BROOKFIELD COMMONS PHASE 3

159 S. LEXINGTON AVENUE

WHITE PLAINS, NEW YORK

Remedial Investigation Work Plan

BCP Site Number: C360246
AKRF Project Number: 210122

Prepared for:

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1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) has been prepared by AKRF, Inc. (AKRF) on behalf of Trinity Brookfield Commons Phase Three Limited Partnership (the "Volunteer") for the "Brookfield Commons Phase 3" project site in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), located at 159 South Lexington Avenue in White Plains, New York (the "Site"). The 1.284-acre Site is also identified as part of White Plains Tax Block 7, Part of Lot 1, Section 125.83. The Site is located in a mixed-use residential, commercial, and institutional area and is developed with a vacant nine-story apartment building with a basement and was surrounded by lawns and asphalt-paved walkways. The Site is part of a multi-story apartment building complex identified as Brookfield Commons or Winbrook. A Site Location Plan is provided as Figure 1.

The project is entered the NYSDEC Brownfield Cleanup Program (BCP) at the investigation stage. A Limited Subsurface (Phase II) Investigation was conducted by AKRF in April 2021 and the findings are included in a Limited Subsurface (Phase II) Investigation Letter Report dated September 2021, which were submitted to the NYSDEC as part of the BCP application. The investigation identified metals and polychlorinated biphenyls (PCBs) in soil, petroleum-related and chlorinated volatile organic compounds (VOCs) in soil vapor samples, and chlorinated VOCs in groundwater at concentrations exceeding the state Class GA Ambient Water Quality Standards and Guidance Values (AWQSGVs). Figures 3 through 6 show the 2021 sampling locations, soil and groundwater concentrations above their respective standards, and soil vapor concentrations.

This RIWP describes the procedures to be used to further investigate and define the nature and extent of the contamination in on-site soil, groundwater, and soil vapor and to establish remedial action objectives, evaluate remedial action alternatives, and select a remedy pursuant to the BCP. The data compiled from the Remedial Investigation (RI) and the Phase II will be used to complete a Remedial Action Work Plan (RAWP). The RI would be completed prior to start of any remedial action/excavation at the Site. All work will be completed in accordance with this RIWP, which includes a Quality Assurance Project Plan (QAPP) (Appendix A) and a Health and Safety Plan (HASP) (Appendix B) and a Community Air Monitoring Plan (CAMP) (Appendix C) will be implemented during all subsurface disturbance activities at the Site, including, but not limited to, advancement and backfilling of soil borings and installation of monitoring wells and temporary soil vapor points for sample collection. The RI field activities within the existing building will be conducted using appropriate equipment prior to demolition activities.

2.0 SITE DESCRIPTION AND HISTORY

2.1 Site Description and Surrounding Land Use

The Site consists of the approximately 1.284-acre parcel developed with a vacant nine-story apartment building with a basement and surrounding lawns and walkways, which were part of a multi-story apartment building complex identified as Brookfield Commons or Winbrook. The buildings were constructed between 1949-1950.

The Site is located in a mixed-use commercial, institutional, and residential neighborhood and is bounded to the north and east by the construction site of the new Brookfield Commons multi-story residential apartment building, known as "Phase 2 or The Overture"; to the south by a parking lot associated with the Winbrook complex, followed by a vacant lot and various commercial uses and former filling stations; and to the west by South Lexington Avenue, followed by various commercial use. The area surrounding the Site generally consists of mixed-use commercial, residential, and institutional properties. A Site Location Map is provided as Figure 1. Surrounding land use is shown on Figure 2.

Based on online White Plains tax and zoning map available on the Westchester County Geographic Information Systems (GIS) website, the Site was zoned as B-3 (business, office and commercial) and classified as 411 (apartments).

2.2 Proposed Site Remediation and Redevelopment

The proposed redevelopment includes demolition of the existing, vacant nine-story apartment building and construction of a 11-story, 174-unit multi-family mixed-income affordable housing building.

The building demolition activities will be completed following completion of the remedial investigation. The Proposed Project will include 90 units of replacement housing, 82 units of new non-WPHA affordable units, and 1 superintendent's unit, associated parking, and community space. Based on the planned development, excavation to approximately 2 to 15 feet below grade is anticipated.

Based upon the proposed redevelopment excavation depths/grades, it is anticipated that remedial measures will be required beneath the basement of the existing building, which will be further evaluated as part of the Remedial Action Work Plan (RAWP) based upon the findings of the RI.

2.3 Site Geology, Hydrogeology, and Subsurface Characteristics

The topography in the general area of the Site is level. Based on the U.S. Geological Survey, White Plains, NY Quadrangle map, the Site is approximately 200 feet above the National Geodetic Vertical Datum of 1988 (an approximation of sea level).

Soil encountered during the April 2021 Limited Subsurface (Phase II) Investigation consisted of historic fill (sand, gravel, silt, concrete, brick, glass, and asphalt) to a depth of approximately 6 feet below grade, underlain by apparent native soils (silt, peat, sand, clay and gravel) to the terminus of the borings at 15 feet below grade. Groundwater was encountered between 4 to 6 feet below grade during the investigation. Groundwater is assumed to flow in a northwesterly direction toward the Bronx River, located approximately 1,600 feet away. However, actual groundwater flow can be affected by many factors including underground utilities, bedrock, and other factors beyond the scope of this study. There are no surface water bodies or streams at or adjacent to the Site.

Based upon the findings of a geotechnical evaluation, as described in Section 3.0, a upper semi-confining layer consisting of clay and/or silt was observed in five of the eight borings, at depths ranging from 3.5 to 15.0 feet bg, with thicknesses of 2.5 to 24 feet. For the remaining geotechnical boring locations, the confining layer would consist of the soft or intermediate to hard rock layers, which was observed at depths ranging from 20 to 30 feet bg.

Utilities, including electrical, sanitary sewer, telecommunications, and water service, serving the existing building are present on the northeast and southwest areas of the Site. Although these utilities will be avoided during the RI, their potential as preferential pathways will be evaluated during the RI.

2.4 Nearby Areas of Public Concern

A review of the existing uses within the surrounding area of the Site identified seven daycare facilities, two schools, White Plains Hospital, and several residential buildings within an approximately 3,000-foot radius. A Citizen Participation Plan (CPP) was prepared and submitted and approved by NYSDEC on March 6,2024, following execution of the Brownfield Cleanup Agreement (BCA).

Land uses immediately to the north of the Project Site include residential uses, followed by institutional and government uses; to the south is retail and the White Plains Hospital, farther to the south; residential uses, followed by commercial and institutional uses to the east; and commercial and residential uses to the west. Overall, the surrounding area is generally built out with a mix of institutional/governmental, residential, community, and commercial uses.

Section 3.0 of this RIWP includes a summary of previous investigation for the Site, inclusive of a Phase I Environmental Site Assessment (ESA). The Phase I ESA reviewed environmental databases to identify historical on-site and off-site contaminated sites and/or spills. Historic closed spills were identified on the larger Winbrook complex, which are all outside the boundaries of the Site. In addition, a spill listing was identified at a former filling station at 26 East Post Road, approximately 100 feet south of the Property. Based on information provided to AKRF, this spill resulted in a plume of petroleum-contaminated groundwater extending from the former filling station onto the larger Winbrook complex. Another off-site spill listing was identified at a gas station at 34 East Post Road, approximately 90 feet southeast of the Property. According to the listing and information provided to AKRF, soil and groundwater contamination was reported downgradient of this facility. Additional details regarding these spill listings are described in Section 3.0.

2.5 Site History

Based on review of historical Sanborn maps, the Property was developed with small residential buildings and associated garages, multiple three to four-story apartment buildings, an upholsterer, and an auto repair shop between 1900 and 1942. These structures were demolished for construction of the existing apartment building and grounds, which were constructed in 1949-1950 as part of the Winbrook housing complex.

3.0 PREVIOUS INVESTIGATIONS

Phase I Environmental Site Assessment – Brookfield Commons Phase 3, 159 South Lexington Avenue, White Plains, New York, AKRF, Inc., June 2021

AKRF, Inc. (AKRF) performed a Phase I ESA of the Property in July 2021. The Property was developed with a nine-story apartment building with a basement and surrounding lawns and walkways, which were part of a multi-story apartment building complex identified as Brookfield Commons or Winbrook. Historical Sanborn maps indicated that the Property was vacant in 1900. Between 1900 and 1942, the Property was developed with small residential buildings and associated garages, multiple three to four-story apartment buildings, an upholsterer and an auto repair shop. These structures were demolished for construction of the existing apartment building and grounds, which were constructed in 1949-1950 as part of the Winbrook housing complex.

The following Recognized Environmental Condition (RECS) were identified:

- Historical land uses on the Property included auto repair and an upholsterer.
- Numerous nearby active- and closed-status petroleum spills, petroleum bulk storage facilities, hazardous waste generators (including generators of chlorinated solvents), and a State BCP site were reported in regulatory databases, including closed-status spills located on off-site areas of the Winbrook complex.
- Active-status NYSDEC Spill No. 9713110 was reported at a former filling station at 26 East Post Road, approximately 100 feet south of the Property. Based on information provided to AKRF, this spill resulted in a plume of petroleum-contaminated groundwater extending from the former filling station onto the Winbrook complex (south-adjacent parking lot of the Property). Remedial activities included removal of contaminated soil, groundwater, and soil vapor, and installation and sampling of numerous groundwater monitoring wells. Groundwater sampling of wells associated with this spill in August and November 2016 did not identify significant concentrations of petroleum-related volatile organic compounds in the wells located on the Property. However, some wells on the Winbrook complex contained chlorinated VOCs, including tetrachloroethylene (PCE) at up to 1,000 parts per billion (ppb) and trichloroethene (TCE) at up to 55 ppb. The source of these chlorinated VOCs has not been identified.
- Active-status NYSDEC Spill No. 1608924 was reported in September 2015 at the gas station at 34 East Post Road, approximately 90 feet southeast of the Property. According to the listing and information provided to AKRF, soil and groundwater contamination was reported downgradient of this facility, and additional investigations were conducted in 2014-2016. Listing detail indicated: a Consent Order was executed by the NYSDEC in February 2018; a Remedial Action Work Plan was submitted to the NYSDEC in January 2019; and, as of August 2019, the City of White Plains intended to take over ownership of the property through the eminent domain process. Three additional closed-status spills were reported at this address.

The following De Minimis Conditions were identified:

- Demolition debris from historical structures on the Property and/or fill materials of unknown origin may be present in the subsurface.
- Chemical storage at the Property included two 5-gallon bucket of hydraulic oil, and cleaning and maintenance chemicals in containers up to one-gallon, which were stored in the basement. The observed chemicals were generally neatly stored and labeled.

In addition, the following considerations outside the scope of ASTM Practice E 1527-13 were identified in connection with the Property:

- Based on the age of the building, window caulking, electrical equipment, fluorescent lighting fixtures, and hydraulic compactor equipment may contain PCBs. In addition, electrical equipment (e.g., switches and thermostats) and fluorescent lamps may contain mercury.
- Suspect asbestos-containing material (ACM) were observed at the Property. Suspect ACM were noted to be in generally good to damaged condition. ACM may also be present in demolition debris in the subsurface at the Property.
- Based on the age of the Property building, lead based paint (LBP) may be present on indoor and/or outdoor surfaces. Painted surfaces were observed to be in generally good to fair condition. LBP may also be present in demolition debris in the subsurface at the Property.

Limited Subsurface Investigation Letter Report, Brookfield Commons Phase 3, 159 South Lexington Avenue, White Plains, New York, AKRF, Inc., September 2021

AKRF conducted a Limited Subsurface Investigation (SI) at the site in April 2021, which included the advancement of six soil borings with the collection and laboratory analysis of 12 soil samples; the installation of four temporary groundwater monitoring wells with the collection and laboratory analysis of four groundwater samples; and the collection of four soil vapor samples from temporary soil vapor points. Findings of the investigation are summarized below:

- A geophysical survey was conducted to locate below grade utilities and potential anomalies, and to clear the boring locations. No anomalies indicative of a UST were identified.
- Subsurface materials consisted of historic fill (sand, gravel, silt, concrete, brick, glass, and asphalt) to approximately six ft below grade surface (bgs), underlain by apparent native soils (silt, peat, sand, clay and gravel) to the terminus of the borings (maximum of 15 feet bgs). Groundwater was encountered between 4 to 6 ft bgs during the investigation. Slightly elevated photoionization detector (PID) readings of up to 1.6 parts per million (ppm) were noted throughout the soil column in soil boring SB-04, and readings of less than 1 ppm were noted near the surface in soil borings SB-01 and SB-05. No petroleum-like odors or other visual evidence of gross contamination was noted in the soil borings. No separate phase product was detected in the purge water from any of the temporary groundwater wells. Elevated PID readings of 7.3 and 5.6 ppm were noted in the purge vapors from SV-01 and SV-04, respectively. Bedrock was not encountered during the investigation.
- Soil sample results are summarized below:
    - Barium, copper, lead, mercury, silver and zinc were detected above the NYSDEC Part 375 Unrestricted Use Soil Cleanup Objectives (UUSCOs) in at least one of the soil samples. Lead was detected above its NYSDEC Part 375 Restricted Residential (RRSCO) and PGWSCO in five of the soil samples. Barium and copper were detected above their RRSCOs in two samples and mercury was detected above its PGWSCO in one sample, all from within the historic fill layer.
    - The PCB Aroclor 1254 was detected in one soil sample above the UUSCO but below the RRSCO and Protection of Groundwater Soil Cleanup Objective (PGWSCOs) for total PCBs.
    - No VOCs or SVOCs were detected above their respective UUSCO, RRSCO, and PGWSCOs in any of the soil samples
- Groundwater sample results are summarized below:

  - PCE was detected above AWQSGVs in two groundwater samples. Cis-1,2-dichloroethylene, TCE, and vinyl chloride were also detected above their respective AWQSGVs in one groundwater sample.

- Soil vapor sample results:
  - Petroleum-related and chlorinated VOCs were identified in the soil vapor samples collected across the Site. VOCs associated with petroleum [including benzene, toluene, ethylbenzene, and xylenes (collectively referred to as BTEX)] were detected at variable concentrations in all the soil vapor samples analyzed. Other petroleum-related VOCs, solvents, and chlorofluorocarbons were also detected in the samples.
  - The chlorinated VOC, PCE, was detected in all the soil vapor samples collected. PCE was detected above its State of New York Air Guideline Values (AGV) of 30 $\mu g/m^3$ in one sample SV-04.

As discussed in Section 5.1.5, the analytical data collected as part of the Limited SI conducted in 2021 included Category B deliverables. This data will be validated, a DUSR will be prepared, and incorporated in the RI report, as appropriate, to supplement the data collected as part of the RI.

Final Geotechnical Evaluation Report, Brookfield Commons Phase 3, 161 South Lexington Avenue, White Plains, New York, GEODesign, Inc. P.C., September 2021

GEODesign, Inc. P.C. (GEODesign) performed a geotechnical evaluation of the Site in 2021, which included six boring (GD-1 through GD-6) and referenced two geotechnical borings performed by AKRF in 2017 (B-6 and B-7), included in Appendix D. The geotechnical evaluation provided six generalized strata descriptions for the site, including:

- Stratum 1 – Uncontrolled Fill: The thickness of this stratum is estimated to be less than 5 feet.
- Stratum 2 – Upper Sand: The thickness of this stratum is approximately 5 feet and it is considered a loose material.
- Stratum 3 – Silt: This stratum was encountered in five of the borings and generally consists of brown and gray silt with varying amounts of sand, clay, and gravel. The thickness of this stratum is approximately 5 to 25 feet and it is considered a medium dense material.
- Stratum 4 – Lower Sand: This stratum generally consists of brown and gray coarse to fine sand with varying amounts of silt and gravel. The thickness of this stratum is approximately 10 to 15 feet and it is considered a very dense material.
- Stratum 5 –Soft Rock: This stratum generally consists of white to light gray decomposed granite. The thickness of this stratum is approximately 0 to 10 feet and it is considered a very dense material.
- Stratum 6 – Intermediate to Hard Rock: This stratum generally consists of white and gray medium to fine grained schist, gneiss, and granite that was slightly to moderately fractured with fresh to moderately weathered joints.

4.0 FIELD PROGRAM

The RI field program will focus on collecting soil, groundwater, and soil vapor data to determine the nature and extent of Site contamination and to assist with determining the appropriate remedial action.

4.1 Field Program Summary

A geophysical survey was conducted as part of the Limited Subsurface Investigation. However, due to the presence of numerous utilities, a second geophysical survey will be conducted across all accessible portions of the Site to refresh markouts indicating the presence of potential USTs and underground utilities, and to clear the proposed sampling locations. The field sampling scope of work consists of: the advancement of nine soil borings with the collection and laboratory analysis of two soil samples per boring; the installation of eight shallow and three deep groundwater monitoring wells with the collection and laboratory analysis of 11 groundwater samples; and the installation of seven soil vapor points with the collection and laboratory analysis of seven soil vapor samples. The proposed sample locations are shown on Figure 7.

The soil boring and temporary soil vapor point locations will be surveyed using a Global Positioning System (GPS) and will be measured off fixed points in the field. The groundwater monitoring wells will be surveyed by a New York State-licensed surveyor. Any field evidence of contamination (visual, olfactory, and/or elevated PID readings) will be recorded on logs for inclusion in the Remedial Investigation Report (RIR). All sampling equipment will be either dedicated or decontaminated between sampling locations.

The scope of work will be conducted by AKRF and its subcontractors. Qualifications for AKRF personnel are included in Section 2.0 of Appendix A. The following sections describe the methods that will be used to complete the aforementioned scope of work.

4.2 Geophysical Survey

The geophysical survey will include ground-penetrating radar (GPR) and magnetometry. GPR uses electromagnetic wave propagation and scattering to image and identify changes in electrical and magnetic properties in the ground. Magnetometers measure irregularities in the magnetic field in a given area. Any anomalies indicative of UST(s) will be marked in the field and surveyed using a GPS.

4.3 Soil Boring Advancement and Sampling

A Geoprobe™ direct-push drill rig will be used to collect soil samples from 14 locations (RI-SB-01 through RI-SB-14), shown on Figure 7, to assess soil quality throughout the Site. Groundwater is anticipated to be encountered between 4 to 6 feet below grade, and the silty-clay semi-confining layer is anticipated to be encountered, if present, at depths ranging from approximately 3.5 to 15 feet bg. Soil borings will be advanced at each location to 5 feet into the silty-clay semi-confining layer and to a minimum depth of 10 feet below grade. If the silty-clay semi-confining layer is not observed, the boring will be advanced to equipment refusal on presumed bedrock. Confining layer(s), if encountered, will be identified and described in the logs.

Five of the borings (SB-02, SB-03, SB-08, SB-12, and SB-13) will be advanced in the basement of the existing vacant building. A concrete core drill will be utilized to drill through the concrete slab and the drill rig will be used to complete the borings.

Soil samples will be inspected by AKRF field personnel for evidence of contamination (e.g., odors, staining), screened for VOCs with a PID equipped with a 10.6 electron volt (eV) lamp, and

continuously logged in a field book using the modified Burmister soil classification system. The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

At least two soil samples will be collected from each boring location. One soil sample will be collected from the upper 2-foot interval below existing grade surface, and one sample from the 2-foot interval directly above the groundwater interface. A third soil sample will be collected from the saturated zone (below the groundwater interface) from each boring location where a monitoring well will be installed (SB-01, SB-06 through SB-11, and SB-14). If obvious signs of contamination (e.g., staining, odors, or elevated PID readings) are observed in the saturated zone in the remaining boring locations, an additional (third) sample will be collected from the respective boring location(s) at the interval with the greatest evidence of contamination. In the absence of contamination, the saturated zone sample will be collected from the interval immediately above the confining layer (silty-clay layer or bedrock).

In addition, surface soil samples (collected from the 0-2-inch interval) will be collected at soil boring locations that are within existing green space or have exposed soil present (i.e., are not within a building or do not have a surface improvement layer such as asphalt, concrete, etc.). Refer to Figure 7 and In-Text Table 1 for anticipated surficial soil sample locations (RI-SB-01, RI-SB-05, RI-SB-10, and RI-SB-13).

If a confining layer is encountered above the groundwater interface, one additional sample will be collected, as appropriate, from the 2-foot interval directly above the confining layer.

In summary, at least two soil samples will be collected from each boring (one from the upper 2-foot interval and one from the interval directly above the groundwater interface). A third soil sample will be collected from the saturated zone of soil borings where a monitoring well will be installed and/or at the interval where obvious contamination is observed in the saturated zone. In the absence of contamination, the saturated zone sample will be collected from the interval immediately above the confining layer (silty-clay layer or bedrock). An additional surface sample will be collected from boring locations in green space or if surface soil is present.

Additional samples may be collected from some or all boring locations based on field findings (odors, elevated PID readings, staining, etc.) and sampling intervals may be biased by field findings. All sampling equipment (e.g., drilling rods and casing, macro core samplers) will be either dedicated or decontaminated between sampling locations.

Samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain-of-custody documentation in accordance with appropriate USEPA protocols to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory. The samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, the total analyte list (TAL) of metals by EPA Method 6000/7000 series plus hexavalent chromium by EPA Method 7196A, cyanide by EPA Method 9012B, 1,4-dioxane by EPA Method 8270, and per- and polyfluoroalkyl substances (PFAS) by EPA Method 1633 using Category B deliverables. The data will be reviewed by a third-party validator and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data.

After each boring is completed, the soil boreholes will be either filled with on-site materials (if not noticeably contaminated) or retrofitted with 2-inch-diamter permanent groundwater monitoring wells. If a confining layer is breached during the soil sampling activities, the boring will be grouted upon completion. Soil cuttings that cannot be used to backfill boreholes and require off-site disposal will be containerized in properly labeled Department of Transportation (DOT)-approved 55-gallon drums for off-site disposal at a permitted facility. If on-site material is

not enough for backfilling the boreholes to grade, concrete or bentonite will be used to fill the borehole to grade. Disposable sampling equipment, including spoons, gloves, bags, paper towels, etc. that come in contact with environmental media will be double-bagged and disposed of as municipal trash in as non-hazardous refuse.

The rationale for the proposed soil sample locations is summarized in In-Text Table 2.

In-Text Table 2
Proposed Soil Sample Rationale

Soil Boring ID	On-Site Location	Analytical Parameters	Rationale
RI-SB-01	Northwestern	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent chromium, cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the northwest portion of the Site, including a surface soil sample.
RI-SB-02	Northwestern	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent chromium, cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the northwest portion of the Site (beneath the existing building), in the footprint of the new building.
RI-SB-03	North-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the north-central portion of the Site (beneath the existing building), in the footprint of the new building near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater.
RI-SB-04	Northeast-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the northeast-central portion of the Site, in the footprint of the new building near where elevated metals were previously detected in soil.
RI-SB-05	West-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the west-central portion of the Site, in the footprint of the new building, near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater, including a surface soil sample.
RI-SB-06	Southwest	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality along the southwestern portion of Site.
RI-SB-07	South-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality along the south-central portion of Site.
RI-SB-08	Central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the central portion of Site (beneath the existing building).
RI-SB-09	Northeast	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality at the northeast border of Site. near where elevated metals were previously detected in soil.

In-Text Table 2
Proposed Soil Sample Rationale

Soil Boring ID	On-Site Location	Analytical Parameters	Rationale
RI-SB-10	North-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the north-central portion of Site, near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater and soil vapor, including a surface soil sample.
RI-SB-11	South-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the south-central portion of Site, near the proposed location of the drainage tank, near where elevated metals were previously detected in soil. including a surface soil sample.
RI-SB-12	Central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the central portion of Site (beneath the existing building).
RI-SB-13	North-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the north-central portion of Site (beneath the existing building), near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater and soil vapor.
RI-SB-14	Southeast	VOCs, SVOCs, Pesticides, PCBs, Metals, Hexavalent Chromium, Cyanide, 1,4-Dioxane, and PFAS	To assess soil quality in the south-east portion of Site.
Notes: QA/QC sampling is discussed in Section 4.8.			

4.4 Groundwater Monitoring Well Installation and Development

Eight permanent shallow groundwater monitoring wells (denoted as RI-MW-01 through RI-MW-08) will be retrofitted into previously advanced soil borings using a Geoprobe™ direct-push drill rig equipped with hollow stem augers at the proposed locations shown on Figure 7. The shallow wells will be constructed with 10 feet of 2-inch diameter 0.02-inch slotted polyvinyl chloride (PVC) well screen set approximately 5 feet below the water table and 5 feet above the water table, which is expected to be encountered at approximately 4 to 6 feet below grade, and a 2-inch diameter solid PVC riser installed to grade.

Three permanent deep monitoring wells (MW-01D, MW-02D, and MW-07D) will be installed adjacent to three of the shallow wells (MW-01, MW-02, and MW-07). The screen intervals of the three deep wells will be installed immediately above the deeper confining layer such as the silty-clay confining layer and/or bedrock. The deep wells will be constructed with 5 to 10 feet of 2-inch diameter 0.02-inch slotted PVC well screen and a 2-inch diameter solid PVC riser installed to grade.

A No. 2 morie sandpack will be installed from the base of the well to approximately 2 feet above the well screen. The annular space around the solid well riser above the sandpack will be sealed with approximately 2 feet of bentonite followed by a non-shrinking grout/cement mixture to approximately one foot below grade. Each of the wells will be finished with a locking j-plug and

flush-mounted well cover with a concrete pad. Well construction logs will be prepared and included as an appendix to the RIR.

The well depths and screen intervals may be adjusted based upon the field findings, including any observed contamination and/or confining layer(s). NYSDEC will be consulted if any deviations to the well construction details described herein are required.

Following installation, each groundwater monitoring well will be developed via pumping and surging to remove any accumulated fines and establish a hydraulic connection with the surrounding aquifer. Development will continue until turbidity within the well is less than 50 nephelometric turbidity units (NTUs) for three successive readings; and until water quality indicators have stabilized to within 10% for pH, temperature, and specific conductivity for three successive readings. In the event that 50 NTUs cannot be achieved, at least three well volumes will be purged from the well. Well development details will be noted on groundwater development logs, included as an appendix to the RIR.

The rationale for the proposed groundwater sample locations is summarized in In-Text Table 3.

In-Text Table 3
Proposed Groundwater Sample Rationale

Soil Boring ID	On-Site Location	Analytical Parameters	Rationale
RI-MW-01	Northwestern	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality in the northwest portion of the Site and define Site-specific groundwater flow direction and elevation.
RI-MW-02	North-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality in the north-central portion of the Site, near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater and soil vapor, and define Site-specific groundwater flow direction and elevation.
RI-MW-03	Southwest	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality along the southwestern portion of Site and define Site-specific groundwater flow direction and elevation.
RI-MW-04	South-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality along the south-central portion of Site and define Site-specific groundwater flow direction and elevation.
RI-MW-05	Central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality in the central portion of Site (beneath the existing building) and define Site-specific groundwater flow direction and elevation.
RI-MW-06	Northeast	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality in the northeast portion of Site near where elevated metals were previously detected in soil and define Site-specific groundwater flow direction and elevation.

In-Text Table 3
Proposed Groundwater Sample Rationale

Soil Boring ID	On-Site Location	Analytical Parameters	Rationale
RI-MW-07	South-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality in the south-central portion of Site near the proposed location of the drainage tank, and near where elevated metals were previously detected in soil and VOCs were previously detected in groundwater.
RI-MW-08	Southeast	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	To assess groundwater quality along the southeast portion of Site and define Site-specific groundwater flow direction and elevation.
RI-MW-01D	Northwestern	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	Deep well to assess groundwater quality in the northwest portion of the Site.
RI-MW-02D	North-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	Deep well to assess groundwater quality in the north-central portion of the Site.
RI-MW-07D	South-central	VOCs, SVOCs, Pesticides, PCBs, Metals, Cyanide, 1,4-Dioxane, and PFAS	Deep well to assess groundwater quality int the south-central portion of Site.
Notes: QA/QC sampling is discussed in Section 4.8.			

4.5 Groundwater Elevation Survey

The groundwater monitoring wells will be surveyed by a New York State-licensed surveyor to determine their accurate location and elevation. Two elevation measurements will be taken at each well location: the at-grade elevation; and the elevation of the top of PVC casing (north side at marking), to facilitate preparation of a groundwater contour map and to determine the direction of groundwater flow. The elevation datum for the sampling points will be based on NAVD 88 Elevation Datum. The groundwater elevation survey will be included as an appendix to the RIR.

4.6 Groundwater Sampling

In accordance with EPA low-flow sampling protocols, the wells will be sampled one to two weeks following their development. Prior to sampling, an electronic interface meter will be used to measure water levels and a bailer will be used to measure any separate phase liquid. The purge water will be monitored for turbidity and water quality indicators [i.e., pH, dissolved oxygen, oxidation-reduction potential (ORP), temperature, and specific conductivity] with measurements collected approximately every 5 minutes. The criteria for stabilization will be three successive readings within the following limits:

- Turbidity (10% for values greater than 5 NTU; if three turbidity values are less than 5 NTU, consider the values as stabilized).
- Dissolved Oxygen (10% for values greater than 0.5 mg/L. If three values are less than 0.5 mg/L, consider the values as stabilized).
- Specific Conductance (3%).

- Temperature (3%).
- pH (±0.1 unit).
- Oxidation/Reduction Potential (±10 minivolts).

Well purge water will be returned to the well, unless it displays field evidence of gross contamination. Purge water displaying field evidence of contamination will be containerized in properly labeled, DOT-approved 55-gallon drums for off-site disposal at a permitted facility.

Groundwater samples slated for laboratory analysis will be placed in laboratory-supplied containers and shipped in accordance with appropriate EPA protocols to a NYSDOH ELAP-certified laboratory. The samples will be analyzed for VOCs by EPA Method 8260, SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, total and dissolved TAL metals by EPA Method 6000/7000 series, cyanide by EPA Method 9012B, PFAS by EPA Method 1633, and 1,4-dioxane by EPA Method 8270 selected ion monitoring (SIM) using Category B deliverables. Filtering of metals will occur in the field. Well sampling details will be noted on groundwater sampling logs, included as an appendix to the RIR.

4.7 Soil Vapor and Ambient Air Sampling

Seven soil vapor samples (denoted as RI-SV-01 through RI-SV-07) will be collected from seven temporary vapor monitoring points at the approximate locations shown on Figure 7. Soil vapor point installation and sampling will be performed in accordance with the guidelines provided in the NYSDOH document entitled, "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006." The soil vapor points will be installed adjacent to the corresponding soil boring at a minimum of 2 feet above the observed water table.

All soil vapor monitoring points will be installed by advancing an expendable drive point using a direct-push drilling rig to the specified depth below grade. At each monitoring point, a 6-inch stainless steel screen implant, connected to Teflon tubing will be installed by hand or through the drilling rods and threaded into the drive point. The sampling tubing will extend from the end of the screen to above grade. The push probe rods will then be removed and the boring will be backfilled with clean silica sand to 3 to 6 inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

The soil vapor samples will be collected over a 2-hour time period from each monitoring point using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum rate of 0.2 liter per minute. Prior to sample collection, the sampling points will be purged of three sample volumes using a low-flow air sampling pump. During purging, an inverted 5-gallon bucket will be placed over the sampling point and helium gas will be introduced through a small hole in the bucket to saturate the atmosphere around the sample port with helium gas. Purged vapors will be collected into a Tedlar bag and field-screened for organic vapors using a PID and for methane using a landfill gas meter or similar instrument. The purged air will also be monitored using a portable helium detector to check for short-circuiting of ambient air into the vapor sampling point. If the purged soil vapor contains greater than 10% helium, additional bentonite will used to enhance the surface seal, and the point will be retested.

Following purging, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a 2-hour regulator, the initial SUMMA canister vacuum (inches of mercury) will be noted. After 2 hours, the flow controller valve will be closed, the final vacuum noted, and the canister placed in a shipping carton for delivery to the laboratory.

All samples will be analyzed for VOCs according to USEPA Method TO-15 by a NYSDOH-certified laboratory with Category B deliverables. Samples will be shipped to the laboratory with appropriate chain of custody documentation. No sample preservation is required for soil vapor or ambient air samples. The data will be reviewed by a third-party validator and a DUSR will be prepared to document the suitability of using the data.

The rationale for the proposed soil vapor sample locations is summarized in In-Text Table 4.

In-Text Table 4
Proposed Soil Vapor Sample Rationale

Vapor Point ID	On-Site Location	Analytical Parameter	Rationale
RI-SV-01	Northwestern	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination in the footprint of the new building.
RI-SV-02	North-central	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination, in the footprint of the new building.
RI-SV-03	Northeast-central	VOCs	To evaluate the nature and extent VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination, in the footprint of the new building.
RI-SV-04	Southwest	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination, in the footprint of the new building.
RI-SV-05	South-central	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination.
RI-SV-06	Southeast	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination.
RI-SV-07	Southern	VOCs	To evaluate the nature and extent of VOCs detected in soil vapor during the limited subsurface investigation and to complete the significant threat determination.

4.8 Quality Assurance / Quality Control (QA/QC)

Additional analysis will be included for quality control measures, as required by the Category B sampling techniques. The QA/QC samples for soil and groundwater will include one field blank, one trip blank, one matrix spike/matrix spike duplicate (MS/MSD), and one blind duplicate sample at a frequency of one sample per 20 field samples per media. The field blank, blind duplicate, and MS/MSD samples will be analyzed for the same analyte list as the accompanying field samples. The laboratory-prepared trip blanks will be submitted for analysis of VOCs only to determine the potential for cross-contamination. QA/QC samples accompanying the soil and groundwater samples will also be analyzed for PFAS by EPA Method 1633 and 1,4-Dioxane by EPA Method 8270 (SIM analysis will be used for groundwater samples). Additionally, one

equipment blank will be collected for each day of groundwater sampling and analyzed for PFAS by EPA Method 1633 only.

The QA/QC samples for soil vapor will include the collection of one ambient (outdoor) air sample and one duplicate soil vapor sample (collected via a split fitting from a select SV location). Both samples will be analyzed for VOCs by EPA Method TO-15. The QAPP describes the QA/QC protocols and procedures that will be followed during implementation of the RIWP. The QAPP is included as Appendix A.

4.9 Decontamination Procedures

All non-dedicated sampling equipment (e.g., submersible pumps and oil/water interface probe) will be decontaminated between sampling locations using the following procedure:

1. Scrub equipment with a bristle brush using a tap water/Alconox® solution.
2. Rinse with tap water.
3. Scrub again with a bristle brush using a tap water/ Alconox® solution.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment.

4.10 Management of Investigation-Derived Waste (IDW)

IDW that does not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be used to fill in the corresponding borehole. Soil and development and purge groundwater IDW exhibiting evidence of contamination will be containerized in DOT-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, development water, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available. All IDW will be disposed of or treated according to applicable local, state, and federal regulations and disposal documentation will be provided to NYSDEC.

5.0 REPORTING REQUIREMENTS

5.1 Remedial Investigation Report (RIR)

Upon completion of all field work and receipt of laboratory analytical results, an RIR will be prepared that will: document field activities; present field and laboratory data; evaluate exposure pathways in an exposure assessment; and discuss conclusions and recommendations drawn from the results of the investigation. All laboratory reports, monitoring well construction logs, groundwater quality purge/sampling logs, and soil vapor sampling logs will be included as appendices in the RIR.

5.1.1 Description of Field Activities

This section of the RIR will describe the field methods used to characterize the Site conditions, including: sampling techniques; field screening equipment; drilling and excavation equipment; monitoring well installation procedures; and management of IDW.

5.1.2 Soil Boring Assessment

The RIR will include a section that presents field and laboratory data for soil results. The section will include a description of soil characteristics and figures illustrating soil boring locations. Field and laboratory analytical results will be presented in the body of the report, summarized in tables and figures, and the detected concentrations will be compared to regulatory standards and/or guidance values. Soil boring logs and laboratory analytical reports will be provided as attachments. If a confining layer is encountered, it will be noted on the soil boring logs and described in the report. Category B deliverables will be provided by the laboratory and a third-party DUSR will be prepared.

5.1.3 Groundwater Assessment

The RIR will include a section that presents field and laboratory data from the groundwater monitoring results. The section will include a description of groundwater characteristics and figures will be provided that illustrate sample locations and results above applicable standards and guidelines. Category B deliverables will be provided by the laboratory and a third-party DUSR will be prepared.

5.1.4 Soil Vapor Assessment

The RIR will include a section that presents field and laboratory data for soil vapor results. Field and laboratory analytical results will be presented in the body of the report, summarized in tables and figures, and the detected concentrations will be presented in tables. Soil vapor sampling logs and laboratory analytical reports will be provided as attachments. Category B deliverables will be provided by the laboratory and a third-party DUSR will be prepared.

5.1.5 Phase II Investigation Results

The RIR will incorporate the soil, groundwater, and soil vapor results, as appropriate, from the Limited SI conducted in 2021. Category B deliverables were provided by the laboratory, and a third-party DUSR will be prepared.

5.1.6 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment will be performed in accordance with DER-10 Section 3.3. The assessment will be included in the RIR.

5.1.7 Green Sustainable Remediation (GSR)

As part of the remedial investigation, GSR strategies will be considered. AKRF will attempt to minimize mobilizations, utilize local contractors and staff, minimize investigation derived waste. The RI will indicate that GSR strategies have been considered.

6.0 SCHEDULE OF WORK

The following tentative schedule has been developed for the project. This schedule is subject to change.

In-Text Table 5
Proposed Project Schedule

Activity	Time To Complete
Submit BCP App & Draft RIWP to NYSDEC	August 23, 2023
NYSDEC Completeness Review	September 25, 2023
NYSDEC 30-Day Public Comment Period for BCP App & RIWP	September 30, 2023
NYSDEC Acceptance to BCP & Issuance of BCA	February 26, 2024
NYSDEC Comments for RIWP	March 15, 2024
Response to RIWP Comments & Approval by NYSDEC	April 30, 2024
Initiate RI Field Activities	May 6, 2024
Submit RI Report to NYSDEC	June 24, 2024
NYSDEC Approves RIR	July 24, 2024
Draft RAWP Submitted	July 24, 2024
45-day Public Comment Period for RAWP	August 2, 2024
NYSDEC Approves RAWP and Issues Decision Document	November 2, 2024
Issue Remedial/Construction Notice Fact Sheet	December 31, 2024
Begin Implementation of RAWP	January 1, 2025
Execution of Environmental Easement (if required)	January 1, 2026
Draft Site Management Plan (SMP) Submitted to NYSDEC	February 1, 2026
Draft Final Engineering Report and Fact Sheet	April 1, 2026
Certificate of Completion and Fact Sheet	July 1, 2026
Completion of Building (first occupancy)	July 1, 2026

7.0 CERTIFICATION

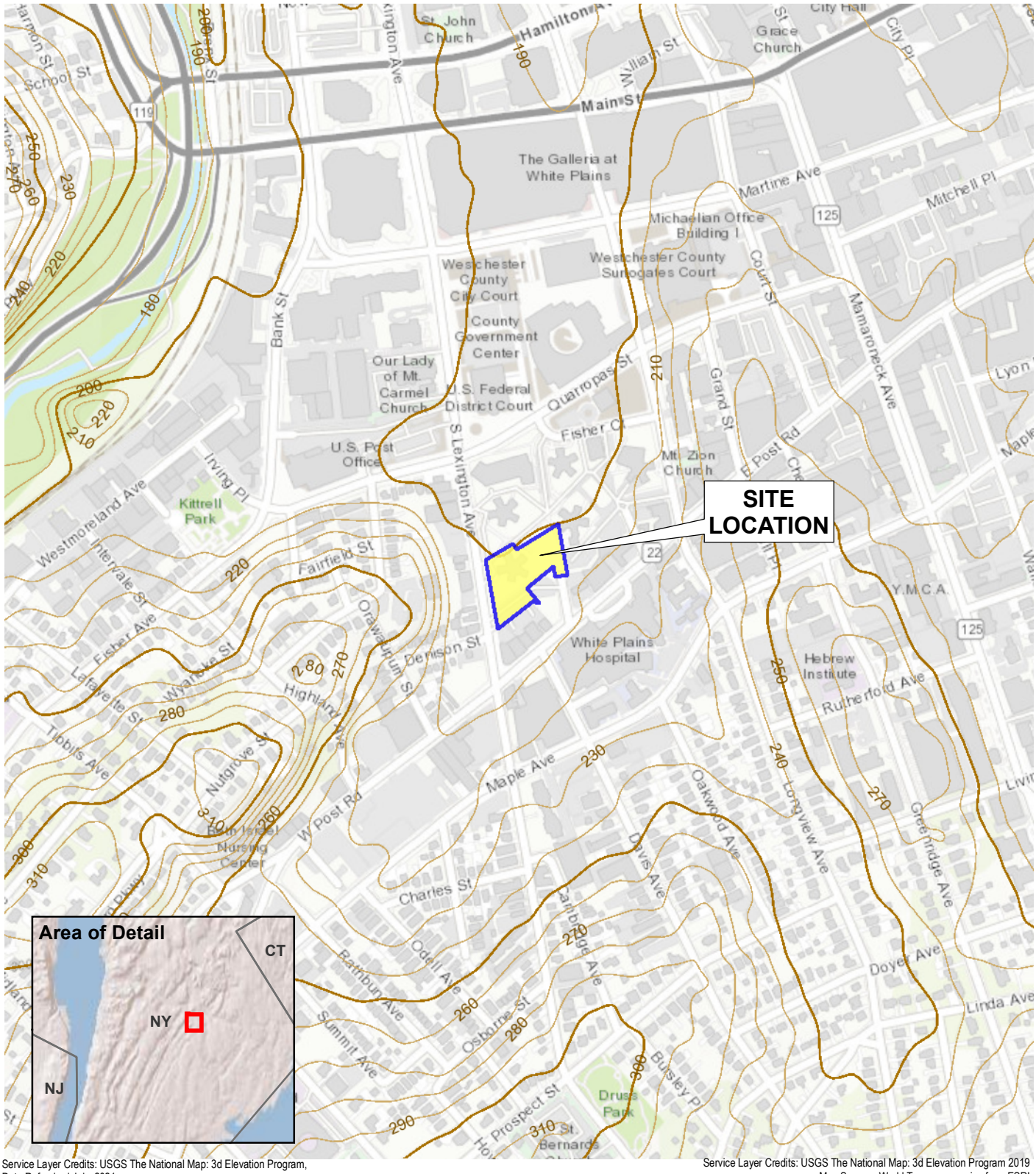
I, Marc S. Godick, QEP, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan (RIWP) was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Marc S. Godick, QEP		April 30, 2024
Name	*Signature*	*Date*

8.0 REFERENCES

1. Phase I Environmental Site Assessment – Brookfield Commons Phase 3, 159 South Lexington Avenue, White Plains, New York, AKRF, Inc., June 2021.
2. Limited Subsurface Investigation Letter Report, Brookfield Commons Phase 3, 159 South Lexington Avenue, White Plains, New York, AKRF, Inc., September 2021.
3. NYSDEC, 6 NYCRR Section 375-6: *Remedial Program Soil Cleanup Objectives (SCOs)*, December 14, 2006.
4. NYSDEC, Division of Water Technical and Operational Guidance Series (1.1.1), June 1998.
5. NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York Air Guideline Values (AGVs) and Table 3.3 Matrix 1 and 2 Chemicals, October 2006; revised in fact sheets released in September 2013 for tetrachloroethene (PCE) and August 2015 for trichloroethene (TCE), and in the May 2017 Matrix Values updates; and February 2024: Updates to Soil Vapor/Indoor Air Decision Matrices.

FIGURES



AKRF
34 South Broadway #401
White Plains, NY 10601

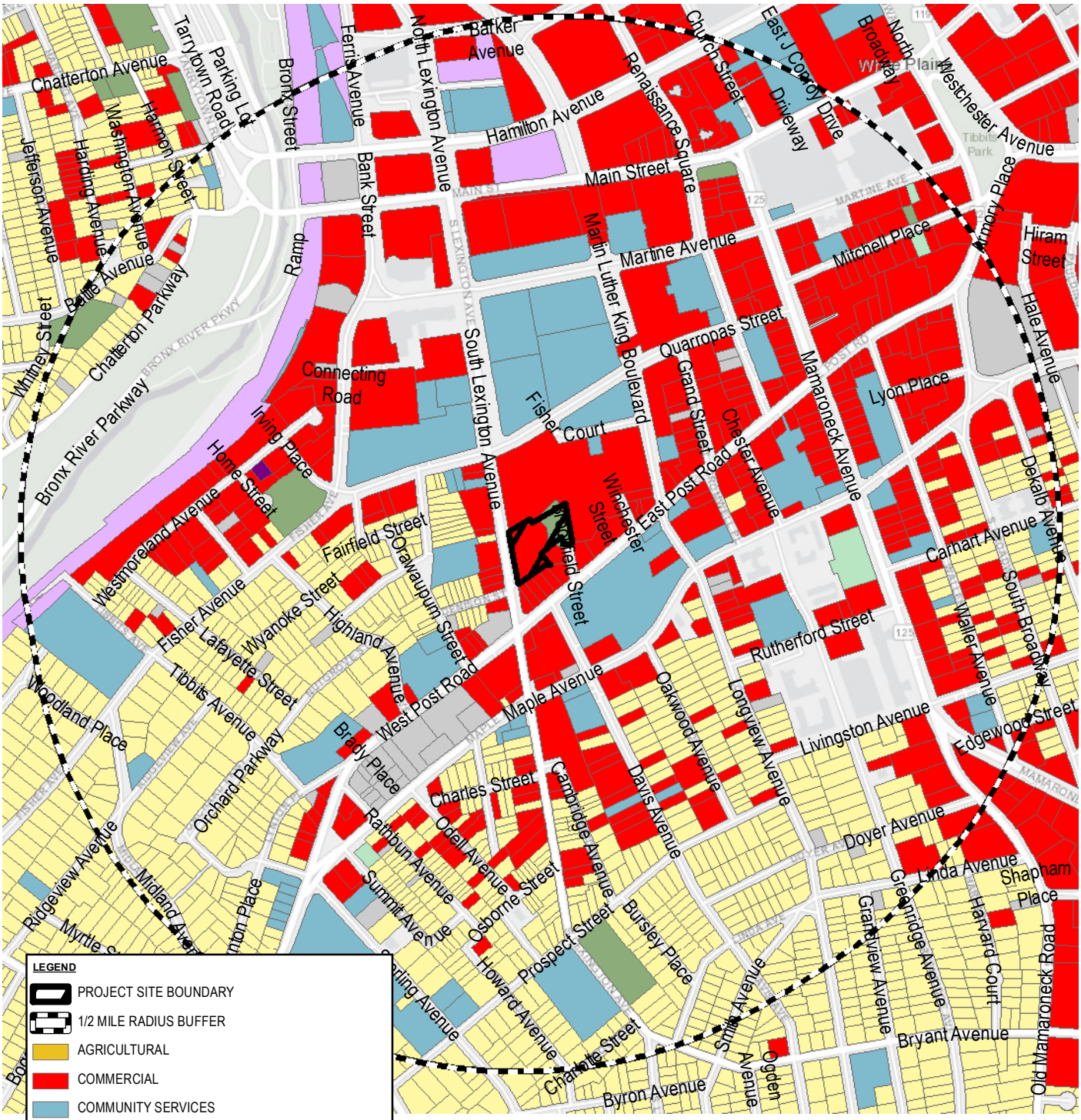
Brookfield Commons Phase 3
White Plains, New York

SITE LOCATION

DATE
8/10/2023

PROJECT NO.
210122

FIGURE
1



Map Source:
giswww.westchestergov.com (GIS database)

0 ¼
Miles

AKRF
34 South Broadway #401
White Plains, NY 10601

Brookfield Commons Phase 3
White Plains, New York

SURROUNDING LAND USE

DATE
3/25/2024

PROJECT NO.
210122

FIGURE
2

LEGEND

- PROJECT SITE BOUNDARY
- 130.27-2-1 — LOT BOUNDARY AND PRINT KEY (BLOCK AND LOT)
- SOIL BORING
- SOIL BORING/TEMPORARY WELL
- SOIL BORING/SOIL VAPOR POINT
- SOIL VAPOR POINT
- AMBIENT AIR SAMPLE LOCATION
- ESTIMATED GROUNDWATER FLOW DIRECTION

0 25 50 100

SCALE IN FEET

Map Source:
giswww.westchestergov.com (GIS database)

Aerial Source:
2021 New York Statewide Digital Orthoimagery

AKRF
34 South Broadway #401
White Plains, NY 10601

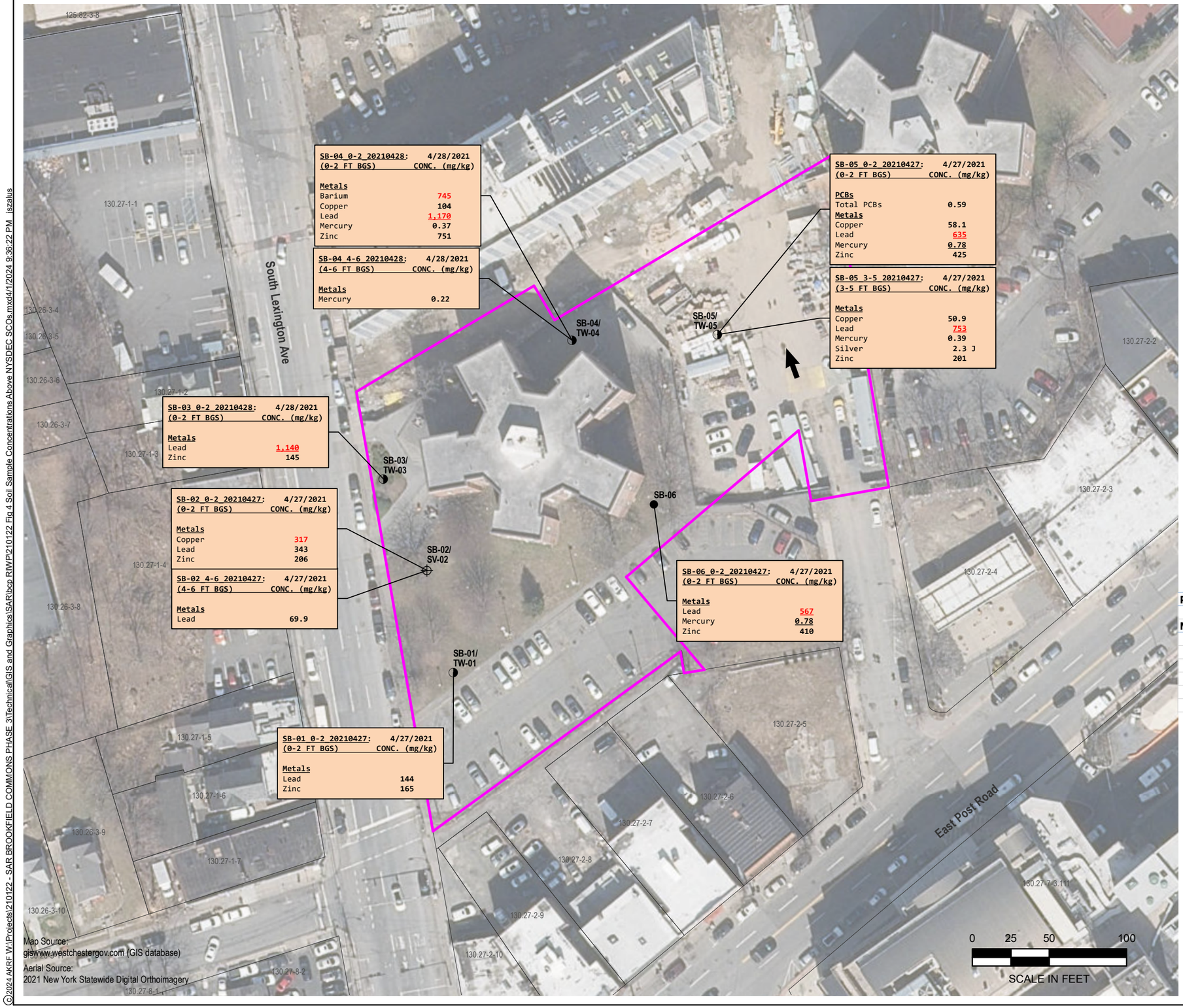
Brookfield Commons Phase 3
White Plains, New York

SITE PLAN AND 2021 SAMPLING LOCATIONS

DATE
4/1/2024

PROJECT NO.
210122

FIGURE
3



Map Source:
giswww.westchestergov.com (GIS database)

Aerial Source:
2021 New York Statewide Digital Orthoimagery

LEGEND

- PROJECT SITE BOUNDARY
- 130.27-2-1 LOT BOUNDARY AND PRINT KEY (BLOCK AND LOT)
- SOIL BORING
- SOIL BORING/TEMPORARY WELL
- SOIL BORING/SOIL VAPOR POINT
- ESTIMATED GROUNDWATER FLOW DIRECTION

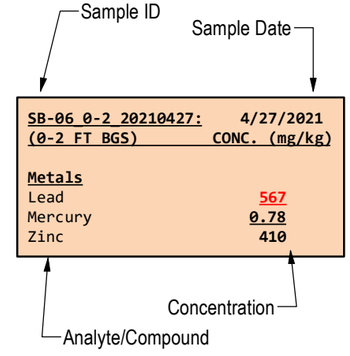
SOIL

Exceedances of NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs) are presented in **bold** font.
Exceedances of NYSDEC Restricted Residential Soil Cleanup Objectives (RRSCOs) are presented in red.
Exceedances of NYSDEC Protection of Groundwater Soil Cleanup Objectives (PGWSCOs) are presented in underlined font.

mg/kg:milligrams per kilogram = parts per million (ppm)

J: The concentration given is an estimated value.

	Part 375 PROTECTION OF GROUNDWATER mg/kg	PART 375 RESTRICTED RESIDENTIAL mg/kg	PART 375 UNRESTRICTED mg/kg
PCBs			
Total PCBs	3.2	1	0.1
Metals			
Barium	820	400	350
Copper	1720	270	50
Lead	450	400	63
Mercury	0.73	0.81	0.18
Silver	8.3	180	2
Zinc	2480	10000	109



AKRF
440 Park Avenue South, New York, NY 10016

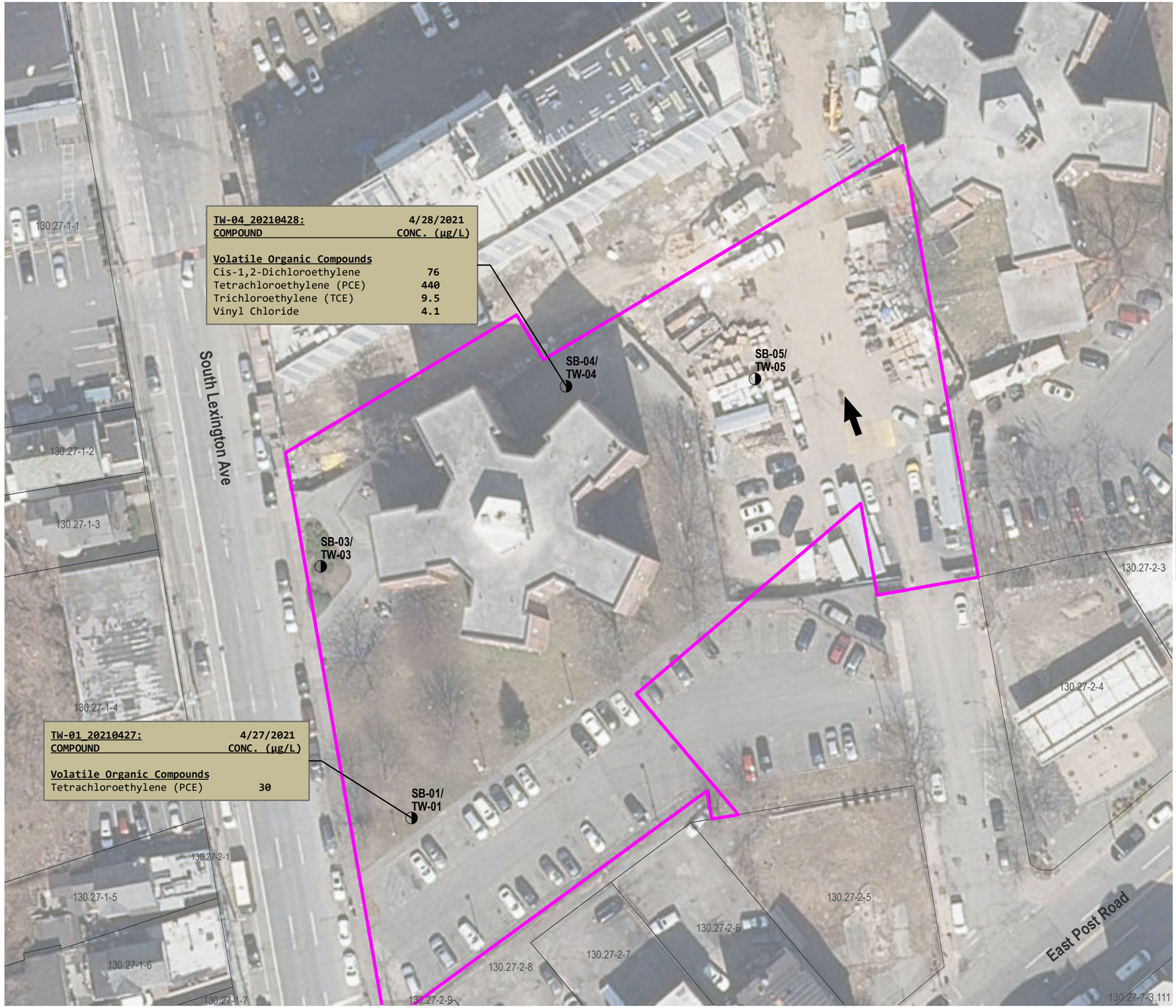
Brookfield Commons Phase 3
White Plains, New York

Soil Sample Concentrations Above NYSDEC SCOs

DATE
4/1/2024

PROJECT NO.
210122

FIGURE
4



LEGEND

- PROJECT SITE BOUNDARY
- 130.27-2-1 LOT BOUNDARY WITH BLOCK AND LOT NUMBER
- SOIL BORING/TEMPORARY WELL
- ESTIMATED GROUNDWATER FLOW DIRECTION

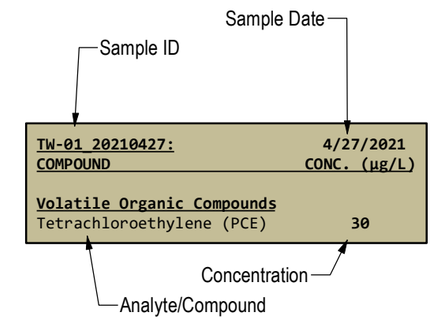
GROUNDWATER

NYSDEC TOGS Class GA Ambient Water Quality Standard and Guidance Values (AWQSGVs):
New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) (1.1.1):

µg/L: micrograms per Liter = parts per billion (ppb)

Only Exceedances of NYSDEC AWQSGVs are shown in bold font.

	NYSDEC AWQSGVs ug/l
Volatile Organic Compounds	
Cis-1,2-Dichloroethylene	5
Tetrachloroethylene (PCE)	5
Trichloroethylene (TCE)	5
Vinyl Chloride	2



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SCALE IN FEET

Map Source:
giswww.westchestergov.com (GIS database)

Aerial Source:
2021 New York Statewide Digital Orthoimagery

AKRF
34 South Broadway #401
White Plains, NY 10601

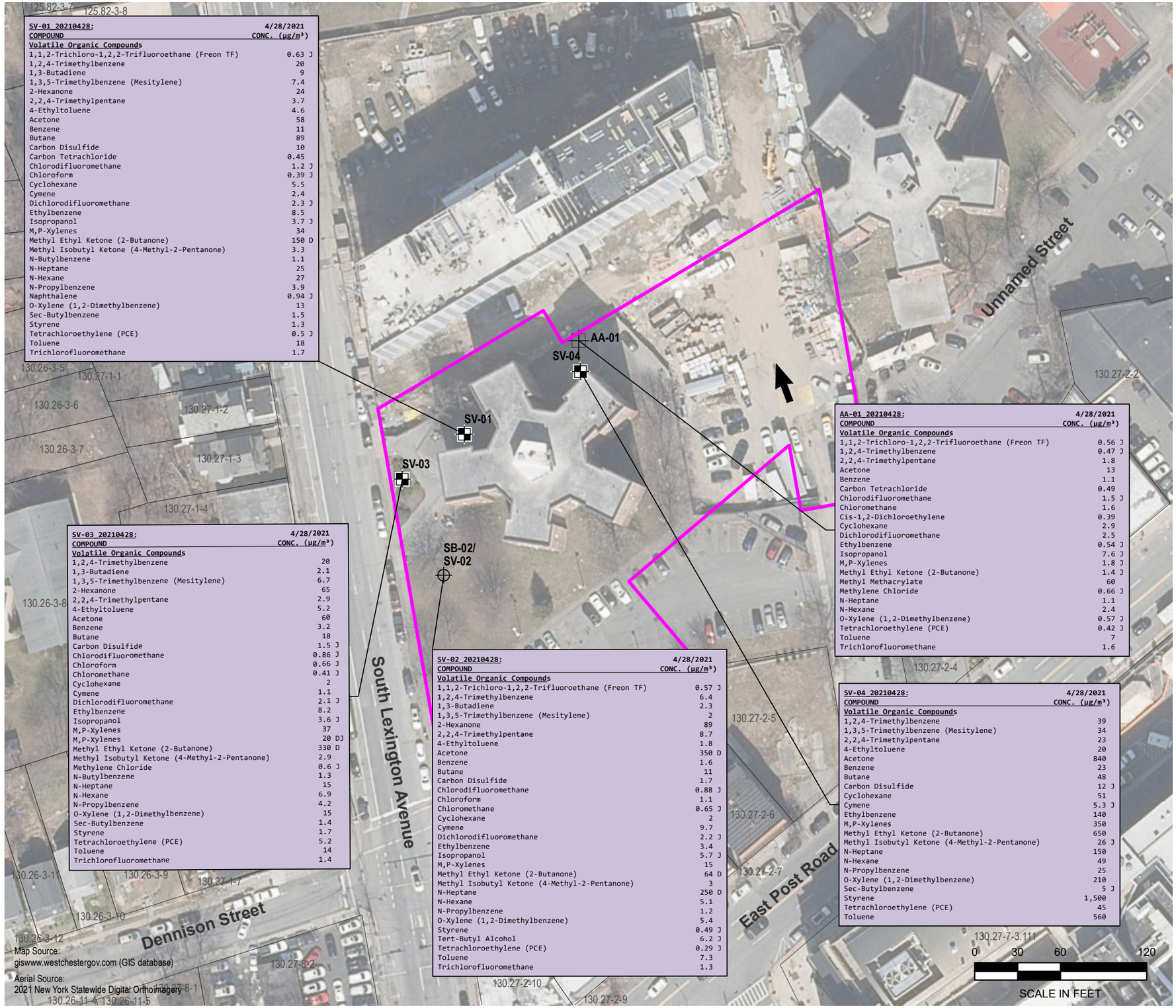
Brookfield Commons Phase 3
White Plains, New York

GROUNDWATER CONCENTRATIONS ABOVE NYSDEC AWQSGVS

DATE
4/1/2024

PROJECT NO.
210122

FIGURE
5



SV-01_20210428:	4/28/2021
COMPOUND	CONC. (µg/m³)
Volatile Organic Compounds	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon TF)	0.63 J
1,2,4-Trimethylbenzene	20
1,3-Butadiene	9
1,3,5-Trimethylbenzene (Mesitylene)	7.4
2-Hexanone	24
2,2,4-Trimethylpentane	3.7
4-Ethyltoluene	4.6
Acetone	58
Benzene	11
Butane	89
Carbon Disulfide	10
Carbon Tetrachloride	0.45
Chlorodifluoromethane	1.2 J
Chloroform	0.39 J
Cyclohexane	5.5
Cymene	2.4
Dichlorodifluoromethane	2.3 J
Ethylbenzene	8.5
Isopropanol	3.7 J
M,P-Xylenes	34
Methyl Ethyl Ketone (2-Butanone)	150 D
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	3.3
N-Butylbenzene	1.1
N-Heptane	25
N-Hexane	27
N-Propylbenzene	3.9
Naphthalene	0.94 J
O-Xylene (1,2-Dimethylbenzene)	13
Sec-Butylbenzene	1.5
Styrene	1.3
Tetrachloroethylene (PCE)	0.5 J
Toluene	18
Trichlorofluoromethane	1.7

SV-03_20210428:	4/28/2021
COMPOUND	CONC. (µg/m³)
Volatile Organic Compounds	
1,2,4-Trimethylbenzene	20
1,3-Butadiene	2.1
1,3,5-Trimethylbenzene (Mesitylene)	6.7
2-Hexanone	65
2,2,4-Trimethylpentane	2.9
4-Ethyltoluene	5.2
Acetone	60
Benzene	3.2
Butane	18
Carbon Disulfide	1.5 J
Chlorodifluoromethane	0.86 J
Chloroform	0.66 J
Chloromethane	0.41 J
Cyclohexane	2
Cymene	1.1
Dichlorodifluoromethane	2.1 J
Ethylbenzene	8.2
Isopropanol	3.6 J
M,P-Xylenes	37
M,P-Xylenes	20 DJ
Methyl Ethyl Ketone (2-Butanone)	330 D
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	2.9
Methylene Chloride	0.6 J
N-Butylbenzene	1.3
N-Heptane	15
N-Hexane	6.9
N-Propylbenzene	4.2
O-Xylene (1,2-Dimethylbenzene)	15
Sec-Butylbenzene	1.4
Styrene	1.7
Tetrachloroethylene (PCE)	5.2
Toluene	14
Trichlorofluoromethane	1.4

SV-02_20210428:	4/28/2021
COMPOUND	CONC. (µg/m³)
Volatile Organic Compounds	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon TF)	0.57 J
1,2,4-Trimethylbenzene	6.4
1,3-Butadiene	2.3
1,3,5-Trimethylbenzene (Mesitylene)	2
2-Hexanone	89
2,2,4-Trimethylpentane	8.7
4-Ethyltoluene	1.8
Acetone	350 D
Benzene	1.6
Butane	11
Carbon Disulfide	1.7
Chlorodifluoromethane	0.88 J
Chloroform	1.1
Chloromethane	0.65 J
Cyclohexane	2
Cymene	9.7
Dichlorodifluoromethane	2.2 J
Ethylbenzene	3.4
Isopropanol	5.7 J
M,P-Xylenes	15
Methyl Ethyl Ketone (2-Butanone)	64 D
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	3
N-Heptane	250 D
N-Hexane	5.1
N-Propylbenzene	1.2
O-Xylene (1,2-Dimethylbenzene)	5.4
Styrene	0.49 J
Tert-Butyl Alcohol	6.2 J
Tetrachloroethylene (PCE)	0.29 J
Toluene	7.3
Trichlorofluoromethane	1.3

AA-01_20210428:	4/28/2021
COMPOUND	CONC. (µg/m³)
Volatile Organic Compounds	
1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon TF)	0.56 J
1,2,4-Trimethylbenzene	0.47 J
2,2,4-Trimethylpentane	1.8
Acetone	13
Benzene	1.1
Carbon Tetrachloride	0.49
Chlorodifluoromethane	1.5 J
Chloromethane	1.6
Cis-1,2-Dichloroethylene	0.39
Cyclohexane	2.9
Dichlorodifluoromethane	2.5
Ethylbenzene	0.54 J
Isopropanol	7.6 J
M,P-Xylenes	1.8 J
Methyl Ethyl Ketone (2-Butanone)	1.4 J
Methyl Methacrylate	60
Methylene Chloride	0.66 J
N-Heptane	1.1
N-Hexane	2.4
O-Xylene (1,2-Dimethylbenzene)	0.57 J
Tetrachloroethylene (PCE)	0.42 J
Toluene	7
Trichlorofluoromethane	1.6

SV-04_20210428:	4/28/2021
COMPOUND	CONC. (µg/m³)
Volatile Organic Compounds	
1,2,4-Trimethylbenzene	39
1,3,5-Trimethylbenzene (Mesitylene)	34
2,2,4-Trimethylpentane	23
4-Ethyltoluene	20
Acetone	840
Benzene	23
Butane	48
Carbon Disulfide	12 J
Cyclohexane	51
Cymene	5.3 J
Ethylbenzene	140
M,P-Xylenes	350
Methyl Ethyl Ketone (2-Butanone)	650
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	26 J
N-Heptane	150
N-Hexane	49
N-Propylbenzene	25
O-Xylene (1,2-Dimethylbenzene)	210
Sec-Butylbenzene	5 J
Styrene	1,500
Tetrachloroethylene (PCE)	45
Toluene	560

LEGEND

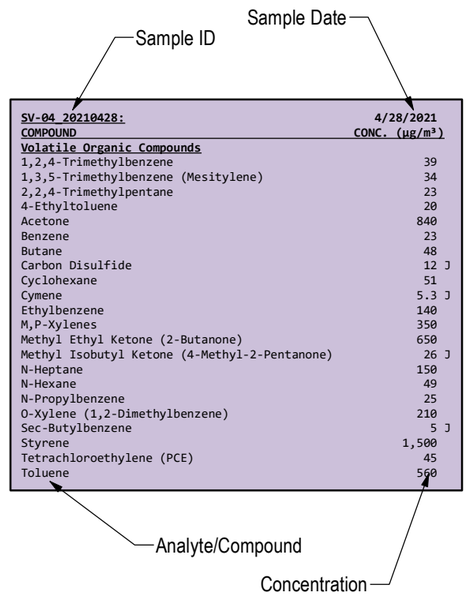
- PROJECT SITE BOUNDARY
- 130.27-2-1 — LOT BOUNDARY WITH BLOCK AND LOT NUMBER
- SOIL BORING/SOIL VAPOR POINT
- SOIL VAPOR POINT
- AMBIENT AIR SAMPLE LOCATION
- ESTIMATED GROUNDWATER FLOW DIRECTION

SOIL VAPOR

J: The concentration given is an estimated value.
D: Analyte concentration obtained from dilution.

µg/m³ - micrograms per cubic meter

Concentrations detected above the laboratory reporting limit are shown



Map Source:
giswww.westchestergov.com (GIS database)

Aerial Source:
2021 New York Statewide Digital Orthoimagery

AKRF
440 Park Avenue South, New York, NY 10016

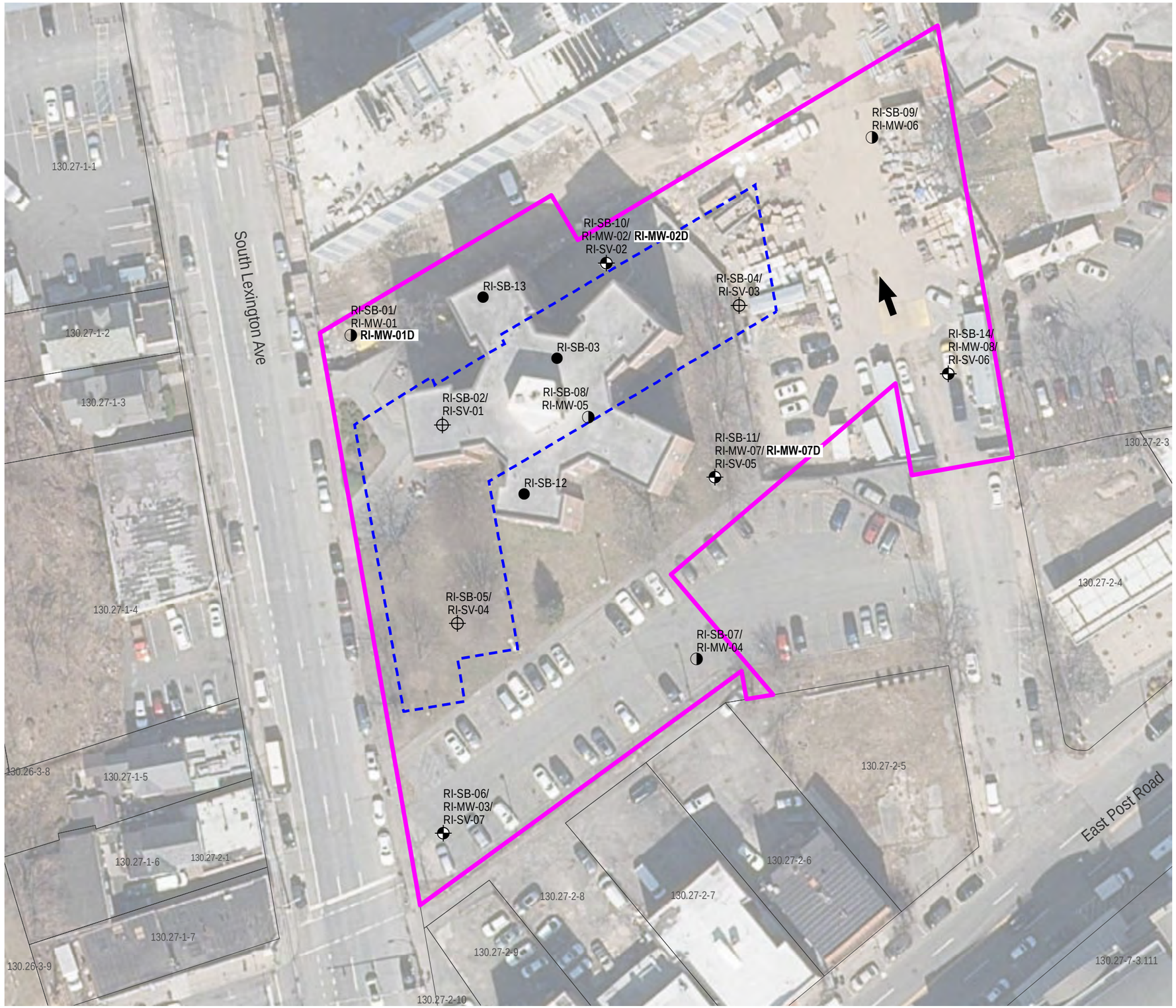
Brookfield Commons Phase 3
White Plains, New York

SOIL VAPOR SAMPLE CONCENTRATIONS

DATE
4/1/2024

PROJECT NO.
210122

FIGURE
6



LEGEND

- PROJECT SITE BOUNDARY
- 130.27-2-1 LOT BOUNDARY AND PRINT KEY (BLOCK AND LOT)
- PROPOSED BUILDING FOOTPRINT
- PROPOSED SOIL BORING
- PROPOSED SOIL BORING/MONITORING WELL
- PROPOSED SOIL BORING/MONITORING WELL/SOIL VAPOR POINT
- PROPOSED SOIL BORING/SOIL VAPOR POINT
- ESTIMATED GROUNDWATER FLOW DIRECTION

0 25 50 100

SCALE IN FEET

Map Source:
giswww.westchestergov.com (GIS database)

Aerial Source:
2021 New York Statewide Digital Orthoimagery

AKRF
34 South Broadway #401
White Plains, NY 10601

Brookfield Commons Phase 3
White Plains, New York

SITE PLAN AND SAMPLING LOCATIONS

DATE
4/19/2024

PROJECT NO.
210122

FIGURE
7

APPENDIX A
QUALITY ASSURANCE PROJECT PLAN

BROOKFIELD COMMONS PHASE 3

159 S. LEXINGTON AVENUE

WHITE PLAINS, NEW YORK

Quality Assurance Project Plan

BCP Site Number: C360246
AKRF Project Number: 210122

Prepared for:

Trinity Brookfield Commons Four Phase Three Limited Partnership
1350 Broadway, Suite #1700
New York, NY 10018

Prepared by:

AKRF, Inc.
34 South Broadway
White Plains, New York 10601
914-949-7336

AUGUST 2023, REVISED APRIL 2024 (REVISION 2)

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of the Draft Remedial Investigation Work Plan (RIWP) at the Brookfield Commons Phase 3 Site located at 159 South Lexington Avenue in White Plains, New York (the "Site"). The 1.28-acre Site is seeking enrollment in the New York State Department of Environmental Conservation's (NYSDEC's) Brownfield Cleanup Program (BCP). The Site is also identified as part of White Plains Tax Block 7, part of Lot 1 Section 125.83. The objective of the QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) of environmental investigative, sampling, and remedial activities conducted during Site remediation and excavation. Adherence to the QAPP will ensure that defensible data will be obtained while completing the remedial work. A Site Location Plan is provided as Figure 1.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 Project Director

The project director will be responsible for the general oversight of all aspects of the project, including scheduling, budgeting, data management, and decision-making regarding the field program. The project director will communicate regularly with all members of the AKRF project team and the New York State Department of Environmental Conservation (NYSDEC) to ensure a smooth flow of information between involved parties. Rebecca Kinal will serve as the project director for the RIWP. Ms. Kinal's resume is included in Attachment A.

2.2 Project Manager

The project manager will be responsible for directing and coordinating all elements of the RIWP. She will prepare reports and participate in meetings with the Site owner and/or the NYSDEC. Colleen Griffiths will serve as the project manager for the RIWP. Ms. Griffiths resume is included in Attachment A.

2.3 Remedial Engineer

The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program and will certify in the Final Engineering Report (FER) that the remedial activities were observed by qualified environmental professionals under her supervision and that the remediation requirements set forth in the RIWP and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. The Remedial Engineer for this project will be Rebecca Kinal, P.E. Ms. Kinal's resume is included in Attachment A.

2.4 Field Team Leader

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP). He will report to the Project Manager on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified, responsible person,

able to act professionally and promptly during soil disturbing activities. Gregory Baird will be the field team leader for the RIWP. Mr. Baird's resume is included in Attachment A.

2.5 Project Quality Assurance/Quality Control Officer

The QA/QC Officer will be responsible for adherence to the QAPP. He will review the procedures with all personnel prior to commencing any fieldwork and will assess implementation of the required procedures. Marc Godick will serve as the QA/QC officer for the RIWP.

2.6 Laboratory Quality Assurance/Quality Control Officer

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. He/she will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued. He/she will conduct a final check on the analytical calculations and sign off on the laboratory reports. Laboratory analysis will be performed by Eurofins Environment Testing Northeast, LLC, ELAP ID 11393. The laboratory QA/QC officer will be determined prior to initiating the RI field activities.

3.0 STANDARD OPERATING PROCEDURES

The following sections describe the standard operating procedures (SOPs) for the sampling activities included in the RIWP. During these operations, safety monitoring will be performed as described in the project Health and Safety Plan (HASP) and all field personnel will wear appropriate personal protective equipment.

3.1 Decontamination of Sampling Equipment

All non-disposable sampling equipment (drilling rods, hand augers, sampling spoons, etc.) will be either dedicated or decontaminated between sampling locations. The decontamination procedure will be as follows:

1. Scrub using tap water/Alconox® mixture and bristle brush.
2. Rinse with tap water.
3. Scrub again with tap water/Alconox® and bristle brush.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment, if possible.

Decontamination will be conducted within five-gallon buckets to capture decontamination water.

3.2 Management of Investigation Derived Waste (IDW)

IDW associated with soil borings or groundwater monitoring well installation that does not exhibit of evidence of contamination (e.g., staining, presence of ash, oily sheens, odors, etc.) will be used to fill in the corresponding borehole. Soil and development and purged water IDW exhibiting evidence of contamination will be containerized in DOT-approved 55-gallon drums. The drums will be sealed at the end of each work day and labeled with the date, the well or boring number(s), the type of waste (i.e., drill cuttings, decontamination fluids, development water, or purge water) and the name of an AKRF point-of-contact. All drums will be labeled "pending analysis" until laboratory data is available. All IDW will be disposed of or treated according to applicable local, state, and federal regulations and disposal documentation will be provided to

NSYDEC. If free of visible contamination, disposable personal protective equipment (PPE) and sampling equipment (scoops, gloves, rope, etc.) will be placed in heavy-duty plastic bags and disposed of as general refuse.

4.0 SAMPLING AND LABORATORY PROCEDURES

4.1 Soil Sampling

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the modified Burmister soil classification system.
- Field screen the sample for evidence of contamination (e.g., odors, staining, etc.) using visual and olfactory methods and screen for volatile organic compounds (VOCs) using a photoionization detector (PID).
- Collect an aliquot of soil from each proposed sample location, place it directly in laboratory-supplied glassware, label the sample in accordance with Section 4.6.1, and place in an ice-filled cooler for shipment to the laboratory. PFAS samples will be collected first to avoid cross-contamination from any of the bottleware or anything used to collect the non-emerging contaminant samples. Samples for PFAS analysis will be put in separate coolers from other sampling jars.
- Complete the proper chain of custody (COC) paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field log book and boring log data sheet, if applicable.
- Decontaminate any soil sampling equipment between sample locations as described in Section 3.1 of this QAPP.

The soil samples will be analyzed for the following:

- VOCs by EPA Method 8260B;
- Semivolatile organic compounds (SVOCs) by EPA Method 8270C;
- Pesticides by EPA Method 8081A;
- Polychlorinated biphenyls (PCBs) by EPA Method 8082;
- Target Analyte List (TAL) of Metals by EPA Method 6000/7000 series (plus hexavalent chromium by EPA Method 7196A);
- cyanide by EPA Method 9012B;
- 1,4-Dioxane by EPA Method 8270; and
- The standard list of 40 per- and polyfluoroalkyl substances (PFAS) compounds by EPA Method 1633.

4.2 Groundwater Sampling

In accordance with EPA low-flow sampling methodology, groundwater samples will be conducted one to two weeks following well development. Groundwater sampling will be conducted according to the following procedures:

- Field screen the sample for evidence of contamination (e.g., odors, staining, etc.) using visual and olfactory methods and screen the well headspace for VOCs using a PID equipped
- Collect the groundwater sample from each proposed sample location in laboratory-supplied glassware, label the sample in accordance with Section 4.6.1, and place in an ice-filled cooler for shipment to the laboratory. Samples analyzed for the emerging contaminants, PFAS, should be contained in a separate cooler.
- Complete the proper COC paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, free phase liquid, etc.) in field log book and boring log data sheet, if applicable.
- Decontaminate any groundwater sampling equipment between sample locations as described in Section 3.1 of this QAPP.

The groundwater samples will be analyzed for the following:

- VOCs by EPA Method 8260B;
- SVOCs by EPA Method 8270C;
- Pesticides by EPA Method 8081A;
- PCBs by EPA Method 8082;
- TAL Metals by EPA Method 6000/7000 series;
- 1,4-Dioxane by EPA Method 8270D Selective Ion Monitoring (SIM); and
- The standard list of 40 PFAS compounds by EPA Method 1633.

4.3 Soil Vapor Sampling

Soil vapor samples will be collected from each of the temporary vapor monitoring points. All soil vapor monitoring points will be installed by advancing an expendable drive point using a direct-push drilling rig to the specified depth below grade. At each monitoring point, a 6-inch stainless steel screen implant, connected to Teflon tubing will be installed by hand or through the drilling rods and threaded into the drive point. The sampling tubing will extend from the end of the screen to above grade. The push probe rods will then be removed and the boring will be backfilled with clean silica sand to 3 to 6 inches above the screen. Hydrated bentonite will be used to fill the remaining void around the sampling tubing to the ground surface.

The soil vapor samples will be collected over a 2-hour time period from each monitoring point using a 6-liter (6L), batch-certified SUMMA canister equipped with a vacuum gauge and flow regulator set at a maximum rate of 0.2 liter per minute. Prior to sample collection, the sampling points will be purged of 3 sample volumes using a low-flow air sampling pump. During purging, an inverted 5-gallon bucket will be placed over the sampling point and helium gas will be introduced through a small hole in the bucket to saturate the atmosphere around the sample port with helium gas. Purged vapors will be collected into a Tedlar bag and field-screened for organic vapors using a PID and for methane using a landfill gas meter or similar instrument. The purged air will also be monitored using a portable helium detector to check for short-circuiting of ambient air into the vapor sampling point. If the purged soil vapor contains greater than 10% helium, additional bentonite will used to enhance the surface seal, and the point will be retested.

Following purging, a soil vapor sample will be collected using the vacuum from the SUMMA canister. Immediately after opening the flow control valve equipped with a 2-hour regulator, the initial SUMMA canister vacuum (inches of mercury) will be noted. After 2 hours, the flow

controller valve will be closed, the final vacuum noted, and the canister placed in a shipping carton for delivery to the laboratory.

All samples will be analyzed for VOCs according to USEPA Method TO-15 by a NYSDOH-certified laboratory with Category B deliverables. Samples will be shipped to the laboratory with appropriate chain of custody documentation. No sample preservation is required for soil vapor or ambient air samples. The data will be reviewed by a third-party validator and a DUSR will be prepared to document the suitability of using the data.

4.4 Laboratory Methods

Table 1 summarizes the laboratory methods that will be used to analyze field samples and the sample container type, preservation, and applicable holding times. An Environmental Laboratory Approval Program (ELAP)-certified laboratory will be used for all chemical analyses in accordance with DER-10 2.1(b) and 2.1(f), including Category B Deliverables.

Table 1
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil	TCL VOCs	8260C	Encore sampler (3) or Terracore Sampler (1)	4 ºC 0 ºC within 24 hrs	48 hours to extract 14 days to analyze
	TCL SVOCs	8270D	Glass 8 oz. Jar	4 ºC	14 days to extract 40 days to analyze
	TAL Metals, Hexavalent Chromium, and Cyanide	6000/7000 Series, 6010C, 7196A, and 9010C/9012B	Glass 8 oz. Jar	4 ºC	6 months holding time; Mercury 28 days holding time; Hexavalent chromium 30 days to extract, 7 days to analyze
	Pesticides	8081B	Glass 8 oz. Jar	4 ºC	14 days to extract 40 days to analyze
	PCBs	8082A	Glass 8 oz. Jar	4 ºC	14 days to extract 40 days to analyze
	1,4-Dioxane	8270D; 0.1 mg/kg RL	Glass 8 oz. Jar	4 ºC	14 days to extract; 40 days to analyze
	PFAS	1633; 0.2 ng/L RL	4 oz. HDPE Plastic Container	≤ 6 ºC,	14 days to extract; 40 days to analyze
Groundwater	VOCs	SW846 8260C	3, 40-ml VOAs	HCl, 4 °C	48 hours to extract; 14 days to analyze
	SVOCs and 1,4-Dioxane	8270D plus Selective Ion Monitoring (SIM); 0.35 µg/L RL	2, 1L Amber Glass	4°C	7 days to extract; 40 days to analyze

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Groundwater (continued)	PCBs	SW846 8082A	1L Amber Glass	4°C	7 days to extract; 40 days to analyze
	Pesticides	SW846 8081B	1L Amber Glass	4°C	7 days to extract; 40 days to analyze
	Metals	SW846 6000/7000 series	1, 250 mL, Plastic	HNO3, 4°C	6 months for metals; 28 days for mercury
	PFAS	1633; 0.2 ng/L RL	3, 250mL Polypropylene Bottles	≤ 6 °C, Trizma	14 days to analyze
Soil Vapor	VOCs	TO-15	6-L SUMMA® Canister	None	14 days

4.5 Quality Control Sampling

In addition to the laboratory analysis of the characterization soil samples for reuse and off-site disposal, additional analysis will be included for quality control measures, as required by the Category B sampling techniques. These samples will include field blanks, equipment blanks (for non-disposable sampling equipment), trip blanks, matrix spike/matrix spike duplicates (MS/MSD), and blind duplicate samples at a frequency of one sample per 20 field samples collected. Additionally, one equipment blank will be collected during each day of groundwater sampling.

4.6 Sample Handling

4.6.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody (COC) documents, and laboratory reports using an alpha-numeric code. Groundwater samples will be identified by the monitoring well number, and soil samples will be identified with the sample depth interval (in parenthesis). Soil samples will be labeled with the depth interval and its location carefully measured and logged in the field book.

The blind duplicate samples will be labeled with a dummy sample location to ensure that they are submitted as blind samples to the laboratory. The dummy identification will consist of the sample type followed by a letter. Trip blanks and field blanks will be identified with "TB" and "FB", respectively, with the collection date in a YYYY/MM/DD format (e.g., TB_20221019 for a trip blank collected on October 19, 2023).

Table 2 provides examples of the sampling identification scheme.

Table 2
Remedial Investigation Sample Nomenclature

Sample Description	Sample Designation
Soil sample RI-SB-01 collected from 0 to 2 feet below grade on October 19, 2024	RI-SB-01_0-2_20241019
Matrix spike/matrix spike duplicate sample from RI-SB-01 on October 19, 2024	RI-SB-01_0-2_20241019_MS RI-SB-01_0-2_20241019_MSD
Blind duplicate sample from 0 to 2 feet at RI-SB-01 on October 19, 2024	RI-SB-X_0-2_20241019
Second blind duplicate soil sample collected from soil boring RI-SB-10 between 0 and 2 feet below grade on October 22, 2024	RI-SB-X2_0-2_20241022
Groundwater sample collected from monitoring well RI-MW-01 on November 2, 2024	RI-MW-01_20241102
Blind duplicate sample of groundwater sample collected from groundwater monitoring well RI-MW-01 on November 2, 2024	RI-MW-X_20241102
Soil vapor sample collected from temporary soil vapor point RI-SV-01 on October 19, 2024	RI-SV-01_20241019
Ambient air sample collected on October 19, 2024	RI-AA-1_20241019

4.6.2 Sample Labeling and Shipping

All sample containers will be provided with labels containing the following information:

- Project identification
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler's initials

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory at least twice per week. At the start and end of each workday, field personnel will add ice to the coolers as needed.

The samples will be prepared for shipment by placing each sample in a sealable plastic bag, then wrapping each container in bubble wrap to prevent breakage, adding freezer packs and/or fresh ice in sealable plastic bags and the chain-of-custody (COC) form. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. Samples collected for PFAS analysis will be collected in separate jars and will be kept in separate coolers and segregated from other samples in accordance with NYSDEC's November 2022 *Sampling, Analysis, and Assessment of PFAS Under NYSDEC's Part 375 Remedial Programs*. All coolers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that the coolers remain sealed during delivery. Soil vapor samples will not require chilling.

4.6.3 Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

4.7 Field Instrumentation

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork, if applicable. Additional calibration will be performed throughout the day as needed. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas.

ATTACHMENT A

RESUMES OF PROJECT QA/QC OFFICER, PROJECT DIRECTOR, PROJECT MANAGER, AND FIELD TEAM LEADER

GREGORY D. BAIRD

TECHNICAL DIRECTOR

Gregory Baird over 15 years of environmental consulting and contracting experience. His range of expertise includes: Due Diligence Phase I Environmental Site Assessments (ESAs), remediation oversight, planning and conducting environmental sampling programs (subsurface soil investigations, waste characterization sampling, groundwater monitoring, and indoor air quality/vapor intrusion surveys), underground storage tank inspections and closure oversight, and potable water sampling. He has prepared Remedial Action Plans (RAPs), Construction Health and Safety Plans (CHASPs) and Remedial Action Work Plans (RAWPs) for various agencies. Gregory also conducts comprehensive asbestos and lead-based paint surveys, prepares asbestos and hazardous materials removal specifications, and manages air monitoring services for asbestos abatement projects.

BACKGROUND

Education
BS, State University of New York at New Paltz, Geology, 2004

Licenses/Certifications
OSHA 40 Hour HAZWOPER
OSHA 10 Hour Construction Safety & Health Course
NYCDEP Asbestos Investigator
NYSDOL Asbestos Inspector, Project Monitor, and Air Technician
United States Environmental Protection Agency Lead Based Paint Risk Assessor and Inspector

Years of Experience
18 years in the industry
16 years with AKRF

References
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GREGORY D. BAIRD

TECHNICAL DIRECTOR

RELEVANT EXPERIENCE

New York City School Construction Authority: On-Call Environmental Consulting

AKRF has undertaken various assignments under four consecutive hazardous materials on-call contracts, including environmental assessment, remedial design, construction support, plumbing disinfection, and potable water (lead) sampling consulting tasks. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments, and subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, design of sub-slab depressurization systems and contract specifications, and construction oversight. The work also includes conducting indoor air quality testing, vapor intrusion assessments, preparation of specifications and construction management for petroleum storage tank removals, and investigation and remediation of spills for existing schools. As the assistant project manager for the plumbing disinfection tasks and lead in drinking water, Gregory Baird provides lead sampling, reporting and remedial recommendations, reviewing and commenting on disinfection plans, supervision of the disinfection and confirmation testing, and preparation of reports documenting the work was conducted in accordance with the specifications and applicable requirements. Gregory also plans and conducts various due diligence and environmental assessment tasks including Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil gas investigations); Indoor Air Quality (IAQ) and Vapor Intrusion (VI) Assessments; and Underground Storage Tank (UST) investigations.

Public Health Lab Harlem Hospital, Manhattan, NY - Remediation Oversight and Community Air Monitoring

Through an on-call contract with the New York City Economic Development Corporation, AKRF is providing construction support and environmental monitoring services during demolition of existing structures and construction of a new public health laboratory on the Harlem Hospital campus. Gregory Baird is serving as the Deputy Project Manager overseeing the AKRF and WBE sub-consultant field staff. AKRF is performing community and work zone air monitoring and overseeing excavation and export of urban fill and petroleum-contaminated soil, documenting spill closure, documenting the import/placement of environmentally clean backfill, and preparation of daily reports to ensure compliance with the NYCDEP-approved RAWP.

New York City Economic Development Corporation, Former Bayside Fuel Oil Company Site Demolition, Brooklyn, NY

AKRF supported New York City Economic Development Corporation (EDC) with the demolition of this former fuel depot. The site is owned by the City of New York Department of Parks and Recreation (DPR) and EDC implemented the demolition of two existing buildings, twelve aboveground storage tanks, a load rack/canopy structure, and above-ground distribution piping. Gregory Baird performed the pre-demolition ACM, lead paint, universal waste and tank content surveys. Gregory oversaw the WBE sub-consultant field staff during air monitoring of asbestos abatement of the structures. AKRF also performed construction management, including reviewing contractor notifications and submittals.

New York City Housing Authority (NYCHA) Permanent Affordability Commitment Together (PACT) Brooklyn Bundle Environmental Consulting Services, Scattered Sites, Brooklyn, NY

GREGORY D. BAIRD

TECHNICAL DIRECTOR

AKRF was retained by Brooklyn Housing Preservation Experience LLC (Omni NY and the Arker Companies) to provide environmental consulting services in connection with a joint application with NYCHA for conversion of assistance under the U.S. Department of Housing and Urban Development's (HUD) Rental Assistance Demonstration (RAD) and Section 18 disposition programs, and associated rehabilitation activities. The proposed action involved 37 residential buildings (approximately 2,625 residential units) within several groups of NYCHA housing developments: Armstrong I/II, Marcy-Greene Avenue Sites A and B, Berry Street-South 9th Street, Independence Towers, Williams Plaza, Warren Street Houses, and Weeksville Gardens. AKRF provided consulting services including preparation of the required environmental review documentation pursuant to the National Environmental Policy Act (NEPA) and HUD environmental standards (24 CFR Part 58), as well as supporting environmental studies related to hazardous materials, noise, and other areas. Gregory Baird prepared the Phase I ESA for the Marcy-Greene Avenue Sites A and B located in the Bedford-Stuyvesant neighborhood of Brooklyn, NY.

New York City Economic Development Corporation, Willets Point Demolition, Queens, NY

AKRF supported the New York City Economic Development Corporation (EDC) with the first phase of the Willets Point Redevelopment Plan, which included the demolition of existing structures. AKRF also supported EDC with review of contractor notifications, submittals and air monitoring during abatement. Gregory Baird conducted the pre-demolition ACM, lead paint and universal waste surveys of approximately 70 structures throughout the 23-acre area site in Queens. Gregory oversaw the WBE sub-consultant field staff during air monitoring of asbestos abatement of the structures.

New York City Economic Development Corporation, Yankee Stadium, Bronx, NY

The analysis of the new Yankee Stadium included a Phase I Environmental Site Assessment of the entire project area and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included geophysical surveys to search for potential underground storage tanks; and soil, soil gas, and groundwater sampling at over 40 locations to determine potential environmental impacts during and after the proposed construction. Gregory Baird provided air monitoring and RAP oversight during the demolition and soil disturbance work.

Hudson River Park Trust, Hudson River Park, New York, NY

AKRF serves as an on-call consultant for the ongoing development of the Hudson River Park, the approximately 5 to 6 mile section of waterfront property from Battery Place to 59th Street along the western edge of Manhattan. Gregory Baird conducted multiple ACM surveys throughout the Park. Gregory also performed asbestos project monitoring during abatement of various areas and project management of field staff during asbestos abatement air monitoring.

United States Tennis Association, USTA NTC Master Plan Support, Queens, NY

AKRF prepared an EIS for the New York City Departments of City Planning (DCP) and Environmental Protection (DEP) as co-lead agencies to analyze the expansion of the National Tennis Center, which includes multiple improvements and construction projects at the USTA campus over several years. The EIS addressed a full range of environmental impacts associated with the tennis stadium, park space, and traffic improvements. Gregory Baird performed a comprehensive asbestos survey of the 20,000-seat Louis Armstrong stadium to identify and quantify ACM.

MARC GODICK, LEP

SENIOR VICE PRESIDENT

Marc S. Godick, LEP is a Senior Vice President of the firm. He holds a BS in Chemical Engineering and an ME in Environmental Engineering. He has broad-based environmental experience which includes management of several on-call contracts and expertise in brownfield redevelopment, site assessment, remedial investigation, design and implementation of remedial measures, compliance assessment, and litigation support.

BACKGROUND

Education

ME, Pennsylvania State University, Engineering Science/Environmental Engineering, 1998
BS, Carnegie Mellon University, Chemical Engineering, 1989

Licenses/Certifications

Licensed Environmental Professional, CT - 396
OSHA 40 Hour HAZWOPER
OSHA 8 Hour Supervisor
OSHA 8 Hour Refresher

Professional Memberships

Member, Westchester County Stormwater Advisory Board, 2011–Present
Member, Westchester County Soil and Water Conservation District, 2005–2010, 2019–Present
Member, Village of Larchmont Planning Board, 2018–2019
Chair/Member, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997–2018
Board of Directors, Sheldrake Environmental Center, Larchmont, New York, 2006–2008
Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997
Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

33 years in the industry
21 years with AKRF

References

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MARC GODICK, LEP

SENIOR VICE PRESIDENT

RELEVANT EXPERIENCE

On-Call Environmental Consulting (Various Locations), New York City School Construction Authority

Marc Godick is Program Manager for an on-call contract with the SCA for environmental assessment, remedial design, and plumbing disinfection. For new school sites, initial due diligence involves conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school and remediation requirements and associated costs. Once design for a school is underway, AKRF would prepare remediation plans and construction specifications and oversee the construction activities. For existing school sites, the work can involve conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, investigation and remediation of spills, and development of remediation cost estimates. Marc also manages AKRF's lead in drinking water sampling and plumbing disinfection work for SCA, including providing recommendations for mitigating exceedances.

On-Call Environmental Consulting Services (Various Locations), New York City Mayor's Office of Environmental Remediation (OER) (administered by NYCEDC)

Marc Godick is managing an on-call contract with the OER for brownfields environmental assessment and remediation. The work has included conducting Phase I environmental site assessments (ESAs) and multi-media sampling of soil, groundwater, and soil vapor for various sites funded by EPA grants. The work plans and investigation reports were completed in accordance with OER and EPA requirements. AKRF also developed a remedial plan for a former gas station site in the Bronx and implemented a remedial plan for capping a park site in Staten Island. In addition, Marc provided support to OER and an affordable housing developer to expedite an application for entry into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), as well as preparation and implementation of the remedial investigation and remedial plan.

New York City Department of Design and Construction, East Side Coastal Resiliency, Manhattan, NY

Marc Godick led the environmental investigation and related support for a multidisciplinary design team selected by the New York City agency partnership of DDC, DPR, and ORR for the Feasibility Study and Pre-Scoping Services for East Side Coastal Resiliency (ESCR) project. The AKRF Team provided design services, for 100+ year storm protection with anticipated sea level rise along the east side of Lower Manhattan. The ESCR subsurface exploration program involved a review of available utility plans and environmental reports involving manufactured gas plant (MGP) and potential petroleum-related contamination along a 2.5-mile study area from Montgomery Street to East 25th Street to develop a Subsurface Investigation Work Plan, which was approved by the NYCDEP. The program included both public and private utility mark-out services across vast areas of the project site containing critical infrastructure to enable the installation of numerous shallow and deep borings and groundwater wells. Marc supervised the implementation of the investigation, which was completed in two phases. He was also responsible for the interpreting the wide-range of environmental parameters to evaluate critical cost and environmental impacts for the City and design team, and to prepare technical reports for submission and approval by the NYCDEP to satisfy for City Environmental Quality Review (CEQR) requirements. He also supported the design and environmental review team, including preparation of the Hazardous Materials chapter for the Environmental Impact Statement, estimating cost impacts to the project for design and cost recovery purposes, and developing a soil management plan. Marc also managed the evaluation of potential hydraulic and contaminant migration impacts associated with former manufactured gas plants along the proposed flood control structure, and prepared a separate mitigation plan approved by NYSDEC to be implemented during construction to address potential coal tar impacts.

Gowanus Canal First Street Turning Basin, New York City Department of Design and Construction (DDC)

MARC GODICK, LEP

SENIOR VICE PRESIDENT

Marc Godick managed the remedial design for restoration of the filled-in former First Street Turning Basin in Brooklyn, New York. The remediation is being conducted as part of an Order of Consent between the City of New York and EPA for the Gowanus Canal Superfund Site. The remedial design included removal of fill and sediment within the fill-in basing in an approximately 475-foot by 50-foot area. The restored basin will provide enhanced waterfront access to the community and a boat launch for canoes and kayaks. Design considerations included geotechnical concerns related to adjacent buildings and new, existing bulkheads; soil, and water management; landscape design; and access/construction logistics. The design was completed in 2019.

3200 Jerome Avenue, Bronx, NY (Former PS 151)

Marc Godick managed the investigation and remediation of a former public school in the Bronx under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The site was contaminated with trichloroethylene (TCE) from historic operations at the property prior to use as a school. The remedial investigation included soil, groundwater, and vapor intrusion assessment both on-site and off-site. The remedial design included excavation of the source area, in-situ chemical oxidation of groundwater, and installation of a sub-slab depressurization system (SSDS) and soil vapor extraction (SVE) system to address to potential vapor intrusion and residual contamination. Implementation of the remedy was complete in late 2014. The completed remediation allows for future multi-family residential, educational, childcare, and/or medical uses. Marc also provided litigation support in connection with a cost recovery claim against the former operator of the site.

Former United Hospital, 406 Boston Post Road, Port Chester, NY

AKRF is providing environmental consulting and site assessment/remediation services for the Former United Hospital site in Port Chester, NY. The approximately 15-acre site, which was developed as a hospital as early as 1915, will be redeveloped into a mixed-use community; an approximately 12-acre portion of the site was accepted in the Brownfield Cleanup Program in October 2020. AKRF has completed due diligence investigations (two Phase I ESAs and a Phase II ESI), prepared/submitted a BCP Application, prepared/submitted a Remedial Investigation Work Plan (RIWP), completed the initial phase of the Remedial Investigation (RI), and prepared an Interim Remedial Investigation Report (RIR). The second phase of the RI will be completed following demolition of the former hospital buildings, which will be followed by the preparation/submittal of the final RIR and a Remedial Action Work Plan (RAWP). AKRF will oversee structural demolition [including implementation of a NYSDEC-approved Community Air Monitoring Plan (CAMP)], which is anticipated to begin in the third quarter of 2023, and will continue to provide field oversight, regulatory coordination, and reporting throughout redevelopment of the site. Marc Godick is the principal in charge, working closely with AKRF's project manager to direct the regulatory and technical aspects of the project.

1731 West Farms Road, Bronx, NY

AKRF is providing environmental consulting and design services for the site of a former dry cleaning equipment repair facility in the West Farms neighborhood of the Bronx, NY. The site, which is enrolled in the NYSDEC Brownfield Cleanup Program, is contaminated with the dry-cleaning solvent tetrachloroethene (PCE) in soil vapor, soil, and groundwater (including in both overburden and bedrock aquifers). AKRF reviewed historical site characterization data, prepared an RAWP, conducted a pre-design investigation to further delineate PCE contamination in soil and groundwater and gather data for in-situ groundwater remediation design, prepared a design document and contract specifications, and coordinated with the design team to select remediation contractors to perform the work. AKRF will oversee site remediation, which is anticipated to begin in second quarter of 2023, and will provide field oversight, regulatory coordination, and reporting throughout redevelopment of the site. Marc Godick is the principal in charge, working closely with AKRF's project manager to direct the

regulatory and technical aspects of the project.

Remediation, Former Industrial Laundry/Dry Cleaning Plant, 2350 Fifth Avenue. New York, NY

Marc Godick managed the assessment, cleanup and post-remedial operations, maintenance and monitoring of the only NYSDEC listed inactive hazardous waste (State Superfund) site in Manhattan, a former laundry/dry cleaning plant in Harlem. Remedial investigation included evaluation of soil, groundwater, soil vapor, indoor air, and building materials. Interim remediation included the removal of contaminated building materials and operation of a sub-slab vapor extraction system retrofitted into the existing building. Marc coordinated with the regulatory agencies, site owner and occupants; and managed the investigation, remedial design, and remedial implementation activities. Phase 1 of the Remedial Action Work Plan consisted of further removal of contaminated building materials. Phase 2 of the remediation included an SSDS retrofitted into the existing building, soil vapor extraction (SVE) system, and chemical oxidation injection. Remedial action work was completed in 2014 and documented in a Final Engineering Report. NYSDEC issued Certificate of Completion in January 2015 and the site has been reclassified to a "Class 4" site (site properly closed – requires continued management). Marc continued to manage the project, including operations, maintenance and monitoring of the SSDS and SVE systems under the NYSDEC-approved Site Management Plan, until the recent sale of the property in March 2023.

Avalon Bay Communities, Inc., Avalon Yonkers – Yonkers, NY

Marc Godick managed the remediation of the Avalon Yonkers project, which is comprised of three separate sites enrolled in the York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), the Former Polychrome East Site, Former Polychrome West Site, and the Former Halstead Quinn/ATI Tank Farm Site. AKRF provided technical support and peer review during development of the Remedial Investigation Reports (RIRs) and Remedial Action Work Plans (RAWPs) for the former Polychrome East and West Sites. AKRF led the negotiations for the remedial scopes for the three sites implemented during the development activities. The remedial elements included hot spot removal and soil management, in-situ soil solidification (ISS), non-aqueous phase liquid (NAPL) containment, monitoring and recovery, dewatering, groundwater treatment and discharge, underground storage tank (UST) removal, site-wide engineered cover systems with a vapor management system (VMS). AKRF provided construction management support and performed environmental monitoring during the remedial activities in accordance with NYSDEC requirements. Prior to and during the remedial work, AKRF completed the design of a shoreline slurry wall, pile plugs, enhanced bioremediation, stormwater utility line anti-seep collars, and vapor the VMS (for the three buildings). AKRF successfully managed the remedial efforts, prepared the Final Engineering Reports (FERs) and Site Management Plans (SMPs), and obtained the Certificates of Completion (COCs) in late 2019.

57 Alexander Street, Rose Associates, Yonkers, NY

Marc Godick manages site assessment/remediation services for the transit-oriented redevelopment of 57 Alexander Street in Yonkers with 440 rental apartments along the Hudson River. The seven-story building is under construction on four acres that will include a landscaped public esplanade and resident amenities. The project is being remediated under the New York State BCP. The remedy included remediation of PCB-impacted soil exceeding EPA Toxic Substance Control Act (TSCA) thresholds, metals and petroleum hot spots, vapor mitigation using a vapor barrier and SSDS, and installation of a site cap. The remediation is nearly complete and occupancy of the building is expected in May 2023. The FER and SMP will be submitted to NYSDEC, and issuance of a COC is anticipated by the end of 2023.

Queens West Project, Avalon Bay Communities, Queens, NY

MARC GODICK, LEP

SENIOR VICE PRESIDENT

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF prepared an Environmental Impact Statement (EIS) that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of this project, Marc Godick managed one of the largest remediation projects completed under the NYSDEC BCP at the time that was contaminated by coal tar and petroleum. The remedy included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, and remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million. Following completion of the remediation, Marc developed a cost allocation model and provided litigation support for a cost recovery action against a former operator of the site, including participation in a deposition as a fact witness prior to settlement between the parties.

COLLEEN GRIFFITHS

VICE PRESIDENT

Colleen Griffiths is a Vice President with diverse experience assessing environmental hazards. Her areas of expertise include overseeing Phase I and Phase II environmental site assessments, asbestos and lead-based paint surveys, preparing environmental specifications, managing air monitoring/project management services for asbestos abatement projects, and community air monitoring programs. She has prepared Remedial Action Plans (RAP), Construction Health and Safety Plans (CHASP) and Remedial Action Work Plans (RAWP) for various agencies.

BACKGROUND

Education
BS, University of Florida, Environmental Economics, 1991

Licenses/Certifications
OSHA 40 Hour HAZWOPER
OSHA 8 Hour Refresher
NYSDOL Certified Asbestos Inspector, Management Planner, and Project Designer

Years of Experience
30 years in the industry
23 years with AKRF

References

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COLLEEN GRIFFITHS

VICE PRESIDENT

RELEVANT EXPERIENCE

New York City School Construction Authority: On-Call Environmental Consulting

Colleen Griffiths serves as the Project Manager for the lead in drinking water and plumbing disinfection tasks under AKRF's on-call hazardous materials consulting contract with the New York City School Construction Authority (NYCSCA). AKRF performed lead in drinking water sampling in about 160 schools during two three-month periods in 2016 and 2017. AKRF continues to provide lead sampling, reporting and remedial recommendations, as new plumbing is installed. AKRF also oversees plumbing disinfection work, which is required prior to new plumbing being placed into service. The assignments involve reviewing and commenting on disinfection plans, supervision of the disinfection and confirmation testing, and preparation of reports documenting the work was conducted in accordance with the specifications and applicable requirements. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

Soil Sampling and Reporting – 31 Sites in New York and 3 Sites in Rhode Island (Confidential Commercial Client)

AKRF performed preliminary soil sampling at 31 commercial sites located in Rockland, Westchester, Putnam and Owego counties in New York and 3 commercial sites located in Rhode Island. Colleen Griffiths is serving as the Project Manager. Ongoing project support will include delineation sampling, waste characterization sampling, project design, bidding support, community air monitoring and construction management.

Public Health Lab Harlem Hospital, Manhattan, NY - Remediation Oversight and Community Air Monitoring

Through an on-call contract with the New York City Economic Development Corporation, AKRF is providing construction support and environmental monitoring services during demolition of existing structures and construction of a new public health laboratory on the Harlem Hospital campus. Colleen Griffiths is serving as the Project Manager. AKRF is performing community and work zone air monitoring and overseeing excavation and export of urban fill and petroleum-contaminated soil, documenting spill closure, documenting the import/placement of environmentally clean backfill, and preparation of daily reports to ensure compliance with the NYCDEP-approved Remediation Action Work Plan (RAWP).

New York City Economic Development Corporation, Former Bayside Fuel Oil Company Site Demolition, Brooklyn, NY

AKRF supported New York City Economic Development Corporation (EDC) with the demolition of this former fuel depot. The site is owned by the City of New York Department of Parks and Recreation (DPR) and EDC implemented the demolition of two existing buildings, twelve aboveground storage tanks, a load rack/canopy structure, and above-ground distribution piping. Colleen Griffiths acted as the hazardous materials project manager and oversaw the pre-demolition ACM, lead paint, universal waste and tank content surveys. Colleen prepared the project specifications and the Remedial Action Plan (RAP) and Construction Health and Safety Plan (CHASP). As project manager, Colleen developed the Community Air Monitoring plan (CAMP), supervised its implementation and reporting during subsurface disturbance and demolition activities. AKRF also performed construction management, including reviewing contractor notifications and submittals.

New York City Housing Authority (NYCHA) On-Call Environmental Consulting Services - Brooklyn RAD Bundle

COLLEEN GRIFFITHS

VICE PRESIDENT

AKRF, Inc. (AKRF) was retained by the New York City Housing Authority (NYCHA) to perform Phase I Environmental Site Assessments (ESAs) of seven complexes in accordance with ASTM E1527-13 and Tier 1 Vapor Encroachment Screens (VES) in accordance with E2600-15. Colleen Griffiths managed preparation of Phase I ESAs of the seven complexes located in the Bedford-Stuyvesant neighborhood of Brooklyn, NY. Based on the findings of the Phase I ESAs and VES, Colleen coordinated preparation of the Phase II Work Plans and Health & Safety Plans, which were subsequently reviewed and approved by the New York City Department of Environmental Protection.

New York City Housing Authority (NYCHA) Permanent Affordability Commitment Together (PACT) Brooklyn Bundle Environmental Consulting Services, Scattered Sites, Brooklyn, NY

AKRF was retained by Brooklyn Housing Preservation Experience LLC (Omni NY and the Arker Companies) to provide environmental consulting services in connection with a joint application with NYCHA for conversion of assistance under the U.S. Department of Housing and Urban Development's (HUD) Rental Assistance Demonstration (RAD) and Section 18 disposition programs, and associated rehabilitation activities. The proposed action involved 37 residential buildings (approximately 2,625 residential units) within several groups of NYCHA housing developments: Armstrong I/II, Marcy-Greene Avenue Sites A and B, Berry Street-South 9th Street, Independence Towers, Williams Plaza, Warren Street Houses, and Weeksville Gardens. AKRF provided consulting services including preparation of the required environmental review documentation pursuant to the National Environmental Policy Act (NEPA) and HUD environmental standards (24 CFR Part 58), as well as supporting environmental studies related to hazardous materials, noise, and other areas. Colleen Griffiths managed the subsurface (Phase II) investigations, and preparation of the Remedial Action Plans (RAPs) and Phase I ESA updates in accordance with Freddie Mac financing requirements.

New York City Economic Development Corporation, Willets Point Demolition, Queens, NY

AKRF supported the New York City Economic Development Corporation (EDC) with Phase 1 of the Willets Point Redevelopment Plan, which includes the demolition of existing structures. AKRF also supported EDC with review of contractor notifications, submittals and air monitoring during abatement. Colleen Griffiths served as the Project Manager and oversaw the pre-demolition ACM, lead paint and universal waste surveys of about 70 structures throughout the 23-acre area site in Queens. Colleen prepared asbestos abatement specifications, and coordinated AKRF investigators, subcontractors and laboratories to accomplish the scope of work under significant time constraints.

Westchester County Department of Parks, Recreation, and Conservation, Merestead Site Development, Bedford, NY

AKRF prepared a Cultural Landscape Report (CLR) for the 130-acre Merestead property which is listed on the National Register of Historic Places. The CLR was part of Westchester County's proposal to rehabilitate of the Main House of the former Sloane Estate in Bedford, New York and to adapt the property for public use. The Merestead CLR was written in keeping with the guidelines provided in Guide to Cultural Landscapes Reports: Contents, Process, and Techniques (National Park Service [NPS] 1998). AKRF's hazardous materials effort provided analysis and design services associated with the rehabilitation of Merestead, a Westchester County Park on the National Register of Historic Places. Colleen Griffiths was responsible for the Phase I ESA, asbestos, lead and mold surveys, and preparation of specifications for rehabilitation of the 130-acre park owned by the Westchester County Parks Department of Parks, Recreation, and Conservation.

New York City Transit Hazardous Materials On-Call Contract, Various Locations, New York City, NY

As part of a five-year, $10 million on-call environmental engineering and consulting services contract with MTA New York City Transit (NYCT), AKRF has performed phase I environmental site assessments, asbestos, lead paint, indoor air quality and hazardous materials consulting services at various stations, tunnels and structures. Colleen Griffiths managed the firm's team of technicians responsible for lead work at construction worksites occupied by multiple contractors and

trades, monitoring contractor work practices, and inspection hazardous waste storage activities. She also lead AKRF's asbestos consulting services, coordinating the efforts of AKRF team members who conducted asbestos surveys and reporting, design services, and asbestos abatement oversight at manholes, stations, tunnels and other structures throughout New York. Colleen also oversaw the various team members, including sub-consultants and laboratories.

Hudson River Park Trust, Hudson River Park, New York, NY

AKRF serves as an on-call consultant for the ongoing development of the Hudson River Park, the approximately 5 to 6 mile section of waterfront property from Battery Place to 59th Street along the western edge of Manhattan. Colleen Griffiths has overseen asbestos, lead, and hazardous materials surveys, specification preparation, and abatement oversight at several piers and buildings throughout the park. Colleen prepared monitoring protocols for the lead-based paint disturbance and application of paints and coatings containing volatile organic compounds. Colleen also performed an asbestos survey and prepared asbestos abatement cost estimates for the Hudson River Park Trust.

Brooklyn Bridge Park Corporation, Brooklyn Bridge Park Phase I ESA and EIS, Brooklyn, NY

The New York State Urban Development Corporation (UDC), doing business as the Empire State Development Corporation (ESDC), in conjunction with its subsidiary, the Brooklyn Bridge Park Development Corporation (BBPDC), will prepare a Draft Environmental Impact Statement (DEIS) assessing the proposed Brooklyn Bridge Park area. The 70-acre Park would stretch along 1.3 miles of the East River between Atlantic Avenue and Jay Street and generally includes the waterfront area and piers, along with some upland property. It provides people with spectacular views of the Manhattan skyline and New York Harbor and includes an array of passive and active recreational opportunities, including lawns, pavilions, and a marina. AKRF prepared the Stormwater Pollution Prevention Plan (SWPPP) in accordance with the standards set forth in the New York State Department of Environmental Conservation (NYSDEC) General Permit for Stormwater Discharges from Construction Activities and, since 2012, AKRF has provided qualified SWPPP inspection services for the various stages of construction. Colleen Griffiths oversaw asbestos and lead survey services, including comprehensive asbestos surveys and lead sampling in five piers and eight buildings. She coordinated the preparation of asbestos and lead survey reports, asbestos abatement specifications, and led oversight of abatement activities and air monitoring.

REBECCA KINAL, PE

VICE PRESIDENT/ENVIRONMENTAL ENGINEER

Rebecca Kinal, PE has extensive experience in the assessment and remediation of soil and groundwater contamination and other hazardous/non-hazardous waste problems. Rebecca's experience includes environmental due diligence, soil and groundwater investigations, leaking underground storage tank studies, soil gas/vapor intrusion surveys, and oversight of small- and large-scale remediation programs, including design of groundwater remediation systems and vapor mitigation systems. She has directed numerous Phase I and Phase II assessments and remediation programs, many of them in conjunction with commercial/residential developers, law firms, lending institutions, and public agencies. She is experienced in the cleanup of contaminated properties under New York State Brownfield Cleanup Program (BCP) regulations and the New York City "E-designation" program. As a part of this work, her duties have included technical and report review, engineering design, proposal writing, scheduling, budgeting, and acting as liaison between clients and regulatory agencies, and project coordination with federal, state, and local authorities.

BACKGROUND

Education
MS, Rensselaer Polytechnic Institute, Hydrogeology, 1995
BS, Lafayette College, Civil Engineering, 1992

Licenses/Certifications
Professional Engineer, NY - 082046-1
OSHA 40 Hour HAZWOPER,
OSHA 8 Hour Refresher

Years of Experience
27 years in the industry
23 years with AKRF

References

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REBECCA KINAL, PE

VICE PRESIDENT / ENVIRONMENTAL ENGINEER

RELEVANT EXPERIENCE

New York City School Construction Authority On-Call Contracts for Environmental Consulting Services, Various Sites, NY

Rebecca Kinal has served as the project manager for AKRF's on-call hazardous materials consulting contract with the New York City School Construction Authority for over 10 years. For potential new school sites, assignments include initial due diligence; Phase I environmental site assessments (ESAs); and subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, contract specifications, and design drawings. The work has also included conducting indoor air quality testing, vapor intrusion assessments, preparation of specifications and construction management for petroleum storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Under the contract, Rebecca has managed several major efforts, including emergency remediation work related to flooding from Superstorm Sandy, expedited due diligence for large portfolios of proposed Universal Pre-Kindergarten (UPK and 3K) sites, specialized indoor air quality testing for a site with mercury contamination, and large Phase II investigations and remedial designs for sites with NYC Office of Environmental Remediation (OER) E-designations and New York State Department of Environmental Conservation (NYSDEC) involvement.

Real Estate Advisory Services – CUNY Real Estate Assets, Various Site, New York City, NY

AKRF teamed with RESGroup on the Real Estate Advisory Services project for City University of New York (CUNY.) Our services included a desk-top review of agency records, previous reports, and regulatory databases to identify environmental concerns at the CUNY-owned properties and assign each one a risk factor with respect to the environmental liabilities and anticipated remediation costs associated with the potential redevelopment. This evaluation was used to assist the project team in their valuation of the properties and selecting which sub-set of properties to market. Rebecca Kinal managed the project and worked with other team members to prepare the report deliverables.

New York City Department of Design & Construction (NYCDDC), East Side Coastal Resiliency (ESCR), New York, NY

AKRF was retained by the NYCDDC to provide a multi-disciplinary design for the protection of Lower Manhattan against another catastrophic hurricane. The main components of the design include levees, berms, retaining walls, cut-off walls, and increasing the ground elevation to mitigate and limit surging flood waters from entering Lower Manhattan. A large portion of the project's subsurface has been impacted by manufactured gas plant (MGP)-related contamination. Rebecca Kinal serves as the Engineer of Record for MGP mitigation design components of the project. Her work includes certification of the Mitigation Work Plan submitted to NYSDEC and review of contract specifications and drawings.

1731 West Farms Road, Bronx, NY

AKRF is providing environmental consulting and design services for the site of a former dry cleaning equipment repair facility in the West Farms neighborhood in the Bronx. The site, which is enrolled in the NYSDEC Brownfield Cleanup Program, is contaminated with the dry cleaner fluid perchloroethene (PCE) in soil vapor, soil, and groundwater (including in both overburden and bedrock aquifers). AKRFs services included preparing a Remedial Remediation

Action Work Plan, conducting a pre-design investigation to further delineate PCE contamination in soil and groundwater and gather data for in situ groundwater remediation design, preparing a design document and contract specifications, and coordinating with the design team to select remediation contractors to perform the work. Rebecca Kinal serves as the project manager and remedial engineer for the project. AKRF will oversee site remediation, anticipated to begin in second quarter of 2023..

Rheingold Houses, Brooklyn, NY

AKRF was retained by Los Sures United HFDC, to design a sub-slab depressurization system (SSDS) for the proposed Rheingold Houses Senior Supportive Housing project in the Bushwick neighborhood of Brooklyn. Rebecca Kinal coordinated with the project team to design the SSDS and prepare associated specifications and drawings. She also provided construction support and reviewed contractor submittals during construction of the new building.

1100 Myrtle Ave, Brooklyn, NY

Rebecca Kinal served as the Engineer of Record for remediation of the 1100 Myrtle Avenue site, a NYSDEC Brownfield redevelopment project in Brooklyn. The remediation included hot spot excavation, UST removal, soil management, a site-wide engineered cover system, and a sub-slab depressurization system (SSDS) and soil vapor extraction system (SVES). Rebecca reviewed the design documents, supervised field inspections, provided support to the project team regarding contractor submittals and field changes, and certified the Final Engineering Report and Site Management Plan. The Site received its Certificate of Completion in December 2000.

Northlight at Edge-on-Hudson, Sleepy Hollow, NY

AKRF was retained by the developer for environmental design and construction support for the redevelopment of Parcel F at Lighthouse Landing (aka, Edge-on-Hudson) with a five-story, 246-unit residential building. AKRF designed a sub-slab depressurization system for the new building and provided environmental oversight during building construction to ensure the work was conducted in accordance with an NYSDEC-approved Site Management Plan for the overall development area. Rebecca Kinal served as the Engineer of Record for the project. Her work included reviewing the design documents, providing support to the project team regarding contractor submittals and field changes, and certified the progress reports submitted the Village of Sleepy Hollow and a Construction Completion Report submitted to the NYSDEC.

Brooklyn Technical High School Athletic Field Improvements, Brooklyn, NY

Rebecca Kinal provided environmental support services to the selected contractor for improvements to the Brooklyn Tech H.S. athletic field facilities. These services included: preparation of an in situ sampling plan for waste characterization and disposal; supervision of waste characterization sampling activities; development and implementation of a community air monitoring program during all soil disturbance; and coordination for removal of a petroleum storage tank discovered construction.

Redevelopment at Polychrome R&D and Manufacturing Sites, AvalonBay, Yonkers, NY

Rebecca Kinal served as the Engineer of Record for remediation of the former Polychrome research and development (R&D) site, a NYSDEC Brownfield redevelopment project along the Hudson River. The remediation included hot spot excavation, LNAPL collection, in-situ soil stabilization (ISS), soil management, groundwater treatment, dewatering, shoreline permitting, groundwater discharge permitting, and a site-wide engineered cover systems, including a vapor barrier and sub-slab depressurization system (SSDS). Rebecca reviewed the design documents, supervised field

inspections, provided support to the project team regarding contractor submittals and field changes, and certified the Final Engineering Report and Site Management Plan. The Site received its Certificate of Completion in December 2019.

Montefiore Medical Center, Various Locations, NY

Rebecca Kinal provides environmental due diligence assistance to Montefiore Medical Center (MMC) for the ongoing expansion of their facilities, primarily in the Bronx and Westchester County. She conducts and manages environmental due diligence tasks related to their property transactions, including Phase I Environmental Site Assessments (ESAs), Phase II investigations, indoor air quality surveys/vapor intrusion assessments, and remediation cost estimates. She also assists MMC in making decisions with respect to environmental risk issues. Projects have ranged from small, single-lot properties to large hospital campuses.

Transaction Support, Confidential Client, Various Locations

Rebecca Kinal provided transaction support related to the proposed sale of a large construction equipment supply company. She managed inspections of 12 of the company's storage and maintenance yards located in New York, New Jersey, Connecticut, Rhode Island and Massachusetts to assess environmental concerns, and advise the client regarding environmental liabilities related to the proposed sale. The work was completed on an expedited turnaround to comply with the due diligence time-frame.

Street-Works Development, Hamilton Green (200 Hamilton Avenue), White Plains, NY

AKRF prepared the EIS under the New York State Environmental Quality Review Act (SEQRA) and provided site planning and environmental services for the development of Hamilton Green—a new vibrant, mixed-use community in downtown White Plains, NY. Rebecca Kinal managed environmental due diligence and remediation planning for the project, which included Phase I and II environmental assessments, a petroleum Spill investigation, preparation of remediation cost estimates, and application and acceptance to the NYSDEC Brownfield Cleanup Program (BCP).

United States Tennis Association, USTA NTC Master Plan Support, Queens, NY

AKRF prepared an EIS for the New York City Departments of City Planning (DCP) and Environmental Protection (DEP) as co-lead agencies to analyze the expansion of the National Tennis Center, which includes multiple improvements and construction projects at the USTA campus over several years. As part of the EIS requirements, AKRF prepared a Remedial Action Plan for implementation during the proposed project's construction. In accordance with the RAP, vapor mitigation systems were incorporated into the design for several of the proposed structures at the facility, including two new stadiums, a new transportation center, and several practice court facilities. Rebecca Kinal prepared the specifications and design drawings for the vapor mitigation and provided construction support to review contractor submittals and inspect the vapor barrier and sub-slab depressurization system installations.

New York City Economic Development Corporation (NYCEDC), Yankee Stadium, Bronx, NY

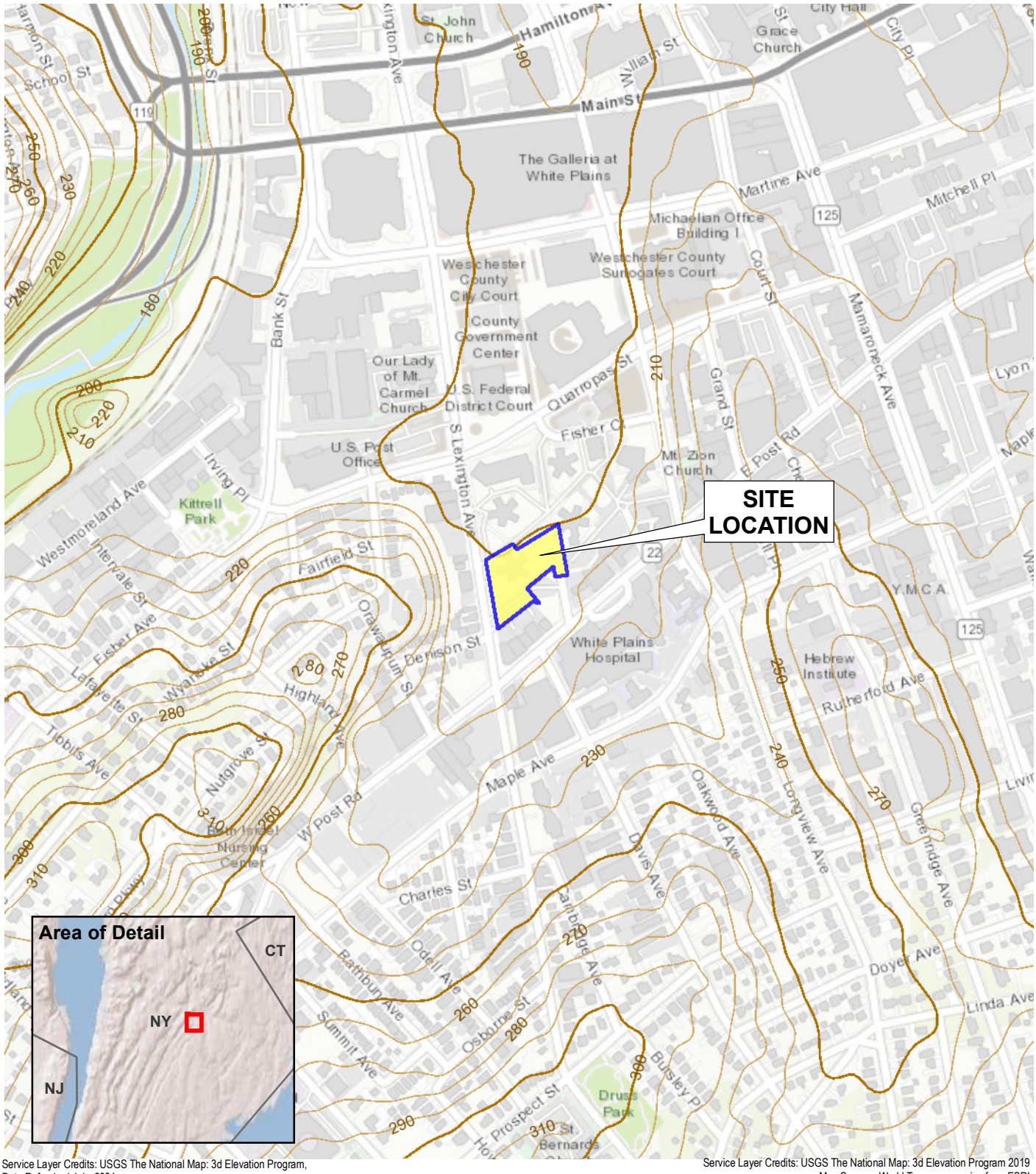
Rebecca Kinal performed the hazardous materials analysis for the Draft Environmental Impact Statement for the proposed new Yankee Stadium. The analysis included a Phase I Environmental Site Assessment of the entire project area and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included geophysical surveys to search for potential underground storage tanks; and soil, soil gas, and groundwater sampling at over 40 locations to determine potential environmental impacts during and after the proposed construction. Remedial Action Plans (RAPs) and Construction Health and Safety Plans (CHASPs) were developed to specify environmental monitoring, soil management protocols, and health and safety requirements during construction

of the new stadium and redevelopment of the old stadium site. Rebecca also managed an extensive community air monitoring program during demolition of the old Yankee Stadium and construction of the New York City Department of Parks and Recreation's Heritage Field, which included short-term and long-term monitoring for airborne particulates and lead.

Roosevelt Union Free School District, Roosevelt UFSD

Rebecca Kinal managed environmental investigation and remediation activities for the sites of three new elementary schools and a new middle school in Roosevelt, New York. Remediation activities included removal/closure of contaminated dry wells and underground petroleum storage tanks, and excavation and off-site disposal of petroleum- and pesticide-contaminated soil. Remediation of the new middle school site, which also included a sub-slab depressurization system, was conducted through coordination with the NYSDEC, NYSDOH, New York State Education Department (NYSED), and the local school district. Upon completion of the remediation and school construction, Rebecca managed confirmatory indoor air testing and preparation of a Final Engineering Report to document the site clean-up. The NYSDEC issued a Certificate of Completion, allowing the new school to open on schedule.

FIGURES



AKRF
34 South Broadway #401
White Plains, NY 10601

Brookfield Commons Phase 3
White Plains, New York

SITE LOCATION

DATE
8/10/2023

PROJECT NO.
210122

FIGURE
1

APPENDIX B

HEALTH AND SAFETY PLAN

BROOKFIELD COMMONS PHASE 3 SITE

159 S. LEXINGTON AVENUE

WHITE PLAINS, NEW YORK

Health and Safety Plan

BCP Site Number: C360246
AKRF Project Number: 210122

Prepared for:

Trinity Brookfield Commons Four Phase Three Limited Partnership
1350 Broadway, Suite #1700
New York, NY 10018

Prepared by:

AKRF, Inc.
34 South Broadway
White Plains, New York 10601
914-949-7336

AUGUST 2023

REVISED APRIL 2024

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ATTACHMENTS

1.0 INTRODUCTION

This Health and Safety Plan (HASP) was prepared by AKRF, Inc. (AKRF) on behalf of Trinity Brookfield Commons Four Phase Three Limited Partnership (the "Volunteer") for the "Brookfield Commons Phase 3" project site located at 159 South Lexington Avenue in White Plains, New York (the "Site"). The 1.28-acre Site is also identified as part of White Plains Tax Block 7, part of Lot 1 Section 125.83. The Site is part of a multi-story apartment building complex identified as Brookfield Commons or Winbrook. The Site is bounded to the north and east by the construction site of the new Brookfield Commons multi-story residential apartment building, known as "Phase 2 or The Overture"; to the south by a parking lot associated with the Winbrook complex, followed by a vacant lot and various commercial uses and former filling stations; and to the west by South Lexington Avenue, followed by various commercial use. The area surrounding the Site generally consists of mixed-use commercial, residential, and institutional properties.

This HASP has been designed to provide workplace safety while completing the field requirements of the Remedial Investigation Work Plan (RIWP).

Historically, the Site was developed with small residential buildings and associated garages, multiple three to four-story apartment buildings, an upholsterer, and an auto repair shop between 1900 and 1942. These structures were demolished for construction of the existing apartment building and grounds, which were constructed in 1949-1950 as part of the Winbrook housing complex.

Based on an evaluation of the data and information from investigations conducted at the Site to date, soil at the Site contains metals and polychlorinated biphenyls (PCBs), petroleum-related and chlorinated volatile organic compounds (VOCs) were detected in soil vapor samples, and chlorinated VOCs were detected in groundwater.

The HASP does not discuss routine health and safety issues common to general construction and excavation, including, but not, limited to slips, trips, falls, shoring, and other physical hazards. All AKRF employees are directed that all work must be performed in accordance with the AKRF's Generic HASP and all Occupation Safety and Health Administration (OSHA)-applicable regulations for the work activities required for the project. This HASP also includes supplemental requirements to minimize potential exposure related to COVID-19 (see Attachment D). All project personnel are furthermore directed that they are not permitted to enter Permit Required Confined Spaces (as defined by OSHA). For issues unrelated to contaminated materials, all non-AKRF employees are to be bound by all applicable OSHA regulations as well as any more stringent requirements specified by their employer in their corporate HASP or otherwise. AKRF is not responsible for providing oversight for issues unrelated to contaminated materials for non-employees. This oversight shall be the responsibility of the employer of that worker or other official designated by that employer.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
(**X**) Biological	(**X**) Explosive/Flammable	( ) Oxygen Deficient Atm.
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
Comments: No personnel are permitted to enter permit confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(**X**) Liquid	(**X**) Solid	( ) Sludge
(**X**) Vapors	( ) Unknown	( ) Other
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	(**X**) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	( ) POTW	(**X**) Other Chlorinated Organic Solvents	(**X**) Motor or Hydraulic Oil	( ) Hospital
(**X**)Petroleum	(**X**) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks	Fill material			(**X**) Fuel Oil	( ) MGP
(**X**) PCBs				(**X**) Waste Oil	( ) Mold
(**X**) Metals					( ) Cyanide
( )Other:					

2.1.4 Chemicals of Concern

Chemical	REL/PEL/STEL	Health Hazards
Barium	REL= 0.5 mg/m^3 PEL= 0.5 mg/m^3	Irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles; hypokalemia.
Benzene	REL: 0.1 ppm N STEL: 1 ppm PEL: 1 ppm O STEL: 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen].
Copper	REL: 1 mg/m^3 PEL: 1 mg/m^3	Irritation eyes, nose, pharynx; nasal septum perforation; metallic taste; dermatitis; In Animals: lung, liver, kidney damage; anemia.
Ethylbenzene	REL: 100 ppm N STEL: 125 ppm PEL: 100 ppm	Irritation eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects.
Fuel Oils	REL: 100 mg/m^3	Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid).
Lead	REL: 0.050 mg/m^3 PEL:0.050 mg/m^3	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension.
Mercury	REL: 0.05 mg/m^3 REL C: 0.1 mg/m^3 PEL: 0.1 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria.

Chemical	REL/PEL/STEL	Health Hazards
PAHs	REL: 0.1 mg/m^3 PEL: 0.2 mg/m^3	Effects reported from occupational exposure to PAHs include chronic bronchitis, chronic cough irritation, bronchogenic cancer, dermatitis, cutaneous photosensitization, and pilosebaceous reactions. Reported health effects associated with chronic exposure to coal tar and its by-products (e.g., PAHs): Skin: erythema, burns, and warts on sun-exposed areas with progression to cancer. The toxic effects of coal tar are enhanced by exposure to ultraviolet light. Eyes: irritation and photosensitivity. Respiratory system: cough, bronchitis, and bronchogenic cancer. Gastrointestinal system: leukoplakia, buccal-pharyngeal cancer, and cancer of the lip. Hematopoietic system: leukemia (inconclusive) and lymphoma. Genitourinary system: hematuria and kidney and bladder cancers.
PCBs	REL: 0.001 mg/m^3 PEL: 0.5 mg/m^3	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen].
Trichloroethylene (TCE)	PEL: 100 ppm PEL C: 200 ppm; 5-min max peak: 300 ppm	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen].
Tetrachloroethylene (PCE)	PEL: 100 ppm PEL C: 200 ppm; max peak: 300 ppm	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen].
Toluene	REL: 100 ppm N STEL: 150 ppm PEL: 200 ppm PEL C: 300 ppm; 10-min max peak: 500 ppm	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Xylene	REL: 100 ppm N STEL: 150 ppm PEL: 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.

Chemical	REL/PEL/STEL	Health Hazards
Zinc	REL: 5 mg/m^3 REL C: 15 mg/m^3 N STEL: 10 mg/m^3 PEL: 5 mg/m^3 (ZnO fume); 15 mg/m^3 (ZnO dust)	Chills, elevated body temperature, myalgia, cough, fatigue, chest pain, stomach cramps, nausea, anemia, changes in cholesterol levels, and vomiting.
Notes: REL: Recommended exposure limit (NIOSH) PEL: Permissible exposure limits (OSHA) STEL: Short-term exposure limit N: NIOSH O: OSHA C: Ceiling		

The potential health effects from these known and suspected on-site contaminants are provided in Attachment A.

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of the HASP and will be on-site whenever field work is occurring. The SSO will have a 4-year college degree in occupational safety or an environmental related science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO and all field personnel is outlined in Section 2.3 of this HASP.

2.3 Training

All personnel who perform sampling activities in the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety and make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before he/she goes onto the Site. A Site safety meeting will be conducted at the start of the project and will be conducted daily, as necessary, to account for changes in Site conditions. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin Site activities. The medical release shall consider the type of work

to be performed and the required PPE. The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste Site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may changed by SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Appropriate barriers will be set up to secure the area and prevent any unauthorized personnel from approaching within 15 feet of the work area.

Site Work Zones			
Task	**Exclusion Zone**	**CRZ**	**Support Zone**
Subsurface Investigation	15 feet from the drill rig or a distance equal to the maximum height of the drill rig (whichever is greater)	25 feet from the drill rig	As Needed

2.6 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards in the soil and soil vapor. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 Work Zone Air Monitoring

Real time air monitoring will be performed with the photoionization detector (PID) and Dust Trak. Measurements will be taken prior to commencement of work and continuously during the work, as outlined in the following table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table:

Instrument	Action Level	Response Action
PID	Less than 10 ppm in breathing zone	Level D or D-Modified
	Between 10 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm. Re-access Site conditions and response actions if elevated PID readings remain.
Dust Trak	Less than 0.25 mg/m^3 above background in breathing zone	Level D or D-Modified
	More than 0.25 mg/m^3 above background in breathing zone	Stop work. Resume work when readings are less than 1.25 mg/m^3.
mg/m^3 = milligrams per cubic meter ppm = parts per million		

2.6.2 Personal Protection Equipment

The personal protection equipment required for various kinds of site investigation tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in this section.

Personal Protection Equipment Requirements		
LEVEL OF PROTECTION & PPE		**All Tasks**
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig/excavator) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig/excavator) (**X**) Nitrile Gloves (**X**) Tyvek for drill operator if NAPL present	Yes
Level C ***(in addition to Level D)*** (**X**) Half-Face Respirator OR (**X**) Full Face Respirator ( ) Full-Face Powered Air Purifier Respirator (PAPR)	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 10 ppm for a 15-minute average (breathing zone)
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breath or any odors detected).		

2.7 General Work Practices

To protect their health and safety, all field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit, fire extinguisher, and disposable eye washes. A designated location will be made known to all parties on Site during the Site safety meeting. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be driven to the White Plains Hospital in White Plains by on-site personnel. Directions to the hospital are provided below, and a hospital route map is attached.

3.1 Hospital Directions

Hospital Name:	White Plains Hospital
Phone Number:	(914) 681-0600
Address/Location:	41 East Post Road, White Plains, NY
Directions:	Turn LEFT/head south from the Site onto South Lexington Avenue Turn LEFT onto East Post Road The Emergency Room will be on the RIGHT

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF, Inc.	Marc Godick	Project Director	914-922-2356 (office)
	Colleen Griffiths	Project Manager	914-922-2363 (office)
	Gregory Baird	SSO	646-823-5477 (cell)
Trinity Brookfield Commons Four Phase Three Limited Partnership	Omalawa Musa	Architect	646-751-5105
New York State Department of Environmental Conservation	Ryan Richard	Assistant Geologist	845-256-3118 (office)
New York State Department of Health	Jonathan Robinson	Project Manager	Jonathan.robinson@health.ny.gov (email)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: _____ Date: _____

AKRF Project Manager

Signed: _____ Date: _____

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

AFFIDAVIT

I,_____(name), of_____(company name), have read the Health and Safety Plan (HASP) for the Brookfield Commons Phase 3 site. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the site.

Signed: _____ Company: _____ Date: _____
Signed: _____ Company: _____ Date: _____
Signed: _____ Company: _____ Date: _____
Signed: _____ Company: _____ Date: _____
Signed: _____ Company: _____ Date: _____
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Signed: _____ Company: _____ Date: _____

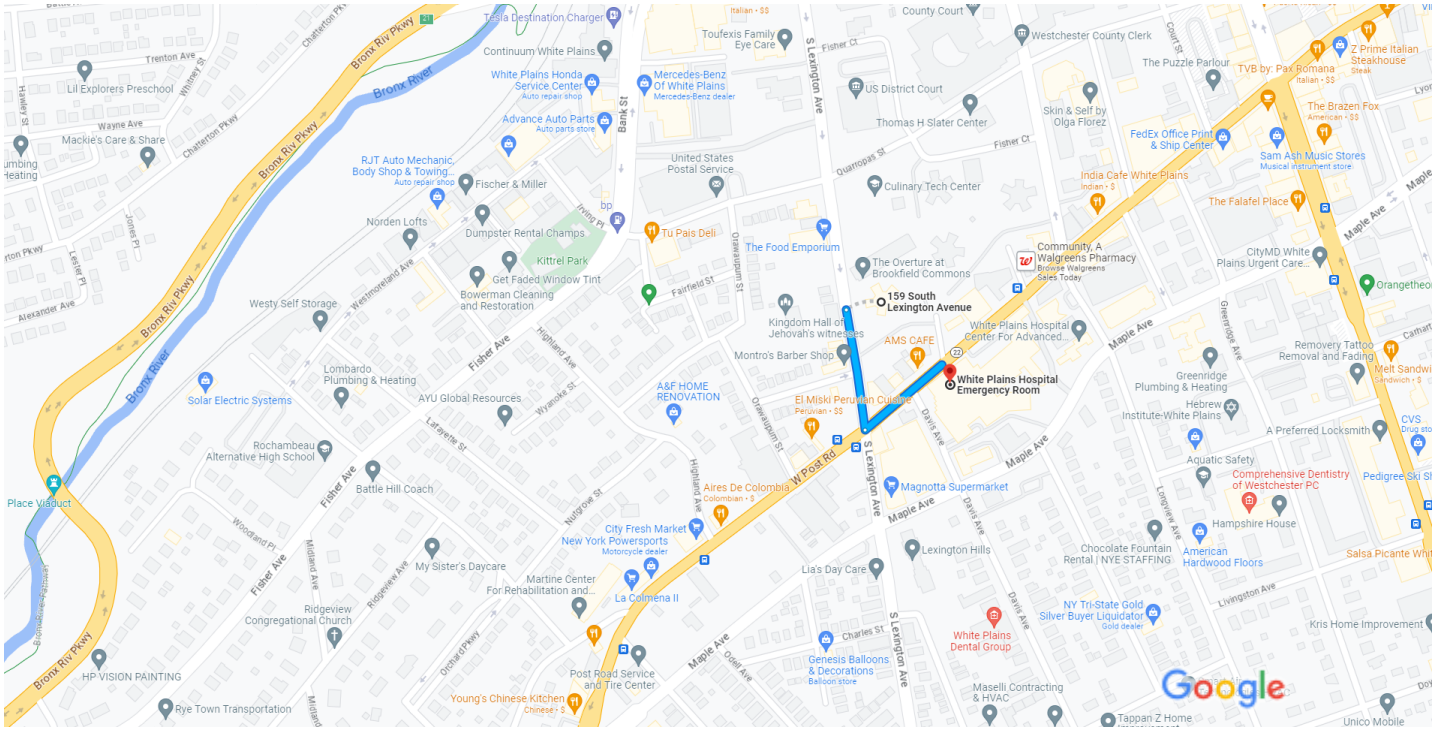
FIGURE 1 – HOSPITAL ROUTE MAP

Google Maps

159 S Lexington Ave, White Plains, NY 10601 to White Plains Hospital Emergency Room, 41 E Post Rd, White Plains, NY 10601

Drive 0.2 mile, 1 min

FIGURE 1 - HOSPITAL ROUTE MAP



159 S Lexington Ave
White Plains, NY 10601

1. Head south on S Lexington Ave toward Dennison St

479 ft

2. Turn left onto E Post Rd
Destination will be on the right

397 ft

White Plains Hospital Emergency Room
41 E Post Rd, White Plains, NY 10601

ATTACHMENT A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BARIUM AND COMPOUNDS

CAS # 7440-39-3

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about barium and barium compounds. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to barium occurs mostly in the workplace or from drinking contaminated water. Ingesting drinking water containing levels of barium above the EPA drinking water guidelines for relatively short periods of time can cause gastrointestinal disturbances and muscle weakness. Ingesting high levels for a long time can damage the kidneys. Barium and barium compounds have been found in at least 798 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is barium?

Barium is a silvery-white metal which exists in nature only in ores containing mixtures of elements. It combines with other chemicals such as sulfur or carbon and oxygen to form barium compounds.

Barium compounds are used by the oil and gas industries to make drilling muds. Drilling muds make it easier to drill through rock by keeping the drill bit lubricated. They are also used to make paint, bricks, ceramics, glass, and rubber.

Barium sulfate is sometimes used by doctors to perform medical tests and to take x-rays of the gastrointestinal tract.

What happens to barium when it enters the environment?

❏ Barium gets into the air during the mining, refining, and production of barium compounds, and from the burning of coal and oil.
❏ The length of time that barium will last in air, land, water, or sediments depends on the form of barium released.
❏ Barium compounds, such as barium sulfate and barium carbonate, which do not dissolve well in water, can last a long time in the environment.
❏ Barium compounds, such as barium chloride, barium nitrate, or barium hydroxide, that dissolve easily in water usually do not last in these forms for a long time in the environment. The barium in these compounds that is dissolved in water quickly combines with sulfate or carbonate that are naturally found in water and become the longer lasting forms (barium sulfate and barium carbonate).
❏ Fish and aquatic organisms can accumulate barium.

How might I be exposed to barium?

❏ Ingesting small amounts present in your food and water or breathing air containing very low levels of barium.
❏ Living in areas with unusually high natural levels of barium in the drinking water.
❏ Working in a job that involves barium production or use.
❏ Living or working near waste sites where barium has been disposed of.

How can barium affect my health?

The health effects of the different barium compounds depend on how well the compound dissolves in water or in the stomach contents. Barium compounds that do not dissolve well, such as barium sulfate, are not generally harmful.

BARIUM AND COMPOUNDS
CAS # 7440-39-3

Barium has been found to potentially cause gastrointestinal disturbances and muscular weakness when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time. Some people who eat or drink amounts of barium above background levels found in food and water for a short period may experience vomiting, abdominal cramps, diarrhea, difficulties in breathing, increased or decreased blood pressure, numbness around the face, and muscle weakness. Eating or drinking very large amounts of barium compounds that easily dissolve can cause changes in heart rhythm or paralysis and possibly death. Animals that drank barium over long periods had damage to the kidneys, decreases in body weight, and some died.

How likely is barium to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified barium as to its carcinogenicity. The EPA has determined that barium is not likely to be carcinogenic to humans following ingestion and that there is insufficient information to determine whether it will be carcinogenic to humans following inhalation exposure.

How can barium affect children?

We do not know whether children will be more or less sensitive than adults to barium toxicity. A study in rats that swallowed barium found a decrease in newborn body weight; we do not know if a similar effect would be seen in humans.

How can families reduce the risks of exposure to barium?

The greatest potential source of barium exposure is through food and drinking water. However, the amount of barium in foods and drinking water are typically too low to be of concern.

Is there a medical test to determine whether I've been exposed to barium?

There is no routine medical test to determine whether you have been exposed to barium. Doctors can measure barium in body tissues and fluids, such as bones, blood, urine, and feces, using very complex instruments. These tests cannot be used to predict the extent of the exposure or potential health effects.

The geometric mean barium level measured in the U.S. general population aged 6 and older is reported by the Centers for Disease Control and Prevention (CDC) as 1.44 μg/g creatinine (measured in urine).

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2.0 milligrams of barium per liter of drinking water (2.0 mg/L), which is the same as 2 ppm.

The Occupational Safety and Health Administration (OSHA) has set Permissible Exposure Limits (PELs) of 0.5 milligrams of soluble barium compounds per cubic meter of workplace air (0.5 mg/m^3) for 8 hour shifts and 40 hour work weeks. The OSHA limits for barium sulfate dust are 15 mg/m^3 of total dust and 5 mg/m^3 for respirable fraction.

The National Institute for Occupational Safety and Health (NIOSH) has set Recommended Exposure Limits (RELs) of 0.5 mg/m^3 for soluble barium compounds. The NIOSH has set RELs of 10 mg/m^3 (total dust) for barium sulfate and 5 mg/m^3 (respirable fraction).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Barium and Compounds (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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COPPER

CAS # 7440-50-8

Division of Toxicology ToxFAQs™ September 2002

This fact sheet answers the most frequently asked health questions (FAQs) about copper. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Copper is a reddish metal that occurs naturally in the environment. It also occurs naturally in plants and animals. Low levels of copper are essential for maintaining good health. High levels can cause harmful effects such as irritation of the nose, mouth and eyes, vomiting, diarrhea, stomach crumps, and nausea. Copper has been found in at least 884 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is copper?

Copper is a reddish metal that occurs naturally in rocks, soil, water, and air. Copper also occurs naturally in plants and animals.

Metallic copper can be easily molded or shaped. Metallic copper can be found in the U.S. penny, electrical wiring, and some water pipes. Metallic copper is also found in mixtures (called alloys) with other metals such as brass and bronze. Copper is also found as part of other compounds forming salts. Copper salts occur naturally, but are also manufactured. The most common copper salt is copper sulfate. Most copper compounds are blue-green in color. Copper compounds are commonly used in agriculture to treat plant diseases like mildew, for water treatment and, as preservatives for wood, leather, and fabrics.

What happens to copper when it enters the environment?

❑ Copper can enter the environment from the mining of copper and other metals and from factories that make or use metallic copper or copper compounds.

❑ It can also enter the environment through domestic waste water, combustion of fossil fuels and wastes, wood production, phosphate fertilizer production, and natural sources (e.g., windblown dust from soils, volcanoes, decaying vegetation, forest fires, and sea spray).

❑ Copper in soil strongly attaches to organic material and minerals.

❑ Copper that dissolves in water becomes rapidly bound to particles suspended in the water.

❑ Copper does not typically enter groundwater.

❑ Copper carried by particles emitted from smelters and ore processing plants is carried back to the ground by gravity or in rain or snow.

❑ Copper does not break down in the environment.

How might I be exposed to copper?

❑ Breathing air, drinking water, eating food, and by skin contact with soil, water, or other copper-containing substances.

❑ Some copper in the environment can be taken up by plants and animals.

❑ Higher exposure may occur if your water is corrosive and you have copper plumbing and brass water fixtures. ❑ You may be exposed to higher amounts of copper if you drink water or swim in lakes or reservoirs recently treated with copper to control algae or receive cooling water from a power plant that may have high amounts of dissolved copper.

❑ Using some garden products (e.g., fungicides) to control plant diseases.

❑ Living near bronze and brass production facilities may expose you to higher copper levels in soil.

❑ You may breathe copper-containing dust or have skin contact if you work in the industry of mining copper or

processing the ore. You may breathe high levels if you grind or weld copper metal.

How can copper affect my health?

Copper is essential for good health, but high amounts can be harmful. Long-term exposure to copper dust can irritate your nose, mouth, and eyes, and cause headaches, dizziness, nausea, and diarrhea.

Drinking water with higher than normal levels of copper may cause vomiting, diarrhea, stomach cramps, and nausea. Intentionally high intakes of copper can cause liver and kidney damage and even death.

How likely is copper to cause cancer?

We do not know whether copper can cause cancer in humans. The EPA has determined that copper is not classifiable as to carcinogenicity.

How can copper affect children?

Exposure to high levels of copper will result in the same type of effects in children and adults. Studies in animals suggest that the young children may have more severe effects than adults; we do not know if this would also be true in humans. There is a very small percentage of infants and children who are unusually sensitive to copper.

We do not know if copper can cause birth defects or other developmental effects in humans. Studies in animals suggest that ingestion of high levels of copper may cause a decrease in fetal growth.

How can families reduce the risk of exposure to copper?

❑ The greatest potential source of copper exposure is through drinking water, especially in water that is first drawn in the morning after sitting in copper pipes and brass faucets overnight.

❑ To reduce exposure, run the water for at least 15-30 seconds before using it.

❑ If you are exposed to copper at work, you may carry copper home on your skin, clothes, or tools. You can avoid this by showering, and changing clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to copper?

Copper is normally found in all tissues of the body, blood, urine, feces, hair, and nails. High levels of copper in these samples can show that you have been exposed to higher than normal levels of copper. Tests to measure copper levels in the body are not routinely available at the doctor's office because they require special equipment. These tests cannot tell the extent of exposure or whether you will experience harmful effects.

Has the federal government made recommendations to protect human health?

The EPA has determined that drinking water should not contain more than 1.3 milligrams of copper per liter of water (1.3 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.1 mg per cubic meter (0.1 mg/m^3) of copper fumes (vapor generated from heating copper) and 1 mg/m^3 of copper dusts (fine metallic copper particles) and mists (aerosol of soluble copper) in workroom air during an 8-hour work shift, 40-hour workweek.

The Food and Nutrition Board of the Institute of Medicine recommends dietary allowances (RDAs) of 340 micrograms (340 µg) of copper per day for children aged 1-3 years, 440 µg/day for children aged 4-8 years, 700 µg/day for children aged 9-13 years, 890 µg/day for children aged 14-18 years, and 900 µg/day for adults.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for Copper (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕthʹ əl bĕnʹ zēnʹ)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- ❏ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- ❏ When lead is released to the air, it may travel long distances before settling to the ground.
- ❏ Once lead falls onto soil, it usually sticks to soil particles.
- ❏ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- ❏ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- ❏ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- ❏ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- ❏ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❑ Avoid exposure to sources of lead.

❑ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❑ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❑ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❑ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

MERCURY
CAS # 7439-97-6

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?

(Pronounced mŭr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.
- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

- Eating fish or shellfish contaminated with methylmercury.
- Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.
- Release of mercury from dental work and medical treatments.
- Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).
- Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea,

vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

Is there a medical test to show whether I've been exposed to mercury?

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCHLORINATED BIPHENYLS

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

❑ PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.

❑ PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.

❑ PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.

❑ PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

❑ Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.

❑ Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.

❑ Breathing air near hazardous waste sites and drinking contaminated well water.

❑ In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects

of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risk of exposure to PCBs?

❑ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

❑ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

❑ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

❑ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ **July 2003**

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

- Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
- Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
- Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
- Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
- Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

- Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
- Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
- Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
- Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

Is there a medical test to show whether I've been exposed to trichloroethylene?

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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TETRACHLOROETHYLENE
CAS # 127-18-4

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

- Much of the tetrachloroethylene that gets into water or soil evaporates into the air.
- Microorganisms can break down some of the tetrachloroethylene in soil or underground water.
- In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.
- It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

- When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.
- When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethyl-

ene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

Is there a medical test to show whether I've been exposed to tetrachloroethylene?

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Milligram (mg): One thousandth of a gram.

Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ZINC
CAS # 7440-66-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about zinc. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Zinc is a naturally occurring element. Exposure to high levels of zinc occurs mostly from eating food, drinking water, or breathing workplace air that is contaminated. Low levels of zinc are essential for maintaining good health. Exposure to large amounts of zinc can be harmful. It can cause stomach cramps, anemia, and changes in cholesterol levels. Zinc has been found in at least 985 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is zinc?

Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in all foods. Pure zinc is a bluish-white shiny metal.

Zinc has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass, and bronze. A zinc and copper alloy is used to make pennies in the United States.

Zinc combines with other elements to form zinc compounds. Common zinc compounds found at hazardous waste sites include zinc chloride, zinc oxide, zinc sulfate, and zinc sulfide. Zinc compounds are widely used in industry to make paint, rubber, dyes, wood preservatives, and ointments.

What happens to zinc when it enters the environment?

❏ Some is released into the environment by natural processes, but most comes from human activities like mining, steel production, coal burning, and burning of waste.
❏ It attaches to soil, sediments, and dust particles in the air.
❏ Rain and snow remove zinc dust particles from the air.
❏ Depending on the type of soil, some zinc compounds can move into the groundwater and into lakes, streams, and rivers.
❏ Most of the zinc in soil stays bound to soil particles and does not dissolve in water.
❏ It builds up in fish and other organisms, but it does not build up in plants.

How might I be exposed to zinc?

❏ Ingesting small amounts present in your food and water.
❏ Drinking contaminated water or a beverage that has been stored in metal containers or flows through pipes that have been coated with zinc to resist rust.
❏ Eating too many dietary supplements that contain zinc.
❏ Working on any of the following jobs: construction, painting, automobile mechanics, mining, smelting, and welding; manufacture of brass, bronze, or other zinc-containing alloys; manufacture of galvanized metals; and manufacture of machine parts, rubber, paint, linoleum, oilcloths, batteries, some kind of glass, ceramics, and dyes.

How can zinc affect my health?

Zinc is an essential element in our diet. Too little zinc can cause problems, but too much zinc is also harmful.

Harmful effects generally begin at levels 10-15 times higher than the amount needed for good health. Large doses taken by mouth even for a short time can cause stomach cramps, nausea, and vomiting. Taken longer, it can cause anemia and decrease the levels of your good cholesterol. We do not know if high levels of zinc affect reproduction in humans. Rats that were fed large amounts of zinc became infertile.

Inhaling large amounts of zinc (as dusts or fumes) can cause a specific short-term disease called metal fume fever. We do not know the long-term effects of breathing high levels of zinc.

Putting low levels of zinc acetate and zinc chloride on the skin of rabbits, guinea pigs, and mice caused skin irritation. Skin irritation will probably occur in people.

How likely is zinc to cause cancer?

The Department of Health and Human Services (DHHS) and the International Agency for Research on Cancer (IARC) have not classified zinc for carcinogenicity. Based on incomplete information from human and animal studies, the EPA has determined that zinc is not classifiable as to its human carcinogenicity.

How can zinc affect children?

Zinc is essential for proper growth and development of young children. It is likely that children exposed to very high levels of zinc will have similar effects as adults. We do not know whether children are more susceptible to the effects of excessive intake of zinc than the adults.

We do not know if excess zinc can cause developmental effects in humans. Animal studies have found decreased weight in the offspring of animals that ingested very high amounts of zinc.

How can families reduce the risks of exposure to zinc?

❑ Children living near waste sites that contain zinc may be exposed to higher levels of zinc through breathing contaminated air, drinking contaminated drinking water, touching or eating contaminated soil.

❑ Discourage your children from eating soil or putting their hands in their mouths and teach them to wash their hands frequently and before eating.

❑ If you use medicines or vitamin supplements containing zinc, make sure you use them appropriately and keep them out of the reach of children.

Is there a medical test to determine whether I've been exposed to zinc?

There are tests available to measure zinc in your blood, urine, hair, saliva, and feces. These tests are not usually done in the doctor's office because they require special equipment. High levels of zinc in the feces can mean high recent zinc exposure. High levels of zinc in the blood can mean high zinc consumption and/or high exposure. Tests to measure zinc in hair may provide information on long-term zinc exposure; however, the relationship between levels in your hair and the amount of zinc you were exposed to is not clear.

Has the federal government made recommendations to protect human health?

The EPA recommends that drinking water should contain no more than 5 milligrams per liter of water (5 mg/L) because of taste. The EPA requires that any release of 1,000 pounds (or in some cases 5,000 pounds) into the environment be reported to the agency.

To protect workers, the Occupational Safety and Health Administration (OSHA) has set an average limit of 1 mg/m^3 for zinc chloride fumes and 5 mg/m^3 for zinc oxide (dusts and fumes) in workplace air during an 8-hour workday, 40-hour workweek.

Similarly, the National Institute for Occupational Safety and Health (NIOSH) has set the same standards for up to a 10-hour workday over a 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Zinc (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATTACHMENT B

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

_____

_____

_____

Summary of any job related injuries, illnesses, or near misses that week:

_____

_____

_____

_____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

_____

_____

_____

Comments:

_____

_____

_____

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

_____

_____

_____

CLASSIFICATION OF INJURY:

__ Abrasions _____ Dislocations ____ Punctures

__ Bites _____ Faint/Dizziness ____ Radiation Burns

__ Blisters _____ Fractures ____ Respiratory Allergy

__ Bruises _____ Frostbite ____ Sprains

__ Chemical Burns _____ Heat Burns ____ Toxic Resp. Exposure

__ Cold Exposure _____ Heat Exhaustion ____ Toxic Ingestion

__ Concussion _____ Heat Stroke ____ Dermal Allergy

__ Lacerations

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

_____

Cost of Damage: $ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

_____

_____

_____

_____

Was weather a factor?:_____

_____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

_____

_____

_____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

_____

_____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

_____

_____

Modifications:

_____

Was injured using required equipment?:

_____

_____

If not, how did actual equipment use differ from plan?:

_____

_____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

_____

_____

_____

_____

_____

ACCIDENT/INCIDENT REPORT REVIEWED BY:

_____ _____

SSO Name Printed SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

_____ _____

Signature Title

_____ _____

Signature Title

_____ _____

Signature Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

_____

_____

_____

Physician's recommendations: _____

_____

_____

_____

Date injured returned to work: _____

Follow-up performed by:

_____ _____

Signature Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT C

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATH!

Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!

Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!

Thumbs up

NO! - NEGATIVE!

Thumbs down

ATTACHMENT D

SPECIAL REQUIREMENTS FOR COVID-19

ON-SITE AND OFF-SITE PROCEDURES TO LIMIT CONTAMINATION AND POTENTIAL SPREAD OF COVID-19

Sources: **CDC - COVID-19 Spread and Prevention Information; OSHA - Workplace Preparation Guidance; CDC - Guidance on Extended Use/Limited Reuse of Respiratory Protection**

1) Maintain minimum 6-foot separation from others whenever possible (social distancing). The virus is thought to spread mainly from person-to-person, between people who are in close contact, through respiratory droplets produced when an infected person coughs or sneezes.

2) Wash your hands frequently with soap and water. Wash for at least 20 seconds and, if no soap is present, use a hand sanitizer that contains at least 60% alcohol.

3) Wear nitrile gloves whenever possible and be especially mindful of touching common surfaces.

4) Disinfect commonly touched surfaces frequently, and items frequently used in public immediately upon returning home.

5) Face Coverings and Masks:

   a) On-site: Wear a cloth face covering or mask at all times when there is no issue with maintaining social distancing. N95/KN95 masks or respirators should be reserved for situations where social distancing on-site is difficult or impossible. Appropriate circumstances for donning an N95/KN95 mask or respirator on-site include, but are not necessarily limited to, going inside the Site trailer; and/or entering, exiting, or traversing the Site if proper social distancing cannot be achieved. This tiered approach will help maintain the supply of N95/KN95 masks so they are available for the highest risk scenarios.

   b) Off-site During Work-related Commute: The CDC now recommends wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain (https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/cloth-face-cover.html). A mask or cloth face covering should worn during your commute to and from the site if you are unable to achieve proper social distancing. Appropriate times to wear a mask or cloth face covering include, but are not necessarily limited to, walking on crowded sidewalks, traveling in a shared vehicle, and/or if you are required to enter an occupied indoor space to acquire supplies for the site.

6) Wear safety glasses or goggles at all times while on-site and some form of eye covering (e.g., sunglasses, prescription and non-prescription glasses, or safety glasses) should be considered when commuting.

7) Avoid touching your face (eyes, nose, and mouth).

8) Cover your nose and mouth when coughing, sneezing, etc./ cough into elbow.

9) Do not spit.

10) Try to take your temperature regularly.

11) Talk to your supervisor if you, your friends or family members that you live with or spend time with have displayed symptoms of COVID-19, tested positive, or are afflicted with even the common cold/flu.

12) Talk to your supervisor if anyone you know at the site tested positive for the COVID-19.

13) Follow any additional health & safety protocols required at the site or elsewhere.

APPENDIX C

COMMUNITY AIR MONITORING PLAN (CAMP)

BROOKFIELD COMMONS PHASE 3 SITE

159 S. LEXINGTON AVENUE

WHITE PLAINS, NEW YORK

Community Air Monitoring Plan

BCP Site Number: C360246
AKRF Project Number: 210122

Prepared for:

Trinity Brookfield Commons Four Phase Three Limited Partnership
1350 Broadway, Suite #1700
New York, NY 10018

Prepared by:

AKRF, Inc.
34 South Broadway
White Plains, New York 10601
914-949-7336

AUGUST 2023

REVISED APRIL 2024

TABLE OF CONTENTS

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) were prepared by AKRF, Inc. (AKRF) on behalf of Trinity Brookfield Commons Four Phase Three Limited Partnership (the "Volunteer") for the "Brookfield Commons Phase 3" project site located at 159 South Lexington Avenue in White Plains, New York (the "Site"). The 1.28-acre Site is also identified as part of White Plains Tax Block 7, part of Lot 1 Section 125.83. The Site is part of a multi-story apartment building complex identified as Brookfield Commons or Winbrook. The Site is bounded to the north and east by the construction site of the new Brookfield Commons multi-story residential apartment building, known as "Phase 2 or The Overture"; to the south by a parking lot associated with the Winbrook complex, followed by a vacant lot and various commercial uses and former filling stations; and to the west by South Lexington Avenue, followed by various commercial use. The area surrounding the Site generally consists of mixed-use commercial, residential, and institutional properties.

Historically, the Site was developed with small residential buildings and associated garages, multiple three to four-story apartment buildings, an upholsterer, and an auto repair shop between 1900 and 1942. These structures were demolished for construction of the existing apartment building and grounds, which were constructed in 1949-1950 as part of the Winbrook housing complex.

Based on an evaluation of the data and information from investigations conducted at the Site to date, soil at the Site contains metals and polychlorinated biphenyls (PCBs), petroleum-related and chlorinated volatile organic compounds (VOCs) were detected in soil vapor samples, and chlorinated VOCs were detected in groundwater.

CAMP monitoring will be performed during all ground intrusive activities outlined in the Remedial Investigation Work Plan (RIWP).

2.0 COMMUNITY AIR MONITORING GUIDELINES AND PROCEDURES

2.1 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of the CAMP and will be on-site whenever field work is occurring. The SSO will have a 4-year college degree in occupational safety or an environmental related science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs.

2.2 Training

All personnel who perform sampling activities in the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910, Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety.

2.3 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support Zone is the area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may be changed by the SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Appropriate barriers will be set up to secure the area and prevent any unauthorized personnel from approaching within 15 feet of the work area.

Site Work Zones			
Task	**Exclusion Zone**	**CRZ**	**Support Zone**
Subsurface Investigation	15 feet from the drill rig or a distance equal to the maximum height of the drill rig (whichever is greater)	25 feet from the drill rig	As Needed

2.4 Community Air Monitoring Plan

Real-time air monitoring for VOCs and particulate levels will be performed at the perimeter of the exclusion zone or work area. Continuous community air monitoring will be performed during the installation of soil borings, monitoring wells, or drilled piles and periodic monitoring will be conducted during the collection of soil and sediment samples; or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or drilling soil, monitoring during well baling/purging, and taking a reading prior to leaving a

sample location. Continuous community air monitoring with fixed stations will not be performed during soil, groundwater and soil vapor investigation activities. Installation of soil borings and monitoring wells is minimally invasive work and is not expected to generate any visible dust. The proposed remedial investigation (RI) work is not likely to result in any potential exposure to the nearby community. Nonetheless, real-time air monitoring for VOCs and particulate levels will be performed at the perimeter of the exclusion zone or work area during these activities.

Special CAMP requirements will be coordinated with NYSDOH during implementation of the work is performed within 20 feet of potentially exposed individuals. The community air monitoring action levels and required responses are listed in the following table:

Instrument	Community Action Level	Response Action
PID	Less than 5 ppm above background	Resume work activities with continued monitoring.
	More than 5 ppm above background, but less than 25 ppm	Vapor suppression and continuous monitoring.
	More than 25 ppm above background	Stop work. Resume work when readings are less than 25 ppm.
Particulate Meter (Dust Trak or similar)	Less than 0.1 mg/m^3 above background	Dust suppression
	Greater than 0.15 mg/m^3 above background	Stop work. Resume work when readings are less than 0.15 mg/m^3.
mg/m^3 = milligrams per cubic meter ppm = parts per million		

2.5 Reporting

All CAMP exceedances will be reported to NYSDEC and NYSDOH on the same day or next business day along with the reason for the exceedance(s), what was done to correct it, and if it was effective. If no exceedances are observed, the CAMP data will be submitted to NYSDEC and NYSDOH weekly.

2.6 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF, Inc.	Marc Godick	Project Director	914-922-2356 (office)
	Colleen Griffiths	Project Manager	914-922-2363 (office)
	Gregory Baird	SSO	646-823-5477 (cell)
Trinity Brookfield Commons Four Phase Three Limited Partnership	Omalawa Musa	Architect	646-751-5105
New York State Department of Environmental Conservation	Ryan Richard	Assistant Geologist	845-256-3118 (office)
New York State Department of Health	Jonathan Robinson	Project Manager	Jonathan.robinson@health.ny.gov (email)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

ATTACHMENT D

FINAL GEOTECHNICAL EVALUATION REPORT

GEO DESIGN

UNDERGROUND INTELLIGENCE

FINAL GEOTECHNICAL EVALUATION REPORT

PROPOSED 9 TO 10-STORY BUILDING
BROOKFIELD COMMONS, PHASE 3
161 SOUTH LEXINGTON AVENUE
WHITE PLAINS, NEW YORK

Prepared for:
Trinity NY Development LLC
1350 Broadway, Suite #1700
New York, NY 10018

Prepared By:
GEODesign, Inc. P.C.
241West 30th Street, 5th Floor
New York, NY 10001

GEODesign File No. 3902-002
September 2021

GEO DESIGN

GEODesign, Inc. P.C.
241 West 30th Street, 5th Floor
New York, NY 10001
(212) 221-6651

September 2, 2021
File No. 3902-002

Omalawa Musa
Trinity NY Development LLC
1350 Broadway, Suite #1700
New York, NY 10018

Re: Final Geotechnical Evaluation Report
Brookfield Commons – Phase 3
161 South Lexington Avenue White Plains, New York

Dear Mr. Musa:

GEODesign, Inc. P.C. (GEODesign) is pleased to submit this preliminary geotechnical evaluation report for the referenced project site.

We appreciate the opportunity to work with you. Please contact us if you have any questions or need additional information.

Sincerely,

GEODesign, Inc. P.C.

Jonathan Ciampi, PE
Principal

Thomas G. Thomann, PhD, PE
Senior Principal / Reviewer

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1.0 – INTRODUCTION AND OBJECTIVES

1.1 GENERAL

This report provides geotechnical recommendations for the design and construction of a proposed building at 161 South Lexington Avenue in White Plains, New York (see Figure 1). Authorization to proceed was obtained in the form of an agreement between Trinity NY Development LLC and GEODesign, Inc. P.C. (GEODesign) dated May 18, 2020.

The geotechnical evaluations and recommendations presented herein are in general accordance with the 2020 NYS Building Code (Code).

1.2 SITE CONDITIONS AND PROJECT UNDERSTANDING

The project site is located at 161 South Lexington Avenue in White Plains, New York. The site is occupied by active parking lots, landscaped areas, walking paths, and a nine-story building (159 South Lexington Avenue). The project site is "Phase 3" of the Brookfield Commons redevelopment project, which has a total of seven phases.

The site is bounded by the Phase 2 portion of the project to the north, Brookfield Street to the east, several multi-story buildings to the south, and South Lexington Avenue to the west. We understand that the Phase 2 building is supported on piles.

The Phase 3 building is proposed to be 9 to 10 stories with no cellar level, and a building footprint of approximately 16,200 sq. ft.

1.3 OBJECTIVES AND SCOPE OF SERVICES

The objectives of this investigation were to evaluate the subsurface conditions at the site and provide geotechnical recommendations for the design and construction of the proposed building. The following scope of services was performed to achieve these objectives:

1. Retained and managed subcontractors to perform test borings and laboratory testing;
2. Provided full time inspection of the test boring operations;
3. Performed engineering evaluations and prepared this geotechnical evaluation report that includes the following:
    a. An Introductory Section presenting project background information and the scope of services;
    b. A Subsurface Conditions section that includes the following:
        - A description of the test boring and laboratory testing procedures and results;
        - A plan showing the test boring locations;
        - A description of the subsurface conditions;
    c. An Analyses and Recommendations section regarding the foundation design that includes the following:
        - Seismic site classification and liquefaction potential;
        - Recommended foundation type, estimated capacity, and bearing elevation;
        - Support of the ground floor slab;
        - Lateral soil and groundwater pressures on below-grade walls;

- Permanent groundwater control measures;

d. A Construction Recommendations section that includes the following:
   - Excavation considerations;
   - Adjacent building support considerations;
   - Temporary groundwater control;
   - Subgrade preparation;
   - Pile installation and testing recommendations;
   - Backfill and compaction control recommendations;
   - Pre-construction condition surveys;
   - Construction inspection and monitoring considerations;
e. A Summary and Conclusions section;
f. Appendices that include test boring logs, laboratory test results, and geophysical test results.

1.4 REPORT ORGANIZATION

This report is divided into five sections. Section 1 presents an introduction and the objectives of the study. Section 2 includes a description of the subsurface investigation methods and results. Section 3 provides engineering evaluation results and the foundation design and construction recommendations. A summary and conclusions are included in Section 4. Limitations of the subsurface explorations, analyses, and recommendations are included in Section 5. Tables and Figures are provided at the end of the text.

2.0 – SUBSURFACE CONDITIONS

2.1 GENERAL

The subsurface investigation included laboratory testing and a field investigation, which included drilling test borings and installing a groundwater observation well. Details of the subsurface investigation and the conditions encountered are described in the following sections.

2.2 SUBSURFACE INVESTIGATION

2.2.1 Test Boring Program

Six test borings, designated GD-1 through GD-6, were performed between May 21 and 24, 2021, at the locations shown in Figures 2. Special inspection of the test borings was performed on a continuous basis by GEODesign personnel under the direction of Mr. Jonathan Ciampi, PE of GEODesign.

The test borings were performed by Craig Geotechnical Drilling Co., Inc. of Mays Landing, NJ using a truck mounted CME-75 drilling rig. The boreholes were advanced using mud rotary drilling techniques with a 2-7/8 or 3-7/8 inch diameter tri-cone roller bit and a 4-inch diameter flush joint casing.

Soil samples were obtained using techniques and equipment in general accordance with the American Society for Testing and Materials (ASTM) Standard Specification D1586-Standard Penetration Test (SPT). The SPT consists of driving a 2 inch O.D. split spoon sampler for a distance of 24 inches, with repeated blows of a 140 lb. hammer free falling a distance of 30 inches. The standard penetration, or N-value, is determined as the number of blows required to advance the sampler 12 inches after the initial 6 inches of penetration. The recovered split-spoon samples were placed in jars, labeled with the project name and number, boring number, sample, depth, SPT blow counts and the amount of recovery.

Rock coring was performed using a five-foot long NX (2-1/8 in. O.D.) core barrel to verify the presence of rock and to assess its relative quality, as indicated by Core Recovery[1] and Rock Quality Designation (RQD)[2]. The top of rock was estimated based on the drilling operations (e.g., excessive rig chatter, difficult penetration) and split spoon sampler refusal (i.e., blow counts greater than 100 for a 6 inch interval).

Upon completion of Boring GD-1, a groundwater observation well was installed. The well was constructed of nominal 2-inch diameter Schedule 25 PVC pipe with a 10-foot screen between depths of approximately 15 and 25 feet, and 15 feet of riser pipe. The annulus between the pipe and the wall of the borehole was backfilled with filter sand. A flush-mount cap was installed at the top of the completed borehole.

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[1] The Core Recovery is defined as the ratio (expressed as a percent) of the total length of recovered core to the length cored.

[2] The Rock Quality Designation (RQD) is defined as the ratio (expressed as a percentage) of the total length of recovered core samples having a length of at least twice the core diameter (e.g., about 4 in for NX-core) to the total length of core.

The GEODesign test boring logs are included in Appendix A.

Two test borings, designated as B-6 (OW) and B-7, were performed by AKRF on August 17 and 18, 2017, at the locations shown in Figure 2. The AKRF boring logs are included in Appendix B.

2.2.2 Laboratory Testing

Geotechnical laboratory testing was conducted on representative soil samples to verify the field classifications and assist in engineering evaluations. The laboratory test results, which include sieve analyses and percent fines are included in Appendix C.

2.3 GENERALIZED SUBSURFACE CONDITIONS

2.2.1 GEODesign Subsurface Investigation

The following generalized strata descriptions are based on interpretations of the subsurface investigation results:

Stratum 1 – Uncontrolled Fill: This stratum consists primarily of black and brown sand with varying amounts of silt and miscellaneous fill such as asphalt, concrete glass, and wood. The N-values range from 11 to 25 blows per foot (bpf), with an average of approximately 18 bpf. The thickness of this stratum is estimated to be less than 5 feet.

Stratum 2 – Upper Sand: This stratum generally consists of brown coarse to fine sand with varying amounts of silt and gravel. The N-values range from 3 to 12 bpf, with an average of approximately 7 bpf, indicative of a loose material. The thickness of this stratum is approximately 5 feet.

Stratum 3 – Silt: This stratum was encountered in borings GD-1, GD-3 and GD-4, as well as the AKRF borings, and generally consists of brown and gray silt with varying amounts of sand, clay, and gravel. The N-values range from 7 to 15 bpf, with an average of approximately 11 bpf, indicative of a medium dense material. The thickness of this stratum is approximately 5 to 25 feet.

Stratum 4 – Lower Sand: This stratum generally consists of brown and gray coarse to fine sand with varying amounts of silt and gravel. The N-values range from 11 bpf to split spoon refusal (i.e. greater than 100 blows per 6 inches of penetration), with an average of approximately 50 bpf, indicative of a very dense material. The thickness of this stratum is approximately 10 to 15 feet.

Stratum 5 –Soft Rock: This stratum generally consists of white to light gray decomposed granite. The N-values were typically split-spoon refusal, indicative of a very dense material. When rock coring was performed, the Core Recovery and RQD were 50% and 23%, respectively. The thickness of this stratum is approximately 0 to 10 feet.

Stratum 6 – Intermediate to Hard Rock: This stratum generally consists of white and gray medium to fine grained schist, gneiss, and granite that was slightly to moderately fractured with fresh to moderately weathered joints. The Core Recovery ranges from 65% to 100% and

the RQD ranges from 40% to 97%. The depth to the top of this stratum, which generally increases from south to north, varies from 20 to 49 feet (el. +180 to +150 feet).

2.4 GROUNDWATER LEVELS

A groundwater observation well was installed in boring GD-1. Additionally, an existing well, installed by others, was located within the proposed building footprint. Measurements taken on May 24, 2021 indicate groundwater depths of approximately 4 and 6 feet, which corresponds to approximately el. +193 to +196 feet.

Groundwater measurements were not taken over an extended period of time; therefore, the measurements do not adequately reflect seasonal or other time dependent variations that may occur. See limitations in Section 5.

3.0 – ANALYSES AND RECOMMENDATIONS

3.1 GENERAL

This section presents engineering analyses, evaluations, and recommendations related to the design and construction of the foundations and below grade structures. The evaluations and recommendations are based on the available subsurface information, our experience on other projects, and the design requirements provided herein for the proposed structure.

3.2 FOUNDATION DESIGN

3.2.1 Seismic Recommendations

Based on the soil profile, the recommended seismic site classification is Site Class "D". In accordance with the Code, if the Risk Category is I&II or III, the Seismic Design Category is "B". The appropriate Risk Category should be determined by the Architect or Structural Engineer. Liquefaction is not a concern at this site.

3.2.2 Foundation Recommendations

3.2.2.1 Columns and Walls

Considering the risk of unacceptable settlement for shallow foundations founded on Stratum 3 and the difficulty and expense of dewatering a site with potentially contaminated groundwater, we recommend that the building be supported on piles.

The vibrations from driving piles could result in unacceptable settlement and/or damage to adjacent structures if they are too close to the pile driving operations. Considering that there does not appear to be any existing buildings or other structures within close proximity of the new building location, we recommend that the building be supported on driven piles.

Considering the soil conditions above the rock and that the depth to bedrock is relatively shallow, it is anticipated that the driven piles will obtain their capacity from bearing on, or close to, the rock. For the purpose of preparing foundation designs, the following driven pile types, sizes, and estimated capacities should be considered:

Pile Type & Size	Estimated Allowable Compression Capacity (tons)	Estimated Allowable Tension Capacity (tons)	Estimated Allowable Lateral Capacity (tons)	Minimum Pile Length (ft)	Minimum Pile Spacing (ft)
HP12x63	150	3.5	5	20	2.5
13-3/8" OD open-ended steel pipe pile	150	3.5	5	20	2.5

Notes:

1. The piles will likely need to be driven to Stratum 6 (rock) to obtain the compression capacities shown above. However, if Stratum 5 (soft rock) is thick enough to provide the necessary resistance to meet the compression capacity and the piles meet the minimum pile length requirements, the piles can be founded within this stratum.
2. The piles should have a minimum yield strength of 50 ksi.
3. The recommended allowable tension capacities are based on the minimum pile length (i.e. pile cutoff to tip) and a factor of safety of 3.
4. The recommended allowable lateral capacities are based on the minimum pile length and a factor of safety of 2.

If the pile tension loads are greater than the pile tension capacity, drilled caissons or tiedown anchors will be required.

3.2.2.2 Ground Floor Slab

The ground floor slab will likely bear on Stratum 1 (fill). This slab could be designed as a slab-on-grade. If the fill contains a large amount of unsuitable material (e.g. wood, refuse, metal, etc.), it will be necessary to remove the material and replace it with acceptable backfill.

3.2.3 Lateral Earth Pressures

The design lateral pressures for permanent below grade walls consist of static and seismic pressures that are influenced by the thickness and type of overburden material, and wall bracing conditions. We recommend that the below grade walls above and below the design groundwater level be designed for a static equivalent hydrostatic lateral soil pressure of 45 pcf and 85 pcf, respectively. (i.e., soil wall pressure is a triangular pressure).

In addition, a seismic lateral soil force of $6H^2$ (lb/ft. of wall), where H is the total vertical height of the wall, in feet, should be included. This force should be applied at a distance of H/3 from the top of the wall (i.e., seismic wall pressure is an inverted triangle).

The recommended lateral pressures do not include any surcharge loads adjacent to the walls or at the ground surface. We recommend that a uniform (i.e., rectangular) lateral pressure distribution of 0.40 times the design surcharge be added to the lateral soil pressure distribution. The structural engineer should determine the magnitude of the design surcharge loads (i.e., live loads).

3.2.4 Permanent Groundwater Control

Based on the measured groundwater level and taking into consideration that the groundwater level may fluctuate due to seasonal conditions, we recommend a design groundwater elevation of +199 feet.

If the bottom of the foundation elements (i.e., slab, elevator pits, ejector pits, etc.) will be above the design groundwater elevation, the below grade walls and the foundation should, at a minimum, be damproofed. Damproofing should be performed at the bottom of the foundation by installing a membrane, such as Grace Construction Products Florprufe, or approved equal. Damproofing of the below grade walls should be performed with a liquid applied membrane (LAM), such as Grace Construction Products Procor, or approved equal, for 2-sided forms, or a membrane, such as Grace Construction Products Preprufe, or approved equal, for blind-sided forms.

If the bottom of the foundation elements will be below the design groundwater elevation, the below grade walls and foundation should be designed to resist groundwater pressures and be waterproofed. Waterproofing materials should be installed on the outside of the perimeter walls (Grace Construction Products Bituthene 3000 for two-sided form applications and Preprufe 160R for blind side applications, or approved equivalent) and directly beneath the foundation (Grace Construction Products Preprufe 300R, or equivalent). The waterproofing on the perimeter walls is typically installed to the ground surface. Waterstops should be installed at applicable locations.

The installation of all waterproofing elements should be inspected on a full-time basis to confirm that the waterproofing is being applied as per the manufacturer's specifications and details.

3.3 CONSTRUCTION RECOMMENDATIONS

3.3.1 Excavation Considerations

Local temporary soil excavations above the natural groundwater level can have cut slopes as steep as 1H:1V (horizontal to vertical). Temporary soil excavations below the natural groundwater level should be no steeper than 2H:1V. The slopes of any excavations adjacent to any existing structures should be no steeper than 2H:1V, unless approved by the SOE engineer.

All vertical soil faces will require temporary support until the new foundation walls and foundations are constructed and the area is properly backfilled. Considering the subsurface conditions and the proposed excavation depths, a feasible support system could consist of sloped excavations and driven soldier piles and timber lagging with sufficient lateral restraint (e.g., anchors, rakers, bracing, etc.), if necessary. Design of the excavation support and lateral

bracing must also consider the protection of surrounding subsurface utilities and other adjacent improvements, and groundwater control.

The design and construction of any slopes and/or temporary excavation support systems should be the responsibility of a licensed New York Professional Engineer. All excavations and temporary support systems should conform to pertinent OSHA and local safety regulations.

3.3.2 Adjacent Building Support

Adjacent building support is required at locations where the new foundations will be placed within the influence zone of adjacent building foundations. Based on a review of the site conditions, it does not appear that any excavation will be performed within the influence zone of any adjacent buildings.

If adjacent building support is required, the analysis and design should be performed by a licensed New York Professional Engineer. Adjacent building support installation should be inspected full time by a qualified engineer acting under the direction of the design engineer.

3.3.3 Temporary Groundwater Control

The groundwater level should be maintained sufficiently below the bottom of the excavation so that the foundation bearing surface can be adequately prepared. The need for temporary groundwater control will depend on the groundwater level at the time of construction and the proposed excavation depths.

Based on a measured groundwater elevation of +196 feet, it should be anticipated that temporary dewatering will be required during excavation operations. Excavations for the pile caps, elevator pits, and/or ejector pits will likely be close to, or lower than the measured groundwater elevation. The amount of dewatering will depend on the final number and depth of the pile caps, elevator pits, and ejector pits. However, we anticipate that localized dewatering with sumps may be appropriate in most cases.

3.3.4 Subgrade Preparation

Subgrade surfaces for the slabs should be level and cleaned of loose soil, mud, and other material (such as concrete, brick, wood, debris, etc.) that can have a negative impact on the performance of the slab.

If necessary, the soil subgrade should be proof-rolled with a minimum of 6 passes of a smooth drum roller with a minimum 1,500 lb. static weight and minimum centrifugal force of 4,000 lbs. or similar approved equipment. The proof-rolling should not be performed when the subgrade is wet, muddy, or frozen.

Any unstable areas which cannot be stabilized by additional compaction should be excavated to competent material and the area backfilled with compacted structural fill or ¾" stone. If the foundation is constructed in the winter, the subgrade should be protected from frost to limit possible subgrade deterioration resulting from freezing and thawing cycles. Concrete should not be poured if the subgrade is wet, muddy, or frozen.

A minimum 6-inch thick layer of compacted coarse aggregate, commonly known as ¾" gravel or crushed stone, or a "mud-slab" (i.e., 2 inches of lean concrete), should be placed on the approved subgrade to protect the subgrade from disturbance.

3.3.5 Driven Pile Installation and Testing

Prior to driving any piles, the contractor should submit Wave Equation Analysis (WEAP) results of the proposed pile and hammer configuration to confirm that the proposed pile driving system will obtain the necessary pile capacity without overstressing the pile.

We recommend that a minimum of six test piles be installed and that all test piles be monitored using a Pile Driving Analyzer (PDA). A PDA provides real-time information regarding pile capacity and stresses during pile driving and will assist in deciding which piles to select for static load testing and will assist in developing the pile driving criteria. The PDA testing should be included in the contractors' scope and be performed by a company with sufficient PDA testing experience.

We recommend performing one static compression load test for the driven piles. The load test should be performed in accordance with ASTM D1143 and the Code requirements.

During the driving of piles, vibration and settlement monitoring should be performed at any structures that might be sensitive to damage due to vibrations.

3.3.6 Backfill and Compaction Requirements

Select backfill or structural backfill should consist of granular soils free of cinder, brick, asphalt, ash, and other unsuitable materials. Such material should not contain any boulders or cobbles larger than about 4 inches across, and should have a fines content (material passing the No. 200 sieve) between 5 and 15 percent. The subgrade underneath the backfill should be properly prepared and inspected (building foundations only) prior to placement of backfill.

All backfill should be placed in lifts not exceeding 8-in. in loose thickness. Backfill placed beneath slabs-on-grade, behind below grade walls, and underneath sidewalks should be compacted to a minimum of 90% of the maximum dry density.

3.3.7 Pre-construction Condition Survey and Monitoring

A pre-construction condition survey of any adjacent structures should be performed if damage occurs to the structures during construction. The report should include written documentation and photographs of the existing condition of the structures.

Based on the survey results, a monitoring program should be developed for the purpose of checking the performance of the adjacent structures and construction procedures. The monitoring program should include, at a minimum, recommendations for the location of survey points to monitor vertical and horizontal movements, locations for crack gauges, and locations for monitoring vibrations during key construction activities. The monitoring program should also include threshold levels for allowable movements and vibrations, and the procedures to be implemented if the threshold levels are exceeded during construction.

3.3.8 Construction Monitoring

We recommend that a geotechnical engineer familiar with the subsurface conditions and foundation design criteria, review and approve the foundation contractor's procedures and provide inspection services during excavation and foundation construction. Geotechnical related inspection services should include the following:

- Review and approval of contractor submittals related to foundation construction;
- Observation and documentation of all phases of excavation and foundation construction;
- Special inspection of the support of excavation;
- Special inspection of the pile installation and testing;
- Special inspection of structural fill placement and compaction.
- Monitoring of adjacent structures and interpretation of the monitoring data.

4.0 – SUMMARY AND CONCLUSIONS

This report provides geotechnical recommendations for the design and construction of a new 9 to 10-story building, as part of the Brookfield Commons Phase 3 development, located at 161 South Lexington Avenue in White Plains, New York.

Based on six test borings by GEODesign and two test borings by AKRF, the subsurface conditions above the bedrock generally consist of less than 5 feet of uncontrolled fill (Stratum 1), 5 feet of loose sand (Stratum 2), 5 to 25 feet of medium dense silt (Stratum 3), 10 to 15 feet of dense sand (Stratum 4), and up to 10 of soft rock (Stratum 5). The top of intermediate to medium hard bedrock (Stratum 6) was encountered at depths ranging from approximately 20 to 49 feet (el. +150 to +180 feet). Groundwater was measured in two wells at depth of approximately 4 and 6 feet (el. +193 to +196 feet).

The recommended seismic site classification is Site Class "D". If the new building is in Risk Category I&II, or III, the Seismic Design Category is "B". Liquefaction does not need to be considered for the foundation design.

Considering the risk of unacceptable settlement for shallow foundations founded on Stratum 3 and the difficulty and expense of dewatering a site with potentially contaminated groundwater, we recommend that the building be supported on piles. This report includes recommendations for driven 150 ton driven piles. We anticipate that localized dewatering with sumps may be appropriate for the construction of pile caps, elevator pits, and ejector pits..

We recommend that at least six test piles be driven with a PDA, prior to the installation of production piles, for the purpose of verifying estimated pile lengths and assisting in developing pile driving criteria for the production piles. We also recommend that one static pile load tests be performed to confirm the allowable compression pile capacity.

The recommended design groundwater elevation is +199 feet. If the bottom of the foundation elements will be above the design groundwater elevation, the below grade walls and the foundation should, at a minimum, be damproofed. If the bottom of the foundation elements will be below the design groundwater elevation, the below grade walls and foundation should be designed to resist groundwater pressures and be waterproofed.

The report includes additional information regarding the subsurface conditions and foundation design recommendations and additional recommendations regarding excavation considerations, adjacent building support, temporary groundwater control, subgrade preparation, driven pile installation and testing, backfill and compaction requirements, pre-construction condition surveys and monitoring, and construction inspection and monitoring.

5.0 – LIMITATIONS

Explorations

1. The analysis and recommendations submitted in this report are based in part upon the data obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to reevaluate the recommendations of this report.
2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.
3. Water level readings have been made in the drill holes at times and under conditions stated on the logs. These data have been reviewed and interpretations made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design, or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by GEODesign. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

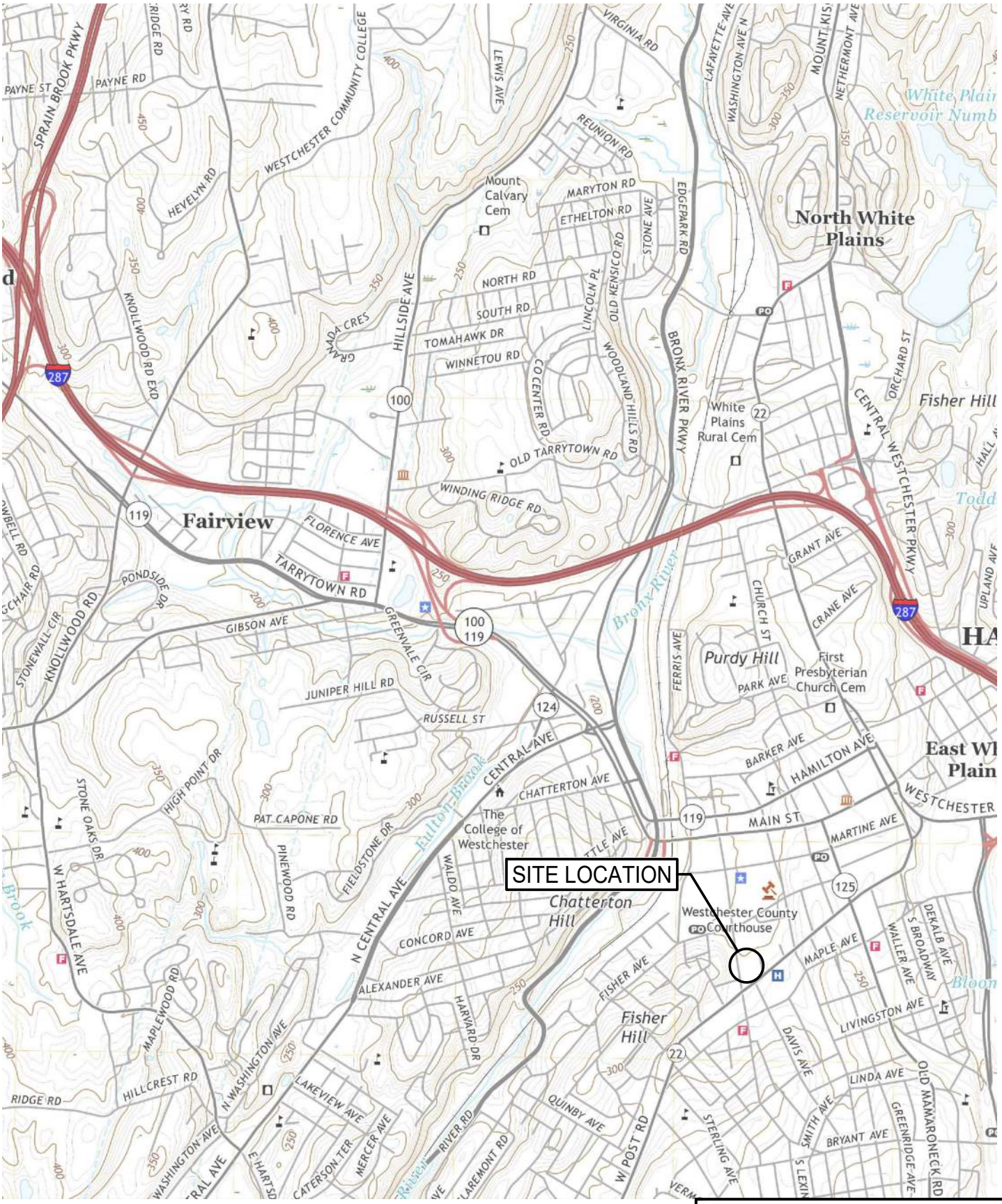
Construction

5. It is recommended that this firm be retained to provide soil engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Uses of Report

6. This report has been prepared for the exclusive use of Trinity NY Development LLC for specific application to the proposed structure Brookfield Commons Phase 3 located at 161 South Lexington Avenue in White Plains, NY in accordance with generally accepted soil and foundation engineering practices. No other warranty, express or implied, is made.

FIGURES



MAP SOURCE: UNITED STATES GEOLOGICAL SURVEY, 2019, THE NATIONAL MAP - WHITE PLAINS, NEW YORK - WESTCHESTER COUNTY QUADRANGLE, 7.5 MINUTE SERIES

GEO DESIGN
241 WEST 30TH STREET, 5TH FLOOR
NEW YORK, NY 10001
212.221.6651
geocompanies.com

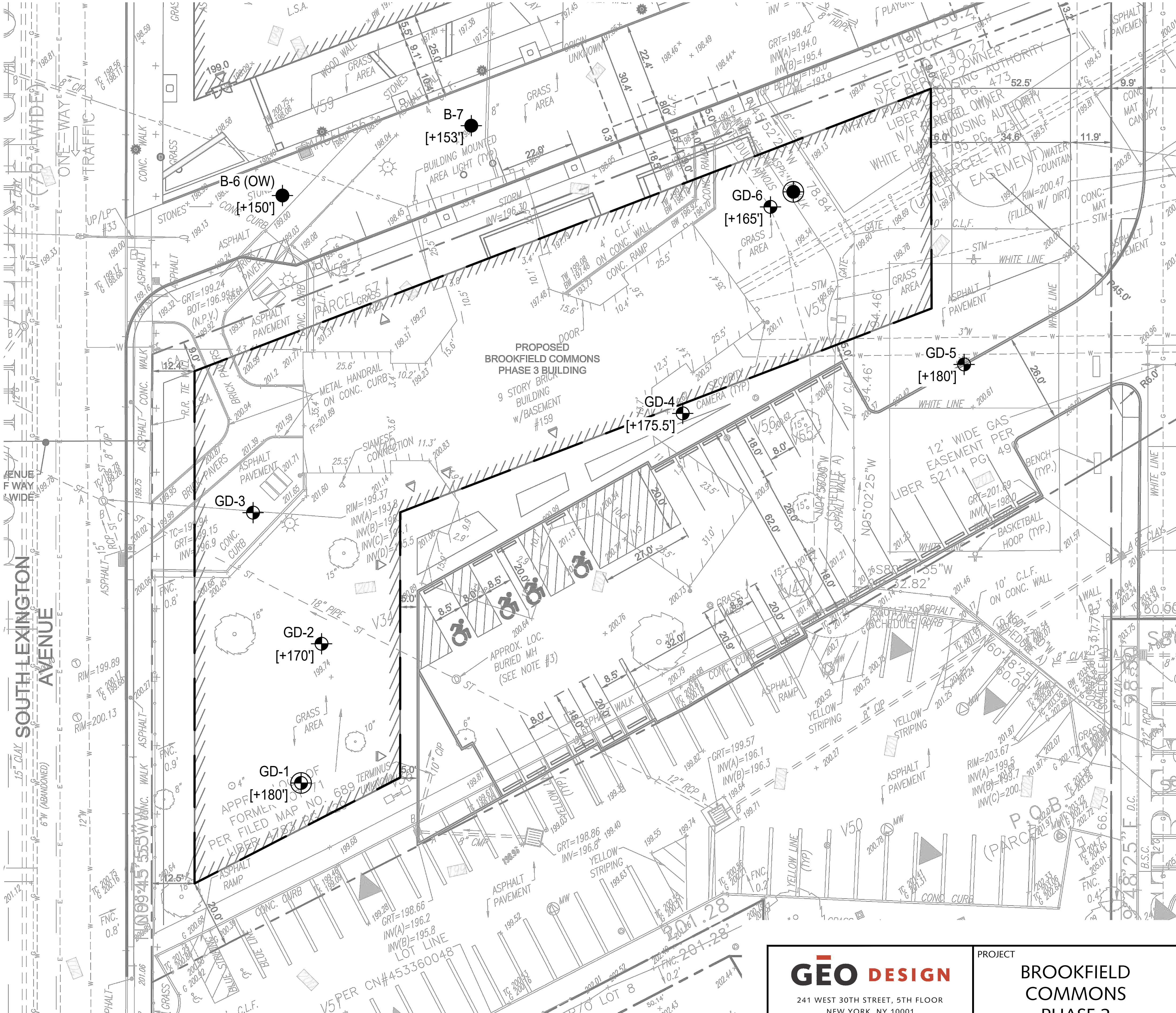
PROJECT
BROOKFIELD COMMONS PHASE 3
WHITE PLAINS, NY

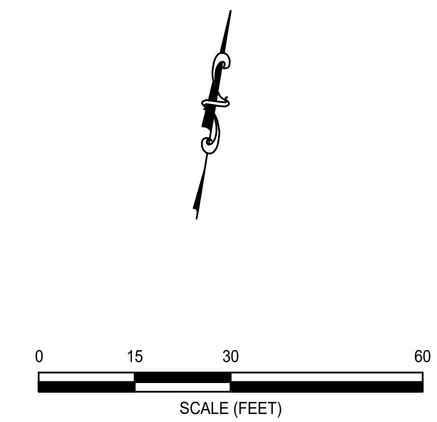
DRAWING TITLE
SITE LOCATION PLAN

PROJECT NO.	3902-002
SCALE	1" = 2000'
DATE	06/09/2021
DESIGNED BY	JC
DRAWN BY	MFA
APPROVED BY	JC

DRAWING NO.
FIGURE 1
01 OF 01

M:\CL\3902 Trinity Financial\002 - BrookfieldCommons\Drawings\SiteLocation\Figure1_SiteLocation.dwg 6/10/2021 8:22 AM GD-STD_3.0.ctb





LEGEND

GD-2	TEST BORING BY GEODESIGN NO. AND LOCATION.
GD-1	TEST BORING WITH GROUNDWATER OBSERVATION WELL BY GEODESIGN NO. AND LOCATION
B-7	TEST BORING BY OTHERS NO. AND LOCATION
	PRE-EXISTING OBSERVATION WELL BY OTHERS
[+170']	ESTIMATED ELEVATION OF TOP OF INTERMEDIATE ROCK OR BETTER

NOTES:

1. BASE MAP DEVELOPED FROM AN ELECTRONIC FILE PROVIDED BY MARVEL ARCHITECTS ENTITLED "SITE PLAN" DATED 4/13/21.
2. ELEVATIONS REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. BORINGS WERE PERFORMED BY CRAIG GEOTECHNICAL DRILLING AND WERE OBSERVED AND LOGGED BY GEODESIGN PERSONNEL.
4. THE LOCATIONS OF THE BORINGS WERE DETERMINED BY TAPING AND VISUAL ESTIMATES FROM EXISTING SITE FEATURES.

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PROJECT	DRAWING TITLE			DRAWING NO.
BROOKFIELD COMMONS PHASE 3 WHITE PLAINS, NY	BORING LOCATION PLAN	PROJECT NO.	3902-002	FIGURE 2
		SCALE	AS INDICATED	
		DATE	6/9/2021	
		DESIGNED BY	JC	
		DRAWN BY	MFA	
		APPROVED BY	JC	01 OF 01

APPENDIX A
GEODESIGN TEST BORING LOGS

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-1
Page No.: 1 of 1
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/21/2021
Foreman:	Mark Aquino	Date Completed:	5/21/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	200 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	25
Coordinates:		Rock Depth (ft):	20

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:	140 lbs	140 lbs	
Hammer Fall:	30 in.	30 in.	
Hammer Type:	Safety - Cathead		

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼ 5/24/21	6.0	194.0	
▼			
▼			

Depth (ft)	SAMPLE INFORMATION: Type	Number	Recovery (inches)	Pen. Resist (blows/6 in.)	Coring Time (min./ft)	Recovery (%)	RQD (%)	Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	STRATA: Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	WELL LOG	REMARKS/ OTHER TESTS
0	SS	1	10	3 3 3 1								SAND 4.0 196.0		(SP) Brown m-f SAND, little topsoil, trace silt		
5												INFERRED BOULDER 6.0 194.0				Hard drilling from 4' to 6'
	SS	2	6	1 7 8 4						34.6	40	CLAY 8.5 191.5		(CL) Light brown CLAY, some fine sand, some gravel, trace wood fragments		Sample 2 was taken from 6'-8'
10	SS	3	15	8 7 15 18						16.8	15	SAND 14.0 186.0		Hard drilling from 8'-10' (SM) Light brown and reddish orange c-f SAND, trace gravel, trace silt		
15	SS	4	0	50/0"								SOFT ROCK 20.0 180.0		No recovery		Hard drilling from 14'-19' Rig chattering Split spoon was bouncing and hit refusal in sample 4
20	C	1	57		1.5 2.5 2.5 3 3.5	95	80					BEDROCK 25.0 175.0		(BEDROCK) Gray, m-f grained, slightly weathered, slightly fractured, meduim hard GRANITE		25' Observation well installed 10' screen + 15' riser Hole was backfilled with filter sand and capped with bentonite
25												Bottom of Exploration at 25.0 ft				

NOTES:
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made. AC = After coring; NR = Not Recorded.
3) Abbreviations: A = Auger; C = Core; MC=Macrocore; D = Driven; G = Grab; PS = Piston Sample; SS = Split Spoon; SSL = Large Split Spoon; ST = Shelby Tube; V = Vane; WOR/H = Weight of Rod/Hammer
4) Proportions Used: Trace = 1-10%; Little = 10-20%; Some = 20-35%; And = 35-50%
5) (SP) = Unified Soil Classification System symbol; [3a] = NYC Building Code Classification

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-2
Page No.: 1 of 2
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/21/2021
Foreman:	Mark Aquino	Date Completed:	5/21/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	200 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	40
Coordinates:		Rock Depth (ft):	30

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:		140 lbs	140 lbs
Hammer Fall:		30 in.	30 in.
Hammer Type:		Safety - Cathead	

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼			
▼			
▼			

Depth (ft)	Type	Number	Recovery (inches)	Pen. Resist (blows/6 in.)	Coring Time (min./ft)	Recovery (%)	RQD (%)	Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
0	SS	1	18	9 10 10 8								FILL		(FILL) Brown fine SAND, little silt, trace brick, trace topsoil	
												3.5 — 196.5			
												SAND			
5	SS	2	12	1 1 2 2						38.3	16.4			(SM) Dark grayish brown m-f SAND, little silt, trace wood	
10	SS	3	9	10 6 6 10										(SM) Yellowish orange c-f SAND, little silt, trace gravel	
15	SS	4	18	88 80 36 26										(SM) Yellowish orange c-f SAND, little gravel, little silt	SS bouncing, switched to auto. hammer Hard drilling from 17-20'
20	SS	5	14	22 15 13 10						17.5	20			(SM) Light brown m-f SAND, little silt	Auto. hammer used for S-5
25															

NOTES:
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2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made. AC = After coring; NR = Not Recorded.
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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-2
Page No.: 2 of 2
File No.: 3902-002

Depth (ft)	SAMPLE INFORMATION: GENERAL Type	Number	Recovery (inches)	SOIL Pen. Resist (blows/6 in.)	ROCK Coring Time (min./ft)	Recovery (%)	RQD (%)	LAB Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	STRATA Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
25	SS	6	1	50/1"								25.5 SAND 174.5 (Continued) SOFT ROCK		(SM) Light brown m-f SAND, little silt	Hard drilling and rig chatter up to 25'
															Auto. hammer used for S-6 and hit refusal
															White rock fragments in water return around 26'
30	C	1	42		3 2 2.5 2.5 3	70	63					30.0 170.0 BEDROCK		(BEDROCK) Gray, m-f grained, slightly fractured, fresh joints, meduim hard GRANITE	
35	C	2	57		3 3 3 3 3.5	95	81					40.0 160.0		(BEDROCK) Gray, m-f grained, slightly fractured, fresh joints, intermediate GRANITE	
40														Bottom of Exploration at 40.0 ft	
45															
50															
55															

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-3
Page No.: 1 of 2
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/24/2021
Foreman:	Mark Aquino	Date Completed:	5/24/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	201 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	37
Coordinates:		Rock Depth (ft):	32

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:		140 lbs	140 lbs
Hammer Fall:		30 in.	30 in.
Hammer Type:		Safety - Cathead	

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼			
▼			
▼			

SAMPLE INFORMATION

Depth (ft)	GENERAL Type	Number	Recovery (inches)	SOIL Pen. Resist (blows/6 in.)	ROCK Coring Time (min./ft)	Recovery (%)	RQD (%)	LAB Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines
0											
5	SS	1	12	1, 2, 1, 2						36.2	55.7
10	SS	2	10	2, 2, 4, 5							
15	SS	3	16	3, 6, 6, 6						26.8	97.9
20	SS	4	12	3, 4, 4, 5							
25											

STRATA Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
0.5 ASPHALT (201.5)			Hard drilling and SS refusal below asphalt
FILL			First sample taken at 5'
4.0 (197.0)			
CLAY		(CL) Brown CLAY and SAND, trace silt	
8.5 (192.5)			
SAND		(SM) Brown and gray m-f SAND, some silt	
13.5 (187.5)			
SILT		(ML) Gray SILT, some clay, little sand	
		(ML) Gray SILT, some clay, little sand	
23.5 (177.5)			
SAND			

NOTES:
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made. AC = After coring; NR = Not Recorded.
3) Abbreviations: A = Auger; C = Core; MC=Macrocore; D = Driven; G = Grab; PS = Piston Sample; SS = Split Spoon; SSL = Large Split Spoon; ST = Shelby Tube; V = Vane; WOR/H = Weight of Rod/Hammer
4) Proportions Used: Trace = 1-10%; Little = 10-20%; Some = 20-35%; And = 35-50%
5) (SP) = Unified Soil Classification System symbol; [3a] = NYC Building Code Classification

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-3
Page No.: 2 of 2
File No.: 3902-002

Depth (ft)	SAMPLE INFORMATION: GENERAL Type	Number	Recovery (inches)	SOIL Pen. Resist (blows/6 in.)	ROCK Coring Time (min./ft)	Recovery (%)	RQD (%)	LAB Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	STRATA Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
25	SS	5	14	25 24 20 13								SAND *(Continued)*		(SP) Brown, black, and orange c-f SAND, trace gravel, trace silt	
												28.0 / 173.0			
												SOFT ROCK			Hard drilling from 28'-30'
30															
	C	1	30		3 1 1.5 1.75 1	50	23							(SOFT ROCK) White and Gray, m-f grained, slightly weathered, moderately fractured, soft GRANITE and SCHIST	
35												37.0 / 164.0			
														Bottom of Exploration at 37.0 ft	
40															
45															
50															
55															

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-4
Page No.: 1 of 2
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/21/2021
Foreman:	Mark Aquino	Date Completed:	5/24/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	200.5 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	30
Coordinates:		Rock Depth (ft):	25

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:		140 lbs	140 lbs
Hammer Fall:		30 in.	30 in.
Hammer Type:		Safety - Cathead	

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼			
▼			
▼			

Depth (ft)	Type	Number	Recovery (inches)	Pen. Resist (blows/6 in.)	Coring Time (min./ft)	Recovery (%)	RQD (%)	Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
0	SS	1	20	7 12 13 8								0.5 TOPSOIL 200.0 FILL		(FILL) Black and brown c-f SAND, little gravel and topsoil, trace concrete, glass, and silt	
												3.5 197.0 SILT			
5	SS	2	12	3 3 4 3										(ML) Brown SILT, some m-f sand	
												8.5 192.0 SAND			
10	SS	3	13	19 21 18 16										(SM) Brown c-f SAND, little silt, trace gravel	
															Hard drilling at 14'
15	SS	4	12	22 16 12 50/1"						11.3	20			(SM) Light brown and yellowish orange c-f SAND, little silt, little gravel	Auto. hammer used for S-4 SS refusal at 19"
												17.0 183.5 SOFT ROCK			
															Hard drilling and rig chatter from 18'-25'
20	SS	5	0	50/0"										No Recovery	SS refusal Spoon bouncing
												25.0 175.5			
25															

NOTES:
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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-4
Page No.: 2 of 2
File No.: 3902-002

Depth (ft)	SAMPLE INFORMATION: GENERAL Type	Number	Recovery (inches)	SOIL Pen. Resist (blows/6 in.)	ROCK Coring Time (min./ft)	Recovery (%)	RQD (%)	LAB Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	STRATA Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
25	C	1	51		7.75 6 5 5 5	85	62					BEDROCK 30.0 170.5		(BEDROCK) White and gray m-f grained, slightly weathered, modereately fractured medium hard GRANITE	
30														Bottom of Exploration at 30.0 ft	
35															
40															
45															
50															
55															

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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-5
Page No.: 1 of 1
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/24/2021
Foreman:	Mark Aquino	Date Completed:	5/24/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	200 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	25
Coordinates:		Rock Depth (ft):	20

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:		140 lbs	140 lbs
Hammer Fall:		30 in.	30 in.
Hammer Type:		Safety - Cathead	

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼			
▼			
▼			

Depth (ft)	Type	Number	Recovery (inches)	Pen. Resist (blows/6 in.)	Coring Time (min./ft)	Recovery (%)	RQD (%)	Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
0												0.5 ASPHALT 3.5			
	SS	1	12	10 6 5 2								FILL		(FILL) Black, gray, brown, and orange c-f SAND, little silt, trace gravel, trace wood fragments	
												3.5 196.5			
												SAND			
5	SS	2	12	3 5 6 6										(SM) Greenish gray m-f SAND, little silt, trace gravel	
												8.5 191.5			
10	SS	3	8	12 23 46 8						8.8	9			(SP) Greenish gray m-f SAND, trace silt, trace gravel	
												13.5 186.5			
15	SS	4	10	10 17 75/1"										(SM) Greenish gray c-f SAND, little silt	Switched to auto. hammer for S-4 after SS was bouncing for 25 blows SS refusal with auto. hammer
												20.0 180.0			
20	C	1	60		3.75 4.5 4.5 3.5 4	100	83					BEDROCK		(BEDROCK) White and gray m-f grained, slightly weathered, moderately fractured, meduim hard GRANITE	
25												25.0 175.0			

Bottom of Exploration at 25.0 ft

NOTES:
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: GD-6
Page No.: 1 of 2
File No.: 3902-002

Boring Company:	Craig Geotechnical Drilling	Date Started:	5/24/2021
Foreman:	Mark Aquino	Date Completed:	5/24/2021
GeoDesign Rep.:	Mehmet Arslaner	Surface El. (ft):	199 (NAVD88)
Rig Type:	CME 75 Truck	Total Depth (ft):	39
Coordinates:		Rock Depth (ft):	34

	Barrel	Casing	Sampler
Type:	NX	FJ	SS
I.D.:	2.2 in.	4.0 in.	1.38 in.
Hammer Wt.:		140 lbs	140 lbs
Hammer Fall:		30 in.	30 in.
Hammer Type:		Safety - Cathead	

GROUNDWATER OBSERVATIONS

DATE	DEPTH (ft)	ELEV. (ft)	NOTES
▼			
▼			
▼			

Depth (ft)	Type	Number	Recovery (inches)	Pen. Resist (blows/6 in.)	Coring Time (min./ft)	Recovery (%)	RQD (%)	Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
0												0.5 ASPHALT 3.5			
	SS	1	20	10 6 8 4								FILL		(FILL) Black and brown c-f SAND, trace asphalt, glass, gravel and silt	
												3.5 195.5 SAND			
5	SS	2	12	3 4 4 3										(SM) Light brown c-f SAND, some to little silt, trace gravel	
10	SS	3	10	5 5 5 19								13.5 185.5		(SM) Greenish gray and brown fine SAND, little silt, trace gravel	
15	SS	4	16	96 24 25 27										(SP) Grayish brown m-f SAND, trace gravel, trace silt	Switched to auto. hammer for S-4 after 25 blows for 0" Inferred boulder at 15'
20	SS	5	14	17 20 17 19								23.5 175.5		(SP) Grayish brown m-f SAND, trace gravel, trace silt	Hard drilling at 23'
25															

NOTES:
1) Stratification lines represent approximate boundary between material types, transitions may be gradual.
2) Water level readings have been made at times and under conditions stated, fluctuations of groundwater may occur due to other factors than those present at the time measurements were made. AC = After coring; NR = Not Recorded.
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4) Proportions Used: Trace = 1-10%; Little = 10-20%; Some = 20-35%; And = 35-50%
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BORING LOG

PROJECT NAME

Brookfield Phase 3
151 South Lexington Ave
White Plains, NY

Boring No.: **GD-6**
Page No.: 2 of 2
File No.: 3902-002

Depth (ft)	SAMPLE INFORMATION: GENERAL Type	Number	Recovery (inches)	SOIL Pen. Resist (blows/6 in.)	ROCK Coring Time (min./ft)	Recovery (%)	RQD (%)	LAB Liquid Limit	Plastic Limit	Moisture Content (%)	Percent Fines	STRATA Depth & Elevation (ft)	SYMBOL	SAMPLE DESCRIPTION	REMARKS/ OTHER TESTS
25	SS	6	22	57 41 26 19						15.9	34.8	28.5 / 170.5		(SM) Gray, light brown, and yellowish orange m-f SAND, some silt	Auto. hammer used
30	SS	7	3	100/1"								30.5 / 168.5 SOFT ROCK		(SP) Gray, light brown, and yellowish orange m-f SAND, trace gravel, trace silt	
35	C	1	55		3.5 3.25 3 3 2.25	92	40					34.0 / 165.0 BEDROCK 39.0 / 160.0		Top 30": (BEDROCK) Black m-f grained, moderately weathered, moderately fractured, intermediate GNEISS Bottom 25": (BEDROCK) White and Gray m-f grained, slightly weathered, moderately fractured, intermediate GRANITE	
40														Bottom of Exploration at 39.0 ft	
45															
50															
55															

APPENDIX B
AKRF TEST BORING LOGS

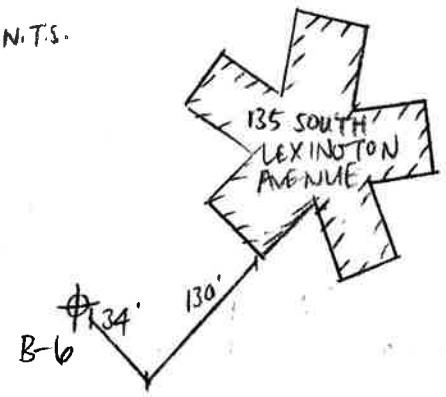
LOG OF BORING B-6

PAGE 1 OF 4

AKRF Engineering, P.C.
440 Park Avenue South
New York, NY 10016

PROJECT NAME:	Brookfield Commons - Winbrook	CONTRACTOR:	Craig Geotechnical Drilling Co, Inc
PROJECT NO.:	170131	RIG TYPE & FOREMAN:	CME 750X - Paul Mullin
PROJECT LOCATION:	135 S Lexington Ave, White Plains NY	SAMPLER TYPE(S):	split spoon, NQ core barrel
BOREHOLE COORD. (N/E):	41.0269° / 73.7711° (not surveyed)	HAMMER TYPE(S)	automatic
ELEVATION/DATUM:	+198 / NAVD 88	DRILL BIT TYPE/DIA.:	tri-cone / 3 7/8" & 2 5/8"
BORING START:	8/17/17 7am	CASING TYPE/DIA.:	steel flush joint / 4"
BORING END:	8/17/17 2pm	WATER LEVEL:	1ST 8' END 6' 24H 7.1'
LOGGED BY:	Janie Pipa	NO. OF SAMPLES:	SS 13 U — C 3
		DRILLING METHOD:	mud rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	F	1	Light to dark brown f-m SAND, some silt, trace f-c gravel - including brick fragments (moist)(medium dense)(Fill)	S-1	20	SS	14 7 9 8	
	F	2						
	F	3	Light to dark brown fine SAND and silt, trace fine gravel - including brick and concrete fragments (moist)(medium dense)(Fill)	S-2	24	SS	6 7 5 6	
	F	4						
	S Class 4	5	Brown to gray f-m SAND, little silt (moist)(loose) (SM)(NYS Class 4)	S-3	18	SS	2 3 3 2	
	S Class 4	6						
	M Class 5	7	Brown to gray SILT and f-m sand (moist)(loose)(ML) (NYS Class 5)	S-4	19	SS	3 3 4 3	
	M Class 5	8						
	M Class 5	9	Gray SILT, trace f-c sand, trace fine gravel (wet) (loose)(ML)(NYS Class 5)	S-5	20	SS	2 3 3 4	
	M Class 5	10						
	M Class 5	11	Gray clayey SILT (wet) (loose)(ML)(NYS Class 5)	S-6	14	SS	1 3 2 3	
	M Class 5	12						
	M Class 5	13						
	M Class 5	14						



BORING LOCATION SKETCH

- sampled 0' to 2'
- sampled 2' to 4'
- drove casing to 4'
  - 118 blows / 0' to 4'
- mixed mud using clean water and ~~f~~ mud polymer
  - full tub
- drilled out to 4'
  - quick / easy advance
  - light brown wash
- sampled 4' to 6'
- sampled 6' to 8'
- pushed casing to 8'
- drilled out to 8'
  - easy advance
  - light gray wash

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LOG OF BORING B-6

PAGE 2 OF 4

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
		15	Gray SILT (wet)(loose) (ML)(NYS class 5)	S-7	19	SS	2 3 4 6	-sampled 8' to 10' -sampled 10' to 12' -drilled out to 15' using drag bit -easy/quick advance -gray wash, 3/4 full tub
		16						
		17						-sampled 15' to 17' -drilled out to 20' -sampled 20' to 22' -drilled out to 25' -smooth/quick advance
		18						
		19						
		20	Gray clayey SILT (wet) (loose)(ML)(NYS class 5)	S-8	12	SS	2 4 5 6	-sampled 25' to 27' -drilled out to 30' -sampled 30' to 30'1" - split spoon refusal -attempted core run 32' to 37' -32' to 33': 1min30sec -advanced to 37' quickly -no recovery in core barrel - possible boulder 32' to 33'
	M Class 5	21						
		22						
		23						
		24						
		25	Gray clayey SILT (wet) (loose)(ML)(NYS class 5)	S-9	12	SS	4 3 5 4	
		26						
		27						
		28						
		29						
		30	Gray clayey SILT (wet)(very dense)(ML) (NYS class 5)	S-10	10	SS	4 3 50/1"	
		31						

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LOG OF BORING B-6

PAGE 3 OF 4

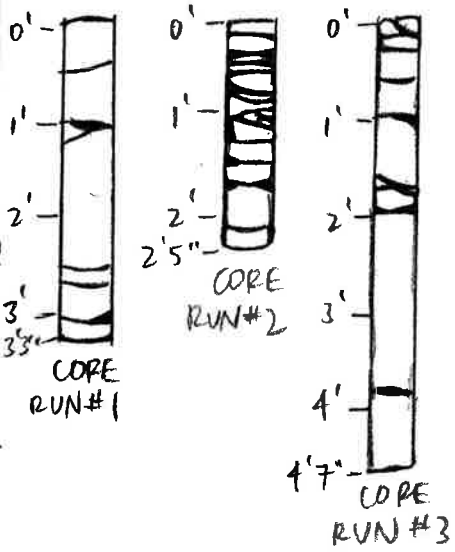
GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN	OBSERVATIONS & NOTES
	S Class 4	33	NO recovery - possible boulder	S10	0	C	1-33	- sampled 37' to 37'11" - split spoon refusal - drilled out to 40' - slow advance - rig chatter 37' to 40'
		34						
		35						
		36						
		37	Light to dark brown f-c SAND, some silt, trace f-c Gravel (wet) (very dense) (SM) (NYS Class 4)	S11	11	SS	33 100/5"	- sampled 40' to 41'5" - split spoon refusal - drilled out to 45' - slow advance - rock fragments coming up in return - lost tooth of roller bit, unable to retrieve
		38						
		39						
	SR	40	Light gray to black soft SCHIST (SR)	S12	17	SS	47 61 100/5"	- installed casing to 33' - pushed 8' to 15' - 135 blows / 15' to 18' - 270 blows / 18' to 23' - 215 blows / 23' to 28' - 323 blows / 28' to 33'
		41						
		42						
		43						- drilled out to 45' - grinding / slow advance
		44						
		45	White to black soft SCHIST (SR)	S13	1	SS	52/1"	- sampled 45' to 45'2" - split spoon refusal - drilled out to estimated top of competent rock at 49' - slow advance - grinding to 49'
		46						
		47						
		48						
TL	R Class 2	49	Light to dark gray slightly fractured slightly weathered gneissic SCHIST (NYS Class 2)	C1	39	C	5:23	- started coring at 49' #note that time per foot of rock coring, in minutes and seconds is recorded in the "BLOWS PER 6-INCH PEN" column total time of run is below time per foot

Form No. LOB-2 Revision No. 0 Print Date: February 29, 2016

LOG OF BORING B-6

PAGE 4 OF 4

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	R Class 2	51	Light to dark gray slightly fractured slightly weathered GNEISSIC SCHIST (NYS Class 2)	C-1	39	C	3:31 (8:54) 5:20 (14:14) 5:15 (19:29) 5:57 (25:26)	CORE RUN #1: 49' to 54' RECOVERY = 39/60" = 65%. RQD = 32"/60" = 53%.
		52						
		53						
		54						CORE RUN #2: 54' to 59' RECOVERY = 29"/60" = 48%. RQD = 0"/60" = 0%.
	SR	55	White to light gray intensely fractured, moderately weathered GNEISS (SR)				3:46	CORE RUN #3: 59' to 64' RECOVERY = 55"/60" = 92%. RQD = 48"/60" = 80%.
		56		C-2	29	C	4:16 (8:02) 2:50 (10:52)	
		57					2:43 (13:35)	
		58					4:07 (17:42)	
		59						
	R Class 2	60	White to light gray slightly fractured, slightly weathered GNEISS (NYS Class 2)				2:41	
		61					3:12 (5:53)	
		62		C-3	55	C	3:19 (9:12)	
		63					3:30 (12:42)	
		64					2:54 (15:36)	
			end of boring at 64'					



ROCK CORE SKETCHES

- installed groundwater observation well in completed borehole

Form No. LOB-2 Revision No. 0 Print Date: February 28, 2016

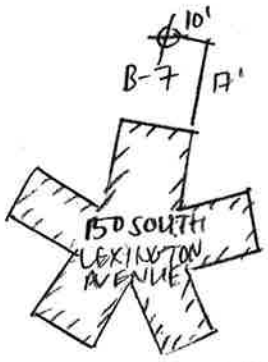
LOG OF BORING B-7

PAGE 1 OF 4

AKRF Engineering, P.C.
440 Park Avenue South
New York, NY 10016

PROJECT NAME:	Brookfield Commons-Winbrook	CONTRACTOR:	Craig Geotechnical Drilling, Inc
PROJECT NO.:	17013	RIG TYPE & FOREMAN:	CME45DX - Paul Mullin
PROJECT LOCATION:	135 S. Lexington Ave, White Plains, NY	SAMPLER TYPE(S):	Split spoon, NQ core barrel
BOREHOLE COORD. (N/E):	41.0270° / -73.7710° (not surveyed)	HAMMER TYPE(S)	automatic
ELEVATION/DATUM:	+198 / NAVD88	DRILL BIT TYPE/DIA.:	tri-cone / 3 7/8"
BORING START:	8/18/17 7am	CASING TYPE/DIA.:	steel flush joint / 4"
BORING END:	8/18/17 130pm	WATER LEVEL:	1ST 6' END - 24H -
LOGGED BY:	Janie Pipa	NO. OF SAMPLES:	SS 12 U - C 2
		DRILLING METHOD:	mud rotary

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
		0	4" topsoil - Dark brown SILT and fine Sand, including roots	S1	19	SS	2 6 8 7	
		2	Brown to red fc sand, some fc gravel, some Silt including cinders and brick fragments (moist) (medium dense) (Fill)	S2	15	SS	3 7 6 5	
		4	Brown f-c Sand and silt, trace fine gravel - including brick and concrete fragments (moist) (medium dense) (Fill)	S3	0	SS	2 1 3 3	
		5	NO recovery					
	FT	6	Gray SILT, little fc Sand, trace fine gravel - including brick fragments (wet) (very loose) (Fill)	S4	9	SS	2 2 1 2	
		8	NO recovery	S5	0	SS	1 2 1 2	
		10	Gray fc SAND and Silt - including plastic and concrete fragments (wet) (very loose) (Fill)	S6	8	SS	1 1 2 1	
		12						
		13						
		14						



BORING LOCATION SKETCH

- Sampled 0' to 2'
- Sampled 2' to 4'
- drove casing to 4'
  - 93 blows to 0' to 4'
- mixed mud using clean water and EZ Mud polymer
- drilled out to 4'
  - brown wash, full tub
  - rig chatter at 2'
- sampled 4' to 6'
- sampled 6' to 8'
- pushed casing to 8'
- drilled out to 8'
  - easy/quick advance

Form No. LOB-1 Revision No. 0 Print Date: February 29, 2016

LOG OF BORING B-7

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	F	15						- sampled 8' to 10' - sampled 10' to 12'
		16	Gray clayey SILT (wet) (loose) (ML) (NYS class 5)	S7	15	SS	4 5 4 5	- drilled out to 15' - rig chatter 14' to 15' - gray wash, 3/4 full tub
		17						- sampled 15' to 17'
		18						- pushed casing to 13'
		19						- drove casing to 18' - 420 blows / 13' to 18'
	M class 5	20						- drilled out to 20'
		21	Gray to brown clayey SILT (wet) (medium dense) (ML) (NYS class 5)	S8	20	SS	12 9 7 7	- rig chatter at 16' - light gray wash, 1/2 full tub
		22						- sampled 20' to 22'
		23						- drilled out to 25'
		24						- rig chatter at 23'
		25						- sampled 25' to 27'
		26	Gray to black fc Sand, and fc Gravel, little Silt (wet) (dense) (SM) (NYS class 4)	S9	13	SS	31 15 24 23	- drilled out to 30' - slow advance at 26' and 29' - rig grinding - gray wash, 3/4 full tub
		27						
	S class 4	28						- drove casing to 28' - 210 blows / 18' to 23' - 480 blows / 23' to 28'
		29						
		30	Gray to black fc sand and fc Gravel trace Silt (wet) (medium dense) (SW) (NYS class 4)	S10	2	SS	6 9 15 15	- drilled out to 30' - chatter at 28' - sampled 30' to 32' - gravel fragment in spoon tip
		31						

LOG OF BORING B-7

PAGE 3 OF 4

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	SAMPLE REC. (INCH)	SAMPLE TYPE	SAMPLE BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	S Class 4	33						- drilled out to 35' - slow advance - grinding 32' to 33' - gray brown wash, ½ full tub
		34						
		35						- sampled 35' to 35'2" - split spoon refusal - spoon bouncing - drive casing to 30' - 107 blows of 28" to 30'
		36	Brown to black fc sand and f-c gravel, trace silt (wet)(very dense)(SW) (NYS Class 4)	S-11	2	SS	50/2"	
		37						- drilled out to 40' - slow, steady advance
		38						- sampled 40' to 40'2" - split spoon refusal
		39						- drilled out to estimated top of competent rock at 46'
		40						- started coring at 46'
	SR	41	Gray to black soft gneissic SCHIST (SR)	S12	1	SS	52/1"	* note that time per foot of rock coring, in minutes and seconds, is recorded in the "BLOWS PER 6-INCH PEN." column total time of core run is below time per foot
		42						
		43						
		44						
		45						
		46						- CORE RUN #1: 46' to 51' RECOVERY = 55"/60" = 92% RQD = 52"/60" = 87%
	R Class 2	47	Light to dark gray fresh GNEISS (NYS Class 2)	C1	55	C	2:53	
		48					1:50 (4:43)	
		49					2:03 (6:46) 2:10 (8:56)	

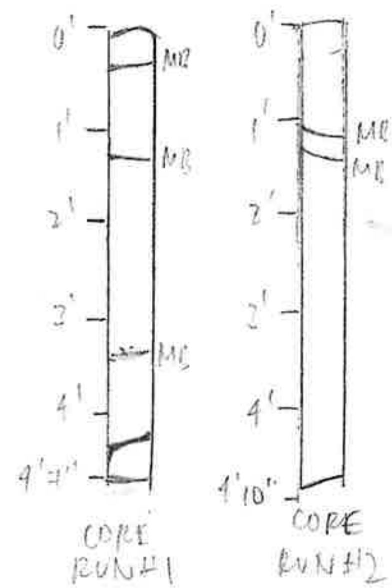
Form No. LOB-2 Revision No. 0 Print Date: February 29, 2016

AKRF

LOG OF BORING B-7

PAGE 4 **OF** 4

GRAPHIC LOG	MATERIAL & CLASS	DEPTH (FT)	MATERIAL DESCRIPTION	SAMPLE NO.	REC. (INCH)	TYPE	BLOWS PER 6-INCH PEN.	OBSERVATIONS & NOTES
	R Class 2	51	Light to dark gray fresh GNEISS (NYS Class 2)	C1	58	C	1:46 ([illegible])	CORE RUN # 2: 51' to 56' RECOVERY = 58"/60" = 97% RQD = 58"/60" = 97%
		52	Light to dark gray fresh GNEISS (NYS Class 2)	C2	58	C	2:29	
		53					1:54 (4:23)	
		54					3:01 (2:24)	
		55					1:23 (9:47)	
		56	end of boring at 56'				2:40 (11:27)	



ROCK CORE SKETCHES
· MB = MECHANICAL BREAK

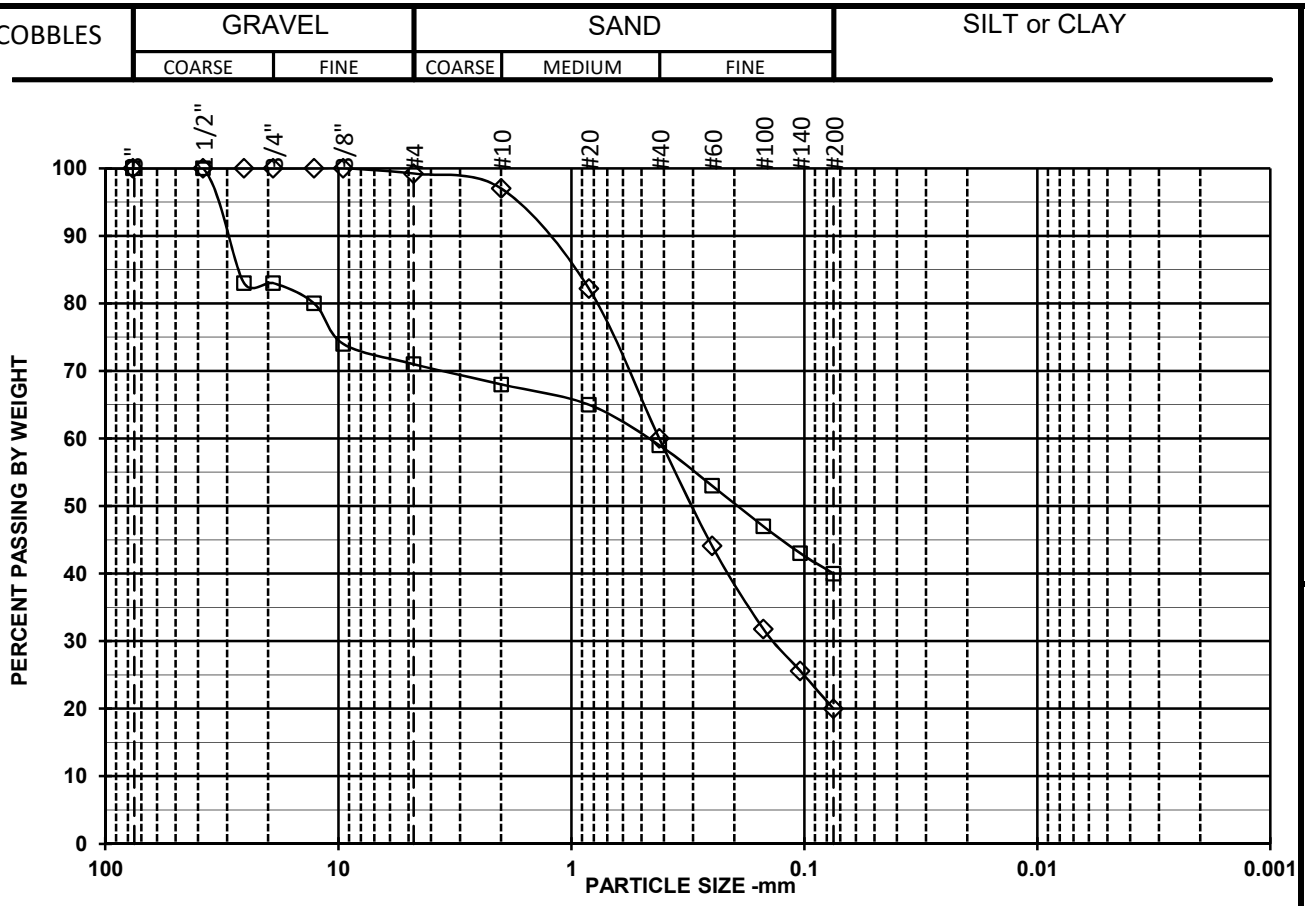
- backfilled borehole using soil cuttings and Hole plug bentonite pellets

APPENDIX C
LABORATORY TEST RESULTS

GeoDesign #3902-002
Brookfield Phase 3
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS			REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	
GD-1	S-2	5-7	34.6	SC	40	
GD-1	S-3	10-12	16.8	SM	15	
GD-2	S-2	5-7	38.3	SM	16.4	
GD-2	S-5	20-22	17.5	SM	20	
GD-3	S-1	5-7	36.2	CL	55.7	
GD-3	S-3	15-17	26.8	ML	97.9	
GD-4	S-4	15-17	11.3	SM	20	
GD-5	S-3	10-12	8.8	SP-SM	9	
CD-6	S-6	25-27	15.9	SM	34.8	

Note: (1) USCS symbol based on visual observation and Sieve reported.



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	34.6				SC		Brownish gray, Clayey sand with gravel, Insufficient sample size	06/09/21
◇	17.5				SM		Brown, Silty sand	06/09/21
○								

Symbol	□	◇	○
Boring	GD-1	GD-2	
Sample	S-2	S-5	
Depth	5-7	20-22	
% +3"	0	0	
% Gravel	29	0.8	
% SAND	31	79.2	
%C SAND	3	2.2	
%M SAND	9	37	
%F SAND	19	40	
% FINES	40	20	
D_{100} (mm)	38.1	9.53	
D_{60} (mm)	0.471	0.419	
D_{30} (mm)		0.13	
D_{10} (mm)			
Cc			
Cu			

Sieve Size/ID #	Percent Finer Data		
6"	100	100.0	
4"	100	100.0	
3"	100	100.0	
1 1/2"	100	100.0	
1"	83	100.0	
3/4"	83	100.0	
1/2"	80	100.0	
3/8"	74	100.0	
#4	71	99.2	
#10	68	97.0	
#20	65	82.2	
#40	59	60.0	
#60	53	44.1	
#100	47	31.8	
#140	43	25.6	
#200	40	20.0	
5μ m			
2μ m			
1μ m			

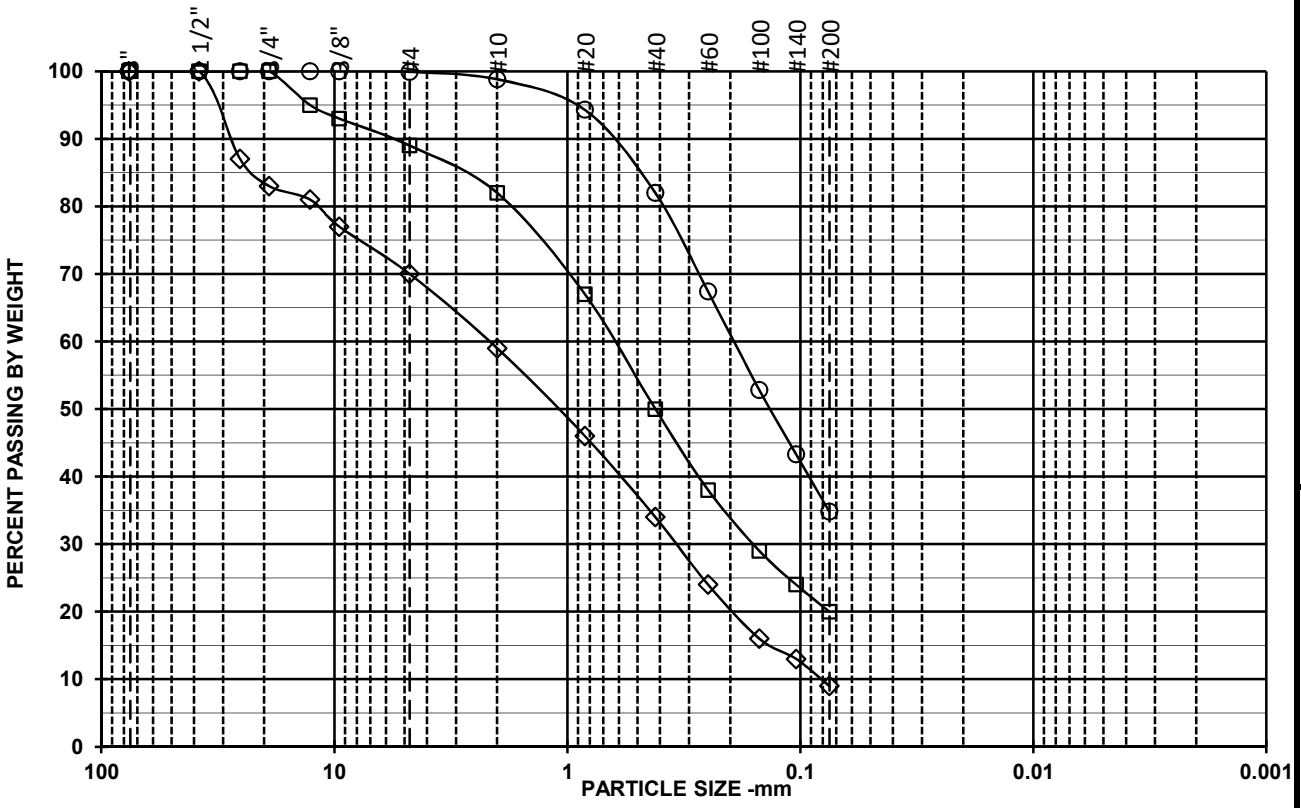
GeoDesign #3902-002

TerraSense, LLC #8110-21008

Brookfield Phase 3

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928

COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



Open Symbols: Sieve analysis by ASTM D6913
Filled symbols: Hydrometer analysis by ASTM D7928 corrected for complete sample

SYMBOL	w (%)	LL	PL	PI	USCS	AASHTO	USCS DESCRIPTION AND REMARKS	DATE
□	11.3				SM		Brown, Silty sand, Insufficient sample size	06/09/21
◇	8.8				SP-SM		Dark brown, Poorly graded sand with silt and gravel, Insufficient sample size	06/09/21
○	15.9				SM		Brown, Silty sand	06/09/21

GeoDesign #3902-002

TerraSense, LLC #8110-21008

Brookfield Phase 3

Symbol	□	◇	○
Boring	GD-4	GD-5	CD-6
Sample	S-4	S-3	S-6
Depth	15-17	10-12	25-27
% +3"	0	0	0
% Gravel	11	30	0.1
% SAND	69	61	65.1
%C SAND	7	11	1.1
%M SAND	32	25	16.8
%F SAND	30	25	47.2
% FINES	20	9	34.8
D_{100} (mm)	19.1	38.1	9.53
D_{60} (mm)	0.631	2.16	0.192
D_{30} (mm)	0.16	0.34	
D_{10} (mm)		0.081	
Cc		0.7	
Cu		26.7	

Sieve Size/ID #	Percent Finer Data		
6"	100	100	100.0
4"	100	100	100.0
3"	100	100	100.0
1 1/2"	100	100	100.0
1"	100	87	100.0
3/4"	100	83	100.0
1/2"	95	81	100.0
3/8"	93	77	100.0
#4	89	70	99.9
#10	82	59	98.8
#20	67	46	94.3
#40	50	34	82.0
#60	38	24	67.4
#100	29	16	52.8
#140	24	13	43.3
#200	20	9	34.8
5μ m			
2μ m			
1μ m			

PARTICLE SIZE DISTRIBUTION
ASTM D6913 & ASTM D7928