October 2023

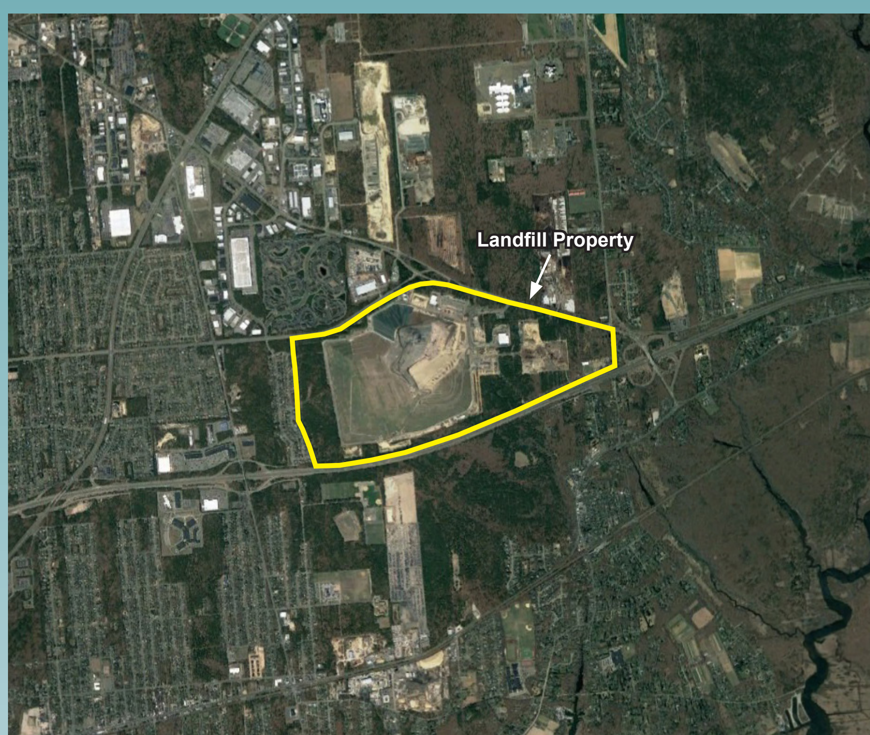
TOWN OF BROOKHAVEN
DEPARTMENT OF RECYCLING AND
SUSTAINABLE MATERIALS MANAGEMENT

-DRAFT-

Emerging Contaminant Plume Investigation Work Plan

Town of Brookhaven Landfill

Suffolk County, New York



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DRAFT

TOWN OF BROOKHAVEN LANDFILL

EMERGING CONTAMINANT PLUME INVESTIGATION

WORK PLAN

Prepared for:

DEPARTMENT OF RECYCLING AND SUSTAINABLE MATERIALS

MANAGEMENT TOWN OF BROOKHAVEN

SUFFOLK COUNTY, NEW YORK

Prepared by:

D&B ENGINEERS AND ARCHITECTS, D.P.C.
WOODBURY, NEW YORK

OCTOBER 2023

TOWN OF BROOKHAVEN LANDFILL
DEPARTMENT OF RECYCLING AND SUSTAINABLE MATERIALS
MANAGEMENT TOWN OF BROOKHAVEN
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

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1.0 INTRODUCTION

Pursuant to an August 8, 2023, letter, the New York State Department of Environmental Conservation (NYSDEC) has requested the Town of Brookhaven (the Town) complete an investigation of the Town of Brookhaven Landfill, located in Yaphank, New York to define the nature and extent of contamination associated with the facility, specific to emerging contaminants. In response to this request, this Emerging Contaminant Plume Investigation Work Plan (the Work Plan) has been prepared by D&B Engineers and Architects, D.P.C. (D&B) under contract with the Town. The Work Plan details the scope of the required investigation to be undertaken by the Town at the Brookhaven Landfill, herein referred to as the Landfill.

The objective of the Emerging Contamination Plume Investigation is to define the nature and extent of contaminants that have been recently detected downgradient of the Landfill in groundwater, including, but not limited to:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS), and
- 1,4 Dioxane

1.1 Site Location and Description

The Town has been operating the Landfill at their 534-acre property located in the Hamlet of Yaphank, New York since 1976. The Town and the New York State Economic Facilities Corporation (NYSEFC) entered into a contract (144-SC) in October 1970, for the construction, ownership, operation and maintenance by the NYSEFC of certain solid waste disposal facilitates within the Town of Brookhaven. The Town acquired the Brookhaven Landfill from the NYSEFC in September of 1976 and took over all ownership, operation and maintenance of the facility. As shown on **Figure 1-1**, the Landfill is located between and adjacent to Horseblock Road and Sunrise Highway and within the Hamlet of Yaphank, New

York. The current configuration of the Landfill is shown on **Figure 1-2,** including the approximate boundary of each landfill module. As shown on **Figure 1-2**, the facility consists of three landfill modules (Cells 1 through 4, Cell 5 and Cell 6) which overlap to a significant degree, as detailed below.

Cell 1 was constructed by the NYSEFC in 1971 with the Town acquiring the landfill in 1974. Cell 1 was constructed with a single 20-mil polyvinyl chloride (PVC) liner. Cell 1 was closed in 1983 and was partially capped in 1985. Cell 2 was constructed in 1980 with a double liner consisting of 20-mil PVC overlain with 20-mil polyethylene. The Town operated Cell 2 from 1980 until 1989. Cell 3 was constructed with a double liner consisting of 80-mil high-density polyethylene (HDPE) overlain with 60-mil PVC and was planned to be a four-acre interim and short-term addition to the landfill complex, being an expansion of Cell 2. It was intended to extend the operating life of the landfill until Cell 4 could become operational, and only received waste in 1989.

Cell 4 was built with a triple-liner system composed of one 60-mil PVC under liner and two 80-mil HDPE over liners and was placed along the north side of Cell 1, and accepted municipal waste and construction/demolition waste (C&D) in the eastern portion of the cell while the western portion accepted waste to energy (WTE) ash. Filling of Cell 4 ceased in 1996; however, some wastes were placed in the Cell in 1997 to achieve final design contours for closure and the cell was capped by 1997.

Cell 5 was built in 1996 and was designed as a discrete landfill mass west of Cell 2 meeting the design requirements of the NYSDEC Long Island Landfill Law, including a double composite liner with a leachate collection system. Cell 5 began operations in 1996, only receiving wastes deemed compliant to the NYSDEC law, including C&D debris, WTE ash, car fluff (ASR), street sweepings, residues from recycling operations, sewage sludge, and dredge spoils. Cell 5 also used processed C&D for most of its daily cover requirements.

1.0 INTRODUCTION

As shown on Figure 1-2, Cell 6 fills a depression between Cells 1-4 and Cell 5 and wraps around both Cell 5 (to the west) and Cells 1-4 (to the east) along the northern portions of these landfills. Given Cells 1 through 4 did not have liners compliant with the then current Part 360 liner requirements, over-liners were installed over the existing caps of the older cells. Cells 6 and 5 essentially have a common, conjoined liner system with both constructed with a double composite liner with a leachate collection system. Cell 6 became operational in 2003 and was filled in 13 phases, receiving waste in compliance with the Long Island Landfill Law. Currently, Cell 5 has been capped by the Town along with the majority of Cell 6. Currently Phases 5 though 13 of Cell 6 are uncapped. Filling is occurring in Cells 11 and 12. The Town will be be constructing the 23-arce capp on Cell 6 by the second quarter of 2024.

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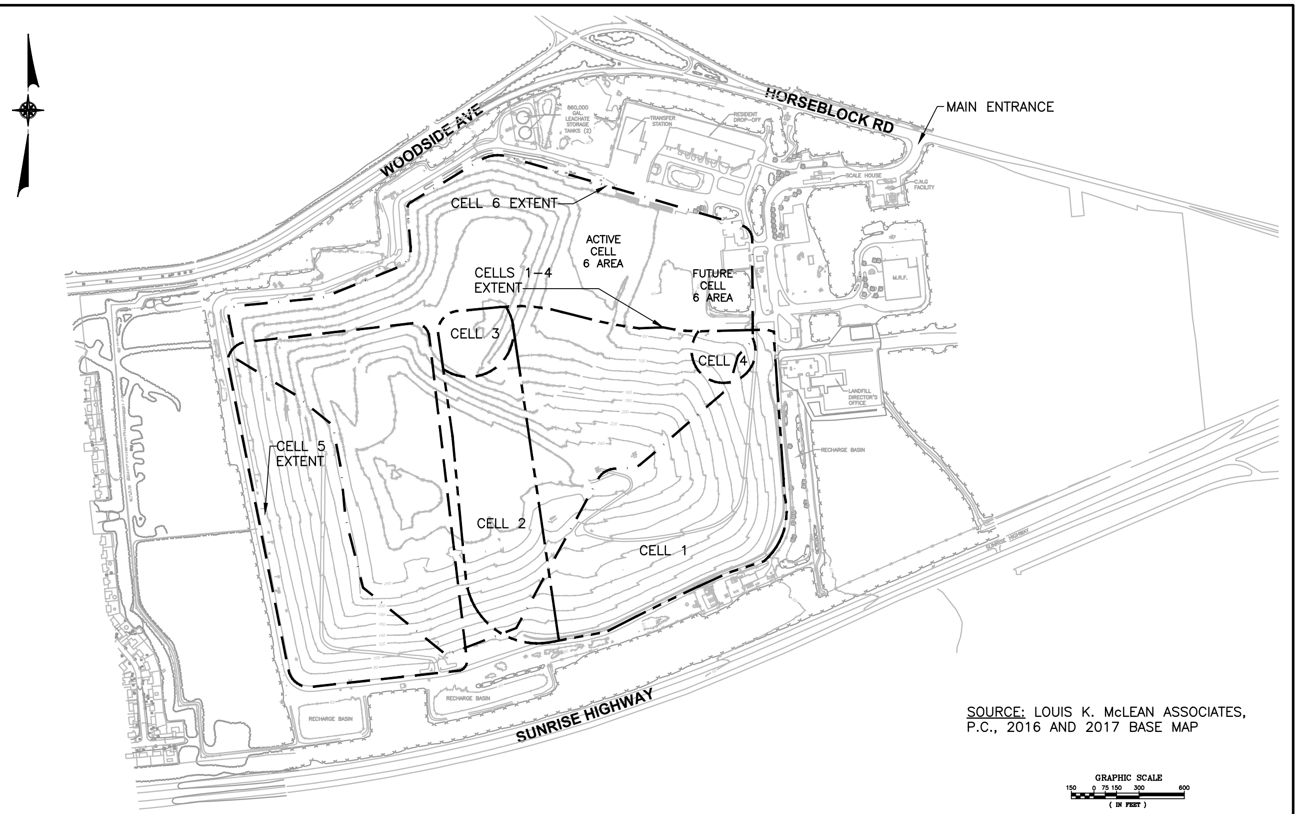
TOWN OF BROOKHAVEN DEPARTMENT OF RECYCLING
AND SUSTAINABLE MATERIALS MANAGEMENT (RSMM)

EMERGING CONTAMINANT
PLUME INVESTIGATION WORK PLAN
SITE LOCATION MAP

FIGURE 1-1



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TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
FACILITY PLAN SHOWING
LANDFILL CELLS

FIGURE 1-2

1.2 Regional Topography, Geology and Hydrogeology

In the last 30 years, several extensive hydrogeologic investigations of the Landfill and downgradient areas have been performed by the Town and others, including the Part 360 Hydrogeologic Investigation completed for the planning of the Landfill Cell 6 expansion. This investigation was performed in accordance with the requirements of Title 6 Part 360-2.11 of the New York State Codes, Rules and Regulations for the construction and expansion of landfills with the final report drafted in 2002. As a result of these studies, the hydrogeologic framework of the Landfill and downgradient areas is well understood. The following summary discussion is based on the information provided in the 2002 Report.

1.2.1 Topography

The natural topography of the landfill property slopes to the east and southeast, with the base elevation of the landfill property being approximately 60 to 75 feet above mean sea level (msl). The landfill cells are perched on the western edge of a shallow valley approximately 2.5 miles wide. South of the Landfill, Beaver Dam Creek occupies the westernmost edge of the valley at an elevation of approximately 20 to 25 feet above msl, while the Carmans River, as well as its tributaries Little Neck Run and Yaphank Creek, occupies the eastern side of the valley southeast of the Landfill. The center of the valley between Beaver Dam Creek and Little Neck Run is relatively flat with an elevation of approximately 15 to 20 feet above msl, with a gentle slope to the south toward the Great South Bay.

1.2.2 Geology

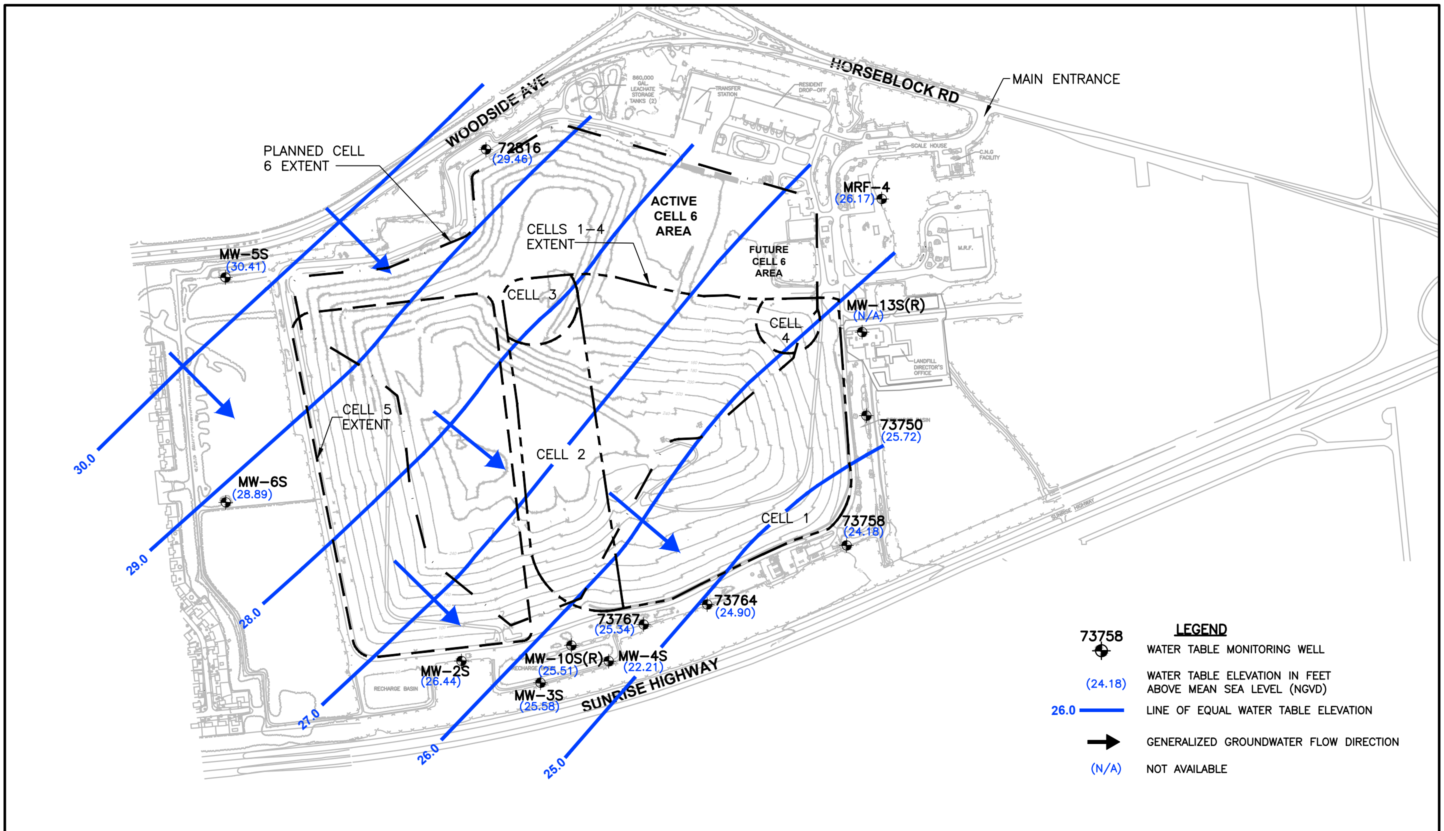
The study area is underlain by approximately 1,600 feet of Cretaceous and Pleistocene aged unconsolidated deposits overlying southeast-sloping, igneous and metamorphic bedrock. The uppermost Pleistocene-aged deposits which comprise the shallow Upper Glacial Aquifer will be the primary focus of the Emerging Contaminant Plume Investigation. Additional detail on this geologic unit and the underlying Cretaceous-aged Magothy Formation are provide below:

- Upper Glacial aquifer: The Upper Glacial aquifer is present below any topsoil/fill and consists of approximately 100 to 130 feet of glacial outwash material deposited during the Pleistocene glaciation. These deposits consist of fine to coarse sand with little gravel and a trace of silt, transitioning to finer sand with increasing amounts of silt below a depth of 100 feet. The water table is located within the unconfined Upper Glacial aquifer throughout the study area.
- Gardiners Clay: Below the base of the Upper Glacial aquifer unconformably lies the Pleistocene-aged Gardiners Clay, a generally fine-grained shallow marine/proglacial marine (transitional) deposit. The Gardiners Clay consists of interbedded clay, silt and some sand. This deposit is approximately 10 feet thick in the study area. The base of the Upper Glacial aquifer and the Gardiners Clay serve as a semiconfining unit between the Upper Glacial and Magothy aquifers, which restrict groundwater flow and contaminant migration from the Upper Glacial aquifer to the Magothy aquifer.
- Magothy aquifer: Lying unconformably beneath the Gardiners Clay is the Cretaceous-aged Magothy formation (also known as the Magothy aquifer). The Magothy aquifer consists of sand, silt and interbedded clay and organic material. It is estimated that the Magothy aquifer is approximately 900 to 1,000 feet thick in the study area.

1.2.3 Hydrogeology

Depth to groundwater generally ranges from approximately 45 to 50 feet below grade in the vicinity of the landfill cells to less than 5 feet below grade at the headwaters of Beaver Dam Creek and near the creek south of Beaver Dam Road. As shown in **Figure 1-3** groundwater within the Upper Glacial aquifer flows in a southeast direction within the Landfill. As shown in **Figure 1-4**, groundwater within the Upper Glacial aquifer continues to travel in a southeasterly direction south and downgradient of the Landfill towards Beaver Dam Creek. Previous investigations (Wexler and Maus, 1988) have found that shallow groundwater downgradient of the Landfill primarily discharges to Beaver Dam Creek, supplying approximately 95 percent of its baseflow. However, deeper groundwater within the Upper

Glacial aquifer will also continue to travel in a southerly direction, past this surface water and eventually discharge to tidal portions of Beaverdam Creek and the Carmens River and its tributary, Little Neck Run.



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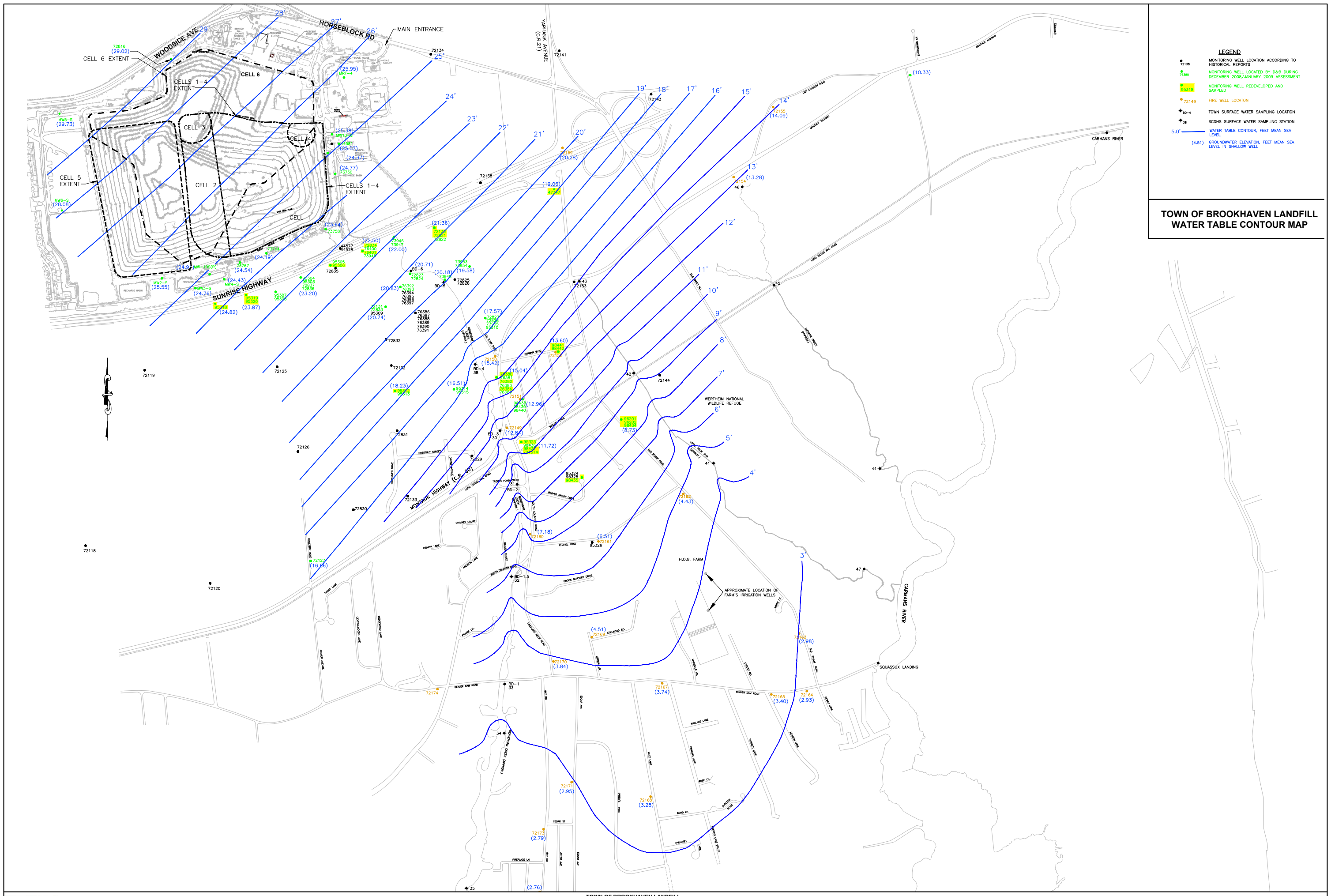
TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

ON-SITE GROUNDWATER CONTOUR MAP

FIGURE 1-3

F:\0667-Corrective Measures\dwg\0667-FIGURE 1-3.dwg, FIG 1-3, 10/6/2023 3:08:51 PM, kalesius



TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAINMENT PLUME INVESTIGATION WORK PLAN

D&B ENGINEERS AND ARCHITECTS

ON-SITE GROUNDWATER CONTOUR MAP

FIGURE 1-4

Based on previously acquired hydraulic data, it has been determined that groundwater within the Upper Glacial aquifer within and downgradient of the Landfill travels at an estimated velocity of approximately 1.8 ft/day. This relatively high flow velocity can be attributed to the highly porous and hydraulically transmissive glacial outwash sands that make up the Upper Glacial aquifer. Based on this groundwater velocity, the travel time for groundwater to travel from the southern boundary of the Landfill to the area of Montauk Highway is estimated to be between 6 to 8 years. Based on the hydraulic gradient observed south of Montauk Highway, it is estimated that groundwater would travel from this area to Beaver Dam Road at a slower rate with a travel time of approximately 12 to 16 years.

Flow in the Upper Glacial aquifer is predominantly horizontal both at and immediately downgradient of the Landfill. Downgradient of the Landfill, however, the water level data indicates a transition to a strong upward flow gradient from the Magothy aquifer to the Upper Glacial aquifer. This upward flow or zone of groundwater discharge is consistent with regional flow patterns within the southern portion of Suffolk County. Due to the upward gradient, landfill contaminants are unlikely to migrate downward toward the Magothy aquifer in this area. The transition to upward groundwater flow generally coincides with the transition to consistent baseflow in Beaver Dam Creek which is generally observed south of Montauk Highway.

1.3 Ongoing Environmental Monitoring Programs

Currently, the Town has two extensive environmental monitoring programs in place that monitors landfill leachate, on-site groundwater, off-site groundwater, and off-site surface water. The Unified Monitoring Program which was implemented in 2005 primarily focuses on the monitoring of landfill leachate and on-site groundwater; whereas the Leachate Plume Monitoring Program, started in 2012, focuses on leachate impacts to off-site groundwater and surface water. In addition, at the request of the NYSDEC, the Town has undertaken an emerging contaminant sampling program starting in 2022. Additional details on each program are provided below.

1.3.1 Unified Monitoring Program

The Unified Monitoring Program (UMP) was initiated in 2005 and is conducted on a semiannual basis. Note that the Town has submitted a revised UMP Work Plan to the NYSDEC that is currently under review. The revised UMP work plan includes the addition of emerging contaminants, specifically Per-and Polyfluoroalkyl Substances (PFAS), 1,4-dioxane, and radionuclides (Radium 226, Radium 228 and total uranium) to the program. However, until the new UMP is approved, NYSDEC has directed the Town to continue its previously approved sampling program. The current UMP includes the following components:

Groundwater Sampling: The groundwater sampling network for the UMP is comprised of 27 existing groundwater wells which are sampled bi-annually or two times per year. The wells and the groundwater zones that they monitor are identified in **Table 1-1** and the well locations are shown on **Figure 1-5**. The Critical Stratigraphic Section identified for monitoring the landfill, consistent with 6 NYCRR Part 363 requirements, is the Upper Glacial aquifer. The downgradient wells and monitored zones within the Upper Glacial aquifer and the underlying Magothy aquifer are shown in cross-sectional view on **Figure 1-6**.

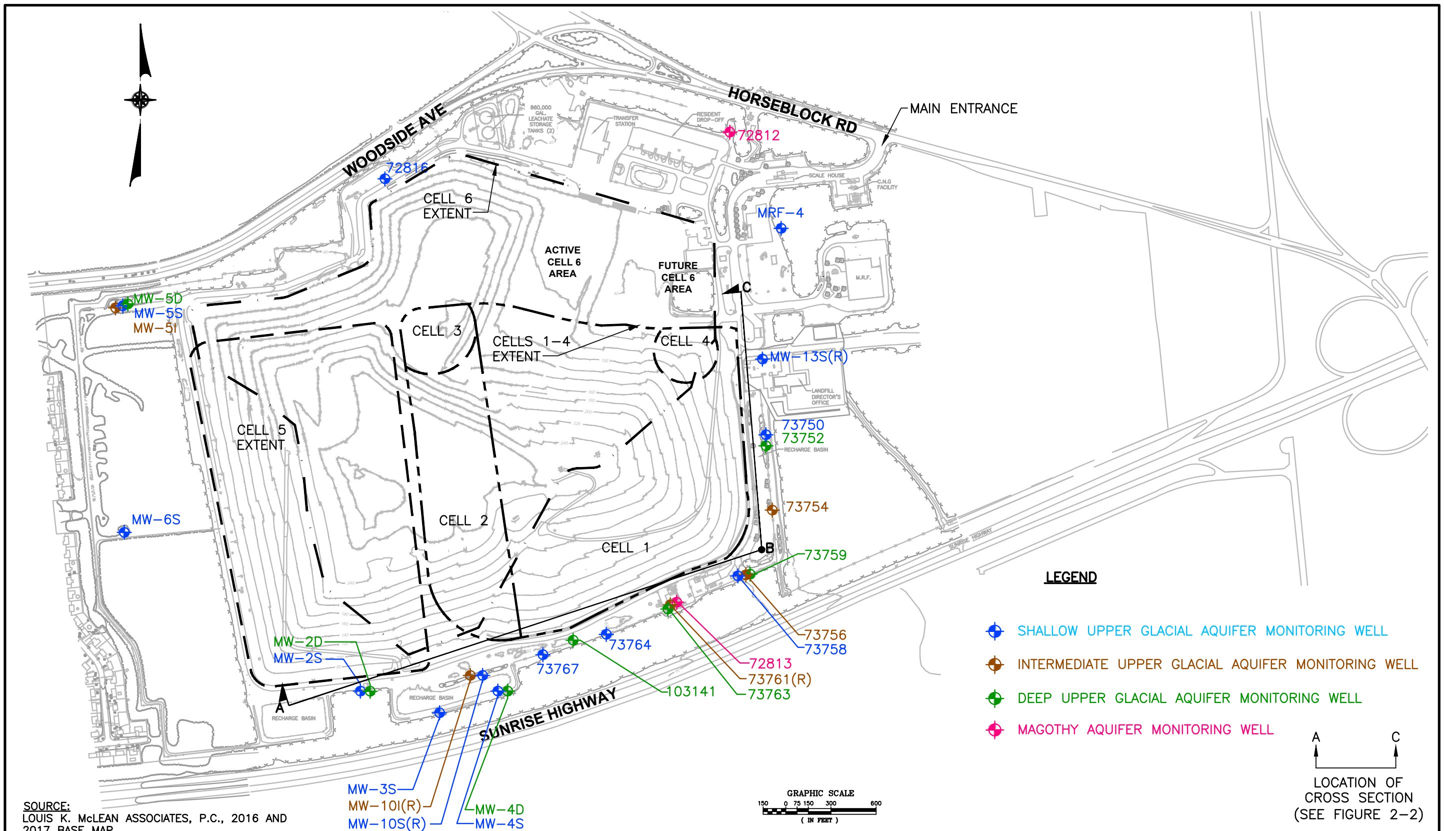
Leachate Sampling: All operational leachate collection systems at the landfill are sampled bi-annually as part of the UMP, which includes Cells 1, 3 and 4; the nine phases of Cell 5; and the twelve phases of Cell 6. In addition, leachate collection chambers associated with the Cell 1 primary system and Cells 3 and 4 primary and secondary systems are also sampled.

Three surface water sample locations in Beaverdam Creek (BD-2, BD-3 and BD-4), which are shown on **Drawing 1,** provided at the end of Section 1.0, are sampled biannually as part of the UMP, in addition to a control sample point in Forge River near the north service road of Sunrise Highway, located approximately one mile east of the landfill.

TABLE 1-1

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
UMP GROUNDWATER MONITORING NETWORK

Monitoring Well ID	Monitoring Zone
Upgradient	
MW-05S	Shallow UG
MW-05I	Intermediate UG
MW-05D	Deep UG
MW-06S	Shallow UG
MW-06D	Deep UG
72812M	Magothy
72816	Shallow UG
Lateral	
MRF-4	Shallow UG
Downgradient	
MW-02S	Shallow UG
MW-02D	Deep UG
MW-03S	Shallow UG
MW-04S	Shallow UG
MW-04D	Deep UG
MW-10S (R)	Shallow UG
MW-10I (R)	Intermediate UG
MW- 13S (R)	Shallow UG
72813M	Magothy
73750	Shallow UG
73752	Deep UG
73758	Shallow UG
73756	Intermediate UG
73759	Deep UG
73761 (R)	Intermediate UG
73763	Deep UG
73764	Shallow UG
73767	Shallow UG
73754	Intermediate UG
103141	Deep UG



SOURCE:
LOUIS K. McLEAN ASSOCIATES, P.C., 2016 AND 2017 BASE MAP.

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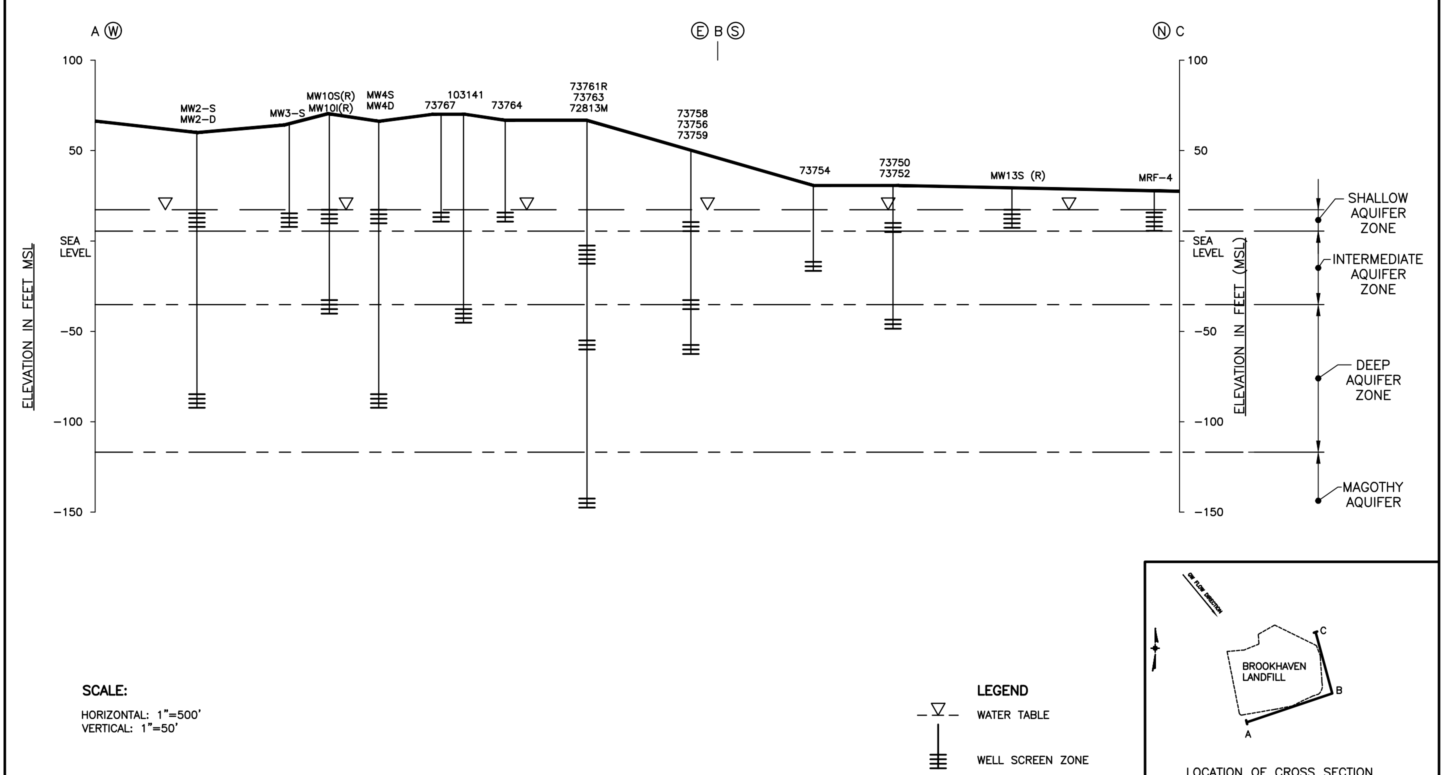
TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
UMP GROUNDWATER MONITORING WELL LOCATIONS

FIGURE 1-5



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TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
DOWNGRADIENT CROSS SECTION SHOWING
UMP WELL SCREENS AND MONITORING ZONES

FIGURE 1-6

The analytical parameters for the media sampled under the UMP are a slightly modified version of the 6 NYCRR Part 363 Baseline Parameter List. The Baseline Parameter List includes field parameters, leachate indicators, inorganic constituents and volatile organic compounds (VOCs). The modifications to this list for the UMP include the addition of methyl tertbutyl ether (MTBE) and 1,4-dioxane. MTBE has been detected historically in leachate samples. 1,4-dioxane was added to the sampling program in 2017 at the request of NYSDEC. In addition, the updated UMP Work Plan also requires the addition of PFAS and radionuclides (Radium 226, Radium 22 and total uranium) to the sampling program.

1.3.2 Off-Site Landfill Leachate Plume Monitoring

Under contract with the Town, D&B completed an extensive investigation of landfill leachate impacts downgradient of the Landfill between 2008 and 2010. The results of the investigation were summarized in the July 2010 "Leachate Plume Characterization Report" (Plume Report) and the August 2011 "Data Summary Report and Leachate Plume Monitoring Plan" (Data Summary Report). The Data Summary Report recommended that the Town implement a long-term water quality monitoring program downgradient of the Landfill. Since 2012, the Town has been implementing this program on an annual basis which includes:

The 33 monitoring wells listed on **Table 1-2** are included in this program**. Drawing 1,** which is provided in the map pocket at the end of Section 1.0, shows the location of each well. The program includes the annual sampling of 23 "core" off-site wells which are sampled every year and ten "alternant" wells that are sampled every other year with five of the 10 wells sampled on alternating years for a total of 28 wells sampled annually. The alternant wells which are sampled every other year include:

- Western Edge Wells :95307, 95308, 95312, 95319, 95320
- Eastern Edge Wells: 47747, 72136, 72821, 98441, 98442

TABLE 1-2

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
LEACHATE PLUME INVESTIGATION GROUNDWATER MONITORING NETWORK

Monitoring Well ID	**Monitoring Zone**
Groundwater Monitoring Well Sampling	
47747	Shallow UG
72136	Intermediate UG
72151M	Upper Magothy
72821	Shallow UG
95307	Intermediate UG
95308	Deep UG
95312	Intermediate UG
95319	Intermediate UG
95320	Deep UG
95323	Shallow UG
96201	Intermediate UG
96202	Deep UG
98434	Shallow UG
98436	Shallow UG
98437	Intermediate UG
98441	Intermediate UG

TABLE 1-2

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
LEACHATE PLUME INVESTIGATION GROUNDWATER MONITORING NETWORK

Groundwater Monitoring Well Sampling (continued)	
98442	Shallow UG
MW-101S	Shallow UG
MW-102S	Shallow UG
MW-102I	Intermediate UG
MW-102D	Deep UG
MW-103S	Shallow UG
MW-103I	Intermediate UG
MW-103D	Deep UG
MW-104S	Shallow UG
MW-104I	Intermediate UG
MW-104D	Deep UG
MW-105S	Shallow UG
MW-105I	Intermediate UG
MW-105D	Deep UG
MW-106S	Shallow UG
MW-106I	Intermediate UG
MW-106D	Deep UG

In addition to the 28 groundwater monitoring wells, the program includes off-site surface water sampling which is performed on a quarterly basis (4 rounds per year) including sampling of five locations on Beaver Dam Creek, one on Little Neck Run, and two on the Carmans River. In addition, D&B incorporates the available data collected by the Suffolk County Department of Health Services (SCDHS) during its own regular monitoring of the water quality of Beaver Dam Creek and the other surface water bodies of concern.

Consistent with the samples collected as part of the UMP, the analysis of the groundwater and surface water samples for the Leachate Plume Monitoring Program consists of a slightly modified version of the NYCRR Part 363 Baseline Parameter List, including field parameters, leachate indicators, inorganic constituents and volatile organic compounds (VOCs). The modification includes the addition of methyl tert-butyl ether (MTBE), and 1,4-dioxane to the VOC list.

1.3.3 Emerging Contaminant Sampling in 2022 and 2023

At the request of the NYSDEC, the Town undertook a quarterly sampling program for emerging contaminants at the Landfill starting in March 2022 which included the testing of groundwater, leachate and surface water for emerging contaminants, including PFAS and 1,4-dioxane, as well as radionuclides (Radium 226, Radium 228 and total uranium). Since March of 2022, D&B has completed a total of seven quarterly sampling rounds with the most recent sampling completed in October 2023. The current sampling protocol includes the sampling of 18 of the 27 UMP wells listed on **Table 1-1**, the collection of discrete leachate samples and the collection of surface water samples downgradient of the Landfill. Leachate samples are collected from the following primary leachate collection systems:

- Cell 1
- Cells 3
- Cell 4

- Cell 5 (Phases 1 through 9)
- Cell 6 (Phases 1 through 13)

Note that there is no collection chamber for Cell 6 Phase 04 since the liner system for Phase 04 is tied into Phases 01 and 02. In addition, Cell 6 Phases 12 and 13 are connected and share a common leachate chamber and sampling system. While the majority of the cells have primary and secondary leachate collection systems, given its age, Cell 1 is designed with only a primary leachate collection system.

Surface water samples are collected from Beaver Dam Creek at the UMP sample locations designated as BD-2, BD-3, BD-4 (shown on Drawing 1) and one control sample from the Forge River located near the north service road of Sunrise Highway, approximately one mile east of the Landfill.

1.4 Current Understanding of the Nature and Extent of Contamination

As described above, the Town is currently monitoring the on-site groundwater, off-site groundwater and off-site surface water to evaluate impacts to groundwater from leachate. The results of the most recent monitoring reports including the UMP Second Semiannual Report of 2022, the Leachate Plume Monitoring Report for Calendar Years 2020-2021 and the Emerging Contaminants and Radionuclide Sampling letter reports for 2022 and 2023 are summarized below.

1.4.1 UMP Second Semiannual Report of 2022

The findings of the UMP Second Semiannual Report from 2022 are as follows:

- Volatile organic compounds (VOCs) were not detected in downgradient groundwater at concentrations above Class GA standards, with the exception of tetrachloroethene (PCE) in intermediate well (10I[R]).

- Eighteen metals were detected at a statistically significant increase in downgradient wells, however, only five of these metals were detected above Class GA groundwater standards/guidance values including iron, manganese, sodium, selenium, and thallium. Note that selenium and thallium were not detected in the leachate from the landfill and the statistically significant increase in the concentrations of iron and manganese occurred downgradient of Cells 1 through 4.

- With regard to leachate indicators in downgradient groundwater monitoring wells, ammonia, which has been identified as a key leachate indicator, was not detected at statistically significant increased concentrations in wells located downgradient of Cells 1 through 4. Overall, ammonia concentrations remain relatively low with generally strong decreasing trends, since Cells 1 through 4 were capped. In addition, trends for alkalinity, hardness, nitrate and sulfate have remained stable since initiation of monitoring.

- Surface water sampling has shown historical total iron concentrations have been detected above Class C (TS) surface water standard in the surface water samples with an increasing trend at two locations and a relatively stable trend in the third and the historical concentration trends of ammonia have generally been decreasing.

- With regard to leachate sampling, VOCs were detected in leachate samples with generally lower detections in the secondary leachate collection systems than the primary systems. 1,4-dioxane and was detected in 36 out of 45 leachate samples. Iron and manganese were detected in the majority of the samples collected from the leachate collection systems of Cells 3, 4, 5, and 6. These metals were detected in downgradient groundwater samples at statistically significant increased concentrations above upgradient concentrations, as well as groundwater standards/guidance values. Ammonia was detected in all leachate collection systems with the exception of Cell 1 and although it continues to be detected above groundwater standards in downgradient monitoring wells, concentrations remain relatively low with generally strong decreasing trends.

Based on the above findings, the UMP Second Semiannual Report of 2022 conclusions included the following:

- Impact to groundwater by leachate downgradient of Cells 1 through 4 continues to generally decrease, especially given the decreasing concentration trends observed for ammonia and VOCs;

- There appears to be no significant adverse impacts to groundwater resulting from the operation of Cells 5 and 6; and

- Leachate from the landfill has not resulted in new significant impacts to groundwater quality.

1.4.2 Leachate Plume Monitoring Report for Calendar Years 2020-2021

As discussed above, this report has focused on the evaluation of a leachate plume migrating from the landfill and to date emerging contaminants have not been sampled as part of this sampling program. Evaluation of the extent of the plume has been performed using concentrations of leachate indicators in groundwater, primarily ammonia. **Drawing 2** (provided in the map pocket at the end of Section 1.0) is a spider diagram that summarizes key leachate parameters for the on-site and off-site monitoring wells sampled as part of the Leachate Plume Monitoring program. The data obtained during performance of this monitoring was used to make the following observations:

The groundwater data collected as part of the leachate plume monitoring program, in general, continues to show improving shallow water quality and declining water quality in intermediate wells further downgradient along the eastern edge of the plume in as well as along the southern leading edge of the plume. In addition, slight changes in the plume configuration towards the southeast were noted. The leachate plume monitoring program has confirmed the following:

- A leachate-impacted groundwater plume extends southeast from Cells 1-4 in the direction of groundwater flow for approximately 9,000 feet to the vicinity of Beaver Dam Road, with a maximum width of approximately 4,500 feet; and
- The plume extends throughout the Upper Glacial aquifer in its centerline (but not the Magothy aquifer) but is more concentrated in the shallow and intermediate zones, especially at its edges. The concentrations of leachate indicator parameters are highest in the centerline.

With regard to surface water, the Leachate Plume Monitoring Report for Calendar Years 2020 -2021 report concluded the following:

- Despite some short-term variability, Beaver Dam Creek has continued to exhibit a general long-term trend of improvement in water quality.

1.4.3 Emerging Contaminant Sampling in 2022 and 2023

The results of the analysis of groundwater samples collected between 2022 and 2023 for emerging contaminants, including PFAS and 1,4 dioxane are summarized on **Drawing 3,** provided in the map pocket at the end of Section 1.0. This data was compared to the Class GA Groundwater guidance values as presented in NYSDEC's Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) guidance document updated in February 2023 to include perfluorooctanoic acid (PFOA), perfluorooctanesulfonic acid (PFOS) and 1,4-dioxane. The following presents a summary of the results of the sampling.

PFAS

Based on a review of the emerging contaminant sampling completed at select groundwater monitoring wells, PFAS were detected in the groundwater samples both upgradient and downgradient of the landfill. Eleven of these wells exceeded the Class GA groundwater guidance value for PFOA and/or PFOS. Higher concentrations of PFAS were detected in the shallow and intermediate groundwater monitoring wells than the deeper groundwater monitoring wells.

The highest concentration of PFOA was detected in groundwater immediately downgradient of Cell 5 in shallow well MW-02S at a concentration of 300 ng/l. The highest concentration of PFOS was detected in shallow well immediately downgradient of Cells 1-4 in shallow wells 73750 at a concentration of 38.8 ng/l. With the exception of the elevated levels of PFOA in MW-02S, the concentrations of PFOA and PFOS in the shallow wells sampled were similar to the concentrations in the intermediate wells sampled. In addition, concentrations of

PFOA and PFOS were higher in wells downgradient of Cells 1 through 4 than the wells downgradient of Cells 5 and 6 with the exception of MW-02S. The concentrations of PFOA and PFOS in the deep wells were lower than the concentrations detected in the shallow and intermediate wells with higher concentrations in the samples collected downgradient of Cells 1 through 4 than Cells 5 and 6. In general, higher concentrations of PFAS were detected downgradient of Cells 1 through 4 than Cells 5 and 6. It should also be noted that 11 of the 21 PFAS compounds analyzed were not detected in the wells downgradient of Cells 5 and 6.

PFAS were detected in all five of the upgradient monitoring wells (72816, MW-05S, MW-05I, MW-05D and MW-06S). PFOA and PFOS were detected in MW-06S at concentrations that exceeded the Class GA groundwater guidance value for PFOA or PFOS in the sample collected in July 2022 at concentrations of 8.3 ng/L and 6.4 ng/L. As discussed in Section 1.5, there are at least nine properties located upgradient of the Landfill that could be considered potential sources of PFAS.

Leachate sampling indicated the highest concentration of PFAS in the leachate collected from Cell 1 and generally higher concentrations of PFAS in the leachate collected from Cells 1 through 4 than Cells 5 and 6.

PFAS were also detected in the three surface water samples collected from Beaverdam Creek (BD-2, BD-3 and BD-4) as well as the control point (Forge River). None of the samples exceeded the Class C Surface Water guidance value for PFOA or PFOS.

1,4-Dioxane

1,4-Dioxane was detected in one of the upgradient monitoring wells, deep monitoring well MW-05D. 1,4-Dioxane was also detected in seven of the thirteen downgradient monitoring wells sampled during 2022 – 2023 sampling events at concentrations above the Class GA groundwater guidance value. Six of the seven wells where concentrations above the Class GA groundwater guidance value were noted were located downgradient of Cells 1 through 4. The highest concentration detected was 12.1 ug/l in intermediate monitoring well 73761(R).

All leachate samples exhibited detectable concentrations of 1,4-dioxane with the highest concentration detected in the leachate from the primary sample from Cell 6 Phase 6.

1,4-Dioxane was detected in surface water samples BD-2 and BD-3 but not at concentrations exceeding the Class C Surface water guidance value. 1,4-Dioxane was not detected in the surface water sample BD-4 and Forge River.

1.4.4 Summary

In an attempt to correlate the results of the above reports, **Table 1-3** presents maximum PFOA, PFOS, 1,4-dioxane and recent concentrations of select leachate indicators (alkalinity, ammonia, chloride, specific conductance, sulfate and total dissolved solids) from select shallow, intermediate and deep wells downgradient of the landfill. As shown, shallow and intermediate wells that have exhibited the higher concentrations of leachate parameters do not always exhibit the higher concentrations of the emerging contaminants. For the deep monitoring wells, Well No. 73759 has shown the highest concentration of leachate parameters as well as the highest concentration of the emerging contaminants. However, note that the

TABLE 1-3

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MAXIMUM CONCENTRATIONS OF PFOS, PFOA, 1,4-DIOXANE, AND LEACHATE PARAMETERS

Parameter	Shallow Monitoring Wells					
	73750	**73758**	**73764**	**MW-02S**	**MW-10S(R)**	**MW-13(S)R**
PFOS (ng/L)	38.8	19	6.8	21	6.4	29
PFOA (ng/L)	88	79	85	300	24	42
1,4-Dioxane (ug/L)	0.65	8.6	5.4	1.4	ND	ND
Alkalinity (as CaCO3) (mg/L)	237	260	147	77.4	80	322
Ammonia (mg/L)	0.58	29.8	15.7	0.1	ND	ND
Chloride (mg/L)	219	95.6	20.6	16.7	81.3	109
Specific Conductance (mS/cm)	0.91	0.754	0.643	0.213	0.554	0.884
Sulfate (mg/L)	77.1	4.1	21.8	26.3	66.1	23.3
Total dissolved Solids (mg/L)	738	374	330	229	340	616

Notes:

ND: Not detected.

1. PFOS, PFOA and 1,4-dioxane data from the emerging contaminant sampling conducted in 2022 and 2023.
Leachate data from Second Annual 2022 UMP Sampling Report.

2. Wells shaded grey are downgradient of Cells 1-4. Wells not shaded are downgradient of Cells 5 and 6.

TABLE 1-3

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MAXIMUM CONCENTRATIONS OF PFOS, PFOA, 1,4-DIOXANE, AND LEACHATE PARAMETERS

Parameter	Intermediate Monitoring Wells		
	73754	**73761**	**MW-10I(R)**
PFOS (ng/L)	38	10	ND
PFOA (ng/L)	100	120	11
1,4-Dioxane (ug/L)	3.5	12.1	0.83
Alkalinity (as CaCO3) (mg/L)	79.1	57	15
Ammonia (mg/L)	1.5	23.7	ND
Chloride (mg/L)	459	145	45.4
Specific Conductance (mS/cm)	1.63	0.851	0.236
Sulfate (mg/L)	45.2	6.5	32.7
Total dissolved Solids (mg/L)	908	438	150

Notes:

ND: Not detected.

1. PFOS, PFOA and 1,4-dioxane data from the emerging contaminant sampling conducted in 2022 and 2023. Leachate data from Second Annual 2022 UMP Sampling Report.

2. Wells shaded grey are downgradient of Cells 1-4. Wells not shaded are downgradient of Cells 5 and 6.

TABLE 1-3

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MAXIMUM CONCENTRATIONS OF PFOS, PFOA, 1,4-DIOXANE, AND LEACHATE PARAMETERS

Parameter	Deep Monitoring Wells			
	103141	**73752**	**73759**	**MW-04D**
PFOS (ng/L)	5.4	13	18	ND
PFOA (ng/L)	ND	12	30	ND
1,4-Dioxane (ug/L)	0.21	2.2	4.9	ND
Alkalinity (as CaCO3) (mg/L)	13.5	28.3	72.9	13.4
Ammonia (mg/L)	ND	0.057	8.6	ND
Chloride (mg/L)	45.1	43.3	96.8	13.8
Specific Conductance (mS/cm)	0.271	0.236	0.841	0.178
Sulfate (mg/L)	25.3	24.9	178	48.1
Total dissolved Solids (mg/L)	154	153	454	155

Notes:

ND: Not detected.

1. PFOS, PFOA and 1,4-dioxane data from the emerging contaminant sampling conducted in 2022 and 2023. Leachate data from Second Annual 2022 UMP Sampling Report.

2. Wells shaded grey are downgradient of Cells 1-4. Wells not shaded are downgradient of Cells 5 and 6.

TABLE 1-3

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MAXIMUM CONCENTRATIONS OF PFOS, PFOA, 1,4-DIOXANE, AND LEACHATE PARAMETERS

Parameter	Shallow Monitoring Wells				
	72816	**MW-05S**	**MW-06S**	**MW-05I**	**MW-05D**
PFOS (ng/L)	1.9	2.3	6.4	2	0.94
PFOA (ng/L)	5.5	5.1	8.3	4.1	7.1
1,4-Dioxane (ug/L)	ND	ND	ND	ND	0.19
Alkalinity (as CaCO3) (mg/L)	51	22.3	2.3	ND	40
Ammonia (mg/L)	ND	ND	ND	ND	ND
Chloride (mg/L)	74.4	75.3	62.4	49.1	66.8
Specific Conductance (mS/cm)	0.428	0.328	0.328	0.26	0.395
Sulfate (mg/L)	10.5	8.3	16	98.1	28.3
Total dissolved Solids (mg/L)	210	196	165	216	228

Notes:

ND: Not detected.

1. PFOS, PFOA and 1,4-dioxane data from the emerging contaminant sampling conducted in 2022 and 2023.
Leachate data from Second Annual 2022 UMP Sampling Report.

deep wells, in general, all have shown significantly lower concentrations of emerging contaminants as compared to the shallow and intermediate wells. Furthermore, MW-2S located immediately downgradient of Cell 5 exhibits the highest PFOA concentration of 300 ng/l but the leachate parameters associated with the well do not indicate any evidence of leachate impacts from Cell 5.

1.5 Contamination Source Review

1.5.1 Environmental Records Search

An environmental database search was recently conducted within the area of the Landfill. Environmental Data Resources, Inc. (EDR) was commissioned to develop a report to document and physically locate all available federal, state, local, tribal and proprietary records for locations associated with reported spills, stored chemicals and/or contaminated media within a selected study area located in the vicinity of the Landfill. While a large number of locations were identified in the EDR report, the majority are not hydraulically upgradient, as described below, or have only stored contaminants of concern without any recorded releases. The full EDR report is presented on the compact disk included in Appendix A. In addition, as a further check against the EDR report, D&B conducted a search of the USEPA database referred to as the PFAS Analytic Tools which is a component of the USEPA Enforcement and Compliance History database (https://echo.epa.gov/).

Many sites located within the study area appear in the database due to chemical storage and/or for registration as hazardous waste generators. Most recorded spills within the study area were petroleum-based and are not associated with 1,4-dioxane or PFAS contamination. A figure showing the limits of the study area is provided as **Figure 1-7.**

1.5.2 Potential Contamination Sources

Given that 1,4-dioxane or PFAS have only been of regulatory concern in the last five or so years, the EDR database does not have a specific category at this time that tracks sites that have been contaminated with these compounds.

D&B ENGINEERS AND ARCHITECTS

TOWN OF BROOKHAVEN LANDFILL
CORRECTIVE MEASURES PLUME CHARACTERIZATION
INVESTIGATION WORK PLAN

POTENTIAL EMERGING CONTAMINANT
SOURCE STUDY AREA

FIGURE 1-7

As a result, D&B has applied alternative screening methods to identify potential sources of these compounds which are detailed below.

Potential sources of 1,4-dioxane were searched based on the storage and/or use of 1,1,1-trichloroethane since 1,4-dioxane was used as a stabilizer for 1,1,1-trichloroethane. However, it should be noted that there is information that suggests that the presence of 1,4-dioxane has been associated with sites contaminated with chlorinated solvents other than 1,1,1-trichloroethane (e.g., trichloroethene [TCE]). This information is based on the observation of 1,4-dioxane in chlorinated solvent plumes where the use/release of 1,1,1-trichloroethane was not documented. As a result, based on this anecdotal information, any of the properties where chlorinated solvents were used/released could be potential sources of 1,4-dioxane.

For PFAS, manufacturing sectors that have been classified as potential sources of PFAS releases to the environment were identified during the database review. However, it should be noted that given the widespread historical use of PFAS compounds in many commercial products along with the low concentrations of PFAS contamination typically being detected in groundwater and drinking water supply wells, it is difficult to conclusively identify specific source(s) of PFAS contamination.

1.5.3 Groundwater Flow

Based on available ascertainable information, the groundwater flow direction in this area of Suffolk County is generally in a southeasterly direction toward Bellport Bay. It should be noted that a groundwater divide is located approximately 6 miles north of the Landfill that runs approximately east-west in the hydraulically upgradient direction. As a result, properties at distances greater than approximately 6 miles north of the Landfill are not likely to impact the site since groundwater on the far side of the divide likely flows to the north. However, the groundwater divide is located outside (i.e., to the north) of the study area.

1.5.4 Mapped Properties

A total of 1,128 records were identified by EDR within the Landfill study area discussed above. Of those records, the following properties have been identified as potential sources of 1,4-dioxane and/or PFAS:

- **Map ID # BS363: Tribology Inc./Tech-Lube Div. of.** - located at 35 Old Dock Road, Yaphank, New York, approximately 0.35 miles northwest and upgradient from the Landfill (contaminants: not identified; 1,1,1-trichloroethane use; potential 1,4-dioxane source due to 1,1,1-trichloroethane use; potential PFAS source due to fire training activities).
- **Map ID # DB603: Hyponex Corporation** - located at 445 Horseblock Rd., Brookhaven, New York, approximately 0.38 miles east and crossgradient from the Landfill (contaminants: perfluorooctanoic sulfonic acid spill; database indicates that DMM to collect samples at composting facility; potential PFAS source due to suspect PFOS spill).
- **Map ID # DZ733: Monaco Cosmetics Inc** - located at 11H Farber Dr., Bellport, New York, approximately 0.63 miles west and crossgradient from the Landfill (contaminants: not identified; potential PFAS source due to suspect cosmetics manufacturing).
- **Map ID # 815 & 816: Brookhaven Fire** - located at 2486 Montauk Highway/8 Seeley St., Brookhaven, New York, approximately 0.78 miles southeast and downgradient from the Landfill (contaminants: not identified; potential PFAS source due to suspect fire training activities).
- **Map ID # 356, 357 & 358: SCDPW Fire Fighting Training Center** - located at Central Ave. & Pine Ave., Yaphank, New York, approximately 0.94 miles northeast and crossgradient from the Landfill (contaminants: not identified; fire training industry; potential PFAS source due to fire training activities).
- **Map ID # 327: Suffolk Co Fire Academy** - located at 30 East Ave., Yaphank, New York, approximately 0.94 miles northeast and crossgradient from the Landfill (contaminants: not identified; potential PFAS source due to suspect fire training activities).
- **Map ID # CA413: Nanoprobes** - located at 95 Horseblock Rd. Unit 1, Yaphank, New York, approximately 0.99 miles northwest and upgradient from the Landfill (contaminants: not identified; generator of 1,4-dioxane waste; potential 1,4-dioxane

source due to its use).

- Map ID # 1049: Cruz Well - located at 172 New Jersey Avenue, Bellport, New York, approximately 1.18 miles south-southwest and downgradient from the Landfill (contaminants: 1,1,1-trichloroethane in groundwater; potential 1,4-dioxane source due to 1,1,1-trichloroethane in groundwater).

- Map ID # 217: Fiber-Shield Industries, Inc - located at 26 Old Dock Rd., Yaphank, New York, approximately 1.19 miles north-northwest and upgradient from the Landfill (contaminants: not identified; indicated that PFOA/PFOS-containing materials are/were not currently or historically used, stored, manufactured or disposed/released at the facility on NYSDEC's PFOA/PFOS Questionnaire).

- Map ID # GM1069: VID Industries - located on Beaver Dam Road, Brookhaven, New York, approximately 1.27 miles south and downgradient from the Landfill (contaminants: not identified; potential PFAS source due to its use as a landfill).

- Map ID # 124: Liere Farm - located at 100 Long Island Ave., Yaphank, New York, approximately 1.59 miles north-northwest and upgradient from the Landfill (contaminants: not identified; waste management industry; potential PFAS source due to its use for waste management activities).

- Map ID # BG308: Amer Avionic Tech Corp - located at 25-1 Industrial Blvd., Medford, New York, approximately 1.66 miles northwest and upgradient from the Landfill (contaminants: not identified; airport industry; potential PFAS source due to its airport industry use).

- Map ID # BG309: Collins Aerospace - Macrolink - located at 25 Industrial Blvd., Medford, New York, approximately 1.66 miles northwest and upgradient from the Landfill (contaminants: not identified; electronics industry; potential PFAS source due to electronics manufacturing).

- Map ID # 215: Apple Environmental Services Corp - located in Medford, New York, approximately 1.82 miles northwest and upgradient from the Landfill (contaminants: not identified; waste management industry; potential PFAS source due to its use for waste management activities).

- Map ID # V115: Whitman Packaging Corp - located at 19 Nicholas Dr., Yaphank, New York, approximately 1.62 miles north-northwest and upgradient from the Landfill (contaminants: not identified; paints and coatings industry; potential PFAS source due to suspect paints/coatings manufacturing).

- Map ID # U108 & U109: Suffolk County Fire Academy - located on Yaphank Avenue, Yaphank, New York, approximately 1.70 miles north-northeast and crossgradient from the Landfill (contaminants: not identified; potential PFAS source due to fire training activities).

- **Map ID # GX1128: Hagerman Fire Department** - located at 1309 Montauk Highway, Yaphank, New York, approximately 1.90 miles southwest and crossgradient from the Landfill (contaminants: not identified; potential PFAS source due to suspect fire training activities).

- **Map ID # R91: Firematics Training Center** - located on Yaphank Avenue, Yaphank, New York, approximately 1.93 miles north-northeast and crossgradient from the Landfill (contaminants: not identified; fire training industry; potential PFAS source due to fire training activities).

- **Map ID # R92: VEEB (Fire Academy) C-551** - located on Yaphank Avenue, Yaphank, New York, approximately 1.93 miles north-northeast and crossgradient from the Landfill (contaminants: not identified; fire training industry; potential PFAS source due to suspect fire training activities).

- **Map ID # 24: Yaphank Fire Department** - located at 31 Main Street, Yaphank, New York, approximately 2.93 miles north and crossgradient from the Landfill (contaminants: not identified; potential PFAS source due to suspect fire training activities).

1.5.5 NYSDEC PFOS/PFOA Facility Identification Survey

In 2016, the NYSDEC performed a statewide survey to identify potential sources of PFOS and PFOA contamination. Questionnaires were sent to select NYSDEC-identified businesses, fire departments, fire training centers, bulk storage facilities, airports and United States Department of Defense (DoD) facilities to ascertain information on whether these facilities use(d), store(d), manufacture(d) or dispose(d) of PFOS or PFOA. D&B reviewed the summary of this survey to identify potential sources that are located in the Landfill study area.

Based on the review, the following facilities identified in the summary are located within study area of the Landfill:

- Suffolk County Fire Academy - located on Yaphank Avenue at Suffolk Avenue in Yaphank, New York, approximately 0.79 miles north-northeast and crossgradient of the

Landfill. This facility indicated that a Class B fire suppression foam was used for training purposes, but it is not known whether the foam contained PFOS/PFOA, and that it does/did not store foam at the facility or experience a spill/leak of foam.

- Caithness Energy, LLC - located at 50 Zorn Blvd. in Yaphank, New York, approximately 0.98 miles north-northwest and upgradient of the Landfill. This facility indicated that a Class B fire suppression foam is/was currently/historically used and spilled/leaked at the facility, but is/was not used for training purposes, fire fighting/other emergency response purposes or at an off-site location.
- Fiber-Shield Industries, Inc. - located at 26 Old Dock Road in Yaphank, New York, approximately 1.19 miles north-northwest and upgradient of the Landfill. This facility indicated that PFOA/PFOS-containing materials are/were not currently or historically used, stored, manufactured or disposed/released at the facility.
- Yaphank Fire Department - located in Yaphank, New York, approximately 2.93 miles north and crossgradient of the Landfill. This facility did not respond to the questionnaire.

1.5.6 Interpreted Contributory Area

Based on the groundwater flow direction discussed above, this section describes the region where the groundwater originates that is flowing toward the Landfill (hereinafter referred to as the "interpreted contributory area") and could therefore affect water quality at this Landfill.

Based on the above, since groundwater was determined to flow in a general southeasterly direction in the area of the Landfill based on available information (USGS maps), groundwater flowing toward the Landfill is anticipated to originate from the northwest and north-northwest directions from the Landfill. Therefore, the interpreted contributory area for the Landfill is the area extending out from the Landfill to the northwest through north-northwest.

As a result, for the purposes of this contaminant source review, only those facilities identified in the environmental database search report provided by EDR as located within this interpreted contributory area were assessed for their likelihood to affect groundwater quality at the Landfill.

This contaminant source review is based on the above groundwater flow direction and interpreted contributory area; if additional information is obtained that may contradict this contributory area or provides evidence of additional contributory areas, the database should be re-reviewed in light of this new information.

1.5.7 Conclusions

Based on the interpreted contributory area discussed above, the following facilities located within the study area and identified above have the potential to impact the Landfill:

- **Tribology Inc./Tech-Lube Div. of.** - located at 35 Old Dock Road, Yaphank, New York, approximately 0.35 miles northwest and upgradient from the Landfill (contaminants: potential 1,4-dioxane and PFAS source).
- **Caithness Energy, LLC** - located at 50 Zorn Blvd. in Yaphank, New York, approximately 0.98 miles north-northwest and upgradient of the Landfill (potential PFAS source).
- **Nanoprobes** - located at 95 Horseblock Rd. Unit 1, Yaphank, New York, approximately 0.99 miles northwest and upgradient from the Landfill (potential 1,4-dioxane source).
- **Liere Farm** - located at 100 Long Island Ave., Yaphank, New York, approximately 1.59 miles north-northwest and upgradient from the Landfill (potential PFAS source).
- **Amer Avionic Tech Corp** - located at 25-1 Industrial Blvd., Medford, New York, approximately 1.66 miles northwest and upgradient from the Landfill (potential PFAS source).
- **Collins Aerospace - Macrolink** - located at 25 Industrial Blvd., Medford, New York, approximately 1.66 miles northwest and upgradient from the Landfill (contaminants: potential PFAS source).
- **Apple Environmental Services Corp** - located in Medford, New York, approximately 1.82 miles northwest and upgradient from the Landfill (potential PFAS source).
- **Whitman Packaging Corp** - located at 19 Nicholas Dr., Yaphank, New York, approximately 1.62 miles north-northwest and upgradient from the Landfill (contaminants: potential PFAS source).

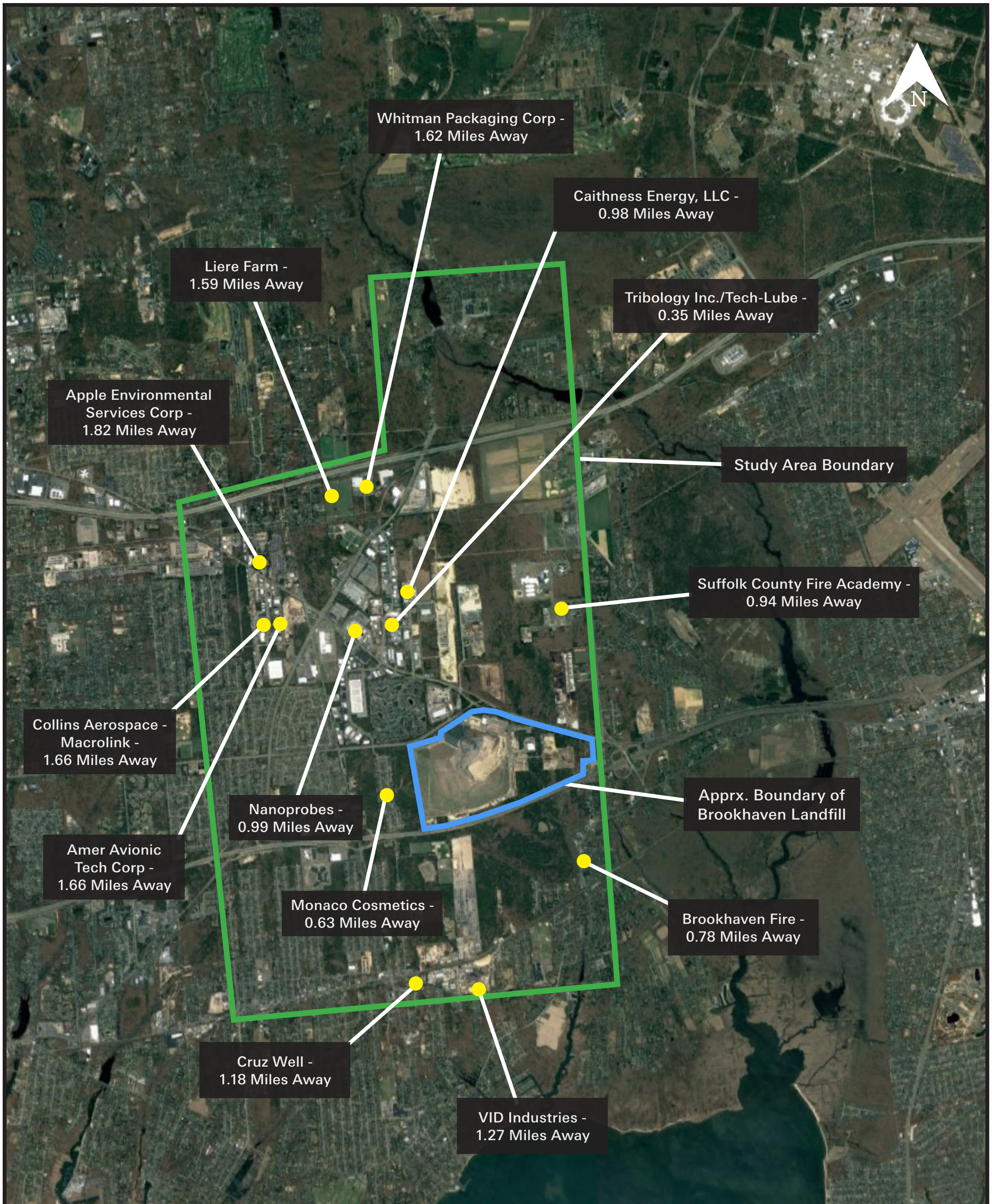
It should be noted that the Suffolk County Fire Academy is located approximately 0.8 miles northeast and crossgradient from the Landfill. While PFAS contamination associated with the Fire Academy may not directly impact groundwater quality at the Landfill, based on the southeasterly regional groundwater flow, it is possible that contaminants from this facility could impact the Carmans River and its tributaries east of the Landfill.

Given the numerous potential sources of PFAS upgradient of the Landfill, the investigation scope of work presented in Section 2 of this work plan includes activities specific to defining upgradient groundwater quality.

In addition, the following facilities within the study area are located downgradient of the landfill:

- **Brookhaven Fire** - located at 2486 Montauk Highway/8 Seeley St., Brookhaven, New York, approximately 0.78 miles southeast and downgradient from the Landfill (contaminants: potential PFAS source).
- **Cruz Well** - located at 172 New Jersey Avenue, Bellport, New York, approximately 1.18 miles south-southwest and downgradient from the Landfill (contaminants: potential 1,4-dioxane source).
- **VID Industries** - located on Beaver Dam Road, Brookhaven, New York, approximately 1.27 miles south and downgradient from the Landfill (contaminants: potential PFAS source).

A figure showing the locations of the above facilities is provided as **Figure 1-8.**



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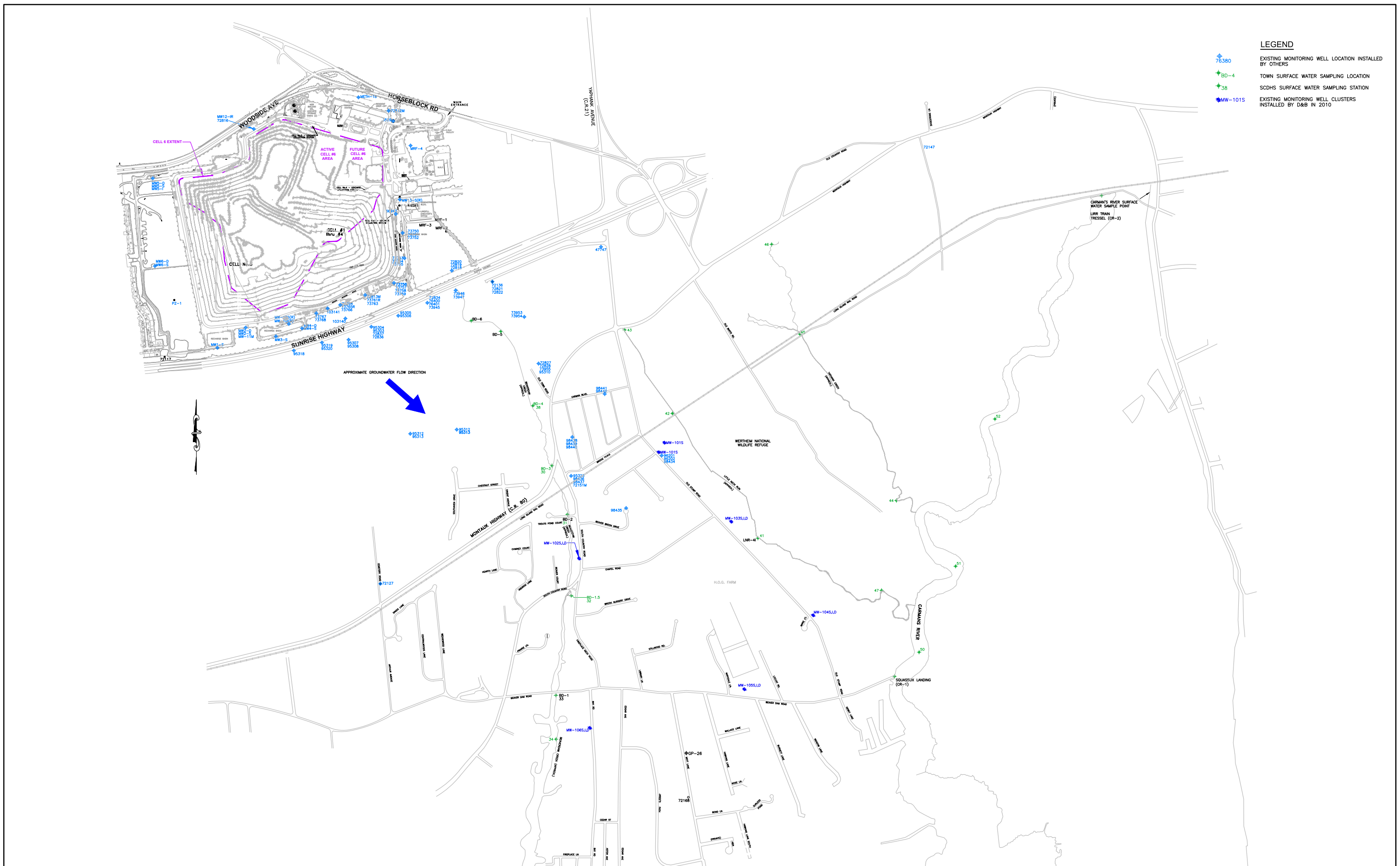
TOWN OF BROOKHAVEN LANDFILL
CORRECTIVE MEASURES PLUME CHARACTERIZATION
INVESTIGATION WORK PLAN

OFF-SITE POTENTIAL EMERGING
CONTAMINANT SOURCE LOCATION MAP

FIGURE 1-8



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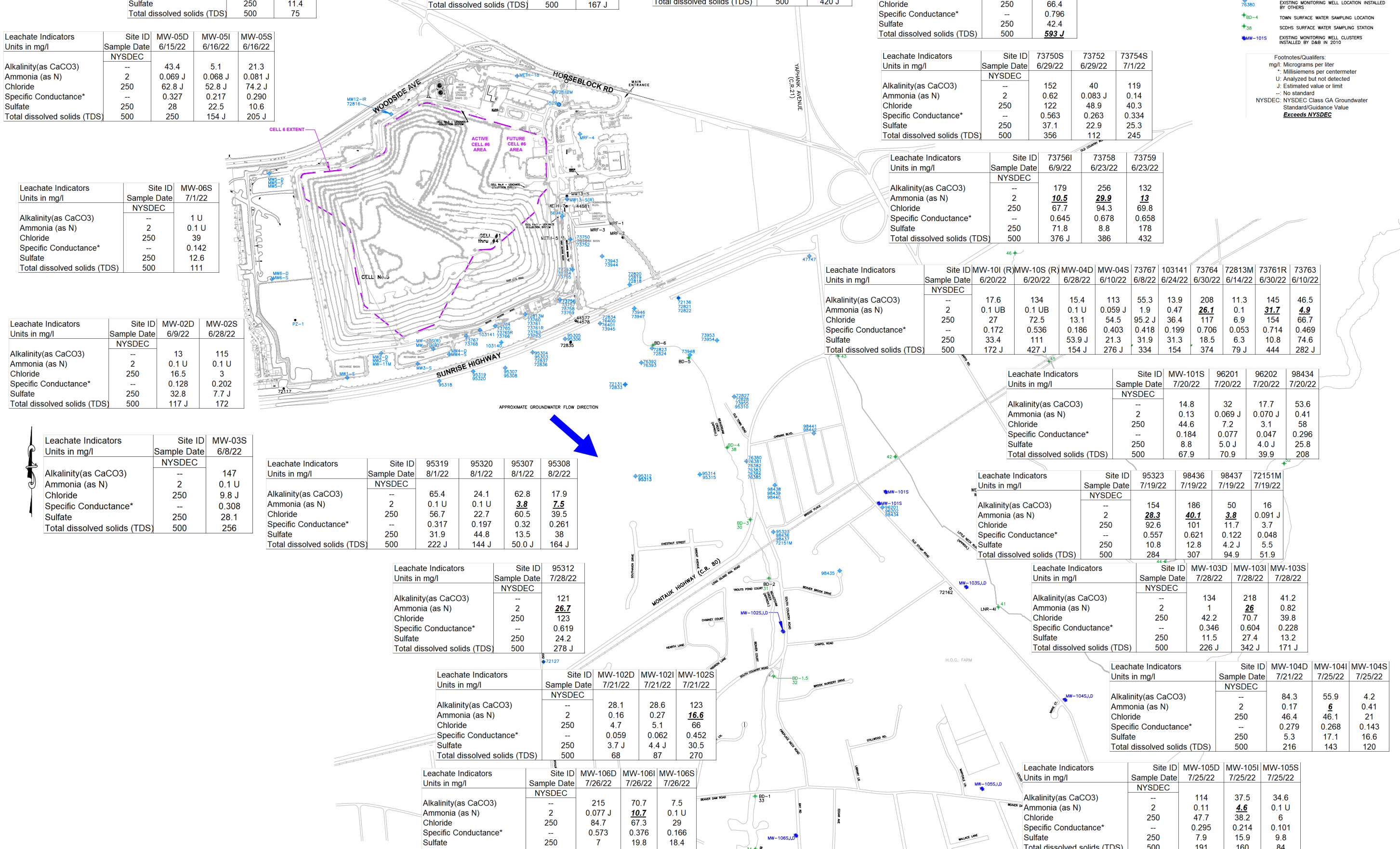
TOWN OF BROOKHAVEN LANDFILL

SUFFOLK COUNTY — NEW YORK

EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

EXISTING ON-SITE AND OFF-SITE GROUNDWATER MONITORING LOCATIONS

PROJECT NO.: 0667
DATE: SEPTEMBER 2023
SCALE: 1"=700'
DRAWING NO.: 1



Leachate Indicators Units in mg/l	Site ID / Sample Date	72816S 6/24/22
	NYSDEC	
Alkalinity(as CaCO3)	--	51.6
Ammonia (as N)	2	0.1 UB
Chloride	250	9.8
Specific Conductance*	--	0.134
Sulfate	250	11.4
Total dissolved solids (TDS)	500	75

Leachate Indicators Units in mg/l	Site ID / Sample Date	72812M 6/10/22
	NYSDEC	
Alkalinity(as CaCO3)	--	11.8
Ammonia (as N)	2	0.1 U
Chloride	250	51.9
Specific Conductance*	--	0.252
Sulfate	250	30.3
Total dissolved solids (TDS)	500	167 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	MRF-04 6/9/22
	NYSDEC	
Alkalinity(as CaCO3)	--	77.5
Ammonia (as N)	2	0.1 U
Chloride	250	158
Specific Conductance*	--	0.546
Sulfate	250	34.9
Total dissolved solids (TDS)	500	420 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-13S (R) 6/27/22
	NYSDEC	
Alkalinity(as CaCO3)	--	356
Ammonia (as N)	2	0.26
Chloride	250	66.4
Specific Conductance*	--	0.796
Sulfate	250	42.4
Total dissolved solids (TDS)	500	***593 J***

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-05D 6/15/22	MW-05I 6/16/22	MW-05S 6/16/22
	NYSDEC			
Alkalinity(as CaCO3)	--	43.4	5.1	21.3
Ammonia (as N)	2	0.069 J	0.068 J	0.081 J
Chloride	250	62.8 J	52.8 J	74.2 J
Specific Conductance*	--	0.327	0.217	0.290
Sulfate	250	28	22.5	10.6
Total dissolved solids (TDS)	500	250	154 J	205 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	73750S 6/29/22	73752 6/29/22	73754S 7/1/22
	NYSDEC			
Alkalinity(as CaCO3)	--	152	40	119
Ammonia (as N)	2	0.62	0.083 J	0.14
Chloride	250	122	48.9	40.3
Specific Conductance*	--	0.563	0.263	0.334
Sulfate	250	37.1	22.9	25.3
Total dissolved solids (TDS)	500	356	112	245

Leachate Indicators Units in mg/l	Site ID / Sample Date	73756I 6/9/22	73758 6/23/22	73759 6/23/22
	NYSDEC			
Alkalinity(as CaCO3)	--	179	256	132
Ammonia (as N)	2	***10.5***	***29.9***	***13***
Chloride	250	67.7	94.3	69.8
Specific Conductance*	--	0.645	0.678	0.658
Sulfate	250	71.8	8.8	178
Total dissolved solids (TDS)	500	376 J	386	432

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-06S 7/1/22
	NYSDEC	
Alkalinity(as CaCO3)	--	1 U
Ammonia (as N)	2	0.1 U
Chloride	250	39
Specific Conductance*	--	0.142
Sulfate	250	12.6
Total dissolved solids (TDS)	500	111

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-10I (R) 6/20/22	MW-10S (R) 6/20/22	MW-04D 6/28/22	MW-04S 6/10/22	73767 6/8/22	103141 6/24/22	73764 6/30/22	72813M 6/14/22	73761R 6/30/22	73763 6/10/22
	NYSDEC										
Alkalinity(as CaCO3)	--	17.6	134	15.4	113	55.3	13.9	208	11.3	145	46.5
Ammonia (as N)	2	0.1 UB	0.1 UB	0.1 U	0.059 J	1.9	0.47	***26.1***	0.1	***31.7***	***4.9***
Chloride	250	27	72.5	13.1	54.5	95.2 J	36.4	117	6.9	154	66.7
Specific Conductance*	--	0.172	0.536	0.186	0.403	0.418	0.199	0.706	0.053	0.714	0.469
Sulfate	250	33.4	111	53.9 J	21.3	31.9	31.3	18.5	6.3	10.8	74.6
Total dissolved solids (TDS)	500	172 J	427 J	154 J	276 J	334	154	374	79 J	444	282 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-02D 6/9/22	MW-02S 6/28/22
	NYSDEC		
Alkalinity(as CaCO3)	--	13	115
Ammonia (as N)	2	0.1 U	0.1 U
Chloride	250	16.5	3
Specific Conductance*	--	0.128	0.202
Sulfate	250	32.8	7.7 J
Total dissolved solids (TDS)	500	117 J	172

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-101S 7/20/22	96201 7/20/22	96202 7/20/22	98434 7/20/22
	NYSDEC				
Alkalinity(as CaCO3)	--	14.8	32	17.7	53.6
Ammonia (as N)	2	0.13	0.069 J	0.070 J	0.41
Chloride	250	44.6	7.2	3.1	58
Specific Conductance*	--	0.184	0.077	0.047	0.296
Sulfate	250	8.8	5.0 J	4.0 J	25.8
Total dissolved solids (TDS)	500	67.9	70.9	39.9	208

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-03S 6/8/22
	NYSDEC	
Alkalinity(as CaCO3)	--	147
Ammonia (as N)	2	0.1 U
Chloride	250	9.8 J
Specific Conductance*	--	0.308
Sulfate	250	28.1
Total dissolved solids (TDS)	500	256

Leachate Indicators Units in mg/l	Site ID / Sample Date	95319 8/1/22	95320 8/1/22	95307 8/1/22	95308 8/2/22
	NYSDEC				
Alkalinity(as CaCO3)	--	65.4	24.1	62.8	17.9
Ammonia (as N)	2	0.1 U	0.1 U	***3.8***	***7.5***
Chloride	250	56.7	22.7	60.5	39.5
Specific Conductance*	--	0.317	0.197	0.32	0.261
Sulfate	250	31.9	44.8	13.5	38
Total dissolved solids (TDS)	500	222 J	144 J	50.0 J	164 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	95323 7/19/22	98436 7/19/22	98437 7/19/22	72151M 7/19/22
	NYSDEC				
Alkalinity(as CaCO3)	--	154	186	50	16
Ammonia (as N)	2	***28.3***	***40.1***	***3.8***	0.091 J
Chloride	250	92.6	101	11.7	3.7
Specific Conductance*	--	0.557	0.621	0.122	0.048
Sulfate	250	10.8	12.8	4.2 J	5.5
Total dissolved solids (TDS)	500	284	307	94.9	51.9

Leachate Indicators Units in mg/l	Site ID / Sample Date	95312 7/28/22
	NYSDEC	
Alkalinity(as CaCO3)	--	121
Ammonia (as N)	2	***26.7***
Chloride	250	123
Specific Conductance*	--	0.619
Sulfate	250	24.2
Total dissolved solids (TDS)	500	278 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-103D 7/28/22	MW-103I 7/28/22	MW-103S 7/28/22
	NYSDEC			
Alkalinity(as CaCO3)	--	134	218	41.2
Ammonia (as N)	2	1	***26***	0.82
Chloride	250	42.2	70.7	39.8
Specific Conductance*	--	0.346	0.604	0.228
Sulfate	250	11.5	27.4	13.2
Total dissolved solids (TDS)	500	226 J	342 J	171 J

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-104D 7/21/22	MW-104I 7/25/22	MW-104S 7/25/22
	NYSDEC			
Alkalinity(as CaCO3)	--	84.3	55.9	4.2
Ammonia (as N)	2	0.17	***6***	0.41
Chloride	250	46.4	46.1	21
Specific Conductance*	--	0.279	0.268	0.143
Sulfate	250	5.3	17.1	16.6
Total dissolved solids (TDS)	500	216	143	120

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-102D 7/21/22	MW-102I 7/21/22	MW-102S 7/21/22
	NYSDEC			
Alkalinity(as CaCO3)	--	28.1	28.6	123
Ammonia (as N)	2	0.16	0.27	***16.6***
Chloride	250	4.7	5.1	66
Specific Conductance*	--	0.059	0.062	0.452
Sulfate	250	3.7 J	4.4 J	30.5
Total dissolved solids (TDS)	500	68	87	270

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-106D 7/26/22	MW-106I 7/26/22	MW-106S 7/26/22
	NYSDEC			
Alkalinity(as CaCO3)	--	215	70.7	7.5
Ammonia (as N)	2	0.077 J	***10.7***	0.1 U
Chloride	250	84.7	67.3	29
Specific Conductance*	--	0.573	0.376	0.166
Sulfate	250	7	19.8	18.4
Total dissolved solids (TDS)	500	370	219	141

Leachate Indicators Units in mg/l	Site ID / Sample Date	MW-105D 7/25/22	MW-105I 7/25/22	MW-105S 7/25/22
	NYSDEC			
Alkalinity(as CaCO3)	--	114	37.5	34.6
Ammonia (as N)	2	0.11	***4.6***	0.1 U
Chloride	250	47.7	38.2	6
Specific Conductance*	--	0.295	0.214	0.101
Sulfate	250	7.9	15.9	9.8
Total dissolved solids (TDS)	500	191	160	84

NO.	DATE	REVISION	INT.

PROJECT ENGINEER: DRAWN BY:
DESIGNED BY: CHECKED BY:

D&B ENGINEERS AND ARCHITECTS

TOWN OF BROOKHAVEN LANDFILL
SUFFOLK COUNTY NEW YORK
EMERGING CONTAMINANT PLUM INVESTIGATION WORK PLAN

SUMMARY OF LEACHATE INDICATOR PARAMETERS AT EXISTING ON-SITE AND OFF-SITE GROUNDWATER MONITORING WELLS

PROJECT NO. 0667
DATE: SEPTEMBER 2023
SCALE: 1"=500'
DRAWING 2

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-05S 3/2/22 Shallow	MW-05S 6/16/22 Shallow	MW-05S 9/12/22 Shallow	MW-05S 12/6/22 Shallow	MW-05S 3/6/23 Shallow	MW-05I 3/3/22 Intermediate	MW-05I 6/16/22 Intermediate	MW-05I 9/15/22 Intermediate	MW-05I 12/8/22 Intermediate	MW-05I 3/1/23 Intermediate	MW-05D 3/2/22 Deep	MW-05D 6/15/22 Deep	MW-05D 9/12/22 Deep	MW-05D 12/6/22 Deep	MW-05D 3/9/23 Deep
	GA ST/ GV															
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2FTS A)	--	U	U	U	U	U	U	U	U	U	U	U	U	U	U	1.2 J
Perfluorobutanesulfonic acid (PFBS)	--	7.9	5.3	3.74	3.4	7.9	U	U	U	U	0.84 J	U	1.9	2.26	U	1.6 J
Perfluorobutanoic acid (PFBA)	--	U	2.8	2.43	6.5	3.7	U	2.9	2.04	4	3	4.2	4.5	4.58	6	5.2
Perfluoroheptanoic acid (PFHpA)	--	U	2.3	U	U	2.1	U	3.2	U	U	1.8	U	2.7	2.29	U	2.7
Perfluorohexanesulfonic acid (PFHxS)	--	U	3.1	2.38	U	1.6 J	U	U	U	U	1.7 J	8.7	8	8	9	9.2
Perfluorohexanoic acid (PFHxA)	--	U	3.7	U	4	3.9	5	5.6	2.86	U	2.4	4.1	5	5.04	5.1	6
Perfluorooctanesulfonic acid (PFOS)	**2.7**	U	2.3	U	U	2.2	U	2	U	U	1.1 J	U	U	U	U	0.94 J
Perfluorooctanoic acid (PFOA)	**6.7**	U	3.9	2.44	5.1	3.5	U	4.1	U	U	3	6.5	**6.8**	6	**7.1**	6.7
Perfluoropentanoic acid (PFPeA)	--	U	3.5	2.19	4.8	4.6	6.1	6.3	3.31	U	3	U	4.1	5.04	5.6	6.4
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.19 J

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-13S(R) 3/7/22 Shallow	MW-13S(R) 6/27/22 Shallow	MW-13S(R) 10/3/22 Shallow	MW-13S(R) 12/6/22 Shallow	MW-13S(R) 3/6/23 Shallow
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	6.7	5.9	5.07 J	3.7	6.6
Perfluorobutanoic acid (PFBA)	--	80	78	90.8 J	46	48
Perfluorodecanoic acid (PFDA)	--	U	U	U J	U	1 J
Perfluoroheptanesulfonic acid (PFHpS)	--	U	U	U J	U	1.3 J
Perfluoroheptanoic acid (PFHpA)	--	32	71	U J	62	45
Perfluorohexanesulfonic acid (PFHxS)	--	18	14	U J	13	13
Perfluorohexanoic acid (PFHxA)	--	200	180D	182 J	140	110
Perfluorononanoic acid (PFNA)	--	U	3.3	19 J	U	5.4
Perfluorooctanesulfonamide (FOSA)	--	U	U	24.3 J	U	U
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**24**	**24**	**5.26 J**	**29**	**20**
Perfluorooctanoic acid (PFOA)	**6.7**	**38**	**36**	U J	**42**	**28**
Perfluoropentanoic acid (PFPeA)	--	280	220D	445 J	150	140
Perfluorotetradecanoic acid (PFTA)	--	U	U	46.7 J	U	U
Perfluorotridecanoic acid (PFTrDA)	--	U	U	320 J	U	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73750 3/3/22 Shallow	73750 6/23/22 Shallow	73750 9/27/22 Shallow	73750 12/13/22 Shallow	73750 3/22/23 Shallow
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	4.3	3.1 J	U	37	19
Perfluorobutanoic acid (PFBA)	--	26	18	4.27	72	46
Perfluorodecanesulfonic acid (PFDS)	--	U	U	5.38	U	U
Perfluorodecanoic acid (PFDA)	--	U	U	U	6.2	4.6
Perfluoroheptanesulfonic acid (PFHpS)	--	U	U	33	U	0.83 J
Perfluoroheptanoic acid (PFHpA)	--	47	26 J	40.7	35	36
Perfluorohexanesulfonic acid (PFHxS)	--	6.4	4.3	6.49	14	12
Perfluorohexanoic acid (PFHxA)	--	56	49	74.9	84	67
Perfluorononanoic acid (PFNA)	--	6.2	6.3	6.91	7.4	5.4
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**30**	**31**	**38.8**	**35**	**23**
Perfluorooctanoic acid (PFOA)	**6.7**	**88**	**41**	**70.3**	**55**	**61**
Perfluoropentanoic acid (PFPeA)	--	53	40	99	86	64
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	U	U	U	U	**0.65**

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	72816 3/8/22 Shallow	72816 6/24/22 Shallow	72816 9/28/22 Shallow	72816 12/9/22 Shallow	72816 3/7/23 Shallow
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	U	U	U	4.3	1.3 J
Perfluorobutanoic acid (PFBA)	--	U	U	U	U	5.7
Perfluoroheptanoic acid (PFHpA)	--	U	U	U	U	7.7
Perfluorohexanesulfonic acid (PFHxS)	--	U	U	U	U	1.6 J
Perfluorohexanoic acid (PFHxA)	--	U	U	U	U	2.9
Perfluorononanoic acid (PFNA)	--	U	U	U	U	1.2 J
Perfluorooctanesulfonic acid (PFOS)	**2.7**	U	1.8	U	U	1.9
Perfluorooctanoic acid (PFOA)	**6.7**	U	U	U	U	5.5
Perfluoropentanoic acid (PFPeA)	--	U	U	U	U	2

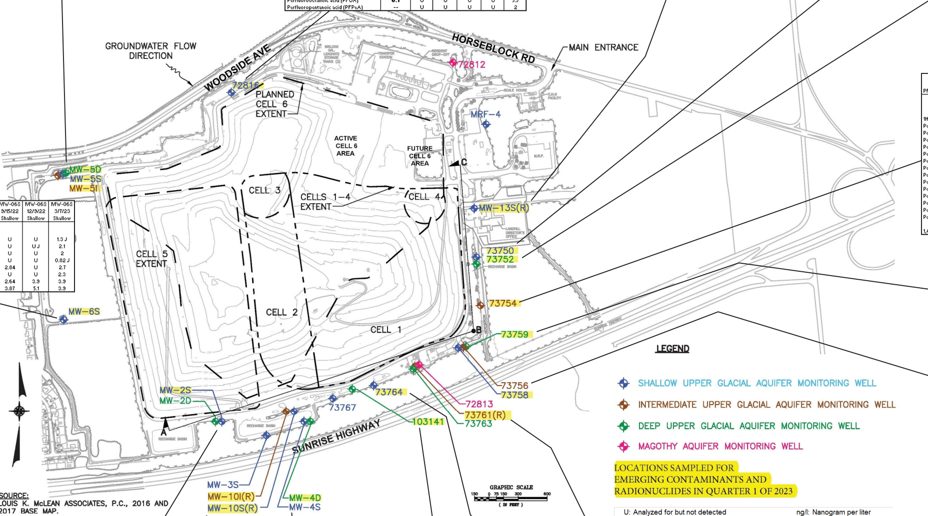
PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73752 3/8/22 Deep	73752 6/29/22 Deep	73752 9/27/22 Deep	73752 12/13/22 Deep	73752 3/17/23 Deep
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	U	U	U	U	1.3 J
Perfluorobutanoic acid (PFBA)	--	4.7	4.2	U	4.3 JH	4.3
Perfluoroheptanesulfonic acid (PFHpS)	--	U	U	2.06	U	U
Perfluoroheptanoic acid (PFHpA)	--	3.7	3.9 J	U	U	4.4
Perfluorohexanesulfonic acid (PFHxS)	--	4.3	3.6	3.58	3.9	4.4
Perfluorohexanoic acid (PFHxA)	--	6	7	2.51	3.9	7
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**13**	**12**	**9.57**	**11**	**10**
Perfluorooctanoic acid (PFOA)	**6.7**	**12**	**11**	6.16	**7.8**	**12**
Perfluoropentanoic acid (PFPeA)	--	7	6.5	2.51	4	8.5
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	U	U	U	**2.2**	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73754 3/15/22 Intermediate	73754 7/1/22 Intermediate	73754 10/4/22 Intermediate	73754 12/15/22 Intermediate	73754 3/16/23 Intermediate
	GA ST/ GV					
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2FTS A)	--	U	U	214	U	U
Perfluorobutanesulfonic acid (PFBS)	--	8.6	5.4 J	35.9	37	6.4
Perfluorobutanoic acid (PFBA)	--	25	27	36.6	46	26
Perfluorodecanoic acid (PFDA)	--	U	2.1	U	U	2
Perfluoroheptanesulfonic acid (PFHpS)	--	U	U	U	U	1.2 J
Perfluoroheptanoic acid (PFHpA)	--	51	70 J	U	9.8	43
Perfluorohexanesulfonic acid (PFHxS)	--	7.1	8.5	U	16	6.6
Perfluorohexanoic acid (PFHxA)	--	51	72	43.4	34	58
Perfluorononanoic acid (PFNA)	--	6.2	6.6	127	U	6.2
Perfluorooctanesulfonamide (FOSA)	--	U	U	108	U	U
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**34**	**38**	U	**12**	**26**
Perfluorooctanoic acid (PFOA)	**6.7**	**36**	**39**	U	**17**	**100**
Perfluoropentanoic acid (PFPeA)	--	57	66	U	22	68
Perfluorotetradecanoic acid (PFTA)	--	U	U	24.7	U	U
Perfluorotridecanoic acid (PFTrDA)	--	U	UJ	134	U	U
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**0.57**	U	U	**3.5**	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-06S 7/1/22 Shallow	MW-06S 9/15/22 Shallow	MW-06S 12/9/22 Shallow	MW-06S 3/7/23 Shallow
	GA ST/ GV				
Perfluorobutanesulfonic acid (PFBS)	--	U	U	U	1.3 J
Perfluorobutanoic acid (PFBA)	--	2.4	U	U J	2.1
Perfluoroheptanoic acid (PFHpA)	--	3.2 J	U	U	2
Perfluorohexanesulfonic acid (PFHxS)	--	7.9	U	U	0.82 J
Perfluorohexanoic acid (PFHxA)	--	11	2.84	U	2.7
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**6.4**	U	U	2.3
Perfluorooctanoic acid (PFOA)	**6.7**	**8.3**	2.64	3.9	3.9
Perfluoropentanoic acid (PFPeA)	--	8.9	3.87	5.1	3.9

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73753 3/11/22 Deep	73753 6/23/22 Deep	73753 9/21/22 Deep	73753 12/7/22 Deep	73753 3/21/23 Deep
	GA ST/ GV					
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine (NEtFOSAA)	--	U	U	U J	U	1.8 J
Perfluorobutanesulfonic acid (PFBS)	--	5.1	U	2.60 J	U	3.8 J
Perfluorobutanoic acid (PFBA)	--	13	14	7.60 J	11	13
Perfluoroheptanoic acid (PFHpA)	--	13	14	8.25 J	11	17
Perfluorohexanesulfonic acid (PFHxS)	--	8.9	9.1	6.66 J	8.6	11
Perfluorohexanoic acid (PFHxA)	--	20	22	12.9 J	16	28
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**18**	**16**	**9.24 J**	**10**	**12**
Perfluorooctanoic acid (PFOA)	**6.7**	**29**	**27**	**15.1 J**	**20**	**30**
Perfluoropentanoic acid (PFPeA)	--	19	18	13.5 J	18	30
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**4.3**	**0.58**	**0.43**	**0.56**	**0.73**

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73758 3/11/22 Shallow	73758 6/23/22 Shallow	73758 9/21/22 Shallow	73758 12/14/22 Shallow	73758 3/21/23 Shallow
	GA ST/ GV					
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2FTS A)	--	U	U	U J	250 J	U
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine (NEtFOSAA)	--	13	10	10.9 J	U	20
Perfluorobutanesulfonic acid (PFBS)	--	4.7	5	4.74 J	U	6.6
Perfluorobutanoic acid (PFBA)	--	45	51	47.8 J	31	110 J
Perfluoroheptanoic acid (PFHpA)	--	14	18	10.9 J	U	26
Perfluorohexanesulfonic acid (PFHxS)	--	14	17	13.3 J	U	24
Perfluorohexanoic acid (PFHxA)	--	45	50	43.8 J	63	83
Perfluorononanoic acid (PFNA)	--	4.4	U	U J	U	2.5 J
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**17**	**13**	**3.57 J**	U	**19**
Perfluorooctanoic acid (PFOA)	**6.7**	**53**	**55**	**46 J**	**67**	**79**
Perfluoropentanoic acid (PFPeA)	--	17	20	19.1 J	18	33
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**4.2**	**4.4**	**8.6**	**8.6**	**6.4**



U: Analyzed for but not detected
UB: Qualified as non detect due to blank result
D: Reported from dilution, estimated value
Exceeds Glass GA Groundwater Guidance Value
*: Monitoring zone relative to the upper glacial aquifer
ng/l: Nanogram per liter
J: Estimated value or limit
JH: Estimated bias high
N/A: Not Analyzed
-: Not Established

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-02S 3/10/22 Shallow	MW-02S 6/28/22 Shallow	MW-02S 9/19/22 Shallow	MW-02S 12/12/22 Shallow	MW-02S 3/24/23 Shallow
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	6.7	4 J	6.3	17	9.8
Perfluorobutanoic acid (PFBA)	--	63	17	16.1	150	100
Perfluoroheptanesulfonic acid (PFHpS)	--	U	U	U	U	1.6 J
Perfluoroheptanoic acid (PFHpA)	--	160	47 J	49.6	61	270
Perfluorohexanesulfonic acid (PFHxS)	--	9	4.6	5.67	6.3	8.9
Perfluorohexanoic acid (PFHxA)	--	160	52	40.7	260	270
Perfluorononanoic acid (PFNA)	--	12	21	9.22	5.7	14
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**20**	**21**	**10.2**	**8.4**	**15**
Perfluorooctanoic acid (PFOA)	**6.7**	**270**	**220D**	**132**	**140**	**300**
Perfluoropentanoic acid (PFPeA)	--	150	49	40.9	440	280
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**0.46**	U	**0.58**	**1.4**	0.34

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-04D 3/14/22 Deep	MW-04D 6/28/22 Deep	MW-04D 9/16/22 Deep	MW-04D 12/12/22 Deep	MW-04D 3/20/23 Deep
	GA ST/ GV					
Perfluoropentanoic acid (PFPeA)	--	U	2.1	U	U	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	MW-10S(R) 3/4/22 Shallow	MW-10S(R) 6/20/22 Shallow	MW-10S(R) 9/20/22 Shallow	MW-10S(R) 12/5/22 Shallow	MW-10S(R) 3/9/23 Shallow	MW-10I(R) 3/4/22 Intermediate	MW-10I(R) 6/20/22 Intermediate	MW-10I(R) 9/20/22 Intermediate	MW-10I(R) 12/5/22 Intermediate	MW-10I(R) 3/9/23 Intermediate
	GA ST/ GV										
Perfluorobutanesulfonic acid (PFBS)	--	9	7.8	4.92 J	6.5	4.1	24	U	U J	U	U
Perfluorobutanoic acid (PFBA)	--	24	29	11.4 J	14	5.1	8.6	U	U J	U	U
Perfluoroheptanoic acid (PFHpA)	--	32	46	22.3 J	31	6.5	4.9	U	U J	U	U
Perfluorohexanesulfonic acid (PFHxS)	--	8.9	7.9	6.34 J	7.5	5.3	5.1	4.3	3.75 J	U	3.8
Perfluorohexanoic acid (PFHxA)	--	56	72	27.2 J	32	8.5	10	U	U J	U	U
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**6.4**	**3.7**	2.43 J	U	2.2	U	U	U J	U	U
Perfluorooctanoic acid (PFOA)	**6.7**	**24**	**20**	**11.6 J**	**22**	**5.3**	**11**	U	U J	U	U
Perfluoropentanoic acid (PFPeA)	--	68	86	32.1 J	41	8.9	9.8	U	U J	U	U
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	U	U	U	U	U	**0.83**	U	U	U	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	103141 3/7/22 Deep	103141 6/24/22 Deep	103141 9/23/22 Deep	103141 12/6/22 Deep	103141 3/20/23 Deep
	GA ST/ GV					
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2FTS A)	--	U	U	U J	15	U
Perfluorobutanesulfonic acid (PFBS)	--	U	2.7	U J	U	1.8 J
Perfluorobutanoic acid (PFBA)	--	U	2.2	U J	U	3
Perfluorohexanesulfonic acid (PFHxS)	--	6.3	8.8	4.44 J	7.4	7.9
Perfluorohexanoic acid (PFHxA)	--	U	U	U J	U	1.4 J
Perfluorononanoic acid (PFNA)	--	U	U	U J	U	U
Perfluorooctanesulfonamide (FOSA)	--	U	U	U J	U	U
Perfluorooctanesulfonic acid (PFOS)	**2.7**	U	**4.7**	**2.93 J**	**5.2**	**5.4**
Perfluoropentanoic acid (PFPeA)	--	U	U	U J	U	2.7
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	0.21	0.21	0.21	U	U

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73764 3/10/22 Shallow	73764 6/30/22 Shallow	73764 9/19/22 Shallow	73764 12/15/22 Shallow	73764 3/10/23 Shallow
	GA ST/ GV					
Perfluorobutanesulfonic acid (PFBS)	--	7.6	5.9 J	7.41	6.8	9
Perfluorobutanoic acid (PFBA)	--	57	40	61.5	58	84
Perfluoroheptanoic acid (PFHpA)	--	30	23 J	22	35	58
Perfluorohexanesulfonic acid (PFHxS)	--	20	18	15.4	15	24
Perfluorohexanoic acid (PFHxA)	--	67	65	65.6	73	120
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**6.8**	**4.3**	**3.56**	**3.5**	**5.5**
Perfluorooctanoic acid (PFOA)	**6.7**	**71**	**45**	**37.7**	**60**	**85**
Perfluoropentanoic acid (PFPeA)	--	40	33	44.4	59	110
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**4.9**	**5.4**	**5.2**	**5.1**	**3.4**

PFAS in ng/l	Sample ID / Sample_date / Well Depth*	73761(R) 3/14/22 Intermediate	73761(R) 6/30/22 Intermediate	73761(R) 9/23/22 Intermediate	73761(R) 12/19/22 Intermediate	73761(R) 3/24/23 Intermediate
	GA ST/ GV					
1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2FTS A)	--	U	U	U J	NA	6.7
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine (NEtFOSAA)	--	U	U	4.11 J	NA	U
Perfluorobutanesulfonic acid (PFBS)	--	6.6	U	5.33 J	NA	4.8
Perfluorobutanoic acid (PFBA)	--	80	48	71.2 J	NA	69
Perfluorodecanoic acid (PFDA)	--	U	6.3	9.46 J	NA	79
Perfluorododecanoic acid (PFDoA)	--	4.2	U	2.21 J	NA	11
Perfluoroheptanoic acid (PFHpA)	--	21	17 J	19.8 J	NA	32
Perfluorohexanesulfonic acid (PFHxS)	--	22	16	16.4 J	NA	13
Perfluorohexanoic acid (PFHxA)	--	76	53	65.0 J	NA	62
Perfluorononanoic acid (PFNA)	--	U	U	4.00 J	NA	22
Perfluorooctanesulfonic acid (PFOS)	**2.7**	**10**	**7**	**7.63 J**	NA	**8.2**
Perfluorooctanoic acid (PFOA)	**6.7**	**100**	**68**	**64.8 J**	NA	**120**
Perfluoropentanoic acid (PFPeA)	--	28	20	31.6 J	NA	23
Perfluoroundecanoic acid (PFUnA)	--	U	U	U J	NA	4.2
1,4-Dioxane (P-Dioxane) in ug/L	**0.35**	**9.4**	**5.8**	**12.1**	**9**	**2.4**

D&B ENGINEERS AND ARCHITECTS

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

SUMMARY OF EMERGING CONTAMINANTS DETECTED IN ON-SITE GROUNDWATER

DRAWING 3

2.0 PLUME INVESTIGATION PROGRAM

2.1 Introduction

As stated in Section 1.0, the objective of the Emerging Contaminant Plume Investigation is to define the nature and extent of contaminants that have been recently detected downgradient of the Landfill in groundwater, including, but not limited to:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS), and
- 1,4 Dioxane

This section provides a detailed description of the proposed tasks to be completed as part of the investigation which will include:

- Task 1 - Existing Monitoring Well and Leachate Sampling
- Task 2 -Shallow Soil Borings
- Task 3 - Vertical Profile Groundwater Sampling
- Task 4 - Monitoring Well Installation and Development
- Task 5 – Groundwater Sampling and Water Level Monitoring
- Task 6- Surface Water and Surface Water Sediment Sampling
- Task 7 - Survey of Sample Locations
- Task 8 - Draft/Final Emerging Contaminant Plume Investigation Report

Note that Section 2.0 provides the proposed investigation scope including the rationale for sampling for each investigation Task, the number of samples to be collected for laboratory analysis, the planned analysis of each sample and the prosed location of each sample point.

Section 3.0 provides additional details on sampling methodology, laboratory analysis and overall program quality assurance/quality control (QA/QC).

2.2 Task 1 - Existing Monitoring Well and Leachate Sampling

As discussed in Section 1.3, the current UMP for the Landfill includes the routine sampling of 27 existing monitoring wells in addition to the collection of leachate and surface water samples on a biannual basis. The next UMP sampling event is currently scheduled for December of 2023. Therefore, this data will be valuable in the characterization of the previously identified emerging contaminants and in the sighting of additional groundwater monitoring wells, that may be required as part of this investigation, see Section 1.5.

As discussed previously in Section 1.3.3, the revised 2023 UMP Work Plan, requires all samples to be analyzed for emerging contaminants (PFAS and 1,4-dioxane) in addition to the modified 6 NYCRR Part 363 Baseline Parameters List. The December 2023 UMP sampling event will provide an extensive amount of data regarding the distribution of PFAS and 1,4 dioxane in on-site groundwater. However, to provide a better understanding of the off-site distribution of the emerging contaminants, D&B will also sample the following existing 16 monitoring wells for emerging contaminants as part of the next UMP sampling round scheduled for December 2023:

Well ID	Monitoring Zone / Location
MW-1S	On-site, Shallow Upper Glacial, Side Gradient of Cell 5
95318	Intermediate Upper Glacial, Downgradient of Cell 5, South of Sunrise Highway
95319	Intermediate Upper Glacial, Downgradient of Cells 5/6, South of Sunrise Highway
95320	Deep Upper Glacial, Downgradient of Cells 5/6, South of Sunrise Highway
95307	Intermediate Upper Glacial, Downgradient of Cells 1/4, South of Sunrise Highway

Well ID	Monitoring Zone / Location
95304	Deep Upper Glacial, Downgradient of Cells 1/4, South of Sunrise Highway
95305	Intermediate Upper Glacial, Downgradient of Cells 1/4, South of Sunrise Highway
95312	Intermediate Upper Glacial, Downgradient, Off-Site Apx. 3,000 ft. South of Landfill
72127	Shallow Upper Glacial Aquifer, Downgradient, Apx. 4,000 ft. South of Landfill
95323	Shallow Upper Glacial Aquifer, Downgradient, Apx. 4,000 ft. South of Landfill
MW-102S	Shallow Upper Glacial, Downgradient, Apx. 6,000 ft South of Landfill
MW-102I -	Intermediate Upper Glacial, Downgradient, Apx. 6,000 ft South of Landfill
MW-103S	Shallow Upper Glacial, Downgradient, Apx. 7,500 ft South of Landfill
MW-03I	Intermediate Upper Glacial, Downgradient, Apx. 7,500 ft South of Landfill
MW-106S	Shallow Upper Glacial, Downgradient, Apx. 8,000 ft South of Landfill
MW-106I	Intermediate Upper Glacial, Downgradient, Apx. 8,000 ft South of Landfill

The locations of the above listed off-site wells are shown on **Drawing 4**, provided in the map pocket at the end of Section 2.0. The sampling methodologies will be consistent with the recently submitted UMP Work Plan submitted to the NYSDEC for approval and consistent with the QA/QC Plan under Section 3.5. Each groundwater sample collected from the 16 additional monitoring wells will be analyzed for PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM, in addition to key leachate indicator parameters including:

- Alkalinity
- Total Dissolved Solids
- Sulfate
- Chloride
- Ammonia

- Conductivity

QA/QC samples will also be submitted for laboratory analysis as detailed in Section 3.4.

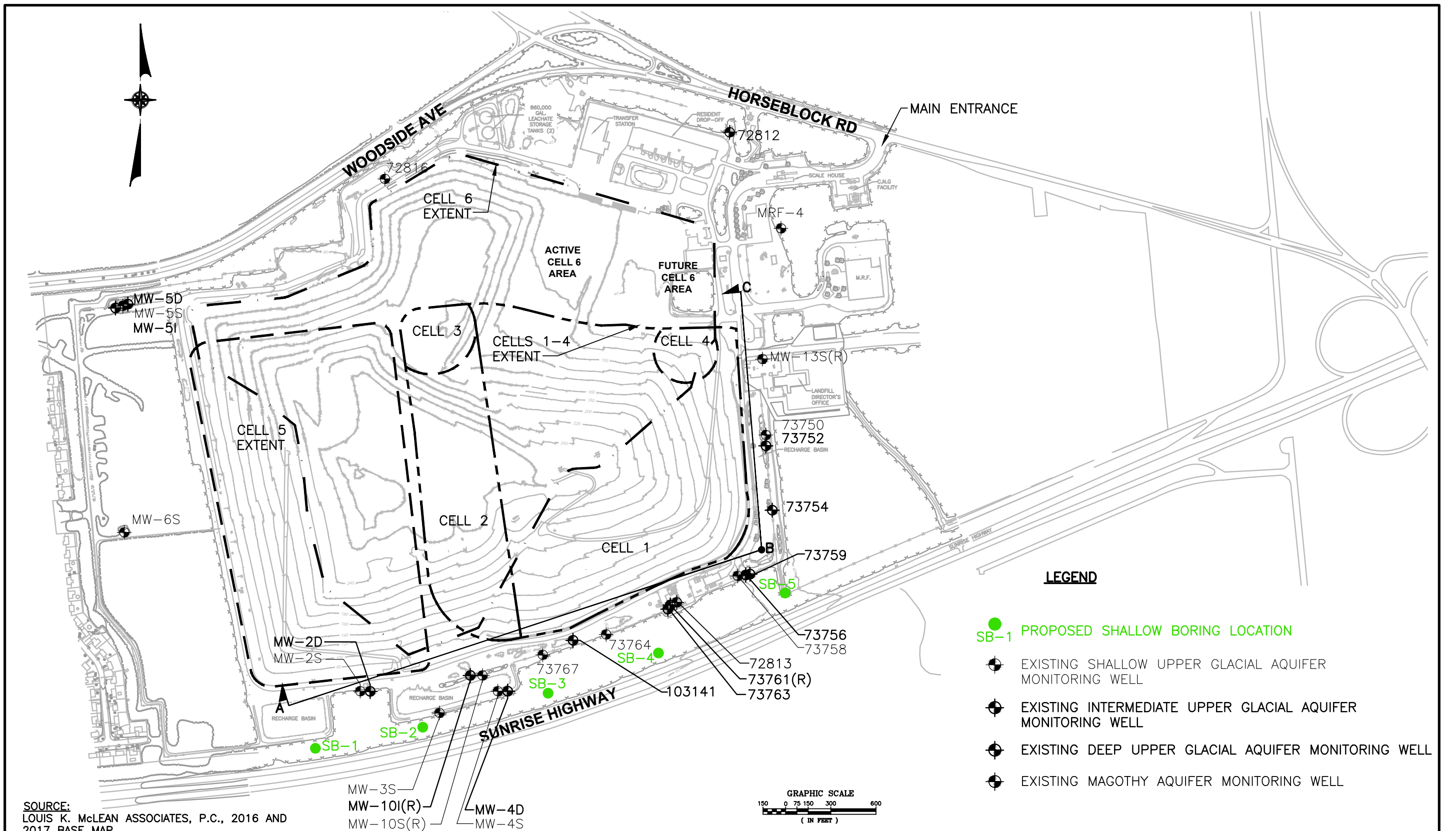
The data generated from the next UMP sample round including the additional 16 wells will be utilized to assess the need for additional monitoring wells to be installed as part of Task 4, detailed below. This data along with the groundwater profile data to be collected under Task 3 will be summarized in an interim report that will be submitted to the Town and the NYSDEC for review and approval prior to the installation of any new wells.

2.3 Task 2 - Shallow Soil Borings and Sample Analysis

A total of five soil borings will be completed along the southern property boundary of the Landfill as shown on **Figure 2-1** as part of Task 2 in order to determine if emerging contaminants are present in shallow soil within the Landfill facility. The soil borings will be completed using direct push, i.e., Geoprobe technology, with soil samples collected continuously from ground surface to the planned boring termination depth of 20 feet. Direct push sampling techniques will allow for the relatively rapid collection of soil samples with minimal disturbance of the ground surface and generation of soil cuttings and other wastes.

The borings will be advanced utilizing a decontaminated macro core soil sampler fitted with a disposable 4-foot acetate liner. During the advancement of each boring, each recovered soil sample will be inspected and characterized by a D&B geologist. Soil observations will be recorded in a boring log by D&B. As discussed in greater detail in Section 3.5.2, each soil boring will be hand cleared from grade to 5 feet using hand tools as a precaution relative to underground utilities. Given samples will be collected in the 5-foot interval for laboratory analysis, hand clearing will be performed using a decontaminated stainless steel hand auger.

Three soil samples per boring will be selected for laboratory



D&B ENGINEERS AND ARCHITECTS

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

PROPOSED LOCATION OF SHALLOW SOIL BORINGS

FIGURE 2-1

F:\0667-Corrective Measures\dwg\0667-FIGURE 2-1.dwg, FIG 2-1, 9/13/2023 3:41:51 PM, DBCadd analysis for PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM during the advancement of each boring with the first sample collected at the 0–2-foot interval, the second sample from the 4-6 feet, both by hand auger, and the third from 8 to 10 feet utilizing the Geoprobe macro core soil sampler. In addition, a fourth sample may be collected deeper than 10 feet if D&B observes any unusual signs of soil discoloration or if a change in lithology is encountered such as a transition from sand to clay before terminating the boring at 20 feet. QA/QC samples will also be submitted for laboratory analysis as part of Task 2, as detailed in Section 3.4.

2.4 Task 3 - Vertical Profile Groundwater Sampling

Prior to selecting additional monitoring wells as part of this investigation, D&B will complete a series of vertical profile borings downgradient of the Landfill as part of Task 3 in order to collect groundwater samples at different intervals within the Upper Glacial Aquifer in areas that currently do not have existing monitoring wells. This area is primarily south of Sunrise Highway and downgradient of Cell 5. The results of the laboratory analysis of the groundwater samples collected as part of this task, along with the recent routine monitoring data obtained from the ongoing monitoring programs (as detailed in Task 1 above) will be used to select the location and depth of the monitoring wells to be installed as part of Task 4, detailed in Section 2.5. Each groundwater sample collected as part of this task will be analyzed for PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM, in addition to key leachate indicator parameters including:

- Alkalinity
- Total Dissolved Solids
- Sulfate
- Chloride
- Ammonia
- Conductivity

QA/QC samples will also be submitted for laboratory analysis as detailed in Section 3.4.

Drawing 4 provides the approximate location of each proposed vertical profile boring. As shown on the **Drawing 4**, eight vertical profile borings will be completed south of Sunrise Highway and downgradient of Cell 5. In addition, two vertical profile borings will be completed within the Landfill facility north and upgradient of Cell 5 between existing well clusters MW-5 and MW-12 to assess the potential for emerging contaminants entering the Landfill from an upgradient source.

Each vertical profile boring will be 80 feet deep and will be advanced by direct-push drilling methods, i.e., Geoprobe. At each location, a Geoprobe SP22 groundwater sampler will be advanced to a depth of 80 feet. Once at depth, the sampling screen will be extended, and a groundwater sample will be collected using dedicated high-density polyethylene (HDPE) tubing and a check valve. The SP22 groundwater sampler will then be pumped using the tubing and check valve for a minimum of 20 minutes while recording standard field parameters such as conductivity, pH, dissolved oxygen, etc.

After pumping for a minimum of 20 minutes and with the stabilization of the field parameters, each sample will be collected by filling each laboratory supplied sample container directly from the discharge tubing. After collecting the 80-foot sample, the SP22 groundwater sampler will then be pulled 10 feet upward and the sampling process will be repeated at shallower intervals. This process will continue until the sample probe has been lifted above the water table. This will provide groundwater samples at each boring location at 10-foot intervals from 80 feet to the top of the water table. Therefore, if the water table is 20 feet below grade at a given location, a total of seven groundwater samples will be collected at the given vertical profile boring.

The results of the laboratory analysis of the groundwater samples along with the recent routine monitoring data obtained for the ongoing monitoring programs and detailed under Task 1 will be used to assess the nature and extent of emerging contaminant contamination within and downgradient of the Landfill and to determine the number, location, and screen setting of each monitoring well to be installed under Task 4 as detailed below.

2.5 Task 4 - Monitoring Well Installation and Development

As discussed in Section 1.3, there exists a very extensive groundwater monitoring network within and downgradient of the Landfill. In addition, the Town currently implements routine groundwater monitoring utilizing the existing monitoring wells which is detailed in Section 1.3. Therefore, additional monitoring wells to be installed as part of Task 4 will only be required as part of this investigation if there appears to be a "data gap" in the existing monitoring well network that will require the addition of new monitoring wells in order to achieve the objective of this emerging contaminant plume investigation.

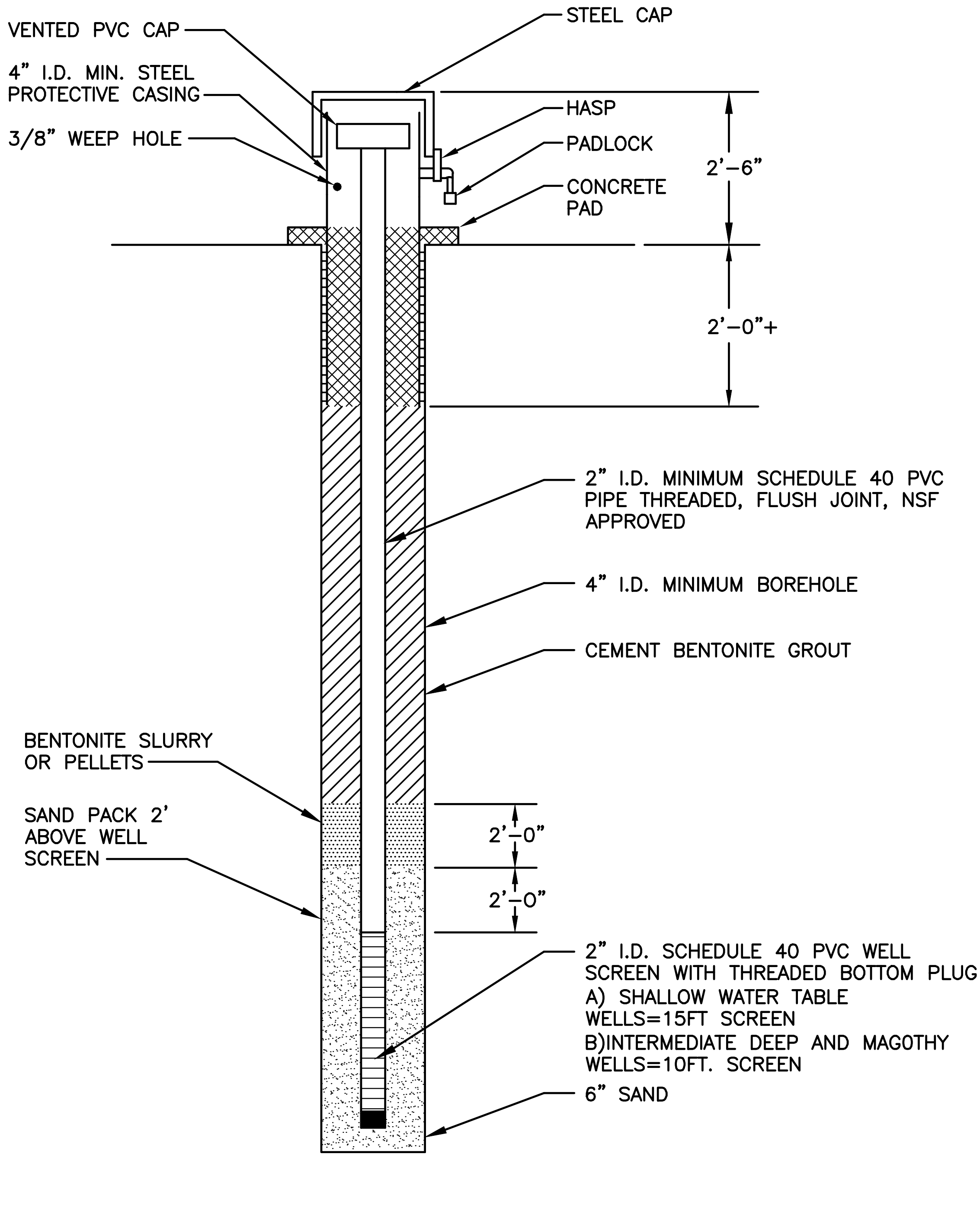
As discussed in Section 2.4, the actual number, location, and screen interval of the monitoring wells to be installed under Task 4 will be determined after the review of the vertical profile boring data obtained from Task 3 in conjunction with the groundwater monitoring data that will be generated as part of the upcoming UMP sampling round, as detailed under Task 1. After completing the vertical profile boring program and the expanded December 2023 UMP sampling round, D&B will draft an interim report presenting this data along with our recommendations for the number of wells and their location for review and approval by the Town and the NYSDEC. It should be noted that, based on the analysis of the data and if it is determined that the existing well network is sufficient for achieving the goals and objectives of the investigation, additional monitoring wells will not be required. Upon acceptance of the recommendations presented in the interim report, D&B will proceed with the installation of monitoring wells, if it is determined that they are needed.

However, for the purposes of this work plan, Task 4 includes the contingency to install up to three separate well clusters each consisting of three monitoring wells, one shallow, one intermediate and one deep well, for a total of nine new monitoring wells. Two well clusters would be considered for south of Sunrise Highway and downgradient of Cell 5. In addition, up to one well cluster may be required within the Landill boundaries to supplement the existing on-site monitoring wells. Based on the extensive hydrogeological investigations completed within and in the vicinity of the Landfill, it is understood that the "Critical Stratigraphic Section" for the Landfill, as defined in Title 6 Part 363-4.4, will be the Upper Glacial aquifer which is estimated to be approximately 100 to 130 feet thick within and downgradient of the Landfill. Therefore, all monitoring wells, if required, will be screened within the Upper Glacial aquifer.

If required, all monitoring wells will be installed by hollow stem augers (HSAs), or equivalent, drilling technology. Soil samples will be collected during the drilling of the deep well of each well cluster at 5-foot intervals utilizing a 2-foot split spoon soil sampler. The recovered soil samples will be described by a D&B geologist using the Unified Soil Classification System (USCS) and blow counts in 6-inch increments will be recorded and boring logs will be prepared. Given that the deeper wells will establish stratigraphy, the shallower monitoring wells in each cluster will not require soil sampling.

Again, if needed, each proposed monitoring well cluster will include a monitoring well installed in the shallow (water table) zone of the Upper Glacial aquifer with an approximate depth of between 20 to 35 feet, depending on the depth to water (i.e., the water table) at the location. All shallow monitoring wells will be installed with a 15-foot well screen with 5 feet placed above the water table and 10 feet below the water table. Each shallow well will be paired with an intermediate Upper Glacial well (total depth of between 50 and 70 feet) and a deep Upper Glacial Well with a total depth of between 80 and 120 feet. All deep and intermediate wells will be installed with a 10-foot screen. **Figure 2-2** depicts the typical monitoring well construction design for shallow, intermediate, and deep wells.

The wells will be installed using a drill rig capable of turning 4.25-inch inner diameter HSAs. Each well will be installed utilizing 2-inch diameter (I.D.) Schedule 40 PVC riser and 0.010-inch slotted well screen. As discussed, all shallow wells will be installed with a 15-foot well screen and all intermediate, deep wells will be installed with a 10-foot screen. A No.1 well



D&B ENGINEERS AND ARCHITECTS, P.C.

TOWN OF BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION
WORK PLAN

GENERAL CONSTRUCTION OF GROUNDWATER MONITORING WELLS

FIGURE 2-2

gravel pack will be placed around each well screen. A bentonite seal will be placed above the sand pack followed by the installation of a cement/bentonite grout to grade. A protective steel casing with a locking cap will be set at the ground surface. The protective casing will extend no more than 3 feet above the ground surface and will be set at least 2 feet below grade. The steel casing will be set in a minimum 2-foot by 2-foot square concrete pad finished approximately 2-inches above the ground surface. The pad will have a surface that slopes radially away from the protective casing. A weep hole will be constructed in the base of the protective casing to allow for drainage.

At the completion of the monitoring well construction, a vented PVC cap will be placed on the riser pipe and the wells will be labeled with the appropriate well designation. The label will be affixed to the protective well casing. Well construction logs will be provided in the Investigation Report, showing details of the monitoring well construction, description of the materials used and elevations of well features. All borehole construction and monitoring well installation will be logged and documented by a D&B Geologist.

After waiting a minimum of 24 hours after installation, all monitoring wells will be developed by pumping and surging until the turbidity of the groundwater achieves a reading of 50 NTUs (nephelometric turbidity units) or less. Well development will be supplemented by measurements of field parameters, including temperature, pH and specific conductance. Development will continue until the field parameters stabilize for a minimum of three consecutive readings of 10 percent variability or less, or as approved by the NYSDEC. When possible, well development water should be recharged on-site. All equipment used for the development of monitoring wells will be decontaminated prior to use and between wells.

2.6 Task 5 -Groundwater Sampling and Water Level Monitoring

Upon completing the installation and development of all monitoring wells under Task

4, D&B will establish a groundwater monitoring program utilizing the newly installed monitoring wells and existing wells to define any groundwater impacts associated with the previously identified emerging contaminants. **Table 2-1** summarizes the currently proposed monitoring wells to be included in the monitoring program which includes up to nine new monitoring wells and 12 existing wells. As discussed under Section 2.5, the actual number of new monitoring wells to be included in the monitoring program under Task 5 will be dependent on how many new wells are actually installed under Task 4. In addition, given the current UMP sampling program already includes the sampling of 27 on-site wells for emerging contaminants on a biannual basis, the existing wells to be included in the sampling program under Task 5 are not in the UMP program and are located off-site and downgradient of the Landfill.

In accordance with the NYSDEC request, a total of four quarterly rounds of groundwater sampling will be performed. The first sampling event will include the collection of groundwater samples for analysis from the 21 monitoring wells for all listed Part 363 Expanded Parameters, including PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM, followed by three rounds of baseline parameters plus any additional parameters which were detected in the initial expanded parameter analysis. However, the three rounds of baseline sampling will also include the analysis of PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM. Where possible, the quarterly rounds under Task 5 will coincide with the UMP biannual sampling rounds to minimize the number of sampling events to be completed at the Landfill. All groundwater samples will be collected utilizing USEPA low-flow groundwater sampling procedures as detailed in Section 3.5 of the QA/QC Plan.

2.7 Task 6 - Surface Water and Surface Water Sediment Sampling

Surface water and surface water sediment sampling will be performed downgradient of the Landfill as part of Task 6. A total of five locations on Beaver Dam Creek will be selected for sampling and two locations on the Carmans River. The locations are shown on **Drawing 4** and

TABLE 2-1
TOWN BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MONITORING WELLS TO BE SAMPLED UNDER TASK 5- QUARTERLY GROUNDWATER SAMPLING PROGRAM

Monitoring Well ID	Monitoring Zone
Existing Groundwater Monitoring Wells	
95312	Intermediate UG
72127	Intermediate UG
95323	Shallow UG
MW-101S	Shallow UG
MW-102S	Shallow UG
MW-102I	Intermediate UG
MW-103S	Shallow UG
MW-103I	Intermediate UG
MW-104S	Shallow UG
MW-104I	Intermediate UG
MW-105S	Shallow UG
MW-105I	Intermediate UG

TABLE 2-1
TOWN BROOKHAVEN LANDFILL
EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
MONITORING WELLS TO BE SAMPLED UNDER TASK 5- QUARTERLY GROUNDWATER SAMPLING PROGRAM

*Proposed Groundwater Monitoring Wells**	
MW-201S	Shallow UG
MW-201I	Intermediate UG
MW-201D	Deep UG
MW-202S	Shallow UG
MW-202I	Intermediate UG
MW-202D	Deep UG
MW-203S	Shallow UG
MW-203I	Intermediate UG
MW-203D	Deep UG

* As discussed in Section 2.5, the listed monitoring wells will only be installed if the findings of Tasks 1 and 3 determine they are needed.

will be consistent with previous sampling locations used by D&B as part of the on-going monitoring programs, including: BD-1, BD-1.5, BD-2 and BD-3 on Beaverdam Creek and Squassux Landing (CR-1) and the LIRR Tressel sample location on Carmans River (CR-2). Consistent with current monitoring programs, Task 6 will include a control sample on Forge River which is located approximately 5 miles to the northeast of the Landfill. Consistent with the groundwater monitoring program under Task 5, a total of four quarterly rounds of surface water sampling will be performed. The first sampling event will include the collection of surface water samples for analysis of all listed Part 363 Expanded Parameters, including PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM, followed by three rounds of baseline parameters plus any additional parameters which were detected in the initial expanded parameter analysis. However, the three rounds of baseline sampling will also include the analysis of PFAS by USEPA Method 1633 and 1,4 Dioxane by USEPA Method 8260 SIM. Where possible, the quarterly rounds under Task 6 will coincide with the Leachate Plume sampling program to minimize the number of sampling events to be completed at the Landfill.

In addition, during the first quarterly round of surface water sampling, D&B will collect surface water sediment from each of the eight (8) locations for PFAS analysis by USEPA Method 1633 and for 1,4 Dioxane analysis by USEPA Method 8260 SIM. In addition, each sediment sample will be analyzed for total organic carbon by USEPA Method 415.3. Two samples will be collected at each location using a hand-driven core sampler with the first sample collected from 0-6 inches and a second sample from 6-12 inches below the stream bottom.

2.8 Task 7 - Survey of Sample Locations

All sample locations will be surveyed and placed on a sample location map for inclusion in the Plume Characterization Investigation Report. The locations and elevations of the monitoring wells that are installed as part of the investigation will be surveyed in accordance with the North American Vertical Datum (NAVD 88) of 1988 and plotted on the sample location map.

2.9 Task 8 - Draft/Final Plume Characterization Investigation Report

D&B will draft an Emerging Contaminant Plume Characterization Investigation Report (Plume Report) that will summarize all data generated by the above tasks. Specifically, the Plume Report will include the following sections:

- Section 1.0 - Introduction: Presents project objectives, background and available historical information and a description of the physical setting of the Landfill and its surroundings.
- Section 2.0 - Investigation Methods: Provides an overview of the field activities associated with the investigation. Additionally, it discusses data management and chemical data validation/usability.
- Section 3.0 - Site Geology and Hydrogeology: Discusses the geology and hydrogeology of the Landfill and downgradient regions and surrounding areas. Section 3.0 will include geologic cross sections, groundwater contour maps and other geologic maps.
- Section 4.0 – Groundwater and Surface Water Quality: Will Present the concentrations of chemical constituents with an emphasis placed on the nature and extent of emerging contaminants present in groundwater and downgradient surface water.
- Section 5.0 - Conclusions and Recommendations: Summarizes the findings of the investigation and presents recommendations.
- Section 6.0 - References: Lists all documents and other sources of information utilized in the preparation of this report.

The Plume Report will also include as appendices:

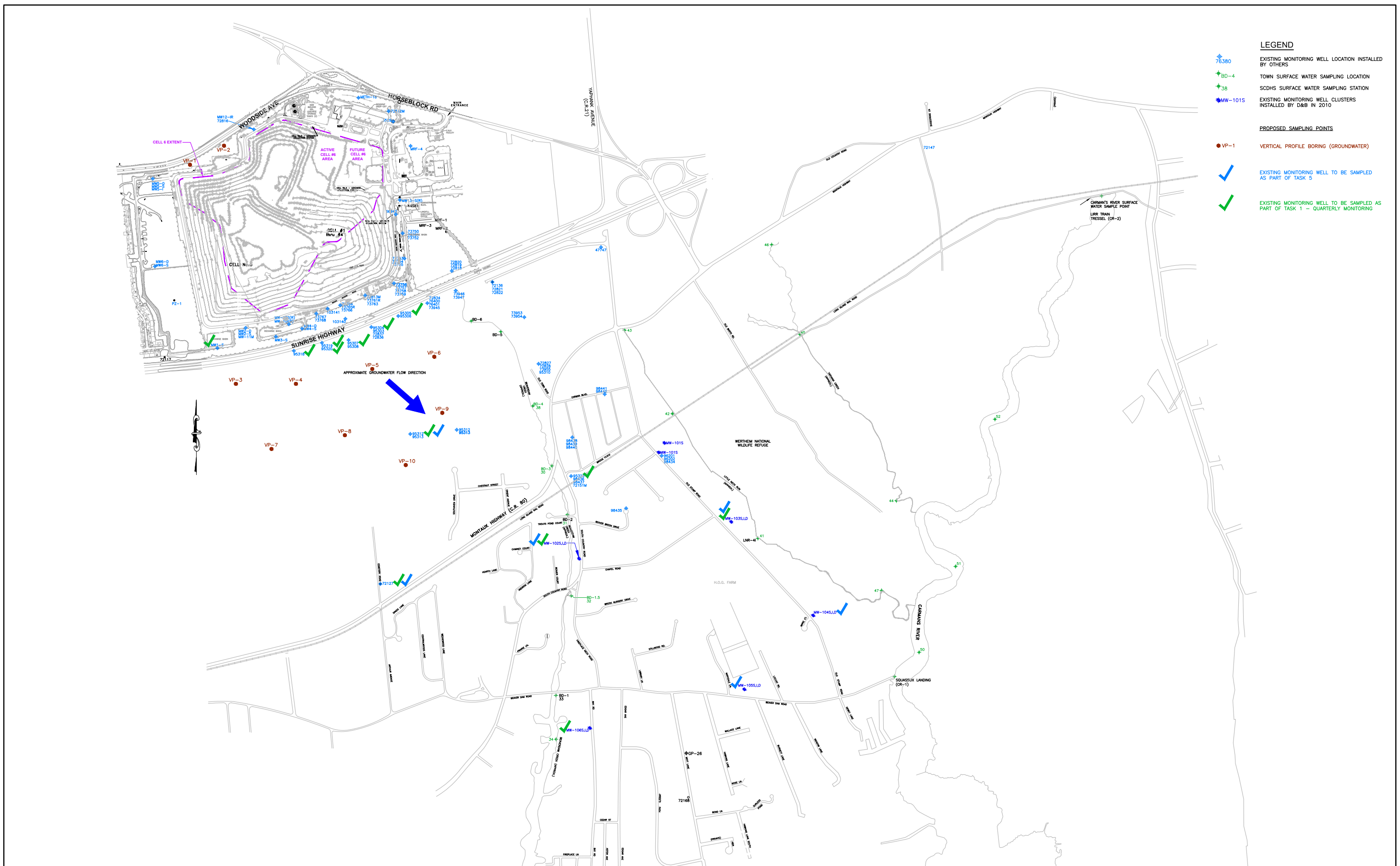
- Soil and test pit boring logs
- Well completion reports
- Groundwater and surface water data summary tables comparing the data to

appropriate groundwater standards (i.e., NYSDEC GA Standards)

- Data validation reports

The following Report deliverables will be provided to the Town and NYSDEC:

- D&B will provide two copies of the draft Report to the Town for review and comment.
- D&B will revise the draft Report in accordance with the Town comments and provide eight copies of the revised draft Report to the Town for distribution to the NYSDEC.
- D&B will revise the draft Report to incorporate regulatory agency comments and provide twelve bound copies, one CD-ROM copy of the final Report to the Town for distribution to regulatory agencies.



NO.	DATE	REVISION	INT.

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D&B ENGINEERS AND ARCHITECTS

TOWN OF BROOKHAVEN LANDFILL

SUFFOLK COUNTY — NEW YORK

EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN

PROPOSED OFF-SITE SAMPLE LOCATION MAP

PROJECT NO.: 0667

DATE: SEPTEMBER 2023

SCALE: 1"=700'

DRAWING NO.: 4

3.0 QUALITY ASSURANCE / QUALITY CONTROL PLAN

3.1 Objective and Scope

The purpose of this Quality Assurance/Quality Control (QA/QC) Plan is to develop and describe the detailed sample collection and analytical procedures that will ensure high quality and valid data. A field sampling program will be conducted for the collection of soil and groundwater samples as part of the Emerging Contaminant Plume Investigation.

3.2 Data Usage

The data generated from this program will be used to define the nature and extent of contaminants that have been recently detected downgradient of the Landfill in groundwater, including, but not limited to:

- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS), and
- 1,4 Dioxane

3.3 Monitoring Network Design and Rationale

As described in Section 2.0 of this Work Plan, the sampling program for chemical analysis is as follows:

- Groundwater - Samples will be collected from monitoring wells and vertical profiling to establish groundwater quality for the site and better understand off-site distribution of the emerging contaminants.
- Surface Water/Sediment – Samples will be collected from Beaverdam Creek, and Carmans River to document surface water and sediment quality.
- Subsurface Soil – Samples will be collected to determine if emerging contaminants are present in shallow soil within the Landfill facility.

3.4 Data Quality Requirements and Assessments

Table 3-1 contains required sample container types, preservation techniques and holding times required for analyses of emerging contaminants and leachate parameters (see **Table 3-2**). Data quality requirements, both accuracy and provision will be met as specified in the corresponding analytical method by an ELAP certified laboratory.

3.4.1 Data Representativeness

The sampling program described in Section 3.0 of this work plan is designed to provide data representative of site conditions.

3.4.2 Data Comparability

Data will be presented in the units designated by the methods specified by the 40 CFR 136 and USEPA SW-846, Sampling, Analysis, and Assessment of Per-and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs dated April 2023 and other analytical methodologies, such as Standard Methods, where appropriate. In addition, sample location, collection procedures and analytical methods from earlier studies will be evaluated for comparability with current procedures and methods.

3.4.3 Data Completeness

The acceptability of 100% of the data is designed as a goal for this project. The acceptability of less than 100% complete data, meeting all laboratory QA/QC protocols and standards, will be evaluated on a case-by-case basis.

3.5 Field Sampling Procedures

The environmental samples that will be collected as part of the Emerging Contaminant Plume Investigation include subsurface soil, groundwater, surface water and surface water sediment samples. The actual number and location of each sample to be collected as part of this investigation is described in Section 2.0. The specific methodologies and equipment required to collect these samples is described in this section.

Note: Special procedures will be followed given the Emerging Contaminant Plume Investigation includes analysis of samples for PFAS. The following guidelines will be observed during all sampling activities to be completed as part of the investigation:

- Ensure field clothing, including boots, does not contain Gore-Tex or Tyvek.
- Gloves will be made of nitrile, no latex gloves will be worn.
- All safety boots are constructed of polyurethane or polyvinyl chloride.
- Field crews, shall avoid fabric softener use in clothing, cosmetics, moisturizers, hand cream unauthorized sunscreen or insect repellent.
- There shall be no Teflon or LDPE containing materials in the sampling train; use HDPE, stainless steel, acetate, silicon or polypropylene.
- There will be no waterproof field books, plastic clipboards, binders or spiral hard cover notebooks on site. Notepads and stainless steel clipboards are acceptable.
- Fill coolers with only regular ice; no chemical ice packs.
- Sample containers and caps must be made of HDPE or polypropylene.
- Use PFAS-free water for decontamination with Alconox or Liquinox.
- Restrict food to water and hydration drinks in the staging area and away from sample collection points.

- Use a pen to clearly label each collected sample with the Sample ID, sample source, and the time and date of collection for accurate identification. No permanent marker should be used.

Prior to the start of any field activities, all D&B field personnel and subcontractors such as drilling crews will receive a memorandum from D&B reminding them of the above special procedures to be followed given the Emerging Contaminant Plume Investigation includes analysis of samples for PFAS. In addition, these procedures will also be discussed as part of the daily pre-work safety meeting (tail gate meeting) held by D&B's on-site safety manager at the start of each work day.

3.5.1 Leachate Sampling

The leachate samples to be collected during the upcoming December 2023 UMP sample round will be utilized for this investigation. Note: The special procedures listed at the beginning of Section 3.5 will be followed when collecting leachate samples given the sampling event includes analysis of samples for PFAS. The method to collect the leachate samples will be as follows:

1. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4 degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.

2. Don a pair of disposable nitrile gloves before sampling.

3. For leachate chambers, start pump manually at the control panel of the Cell. Turn leachate collection pump on and off, as appropriate, to produce flow to fill stainless steel buckets, if not sampled directly. For leachate samples that are sampled directly from a leachate manhole, open the manhole vault and utilize a stainless-steel bucket attached to a rope to retrieve a sample.

4. Obtain volatile organic and 1,4-dioxane samples in the 40 mL vials provided by the laboratory. Gently pour the sample into the sample vials taking care not to spill water on the outside of the vials or overfill the vials. Replace the cover on the sample vials. Samples for volatile organic and 1,4-dioxane analysis should have no air space in the sample vials prior to sealing. This is accomplished by filling the vial such that there is a meniscus on top. Carefully, slide the septum, Teflon side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If bubbles appear, reopen the vial, remove the septum and add additional sample (or resample). Replace the septum, recap and check for bubbles. Continue until vial is bubble-free.

5. Collect the remaining samples. Gently pour the sample into the sample containers taking care not to spill water on the outside of the containers or overfill the containers. Replace cover on the sample containers.

6. Return sample containers to sample cooler. Place PFAS sample containers in laboratory-provided plastic bags and return sample containers to sample cooler.

3.5.2 Shallow Soil Borings and Soil Sampling

The following procedure will be utilized for the collection of soil samples from the five shallow soil borings to be completed as part of Task 2. Note: The special procedures listed at the beginning of Section 3.5 will be followed when completing Task 2 given the sampling event includes analysis of samples for PFAS. All soil borings will be completed using direct-push drilling technology, i.e., by Geoprobe as follows:

1. Prior to undertaking any drilling, the drilling contractor will have the One-Call and Code 753 mark-outs completed in the area of the drilling project. The drilling will not commence until the location of all underground utilities has been verified. As a further precaution, the driller will "clear" the boring by hand digging to at least five feet before advancing the boring with the drilling equipment. Note that, given soil samples will be collected at intervals shallower than 5 feet, the hand clearing will be performed using a decontaminated stainless steel hand auger.

2. All non-dedicated sampling equipment will be decontaminated before and between sampling locations as described in Section 3.6.

3. Each boring will be advanced with a 4-foot Geoprobe macro core sampler after successfully hand clearing the boring to five feet with the stainless steel hand auger.

Soil samples will be collected continuously in four-foot intervals until boring termination.

4. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4 degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.

5. Immediately after retrieving sample, obtain an organic vapor measurement with a PID. All soil samples selected for analysis will be placed in the appropriate laboratory supplied containers immediately upon recovery from the macro core sampler.

6. Each recovered soil sample will be carefully inspected and characterized in by a D&B geologist accordance with the Unified Soil Classification System. A description of any evidence of contamination (e.g., staining, sheens, odors) will be documented. D&B will document our observations at each boring in a standardized boring log.

7. Three soil samples per boring will be selected for laboratory analysis during the advancement of each boring with the first sample collected at the 0 to2-foot interval, the second sample from the 4 to 6 feet, both by hand auger, and the third from 8 to 10 feet by Geoprobe macro core sampler. In addition, a fourth sample may be collected deeper than 10 feet if D&B observes any unusual signs of soil discoloration or if a change in lithology is encountered such as a transition from sand to clay before terminating the boring at 20 feet.

8. All drill cuttings generated during the soil boring program will be placed back in the borehole when completed.

9. After labeling, each sample will be placed in a laboratory supplied cooler with ice.

3.5.3 Vertical Profile Groundwater Sampling by Geoprobe

As discussed in Section 2.4, a total of ten vertical profile borings will be completed to 80 feet below grade and will be advanced by direct-push drilling methods, i.e., Geoprobe. Note: The special procedures listed at the beginning of Section 3.5 will be followed when collecting the vertical profile groundwater samples given the sampling event includes analysis of samples for PFAS. The procedure for collecting the vertical profile groundwater samples will be as follows:

1. Prior to undertaking any drilling, the drilling contractor will have the One-Call and Code 753 mark-outs completed in the area of the drilling project. The drilling will not commence until the location of all underground utilities has been verified. As a further precaution, the driller will "clear" the boring by hand digging to at least five feet before advancing the boring with the drilling equipment.

2. All non-dedicated sampling equipment will be decontaminated before and between sampling locations as described in Section 3. 6.

3. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4 degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.

4. After successfully hand clearing to five feet, each boring will be advanced starting at ground surface to a depth of 80 feet below grade using Geoprobe steel drill rods connected to the SP22 groundwater sampler. After the sampler has advanced to 80 feet, the sampler screen will be exposed by pulling back the protective steel casing.

5. The (HDPE) tubing and check valve will then be placed through the steel casing and into the screen zone of the SP22 sampler. The check valve will then be osculated to pump the groundwater from the sampler.

6. Field analysis equipment used for the measurement of field parameters, including pH, conductivity, temperature, turbidity and dissolved oxygen probes, shall be calibrated in accordance with the manufacturer's procedures. All calibration methods, procedures and results shall be documented in the calibration log and field notebook.

7. After pumping for a minimum of 20 minutes and with the stabilization of the field parameters, each sample will be collected by filling each laboratory supplied sample container directly from the discharge tubing. Gently pour the sample into the sample container, if not sampled directly, taking care not to spill the sample on outside of container or overfill container, and replace cover the sample bottle. For 1,4-dioxane samples, make sure that there are no air bubbles in the sample vial after it has been capped. This is done by filling the vial such that there is a meniscus on top. Carefully slide the septum, Teflon side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If the bubbles appear, reopen the vial, remove septum and add more sample (or resample). Replace septum, recap and check for bubbles. Continue until vial is bubble-free.

8. After collecting the 80-foot sample, the SP22 groundwater sampler will then be pulled 10 feet upward and the sampling process will be repeated at the 70-foot interval.

9. This process will continue until the sample probe has been lifted above the water table. This will provide groundwater samples at each boring location at 10-foot intervals from 80 feet to the top of the water table. Therefore, if the water table is 20 feet below grade at a given location, a total of seven groundwater samples will be collected at the given vertical profile boring.

10. After collecting the last water table sample, the Geoprobe drill rods and sampler will be removed, allowing the borehole to collapse.

11. After filling and labeling each laboratory supplied container, the sample containers will be placed in a laboratory supplied cooler with ice.

3.5.4 Monitoring Well Installation and Development

After completing Tasks 1 and 3, D&B will review the results and prepare a draft interim report presenting the data. It should be noted that, based on the analysis of the data and if it is determined that the existing well network is sufficient for achieving the goals and objectives of the investigation, additional monitoring wells will not be required. However, if additional data is needed based on review of results, the draft interim report will include our recommendations for the number of wells and their location for review and approval by the Town and the NYSDEC. Upon acceptance of the recommendations presented in the interim report, D&B will proceed with the installation of monitoring wells, if it is determined that they are needed. As discussed in Section 2.5, Task 4 includes the installation of up to three groundwater monitoring well clusters with each cluster consisting of three wells, for a maximum of nine new monitoring wells.

If required, all monitoring wells will be installed by Hollow Steam Auger (HSA) drilling method, or equivalent drilling technology. Note: The special procedures listed at the beginning of Section 3.5 will be followed when completing Task 4 given the monitoring wells will be used to collect groundwater samples for PFAS analysis.

Each proposed monitoring well cluster will include a monitoring well installed in the shallow (water table) zone of the Upper Glacial aquifer with an approximate depth of between 20 to 35 feet, depending on the depth to water (i.e., the water table) at the location. All shallow monitoring wells will be installed with a 15-foot well screen with 5 feet placed above the water table and 10 feet below the water table. Each shallow well will be paired with an intermediate Upper Glacial well (total depth of between 50 and 70 feet) and a deep Upper Glacial Well with a total depth of between 80 and 120 feet. All deep and intermediate wells will be installed with a 10-foot screen. **Figure 2-2** depicts the typical monitoring well construction design for shallow, intermediate, and deep wells.

The wells will be installed using a drill rig capable of turning 4.25-inch inner diameter HSAs. Each well will be installed utilizing 2-inch diameter (I.D.) Schedule 40 PVC riser and 0.010-inch slotted well screen. As discussed, all shallow wells will be installed with a 15-foot well screen and all intermediate, deep wells will be installed with a 10-foot screen. A No.1 well gravel pack will be placed around each well screen. A bentonite seal will be placed above the sand pack followed by the installation of a cement/bentonite grout to grade. A protective steel casing with a locking cap will be set at the ground surface. The protective casing will extend no more than 3 feet above the ground surface and will be set at least 2 feet below grade. The steel casing will be set in a minimum 2-foot by 2-foot square concrete pad finished approximately 2-inches above the ground surface. The pad will have a surface that slopes radially away from the protective casing. A weep hole will be constructed in the base of the protective casing to allow for drainage. At the completion of the monitoring well construction, a vented PVC cap will be placed on the riser pipe and the wells will be labeled with the appropriate well designation. The label will be affixed to the protective well casing. All borehole construction and monitoring well installation will be logged and documented by a D&B Geologist.

After waiting a minimum of 24 hours after installation, all monitoring wells will be developed by pumping and surging until the turbidity of the groundwater achieves a reading of 50 NTUs (nephelometric turbidity units) or less. Well development will be supplemented by measurements of field parameters, including temperature, pH and specific conductance. Development will continue until the field parameters stabilize for a minimum of three consecutive readings of 10 percent variability or less, or as approved by the NYSDEC. When possible, well development water should be recharged on-site. All equipment used for the development of monitoring wells will be decontaminated prior to use and between wells.

The well installation procedure is as follows:

1. Prior to undertaking any drilling, the drilling contractor will have the One-Call and Code 753 mark-outs completed in the area of the drilling project. The drilling will not commence until the location of all underground utilities has been verified. As a further precaution, the driller will "clear" the boring by hand digging to at least five feet before advancing the boring with the drilling equipment.
2. All non-dedicated sampling equipment will be decontaminated before and between sampling locations as described in Section 3.6.
3. After successfully hand clearing to five feet, each boring will be advanced with 4.25-inch inner diameter HSAs. Subsurface soil samples will be collected during the completion of the deep boring at each well cluster at 5-foot intervals using a split-spoon soil sampler.
4. Each recovered soil sample will be carefully inspected and characterized in by a D&B geologist accordance with the Unified Soil Classification System. A description of any evidence of contamination (e.g., staining, sheens, odors) will be documented. D&B will document our observations at each boring in a standardized boring log.
5. If difficulties with "running sands" are encountered which hinder soil sampling, potable water will be added to the hollow stem augers to maintain a positive hydrostatic head.
6. The final depth of each borehole will be below the water table at a depth that will allow 6 inches of sand pack to be placed between the screen bottom and bottom of the boring, as well as to allow the screen to intersect the water table. For mid-depth or deep overburden wells, the borings must be deep enough to allow 6 inches of

sand pack between well screen bottom and boring bottom, and allow the screen to intersect the zone of concern.

7. At the completion of borehole construction and soil sampling, the well screen and riser pipe will be lowered into the hollow stem augers and set at the desired depth. Sand pack of a grain size appropriate for the selected screen opening size and geologic conditions will be placed into the annular space to a minimum height of 2 feet above the top of the well screen using a tremie pipe or other suitable method. Generally, No. 2 morie sand will be used. During this time, the augers will be slowly removed. The well pipe will also be pulled up no more than 1/2-foot to allow sand material to fill the borehole beneath the well screen.

8. Upon completing the placement of the sand pack, a minimum 2-foot thick bentonite pellet, chip or slurry seal will be tremied in the annular space. Bentonite pellets or bentonite chips, if used, will be hydrated with potable water and allowed to swell for a minimum of 1/2 hour before introducing the cement bentonite grout in the remaining annular space. The cement-bentonite grout will be pressure pumped into the annular space by the tremie method.

9. The monitoring wells will be completed with approximately 2-1/2 feet of riser above ground surface and protected with a locking steel casing with minimum diameter of 4 inches. The protective casing will be at least 5 feet in length and secured into the borehole using concrete sand or gravel mix. The surface seal will be completed with a 3-foot diameter formed concrete pad and will be constructed to drain surface water away from the well. The protective casing will have a locking cap and weep hole, and be marked with the monitoring well identification. In cases where monitoring wells will be installed in roadways, parking lots or through floors, flush mount protective casings will be used. In such cases, a locking watertight PVC well cap will be installed inside of a curb box with bolted, watertight cover.

10. All borehole construction and monitoring well installation will be logged and documented by a D&B geologist or environmental scientist. Notes will be kept in both bound field books and on boring logs and monitoring well construction logs. The boring logs will include the depths of stratigraphic changes, description of all samples, details of drilling techniques, listing of soil samples collected for laboratory analyses.

11. After waiting a minimum of 24 hours after installation, all monitoring wells will be developed by pumping and surging until the turbidity of the groundwater achieves a reading of 50 NTUs (nephelometric turbidity units) or less, or until NYSDEC approves cessation of development. Well development will be supplemented by measurements of field parameters, including temperature, pH and specific conductance. Development will continue until the field parameters stabilize for a minimum of three consecutive readings of 10 percent variability or less, or as

approved by the NYSDEC. When possible, well development water should be recharged on-site. All equipment used for the development of monitoring wells will be decontaminated prior to use and between wells.

3.5.5 Groundwater Sampling and Water Level Monitoring

As discussed in Section 2.2, Task 1 includes the sampling of 16 existing groundwater monitoring wells. The sampling of the existing wells will be performed as part of the December 2023 UMP sampling event. In addition, as detailed in Section 2.6, Task 5 of the Emerging Contaminant Plume Investigation includes collecting four quarterly rounds from up to nine newly installed monitoring wells in addition to 12 existing monitoring wells. Note: The special procedures listed at the beginning of Section 3.5 will be followed when completing Tasks 1 and 5 given the sampling events include the analysis of samples for PFAS. The sampling method to be used in this investigation will be consistent with the current monitoring programs currently being implemented at the Landfill including the UMP.

Prior to sampling, groundwater level measurements will be obtained from each of well. Groundwater level measurements of all wells will be made within an 8-hour period of uniform weather conditions.

All water level measurements will be made using a fixed reference point at each measurement location. Downhole instruments will be decontaminated between each measurement location. The static water level will be measured to the nearest 0.01 foot. Groundwater level data will be used to construct groundwater surface elevation maps and used to determine local horizontal flow direction, as well as vertical gradients.

The groundwater sampling method is as follows:

1. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4

degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.

2. Don a pair of disposable nitrile gloves and unlock the monitoring well. Remove J-plug to the well.

3. Measure the depth of water using a decontaminated water level indicator and calculate the volume of standing water in the well.

4. All nondedicated sampling and measuring equipment must be decontaminated before use in accordance with Section 3.6. At a minimum, equipment should be disassembled (when appropriate) and scrubbed in a non-phosphate, laboratory-grade detergent with PFAS laboratory supplied water for sampling events that include PFAS.

5. Given the analysis includes PFAS for all groundwater samples, nondedicated bladder pumps fitted with disposable high density polyethylene discharge tubing shall be used for purging and sampling. For all other sampling events, a submersible groundwater sampling pump shall be for purging and sampling.

6. Field analysis equipment used for the measurement of field parameters, including pH, conductivity, temperature, turbidity and dissolved oxygen, shall be calibrated in accordance with the manufacturer's procedures. All calibration methods, procedures and results shall be documented in the field notes.

7. The sample pump intake shall be positioned within the well's screened section. For wells screened across the water table, the pump should be set in the lower one-third of the screened interval.

8. Remove three to five times the volume of standing water by pumping from the well until field parameters (pH, Eh, conductivity, temperature, dissolved oxygen and turbidity) stabilize, or until the well is dry, whichever occurs first, with the bladder pump. Turbidity must be less than 50 NTUs prior to collection of a sample for inorganic analysis.

9. Except for volatile organic samples, collect sample from pump outlet hose directly into sample bottle.

10. Obtain a volatile organic and 1,4-dioxane sample by using a disposable VOA tipped bailer. Gently pour the sample into the sample vials (40 mL) taking care not to spill water on the outside of the vials or overfill the vials. Replace the covers on the vials. Samples for volatile organic and 1,4-dioxane analysis should have no air space in the sample vial prior to sealing. This is accomplished by filling the vial such that there is a meniscus on top. Carefully, slide the septum, Teflon side down, onto

the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If bubbles appear, reopen the vial, remove the septum and add additional sample (or resample). Replace the septum, recap and check for bubbles. Continue until vial is bubble-free.

11. Collect the remaining samples From the pumps discharge tubing, carefully allow the sample to fill up the remaining sample into the sample containers taking care not to spill water on the outside of the containers or overfill the containers. Replace cover on the sample containers.

12. After filling and labeling each laboratory supplied container, the sample containers will be placed in a laboratory supplied cooler with ice.

3.5.6 Surface Water and Surface Water Sediment Sampling

As discussed in Section 2.7, surface water and surface water sediment sampling will be performed downgradient of the Landfill as part of Task 6. A total of five locations on Beaverdam Creek will be selected for sampling and two locations on the Carmans River. The locations are shown on Drawing 4 and will be consistent with previous sampling locations completed by D&B as part of the on-going monitoring programs, including: BD-1, BD-1.5, BD-2 and BD-3 on Beaverdam Creek and Squassux Landing (CR-1) and LIRR Tressel sample location on Carmans River (CR-2). Consistent with current monitoring programs, Task 6 will include a control sample on Forge River which is located approximately 5 miles to the northeast of the Landfill. Note: The special procedures listed at the beginning of Section 3.5 will be followed when completing Task 6 given the sampling event includes analysis of samples for PFAS.

Additionally, water levels will be obtained at each surface water sample location by installing a fixed measuring point such as a staff gauge or permanent mark, on a fixed surface and measuring the depth to the surface of the water body. The measuring points will be surveyed for location and elevation. The surface water level measurements will be integrated with the groundwater level measurements collected during the groundwater sampling events to develop a comprehensive groundwater flow map.

The following procedures will be utilized in the collection of the surface water samples:

1. Make sure that the sample equipment (polyethylene dipper) has been decontaminated utilizing the procedures outlined in Section 3.6.
2. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4 degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.
3. Remove laboratory precleaned sample containers from sample cooler, label container with an indelible marker,
4. Wear disposable gloves and boots if it is necessary to enter the water.
5. Enter the water downstream of the sample location with minimum disturbance of the sediment and lower the sample dipper/ladle (or sample container) slowly into the water making sure that the sample is taken just below the surface of the water (or at the water/air interface if there is a sheen present) and raise the sample container or sampler out of the surface water. Sample surface water first at the most downstream location and move sequentially upstream.
6. Gently pour the sample into the sample container, if not sampled directly, taking care not to spill the sample on outside of container or overfill container, and replace cover the sample bottle. For volatile organic and 1,4-dioxane samples, make sure that there are no air bubbles in the sample vial after it has been capped. This is done by filling the vial such that there is a meniscus on top. Carefully slide the septum, Teflon side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If the bubbles appear, reopen the vial, remove septum and add more sample (or resample). Replace septum, recap and check for bubbles. Continue until vial is bubble-free.
7. After filling and labeling each laboratory supplied container, the sample containers will be placed in a laboratory supplied cooler with ice.

After completing the water sample at a given location and a sediment sample is required, the sediment sample will be collected as follows:

1. Make sure that the stainless-steel core sampler has been decontaminated utilizing the procedures outlined in Section 3.6.

2. Complete an inventory of the laboratory supplied containers to ensure all proper containers are provided with all necessary preservatives. Ensure the laboratory provided sample cooler has ample ice to maintain a sample temperature of 4 degrees Celsius. Select the needed sample containers and fill out all the sample labels with the sample ID, date and time of sample collection, analysis, etc.

3. Wear disposable gloves and boots if it is necessary to enter the water.

4. Enter the water downstream of the sample location with minimum disturbance of the sediment and advance the core sampler with the slide hammer approximately 12 inches into the stream sediment at the sample location.

5. Pull the core sampler out and extract the sample from the stream bottom.

6. Each recovered sediment sample will be carefully inspected and characterized in by a D&B geologist accordance with the Unified Soil Classification System. A description of any evidence of contamination (e.g., staining, sheens, odors) will be documented and photographs taken.

7. Divide the sediment sample into a 0-to-6-inch section and a 6-to-12-inch section and please each separate sample in the appropriate laboratory supplied sample containers.

8. Repeat steps 4 and 5 if the recovery of the first core sampler is insufficient to fill all the required laboratory containers.

9. After filling and labeling each laboratory supplied container, the sample containers will be placed in a laboratory supplied cooler with ice.

3.6 Decontamination Procedures

Whenever feasible, field sampling equipment should be dedicated to a particular sampling point. In instances where this is not possible, a field cleaning (decontamination) procedure will be used in order to reduce the chances of cross-contamination between sample locations. A decontamination station will be established for the field activities. This will be an area located away from the source of contamination so as not to adversely affect the decontamination procedure but close enough to the sampling location to keep equipment handling to a minimum.

Non-disposable equipment will be decontaminated at appropriate intervals (e.g., prior to initial use, prior to moving to a new sampling location and prior to leaving the site). Different decontamination procedures are used for various types of equipment that perform the field activities. When using field decontamination, it is advisable to start sampling in the area of the site with the lowest contaminant probability and proceed through to the areas of highest suspected contamination.

Teflon, PVC, HDPE and stainless-steel sampling equipment decontamination procedures will be the following:

- Wash thoroughly with non-residual detergent (such as Alconox) and potable water using a brush to remove particulate matter or surface film.
- Rinse thoroughly with potable water.
- Rinse thoroughly with distilled water.
- Rinse thoroughly with distilled water and air dry.

The first step, a soap and water wash, is to remove all visible particulate matter and residual oils and grease. This is followed by a potable water rinse and a distilled/deionized water rinse to remove the detergent.

Submersible sampling pumps that are placed in monitoring wells shall be decontaminated with a non-residual detergent rinse and by pumping approximately 5 gallons of potable water through the pump. Since dedicated new lengths of polyethylene tubing shall be used for sampling each well, the tubing shall not be decontaminated. Unless otherwise specified, the submersible pumps, electrical wire and safety wire shall be decontaminated prior to sampling the first well and between each subsequent well as follows:

- Potable water rinse
- Non-residual detergent and potable water scrub
- Potable water rinse
- Distilled/deionized water rinse

In lieu of a safety wire, a new length of polypropylene safety rope may be utilized for the submersible pump for each location.

PFAS Equipment Decontamination

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, TeflonTM) materials including plumbers' tape and sample bottle cap liners with a PTFE layer.

For equipment used in PFAS sampling, standard two step decontamination using non-residual detergent (such as Alconox) and clean, PFAS-free water will be performed. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

3.7 Laboratory Sample Custody Procedures

The laboratory shall be a NYSDOH ELAP and CLP certified laboratory meeting the requirements for sample custody procedures, including cleaning and handling sample containers and analytical equipment. The laboratories' Standard Operating Procedures will be available upon request.

3.8 Field Management Procedures

Proper management and documentation of field activities is essential to ensure that the necessary work is conducted in accordance with the sampling plan and QA/QC Plan in an efficient and high-quality manner. Field management procedures include following proper chain of custody procedures to track a sample from collection through analysis, noting when and how samples are split (if required), preparing a Location Sketch, completing Sample Information Record Forms, Chain of Custody Forms, and Boring and Well Construction Logs, maintaining a daily Field Log Book, preparing Daily Field Activity Reports, completing Field Change Forms and filling out a Daily Air Monitoring Form. Proper completion of these forms and the field log book are necessary to support the consequent actions that may result from the sample analysis. This documentation will support that the evidence was gathered and handled properly. Field forms that will to utilized by the D&B field staff are provided in **Appendix B**.

3.8.1 Location Sketch

Sampling locations are to be noted on the Location Sketch, with reference to permanent reference points (if possible).

3.8.2 Sample Information Record

At each sampling location, the Sample Information Record form is filled out and maintained including, but not limited to,

- Site name
- Sample crew
- Sample location/well number

- Field sample identification number
- Date
- Time
- Weather
- Temperature
- Sample type/method of collection
- Well information (groundwater only)
- Field test results
- Constituents sampled
- Remarks

3.8.3 Chain of Custody

The Chain of Custody (COC) is initiated at the laboratory with bottle preparation and shipment to the site. The COC remains with the sample at all times and bears the name of the person assuming responsibility for the samples. This person is tasked with maintaining secure and appropriate handling of the bottles and samples. When the form is complete, it should indicate that there was no lapse in sample accountability. A sample is considered to be in an individual's custody if any of the following conditions are met:

- It is in the individual's physical possession, or
- It is in the individual's view after being in his or her physical possession, or
- It is secured by the individual so that no one can tamper with it, or
- The individual puts it in a designated and identified secure area.

In general, Chain of Custody Forms are provided by the laboratory contracted to perform the analytical services. At a minimum, the following information should be provided on these forms:

- Project name and address
- Project number
- Sample Number
- Date
- Time
- Sample location
- Sample type
- Analysis
- Number of containers
- Remarks
- Type of waste
- Sampler(s) name(s) and signature(s)
- Spaces for relinquished by/received by signatures and date/time

The Chain of Custody Form is filled out and signed by the person performing the sampling. The original form travels with the sample and is signed each time the sample is relinquished to another party, until it reaches the laboratory or analysis is completed. The field sampler keeps one copy and a copy is retained for the project file. All samples and the Chain of Custody Form will be delivered to the laboratory 24 to 48 hours from day of collection. The sample bottle must also be labeled with a waterproof marker with a minimum of the following information:

- Sample number
- Analysis to be performed
- Date

A copy of the completed form is returned by the laboratory with the analytical results.

3.8.4 Field Log Book

Field log books must be bound and should have consecutively numbered, water resistant pages. All pertinent information regarding the site sampling procedures must be documented. Notations should be made in log book fashion, noting the time and date of all entries. Information recorded in this notebook should include, but not be limited to, the following:

- Project name, number and address
- Name, address and phone number of field contact
- Waste generator and address, if different from above
- Type of process (if known) generating waste
- Type of waste
- Suspected waste composition, including concentrations Daily entries are made for the following information:
- Purpose of sampling
- Location of sampling point
- Number(s) and volume(s) of sample(s) collected
- Description of sampling point and sampling methodology
- Date and time of collection
- Collector's sample identification number(s)

- Sample distribution and method of storage and transportation
- Calibration of equipment and results
- References such as maps of the sampling site or photographs of sample collection
- Field observations, including results of field analyses (e.g., pH, turbidity, temperature, specific conductance), water levels, drilling logs and borings
- Signature of personnel responsible for completing log entries

3.8.5 Daily Field Activity Reports

Field activity reports will be prepared for each day field activities are being conducted and will include the following:

- Field observations, including results of field analyses (e.g., pH, turbidity, temperature, specific conductance), water levels, drilling logs and borings
- Signature of personnel responsible for completing log entries

3.8.6 Air Monitoring

Whenever air monitoring using an organic vapor analyzer or dust indicator is required, an Air Monitoring Form needs to be completed.

3.9 Calibration Procedures and Preventative Maintenance

The following information regarding equipment will be maintained at the project site:

1. Equipment calibration and operating procedures which will include provisions for documentation of frequency, conditions, standards and records reflecting the calibration procedures, methods of usage and repair history of the measurement system. Calibration of field equipment will be done daily at the sampling site so that

any background contamination can be taken into consideration and the instrument calibrated accordingly.

2. A schedule of preventive maintenance tasks, consistent with the instrument manufacturer's specific operation manuals that will be carried out to minimize down time of the equipment.

3. Critical spare parts, necessary tools and manuals will be on hand to facilitate equipment maintenance and repair.

Calibration procedures and preventive maintenance, in accordance with the NYSDEC 2005 ASP, for laboratory equipment is contained in the laboratory's standard operating procedures (SOP) and is available upon request.

3.10 Documentation, Data Reduction and Reporting

The laboratory will be a NYSDOH ELAP and CLP certified laboratory meeting requirements for documentation, data reduction and reporting. All data will be catalogued according to sampling locations. NYSDEC "Sample Identification and Analytical Requirements Summary" and "Sample Preparation and Analysis Summary" forms will be completed and included with the data package. The sample tracking form will reflect the year of the NYSDEC ASP used.

3.11 Data Validation

Data validation will be performed in order to define and document analytical data quality in accordance with NYSDEC requirements that project data must be of known and acceptable quality. The analytical and validation processes will be conducted in conformance with the NYSDEC ASP dated July 2005.

Because the NYSDEC Analytical Services Protocol is based on the USEPA CLP, the USEPA Functional Guidelines for Evaluating Organics and Inorganics Analyses for the Contract

Laboratory Program (CLP) will assist in formulating standard operating procedures (SOPs) for the data validation process. The data validation process will ensure that all analytical requirements specific to this work plan, including the QA/QC Plan are followed. Procedures will address validation of routine analytical services (RAS) results based on the Expanded Parameter List for standard sample matrices.

The data validation process will provide an assessment of the laboratory's performance based upon contractual requirements and applicable analytical criteria. The report generated as a result of the data validation process will provide a base upon which the usefulness of the data can be evaluated by the end user of the analytical results. The overall level of effort and specific data validation procedure to be used will be equivalent to a minimum of "20% validation" of all analytical data in any given data package.

During the review process, it will be determined whether the laboratory submittals for sample results are supported by sufficient backup data and QA/QC results to enable the reviewer to conclusively determine the quality of data. Each data package will be checked for completeness and technical adequacy of the data.

"Qualified" analytical results for any one field sample are established and presented based on the results of specific QC samples and procedures associated with its sample analysis group or batch. Precision and accuracy criteria (i.e., QC acceptance limits) are used in determining the need for qualifying data. Where test data have been reduced by the laboratory, the method of reduction will be described in the report. Reduction of laboratory measurements and laboratory reporting of analytical parameters shall be verified in accordance with the procedures specified in the NYSDEC program documents for each analytical method (i.e., recreate laboratory calculations and data reporting in accordance with the method specific procedure). The standard operating guidelines manuals and any special analytical methodology required are expected to specify documentation needs and technical criteria and will be taken into consideration in the validation process.

Upon completion of the review, a summary report will be developed to include a cover letter, a brief summary of each QA/QC parameter, the completed QA/QC check lists for each data package and the "qualified" analytical results for each sample analyzed. This summary report will be submitted to NYSDEC in the final report.

The following is a description of the two-phased approach to data validation planned to be used in this project. The first phase is called checklisting and the second phase is the analytical quality review, with the former being a subset of the latter.

- Checklisting - The data package is checked for correct submission of the contract required deliverables, correct transcription from the raw data to the required deliverable summary forms and proper calculation of a number of parameters.
- Analytical Quality Review - The data package is closely examined to recreate the analytical process and verify that proper and acceptable analytical techniques have been performed. Additionally, overall data quality and laboratory performance is evaluated by applying the appropriate data quality criteria to the data to reflect conformance with the specified, accepted QA/QC standards and contractual requirements.

3.12 Performance and System Audits

The laboratory will be a NYSDOH ELAP and CLP certified laboratory satisfactorily completing performance audits and performance evaluation samples.

3.13 Corrective Action

The laboratory will be a NYSDOH ELAP and CLP certified laboratory meeting requirements for corrective action protocols, including sample "clean up" to attempt to mitigate "matrix interference."

The 07/05 NYSDEC ASP protocols include both mandatory and optional sample cleanup and extraction methods. Cleanup is required by the 07/05 NYSDEC ASP in order to meet contract required detection limits. There are several optional cleanup and extraction methods noted in the 07/05 NYSDEC ASP protocol. These include: florisil column cleanup, silica gel column cleanup, gel permeation chromatography (GPC), acid-base partition and steam distillation.

3.14 Trip Blanks (Travel Blanks)

The primary purpose of this type of blank is to detect additional sources of contamination that might potentially influence contaminant values reported in actual samples both quantitatively and qualitatively. The following have been identified as potential sources of contamination.

- Laboratory reagent water
- Sample containers
- Cross contamination in shipment
- Ambient air or contact with analytical instrumentation during preparation and analysis at the laboratory
- Laboratory reagents used in analytical procedures

A trip blank consists of a pair of 40 ml sample vials filled at the laboratory with laboratory demonstrated analyte free water. Trip blanks will be handled, transported and analyzed in the same manner as the samples acquired that day, except that the sample containers themselves are not opened in the field. Rather, the blanks only travel with the sample cooler. Trip blanks must accompany samples at a rate of one per shipment or two-day sampling event. The temperature of the trip blanks must be maintained at 4°C while on-site and during shipment. Trip blanks must return to the laboratory with the same set of bottles they accompanied in the field.

The purpose of a trip blank is to control sample bottle preparation and blank water quality, as well as sample handling. Thus, the trip blank travels to the site with the empty sample bottles and back from the site with the collected samples in an effort to simulate sample handling conditions. Contaminated trip blanks may indicate inadequate bottle cleaning or blank water of questionable quality. Trip blanks are implemented when collecting water samples and analyzed for volatile organic compounds only.

3.15 Field Blanks (Field Rinsate Blanks)

The primary purpose of this type of blank is to provide an additional check on possible sources of contamination beyond that which is intended for trip blanks. A field blank is used to indicate potential contamination from ambient air and from sampling instruments used to collect and transfer samples from point of collection into sample containers.

A field blank is conducted using two identical sets of laboratory cleaned sample containers. One set of containers is empty and will serve as the sample containers to be analyzed. The second set of containers is filled at the laboratory with laboratory demonstrated analyte free water. Field blanks are handled, transported and analyzed in the same manner as the samples acquired that day. At the field location, preferably in the most contaminated area, this analyte free water is passed through clean/decontaminated sampling equipment and placed in the empty sample container for analysis. (Note: It may be necessary for the laboratory to provide extra full volatile organics vials to ensure sufficient volume of blank water to eliminate headspace.) The reason for suggesting that field blanks be performed in the most contaminated area is to attempt to simulate a worst-case scenario regarding field ambient air and equipment contributions to sample contamination. Field blanks must be performed daily or for each "batch" of samples that were collected in the same manner up to a maximum of 20 samples.

Field blanks must return to the laboratory with the same set of sample bottles they accompanied to the field. Field blanks must be packaged with their associated matrix. They are analyzed for the same range of compounds as the environmental samples collected in each "batch."

3.16 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes and matrix spike duplicates are used by the laboratory as part of its internal Quality Assurance/Quality Control Program (QA/QC). This QA/QC check is consistent with the New York State Department of Environmental Conservation Quality Analytical Services Protocol. One liquid and one solid matrix spike sample will be collected and submitted for laboratory analysis for every 20 samples of a similar matrix. A matrix spike duplicate will also be collected and submitted for each matrix (liquid and solid). These samples will be selected using a random number generator.

3.17 Method Blanks and Field Duplicates

Method blanks are analyzed daily by the laboratory to check for contamination which may be introduced to the sample as a result of the analytical procedure itself. In instances where a particular compound is found in the method blank and in the environmental sample, the concentration in the environmental sample must be at least 10 times that of the method blank in order for the result to be valid.

One field duplicate sample will be collected for analysis during each sampling event. The sample will be selected using a random number generator.

Table 3-1
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 1 Monitoring Wells	Grab	Groundwater	PFAS	16**	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Groundwater	1,4-Dioxane	16**	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM
	Grab	Groundwater	Leachate Parameters*	16**	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

*Leachate parameters to include Alkalinity, TDS, sulfate, chloride, ammonia, and conductivity
**Plus One set of MS/MSD and duplicate, field blank per 20 samples or SDG. One Field Reagent Blank per day.
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples*	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 2 Shallow Soil Borings (Five Borings, 4 samples per boring)	Grab	Soil	PFAS	20	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Soil	1,4-Dioxane	20	Glass, 2 oz/2 ICHEM 200 Series or equivalent	Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

* Plus One set of MS/MSD and duplicate and field blank per 20 samples or SDG
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 3 Vertical Profiles	Grab	Groundwater	PFAS	70**	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Groundwater	1,4-Dioxane	70**	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM
	Grab	Groundwater	Leachate Parameters*	70**	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

*Leachate parameters to include Alkalinity, TDS, sulfate, chloride, ammonia, and conductivity
**Plus One set of MS/MSD and duplicate, and field blank per 20 samples or SDG. One Field Reagent Blank per day.
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples***	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 5 Monitoring Wells	Grab	Groundwater	6 NYCRR Baseline Parameters					
	Grab	Groundwater	Volatile Organics	21****	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Grab	Groundwater	Metals	21****	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Grab	Groundwater	Cyanide	21****	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Grab	Groundwater	Leachate Parameters	21****	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)
	Grab	Groundwater	PFAS	21****	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples***	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Grab	Groundwater	1,4-Dioxane	21****	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7 0 6 0
Thallium 7841

*** 3 rounds of sampling
**** Number of samples is based on 12 existing wells and 9 new wells. The actual number of new monitoring wells to be sampled as part of Task 5 will be dependent on how many are installed under Task 4.
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 6 Beaverdam Creek Carmens River Surface Water	Grab	Surface water	6 NYCRR Baseline Parameters					
	Grab	Surface water	Volatile Organics	6	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Grab	Surface water	Metals	6	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Grab	Surface water	Cyanide	6	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Grab	Surface water	Leachate Parameters	6	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)
	Grab	Surface water	PFAS	6	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Grab	Surface Water	1,4-Dioxane	6	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Matrix Spike/ Matrix Spike Duplicate	Groundwater/ Surface Water	6 NYCRR Baseline Parameters					
		Groundwater/ Surface Water	Volatile Organics	1 per 20	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
		Groundwater/ Surface Water	Metals	1 per 20	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
		Groundwater/ Surface Water	Cyanide	1 per 20	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
		Groundwater/ Surface Water	Leachate Parameters	1 per 20	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
		Groundwater/ Surface Water	PFAS	1 per 20	HDPE 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
		Groundwater/ Surface Water	1,4-Dioxane	1 per 20	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Field Blank	Water	6 NYCRR Baseline Parameters					
	Field Blank	Water	Volatile Organics	1 per 20	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Field Blank	Water	Metals	1 per 20	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Field Blank	Water	Cyanide	1 per 20	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Field Blank	Water	Leachate Parameters	1 per 20	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)
	Field Blank	Water	PFAS	1 per day	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Field Reagent Blank	Water	PFAS	1 per day	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Field Blank	Water	1,4-Dioxane	1 per day	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

** Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Laboratory	Method Blank	Water	6 NYCRR Baseline Parameters					
	Method Blank	Water	Volatile Organics	*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Method Blank	Water	Metals	*	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Method Blank	Water	Cyanide	*	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Method Blank	Water	Leachate Parameters	*	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)
	Method Blank	Water	PFAS	*	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Method Blank	Water	1,4-Dioxane	*	Glass, 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

* As required by the 07/05 NYSDEC ASP and SW-846 methods

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Trip Blank	Water	Volatile Organics	15*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
Site/Study Area	Trip Blank	Water	1,4-Dioxane	15*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

*As required by 07/05 NYSDEC ASP, estimated based on three-week sampling program for aqueous samples.
VTSR: Verified Time of Sample Receipt to the laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 5 Monitoring Wells	Grab	Groundwater	6 NYCRR Expanded Parameters					
	Grab	Groundwater	Volatile Organics	21****	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Grab	Groundwater	Semi Volatile Organics	21****	Glass, amber/ 1L/ 2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8260
	Grab	Groundwater	Metals	21****	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Grab	Groundwater	Cyanide	21****	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Grab	Groundwater	Leachate Parameters	21****	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (See Table 3-2)
	Grab	Groundwater	Pesticides/ Herbicides/ PCBs	21****	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8080

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 5 Monitoring Wells	Grab	Groundwater	Dioxins and Furans	21****	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846 Method 8280
	Grab	Groundwater	Radionuclides Total (Radium-226, Radium-228, Uranium)	21****	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 pH<2 Cool to 4oC	6 months after VTSR for analysis	Method 903.1, 904, ASTM D5174-97
	Grab	Groundwater	Radionuclides, Dissolved (Radium- 226, Radium-228, Uranium)	21****	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Grab	Groundwater	PFAS	21****	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Groundwater	1,4-Dioxane	21****	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

**** Number of samples is based on 12 existing wells and 9 new wells. The actual number of new monitoring wells to be sampled as part of Task 5 will be

dependent on how many are installed under Task 4.
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 6 Beaverdam Creek and Carmans River	Grab	Surface Water	6 NYCRR Expanded Parameters					
	Grab	Surface Water	Volatile Organics	7	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260
	Grab	Surface Water	Semi Volatile Organics	7	Glass, amber/ 1L/ 2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8260
	Grab	Surface Water	Metals	7	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Grab	Surface Water	Cyanide	7	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Grab	Surface Water	Leachate Parameters	7	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (See Table 3-2)

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Grab	Surface Water	Pesticides/ Herbicides/ PCBs	7	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8080

Table 3-1 (Continued)
TOWN OF BROOKHAVEN EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 6 Beaverdam Creek and Carmans River	Grab	Surface Water	Dioxins and Furans	7	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846 Method 8280
	Grab	Surface Water	Radionuclides Total (Radium-226, Radium-228, Uranium)	7	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 pH<2 Cool to 4oC	6 months after VTSR for analysis	Method 903.1, 904, ASTM D5174-97
	Grab	Surface Water	Radionuclides, Dissolved (Radium- 226, Radium-228, Uranium)	7	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Grab	Surface Water	PFAS	7	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Surface Water	1,4-Dioxane	7	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

<u>**Method</u>
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Matrix Spike/ Matrix Spike Duplicate	Groundwater/ Surface Water	6 NYCRR Expanded Parameters					
		Groundwater/ Surface Water	Volatile Organics	1 per 20	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
		Groundwater/ Surface Water	Semi Volatile Organics	1 per 20	Glass, amber/ 1L/ 2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8260
		Groundwater/ Surface Water	Metals	1 per 20	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
		Groundwater/ Surface Water	Cyanide	1 per 20	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
		Groundwater/ Surface Water	Leachate Parameters	1 per 20	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)
		Groundwater/ Surface Water	Pesticides/ Herbicides/ PCBs	1 per 20	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8080

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Matrix Spike/ Matrix Spike Duplicate	Groundwater/ Surface Water	Dioxins and Furans	1 per 20	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846 Method 8280
		Groundwater/ Surface Water	Radionuclides, Total (Radium-226, Radium-228, Uranium)	1 per 20	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
		Groundwater/ Surface Water	Radionuclides, Dissolved (Radium- 226, Radium-228, Uranium)	1 per 20	Plastic/1L/1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
		Groundwater/ Surface Water	PFAS	1 per 20	HDPE, 100 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
		Groundwater/ Surface Water	1,4-Dioxane	1 per 20	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM

**Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Field Blank	Water	6 NYCRR Expanded Parameters					
	Field Blank	Water	Volatile Organics	1 per 20	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Field Blank	Water	Semi Volatile Organics	1 per 20	Glass, amber/ 1L/ 2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8260
	Field Blank	Water	Metals	1 per 20	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Field Blank	Water	Cyanide	1 per 20	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Field Blank	Water	Leachate Parameters	1 per 20	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Field Blank	Water	Pesticides/ Herbicides/ PCBs	1 per 20	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8080

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Field Blank	Water	Dioxins and Furans	1 per 20	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846 Method 8280
	Field Blank	Water	Radionuclides, Total (Radium-226, Radium-228, Total Uranium)	1 per 20	Plastic/1L1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Field Blank	Water	Radionuclides, Dissolved (Radium- 226, Radium-228, Uranium)	1 per 20	Plastic/1L1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Field Blank	Water	PFAS	1 per day	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Field Reagent Blank	Water	PFAS	1 per day	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Field Blank	Water	1,4-Dioxane	1 per 20	Glass, clear/40 mL/ 2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days	SW-846, Method 8260 SIM

Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7 0 6 0
Thallium 7841
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Laboratory	Method Blank	Water	6 NYCRR Expanded Parameters					
	Method Blank	Water	Volatile Organics	*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
	Method Blank	Water	Semi Volatile Organics	*	Glass, amber/ 1L/ 2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8260
	Method Blank	Water	Metals	*	Plastic/ 250 mL/1 ICHEM 300 Series or equivalent	HNO3 to pH <2, Cool to 4°C	26 days after VTSR for Hg analysis, 6 months after VTSR for analysis of all others	SW-846, Method 6010**
	Method Blank	Water	Cyanide	*	Plastic/500 ml/1 ICHEM 300 Series or equivalent	NaOH to pH >12, Cool to 4°C	12 days after VTSR for analysis	SW-846, Method 9014
	Method Blank	Water	Leachate Parameters	*	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
	Method Blank	Water	Pesticides/ Herbicides/ PCBs	*	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846, Method 8080

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Laboratory	Method Blank	Water	Dioxins and Furans	*	Glass, amber/ 1L/2 ICHEM 300 Series or equivalent	Cool to 4°C	5 days after VTSR for extraction, 40 days after extraction for analysis	SW-846 Method 8280
	Method Blank	Water	Radionuclides, Total (Radium-226, Radium-228, Total Uranium)	*	Plastic/1L1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Method Blank	Water	Radionuclides, Dissolved (Radium-226, Radium-228, Total Uranium)	*	Plastic/1L1 ICHEM 300 Series or equivalent	HNO3 to pH<2 Cool to 4°C	6 months after VSTR for analysis	Method 903.1, 904, ASTM D5174-97
	Method Blank	Water	PFAS	*	HDPE mL, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Method Blank	Water	1,4-Dioxane	*	Glass, clear/40 mL/ 2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days	SW-846, Method 8260 SIM

*As required by the 07/05 NYSDEC ASP.
Method
Selenium 7740
Mercury 7470
Lead 7421
Arsenic 7060
Thallium 7841

VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Site/Study Area	Trip Blank	Water	Volatile Organics	5*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH <2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030
Site/Study Area	Trip Blank	Water	1,4-Dioxane	5*	Glass, clear/ 40 mL/2 ICHEM 300 Series or equivalent	HCl to pH<2, Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260/5030

*As required by 07/05 NYSDEC ASP, estimated based on one week sampling program for aqueous samples.
VTSR: Verified Time of Sample Receipt to the laboratory.

Table 3-1 (Continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION WORK PLAN
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Number of Samples	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Task 6 Bever Dam Creek and Carmans River	Grab	Sediment	PFAS	14**	HDPE, 500 mL/2 ICHEM 300 Series or equivalent	<6°C but >0°C	28 days after VTSR for analysis	Method 1633
	Grab	Sediment	1,4-Dioxane	14**	Glass, 2 ozL/2 ICHEM 300 Series or equivalent	Cool to 4°C	7 days after VTSR for analysis	SW-846, Method 8260 SIM
	Grab	Sediment	Total Organic Carbon	14**	See Table 3-2	See Table 3-2	See Table 3-2	2005 NYSDEC ASP (see Table 3-2)

**Plus One set of MS/MSD and duplicate and field blank per 20 samples or SDG
VTSR: Verified Time of Sample Receipt to the Laboratory.

Table 3-2
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION LEACHATE PARAMETERS
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES*

Parameter	Method of Analysis	Preservation	Container	Holding Time
Ammonia	Method 350.3	H_2SO_4 to pH <2; Cool to 4°C	Plastic or Glass	26 days
Total Organic Carbon	Method 415.1	H_2SO_4 to pH <2; Cool to 4°C	Glass	26 days
Total Dissolved Solids	Method 160.1	Cool to 4°C	Plastic or Glass	5 days
Alkalinity	Method 310.1	Cool to 4°C	Plastic or Glass	12 days
Chloride	Method 325.3	Cool to 4°C	Plastic or Glass	26 days
Total Kjeldahl Nitrogen	Method 351.3	H_2SO_4 to pH <2; Cool to 4°C	Plastic or Glass	26 days
Nitrate	Method 352.1	H_2SO_4 to pH <2; Cool to 4°C	Plastic or Glass	26 days
BOD (5-day)	Method 405.1	Cool to 4°C	Plastic or Glass	24 hours
COD	Method 410.1	H_2SO_4 to pH <2; Cool to 4°C	Plastic or Glass	26 days

*From 07/05 NYSDEC ASP.

Table 3-2 (continued)
TOWN OF BROOKHAVEN LANDFILL EMERGING CONTAMINANT PLUME INVESTIGATION LEACHATE PARAMETERS
METHOD OF ANALYSIS, PRESERVATION AND HOLDING TIMES*

Parameter	Method of Analysis	Preservation	Container	Holding Time
Sulfate	Method 375.4	Cool to 4°C	Plastic or Glass	26 days
Chromium (hexavalent)	Method 218.5	Cool to 4°C	Plastic or Glass	24 hours
Color	Method 110.2	Cool to 4°C	Plastic or Glass	24 hours
Hardness (total)	Method 130.2	HNO_3 to pH <2	Plastic or Glass	6 months
Boron	Method 212.3	None required	Plastic	6 months
Phenol	Method 420.1	H_2SO_4 to pH <2 Cool to 4°C	Plastic or Glass	26 days
Bromide	Method 320.1	Cool to 4°C	Plastic	26 days

*From 07/05 NYSDEC ASP.

4.0 PROJECT ORGANIZATION

The Emerging Contaminant Plume Investigation will be completed by D&B under contract with the Town. Key members of the project team and their responsibilities are described below.

Key Position	Contact Name	Responsibilities
Consultant		
Project Director	Mr. Frank DeVita Telephone: (516) 364-9890 e-mail: fdivita@db-eng.com	The Project Director is responsible for interfacing directly with the Town's upper management and is responsible for maintaining the project schedule, keeping the project within budget, and ensuring the technical adequacy of the work performed.
Project Manager	Mr. Thomas P. Fox, P.G. Telephone: (516) 364-9890 e-mail: tfox@db-eng.com	The Project Manager is responsible for managing the day-to-day project schedule, managing subcontractors and D&B's field personnel, ensuring the field investigation is completed in accordance with the NYSDEC-approved workplan. The Project Manager will also be responsible for drafting investigation reports and other technical memorandums.
Field Supervisor	Mr. Keith Robins, P.G. Telephone: (516) 364-9890 e-mail: krobins@db-eng.com	The Field Supervisor will be responsible for working with the Project Manager to coordinate, oversee and ensure that all requirements are strictly adhered to on field activities.
QA/QC Officer	Ms. Robin Petrella Telephone: (516) 364-9890 e-mail: rpetrella@db-eng.com	The Technical Director will provide technical support and overall quality assurance for the project. The primary objective of the Technical Director is to ensure compliance with all regulatory guidance and regulations.

Key Position	Contact Name	Responsibilities
Health and Safety Officer	Mr. David Zaremsky Telephone: (516) 364-9890 e-mail: dzaremsky@db-eng.com	The Health and Safety Officer will ensure that the health and safety plan is properly implemented and that all D&B personnel are trained in the site-specific project health and safety requirements, as well as those of the Town.
Project		

5.0 PROJECT SCHEDULE

An overall investigation schedule is provided as **Figure 5-1**. The schedule starts with the final approval of the Emerging Contaminant Plume Investigation Work Plan by the NYSDEC. The schedule assumes that the NYSDEC review period for submitted reports and technical memorandums would not exceed 30 days. Based on the proposed schedule presented on **Figure 5-1**:

- D&B would mobilize within two weeks of receiving the final approval of the work plan with the implementation of Tasks 1, Task 2, Task 3 and Task 4. Task 1 would also coincide with the planned December 2023 UMP sampling event so that the data from the UMP sampling event can be integrated with data generated from the planned off-site groundwater sampling to be completed at part of Task 1. It is anticipated that the four Tasks will take four weeks to complete. The schedule provides four weeks for the laboratory analysis of collected samples.

- Based on the above, we would anticipate having an interim report drafted and submitted to the NYSDEC for review under Task 3 within 17 weeks of receiving work plan approval. As discussed in Section 2.4, the interim report would combine the data generated from Tasks 1, 2 and Task 3 to determine the number, location and screen setting of monitoring wells to be installed at part of Task 4.

- Assuming the NYDEC approves the recommended well installations presented in the report by week 22, we anticipate all monitoring wells will be installed and developed by week 29 and the first quarterly sampling event would be completed by week 33.

- We anticipate each quarterly sampling event will take two weeks to complete. As shown in **Figure 5-1**, there will be an approximate 12-week gap between each quarterly sampling round. Therefore, the fourth and last sampling round would be completed by week 73. Again, assuming a 30-day turnaround for the laboratory data, D&B would anticipate having a draft Plume Investigation Report for review by the Town by week 82.

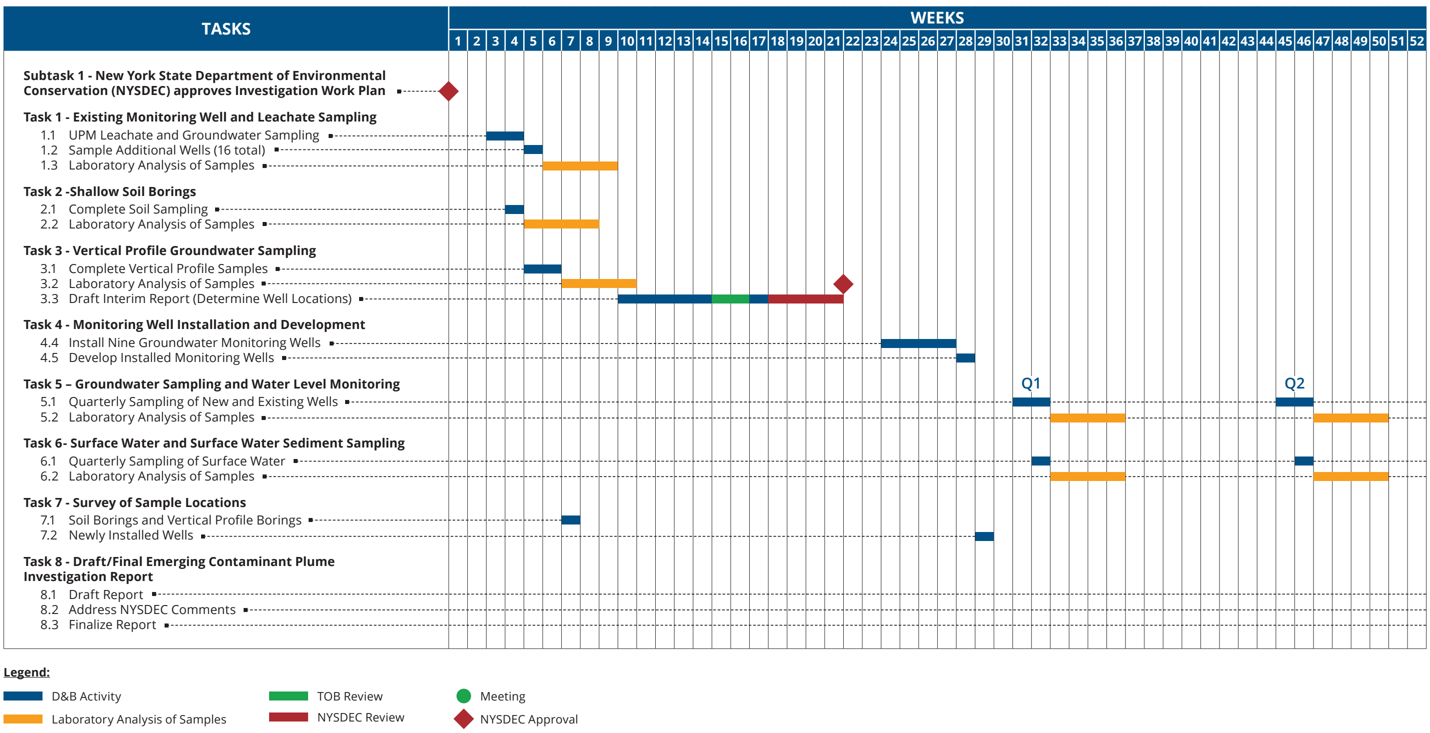
- Assuming two 30-day review periods for the NYSDEC and two two-week review periods for the Town, we would estimate that the final Plume Report would be approved by the NYSDEC within 96 weeks of approval of the work plan.

TOWN OF BROOKHAVEN

PROJECT SCHEDULE

TOWN OF BROOKHAVEN DEPARTMENT OF RECYCLING AND SUSTAINABLE MATERIALS MANAGEMENT

TOWN OF BROOKHAVEN LANDFILL CORRECTIVE MEASURES WORK PLAN



TOWN OF BROOKHAVEN

PROJECT SCHEDULE

TOWN OF BROOKHAVEN DEPARTMENT OF RECYCLING AND SUSTAINABLE MATERIALS MANAGEMENT
TOWN OF BROOKHAVEN LANDFILL CORRECTIVE MEASURES WORK PLAN

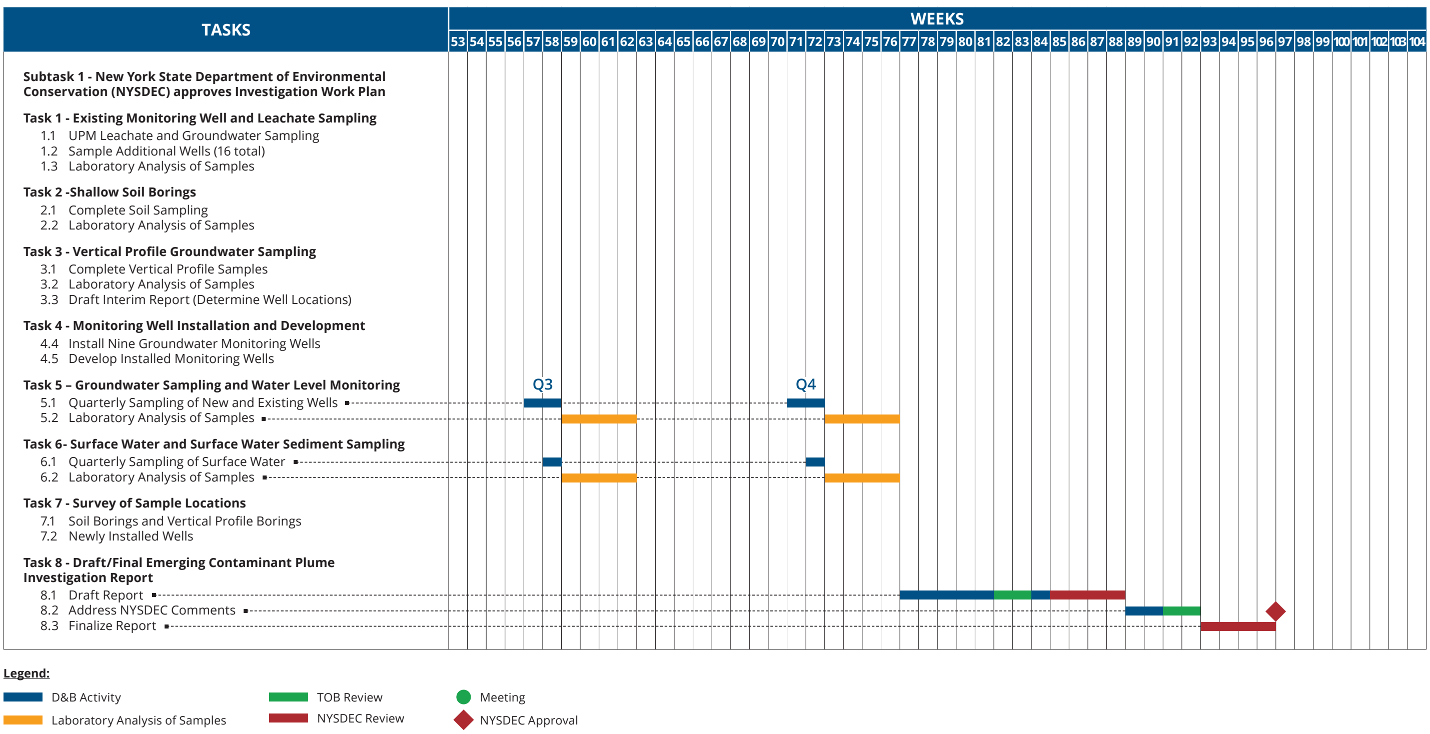


FIGURE 5 - 1

APPENDIX B

FIELD DOCUMENTATION FORMS

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ____________________

AIR MONITORING FORM

Project Name: ______________________________

Project Number: ______________________________ Instrument: ____________________

Recorded by: ______________________________ Calibration Date: ________________

Weather Conditions: ______________________________

Time	Location	Wind Speed and Direction	Reading	Observations

Recording Procedures/Remarks: ______________________________

Dvirka and Bartilucci CONSULTING ENGINEERS A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.	**Project No.:** **Project Name:**	**Boring No.:** **Sheet ___ of ___ .** **By:**
Drilling Contractor: . **Driller:** **Drill Rig:** **Date Started:**	**Geologist:** **Drilling Method:** **Drive Hammer Weight:** **Date Completed:**	**Boring Completion Depth:** " **Ground Surface Elevation:** **Boring Diameter:**

	Soil Sample				Headspace Analysis				
Depth (ft.)	**No.**	**Type**	**Blows Per 6"**	**Rec**	**FID ppm**	**PID ppm**	**CH4 ppm**	**Sample Description**	**USCS**
-0-									
-1.5'-									
-2-									
-3-									
-4-									
-5-									
-6-									
-7-									
-8-									
-9-									
-10-									

Sample Types: **SS =** **ST =** **D&M =** **UC =** Undisturbed Core (Dennison Type)	**NOTES:**

Document something (even if it's the same thing) every 15 minutes!!!!!!!!

At a minimum, document the following daily:

- Days date
- Project ID (i.e., Plant 12 RCRA Program, Plant 5 RCRA Program, etc.)
- Arrival time on-site (D&B and Contractor personnel)
- Personnel on-site (names and affiliation)
- Equipment on-site
- Weather conditions (approx.. temperature, wind speed and direction and weather conditions – sunny, clear, rain, etc.)
- Site conditions (i.e., dry, wet, etc.)
- Planned activities (according to the Contactor)
- Quantities of materials delivered to site and expended
- Contractor questions/comments
- D&B questions/comments/responses
- Telephone conversations
- Break times/schedule
- Visual observations during excavation/demolition activites
- Daily totals (effort, quantities, equipment)

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ___________________

DAILY EQUIPMENT CALIBRATION LOG

Project Name: ________________________________

Project Number: ________________________________ Calibrated by: __________________________

Instrument Name and Model Number	Calibration Method	Time	Readings and Observations

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ____________________

DAILY FIELD ACTIVITY REPORT

Report Number: ____________________ Project Number: ____________________

Field Log Book Page Number: ____________________

Project: ____________________

Address: ____________________

Weather: (AM) ____________________ Rainfall: (AM) __________ Inches

(PM) ____________________ (PM) __________ Inches

Temperature: (AM) ______ ºF Wind Speed: (AM) ______ MPH Wind Direction: (AM) ______

(PM) ______ ºF (PM) ______ MPH (PM) ______

Site Condition: ____________________

Personnel On Site:	Name	Affiliation	Arrival Time	Departure Time

Subcontractor Work Commencement: (AM) ____________________ (PM) ____________________

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ____________________

DAILY FIELD ACTIVITY REPORT

Subcontractor Work Completion: (AM) ____________________ (PM) ____________________

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ___________________

DAILY FIELD ACTIVITY REPORT

Work Performed by subcontractor(s) (includes equipment and labor breakdown):

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ___________________

DAILY FIELD ACTIVITY REPORT

General work performed today by D&B Engineers:

____

____

____

____

____

List specific inspection(s) performed and results (include problems and corrective actions):

____

____

____

____

____

List type and location of tests performed and results (include equipment used and monitoring results):

____

____

____

____

____

Verbal comments received from subcontractor (include construction and testing problems, and recommendations/resulting actions):

____

____

____

____

____

Prepared by: ______________________ Reviewed by: ______________________

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ___________________

LOCATION SKETCH

Project ______________________________________ Sample Crew ____________________________

Sample(s) Locations(s) ____

Sample(s) and/or Well Number(s) ____

____

Location of sample points, wells, borings, etc., with reference to three permanent reference points.
Measure all distances, clearly label roads, wells and permanent features.

N

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Date: ____________________

SAMPLE INFORMATION RECORD

Site: ____________________ **Sample Crew:** ____________________

Sample Location/Well No. ____________________

Field Sample I.D. Number ____________________ **Time** ____________________

Weather ____________________ **Temperature** ____________________

Sample Type:

Groundwater ____________________ **Sediment** ____________________

Surface Water/Stream ____________________ **Air** ____________________

Soil ____________________ **Other (describe, i.e. water, septage, etc.)** ____________________

Well Information (fill out for groundwater samples)

Depth to Water ____________________ **Measurement Method** ____________________

Depth of Well ____________________ **Measurement Method** ____________________

Volume Removed ____________________ **Removal Method** ____________________

Field Test Results

Color ____________________ **pH** ____________________ **Odor** ____________________

Temperature (°F) ____________ **Specific Conductance (umhos/cm)** ____________________

Other (OVA, Methane Meter, etc. ____________________

____

Constituents Sampled

____________ ____________ ____________ ____________

____________ ____________ ____________ ____________

Remarks:

____

____

____

Well Casing Volumes

GAL/FT	**1¼" = 0.077**	**2" = 0.16**	**3" = 0.37**	**4" = 0.65**
	1½ =0.10	**2½ " = 0.24**	**3½ = 0.50**	**6" = 1.46**

Survey Requirements for the Hempstead/Intersection Street
Former MGP Site Investigation

Introduction

The purpose of this memorandum is to provide the KeySpan Energy Corp. (KSE) survey crew and drafting department with clear direction as to the survey needs related to the Hempstead/Intersection Former MPG Site Investigation currently scheduled to begin in mid-July 2000. A second objective is to formalize field survey data documentation and data deliverable procedures that have evolved since undertaking the Former MGP Site Investigation program in August of 1999.

Initial Site Survey and Development of Site Grid

D&B have recently received a copy of the KSE site survey for the Hempstead/Intersection Street site, which includes a 100-foot grid. We request a digital copy of this survey in AutoCAD Version 14 so that we can overlay the same grid on our sample map and at the same time ensure that our sample map is consistent with KSE's current survey, i.e. consistent property boundaries, building details etc. The establishment of this 100-foot grid on the site and properties directly to the east and ____ of the site by the KSE survey crew is requested to assist in the location of proposed sample locations.

Sample Point Survey Requirements

All completed sample points and air monitoring stations completed or utilized during the completion of the field investigation will require surveying. This will include but not limited to:

- Completed soil borings and soil probes
- Surface soil samples
- Groundwater probes
- Soil Vapor Probes
- Test Pits and Trenches
- Installed Groundwater Monitoring Wells
- Existing Monitoring wells
- Ambient Air Samples
- Perimeter Air Monitoring Stations
- Surface Water\Storm Water and Sediment Sample Locations
- Surface Water Staff Gages

We have included a current list of all proposed sample points to be completed under this investigation program. Please note that this list will likely evolve with the progression of fieldwork and we will periodically provide the KSE Survey crew with an updated list.

Note that all points will require at a minimum an "x" coordinate, "y" coordinate and a "z" coordinate. All survey points should be within an accuracy of +- 0.01-foot. The X/Y coordinate system should be in the New York State Plane Coordinate System or other coordinate system already established for the site by KSE. However, while currently proposed off-site sample points are relatively close to the site, there is a potential for future points to be some distance from the site, possibly by as much as 1 mile. This should be considered when selecting the coordinate system given the same coordinate system must be maintained through the completion of this project.

All elevation data should be in accordance with the National Geodetic Vertical Datum (NGVD) of 1927. Additional survey requirements are as follows:

Existing and New Groundwater Monitoring Wells

It is critical that "top of casing" elevations for all monitoring wells be completed as uniformly and accurately as possible given they will become established reference points to be used in obtaining groundwater potentiometric head measurements critical in characterizing study area hydrogeology. Attachment A consists of a schematic of the two most commonly used monitoring well construction types used in site investigations showing the two points requiring elevations: the ground surface elevation and the top of casing elevation. For consistency, we request that the KSE survey crew place a small notch on the north side of each well casing rim and use this notched point as the measuring point for the top of casing elevation. This will require the KSE survey crew to open the protective cover of each well and remove the locking plug on each well prior to measuring the top of casing elevation.

Test Pits and Trenches

Upon completion of each test pit, the corners of the excavation will be staked by D&B. It is requested that the KSE survey crew survey all staked corners of the completed test pits and trenches so that the dimensions on each pit can be accurately represented on the sample location map.

Survey Scheduling

Throughout the completion of the field investigation program, D&B will work closely with the KSE on-site manager in scheduling the KSE survey crew. It is anticipated that the KSE survey crew will be requested periodically throughout the course of the field investigation to survey completed points. We will only request the survey crew after several dozen points have been completed so that the crew will have at least one full day of work. It is anticipated that all planned sample points to be completed under the currently scoped Hempstead/Intersection Street Former MGP Investigation will take a two man survey crew 4 to 6 days to fully survey.

Survey Data Documentation

We request that the KSE survey crew work closely with the D&B Field Operations Manager and the KSE on-site manager to ensure all sample points are correctly surveyed and proper sample designations are used. It is requested that the KSE survey crew use the attached sample list to record which sample points have been surveyed. This will facilitate ensuring all sample points have been surveyed and proper sample labels have been used to record the generated survey data.

Survey Data Deliverables

Note that the following directions and specifications are intended to facilitate efficient and rapid development by D&B of the GIS-Key database for the Hempstead project and the subsequent development of data graphics to be used in the investigation report.

We request the KSE survey/drafting department draft a sample location map based on the previously provided site survey. Note that, prior to developing this map, consideration should be made for the possibility that additional off-site sample points may be required in the future which may be located some distance from the site. This may require the development of a second "off-site" sample map or the extension of the existing survey map to cover these points. However, at this time only one sample map appears to be needed.

We request that the KSE drafting department maintain the same sample location symbols which D&B has been developed for the overall KSE Former MGP Site Investigation Program. The list of sample symbols are provided as Attachment B. Please note that we can provide KSE an AutoCAD Release 14 digital file with these exact symbols, if needed.

We request that the sample map be provided to D&B in digital format as an AutoCAD Release 14 document. All existing monitoring wells, historic sample points and completed sample points should be provided as separate layers within the provided AutoCAD file. Only sample points should be included in the grouped layers. Finally, we request a separate ASCII text file with all surveyed sample points. This information should be grouped exactly as the AutoCAD layers described above with existing monitoring wells, historic sample points and completed sample points provided as separate text files.

G:\TFox\Hempstead\Survey Requirements for the Hempstead.doc

Dvirka and Bartilucci CONSULTING ENGINEERS A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.	**Project No.:** **Project Name:**	**Test Pit No.:** **Sheet of** **By**:
Contractor: **Operator:** **Equipment:**	**Geologist:** **Test Pit Method:** **Date Started:** **Date Completed:**	**Test Pit Completion Depth:** **Ground Surface Elevation:** **Test Pit Dimension(s):**

Weather Conditions:

Depth *(ft.)*	**OVA** *(ppm)*	**PID** *(ppm)*	**Description of Materials**	**Remarks**
-0-				
-1-				
-2-				
-3-				
-4-				
-5-				
-6-				
-7-				
-8-				
-9-				
-10-				

NOTES: