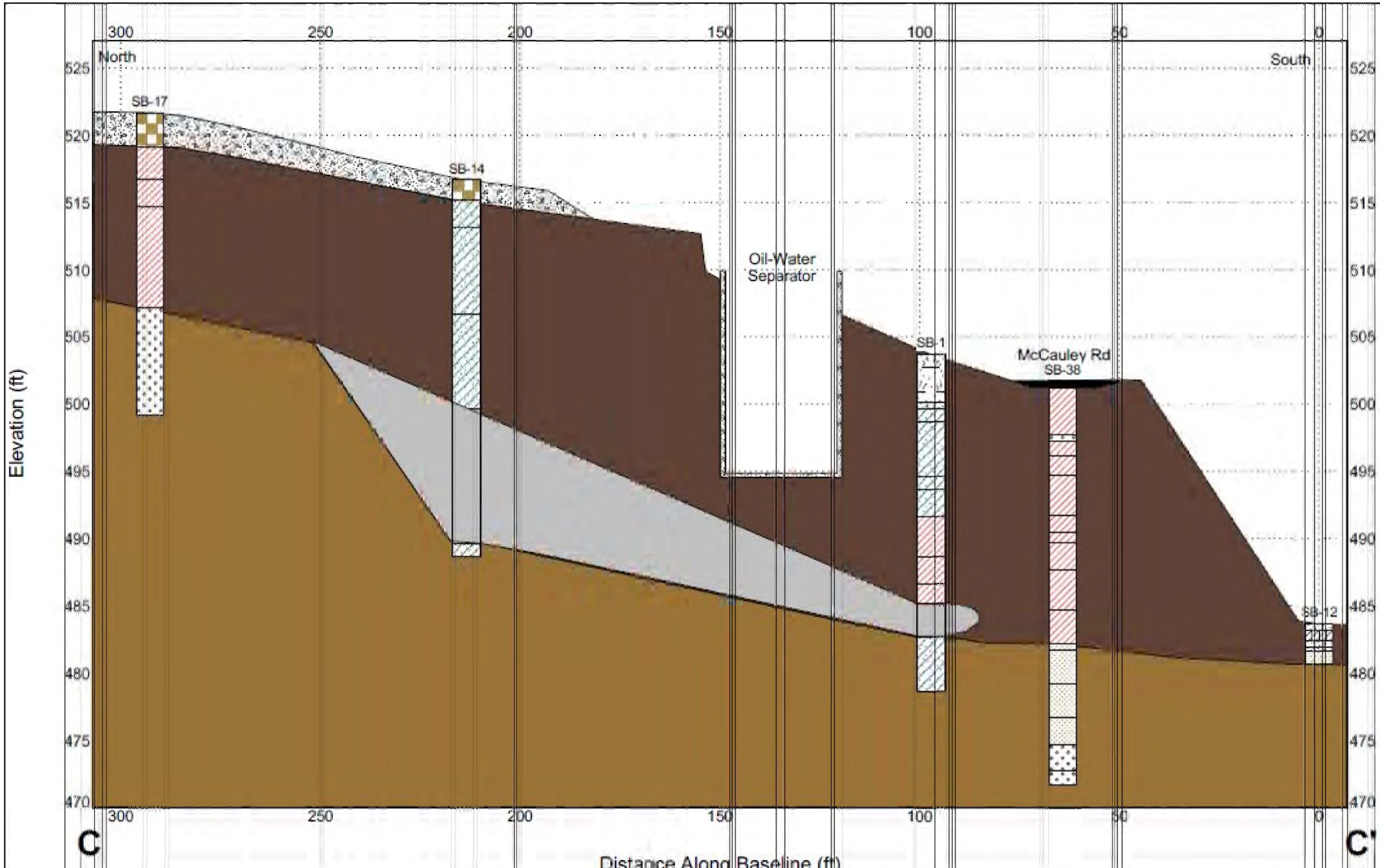
Geosyntec consultants

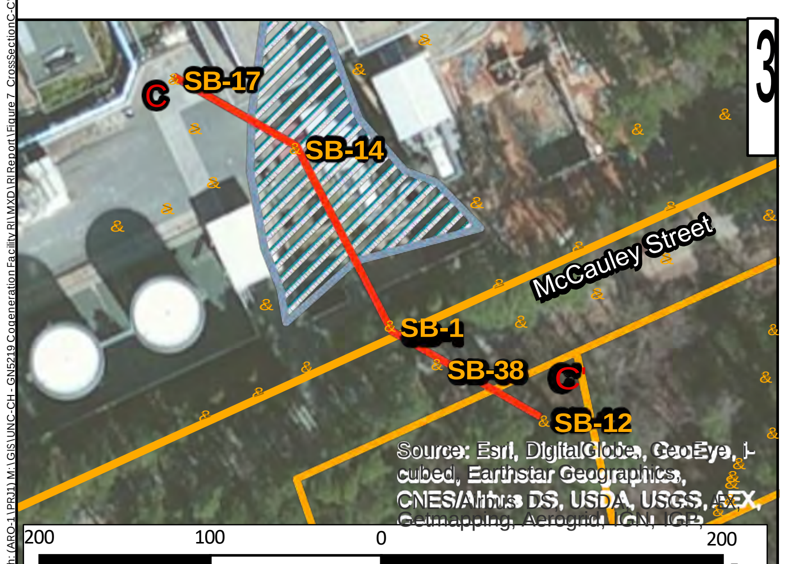
Figure 6

Raleigh, NC | June 2020

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

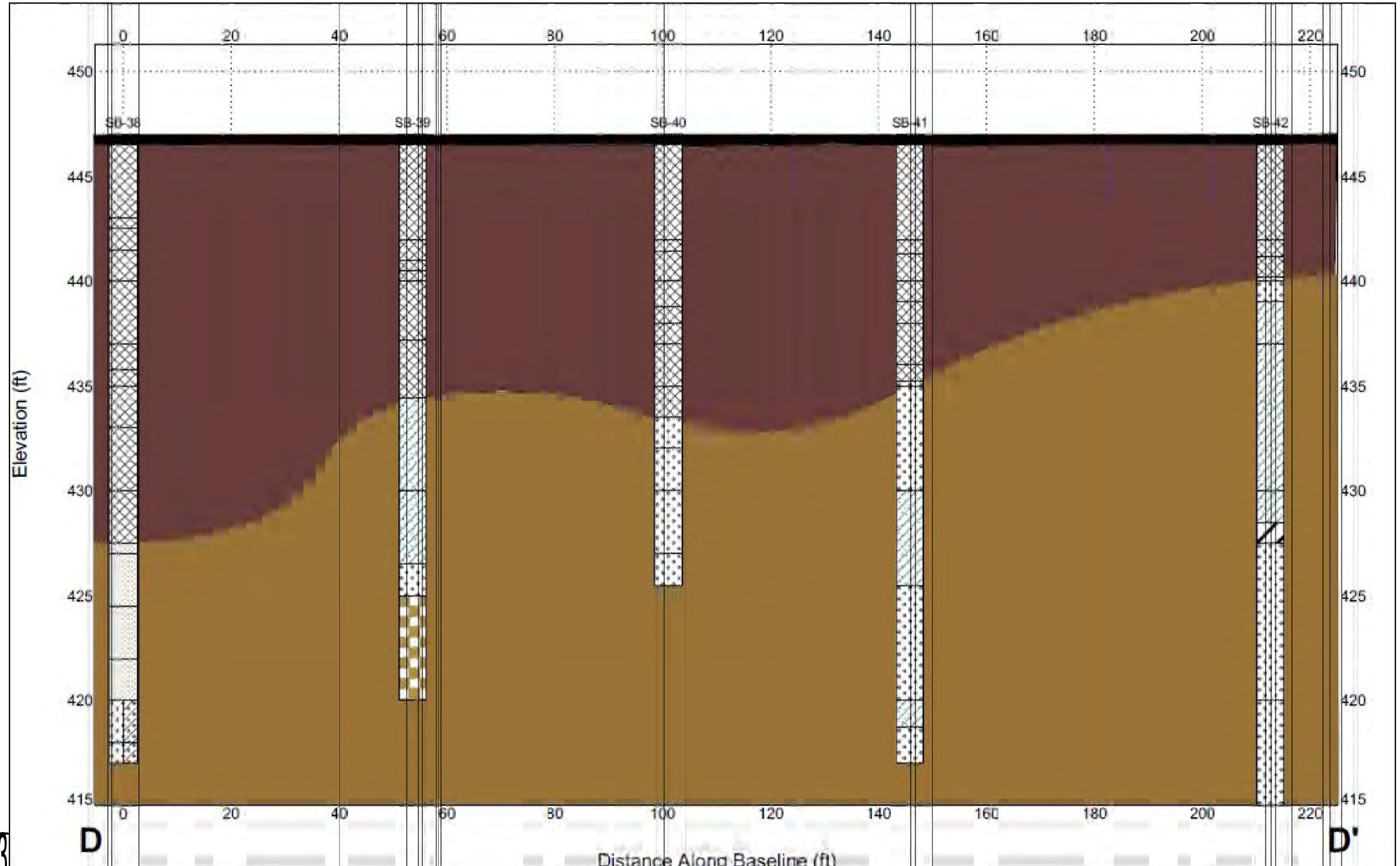
Geosyntec consultants

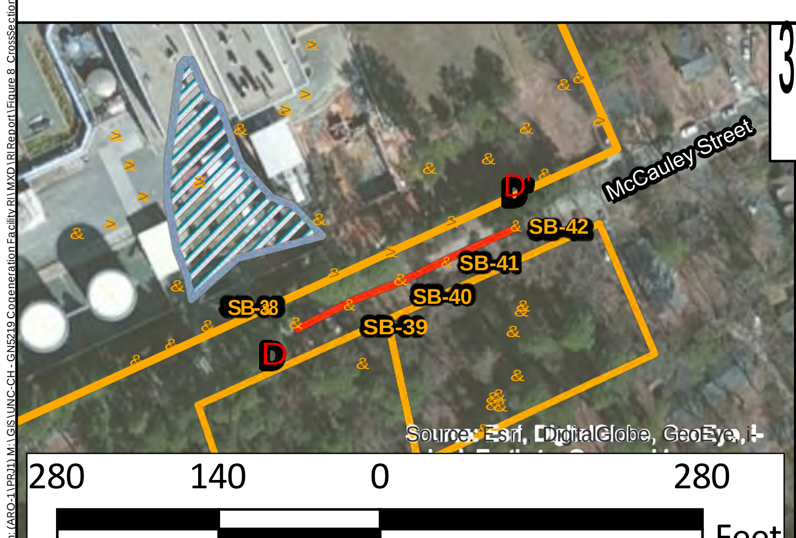
Raleigh, NC | June 2020

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

Raleigh, NC | June 2020

Figure 8

APPENDIX A

Email concerning Sediment and Surface Water Status

Michael Schott

From: Eric Nesbit
Sent: Monday, November 30, 2015 10:52 AM
To: Michael Schott
Subject: FW: UNC Sediment/Surface Water Screening report Site ID No. NCR000010272

From: Macdonald, Janet K [mailto:janet.macdonald@ncdenr.gov]
Sent: Friday, November 20, 2015 3:16 PM
To: Eric Nesbit
Subject: RE: UNC Sediment/Surface Water Screening report Site ID No. NCR000010272

Hi Eric,

I heard back from the toxicologist, but she could not address the leaching concerns. Your best argument for the PAHs is that they have not been detected in groundwater. What are the PAH concentrations in the soil source area, and what is the age of the release? If source soil concentrations are higher than what is in sediment and the release was more than 15 years ago, then the leachability is addressed. The leachability of contaminated soil and/or sediment cannot be compared with MCLs unless you are pursuing a risk-based cleanup. Just be sure that this is addressed in your final RI report.

For the ecological risk assessment, our toxicologist, Hanna Assefa, provided the following:

"Janet, I have reviewed and concur with the conclusions. The contaminant concentrations in sediment and water are not likely to pose risk and hazard to humans above allowable limits. This is because of the concentrations being lower than screening concentrations, and MCLs and also due to the nature of the surface water body being a narrow shallow ditch where exposure will be unlikely to limited. For ecological risk the benchmarks used for comparison are appropriate."

Janet Macdonald
Phone:(919) 707-8349

From: Eric Nesbit [mailto:ENesbit@Geosyntec.com]
Sent: Friday, October 09, 2015 3:41 PM
To: Macdonald, Janet K <janet.macdonald@ncdenr.gov>
Subject: UNC Sediment/Surface Water Screening report Site ID No. NCR000010272

Janet,

Attached please find the Sediment and Surface Water Screening report for the UNC Chapel Hill site no. NCR000010272.

In addition to sampling the sediment and surface water against applicable screening criteria this report contains an ecological risk evaluation and recommendation for selection and applicability of appropriate screening criteria for review.

Thanks,

Eric Nesbit, PE
Principal

Geosyntec Consultants of NC, PC
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Suite 430
Raleigh, NC 27607
Phone: (919) 424-1823
Mobile: (919) 796-4137
www.Geos ntec.com

Geosyntec
consultants

engineers | scientists | innovators

APPENDIX B

Feasibility Study

Geosyntec consultants

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

FEASIBILITY STUDY

UNC-CH COGENERATION FACILITY

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

December 2017

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.

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.

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1. INTRODUCTION

On behalf of The University of North Carolina at Chapel Hill (UNC-CH), Geosyntec Consultants of NC, PC (Geosyntec) has prepared this Feasibility Study (FS) 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 notification was prompted when soils suspected of containing coal combustion by-products (CCBs) were encountered 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. Within 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 complete a Remedial Investigation (RI).

The RI assessed fill areas in the southern portion of the Facility, the section of McCauley Street constructed of fill material and the creek or stream floodplain bisecting one of the two UNC-CH owned lots south of McCauley Street. **Figure 2** summarizes the areas investigated and estimates the areal extent of the impacted soil.

The Remedial Investigation Report (RIR) was submitted on May 27, 2016. The RIR concluded that concentrations of some contaminants of concern (COCs) exceeded their respective Remedial Goals (RGs) in soil (within facility property and in isolated pockets south of McCauley Street) and in a limited area of groundwater. The RIR recommended "No Further Action" for the in-stream sediment and surface water. This FS evaluates remedial alternatives or options for soil and groundwater per the requirements of the REC program rules and implementation guidance.

2. SOIL

2.1 Soil Remedial Goals

The RIR concluded both surface (0-1 foot below ground surface) and subsurface (deeper than 1 foot below ground surface) soil within the Facility's fence line contain COCs at concentrations exceeding their respective RGs. In addition, two isolated pockets of CCBs located on one of the lots south of McCauley Street contain COCs at concentrations exceeding their respective RGs.

COCs for soil and their respective RGs were established in accordance with Appendix D and E of the REC Program Implementation Guidance (October 2015) and presented in the RIR. The soil COCs and their respective RGs are presented in the table below.

Soil COC	Units	RG
2,3,7,8-tetrachloroonthrene	ng/kg	4.8
Calculated Dioxin/Furan TEQ	ng/kg	1.1
Calculated Hexachlordibenzo -p-dioxin, Mixre	ng/kg	625
1-Methylnaphthlene	µg/kg	112,500
Benz(a)anthrne	µg/kg	1,000
Benzo(a)pyrne	µg/kg	100
Benzo(b)fluorahene	µg/kg	1,000
Benzo(k)fluorahene	µg/kg	10,000
Chrysene	µg/kg	100,000
Dibenz(a,h)antacene	µg/kg	100
Indeno(1,2,3-cd)rene	µg/kg	1,000
Naphthalen	µg/kg	7,647
PAH TEQ	µg/kg	100
Aluminum	mg/kg	42,996
Arsenic	mg/kg	3.2
Barium	mg/kg	3,000
Beryllium	mg/kg	32
Cobalt	mg/kg	30.9
Copper	mg/kg	620
Iron	mg/kg	59,291
Lead	mg/kg	400
Manganes	mg/kg	1,542
Mercury	mg/kg	1.9
Selenium	mg/kg	78
Thallium	mg/kg	0.16
Vanadium	mg/kg	96.2

Notes:
TEQ indicates total equivlents
PAH indicates polyaromaic hydrocarbons
kg indicates kilograms
mg indicates milligrams
µg indicates micrograms
ng indicates nanograms

2.2 Remedial Action Objectives for Soil

Remedial action objectives for soils include:

- Prevent human exposure to soil containing COCs at concentrations above acceptable risk levels (carcinogenic and non-carcinogenic);
- Prevent migration of soil containing COCs at concentrations above acceptable risk levels (carcinogenic and non-carcinogenic); and
- Restore concentrations of COCs in soils to acceptable risk levels (carcinogenic and non-carcinogenic).

Note, sampling of in-stream sediment and surface water in the creek or stream was conducted during the RI to determine any potential for human health or ecological risk associated with the creek or stream bisecting one of the two UNC-CH owned lots south of McCauley Street. From this sampling and data evaluation, "No Further Action" was recommended for the in-stream sediments and surface water. NCDEQ concurred with this recommendation. Furthermore, no apparent ecological receptors are associated with soils entire within the Facility parcel or on the lots south of McCauley Street. Therefore, no remedial action objectives for soil are established to protect ecological receptors.

2.3 Response Actions for Soil

A focused list of response actions considered for soil included:

- Low-Permeability Cap and Clean Cover;
- Excavation with Off Site Disposal;
- In Situ Solidification/Stabilization; and
- Risk-Based Remediation.

This list of response actions is expanded in **Table 1** to include applicable technologies, and screens each for potential effectiveness and implementability. This initial list was based on the Department of Defense's (and other participating agencies in the Federal Remediation Technology Roundtable) Remediation Technologies Screening Matrix, Version 4.0. Geosyntec considered the COCs and site characteristics in developing this focused list.

All technologies are considered implementable and able to achieve at least one of the remedial action objectives, and are therefore retained for further evaluation.

2.4 Remedial Alternatives for Soil

The response actions were then developed into comprehensive remedial alternatives and evaluated against the following criteria:

a. Protection of human health and the environment, including attainment of cleanup goals;
b. Compliance with applicable regulations;
c. Long-term effectiveness and permanence;
d. Short-term effectiveness;
e. Reduction of toxicity, mobility and volume;
f. Technical and logistical feasibility (implementability);

g. Cost[1]; and
h. Community Acceptance.

Criteria "a." and "b." were considered required or threshold factors with the remaining criteria considered as balancing or modifying factors. Each remedial alternative was then "scored" qualitatively (scale of 1 to 10) based on professional judgement against the others. A score of "1" implies the alternative is "not effective in meeting the criteria" and "5" being "moderately effective". A score of "10" would imply the alternative would be "completely effective".

As detailed in the sections below, remedial alternatives were developed separately for impacted soils within the Facility's existing fence line/compound and for the isolated pockets of CCBs located on one of the University owned lots south of McCauley Street. Remedial alternatives were developed separately for these two areas due to inherently independent exposure scenarios and affected populations between the two areas.

2.4.1 Remedial Alternatives for Soil within Facility

For the impacted soils within the Facility's existing fence line/compound, anticipated populations include Facility employees, Facility visitors, Construction Workers and possible Trespassers. A list of remedial alternatives considered for within the Facility's existing fence line/compound includes the following:

1. Alternate Remedial Goals with Land Use Restrictions;
2. Low-Permeability Cap and Clean Cover with Alternate Remedial Goals/Land Use Restrictions;
3. Select in-situ Solidification/Stabilization with Alternate Remedial Goals/Land Use Restrictions; and
4. Select Excavation/Disposal with Alternate Remedial Goals/Land Use Restrictions.

Table 2 presents the evaluation of remedial alternatives for the Facility's fence line. The evaluation of the alternatives versus the threshold criteria indicates that all can comply with applicable regulations, but that the intrusive remedies (cap, excavation, or solidification/stabilization) are more protective of human health and the environment than developing alternate RGs, since they actively address the CCB impacted soil that is accessible on site.

However, the evaluation of the alternatives against the balancing and modifying criteria is significantly in favor of developing alternate RGs, primarily due to technical feasibility and cost-effectiveness. The intrusive remedies would require a significant amount of permitting and coordination with the site operations, and capital costs for the intrusive remedies are more than seven times greater on average than developing alternate RGs. Long-term effectiveness, as well as permanent reduction in toxicity, mobility, and volume, do not strongly favor any remedy, since

[1] All cost estimates presented in this report were developed assuming that Class 4 Order of Magnitude level estimates (Association for the Advancement of Cost Engineering [AACE]) represent the actual installed cost within a range of -30 percent to +50 percent. Net present value costs were calculated using an annual 2 percent discount rate. The final costs of the project will depend on final approved design, actual labor and material costs, and competitive variable factors. Detailed estimates and a summary table of costs are provided in **Appendix A**.

most of the CCB impacted soil is inaccessible due to conflicts with existing buildings, utilities, and other site improvements.

Overall, it was determined that developing alternate RGs with land use restrictions and institutional controls to protect human health is the preferred option. A removal action would not be effective because not all CCB impacted soil is accessible; for example, soil boring SB-14 exceeds RGs at an interval of 19 to 23 feet below grade, but is in a central portion of the cogeneration facility. It is not practical to excavate or mix soil in this deep interval of the former fly ash basin without damaging facility infrastructure. Therefore, any intrusive action performed within the Facility's existing fence line/compound will only be a partial remedy that will still require land use restrictions. Furthermore, the site is expected to continue present operations for the foreseeable future. Treatment of the limited soil impacts to Unrestricted Use standards is not a practical or cost-effective approach for an active cogeneration facility.

2.4.2 Remedial Alternatives for Soil outside Facility

There are two isolated pockets of CCBs on one of two lots south of McCauley Street. One pocket is evident in a 300-square foot sandbar deposited along inside the banks of the stream immediately below the outfall. The second is a 280-square foot subsurface deposition in the vegetated floodplain. For these two pockets of CCBs, anticipated populations that could potentially be exposed to CCB-impacted soils include possible Trespassers. A list of remedial alternatives considered for the isolated pockets of CCBs includes the following:

1. Alternate Remedial Goals with Land Use Restrictions;
2. Excavation/Disposal; and
3. Select Excavation/Disposal with select Solidification/Stabilization and Alternate Remedial Goals/Land Use Restrictions.

A cap was not considered for the pockets of CCB impacted soil due to the potential for erosion during a flood event rendering the cap ineffective.

Table 3 presents the evaluation of remedial alternatives for the lots south of McCauley. The evaluation of the alternatives versus the threshold criteria indicates that excavation with disposal is considered the most protective of human health and the environment of the alternatives evaluated, since the other alternatives would leave at least some impacted material in place. All alternatives can comply with applicable regulations.

The evaluation of the alternatives against the balancing and modifying criteria is also in favor of excavation, despite the higher capital cost as compared to developing alternate RGs. This is primarily because all CCB impacted soils south of McCauley are relatively accessible. Therefore, the implementation of this remedy would not be as difficult as with the facility soils, and will result in a permanent reduction in toxicity. Additionally, excavation and site restoration will have secondary aesthetic benefits to this area unrelated to the CCB impacts, as various debris, litter, and invasive vegetation can be removed and replaced with native stabilizing material. Community acceptance of this option is believed to be high, as well, and this alternative would eliminate the need for land use restrictions. It is noted that monitoring and maintenance of site restoration will be required for a few years after completion.

2.5 Proposed Remedial Action for Soil

For the CCB impacts inside the facility's fence line, Geosyntec recommends developing alternate RGs, for two principal reasons:

- Exceedances of the soil RGs are fairly limited spatially and numerically, even compared to Unrestricted Use screening criteria. It is anticipated that there will be little to no remaining soil COCs after developing alternate RGs with little to no change in their protectiveness, and that the scope of the remediation would ultimately be minor, if required; and
- Land use restrictions will be required regardless of what intrusive remedy (i.e., excavation, capping, mixing, etc.) is employed, due to the numerous site assets that are anticipated to operate for the foreseeable future.

For the pockets of CCBs south of the site, the pockets could be left in place. It is noted that a Risk Assessment for the pockets of CCBs located in the stream determined that there are no unacceptable risks or hazards from sediment in the stream and NCDEQ concurred with this assessment. Management of CCB impacted soils in place would require land use restrictions in perpetuity.

.

3. GROUNDWATER

3.1 Groundwater Remedial Goals

The RIR concluded the groundwater signature or fingerprint emanating from the source areas (MW-2 & MW-3) includes sulfate and total dissolved solids (TDS) with cobalt and manganese elevated about 1 to 2 orders of magnitude above their respective standards. While the exceedances of these parameters may be attributable to the presence of CCB-impacted media, it merits noting that the signature lacked polynuclear aromatic hydrocarbons (PAHs) and only one exceedance above its standard of dioxins/furans was recorded over five sampling events. While the environmental signature of CCBs in groundwater can vary significantly, depending on the type of power station, coal source, aging in the environment, and other factors, the RIR data demonstrated relatively minor impact overall.

COCs for groundwater and their respective Remediation Goals were established in accordance with Appendix D of the REC Program Implementation Guidance (October 2015) and presented in the RIR. The groundwater COCs and their respective RGs are presented in the table below.

Groundwater COCs	Units	RG
Calculated D/F TEQ	ng/L	0.0002
Benzo(a)pyrene	µg/L	0.005
Dibenz(a,h)anthracene	µg/L	0.005
Indeno(1,2,3-cd)pyrene	µg/L	0.05
PAH TEQ	µg/L	0.005
Sulfate	mg/L	250
TDS	mg/L	500
Total Chromium	µg/L	10
Cobalt	mg/L	0.001
Iron	µg/L	578
Manganese	µg/L	70
Vanadium	mg/L	0.0003

Notes:
L indicates liters
mg indicated milligrams
µg indicates micrograms
ng indicates nanograms
D/F TEQ indicates dioxinuran total equivalents
TDS indicates total dissoved solids
PAH indicates polyaromaic hydrocarbons

Note, RGs were established for the dioxins/furans Toxic Equivalent Quantity and select PAHs due to a few, isolated exceedances of these constituents during the RI. Geosyntec collected groundwater samples again in May 2016 after recording the inconsistent exceedances of PAHs and dioxins/furans. Those results are presented with the groundwater results from the Remedial Investigation in **Table 4**. The May 2016 results reinforce the signature or fingerprint trends identified early in the remedial investigation, including a lack of PAHs and dioxins /furans, which are amongst the most problematic CCB-attributed parameters from a toxicity/risk perspective.

Figure 3 summarizes the groundwater exceedances. 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. At MW-4, the typical CCB groundwater signature does not appear to be present, however, chromium is elevated. The signature or fingerprinted groundwater plume appears to be lacking at MW-5 as well.

3.2 Remedial Action Objectives for Groundwater

Remedial action objectives for the groundwater site wide include:

- Prevent human exposure to groundwater containing COCs at concentrations above acceptable risk levels (carcinogenic and non-carcinogenic);
- Prevent exposure to human and ecological receptors in the creek or stream to groundwater COCs at concentrations more than acceptable risk levels (carcinogenic and non-carcinogenic); and
- Restore groundwater concentrations of COCs to acceptable risk levels (carcinogenic and non-carcinogenic).

3.3 Response Actions for Groundwater

A focused list of response actions considered for groundwater included:

- Source Area Cap;
- Permeable Reactive Barrier (PRB);
- Groundwater Extraction and Treatment;
- Monitored Natural Attenuation (MNA); and
- Risk-Based Remediation.

This list of response actions is expanded in **Table 5** to include applicable technologies, and screens each for potential effectiveness and implementability. This initial list was based on the Electric Power Research Institute's technical report on groundwater remediation of inorganic constituents at coal combustion product management sites (EPRI, 2006) and the REC Program's Implementation Guidance (NCDEQ, 2015). Geosyntec considered the nature of the COCs, COC concentrations and site characteristics in developing this focused list.

Source area capping was removed from further consideration because a residual to significant amount of CCBs remains below the static water table. Additional capping of vegetated or soil exposed areas inside the facility's fence line would not affect leachate generation and therefore would be minimally effective. All other response actions were retained.

3.4 Remedial Alternatives for Groundwater

The response actions that passed the initial screening step were developed into comprehensive remedial alternatives. A list of the remedial alternatives considered includes the following:

1. Site wide MNA;
2. Site wide Risk-Based Remediation;
3. MNA of groundwater within Facility's fence line and a PRB to mitigate offsite migration;

4. Risk-Based Remediation of groundwater within Facility's fence line and a PRB to mitigate offsite migration; and
5. Groundwater Extraction and Treatment.

These alternatives were evaluated against the same criteria as the soil remedial alternatives discussed in Section 2. **Table 6** presents this evaluation for groundwater. As before, criteria "a." and "b." were considered required or threshold factors with the remaining criteria considered as balancing or modifying factors. Each remedial alternative was then "scored" qualitatively based on professional judgement against the others. Higher "scores" are credited to alternatives that are deemed to better satisfy the requirements of the criteria.

The evaluation of the alternatives versus the threshold criteria presumes that the PRB alternatives, as well as the groundwater extraction and treatment remedy, are more protective of human health and the environment versus the MNA and risk-based remediation alternatives. This presumption is largely dependent on the adequacy of the current plume characterization and delineation, efficacy of engineering the PRB or extraction and treatment system, and efficacy of construction and implementation of the remedy. Conversely, MNA is considered the most compliant with applicable regulations (assuming the remedial design investigation would confirm the plume is stable), whereas the PRBs, pump and treat, and risk-based remediation approaches would require extensive permitting and approvals.

The criteria for long-term effectiveness and permanence, as well as for reduction of toxicity, mobility, and volume, marginally favor the PRBs and pump and treat alternatives, as they will reduce some COC mass and mitigate offsite migration; the preference is considered marginal because the migrating impacts are quite minimal. Short-term effectiveness strongly favors risk-based remediation and MNA, since the more intrusive remedies (i.e. the PRBs) would pose construction hazards during implementation.

Technical and logistical feasibility strongly favors MNA over the other alternatives, assuming the plume is stable. The presumed CCB signature of constituents (e.g. sulfate, TDS, cobalt, and manganese) in Site groundwater are in combination not generally well-suited to treatment by active remedial measures such as PRBs or pump and treat. Moreover, besides dubious efficacy in meeting the RGs, PRBs and/or a pump and treat system would require several permits and permissions, and would also pose implementation challenges installing the system between the facility assets and the right-of-way. Because of the dearth of efficacious active remedies that could be brought to bear for the Site's CCB signature of constituents in groundwater, MNA remains the clear preferred alternative as long as the plume remains stable. The cost criterion strongly favors MNA for similar reasons; design, construction, and long-term operation of the PRBs or pump and treat system is anticipated to cost at least twice that of MNA or risk-based approach. Community acceptance is expected to slightly favor the migration mitigation remedies (PRBs or pump-and-treat) over the MNA or risk-based approach.

Overall, considering the balancing or modifying factors results in a relative parity of remedial alternatives between MNA, risk-based remediation, and pump-and-treat alternatives. Both the PRB technology and pump and treat may have significant limitations insofar as their applicability to the Site groundwater signature constituents. The PRBs are the only alternatives eliminated in the evaluation, primarily because they achieve a similar result to the pump and treat system (i.e., mitigation of offsite migration) but at a higher cost and more technically difficult implementation. Therefore, as long as the plume remains stable with respect to the presence of the presumed CCB-related constituents, MNA remains the better remedial for the Site. While the balancing and modifying factors, establishment of quantitative RGs, and NCDEQ remediation guidance are all critical elements to the development of appropriate and protective remedial strategies, the professional judgement of the Registered Site Environmental Manager is also an essential component of the process.

3.5 Proposed Remedial Action for Groundwater

Geosyntec recommends selecting MNA followed by a risk-based approach for impacted groundwater at the site as long as periodic monitoring data continue to demonstrate plume stability. A more detailed evaluation of the MNA processes would enhance the understanding of when closure could be achieved.

4. REFERENCES

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Tables

Table 1
Response Actions for Soil
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Response Actons	Technology	Options	Description	Comments	Retained for Further Evaluation?
Low-Permeab Cap and Cl Cover	Concrete or Asphat	Concrete or Asphal	Containment strategy that leaves impacted materal n place under an impermeable cap, thereby minimizing exposure to impacted soil and preventing or minimizing vertical infiltration of water into underlying soil.	Requires NCDEQ Concurrence. Requires a DPLUR and Notice. Does reduce the toxicity, mobility or volume of impacted soil, but it does prevent migration of impacted soil. Could be designed and implemented relatively quickly. Would require some long-term preventative maintenance to ensure effectiveness over time.	Yes
	RCRA Subtitle C	RCRA Subtitle C			
	RCRA Subtitle D	Water Harvesting			
		Vegetative Cover or Evapotransperative C			
Excavation withff Site Disposa	Excavation with Offite Disposal	Excavation with Off S Disposal	Contaminated soil is excavated and removed to a permitted off site treatment or disposal facility.	Ensures effectiveness by complete removal of impacted material and proper treatment/disposal offsite. Confirmation sampling around excavation areas confirms delineation of treatment zone. Implementaton can be a challenge particularly at active sites.	Yes
In Situ Solidificatio / Stablization	Auger/Cassion	Auger/Cassion	Traps or immobilizes COCs in place by mixing sil with reagents like Portland cement.	The target COC group is generally inorganics. May have limited effectiveness against SVOCs. May require NCDEQ Concurrence, an if approved/selected, a DPLUR and Notice.	Yes
	Injector Head Syst	Injector Head Syst			
	Vitrification	Vitrification	Uses an electric current to melt the impacted soil thereby immobiizing most inorganics and destroying organics.	an destroy or remove organics and immobilize inorganics. May require NCDEQ Concurrence, and if approved/selected, a DPLUR and Notice.	
Risk Based Remediatio	Risk Based Remediaton	Alternate Remedial Gos with Land Use Restricns	Considered a containment remedy.	Requires NCDEQ Concurrence. Requires a DPLUR and Notice.	es

Notes:
RCRA indicated Resource Conversation and Recovery Act
NCDEQ indicates North Carolina Department of Environmental Quality
DPLUR indicates Declaration of Perpetual Land Use Restrictions
COC indicates contaminant of concern
SVOC indicates semi-volatile organic compound

Table 2
Remedial Alternatives Evaluation for Soil
(Within Facility)
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Stuy Criteria	**Alternate Remedial Goals with Land Use Restrictions**	**Scre**	**Cap with Alternate Remedial Goals / Land Use Restrictions**	**Sore**	**Select in situ Solidification / Stabilization with Alternate Remedial Goals / Land Use Restrictions**	**Sore**	**Select Excavation / Disposal with Alternate Remedial Goals / Land Use Restrictions**	**Score**
1. Protection of hman health and t environmen including attainent of cleanup gols.	REC Program Guidance (appendix F.2) allows for se of standard industrial / commercial cleanup levels o calculated, site-specific cleanup levels developed b following USEPA risk assessment procedures. Protection of Groundwater goals must be met. Remedial Action would be required to address soil exceeding any revised, alternate remedial goals.		An engineered cap would minimize human exposureo and migration of impacted soil, protecting both huma health and the environment. Land use restrictions with revised, alternate remedial goals are required for any containment remedy.		Solidification / Stabilization would minimize the migration of sil COCs protecting primarily the environment. CCBs present undr existing buildings, utilities and other site improvements will preent treatment of all CCB impacted soil. Remedies where contaminants will remain above unrestricted ue levels require land use restrictions.	6	Excavation with disposal of impacted soils followed by backfilling with confirmed clean fill is considered protective of human health and the environment. CCBs present under existing buildings, utilities and other site improvements will prevent treatment of all CCB impacted soil. Remedies where contaminants will remain above unrestricted use levels require land use restrictions.	6
2. Complianceith applicable regulans.	Requires NCDEQ concurrence. Requires a DPL and Notice.		Requires NCDEQ concurrence. Requires a DPLUR and Notice.	5	Because not all of the CCB impacted soils can be treated with in situ methods due to conflicts with buildings and other site improvements, land use restrictions are anticipated. Would require NCDEQ concurrence, a DPLUR and a Notice.		Because not all of the CCB impacted soils can be excavated / disposed of due to conflicts with buildings and other site improvements, land use restrictions are anticipated. Would require NCDEQ concurrence, a DPLUR and a Notice.	5
3. Long-term effectiveness ad permanenc	Land use is expected to remain industrial / commeial in nature for the foreseeable future. Land use restrictions are expected to be moderately to highly effective and permanent.	5	Long term effectiveness and permanence of the cap is dependent on proper inspection and maintenance of t cap. Land use is expected to remain as is for the foreseeab future. Overall, the remedy is expected to be moderaly to highly effective and permanent.	6	A treatability study would be required to select the proper reace media and dose. Processing of impacted soil below the water tale may require dewatering. Long term effectiveness and permanene is a function of these parameters and more as well as proper implementation of the remedial design. Land use is expected to remain as is for the foreseeable future. Overall, the remedy is expected to be moderately effective and permanent.		Excavation is one of the most effective means to achieving long-term effectiveness and permanence because impacted soils are removed from the site and transported to a permitted facility. Land use is expected to remain as is for the foreseeable future. Overall, the remedy is expected to be moderately effective and permanent.	6
4. Short-term effectivenes.	Leaving impacted material in place at the active facility would pose a risk to Facility workers, visito, construction workers and the environment, which would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protectiv equipment worn while in the presence of impacted soil. Treatment / management of any waste generad at the site (e.g., routine construction) would be in accordance with applicable rules / regulations.		Risk during implementation to Facility workers, visrs, construction workers and the environment would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protective equipmnt worn during construction. Treatment / management o any waste generated would be in accordance with applicable rules / regulations.	5	Risk during implementation to Facility workers, visitors, construction workers and the environment would be controlled and managed by implementing best management practices, appropte health and safety measures and appropriate personal protective equipment worn during construction. Treatment / management o any waste generated would be in accordance with applicable rus / regulations.		Risk during implementation to Facility workers, visitors, construction workers and the environment would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protective equipment worn during construction. Treatment / management of any waste generated would be in accordance with applicable rules / regulations.	4

Table 2
Remedial Alternatives Evaluation for Soil
(Within Facility)
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Stuy Criteria	Alternate Remedial Goals with Land Use Restrictions	Scre	Cap with Alternate Remedial Goals / Land Use Restrictions	Sore	Select in situ Solidification / Stabilization with Alternate Remedial Goals / Land Use Restrictions	Sore	Select Excavation / Disposal with Alternate Remedial Goals / Land Use Restrictions	Score
5. Reducti toxicity, moblity and volum.	REC Program Guidance (appendix F.2) alls for use of standard industrial / commercial cleanup levels or calculated, site specific cleanup levels developed by following USPA risk assessment procedures. Remedial Actin would be required to address soil exceedingny revised, alternate remedial goals, if present.	5	Capping is a containment technology. Capping would reduce contaminant migration and limit exposure pathways. Land use restrictions would do the same.		Solidification / Stabilization reduces the mobility of contaminants through physical and chemical means. Solidification / stabilization traps or immobilizes contaminants in the soil at depth. Land use restrictions would reduce contaminant migrati and limit exposure pathways.		Excavation / disposal reduces the volume of waste on site by removing it and disposing of it in a presumably safer site / location. Pretreatment of the waste prior to transportation and disposal is not anticipated. Land use restrictions would further reduce contaminant migration of impacted soil left in place (due to conflicts with buildings or other site improvements) and limit exposure pathways.	6
6. Technicald logistical feasiility (implementabiity).	Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipmentd workers for monitoring are available.		Capping is a well-proven and readily implementable technology that is commonly usd for remediation. Design services, capping materials and construction contractors able to construct the cap are readily available. Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipment and workers for monitoring are available.	5	Solidification / stabilization processes are well demonstrated, can be applied to most common sites and waste types, require conventional materials handling and are available competitively from a number of vendors. The presence of buildings, utilities and other site improvements will prevent treatment of all CCB impactd soil. Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipment and workers for monitori are available.		Excavation / disposal is well proven and readily implementable. Excavation is one of the most common methods for cleaning up waste sites. Buildings and other site improvements will prevent some impacted soil from being excavated / disposed of. Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipment and workers for monitoring are available.	5
7. Cost.	Capital costs are low. Capital costs include obtaining consent from NCDEQ, the remedil action plan process, developing alternate remedial goals via USEPA Risk Assessmen protocol and developing land use restrictions and notices and attaching them to the deed. O&M costs are low. O&M costs include f, maintenance of any engineered controls, a annual inspection of any engineered control.	8	Capital costs are medium to high. Capital cost include obtaining consent from NCDEQ, the remedial action plan process, developing alterne remedial goals and land use restrictions /notices Capital costs also include design and constructon of the cap. O&M costs are low to medium. O&M costs include fees, maintenance of any engineered controls, and annual inspection of a engineered controls. O&M costs also include inspection and maintenance of the cap.	4	Capital costs are medium to high. Capital costs include obtaining consent from NCDEQ, the remedial action plan process, developing alternate remedial goals and land us restrictions /notices. Capital costs also include design ad implementation of the solidification / stabilization remed. O&M costs are low to medium. O&M costs include fees, maintenance of any engineered controls, and annual inspection of any engineered controls. O&M costs also include performance monitoring.		Capital costs are medium to high. Capital costs include obtaining consent from NCDEQ, the remedial action plan process, developing alternate remedial goals and land use restrictions /notices. Capital costs also include design and implementation of the excavation and disposal. O&M costs are low to medium. O&M costs include fees, maintenance of any engineered controls, and annual inspection of any engineered controls. O&M costs also include performance monitoring.	3
8. Communiy acceptance.	Acceptance is expected to be medium.		Acceptance is expected to be medium.		Acceptance is expected to be medium.		Acceptance is expected to be medium.	5
Total Scor		46		42		39		40

Notes:

1. The Score is a qualitative assessment of the relative potential to satisfy the criteria.
   Higher scores (1 to 10) indicate the alternative better satisfies the requirements of the criterion.
   Therefore, cost-effective alternatives earn a higher score than more expensive alternatives.
   See Appendix A for a summary table and detailed cost sheets for each alternative.
2. Acronyms used above consist of:

REC indicates registered environmental consultant.
USEPA indicates United States Environmental Protection Agency
NCDEQ indicates North Carolina Department of Environmental Quality
DPLUR indicates Declaration of Perpetual Land Use Restrictions
O&M indicates operation and maintenance
CCB indicates coal combustion byproducts
COC indicates contaminant of concern
NPC indicates net present value

Table 3
Remedial Alternatives Evaluation for Soil
(South of McCauley Street)
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Study Ceria	Alternate Remedial Goals with Land Use Restrictions	core	Excavation / Disposal	core	Select Excavation / Disposal and Solidify / Stabilize with Alternate Remedial Goals and Land Use Restrictions	Score
1. Protection ofan health and the environment, incuding attainment of clenup goals.	REC Program Guidance (appendix F.2) allow for use of standard industrial / commercial cleanup levels or calculated, site specific cleanup level developed by following USEPA risk assessmnt procedures. Protection of Groundwater goals must be met. Remedial Action would be requied to address soil exceeding any revised, alternat remedial goals.	7	Excavation with disposal of impacted soils followed by backfilling with confirmed cleanill is considered protective of human health and t environment. It is expected that both pockets could be removed completely and that clean confirmation samples could be achieved. No Land Use Restrictions are anticipated. Excavation would disturb established, mature vegetation and temporarily destablize the cree banks.		Excavation with disposal / backfilling of one of the CCB pockets is considered protective of human health and the environment. Solidification / stabilization of the second pocket would minimize migration of the CCBs and soils impacted with CCBs. Excavation would disturb established, mature vegetation and temporarily destabilize the creek banks. Remedies where contaminants will remain above unrestricted use levels require land use restrictions.	7
2. Compliance wth applicable regultions.	Requires NCDEQ concurrence. Requires a DPLUR and Notice.		Would require permitting for wetlands or watr of the US, stream buffers and the Jordan Lake res. USACE, State, County and Town permitting i anticipated.	6	Would require permitting for wetlands or water of the US, stream buffers and the Jordan Lake rules. USACE, State, County and Town permitting is anticipated. Would require NCDEQ concurrence, a DPLUR and a Notice.	6
3. Long-term effectiveness an permanence.	The lot is expected to remain in UNC-CH possession for the foreseeable future. Land us restrictions are expected to be moderately to highly effective and permanent.		Excavation with disposal and backfilling is expected to be permanent and effective over te long term. It is expected that both pockets cd be removed completely and no land use restrictions are anticipated.		A treatability study would be required to select the proper reactive media and dose. Processing of impacted soil below the water table may require dewatering. Long term effectiveness and permanence is a function of these parameters and more as well as proper implementation of the remedial design. Land use is expected to remain as is for the foreseeable future. Overall, the remedy is expected to be moderately effective and permanent.	8
4. Short-term effectiveness.	Leaving impacted material in place would pos a risk to UNC-CH employees and contractors, which would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protective equipment. Engineering controls could be constructed to manage risk for trespassers.		Risk during construction to UNC-CH employes, construction workers and the environment wd be controlled and managed by implementing bet management practices, appropriate health a safety measures and appropriate personal protective equipment worn during constructi Treatment / management of any waste generaed would be in accordance with applicable rules regulations. Engineering controls could be constructed to manage risk for trespassers. Short term disturbance of the soil and establisd vegetation is expected.		Risk during implementation to UNC-CH employees, construction workers and the environment would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protective equipment worn during construction. Treatment / management of any waste generated would be in accordance with applicable rules / regulations. Engineering controls could be constructed to manage risk for trespassers. Short term disturbance of the soiland established vegetation is expected.	6

Table 3
Remedial Alternatives Evaluation for Soil
(South of McCauley Street)
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Study Ceria	Alternate Remedial Goals with Land Use Restrictions	core	Excavation / Disposal	core	Select Excavation / Disposal and Solidify / Stabilize with Alternate Remedial Goals and Land Use Restrictions	Score
5. Reduction of tcity, mobility and vole.	REC Program Guidance (appendix F.2) allow for use of standard industrial / commercial cleanup levels or calculated, site specific cleanup level developed by following USEPA risk assessmnt procedures. Remedial Action would be requird to address soil exceeding any revised, alternat remedial goals.	5	Complete removal of impacted material and proper treatment/disposal offsite. Pretreatmet of the waste prior to transportation and disposals not anticipated. Excavation could mobilize soils currently vegetated and disturb the stable creek bank.		Excavation / disposal reduces the volume of waste on site by removing it and disposing of it in a presumably safer site / location. Pretreatment of the waste prior to transportation and disposal is not anticipated. Solidification / stabilization reduces the mobility of contaminants by trapping or immobilizing them in the soil at depth. Excavation could mobilize soils currently vegetated and disturb the stable creek bank. Land use restrictions would further reduce contaminant migration of impacted soil left in place and limit exposure pathways.	6
6. Technical a logistical feasib (implementability.	Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipment and workers for monitoring are available.		Would require permitting for wetlands or watr of the US, stream buffers and the Jordan Lake res. USACE, State, County and Town permitting i anticipated. Remedial Action contractors capable of excavation and disposal are readily available.	6	Excavation / disposal is well proven and readily implementable. Excavation is one of the most common methods for cleaning up waste sites. Solidification / stabilization processes are also well demonstrated, can be applied to most common sites and waste types, require conventional materials handling and are available competitively from a number of vendors. Requires NCDEQ concurrence. Requires a DPLUR and Notice. Necessary equipment and workers for monitoring are available.	5
7. Cost.	Capital costs are low. Capital costs include obtaining consent from NCDEQ, the remedial action plan process, developing alternate remeal goals via USEPA Risk Assessment protocol a developing land use restrictions and notices a attaching them to the deed. O&M costs are low O&M costs include fees, maintenance of any engineered controls, and annual inspection ofny engineered controls.	8	Capital costs are medium to high. Capital cots include obtaining proper permits / approvals a the remedial action plan process. Capital cos also include design and implementation of the excavation and disposal. O&M costs are lowo medium. O&M costs may include monitorior site restoration and any repair necessary for a period of years.	4	Capital costs are medium to high. Capital costs include obtaining consent from NCDEQ, obtaining proper permits / approvals, the remedial action plan process, developing alternate remedial goals and land use restrictions /notices. Capital costs also include design and implementation of the excavation / disposal and solidification / stabilization. O&M costs are low to medium. O&M costs include fees, maintenance of any engineered controls, and annual inspection of any engineered controls. O&M costs also include performance monitoring.	2
8. Community acceptance.	Acceptance is expected to be high.		Acceptance is expected to be medium.		Acceptance is expected to be medium.	5
Total		49		46		45

Notes:

1. The Score is a qualitative assessment of the relative potential to satisfy the criteria.
Higher scores (1 to 10) indicate the alternative better satisfies the requirements of the criterion.
Therefore, cost-effective alternatives earn a higher score than more expensive alternatives.
See Appendix A for a summary table and detailed cost sheets for each alternative.
2. Acronyms used above consist of:

REC indicates registered environmental consultant.
USEPA indicates United States Environmental Protection Agency
NCDEQ indicates North Carolina Department of Environmental Quality
CCB indicates coal combustion byproducts
COC indicates contaminant of concern
USACE indicates United States Army Corps of Engineers

DPLUR indicates Declaration of Perpetual Land Use Restrictions
O&M indicates operation and maintenance

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

Method Type	Analytenits		2Ls and IMACs	Final Remediation Goals for Groundwater	Location	M1					M2					N 3								
					Sample ate	3/10/	9/9/	4/2015	11/2015	5/5/2016	3/11/	9/9/	4/2015	11/21/2015	5/6/	3/10/2014	3/10/ (D	9/10/	9/10/2014 (Dup)	4/24/2015	4/24/ (D	11/2015	11/21/2015 (D	5/6/
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HpCD)	ng/L	-	-		<0.	0.	<0.	0.	<0.00054U	<0.	0.	0.	<0.	<0.	<0.00038U	<0.	<0.	<0.00045U	<0.00075U	<0.	<0.	<0.	<0.
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HDF)	ng/L	-	-		<0.	0.	<0.	<0.	<0.00015U	0.	0.	0.	0.	<0.	<0.00037U	<0.	<0.J	<0.000094U	<0.00017U	<0.	<0.J	0.	<0.
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HDF)	ng/L	-	-		<0.	0.	<0.	<0.	<0.00021U	<0.	0.	<0.	<0.	<0.	<0.00033U	<0.	<0.	<0.000046U	<0.00021U	<0.	<0.	<0.	<0.
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCD)	ng/L	-	-		0.	<0.	<0.	<0.	<0.	<0.	<0.	0.	<0.	<0.	<0.000087U	<0.	<0.	<0.000086U	<0.00011U	<0.	<0.	<0.	<0.
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCF)	ng/L	-	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.00022U	<0.	0.	<0.000086U	<0.00006U	<0.	<0.	<0.	<0.
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCD)	ng/L	-	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	0.	<0.	<0.	<0.000095U	<0.	<0.	<0.000087U	0.	<0.J	<0.	<0.	<0.
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCF)	ng/L	-	-		<0.	<0.	0.	<0.	<0.	<0.	<0.	0.	0.	<0.	<0.00022U	<0.	<0.	<0.000082U	<0.	<0.	<0.	<0.	<0.
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCD)	ng/L	-	-		<0.	0.	<0.	<0.	<0.00006U	0.	<0.	<0.	<0.	<0.	<0.00042U	<0.	<0.	<0.00033U	<0.	<0.	<0.	<0.	<0.
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCF)	ng/L	-	-		<0.	0.	<0.	<0.	<0.	<0.	0.	<0.	<0.	<0.	<0.00019U	<0.	<0.	<0.0001U	<0.	<0.	<0.	<0.	<0.
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	g/L	0.0002	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.000055U	<0.	<0.	<0.000027U	<0.	<0.	<0.	<0.	<0.
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD	ng/L	-	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	0.	<0.	<0.	<0.000041U	<0.	<0.	<0.00004U	0.	<0.	<0.	<0.	<0.
	1,2,3,7,8-Pentachlorodibenzofuran (PeCD)	ng/L	-	-		<0.	<0.	<0.	<0.	0.	0.	<0.	<0.	<0.	<0.	0.00058J	<0.J	<0.J	0.00028J	<0.	<0.	<0.	<0.	<0.
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCF)	ng/L	-	-		<0.	0.	0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.000035U	<0.	<0.	<0.000089U	<0.	0.	<0.	<0.	<0.
	2,3,4,7,8-Pentachlorodibenzofuran (PeCD)	ng/L	-	-		<0.	<0.	<0.	0.	0.	<0.	0.	<0.	<0.	<0.	<0.00034U	<0.	<0.	<0.000077U	<0.	<0.	<0.	<0.	<0.
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	g/L	-	-		0.	<0.	<0.	<0.	0.	<0.	<0.	<0.	<0.	<0.	<0.000038U	<0.	<0.	<0.000062U	<0.	<0.	<0.	<0.	<0.
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (OCD)	ng/L	-	-		<0.	0.	0.	0.	<0.0035U	0.	0.	0.	0.	<0.	<0.00051U	<0.	<0.	<0.0025U	<0.0037U	<0.	<0.	0.	0.
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (ODF)	ng/L	-	-		<0.	0.	0.	<0.	<0.00058U	<0.	0.	0.	0.	<0.	<0.00013U	<0.	<0.	<0.0015U	<0.0081U	<0.	<0.	<0.	<0.
	Calculated Dioxin/Furan TEQ	g/L	0.0002	0.0002		0.	0.	0.	0.	0.	0.	0.	0.	0.	ND	0.0000174	ND	0.	0.0000084	0.	0.	ND	0.	0.
	Calculated Hexachlorodibenzo-p-dioxin,ixture	ng/L	-	-		0.	0.	ND	ND	ND	0.	ND	0.	ND	ND	ND	ND		ND	0.	ND		ND	ND
SVOCs	1-Methylnaphthalene	g/L	1	-		<0.	<0.	<0.	<0.	<0.0055U	<0.	<0.	<0.	<0.	<0.	<0.0055U	<0.	<0.	<0.0054U	<0.0055U	<0.	<0.	<0.	<0.
	2-methylnaphthalene	g/L	30	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.005U	<0.	<0.	<0.0049U	<0.	<0.	<0.	<0.	<0.
	Acenaphthene	g/L	80	-		<0.	<0.	<0.	<01U	<0.01U	<0.	<0.	<0.	<0.	<0.	<0.011U	<0.	<0.	<0.01U	<0.01U	<0.	<0.	<0.	<0.
	Acenaphthylene	g/L	200	-		<0.	<0.	<0.	<0.	<0.0096U	<0.	<0.	<0.	<0.	<0.	<0.0097U	<0.	<0.	<0.0095U	<0.0096U	<0.	<0.	<0.	<0.
	Anthracene	g/L	2	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.000014U	<0.	<0.	<0.000014U	<0.	<0.	<0.	<0.	<0.
	Benz(a)anthracene	g/L	0.05	-		<0.	<0.	<0.	<0.	<0.0031U	<0.	<0.	<0.	<0.	<0.	<0.0031U	<0.	<0.	<0.0031U	<0.0031U	<0.	<0.	<0.	<0.
	Benzo(a) pyrene	g/L	0.005	0.005		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.005U	<0.	<0.	<0.0049U	<0.	<0.	<0.	<0.	<0.
	Benzo(b)fluoranthene	g/L	0.05	-		<0.	<0.	<0.	0.	<0.0033U	<0.	<0.	<0.	<0.	<0.	<0.0033U	<0.	<0.	<0.0033U	<0.0033U	<0.	<0.	<0.	<0.
	Benzo(g,h,i)perylene	g/L	200	-		<0.	<0.	<0.	<0.	<0.0034U	<0.	<0.	<0.	<0.	<0.	<0.0035U	<0.	<0.	<0.0034U	<0.0034U	<0.	<0.	<0.	<0.
	Benzo(k)fluoranthene	g/L	0.5	-		<0.	<0.	<0.	0.	<0.0049U	<0.	<0.	<0.	<0.	<0.	<0.0049U	<0.	<0.	<0.0048U	<0.0049U	<0.	<0.	<0.	<0.
	Chrysene	g/L	5	-		<0.	<0.	<0.	0.	<0.0031U	<0.	<0.	<0.	<0.	<0.	<0.0031U	<0.	<0.	<0.003U	<0.0031U	<0.	<0.	<0.	<0.
	Dibenz(a,h)anthracene	g/L	0.005	0.005		<0.	<0.	<0.	<0.	<0.0047U	<0.	<0.	<0.	<0.	<0.	<0.0047U	<0.	<0.	<0.0046U	<0.0047U	<0.	<0.	<0.	<0.
	Fluoranthene	g/L	300	-		<0.	<0.	<0.	0.	<0.0044U	<0.	<0.	<0.	<0.	<0.	<0.0044U	<0.	<0.	<0.0043U	<0.0044U	<0.	<0.	<0.	<0.
	Fluorene	g/L	300	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.018U	<0.	<0.	<0.018U	<0.	<0.	<0.	<0.	<0.
	Indeno(1,2,3-c,d)pyrene	g/L	0.05	0.05		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.014U	<0.	<0.	<0.014U	<0.	<0.	<0.	<0.	<0.
	Naphthalene	g/L	6	-		<0.	<0.	<0.	<0.	0.	<0.	0.	<0.	<0.	<0.	<0.0052U	<0.	<0.	<0.0051U	<0.0051U	<0.	<0.	<0.	<0.
	Phenanthrene	g/L	200	-		<0.	<0.	<0.	0.	<0.0094U	<0.	<0.	<0.	<0.	<0.	<0.0095U	<0.	<0.	<0.0093U	<0.0094U	<0.	<0.	<0.	<0.
	Pyrene	g/L	200	-		<0.	<0.	<0.	0.	<0.0078U	<0.	<0.	<0.	<0.	<0.	<0.0079U	<0.	<0.	<0.0077U	<0.0078U	<0.	<0.	<0.	<0.
	PAH TEQ	g/L	0.005	0.005		ND	ND		0.	ND	ND	ND		ND	ND	ND	ND		ND	ND	ND		ND	ND
General Chemistry	Bicarbonate as CaCO3	g/L	-	-		76	-	-	-	-	140	-	-	-		55	-	-	-	-	-	-	-	-
	Chloride	g/L	250	-		27	-	-	-	-	19	-	-	11B	-	45	-	-	-	-	-	54B	53B	-
	Sulfate	g/L	250	250		69	77	71B	71B	62B	170	140		90B	85	330	-	290	280	330	350		340B	330B
	Sulphide	g/L	-	-		<0.	-	-	-	-	<0.	-	-	-		<0.79U		-	-	-	-	-	-	-
	TDS	g/L	500	500		260	200		180	150	400	320		250	530	600	-	650	640	670	670		680	630
	TSS	g/L	-	-		6	-	-	-	-	<1U	-	-	-		<1U		-	-	-	-	-	-	-
Metals	Aluminium	g/L	-	-		0.	1	0.	0.75	0.	<0.	<0.	<0.	<0.	<0.	0.	<0.J	<0.	<0.018U	<0.	<0.	<0.	<0.	0.
	Antimony	g/L	0.001	-		<0.	<0.	<0.	<0.	<0.0031U	<0.	<0.	<0.	<0.	<0.	<0.0031U	<0.	<0.	<0.0031U	<0.0031U	<0.	<0.	<0.	<0.
	Arsenic	g/L	10	-		<4U	8.	<4U	<4.4U	<4U	<4U	6.	<4U	5J	<4U	<4U	<4U	<4U	<4U	<4UJ	5.	12J	12J	<4.4
	Barium	g/L	700	-		42	36	37B	38	35	87	53	57B	39J	50	22	21	18	19	19	19		19	20
	Beryllium	g/L	0.004	-		<0.	<0.	<0.	<0.	<0.00047U	<0.	<0.	<0.	<0.	<0.	0.00053J	0.	0.	0.00069J	0.	0.	0.	0.	0.
	Cadmium	g/L	2	-		<0.	<0.	<0.	<45U	<0.45U	<0.	<0.	<0.	<0.	<0.	0.67J	0.	<0.	<0.45U	0.	0.	<0.	<0.	0.
	Calcium	g/L	-	-		24	15	13	10	9	31	24	22	15	17	61	-	65	63	78	77		74	71
	Chromium (III+VI)	g/L	10	10		0.	2.	1.	5.5J	1.	<0.	<0.	<0.	2.	<0.	<0.66U	<0.	<0.	<0.66U	<0.66U	<0.	2.	1.	0.
	Cobalt	g/L	0.001	0.001		<0.	<0.	<0.	<0.	<0.0012U	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	Copper	g/L	1	-		<0.	0.	<0.	<0.	<0.0042U	<0.	0.	<0.	<0.	<0.	0.	<0.J	0.	0.	<0.0014U	<0.	<0.	<0.	<0.
	Iron	g/L	300	578		140	1,	430	540	<	<	340		140	560J	200	67J		450	370	340		330	940J
	Lead	g/L	15	-		<2U	<2U	<2U	<2.6U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2.6	<2.6
	Magnesium	g/L	-	-		5	3	2.8	2.3	2	7	5	5.6	3	3	16	-	19	18	20	20		20	
	Manganese	g/L	50	70		190	50	22	17	<	6,	5700	6,	3,	4400B	8,500	8,	7,	7,600	8,	8,	7,	7,	7,
	Mercury	g/L	1	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.		<0.027U	<0.	<0.	<0.027U	<0.	<0.	<0.	<0.	<0.
	Nickel	g/L	100	-		<1U	<1U	2.	<1.3U	<1U	5.	4.	5.9J	2.	3.	31J	32J		27J	26J	25J		25J	22J
	Potassium	g/L	-	-		3	2.	2.	2.8J	<3U	3	3	3.6	2.	3.	9	-	8.5	8	8	8	9.5	10	8.
	Selenium	g/L	20	-		<4U	<4U	5.	13J	5.	<4U	<4U	<4U	<4U	<4U	<4U	<4U	<4U	<4U	<4U	<4U	16J	14J	<4.9
	Silver	g/L	20	-		<0.	<0.	<0.	<93U	<0.93U	1.	2.	<0.	<0.	<0.	<0.93U	<0.	2.	1.	2.	2.	<0.	<0.	<0.
	Sodium	g/L	-	-		57	42	41	40B	34B	99J	69	75	62B	66B	100	-	99	97	110	100		97B	88B
	Thallium	g/L	0.0002	-		<0.	<0.	<0.	0.	<0.0049U	<0.	<0.	<0.	0.	<0.	<0.0049U	<0.	<0.	<0.0049U	<0.0049U	<0.	0.	0.	<0.
	Vanadium	g/L	0.0003	0.0003		<0.0011U	0.003J	<0.0011U	0.0023J	<0.0011U	<0.0011U	<0.0011U	<0.0011U	0.0017J	<0.0011U	<0.0011U	<0.0011U	0.0011J	0.0014J	<0.0011U	<0.0011U	<0.0011UJ	0.0014J	0.0029J
	Zinc	g/L	1	-		0.02U	0.013J	0.0082J	0.011J	0.009J	<0.02U	0.0062J	0.093	0.005J	0.0096J	0.052	0.052	0.038	0.037	0.038	0.035	0.088J	0.22J	0.078

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.

. B is a laboratory flag indicating compound was detected in both the method blank and sample
. Groundwater remediation goals reference NCDENRs 2L and IMAC standards from April 1, 2013.
0. TDS indicates total dissolved solids.
1. TSS indicates total suspended solids.
2. PAH indicates polyaromatic hydrocarbon.
3. ND indicates all of the input parameters in the calculated parameter equation were non-detect.
14. Highlighted concentrations are exceedences of screening criteria.

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

Method Type	Analytenits		2Ls and IMACs	Finl Remediation Goals for Groundwater	Location	PZ/ W-4				MW-5				
					Sample ate	9/2014	4/21/2015	11/19/2015	5/6/	9/2014	4/2015	11/19/2015	5/5/	5/5/2016 (Dup)
Dioxins and Furans	1,2,3,4,6,7,8-Heptachlorooxanthrene (HDD)	ng/L	-	-		<0.	0.	<0.00017U	<0.	<0.	0.	<0.00013U	<0.	<0.00033U
	1,2,3,4,6,7,8-Heptachlorodibenzofuran (pCDF)	ng/L	-	-		<0.	0.	<0.00005U	<0.	<0.	0.	<0.00022U	<0.	<0.000064U
	1,2,3,4,7,8,9-Heptachlorodibenzofuran (pCDF)	ng/L	-	-		<0.	<0.00016U	<0.00069U	<0.	<0.	<0.	<0.	<0.	<0.000099U
	1,2,3,4,7,8-Hexachlorooxanthrene (HxCD)	ng/L	-	-		<0.	<0.00013U	<0.00011U	<0.	<0.	<0.	<0.00012U	<0.	<0.00017U
	1,2,3,4,7,8-Hexachlorodibenzofuran (HxDF)	ng/L	-	-		<0.	<0.00007U	<0.00011U	<0.	<0.	0.	<0.	<0.	<0.0002U
	1,2,3,6,7,8-Hexachlorooxanthrene (HxCD)	ng/L	-	-		<0.	0.	<0.00011U	<0.	<0.	<0.	<0.00013U	<0.	<0.00015U
	1,2,3,6,7,8-Hexachlorodibenzofuran (HxDF)	ng/L	-	-		<0.	<0.	<0.0001U	<0.	<0.	<0.	<0.	<0.	<0.0002U
	1,2,3,7,8,9-Hexachlorooxanthrene (HxCD)	ng/L	-	-		<0.	<0.00012U	<0.00041U	<0.	<0.	<0.	<0.00012U	<0.	<0.00015U
	1,2,3,7,8,9-Hexachlorodibenzofuran (HxDF)	ng/L	-	-		<0.	<0.	<0.00013U	<0.	<0.	0.	<0.	<0.	<0.00029U
	2,3,7,8-Tetrachlorooxanthrene (TCDD)	g/L	0.0002	-		<0.	<0.	<0.00012U	<0.	<0.	<0.	<0.00014U	<0.	<0.00017U
	1,2,3,7,8-Pentachlorooxanthrene (PeCDD	ng/L	-	-		<0.	<0.00028U	<0.0001U	<0.	<0.	<0.	<0.	<0.	<0.0001U
	1,2,3,7,8-Pentachlorodibenzofuran (PeCF)	ng/L	-	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.00015U
	2,3,4,6,7,8-Hexachlorodibenzofuran (HxDF)	ng/L	-	-		<0.	0.	<0.00011U	<0.	<0.	0.	<0.	<0.	<0.00021U
	2,3,4,7,8-Pentachlorodibenzofuran (PeCF)	ng/L	-	-		<0.	<0.00005U	<0.00008U	<0.	<0.	<0.	<0.	<0.	<0.00014U
	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	g/L	-	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.00011U	<0.	<0.00022U
	1,2,3,4,6,7,8,9-Octachlorooxanthrene (ODD)	ng/L	-	-		<0.	<0.	<0.0021U	0.	<0.	<0.	<0.	<0.	<0.00093U
	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (CDF)	ng/L	-	-		<0.	<0.	<0.00036U	<0.	<0.	<0.	<0.00085U	<0.	<0.0011U
	Calculated Dioxin/Furan TEQ	g/L	0.0002	0.0002		ND	0.	ND	0.	0.	0.	ND	ND	
	Calculated Hexachlorodibenzo-p-dioxin,ixture	ng/L	-	-		ND	0.	ND		0.	ND	ND	ND	
SVOCs	1-Methylnaphthalene	g/L	1	-		<0.	<0.	<0.0054U	<0.	<0.	<0.	<0.	<0.	<0.0055U
	2-methylnaphthalene	g/L	30	-		<0.	<0.	<0.0049U	<0.	<0.	<0.	<0.	<0.	<0.005U
	Acenaphthene	g/L	80	-		<0.	<0.	<0.01U	<0.	<0.	<0.	<0.01U	<0.	<0.01U
	Acenaphthylene	g/L	200	-		<0.	<0.	<0.0096U	<0.	<0.	<0.	<0.	<0.	<0.0096U
	Anthracene	g/L	2	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.000014U
	Benz(a)anthracene	g/L	0.05	-		<0.	<0.	<0.0031U	<0.	<0.	<0.	0.	<0.	<0.0031U
	Benzo(a) pyrene	g/L	0.005	0.005		<0.	<0.	<0.0049U	<0.	<0.	<0.	0.	<0.	<0.005U
	Benzo(b)fluoranthene	g/L	0.05	-		<0.	<0.	<0.0033U	<0.	<0.	<0.	0.	<0.	<0.0033U
	Benzo(g,h,i)perylene	g/L	200	-		<0.	<0.	<0.0034U	<0.	<0.	<0.	0.	<0.	<0.0034U
	Benzo(k)fluoranthene	g/L	0.5	-		<0.	<0.	<0.0048U	<0.	<0.	<0.	0.	<0.	<0.0049U
	Chrysene	g/L	5	-		<0.	<0.	<0.0031U	<0.	<0.	<0.	0.	<0.	<0.0031U
	Dibenz(a,h)anthracene	g/L	0.005	0.005		<0.	<0.	<0.0046U	<0.	<0.	<0.	0.	<0.	<0.0047U
	Fluoranthene	g/L	300	-		<0.	<0.	<0.0043U	<0.	<0.	<0.	<0.	<0.	<0.0044U
	Fluorene	g/L	300	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.018U
	Indeno(1,2,3-c,d)pyrene	µg/L	0.05	0.05		<0.	<0.	<0.	<0.	<0.	<0.	0.	<0.	<0.014U
	Naphthalene	g/L	6	-		<0.	<0.	<0.0051U	<0.	<0.	<0.	<0.	<0.	<0.0052U
	Phenanthrene	g/L	200	-		<0.	<0.	<0.0094U	<0.	<0.	<0.	<0.	<0.	<0.0094U
	Pyrene	g/L	200	-		<0.	<0.	<0.0078U	<0.	<0.	<0.	0.	<0.	<0.0078U
	PAH TEQ	g/L	0.005	0.005		ND	ND	ND		ND	ND	0.	ND	
General Chemistry	Bicarbonate as CaCO3	g/L	-	-		-	-	-		-	-	-		-
	Chloride	g/L	250	-		-	-	-		-	-	-		-
	Sulfate	g/L	250	250		53	62B	73B		170	200B	200J	210B	210B
	Sulphide	g/L	-	-		-	-	-		-	-	-		-
	TDS	g/L	500	500		140	140	170		420	390	410	420	
	TSS	g/L	-	-		-	-	-		-	-	-		-
Metals	Aluminium	g/L	-	-		0.	0.	0.	0.	<0.	0.	0.	<0.	<0.018U
	Antimony	g/L	0.001	-		<0.	<0.	<0.0031U	<0.	<0.	<0.	<0.	<0.	<0.0031U
	Arsenic	g/L	10	-		<4U	<4U	7.	<4U	<4U	<4U	5.	5.	<4.4UJ
	Barium	g/L	700	-		34	32B	41		18	23B	21	21	
	Beryllium	g/L	0.004	-		<0.	<0.00047U	<0.00047U	<0.	<0.	<0.	<0.00047U	<0.	<0.00047U
	Cadmium	g/L	2	-		<0.	<45U	<0.45U	<0.	<0.	<0.	<0.45U	<0.	<0.45U
	Calcium	g/L	-	-		14	15	20		42	37	40	42	
	Chromium (III+VI)	g/L	10	10		19	26	29		<0.	0.	4.	0.	0.73J
	Cobalt	g/L	0.001	0.001		<0.	<0.	<0.0012U	<0.	0.	0.	0.	0.	0.0016J
	Copper	g/L	1	-		0.	<0.	<0.0014U	<0.	0.	<0.	<0.	<0.	<0.0042U
	Iron	g/L	300	578		<	35J	70J		<	36J	67J	<	<100U
	Lead	g/L	15	-		<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2U	<2.6U
	Magnesium	g/L	-	-		4.1	4.5	5	2	14	13	13	13	
	Manganese	g/L	50	70		7.7J	4.3J	4U		28	38	22B	17B	
	Mercury	g/L	1	-		<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.	<0.0027U
	Nickel	g/L	100	-		1.8J	2.3J	<1U	<1U	5.	7.6J	3.	5.	5.4J
	Potassium	g/L	-	-		3.6	3.8	3	3.	2.	2.7J	2.	3B	
	Selenium	g/L	20	-		<4U	5J	<4U	<4U	<4U	<4U	11J	<4U	<4.9U
	Silver	g/L	20	-		<0.	<93U	<0.93U	<0.	<0.	<0.	<0.93U	<0.	<0.93U
	Sodium	g/L	-	-		15	15	14B		61	61	63B	63B	
	Thallium	g/L	0.0002	-		<0.	<0.	0.	<0.	<0.	<0.	0.	0.	<0.0049UJ
	Vanadium	g/L	0.0003	0.0003		<0.0011U	<0.0011U	<0.0011U	0.0012J	<0.0011U	<0.0011U	<0.0011U	<0.0011U	<0.0011U
	Zinc	g/L	1	-		0.0088J	0.0076J	0.0075J	0.0077J	<0.0045U	0.0046J	<0.0045U	<0.0045U	<0.0045U

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.

Table 5
Response Actions for Groundwater
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Response Actons	Technology	Options	Description	Comments	Retained for Further Evaluation?
Source Area C	Barrier Caps	Low Permeability Material	To prevent or reduce infiltration of water into source area, thereby limiting the amount eaching of contaminated unsaturated soil into groundwater.	Not effective when CCBs are largely below the water able, as groundwater will still generate leachate.	No
	Evapotranspirative Cap	Soil & Vegetation Sequencing			
Permeable Reactivarrier	Permeable Reactive Barrier	Continuous	In Situ remedy that installs a passive barrier trench, either with conventional excavatio equipment (e.g., backhoes) or with more advanced technologies (e.g., one pass trenching). Selection of the trenching technology is usually determined based on depth, cost, and access considerations. There are numerous reactive media options, including mulch and propietary blends of zero-valent iron.	Project specific COCs are able to be remediated using RB technology. A passive remedy at the downgradient facility property boundary could be effective at mitigating offiste migration of impacted groundwater.	Yes
		Funnel and Gate			
		n Situ Reactive Vessels			
Groundwater Extration and Treatmen	Groundwater Extraction and Treatment	Filtration	Pumping groundwater to capture plume mass and/or exert hydraulic containment of a igrating plume. Treatment of extracted groundwater varies considerably, with consideration not only of the COCs, but also potential complications from naturally occurring sources of metals that can cause scaling and biofouling of equipment. Discharge of treated water to either surface water or subsurface infiltration (via permit) or sewer (usually with fees).	The facility currently discharges wastewater to the Orane County POTW. Treated groundwater could be ncorporated into this ongoing disposal, and the quantity of groundwater is not expected to be significant. Operation and maintenance of a pump and treat system can be onerous as compared to other in situ remedies, but would effectively meet the groundwater remedial action objectives.	Yes
		Reverse Osmosis			
		Chemical Precipitation of Metals			
		dsorption (granular activated carbon)			
Monitored Natural Anuation	Monitored Natural Attenuation	Monitored Natural Attenuation	Monitoring of biotic and abiotic degradation / transformation of COCs.	MNA can be a viable approach if the plume is stable or shrinking, geochemical evidence of attenuation is documented, there is no exposure to contaminated groundwater, and the source of contaminants is identifid and addressed. MNA may be appropriate when it can achieve the objectives in a reasonable timeframe.	es
Risk Based Remiation	Risk Based Remediation	Alternate Remedial Goals with Land Ue Restrictions	Considered a containment remedy.	Requires NCDEQ Concurrence. Requires consent from Town of Chapel Hill for impacts to McCauley Street. Requires a Notice of Intent to Remediate. Requires a PLUR and Notice.	Yes

Table 6
Remedial Alternatives Evaluation for Groundwater
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Study Creria	Sitewide Monitored Natural Attenuation	Sore	Sitewide Risk Based Remediation	Sore	MNA for Facility Parcel with Permeable Reactve Barrier Downgradient	core	Risk Based Remediation for Facility Parcel with Permeble Reactive Barrier Downgradient	core	Facility Parcel Pump and Treat Groundwater System	Score
1. Protection of humaalth and the environment, including attainment cleanup goals.	COC concentration trends over time suggest the plume is stable. Confirmation of MNA processs will be required. Sediment and surface water ihe drainage feature was assessed as part of the remdial investigation. Risk to human health and ecologcal receptors was assessed. NCDEQ concluded th risk to humans and ecological receptors from site CCs in the sediment and surface water was low and acceptable. Currently no shallow groundwater use, therefor no vector for impact.		A tiered approach is used to determine risk to huma health from exposure to groundwater. Remedial gls for COCs may be further revised based on site specfic conditions and exposure scenarios. Remedial Acti would be required to address groundwater exceedi the revised remedial goals. Sediment and surface wter in the drainage feature was assessed as part of the remedial investigation. Risk to human health and ecological receptors was assessed. NCDEQ conclued the risk to humans and ecological receptors from t sediment and surface water was low and acceptable Currently no shallow groundwater use, therefore no vector for impact.	5	Confirmation of MNA processes will be required. Permeable reactive barriers may protect downgradient of source areas. Must be engineere with appropriate reactive media to provide effectie residence time. Must be engineered / located to capture the plume. Numerous reactive media maye used. Can use a mixed media approach. Would rere Treatability testing.	6	For risk based remediation, a tiered approach is used to determine risk to human health from exposure to groundwter. Remedial goals for COCs may be further revised based onite specific conditions and exposure scenarios. Remedial acton would be required to address groundwater exceeding the revised remedial goals. Permeable reactive barriers may protect downgradient of source areas. Must be engineered with appropriate reactiv media to provide effective residence time. Must be enginer ed / located to capture the plume. Numerous reactive mediaay be used. Can use a mixed media approach. Would require Treatability testing.	6	A remedial design investigation is required to determine the effectiveness of meeting remedial goals within a reasonable timeframe. COC concentration trends over time suggest the plume is stable. Nonetheless, a groundwater pump and treat system will provide further control of the Site groundwater hydrology and plume stability, and provide ex-situ treatment of the groundwater. Pump and treat is a conventional, established technology for achieving hydraulic containment of a plume. Would likely require an aquifer pump test to demonstrate effective capture. Extracted groundwater would be treated and then discharged to a stream or POTW.	7
2. Compliance with applicable regulations	No permitting required. No compliance conflics are anticipated.		Requires NCDEQ concurrence. Requires consent fom Town of Chapel Hill for impacts to McCauley Stree. Requires a Notice of Intent to Remediate. Requires DPLUR and Notice. No compliance conflicts are anticipated.		For monitored natural attenuation, no permitting i required. For permeable reactive barrier, need to evaluate permitting needs for wetlands or water of the US, stream buffers and the Jordan Lake rules. USACE State, County and Town permitting may be requird.	6	For risk based remediation, requires NCDEQ concurrence Requires consent from Town of Chapel Hill for impacts to McCauley Street. Requires a Notice of Intent to Remediat. Requires a DPLUR and Notice. No compliance conflicts ae anticipated. For permeable reactive barrier, need to evaluate permittin needs for wetlands or water of the US , stream buffers ahe Jordan Lake rules. USACE, State, County and Town permitting may be required.		Requires a Notice of Intent to Remediate to NCDEQ. Requires a DPLUR and Notice. No compliance conflicts are anticipated. For a pump and treat system, town and/or county permitting will be required for the treatment building installation, and connection to the OWASA sanitary sewer. The Co-Generation facility may require special approvals for performing construction activities on the facility.	5
3. Long-term effectivness and permanence.	If MNA processes are confirmed, long term effectiveness and performance is expected to b moderate to high. Long term monitoring is anticipated.		If risk based remediation is approved and implemeed, revised remedial goals would be permanent and effective long term. Groundwater on site exceedinghe revised remedial goals would require supplemental remedial action.	6	If MNA processes are confirmed, long term effectiveness and performance is expected to be moderate to high. Long term monitoring is anticipated. May require replenishment of reactive media.		For risk based remediation, revised remedial goals woul permanent and effective long term. Groundwater on site exceeding the revised remedial goals would require supplemental remedial action. May require replenishment of reactive media.		Pump and Treatment is expected to be a plume containment remedy. Long-term effectiveness and performance at containing the plume is expected to be high. Long term monitoring is anticipated. Will require routine maintenance of the system, including, among others, pump and filter maintenance.	8
4. Short-term effectivness.	Risk during implementation to site workers, the general public and the environment would be controlled and managed by implementing best management practices, appropriate health and sfety measures and appropriate personal protective equipment worn during monitoring. Treatment / management of any waste generated would be i accordance with applicable rules / regulations.		Risk during implementation to site workers, the geral public and the environment would be controlled a managed by implementing best management practics, appropriate health and safety measures and approprate personal protective equipment worn during monitorng. Treatment / management of any waste generated wuld be in accordance with applicable rules / regulations	8	Risk during construction and implementation to ste workers, the general public and the environment wd be controlled and managed by implementing best management practices, appropriate health and safty measures and appropriate personal protective equipment. Treatment / management of any waste generated would be in accordance with applicable rules / regulations.	5	Risk during construction and implementation to site workes, the general public and the environment would be controlle and managed by implementing best management practices appropriate health and safety measures and appropriate personal protective equipment. Treatment / management any waste generated would be in accordance with applicabe rules / regulations.		Risk during construction and implementation to site workers, the general public and the environment would be controlled and managed by implementing best management practices, appropriate health and safety measures and appropriate personal protective equipment. Treatment / management of any waste generated would be in accordance with applicable rules / regulations.	6

Table 6
Remedial Alternatives Evaluation for Groundwater
UNC-CH Cogeneration Facility - Chapel Hill, North Carolina

Feasibility Study Creria	Sitewide Monitored Natural Attenuation	Sore	Sitewide Risk Based Remediation	Sore	MNA for Facility Parcel with Permeable Reactve Barrier Downgradient	core	Risk Based Remediation for Facility Parcel with Permable Reactive Barrier Downgradient	core	Facility Parcel Pump and Treat Groundwater System	Score
5. Reduction of toxicty, mobility and volume.	Sorption of COCs onto the aquifer matrix and precipitation of COCs are often the primary attenuation factors for inorganic COCs. Additil monitoring and plume modeling will be requireo confirm MNA processes are adequate.		A tiered approach is used to determine risk to humn health from exposure to groundwater. Remedial gls for COCs may be further revised based on site speific conditions and exposure scenarios.		For MNA, sorption of COCs onto the aquifer matix and precipitation of COCs are often the primary attenuation factors for inorganic COCs. Additiona monitoring and plume modeling will be required t confirm MNA processes are adequate. For permeable reactive barriers, immobilization o COCs at sites impacted with coal combustion byproducts is often the dominant method to contr toxicity and mobility. The selected reactive meda should be able to immobilize a COC within the designed residence time. Numerous reactive meda may be used. Can use a mixed media approach. Wd require Treatability testing.	7	For risk based remediation, remedial goals for COCs ma be further revised based on site specific conditions and expose scenarios. Remedial action would be required to addres groundwater exceeding the revised remedial goals. For permeable reactive barriers, immobilization of COC at sites impacted with coal combustion byproducts is oftehe dominant method to control toxicity and mobility. The selected reactive media should be able to immobilize a CC within the designed residence time. Numerous reactiveedia may be used. Can use a mixed media approach. Would rquire Treatability testing.	8	Pump and treat is typically implemented to either capture source zone mass (reducing toxicity and volume) or to provide hydraulic containment (reducing mobility). For this site, pump and treat would provide containment and would therefore reduce mobility of COC mass while only offering a limited degree of toxicity and volume reduction.	8
6. Technical and logitical feasibility (implemenability).	No permits required. No treatment, storage a or disposal services are required. Necessary equipent and workers for monitoring are available.		Requires NCDEQ concurrence. Requires consentrom Town of Chapel Hill for impacts to McCauley Stret. Requires a Notice of Intent to Remediate. Require a DPLUR and Notice. Necessary equipment and workers for monitoring are available.		For MNA, no permits required. No treatment, storge and / or disposal services are required. Necessary equipment and workers for monitoring are availabl. For permeable reactive barriers, need to evaluate permitting needs for wetlands or water of the US, stream buffers and the Jordan Lake rules. USACE State, County and Town permitting may be requird. Contractors skilled in reactive barrier installation ae available. Treatment, storage and /or disposal serices are anticipated to be required during the initial construction and if reactive media must be replace. Necessary equipment and workers for monitoringre available.	4	For risk based remediation, requires NCDEQ concurrenc. Requires consent from Town of Chapel Hill for impactso McCauley Street. Requires a Notice of Intent to Remedite. Requires a DPLUR and Notice. Necessary equipment ad workers for monitoring are available . For permeable reactive barriers, need to evaluate permiting needs for wetlands or water of the US, stream buffers ahe Jordan Lake rules. USACE, State, County and Town permitting may be required. Contractors skilled in reactve barrier installation are available. Treatment, storage andor disposal services are anticipated to be required during t initial construction and if reactive media must be replace. Necessary equipment and workers for monitoring are available.		For a groundwater pump and treat system, NCDEQ may require concurrence, though compliance issues are not anticipated. Additionally, permits will be required from OWASA and the Town of Chapel Hill for the sanitary sewer connection and treatment building installation, respectively. Groundwater pump and treat systems are a common remedial alternative - there should not be challenges identifying contractors skilled and qualified to perform the work. Treatment, storage, and / or disposal services are anticipated to be required during the initial construction. Discussion with the Cogen facility indicates that a nearby POTW discharge (350 feet) is a feasible location for treated water. Additionally, the limited impacts to groundwater (i.e., sulfate, dissolved solids, etc.) will be easy to mitigate ex situ. The primary implementation challenge with pump and treat is achieving an effective drawdown in the saprolite, as production rates in the formation will be very limited, which will require several extraction wells.	4
7. Cost.	Capital cost are medium to low. Capital costs wd include the remedial action plan process. O&Mosts are medium. O&M costs include compliance a performance monitoring and plume modeling.	6	Capital costs are medium to low. Capital costs incude obtaining consent from the Town of Chapel Hill a NCDEQ, the remedial action plan process, developi land use restrictions and notices and attaching the to the deed. O&M costs are low. O&M costs include fees, maintenance of any engineered controls, and annual inspection of any engineered controls.	5	Capital cost are high. Capital Cost include the remedial action plan process, design and construcion. Capital cost are dependent on plume and aquifer depth, plume width and geotechnical considerati. O&M costs are medium to high. O&M cost incl compliance monitoring, performance monitoring, plume modeling and replacement or rejuvenation of reactive media.		Capital cost are high. Capital Cost include the remedial ation plan process, design and construction. Capital cost are dependent on plume and aquifer depth, plume width and geotechnical considerations. Capital costs also include obtaining consent from the Town of Chapel Hill and NCEQ, developing land use restrictions and notices and attachi them to the deed. O&M costs are medium to high. O& cost include compliance monitoring, performance monitoringnd replacement or rejuvenation of reactive media. O&M cots include fees, maintenance of any engineered controls a annual inspections.	2	Capital cost are high. Capital Cost include remedial design investigation, the remedial action plan process, design and construction. Capital cost are dependent on plume and aquifer depth, plume width and geotechnical considerations. Capital costs also include obtaining consent from the NCDEQ for the remedial action plan process. O&M costs are medium to high. O&M cost include compliance monitoring; performance monitoring; and routine maintenance (e.g. filter replacement, pump inspection, etc.). O&M costs include fees, maintenance of any engineered controls and annual inspections.	2
8. Community acceptnce.	Acceptance is expected to be low.		Acceptance is expected to be low.		Acceptance is expected to be medium.		Acceptance is expected to be medium.	5	Acceptance is expected to be medium.	5
Total		46		45		40		40		45

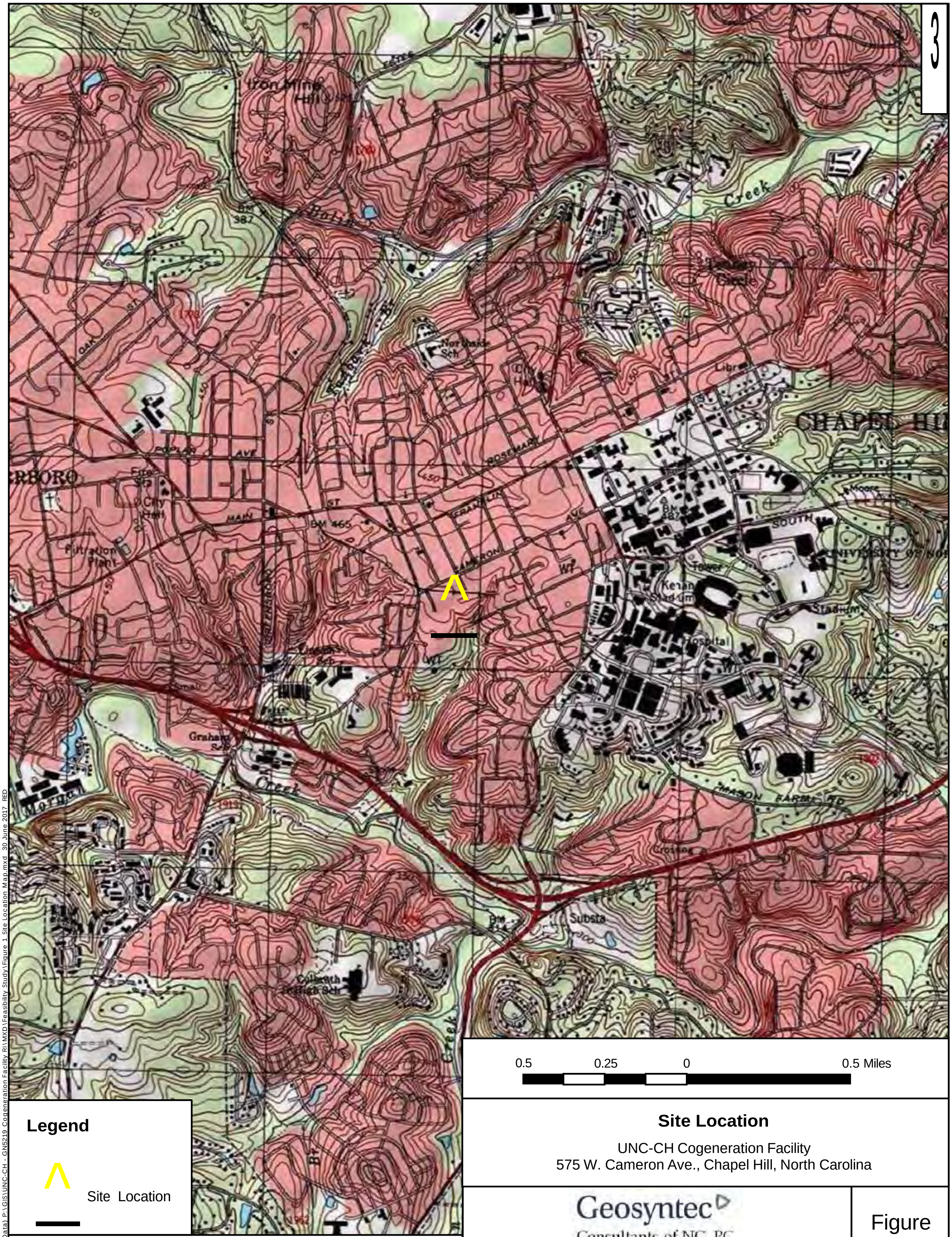
Notes:

1. The Score is a qualitative assessment of the relative potential to satisfy the criteria.
   Higher scores (1 to 10) indicate the alternative better satisfies the requirements of the criterion.
   Therefore, cost-effective alternatives earn a higher score than more expensive alternatives.
   See Appendix A for a summary table and detailed cost sheets for each alternative.

2. Acronyms used above consist of:
   REC indicates registered environmental consultant.
   USEPA indicates United States Environmental Protection Agency
   NCDEQ indicates North Carolina Department of Environmental Quality
   DPLUR indicates Declaration of Perpetual Land Use Restrictions
   O&M indicates operation and maintenance
   CCB indicates coal combustion byproducts
   COC indicates contaminant of concern
   USACE indicates United States Army Corps of Engineers
   MNA indicates monitored natural attenuation

Figures

3



0.5 | 0.25 | 0 | 0.5 Miles

Site Location

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

Legend

Site Location

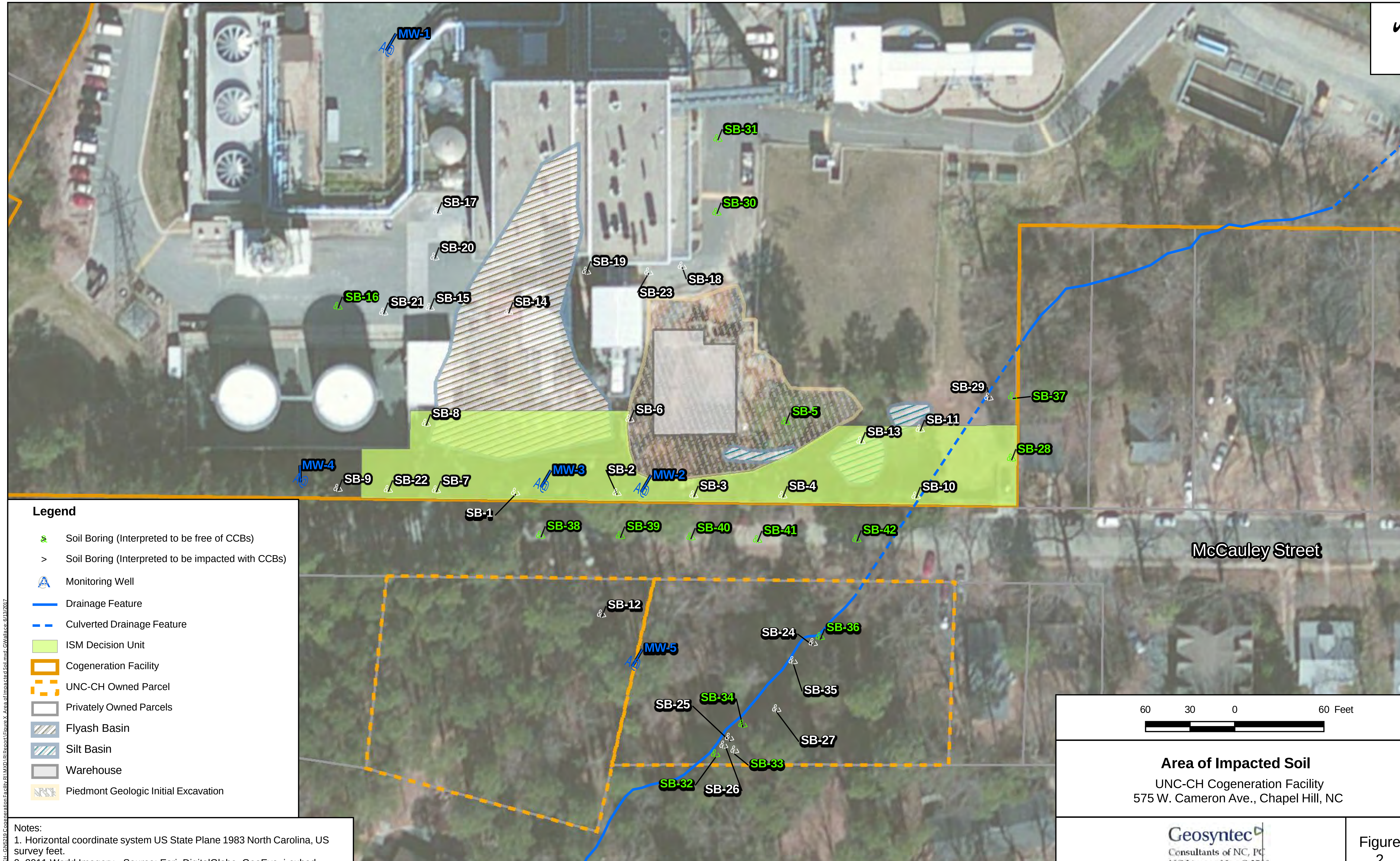
Notes:
1. Source: 2013 National Geographic Society, i-cubed

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

Raleigh, NC | July 2017

Figure 1

Path: (Raleigh-01/Data) P:\GIS\UNC-CH - GN5219 Cogeneration Facility RI\MXD\Feasibility Study\Figure 1 Site Location Map.mxd 30 June 2017 RED



Legend

- Soil Boring (Interpreted to be free of CCBs)
- Soil Boring (Interpreted to be impacted with CCBs)
- Monitoring Well
- Drainage Feature
- Culverted Drainage Feature
- ISM Decision Unit
- Cogeneration Facility
- UNC-CH Owned Parcel
- Privately Owned Parcels
- Flyash Basin
- Silt Basin
- Warehouse
- Piedmont Geologic Initial Excavation

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 Community.

Area of Impacted Soil

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

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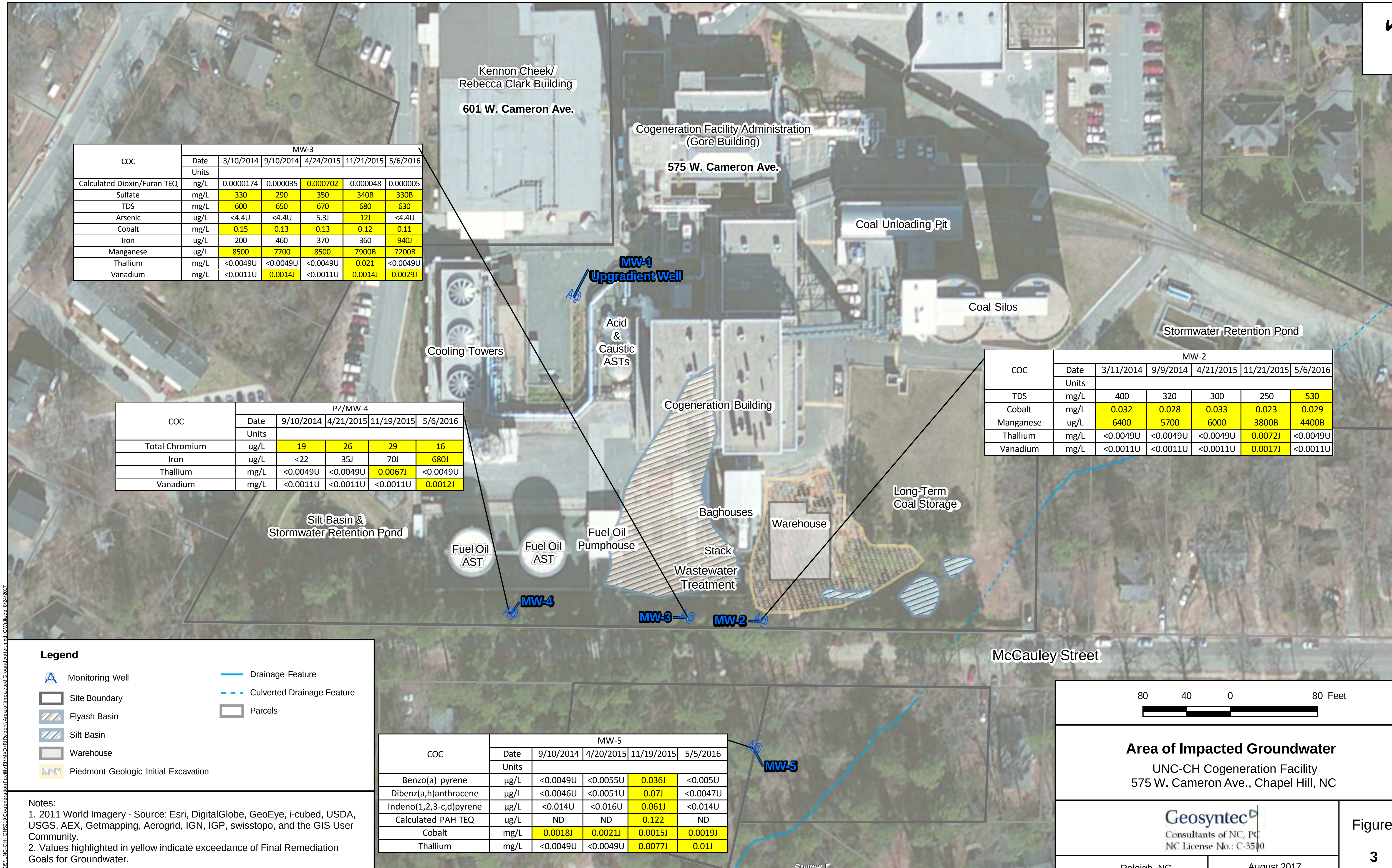
Raleigh, NC	July 2017	Figure 2



COC	MW-3					
	Date	3/10/2014	9/10/2014	4/24/2015	11/21/2015	5/6/2016
	Units					
Calculated Dioxin/Furan TEQ	ng/L	0.0000174	0.000035	0.000702	0.000048	0.000005
Sulfate	mg/L	330	290	350	340B	330B
TDS	mg/L	600	650	670	680	630
Arsenic	ug/L	<4.4U	<4.4U	5.3J	12J	<4.4U
Cobalt	mg/L	0.15	0.13	0.13	0.12	0.11
Iron	ug/L	200	460	370	360	940J
Manganese	ug/L	8500	7700	8500	7900B	7200B
Thallium	mg/L	<0.0049U	<0.0049U	<0.0049U	0.021	<0.0049U
Vanadium	mg/L	<0.0011U	0.0014J	<0.0011U	0.0014J	0.0029J

COC	MW-2					
	Date	3/11/2014	9/9/2014	4/21/2015	11/21/2015	5/6/2016
	Units					
TDS	mg/L	400	320	300	250	530
Cobalt	mg/L	0.032	0.028	0.033	0.023	0.029
Manganese	ug/L	6400	5700	6000	3800B	4400B
Thallium	mg/L	<0.0049U	<0.0049U	<0.0049U	0.0072J	<0.0049U
Vanadium	mg/L	<0.0011U	<0.0011U	<0.0011U	0.0017J	<0.0011U

COC	PZ/MW-4				
	Date	9/10/2014	4/21/2015	11/19/2015	5/6/2016
	Units				
Total Chromium	ug/L	19	26	29	16
Iron	ug/L	<22	35J	70J	680J
Thallium	mg/L	<0.0049U	<0.0049U	0.0067J	<0.0049U
Vanadium	mg/L	<0.0011U	<0.0011U	<0.0011U	0.0012J

COC	MW-5				
	Date	9/10/2014	4/20/2015	11/19/2015	5/5/2016
	Units				
Benzo(a) pyrene	µg/L	<0.0049U	<0.0055U	0.036J	<0.005U
Dibenz(a,h)anthracene	µg/L	<0.0046U	<0.0051U	0.07J	<0.0047U
Indeno(1,2,3-c,d)pyrene	µg/L	<0.014U	<0.016U	0.061J	<0.014U
Calculated PAH TEQ	ug/L	ND	ND	0.122	ND
Cobalt	mg/L	0.0018J	0.0021J	0.0015J	0.0019J
Thallium	mg/L	<0.0049U	<0.0049U	0.0077J	0.01J

Legend

- Monitoring Well
- 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.
2. Values highlighted in yellow indicate exceedance of Final Remediation Goals for Groundwater.

80 40 0 80 Feet

Area of Impacted Groundwater

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

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Figure 3

Appendix A

Summary Comparison of Remediation Cost Estimates
UNC-CH Cogeneration Facility, Chapel Hill, NC

Facility Soils

Item	*Facility Soil RA1:* Alternate Remedial Goals with Land Use Restrictions			*Facility Soil RA2:* Cap with Alternate Remedial Goals and Land Use Restrictions			*Facility Soil RA3:* Select in-situ Solidification/Stabilization with Alternate Remedial Goals and Land Use Restrictions			*Facility Soil RA4:* Select Excavation and Disposal with Alternate Remedial Goals and Land Use Restrictions		
	-30%	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*
Capital Cost Range	*$70,000*	**$100,000**	*$150,000*	*$293,000*	**$418,000**	*$627,000*	*$622,000*	**$889,000**	*$1,334,000*	*$506,000*	**$723,000**	*$1,085,000*
Annual Cost Range	*$21,000*	**$30,000**	*$45,000*	*$39,000*	**$55,000**	*$83,000*	*$42,000*	**$60,000**	*$90,000*	*$35,000*	**$50,000**	*$75,000*
20-Year Net Present Value Cost Range	*$414,000*	**$591,000**	*$887,000*	*$922,000*	**$1,317,000**	*$1,976,000*	*$1,309,000*	**$1,870,000**	*$2,805,000*	*$1,079,000*	**$1,541,000**	*$2,312,000*

Offsite Soils

Item	*Offsite Soil RA1:* Alternate Remedial Goals with Land Use Restrictions			*Offsite Soil RA2:* Excavation and Disposal			*Offsite Soil RA3:* Select Excavation and Disposal and Solidification/Stabilization with Alternate Remedial Goals and Land Use Restrictions		
	-30%	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*
Capital Cost Range	*$70,000*	**$100,000**	*$150,000*	*$186,000*	**$266,000**	*$399,000*	*$329,000*	**$470,000**	*$705,000*
Annual Cost Range	*$21,000*	**$30,000**	*$45,000*	*$32,000*	**$45,000**	*$68,000*	*$39,000*	**$55,000**	*$83,000*
20-Year Net Present Value Cost Range	*$414,000*	**$591,000**	*$887,000*	*$701,000*	**$1,002,000**	*$1,503,000*	*$958,000*	**$1,369,000**	*$2,054,000*

Groundwater

Item	*Groundwater RA1:* Sitewide Monitored Natural Attenuation			*Groundwater RA2:* Sitewide Risk Based Remediation			*Groundwater RA3:* MNA for Facility and Permeable Reactive Barrier Downgradient			*Groundwater RA4:* Risk Based Remediation for Facility and Permeable Reactive Barrier Downgradient		
	-30%	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*	*-30%*	**Probable Cost**	*50%*
Capital Cost Range	*$35,000*	**$50,000**	*$75,000*	*$88,000*	**$125,000**	*$188,000*	*$221,000*	**$316,000**	*$474,000*	*$270,000*	**$386,000**	*$579,000*
Annual Cost Range	*$18,000*	**$25,000**	*$38,000*	*$21,000*	**$30,000**	*$45,000*	*$32,000*	**$45,000**	*$68,000*	*$32,000*	**$45,000**	*$68,000*
20-Year Net Present Value Cost Range	*$321,000*	**$459,000**	*$689,000*	*$431,000*	**$616,000**	*$924,000*	*$736,000*	**$1,052,000**	*$1,578,000*	*$785,000*	**$1,122,000**	*$1,683,000*

Notes:
- This is not an offer for construction and/or project execution. These AACE Class 4 order of magnitude cost estimates are assumed to represent the actual installed cost within the range of - 30 percent to + 50 percent of the costs indicated. The cost estimate has been prepared for guidance in project evaluation and implementation from the information available at the time of the estimate.
- The cost to select alternate RGs and land use restrictions for both facility and offsite soils would be Facility Soil RA1 only (i.e., the labor effort would extend to both areas).

APPENDIX C

Memorandum: Wetlands and Stream Assessment on Two Undeveloped, University Owned Lots

Geosyntec Consultants of NC, P.C.

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2501 Blue Ridge Road, Suite 430
Raleigh, NC 27607
PH 919.870.0576
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Geology Firm License # C-295
www.geosyntec.com

Memorandum

Date:	19 January 2023
To:	Cathy Brennan, Executive Director of UNC-CH Environment, Health & Safety William Lowery II, PE, Manager of UNC-CH Cogeneration Systems
From:	Eric Nesbit, PE, RSM, Senior Principal at Geosyntec Consultants of NC, P.C.
Subject:	Wetlands and Stream Assessment on Two Undeveloped, University Owned Lots

Geosyntec Consultants of NC, P.C. performed a wetland delineation and stream assessment to support the removal of two small, isolated pockets of impacted soil located south of McCauley Street from the Cogeneration Facility. **Figure 1** presents the surveyed area. The proposed removal actions are part of the larger soil remedy for the voluntary, Coal Combustion Byproducts (CCB) remediation at the Cogeneration Facility. Remediation of CCBs, impacted soil and groundwater is being implemented consistent with North Carolina's Department of Environmental Quality (NCDEQ) Registered Environmental Consultant (REC) program.

Streams and wetlands are federally protected under Section 401 and Section 404 of the Clean Water Act. Delineation and characterization of any conflicting wetlands and or streams was required to assess the potential for impacts to the wetlands or stream resulting from the removal actions. Geosyntec personnel experienced in wetlands and stream delineation and characterization located the two proposed removal areas and along with likely equipment access routes to identify and delineate any conflicts for regulatory determination and subsequent permitting.

The two pockets of impacted soil are further regulated by the NCDEQ for the Jordan Water Supply Nutrient Strategy[1].

Geosyntec has prepared this memorandum of findings for UNC-CH's use in obtaining the necessary permits required to complete the removal actions.

[1] North Carolina General Assembly. Jordan Water Supply Nutrient Strategy: Protection of Existing Riparian Buffers. 15A NCAC 02B .0267

WETLAND AND STREAM ASSESSMENT METHODOLOGY

Wetlands and other waters of the United States (U.S.) are federally protected under Section 404 of the Clean Water Act (CWA). The definition of wetlands (40 Code of Federal Regulations §230.3(t)) is "*those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas*."

Geosyntec performed a wetlands/waters delineation of the Site in accordance with the three-parameter methodology outlined in the *1987 U.S. Army Corps of Engineers (USACE) Wetlands Delineation Manual*[2] (Manual), the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0)*[3].

The three parameters required for identifying a jurisdictional wetland are as follows:

- The presence of hydrology - At each data point, the delineator evaluates the area for evidence of hydrology. The Manual identifies both primary and secondary hydrologic indicators, where one primary indicator or two secondary indicators must be evident. Some examples of wetland hydrology indicators include saturation in the upper 12 inches of the soil profile, inundation, water marks on vegetation, drift lines, sediment deposits, drainage patterns, oxidized root channels, and water-stained leaves.
- The presence of hydrophytic vegetation - Plant species are assigned a regionally based facultative status, by the U.S. Department of Agriculture (USDA), which describes a particular species' tolerance of water. A plant's facultative status suggests habitat preference(s) in each region with respect to its aptitude to grow in low-oxygen (anaerobic) conditions. Hydrophytic, or "water loving", vegetation are those plants which have adapted to growing in the anaerobic conditions associated with prolonged saturation or flooding. Hydrophytic species can have a facultative status of "facultative" (FAC), "facultative wet" (FACW), or "obligate" (OBL). If, after defining a study plot that contains vegetation representative of the larger area being described and identifying all species within it, 50 percent or greater of all identified species have an assigned facultative status of FAC, FACW or OBL, wetland vegetation criteria is met.

---

[2] Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Department of the Army, Waterways Experiment Station. Vicksburg, Mississippi. 117 pages.

[3] Wetlands Regulatory Assistance Program. 2012. Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Eastern Mountains and Piedmont Region (Version 2.0). U.S. Army Corps of Engineers ERDC/EL TR-12-9. Vicksburg, MS.

- The presence of hydric soils - Evaluating the presence of hydric soils requires that the delineator sample the upper 12 inches of soil to obtain a profile description and identify hydric soil indicators, such as histosols, histic epipedons, sulfidic odor, aquic moisture regime, reducing conditions, gleyed or low-chroma colors, concretions, etc. In most cases, hydric soils are most efficiently identified by the profile description, where the soil coloration is compared to the Munsell Color chart system to determine if the material meets hydric conditions.

An area is classified as a wetland only in instances where all three parameters exist (under normal circumstances). If one or more criteria are absent, then the area is deemed an upland. To sufficiently justify the wetland boundary line, a wetland data point and an upland data point are obtained at each respective location (a minimum of one pair of data points per wetland). As the delineator reviews the area and obtains data points, visible indicators (e.g., abrupt changes in vegetation, elevation, surface water, etc.) often become apparent, allowing the delineator to establish the wetland boundary more efficiently.

A Geosyntec biologist conducted an on-site wetland assessment in accordance with the methodologies prescribed by the USACE and U.S. Environmental Protection Agency (EPA) pursuant to Sections 401 and 404 of the CWA. During the wetland assessment, Geosyntec located and delineated the boundaries of all aquatic resources within the ecological survey area as depicted in **Figure 2**. Geosyntec flagged the boundaries of all delineated features with sequentially numbered, pink high visibility flagging and recorded the flag locations using a GeoExplorer 7x global positioning system (GPS) receiver capable of submeter accuracy and the Environmental Systems Research Institute (ESRI) Collector mobile application for delineation mapping purposes.

A North Carolina Division of Water Quality (NCDWQ) 4.11 Stream Form is used in the state of North Carolina to determine whether a stream is ephemeral, intermittent, or perennial. The form gives a scaled score for a series of categories related to geomorphology, hydrology, and biology. Streams scoring less than 19 are considered ephemeral, streams scoring 19-29 are considered intermittent, and streams scoring 30 or more are considered perennial.

FINDINGS

One wetland was delineated within the survey area; identified in **Table 1** and depicted on **Figure 2.** A photographic log is included as **Appendix A**. Geosyntec completed Wetland Determination Data Forms (**Appendix B**), where appropriate, and documented conditions observed during the assessments. Wetland acreage reported is the amount of wetland within the defined survey area.

Wetland 1: 0.04-acre Forested Wetland (PFO)

Wetland 1 consists of mature, second growth forested wetland mostly within a drainage that is fed by a seep and groundwater flow. The wetland connects to Stream 1, outside of the survey area.

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Vegetation is dominated by sweetgum (*liquidambar styraciflua*), tulip poplar (*Liriodendron tulipifera*), boxelder (*Acer negundo*), sweetshrub (*Calycanthus floridus*), and Japanese holly (*Ilex crenata*). Most dominant species are facultative to obligate wetland plants. Tulip poplar (FACU) has been identified as a problematic species because of its ability to colonize moist areas. The wetland exhibited hydrology in the form of a sparsely vegetated concave surface, geomorphic position, and presence of reduced iron.

Stream 1: 0.05-acre/150 linear feet, Un-named, Perennial stream

One stream, identified in **Table 1**, and no other Waters of the U.S. were identified within the survey area. A Geosyntec biologist who has completed the Surface Water Identification and Training Certification workshop completed a DWR 4.11 stream form for Stream 1.

Stream 1 is a perennial stream located along the eastern edge of the Site. It begins off-site and enters the Site via a culvert under McCauley Street. The stream generally flows from the northeast to the southwest. At the time of the delineation, the water was flowing clear. Approximate bank width is 10-20’ with well-defined banks. Stream bed substrate includes silt, sand, gravel, and cobble. Normal base flow depth is approximately 3-12”. The stream was heavily impacted by debris and discarded garbage, and likely experiences a flashy hydrograph, indicative of an urban watershed with large amounts of impervious surface. The DWR 4.11 stream form (**Appendix C**) indicated the stream as having a score of 44.25; indicating the stream as perennial.

Table 1. Delineated Features Identified Within the Survey Area

Resource	Latitude	Longitude	Total Area (acres)
Wetlands			
Wetland 1 (PFO/PSS)	35.90538	-79.061315	0.04
Wetlands Total	**0.04**		
Streams			
Stream 1	35.905522	-79.060979	0.05/150 linear feet
Streams Total	**0.05/150 linear feet**		
Other Waters of the U.S.			
NA	NA	NA	NA
Other Waters of U.S. Total	**0.0**		
Other Waters			
NA	NA	NA	NA
Other Waters Total	**0.0**		
Total	**0.0**		

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CONCLUSION

Geosyntec identified approximately 0.04 acres of wetlands and 0.05 acres (150 linear feet) of streams or other waters within the survey area.

As shown in **Figure 3**, both pockets of impacted soil are outside the delineated wetland/stream. However, Geosyntec and its remediation contractor may elect to bridge the wetland with temporary mud-mats to facilitate removal of excavated, stockpiled soil.

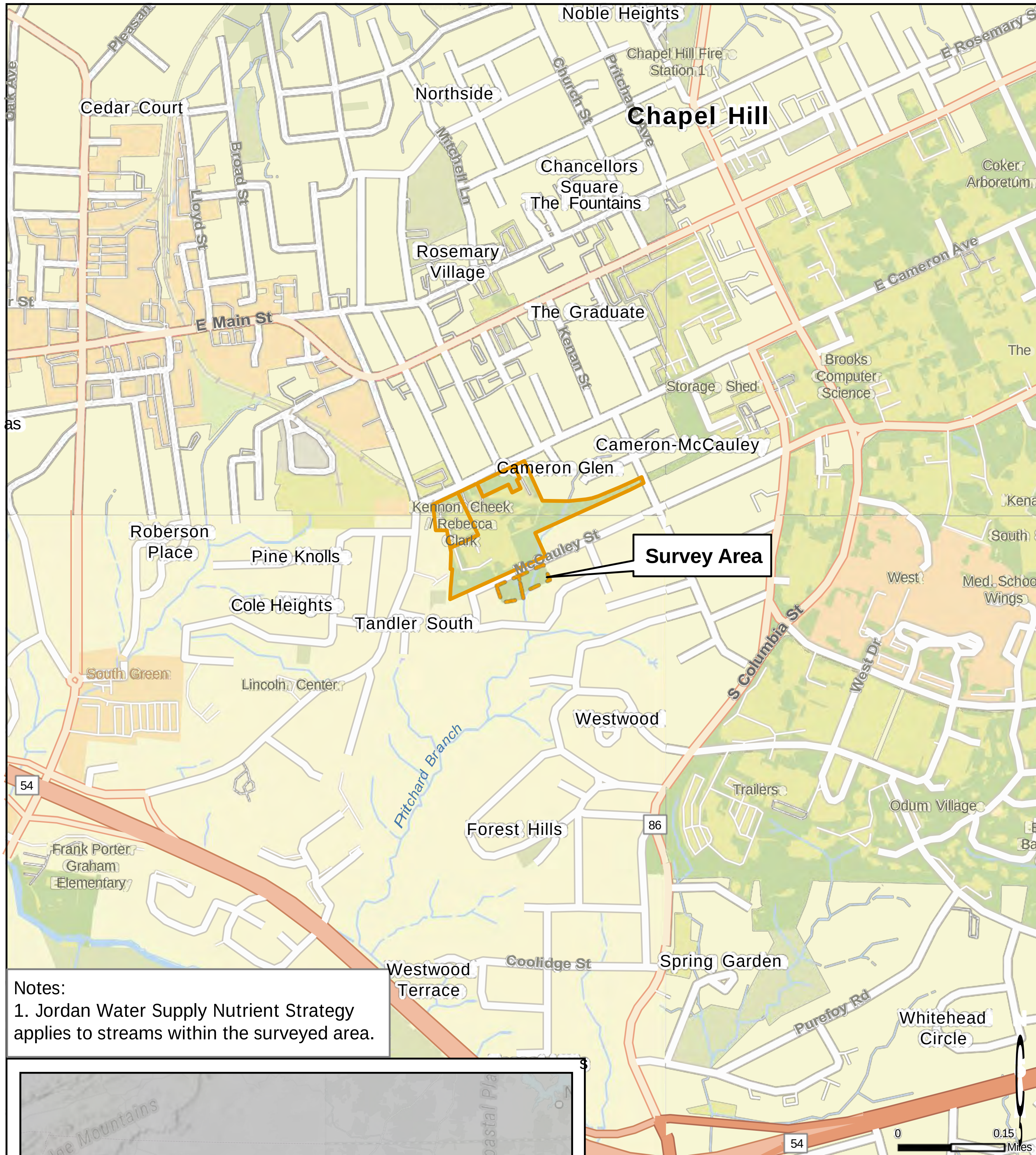
Prior to conducting the removal action, UNC-CH will require a NCDEQ permit consistent with the Jordan Water Supply Nutrient Strategy.

Nathan Weaver
Scientist

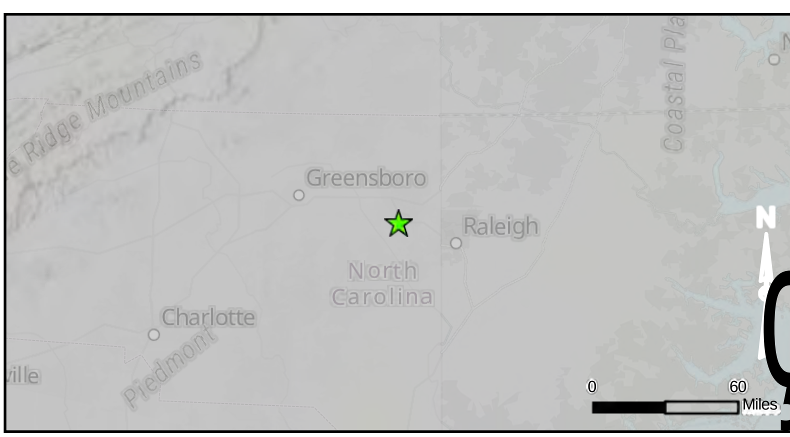
Eric Nesbit, PE, RSM
Senior Principal

* * * * *

FIGURES



Notes:
1. Jordan Water Supply Nutrient Strategy applies to streams within the surveyed area.



Site Location Map

UNC Cogen Remediation
Chapel Hill, North Carolina

Geosyntec consultants

Geosyntec Consultants of NC, P.C.
NC License No.: C-3500 and C-295

Raleigh, North Carolina | December 2022

Figure

1

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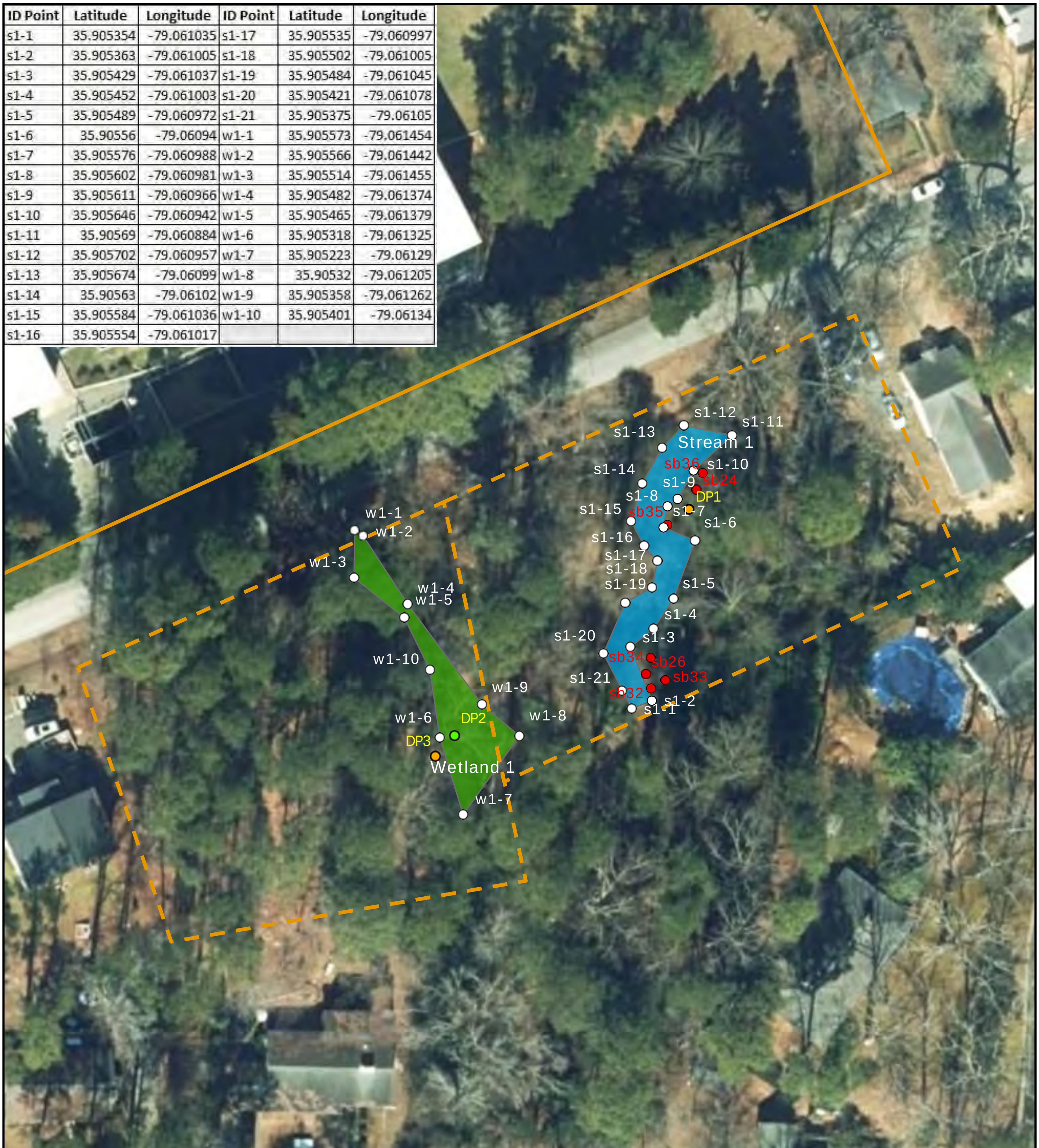
ID Point	Latitude	Longitude	ID Point	Latitude	Longitude
s1-1	35.905354	-79.061035	s1-17	35.905535	-79.060997
s1-2	35.905363	-79.061005	s1-18	35.905502	-79.061005
s1-3	35.905429	-79.061037	s1-19	35.905484	-79.061045
s1-4	35.905452	-79.061003	s1-20	35.905421	-79.061078
s1-5	35.905489	-79.060972	s1-21	35.905375	-79.06105
s1-6	35.90556	-79.06094	w1-1	35.905573	-79.061454
s1-7	35.905576	-79.060988	w1-2	35.905566	-79.061442
s1-8	35.905602	-79.060981	w1-3	35.905514	-79.061455
s1-9	35.905611	-79.060966	w1-4	35.905482	-79.061374
s1-10	35.905646	-79.060942	w1-5	35.905465	-79.061379
s1-11	35.90569	-79.060884	w1-6	35.905318	-79.061325
s1-12	35.905702	-79.060957	w1-7	35.905223	-79.06129
s1-13	35.905674	-79.06099	w1-8	35.90532	-79.061205
s1-14	35.90563	-79.06102	w1-9	35.905358	-79.061262
s1-15	35.905584	-79.061036	w1-10	35.905401	-79.06134
s1-16	35.905554	-79.061017			



Legend

ID Point
Soil Boring Location

Datapoint
Upland
Wetland

Delineated Feature
Stream (Ordinary High Water Mark)
Wetland

UNC Site Parcels
Cogeneration Facility
Parcel Lot Lines

0 40 Feet

Delineated Features Map

UNC Cogen Remediation
Chapel Hill, North Carolina

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Figure 2

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Legend

- ID Point
- Soil Boring Location

Datapoint

- Upland

Delineated Feature

- Stream (Ordinary High Water Mark)

UNC Site Parcels

- Parcel Lot Lines
- Impacted Soil Areas for Removal

0 12 Feet

Areas of Impacted Soil for Removal

UNC Cogen Remediation
Chapel Hill, North Carolina

Geosyntec consultants

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Raleigh, North Carolina | December 2022

Figure 3

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APPENDIX A

PHOTOLOG

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: UNC Cogeneration Facility	**Project Number: GN6666**
Site: UNC Cogeneration Facility	**Location: Orange County, NC**

Photograph 1

Date: 9/27/2022

Direction: Northeast

Comments: Stream 1 conditions in the southern portion of the survey area.

Photograph 2

Date: 9/27/2022

Direction: Southwest

Comments: Stream 1 conditions in the southern portion of the survey area. The surface water is reduced (possibly from erosion covering the stream) and there is a presence of debris and trash. The property boundary ends at the overhanging vegetation.

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: UNC Cogeneration Facility | **Project Number: GN6666**

Site: UNC Cogeneration Facility | **Location: Orange County, NC**

Photograph 3

Date: 9/27/2022

Direction: East

Comments: An aerial view of the upper portion of wetland 1, facing southwest towards it's ultimate confluence with stream 1 outside of the survey area.

Photograph 4

Date: 9/27/2022

Direction: Southwest

Comments: Stream 1 conditions in the northern portion of the survey area, there is a large amount of debris due to proximity to McCauley St.

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: UNC Cogeneration Facility | **Project Number: GN6666**

Site: UNC Cogeneration Facility | **Location: Orange County, NC**

Photograph 5

Date: 9/27/2022

Direction: N/A

Comments: Soil profile for data point 1, an upland data point.

Photograph 6

Date: 9/27/2022

Direction: North

Comments: Habitat conditions at data point 1, looking north along stream 1.

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: UNC Cogeneration Facility	**Project Number: GN6666**
Site: UNC Cogeneration Facility	**Location: Orange County, NC**

Photograph 7

Date: 9/27/2022

Direction: N/A

Comments: Soil profile for data point 2, a wetland data point.

Photograph 8

Date: 9/27/2022

Direction: North

Comments: Habitat conditions at data point 2. Primary hydrology is saturation from groundwater flow. Wetland boundary is flagged with pink tape.

GEOSYNTEC CONSULTANTS
PHOTOGRAPHIC RECORD

Client: UNC Cogeneration Facility	**Project Number: GN6666**
Site: UNC Cogeneration Facility	**Location: Orange County, NC**

Photograph 9

Date: 9/27/2022

Direction: N/A

Comments: Soil profile for data point 3, an upland data point.

Photograph 10

Date: 9/27/2022

Direction: North

Comments: Habitat conditions at data point 3, looking north along wetland 1.

APPENDIX B

WETLAND DATAPOINT FORMS

WETLAND DETERMINATION DATA FORM – Eastern Mountain Piedmont Region

Site: UNC Cogen Remediation City/County: Chapel Hill Sampling Date: 9/27/2022

Applicant/Owner: UNC State: NC Sampling Point: DP1up

Investigator(s): Nathan Weaver Section, Township, Range: NA

Landform: (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): None Slope %: 0-2%

Subregion (LRR or MLRA): MLRA 136/LRR P Lat. 35.9055250 Long. -79.06088100 Datum: WGS 1984

Soil Map Unit Name: Wedowee sandy loam, 15-25% slopes NWI Classification: NA

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ naturally problematic?

Are Normal Circumstances Present? Yes ____ No X (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ____ No X	**Is the Sampled Area within a Wetland?**	
Hydric Soil Present?	Yes X No ____	**Yes** ____	**No** X
Wetland Hydrology Present?	Yes ____ No X		

Remarks:

Abnormally dry

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		True Aquatic Plants (B14)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)		Stunted or Stressed Plants (D1)
	Inundation Visible on Aerial Imagery (B7)				Geomorphic Position (D2)
					Shallow Aquitard (D3)
	Water Stained Leaves (B9)				Microtopographic Relief (D4)
					FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

(See Climatic Summary below)

Remarks:

The field surveys were conducted on 27 September, 2022 during a period in which the region had received less than normal rainfall amounts for the September month-to-date (MTD) (0.99" compared to a 4.97" normal value) as of September 27th. This includes the most recent precipitation events prior to surveys in which 0.04" and 0.43" were recorded on September 11th and 13th, respectively. Based on the year-to-date (YTD) accumulating total on September 27th the observed value was 37.54" which is +0.27" above than the normal value of 37.27" according to the nearest National Weather Service climate station in Chapel Hill, NC. A review of regional drought conditions from the website droughtmonitor.gov indicated abnormally dry conditions existed for the regional area for the week of September 27th. In addition, based on the results of the climate analysis using the Antecedent Precipitation Tool (Deter, USACE v.1.0.13) the calculated output was a TOOL NOT WORKING value "Normal Conditions" with the graphic indicating the 30-day Rolling Total was located within the 30-Year Normal Range (see attached graphic). Based on the high to slightly high YTD totals and recent rain events, the delineators felt that surface hydrology was seasonally normal with only minimal stormwater influence affecting the typical surface hydrology.

VEGETATION (Four Strata) - Use scientific names of plants — Sampling Point: DP1up

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Sapling/Shrub Stratum (Plot size: r=15')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ligustrum sinense*	70	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	70 = Total Cover		
50% of total Cover: 35	20% of Total Cover: 14		

Herb Stratum (Plot size: r=5')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Ligustrum sinense*	10	Y	FACU
2. *Liquidambar styraciflua*	5	Y	FAC
3. *Ilex opaca*	5	Y	FACU
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	20 = Total Cover		
50% of total Cover: 10	20% of Total Cover: 4		

Woody Vine Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Tot Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 1 (A)

Total number of dominant species across all strata: 4 (B)

Percent of dominant species that are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index Worksheet

Total % cover of:			Multiply by:
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	5	x 3	15
FACU species	85	x 4	340
UPL species	0	x 5	0
Column Total	90 (A)		355 (B)
Prevalence Index:			3.9 (B/A)

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0*
___ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes ___ **No** X

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP1up

Profile Description: (Describe to depth needed to document the indicator or confirm absence of indicators.)

Depth	Matrix		Redox Features					
(inches)	Color	%	Color	%	Type*	Loc**	Texture	Remarks
0-9	10yr3/2	100					Loam / Clay	
9-13	10yr5/2	90	7.5yr4/6	10	C	M	Sandy	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

	Histosol (A1)		Stripped Matrix (S6)
	Histic Epipedon (A2)		Dark Surface (S7)
	Black Histic (A3)		Polyvalue Below Surface (S8) (MLRA 147, 148)
	Hydrogen Sulfide (A4)		Thin Dark Surface (S9) (MLRA 147, 148)
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)
	2 cm Muck (A10) (LRR N)	X	Depleted Matrix (F3)
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)
	Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)		Redox Depressions (F8)
			Fe-Mn Masses (F12) (LRR N, MLRA 136)
	5 cm Mucky Peat or Peat (S3)		Umbric Surface (F13) (MLRA 136, 122)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19) (MLRA 148)
	Sandy Redox (S5)		Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils ***

	2 cm Muck (A10) (MRLA 147)
	Coast Prairie Redox (A16) (MLRA 147, 148)
	Piedmont Floodplain Soils (F19) (MLRA 136, 147)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: no

Depth (inches): ______

Hydric Soil Present? **Yes** X **No** ______

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountain Piedmont Region

Site: UNC Cogen Remediation City/County: Chapel Hill Sampling Date: 9/27/2022

Applicant/Owner: UNC State: NC Sampling Point: DP2wet

Investigator(s): Nathan Weaver Section, Township, Range: NA

Landform: (hillslope, terrace, etc.): basin Local relief (concave, convex, none): Concave Slope %: 0-2%

Subregion (LRR or MLRA): MLRA 136/LRR P Lat. 35.9053230 Long. -79.06129800 Datum: WGS 1984

Soil Map Unit Name: Wedowee sandy loam, 15-25% slopes NWI Classification: NA

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ naturally problematic?

Are Normal Circumstances Present? Yes ____ No X (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes X No ____

Hydric Soil Present? Yes X No ____

Wetland Hydrology Present? Yes X No ____

Is the Sampled Area within a Wetland? **Yes** X **No** ____

Remarks:

Abnormally dry

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)	
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		True Aquatic Plants (B14)	X	Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)	X	Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)	X	Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
X	Iron Deposits (B5)		Other (Explain in Remarks)		Stunted or Stressed Plants (D1)
######	Inundation Visible on Aerial Imagery (B7)			X	Geomorphic Position (D2)
					Shallow Aquitard (D3)
	Water Stained Leaves (B9)				Microtopographic Relief (D4)
					FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** X **No** ____

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

(See Climatic Summary below)

Remarks:

The field surveys were conducted on 27 September, 2022 during a period in which the region had received less than normal rainfall amounts for the September month-to-date (MTD) (0.99" compared to a 4.97" normal value) as of September 27th. This includes the most recent precipitation events prior to surveys in which 0.04" and 0.43" were recorded on September 11th and 13th, respectively. Based on the year-to-date (YTD) accumulating total on September 27th the observed value was 37.54" which is +0.27" above than the normal value of 37.27" according to the nearest National Weather Service climate station in Chapel Hill, NC. A review of regional drought conditions from the website droughtmonitor.gov indicated abnormally dry conditions existed for the regional area for the week of September 27th. In addition, based on the results of the climate analysis using the Antecedent Precipitation Tool (Deter, USACE v.1.0.13) the calculated output was a TOOL NOT WORKING value "Normal Conditions" with the graphic indicating the 30-day Rolling Total was located within the 30-Year Normal Range (see attached graphic). Based on the high to slightly high YTD totals and recent rain events, the delineators felt that surface hydrology was seasonally normal with only minimal stormwater influence affecting the typical surface hydrology.

Primary hydrology for the data point is groundwater flow and seepage from adjacent uplands.

VEGETATION (Four Strata) - Use scientific names of plants Sampling Point: DP2wet

Tree Stratum Plot size: r=30'	Absolute % Cover	Dominant Species?	Indicator Status
1. *Liquidambar styraciflua*	20	Y	FAC
2. *Liriodendron tulipifera*	15	Y	FACU
3. *Acer negundo*	10	Y	FAC
4.			
5.			
6.			
7.			
	45 = Total Cover		
50% of total Cover: 22.5	20% of Total Cover: 9		

Sapling/Shrub Stratum Plot size: r=15'	Absolute % Cover	Dominant Species?	Indicator Status
1. *Calycanthus floridus*	15	Y	FACU
2. *Ilex crenata*	5	Y	FAC
3.			
4.			
5.			
6.			
7.			
8.			
9.			
	20 = Total Cover		
50% of total Cover: 10	20% of Total Cover: 4		

Herb Stratum Plot size: r=5'	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	0 = Total Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Woody Vine Stratum Plot size: r=30'	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Tot Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC:	3	(A)
Total number of dominant species across all strata:	5	(B)
Percent of dominant species that are OBL, FACW, or FAC:	60%	(A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	35	x 3	105
FACU species	30	x 4	120
UPL species	0	x 5	0
Column Total	65 (A)		225 (B)
		Prevalence Index:	3.5 (B/A)

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
X 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0*
___ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes X **No** ___

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP2wet

Profile Descriiot : (De cribe to de th need d to docu ent the indi ator or cor firm absence of ind cato s.)

Dh	Matri		Redox Fures					
(inches)	Color	%	Color	%	Type*	Loc*	Texture	Remarks
0-1	10yr3/2	100					Loam Clay	
6	2.5yr5/4	50	5yr5/6	50	C	M	Loam Clay	
6-	2.5yr5/2	80	5yr5/6	20	C	M,Pl	Loam Clay	
11-14	10yr3/1	97	7.5yr5/6	3	C	M	Sandy	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)

	Histosol (A1)		Stripped Matrix (S6)
	Histic Epipedon (A2)		Dark Surface (S7)
	Black Histic (A3)		Polyvalue Below Surface (S8) (MLRA 147, 148)
	Hydrogen Sulfide (A4)		Thin Dark Surface (S9) (MLRA 147, 148)
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)
	2 cm Muck (A10) (LRR N)	X	Depleted Matrix (F3)
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)
	Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)		Redox Depressions (F8)
			Fe-Mn Masses (F12) (LRR N, MLRA 136)
	5 cm Mucky Peat or Peat (S3)		Umbric Surface (F13) (MLRA 136, 122)
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19) (MLRA 148)
	Sandy Redox (S5)		Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils ***

	2 cm Muck (A10) (MRLA 147)
	Coast Prairie Redox (A16) (MLRA 147, 148)
	Piedmont Floodplain Soils (F19) (MLRA 136, 147)
	Very Shallow Dark Surface (TF12)
	Other (Explain in Remarks)

***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**

Restrictive Layer (if observed)

Type: no

Depth (inches): ____

Hydric Soil Present? Yes X **No** ____

Remarks:

WETLAND DETERMINATION DATA FORM – Eastern Mountain Piedmont Region

Site: UNC Cogen Remediation City/County: Chapel Hill Sampling Date: 9/27/2022

Applicant/Owner: UNC State: NC Sampling Point: DP3up

Investigator(s): Nathan Weaver Section, Township, Range: NA

Landform: (hillslope, terrace, etc.): slope Local relief (concave, convex, none): Convex Slope %: 10-25%

Subregion (LRR or MLRA): MLRA 136/LRR P Lat. 35.9053100 Long. -79.06130800 Datum: WGS 1984

Soil Map Unit Name: Wedowee sandy loam, 15-25% slopes NWI Classification: NA

Are climatic/hydrologic conditions on the site typical for time of year? Yes ____ No X (If no, explain in the Remarks)

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ significantly disturbed?

Are Vegetation ____ ,Soil ____ ,or Hydrology ____ naturally problematic?

Are Normal Circumstances Present? Yes ____ No X (If needed, explain any answers in Remarks)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes ____ No X

Hydric Soil Present? Yes ____ No X

Wetland Hydrology Present? Yes ____ No X

Is the Sampled Area within a Wetland? **Yes** ____ **No** X

Remarks:

Abnormally dry

HYDROLOGY

Wetland Hydrology Indicators:

	Primary Indicators (minimum of one is require; check all that apply)				Secondary Indicators (minimum of two required)
	Surface Water (A1)		Aquatic Fauna (B13)		Surface Soil Cracks (B6)
	High Water Table (A2)		True Aquatic Plants (B14)		Sparsely Vegetated Concave Surface (B8)
	Saturation (A3)		Hydrogen Sulfide Odor (C1)		Drainage Patterns (B10)
	Water Marks (B1)		Oxidized Rhizospheres on Living Roots (C3)		Moss Trim Lines (B16)
	Sediment Deposits (B2)		Presence of Reduced Iron (C4)		Dry-Season Water Table (C2)
	Drift Deposits (B3)		Recent Iron Reduction in Tilled Soil (C6)		Crayfish Burrows (C8)
	Algal Mat or Crust (B4)		Thin Muck Surface (C7)		Saturation Visible on Aerial Imagery (C9)
	Iron Deposits (B5)		Other (Explain in Remarks)		Stunted or Stressed Plants (D1)
	Inundation Visible on Aerial Imagery (B7)				Geomorphic Position (D2)
					Shallow Aquitard (D3)
	Water Stained Leaves (B9)				Microtopographic Relief (D4)
					FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ____ No ____ Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? Yes ____ No X Depth (inches): ____
(includes capillary fringe)

Wetland Hydrology Present? **Yes** ____ **No** X

Describe Recorded Data (stream guage, monitoring well, aerial photos, previous inspections), if available:

(See Climatic Summary below)

Remarks:

The field surveys were conducted on 27 September, 2022 during a period in which the region had received less than normal rainfall amounts for the September month-to-date (MTD) (0.99" compared to a 4.97" normal value) as of September 27th. This includes the most recent precipitation events prior to surveys in which 0.04" and 0.43" were recorded on September 11th and 13th, respectively. Based on the year-to-date (YTD) accumulating total on September 27th the observed value was 37.54" which is +0.27" above than the normal value of 37.27" according to the nearest National Weather Service climate station in Chapel Hill, NC. A review of regional drought conditions from the website droughtmonitor.gov indicated abnormally dry conditions existed for the regional area for the week of September 27th. In addition, based on the results of the climate analysis using the Antecedent Precipitation Tool (Deter, USACE v.1.0.13) the calculated output was a TOOL NOT WORKING value "Normal Conditions" with the graphic indicating the 30-day Rolling Total was located within the 30-Year Normal Range (see attached graphic). Based on the high to slightly high YTD totals and recent rain events, the delineators felt that surface hydrology was seasonally normal with only minimal stormwater influence affecting the typical surface hydrology.

VEGETATION (Four Strata) - Use scientific names of plants Sampling Point: DP3up

Tree Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Magnolia tripetala*	30	Y	FACU
2. *Magnolia grandiflora*	20	Y	FACU
3. *Carpinus caroliniana*	20	Y	FAC
4. *Liriodendron tulipifera*	10	N	FACU
5. *Pinus taeda*	5	N	FAC
6.			
7.			
	85 = Total Cover		
50% of total Cover: 42.5	20% of Total Cover: 17		

Sapling/Shrub Stratum (Plot size: r=15')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Magnolia tripetala*	10	Y	FACU
2. *Ilex crenata*	10	Y	FAC
3. *Liquidambar styraciflua*	5	Y	FAC
4.			
5.			
6.			
7.			
8.			
9.			
	25 = Total Cover		
50% of total Cover: 12.5	20% of Total Cover: 5		

Herb Stratum (Plot size: r=5')	Absolute % Cover	Dominant Species?	Indicator Status
1. *Calycanthus floridus*	5	Y	FACU
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
	5 = Total Cover		
50% of total Cover: 2.5	20% of Total Cover: 1		

Woody Vine Stratum (Plot size: r=30')	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	0 = Tot Cover		
50% of total Cover: 0	20% of Total Cover: 0		

Dominance Test Worksheet

Number of dominant species that are OBL, FACW, or FAC: 3 (A)

Total number of dominant species across all strata: 7 (B)

Percent of dominant species that are OBL, FACW, or FAC: 43% (A/B)

Prevalence Index Worksheet

Total % cover of:		Multiply by:	
OBL species	0	x 1	0
FACW species	0	x 2	0
FAC species	40	x 3	120
FACU species	75	x 4	300
UPL species	0	x 5	0
Column Total	115 (A)		420 (B)
		Prevalence Index:	3.7 (B/A)

Hydrophytic Vegetation Indicators:

___ 1 - Rapid Test for Hydrophytic Vegetation
___ 2 - Dominance Test is >50%
___ 3 - Prevalence Index is ≤3.0*
___ Problematic Hydrophytic Vegetation* (Explain)

*Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic

Definitions of Four Vegetation Strata:

Tree - Woody plants, excluding vines, 3 in. (7.6cm) or more in diameter at breast height (DBH), regardless of height.

Sapling/Shrub - Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1m) tall.

Herb - All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.

Woody Vine - All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present?

Yes ____ **No** X

Remarks: (if observed, list morphological adaptations below).

SOIL Sampling Point: DP3up

Profile Descriior : (De cribe to de th need d to docu ent the indi ator or cor firm absence of inc cato s.)

Dh	Matri		Redox Fures					
(inches)	Color	%	Color	%	Type*	**	Texture	Remarks
0-4	10yr4/3						Loam / Clay	
4-13	10yr5/6						Loam / Clay	

*Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand grains **Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted)				Indicators for Problematic Hydric Soils ***	
	Histosol (A1)		Stripped Matrix (S6)		2 cm Muck (A10) (MRLA 147)
	Histic Epipedon (A2)		Dark Surface (S7)		Coast Prairie Redox (A16) (MLRA 147, 148)
	Black Histic (A3)		Polyvalue Below Surface (S8) (MLRA 147, 148)		Piedmont Floodplain Soils (F19) (MLRA 136, 147)
	Hydrogen Sulfide (A4)		Thin Dark Surface (S9) (MLRA 147, 148)		Very Shallow Dark Surface (TF12)
	Stratified Layers (A5)		Loamy Gleyed Matrix (F2)		Other (Explain in Remarks)
	2 cm Muck (A10) (LRR N)		Depleted Matrix (F3)		
	Depleted Below Dark Surface (A11)		Redox Dark Surface (F6)		***** Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.**
	Thick Dark Surface (A12)		Depleted Dark Surface (F7)		
	Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)		Redox Depressions (F8)		
			Fe-Mn Masses (F12) (LRR N, MLRA 136)		
	5 cm Mucky Peat or Peat (S3)		Umbric Surface (F13) (MLRA 136, 122)		
	Sandy Gleyed Matrix (S4)		Piedmont Floodplain Soils (F19) (MLRA 148)		
	Sandy Redox (S5)		Red Parent Material (F21) (MLRA 127, 147)		

Restrictive Layer (if observed)

Type: no

Depth (inches): ______

Hydric Soil Present? Yes ______ **No** X

Remarks:

APPENDIX C

NC DWQ STREAM FORM

NC DWQ Stream Identification Form Version 4.11

Date: September 27, 2022	**Project/Site**: UNC Cogeneration Facility	**Latitude:** 35.905384
Evaluator: Nathan Weaver	**County:** Orange	**Longitude:** -79.061593
Total Points: 44.25 *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30**	**Stream Determination (circle one)** Perennial (>30)	**Other:** S1 *Stream ID*:

A. Geomorphology (Subtotal = 20)	Absent	Weak	Moderate	Strong	Score
1[a.] Continuity of channel bed and bank	0	1	2	3	Strong (3)
2. Sinuosity of channel along thalweg	0	1	2	3	Moderate (2)
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3	Strong (3)
4. Particle size of stream substrate	0	1	2	3	Strong (3)
5. Active/relict floodplain	0	1	2	3	Weak (1)
6. Depositional bars or benches	0	1	2	3	Moderate (2)
7. Recent alluvial deposits	0	1	2	3	Moderate (2)
8. Headcuts	0	1	2	3	Absent (0)
9. Grade control	0	0.5	1	1.5	Absent (0)
10. Natural valley	0	0.5	1	1.5	Moderate (1)
11. Second or greater order channel	No = 0		Yes = 3		Yes (3)

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 12)					
12. Presence of Baseflow	0	1	2	3	Strong (3)
13. Iron oxidizing bacteria	0	1	2	3	Moderate (2)
14. Leaf litter	1.5	1	0.5	0	Weak (1)
15. Sediment on plants or debris	0	0.5	1	1.5	Strong (1.5)
16. Organic debris lines or piles	0	0.5	1	1.5	Strong (1.5)
17. Soil-based evidence of high water table?	No = 0		Yes = 3		Yes (3)

C. Biology (Subtotal = 12.25)					
18. Fibrous roots in streambed	3	2	1	0	Absent (3)
19. Rooted upland plants in streambed	3	2	1	0	Absent (3)
20. Macrobenthos (note diversity and abundance)	0	1	2	3	Strong (3)
21. Aquatic Mollusks	0	1	2	3	Absent (0)
22. Fish	0	0.5	1	1.5	Absent (0)
23. Crayfish	0	0.5	1	1.5	Absent (0)
24. Amphibians	0	0.5	1	1.5	Strong (1.5)
25. Algae	0	0.5	1	1.5	Moderate (1)
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0				FACW (0.75)

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:
Many frogs and salamanders; Water beetles, snails, nematode worms, caddisfly without shell. Several of these species could indicate disturbed, lower quality water. But, given the abundance, and late time of growing season, I chose to give a strong score.

Sketch: