Bristol Myers Squibb™

Joshua Cook, P.E.
Professional Engineer 1
New York State Department of Environmental Conservation
615 Erie Blvd West, Syracuse, NY 13204

May 18, 2022

C734138
Bristol-Myers Squibb
Acceptance of NYSDEC Comments on Ley Creek Delineation Work Plan

Dear Mr. Cook,

We are in receipt of the May 5, 2022 New York State Department of Environmental Conservation (NYSDEC) letter, approving as modified the April 4, 2022 Ley Creek Delineation Work Plan (work plan) for the Bristol-Myers Squibb (BMS) Restoration Area, prepared on behalf of BMS by B&B Engineers & Geologists of New York, P.C., an affiliate of Geosyntec Consultants, Inc. Following review of the letter, BMS finds NYSDEC proposed modifications acceptable. As requested, a copy of this BMS acceptance letter and the NYSDEC approval letter will be attached to the front of all copies of the work plan and provided to all field staff that will be conducting the work.

In accordance with Section 3.2 of the work plan, a site reconnaissance is planned to evaluate sediment sampling locations. The NYSDEC requested a minimum of 14 days advanced notice of the planned site reconnaissance. Geosyntec has proposed a two-day field event for the site reconnaissance on June 6-7, 2022 (one day to review background locations and a 2nd day to review downstream locations). Please advise your ability to accommodate these dates.

Please contact Anne Locke at 315-432-2660 or anne.locke@bms.com with any questions.

Sincerely,

Ketan Gujarathi
General Manager, Syracuse

EHS Central Files

Ec:
Gary Priscott (NYSDEC)
Rebecca Quail (NYSDEC DFW)
Mary Jo Crance (NYSDEC DFW)
Sara Bogardus (NYSDOH)
Scarlett McLaughlin (NYSDOH)
Richard Mator (BMS)
Kirk Wolfgang (BMS)
Anne Locke (BMS)
William Pufko (BMS)
Robert Tyson (Bond)
Ron Arcuri (Geosyntec)
Jean Zodrow (Geosyntec)
Dan Elliott (Geosyntec)
Susan Welt (Geosyntec)

Ketan Gujarathi
Sr Director, General Manager,
Syracuse | GPS

PO Box 4755
Syracuse, NY 13221
bms.com

Office +1 315 432-2079
ketan.gujarathi@bms.com

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Environmental Remediation, Region 7
615 Erie Boulevard West, Syracuse, NY 13204-2400
P: (315) 426-7519, (315) 426-7551 | F: (315) 426-2653
www.dec.ny.gov

May 5, 2022

Ketan Gujarathi
Senior Director, General Manager, Syracuse
Bristol-Myers Squibb Company
PO Box 4755
Syracuse, NY 13221

Re: Bristol-Myers Squibb Restoration Area, Site ID No. C734138
Village of East Syracuse, Town of DeWitt, Onondaga County
Sediment Delineation Work Plan - April 2022

Dear Ketan Gujarathi:

The New York State Department of Environmental Conservation (Department) has reviewed the *Ley Creek Delineation Work Plan* (work plan) for the Bristol-Myers Squibb Restoration Area (site), dated April 4, 2022, which was prepared by B&B Engineers & Geologists of New York, P.C., an affiliate of Geosyntec Consultants, Inc. (Geosyntec) on behalf of the Bristol-Myers Squibb Company (BMS). With the following modifications, the work plan is approved.

1. There were revisions completed to the October 2020 version of the Fish and Wildlife Resources Impact Analysis (FWRIA). The final, approved version is dated February 2021.

2. Section 2.3, 4th Paragraph, 2nd Sentence – In 2015, background samples were collected in the South Branch of Ley Creek (Ley Creek) at five locations (ULC-1 through ULC-5).

3. Section 3.3 – The Department understands that the number of background samples, n, proposed to be collected from each background area represents the total number of samples to be collected, which are proposed to be collected from several locations in the vicinity of the background locations identified on Figure 8. The actual sampling locations for both Ley Creek and Headson's Brook will be determined during the Study Area Reconnaissance as specified in Section 3.2.

   The work plan is modified for Ley Creek as follows:

   a. Background samples must be collected along the stretches of Ley Creek identified on the attached figure in yellow, which include:

i. the stretch beginning north of (downstream of) Interstate I-690, extending approximately 500 feet north to West Second Street, then extending approximately 600 feet generally west along the south side of West Second street, ending before the culvert under West Second Street; and

ii. the stretch beginning approximately 125 feet south of the CSX railroad property, where Ley Creek exits a ponded area, extending north approximately 250 feet to the southern side of the BMS wastewater treatment facility (excluding the culverted sections under the rail lines), then extending approximately 650-700 feet generally to the west along the south side of the BMS wastewater treatment facility.

b. A total of 20 samples must be collected.

c. Background samples must also be analyzed for polychlorinated biphenyls (PCBs) and target analyte list metals. This will be necessary, at a minimum, to support any toxicity testing that may be necessary in the future, as per Data Quality Objective (DQO) #3, and might support other DQO's.

4. Section 3.3 – As per the Department's guidance document *DER-10: Technical Guidance for Site Investigation and Remediation* dated May 2010, as updated by its Errata Sheet (DER-10), section 3.8.3(c)(1), the statistical methodology that will be used to calculate background contaminant concentrations must be defined in the work plan. The background concentration must be calculated as the 75th percentile concentration after removing outliers. An outlier is defined, for the purposes of this work plan, as a concentration greater than 1.5 times the range of the 25th to 75th percentile added to the concentration of the 75th percentile. The background sample data must be transformed to natural logarithms before performing the outlier test, because it is assumed that natural background chemical concentrations are log-normally distributed.

5. Section 3.3, Section 4.2, Table 3, & Figure 8 – BCP-SED-ULC-7 already exists, and it is not near the proposed location, so the sample ID must be modified.

6. Section 3.5 – The Department's evaluation of the results will not be limited to the Indicator Compounds, though their presence or absence will be part of the consideration of the results.

7. Section 4 – Sampling for per- and polyfluoroalkyl substances (PFAS) at one background location for Headson's Brook and three for Ley Creek is not sufficient. See DER-10, in particular sections 3.8.3(b).2.ii. and 3.8.3(c). Samples must be collected from at least five upstream locations. Samples must be collected at UHB-1, UBH-2, UHB-3, UHB-4, UHB-5, ULC-2, ULC-3, ULC-4, and ULC-5 as done for other contaminants. Sampling at the stormwater outfalls along Burnet Avenue, as proposed, is acceptable. Given the proximity of ULC-1 to the proposed Burnet

Avenue stormwater outfall samples, BMS/Geosyntec can evaluate if ULC-1 should be included as a sampling location or not.

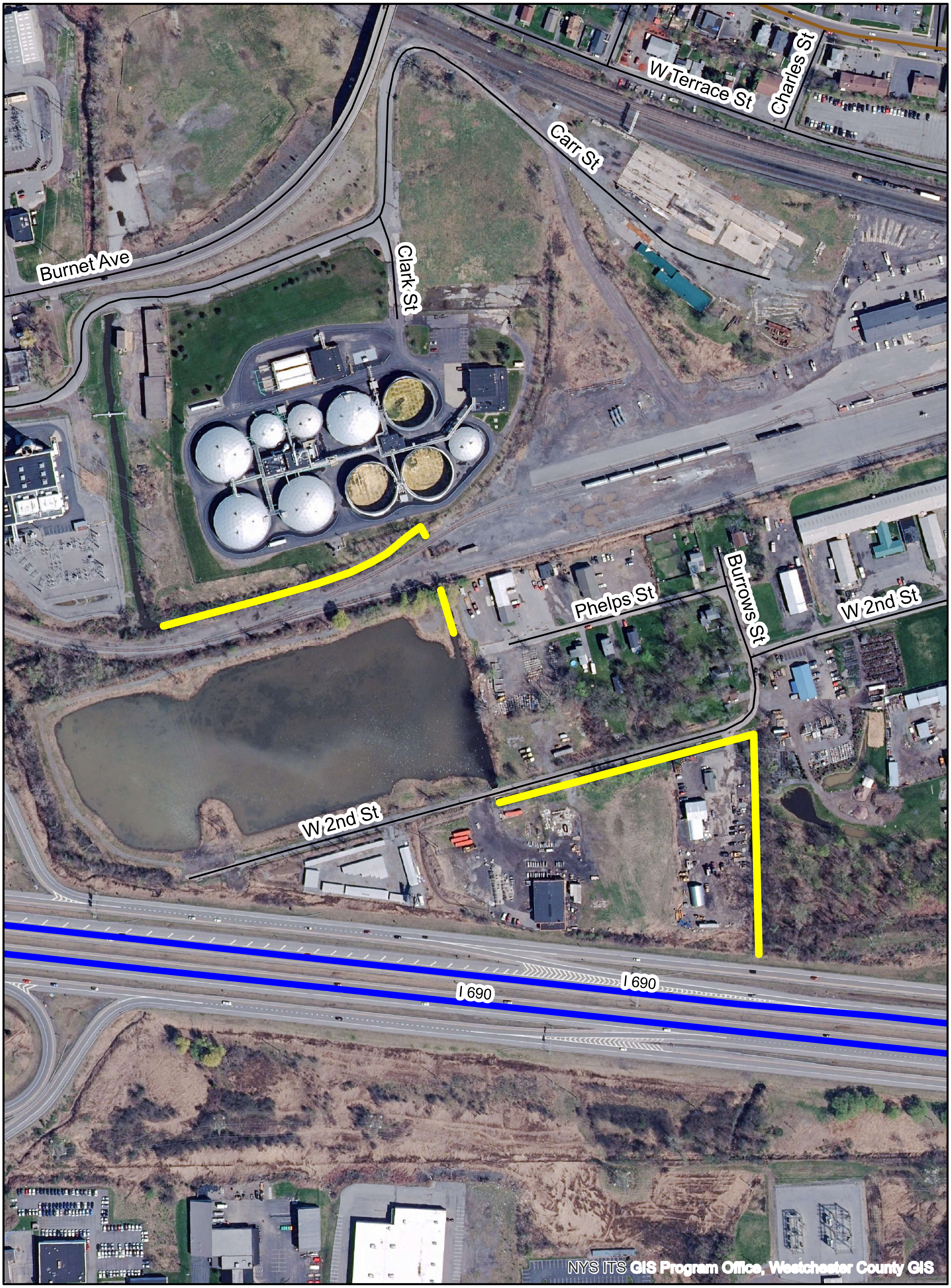
Pursuant to 6 NYCRR 375-1.6(d)(3), BMS must respond in writing within 15 days as to whether the modifications will be accepted. If accepted, BMS/Geosyntec's acceptance letter and this letter must be attached to the front of all copies of the work plan and provided to all field staff that will be conducting the work. Alternatively, BMS/Geosyntec can submit a revised work plan within 30 days of the date of this letter. If you have any questions, please do not hesitate to contact me at 315-426-7411 or joshua.cook@dec.ny.gov.

Sincerely,

Joshua P. Cook, P.E.
Professional Engineer 1

Enclosure

ec: Gary Priscott (NYSDEC)
Joshua Cook (NYSDEC)
Rebecca Quail (NYSDEC DFW)
Mary Jo Crance (NYSDEC DFW)
Scarlett McLaughlin (NYSDOH)
Sara Bogardus (NYSDOH)
Ketan Gujarathi (BMS)
William Pufko (BMS)
Rich Mator (BMS)
Kirk Wolfgang (BMS)
Anne Locke (BMS)
Ron Arcuri (Geosyntec)
Jean Zodrow (Geosyntec)
Dan Elliott (Geosyntec)
Susan Welt (Geosyntec)



W Terrace St
Charles St
Carr St
Burnet Ave
Clark St
Phelps St
Burrows St
W 2nd St
W 2nd St
I 690
I 690
NYS ITS GIS Program Office, Westchester County GIS

Prepared for

Bristol-Myers Squibb
Syracuse North Campus Restoration Area
3551 Burnet Avenue
East Syracuse, NY

Revised Ley Creek Delineation Work Plan

NYSDEC Site ID # C734138

Prepared by

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

Geosyntec consultants
engineers | scientists | innovators

5313 Campbells Run Rd #150
Pittsburgh, PA 15205

Project Number MP1886

April 2022

CERTIFICATION

I Susan Welt certify that I am currently a NYS registered professional engineer [as defined in 6 NYCRR Part 375] and that this Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

Susan B. Welt 4 APRIL 2022

Susan B. Welt, M.P.H., P.E. (NY)

STATE OF NEW YORK
SUSAN BETH WELT
084913-1
LICENSED PROFESSIONAL ENGINEER

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

ACRONYMS AND ABBREVIATIONS

ACC	American Chemistry Council
BDA	BMS Brownfield Development Area
BMS	Bristol-Myers Squibb Company
Bureau Veritas	Bureau Veritas North America at Lake Zurich, Illinois
COPEC	Contaminants of Potential Ecological Concern
CSM	Conceptual Site Model
DER	Division of Environmental Remediation
DQO	Data Quality Objectives
ERA	Ecological Risk Assessment
Eurofins	Eurofins Lancaster Laboratories Environmental LLC in Lancaster, Pennsylvania
FWRIA	Fish and Wildlife Resources Impact Analysis
Geosyntec	B&B Engineers & Geologists of New York, P.C., a subsidiary of Geosyntec Consultants, Inc.
Ley Creek	South Branch of Ley Creek
MIBK	methyl isobutyl ketone
NYSDEC	New York State Department of Environmental Conservation
PCB	Polychlorinated Biphenyl
PFAS	Per- and Polyfluoroalkyl Substances
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SGV	Sediment Guidance Values
SVOC	Semivolatile Organic Compound(s)
TAL	Target analyte list
TOC	Total Organic Carbon
VOC	Volatile Organic Compound(s)
Work Plan	Ley Creek Delineation Work Plan

1. INTRODUCTION

On behalf of Bristol-Myers Squibb Company (BMS), B&B Engineers & Geologists of New York, P.C., a subsidiary of Geosyntec Consultants, Inc. (collectively, Geosyntec) is providing this Ley Creek Delineation Work Plan (Work Plan) to the New York State Department of Environmental Conservation (NYSDEC) for the BMS Syracuse North Campus Restoration Area Brownfield Development Area (BDA) Site No. C734138. The results of a Fish and Wildlife Resources Impact Analysis (FWRIA) Step 1 (Pathway Analysis) through Step 2B (Criteria-Specific Analysis) performed by Arcadis (2020) indicated that complete exposure pathways between contaminants associated with the BDA in sediment and benthic invertebrates are present in Ley Creek. Because select BDA process-related chemicals have been detected at the furthest downstream sediment sample location within Ley Creek in the area previously investigated, NYSDEC has requested delineation of the extent of contamination in Ley Creek sediment downstream from the BDA in its April 23, 2021 letter.

This Work Plan, prepared in accordance with the NYSDEC (2010) DER-10 Technical Guidance for Site Investigation and Remediation and the NYSDEC (2014a) Screening and Assessment of Contaminated Sediment guidance, provides the rationale, scope, and methods for additional delineation-related sediment sampling to address NYSDEC comments, and distinguish BMS-specific contaminants of potential ecological concern (COPEC) from regional contaminants with elevated (i.e., concentrations that exceed NYSDEC Class A Sediment Guideline Values [SGV]) concentrations present in Ley Creek sediment.

1.1. BDA Location

The BDA is a 24-acre parcel of the BMS Syracuse North Campus facility located at 3551 Burnet Avenue, East Syracuse, New York (**Figure 1**). The BMS Syracuse North Campus facility is bound by the CSX railroad to the northeast, Burnet Avenue to the south, and Thompson Road to the west. The BDA is bound by approximately 4.5 acres of mixed greenspace and pavement to the northwest, current BMS manufacturing operations to the east, parking areas to the south, and Thompson Road to the west. The South Branch of Ley Creek (Ley Creek) runs south to north approximately 900 feet (ft.) east of the BDA and receives discharges from the BDA stormwater system. The focus of this Work Plan is the Study Area which is defined as Ley Creek from its emergence at the northern side of the CSX railroad overpass extending for approximately 1500 ft. downstream in Ley Creek along with tributaries to this section of Ley Creek.

1.2. Project Team

The Geosyntec Project Team for implementation of this Work Plan is led by Dr. Jeanmarie Zodrow. Dr. Zodrow will be the day-to-day lead on sediment investigation activities and data analysis. The project chemist and Quality Assurance Manager is Ms. Julia Caprio. Ms. Caprio will be responsible for coordination with laboratories regarding sample volumes, logistics, schedule, detection limits and matrix interferences, and ensuring overall data quality. Data validation will be performed by Geosyntec's chemistry group located in Knoxville, Tennessee, led by Ms. Caprio. The Field Team lead and Health and Safety Officer will be Joel Conzelmann.

Analytical support is provided by the New York State Environmental Laboratory Accreditation Program certified Eurofins Lancaster Laboratories Environmental LLC in Lancaster, Pennsylvania (Eurofins), and Bureau Veritas North America at Lake Zurich, Illinois (Bureau Veritas).

Contact information for Project Team Members is provided in **Table 1**; qualifications are provided in **Attachment A.**

1.3. Objectives

Based on the location of the BDA, there are potential off-site sources of COPECs that will impact Ley Creek, both upstream and downstream of the BDA. However, as these sources are unrelated to historical activities at the BDA, the delineation approach needs to account for external sources.

Therefore, the purpose of this Work Plan is to obtain information to:

1) Define BDA-specific compounds; and

2) Delineate the nature and extent of potential impacts from BDA-process related (i.e., BDA-specific) compounds to ecological receptors in the downstream area of Ley Creek.

BDA-specific compounds are compounds associated with processes historically performed in the BDA (i.e., no other potential source anticipated) and, as such, would not be present in upstream sediment and would be expected to decrease in sediment with distance downstream of the BDA.

The following sections of this Work Plan provide the scope and methods for delineation sampling for Ley Creek and provide a lines of evidence approach to evaluate what impact, if any, is apparent in sediment as a result of BDA-operations.

2. BACKGROUND

Development of the Site began in 1943 and the BDA formerly was primarily covered with buildings, parking lots, and access roads. A transformation project completed in 2012 resulted in the demolition of multiple buildings and the conversion of portions of the BDA to greenspace. The BDA, now primarily covered with green space and paving, is located in a mixed industrial, commercial, and residential area. The BDA is generally not accessible to the public or wildlife due to its location within a larger BMS property which is a restricted access, secure facility. Topography at the BDA slopes toward Ley Creek to the east and Headson's Brook to the north.

The BDA has been undergoing remedial investigation (RI) work under the RI Work Plan (O'Brien & Gere Engineers, Inc. 2013) as approved with modifications by the NYSDEC (April 3, 2013), and accepted by BMS (April 18, 2013). The Step 1A FWRIA was completed following the approved Phase 1A Remedial Investigation Work Plan – Fish and Wildlife Resources Impact Analysis Module (Arcadis, 2014) and Phase 1A Remedial Investigation Work Plan – Sediment Sampling Module Addendum (Arcadis, 2019). Arcadis (2020) details the FWRIA Step 1A analysis, which describes cover types, wetlands, and ecological communities in the vicinity, according to Ecological Communities of New York State, Second Edition (NYSDEC, 2014b). Briefly, the majority of the surrounding area is represented by residential/commercial/industrial land uses, including homes, commercial shopping centers, industrial facilities, and impervious surfaces (e.g., roadways, parking lots). A limited amount of landscaped vegetation exists in these areas. Successional old field and successional northern hardwood are located in isolated areas along the riparian corridor of Ley Creek.

Surface water bodies in the vicinity of the BDA include the South Branch of Ley Creek (a Class C Stream) located approximately 900 ft. to the east and Headson's Brook (a drainage ditch), located approximately 70 ft. to 500 ft. to the northeast, both of which receive stormwater from areas of the BDA via a series of five outfalls **(Figure 2)**. Ley Creek also receives urban stormwater from outfalls near the Burnet Avenue overpass and other portions of the BMS facility (**Figure 2**).

2.1. <u>Ley Creek</u>

As noted by Arcadis (2020), a review of historical aerials shows that since 1939, Ley Creek has been highly channelized to flow along railroad tracks and roads. The South Branch of Ley Creek originates as a series of small tributaries and drainage ditches in what is currently a commercial shopping area between Erie Boulevard East and the Interstate 690, and drainage ditches along Interstate 690. Ley Creek runs below Interstate 690 and travels north past a large retention pond and multiple industrial or warehouse facilities while making multiple 90 degree turns along roadways prior encountering the stormwater system outfalls originating from the BDA.

The historical pathway of Ley Creek is compared to its current configuration in **Figure 3**. The sharp turns observed in Ley Creek upstream of Burnet Avenue support that Ley Creek no longer represents a natural stream and has been highly modified over time. South of Burnet Avenue, localized areas of freshwater emergent wetlands are present as shown in Arcadis (2020).

Following the confluence with Headson's Brook, the South Branch of Ley Creek immediately passes below a major CSX railroad line. Emerging on the north side of the railroad, Ley Creek turns sharply to the west and travels for approximately 750 ft. before turning sharply north again. As noted above, the nature of Ley Creek reflects an altered, channelized water body rather than a naturally meandering stream. Ley Creek curves to the west at West Manlius Street and continues northwest with a more natural meander where it is joined by an unnamed tributary and later by Sanders Creek before continuing to the main branch of Ley Creek. The land use surrounding Ley Creek within and further downstream of the Study Area is primarily residential to the east and mixed commercial and industrial to the west.

A review of the NYSDEC Info Locator mapping system provides an overview of current industrial facilities and potential discharges into Ley Creek within the Study Area **(Figure 4a)**. Just east of where Ley Creek passes beneath the CSX railroad line, at 617 W Manlius Street, a wood treatment facility is located and permitted to discharge up to 12.5 tons of volatile organic compounds (VOC) per year via air emissions. Two closed 4,000-gallon capacity petroleum bulk fuel storage tanks associated with a metal production facility are also located at 617 W Manlius Street. These facilities are not directly adjacent to Ley Creek, but based on visual reviews, runoff from these facilities is inferred to reach a road and drainage ditch that runs along the CSX railroad prior to discharging into Ley Creek. Facilities adjacent to Ley Creek downstream of the confluence with Headson's Brook include a granite supply company (114 Marcy Street), an auto repair shop (701 W Manlius Street), a medical supply company (103 Horton Place), a manufacturer of industrial drum handling equipment (727 W Manlius Street), and a Wegmans grocery store (4256 James Street), along with some residential buildings along W Manlius Street. All the Study Area commercial and industrial properties include extensive areas of impermeable surfaces that may contribute contaminants into Ley Creek in stormwater runoff. The structures currently present have been there since at least 1995 based on a review of historical satellite images. Notably, in 1995, a ditch appears to bisect Ley Creek, providing additional stormwater input from the CSX railroad and the drum manufacturing facility (**Figure 4b**). A detailed review of historical owners has not been performed.

A search of spills to this portion of Ley Creek from the NYSDEC Spill Incidents Database identified one gasoline spill into Ley Creek reported near W Manlius Street. An unknown amount of gasoline was released into Ley Creek on August 26, 1992, from an unknown source. The database also returned spill results along the CSX railway, including a spill of 2000 gallons of diesel fuel approximately 1.7 miles north along the railway following a train derailment in 2013.

To the east of where Ley Creek bends north at Wegmans, a drainage ditch appears to run between the CSX railroad and Wegmans prior to discharging into Ley Creek. Beyond the Study Area, Ley Creek continues to run alongside major roadways, multiple bulk fuel storage facilities, and a waste transfer facility. At least two industrial operations (an aluminum recovery facility and a wastewater facility) are permitted to discharge into Ley Creek directly.

2.2. Preliminary Habitat Descriptions

Limited habitat is present at the BDA. The small riparian corridor near Ley Creek may provide habitat for some small mammals and birds, but a limited number of individuals would be expected due to the small size of the successional old field and successional northern hardwoods present. High quality habitat is not present in the paved and landscaped portions of the BDA; however, common species in mixed residential/industrial areas may be observed (e.g., racoons, squirrels, songbirds).

Ley Creek is a first to second order headwater stream that has been highly channelized and altered to provide efficient stormwater drainage for the 30-square mile watershed. Proximal to the stormwater outfalls from the BDA, channel width averages 12 feet, bank heights are approximately 3 feet, and water depths range from a few inches to several feet, depending on conditions. The sediments of Ley Creek in this area are primarily silts and sands overlying gravel and cobbles. Sediment samples collected along Ley Creek and upstream of Burnet Ave are generally described as silts to sands with a higher gravel content observed in limited areas of higher flow, such as in the vicinity of municipal stormwater outfalls.

The NYSDEC stream classification system indicates that Ley Creek is a Class C waterbody, which is considered suitable for fish, shellfish, and wildlife propagation and survival. However, the limited area of upland habitat proximal to the BDA would reduce the frequency of wildlife use of Ley Creek. Habitat quality for aquatic life in Ley Creek is reduced on a regional level due to urban and industrial activities (NYSDEC, 2008).

2.3. Previous Sediment and Surface Water-Related Investigations

Sediment and surface water data were initially collected in 2015 and 2019 under NYSDEC-approved sampling plans to support FWRIA activities, including evaluating the nature and extent of compounds in the vicinity of stormwater outfalls.

In 2015, a total of 46 sediment samples plus three duplicate samples were collected from Headson’s Brook near Outfalls 001, 002, and 003, Ley Creek near Outfalls 007 and 009 and the upstream reaches of both Headson’s Brook and Ley Creek to characterize potential regional contamination and the nature of potentially depositional sediments. In general, samples were analyzed in the 0- to 6-inch and 6- to 12-inch intervals, and every 12 inches at greater depths. All locations were sampled to refusal, which ranged from less than 6 inches to 46 inches below sediment surface. All 2015 sediment samples were analyzed for semi-volatile organic compounds (SVOC), polycyclic aromatic hydrocarbons (PAH), inorganics (metals and cyanide), pharmaceutical compounds, polychlorinated biphenyls (PCB), pesticides, VOC, glycols, and alcohols.

In 2019, additional sediment sampling was conducted to further delineate contaminants in sediment. A total of 32 sediment samples were collected, including paired samples in depositional and mid-channel areas, and additional upstream sample locations. The 2019 sediment samples were analyzed for SVOC, PAH, inorganics (metals and cyanide) and VOC – a reduced analyte list that was determined based on the results of the 2015 sampling. All historical sediment sampling locations are shown in **Figure 5**.

As part of the 2015 sediment samples, background sediment samples were collected upstream of outfalls that serve the BDA area within Headson's Brook and Ley Creek. Background sediment samples were collected at five locations in Headson's Brook (UHB-1, UHB-2, UHB-3, UHB-4, and UHB-5) and seven locations in Ley Creek (ULC-1, ULC-2, ULC-3, ULC-4, ULC-5, ULC-6, and ULC-7) upstream of the BDA. In 2019, additional sediment samples were collected from upstream (background) locations (ULC-06 and ULC-07). To determine if there were significant differences between near-site and background datasets, hypothesis testing and comparison of site data to background screening levels (calculated as upper threshold levels [UTL]) were used. The 95/95 UTL (one-sided 95% upper tolerance limit for the 95th percentile) were calculated using USEPA's (2016) ProUCL version 5.1.002 software which incorporates criteria for selecting the most reliable method of UTL calculation. This method of establishing upper bounds for background is consistent with USEPA guidance (1989; 1992; 2009) and follows requirements for sample size, degree of censoring (detects), and data distribution or goodness-of-fit testing results.

Surface water samples were also collected from 10 locations in Ley Creek in the vicinity and upstream of BDA-related stormwater outfalls. Surface water samples were analyzed for SVOC and tentatively identified compounds, PAH, Target Analyte List metals, VOC, and water quality parameters.

All historical sediment and surface water data are provided in Arcadis (2020).

As discussed in the FWRIA [Arcadis (2020)], the Step 2B analyses resulted in no exceedances of TOGS 1.1.1 criteria in surface water samples collected in July 2019. In sediment, the Step 2B analyses resulted in the identification of the following refined COPEC in Ley Creek:

- Metals: barium, copper, lead, selenium, silver, and zinc were identified as refined COPEC. Lead and silver were identified as refined COPEC based on the high frequency of detection and exceedances of background and SGV. Barium, copper, selenium, and zinc were identified as COPEC based on Class C SGV exceedances, but hypothesis testing indicated that the samples in the vicinity of BDA-related outfalls were not statistically significantly elevated compared to background. Inorganics were evaluated as Effects-range median quotients and show that concentrations of metals are variable and highest in the background area of Ley Creek and along Ley Creek proximal to the BDA. None of the inorganic COPEC are process related and regional sources of metals such as stormwater appear to be significant contributors to concentrations in Ley Creek.

- VOC: Benzene, chloroform, methyl isobutyl ketone (MIBK), methylene chloride, and naphthalene were identified as refined COPEC based on background and SGV exceedances; however, exceedance frequency was low and VOC are generally not expected to drive toxicity in sediments due to their volatility. Contributions of VOC in sediment include both BDA-related and background sources. Cyclohexane was identified as a refined COPEC based on Class C SGV exceedance, but below Site-specific SGV. Ethyl ether, n-butanol, tert-butylbenzene, and tert-butanol were retained as uncertain COPEC due to a lack of SGV. Benzene, MIBK, methylene chloride, n-butanol, and tert-butanol are BDA-related COPEC.

- SVOC: 3&4-methylphenol and carbazole were identified as refined COPEC based on the high frequency of detection and exceedances of background and SGV. Additional SVOC (butylbenzyl phthalate, dibenzofuran, and phenol) were identified as COPEC, but are not considered risk drivers due to low frequency of detection or being below Site-specific SGV. Acetophenone and N,N-dimethylaniline are considered uncertain COPEC due to the lack of SGV. N,N-dimethylaniline is a BDA-related COPEC.

- PAH: Total PAH were identified as refined COPEC based on the high frequency of detection, exceedances of background and SGV, and PAH Toxic Units greater than one. However, evaluation of the PAH profile for sediment samples indicated an urban background fingerprint, and the role of historical sources and sediment deposition is unknown. PAH are not BDA-related compounds and regional sources of metals such as stormwater appear to be significant contributors to concentrations in Ley Creek.

- Total PCB: Total PCB were identified as a refined COPEC based on the frequency of detection and exceedances of SGV. Hypothesis testing indicated that the samples in the vicinity of BDA-related outfalls were not statistically significantly elevated compared to background. Due to high TOC in sediments that reduce bioavailability, PCB are not considered a risk driver. PCB are not BDA-related compounds.

- Pesticides: 4,4-DDT and 4,4-DDE were identified as refined COPEC based on the high frequency of detection, exceedances of background, and SGV. 4,4-DDD, aldrin, alpha-chlordane and endosulfan sulfate were identified as refined COPEC, but detection frequencies were low and/or hypothesis testing indicated that the samples in the vicinity of BDA-related outfalls were not statistically significantly elevated compared to background. Pesticides are not BDA-related compounds, though other BDA or facility uses are uncertain. There are regional sources of pesticides due to their persistence and extensive historical use.

- Alcohols and Glycols: Only methanol was identified as a refined COPEC; however, SGV exceedance was low, indicating methanol is unlikely to be a risk driver. Methanol is a BDA-related COPEC.

- Pharmaceuticals: Two pharmaceutical compounds were detected in sediments – tetracycline and penicillin V. Arcadis (2020) calculated Site-specific SGV for these compounds from probable no-effect concentrations from literature. Both pharmaceutical compounds were below their Site-specific SGV.

2.4. Conceptual Site Model

The conceptual site model (CSM) identifies the potential sources, impacted media, and chemical migration pathways, receptors, and potentially complete exposure pathways. Potential exposure pathways must meet specific criteria for an exposure to occur. The CSM for ecological receptors in Ley Creek is shown in **Figure 6**. Aside from necessary habitat for ecological receptors, a complete exposure pathway must include the following elements:

- Contaminant source (e.g., BDA-related discharges, stormwater, regional sources);
- Primary or secondary mechanisms for contaminant release and transport;
- Exposure point (e.g., sediments in Ley Creek);
- Feasible route of exposure (e.g., direct contact, incidental ingestion); and
- Receptor (e.g., benthic invertebrates).

A complete exposure pathway indicates the potential for contact between compounds reported in media and the ecological receptors that are present or have the potential to occur in Ley Creek at the BDA.

Potential sources and transport mechanisms that may have resulted in COPEC in Ley Creek upstream, at, and downstream of the BDA include:

- Historical discharges of BDA-related chemicals or wastes through outfalls;
- Stormwater-related discharges from BMS outfalls and municipal outfalls and settling of stormwater solids in depositional areas;
- Runoff from adjacent railways;
- Runoff from impervious surfaces adjacent to upstream portions of Ley Creek (e.g., I-690, Thompson Road, commercial shopping centers, properties with outdoor storage of scrap metal and other unknown materials that are visible on aerial images);
- Contributions from a large stormwater retention pond along the upstream reach of Ley Creek;
- Contributions from drainage ditches running both east and west and discharging into Ley Creek downstream of the BDA; and
- Stormwater runoff from multiple facilities along Ley Creek downstream of the BDA.

The relative contribution of these sources is not fully understood; however, regional sources (not BDA) appear to be the predominant source (Arcadis, 2020) based on:

- the high frequency of elevated (above SGV) concentrations of compounds (PAH and metals in particular) in upstream samples,

- physical indications of high-flow stormwater discharges from municipal stormwater outfalls (indicated by high gravel content and low fine material at municipal outfall locations), and

- the results of PAH forensic analysis, which indicates that PAH distributions reflect urban background sources.

Considering the contaminant types, and available habitat and food sources at the BDA, complete and significant exposure pathways are limited to the exposure of benthic invertebrates and other aquatic life to sediment-associated compounds in Ley Creek. There is a potential for wildlife receptors to forage in Ley Creek; however, the riparian corridor along Ley Creek is very narrow and additional upland areas provide low quality habitat that will not support a high number of individuals from a wildlife population. As the appropriate assessment endpoints for non-special status species is the protection of the wildlife community or population (EPA, 1997), a large enough chemically impacted area that supports a high enough proportion of a population to cause an effect is needed for adverse population level risks; research has indicated that typically 80 or more acres of impacted area and habitat is needed for adverse effects to wildlife populations to occur (Tannenbaum, 2005).

3. DOWNSTREAM LEY CREEK SEDIMENT INVESTIGATION

This section presents the sampling and analysis plan proposed to collect data to further delineate the extent of BDA-specific inputs to sediment in Ley Creek within the Study Area. This plan describes (i) the rationale for a phased sediment sampling approach where sampling locations directly downstream of the railroad overpass are sampled in Phase 1, with additional sample locations identified that will be sampled in Phase 2 if additional delineation is required; (ii) the field investigation and sampling strategy, including methods and proposed sampling locations; and (iii) target analytes, analytical methods, and analysis frequency.

3.1. Data Quality Objectives

Data Quality Objectives (DQO) were defined to guide the data collection and analysis, as outlined by EPA (2006). The specific DQO for the Downstream Ley Creek Sediment Investigation are provided below and summarized in **Table 2**:

- DQO #1: Define and delineate the extent of BDA-specific chemicals in the downstream portions of Ley Creek by:
  - Performing sediment sampling for PFAS at BDA outfalls, and from background locations, including near urban stormwater outfalls (located near the Burnet Avenue overpass). Should the type and concentrations of PFAS at BDA outfalls differ from those upstream, then PFAS will be included in the analyte list for sediment samples collected during the Phase 1 and, if needed, Phase 2 sampling events to further evaluate its downstream distribution;
  - Analyzing Phase 1 samples for a target list of BDA-specific sediment associated compounds and evaluating the presence of these compounds against relevant SGVs or upstream concentrations;
  - If Phase 1 sample results indicate the presence of BDA-specific sediment associated compounds above SGVs or background, additional Phase 2 samples will be collected. If B&B/BMS determine that Phase 2 sampling is not required, the validated PFAS and Phase 1 data will be submitted to the NYSDEC for review with a justification and request for approval to forego the Phase 2 sampling; and
  - Analyze sediment data using lines of evidence, including but not limited to concentration distribution in sediment and potential input from off-site sources, to determine the extent of BDA-specific compounds.
- DQO #2: Evaluate potential contributions from non-BDA sources to the downstream portion of Ley Creek by:
  - Collecting samples from unnamed tributaries to the east and west during Phase 1 and Phase 2, respectively;

  - Collecting sediment samples from areas anticipated to be impacted by stormwater runoff pathways and a historical drainage ditch; and
  - Analyze sediment data using lines of evidence, including but not limited to concentration distribution in sediment and potential input from off-site sources, to determine the extent of BDA-specific compounds.
- DQO #3: Obtain data to assist in guiding subsequent investigation activities, which may include toxicity testing by:
  - Collecting sediment samples from areas anticipated to be impacted by stormwater runoff pathways and a historical drainage ditch; and
  - Analyzing Phase 1 sampling locations for a target list of BDA-specific sediment associated compounds and evaluating the presence of these compounds against upstream concentrations.

3.2. BDA Sample Locations

The Study Area for this Downstream Ley Creek Sediment Investigation includes the area immediately downstream of the railroad crossing of Ley Creek and extending for approximately 750 feet downstream in Ley Creek, along with tributaries to this portion of Ley Creek. This Study Area was determined based on areas of sediment deposition, stormwater runoff, and other non-BDA related inputs. Sample locations reflect the use of a phased, iterative sampling approach. Approximately one month prior to the collection of Phase 1 sediment samples, a Study Area Reconnaissance will be performed, including:

- a visual survey of potential non-BDA inputs to the sample locations. As needed, sampling locations will be adjusted to target potential non-BDA contributions to Ley Creek.
- sediment probing of each sample location to evaluate sediment thickness and whether the proposed location is within a depositional or an erosional area. Sediment sample locations will be adjusted to target areas of deposition with sufficient sediment thickness (minimum of 24 inches of sediment) for sample collection.
- evaluating and collecting a sample from the sample location LC-SED-20 during Phase 1 if no other depositional areas with sufficient sediment thickness are observed upstream within the Phase 1 or Phase 2 reaches .
- PFAS sampling upstream of the Study Area (as described in Section 4).

NYSDEC will be notified at least 14 days in advance of the Study Area Reconnaissance to allow in-field review of sediment sampling locations by NYSDEC.

The total number of sampling locations along Ley Creek (n = 12) was determined using Balduck's Method, as outlined in NYSDEC (2014). Sample locations were placed for spatial coverage and considering the following criteria (**Figure 7** and in **Table 3)**:

- One sediment sample location will be placed at the immediate exit of Ley Creek from the railroad crossing.
- Sediment sample locations have been placed at bends in Ley Creek where water velocity is expected to be slow and sediment deposition to occur. Samples in depositional areas will be collected from the bank with expected higher deposition.
- Sediment sample locations have been placed as close as possible to areas of expected discharges, including likely stormwater runoff pathways, based on visual observations, and the location of a historic drainage ditch from the CSX and other properties based on historical photo reviews.
- Sediment sample locations have been placed in areas adjacent to Ley Creek where unnamed tributaries may contribute chemical discharges from non-BDA sources.

3.3. Background Sample Locations

Technical Guidance for Site Investigation and Remediation dated May 2010, as updated by its Errata Sheet (DER-10), background sediment samples should not be collected from areas impacted by the site or "adjacent contaminated sites" (see 3.8.3(b)2.ii.(3)) unless it can be "demonstrated that the contamination in the area is due to generally occurring pollution related to the urban or industrial nature (anthropogenic) of the surrounding area" (see 3.8.3(b)2.ii.(4)). In light of this guidance, BMS, NYSDEC, and Geosyntec representatives participated in a site visit on November 16, 2021 to identify potential background sample locations. Prior to the site visit, NYSDEC Division of Fish and Wildlife performed a desktop pre-screening of candidate background sampling locations to be evaluated in the field. The candidate sample locations were evaluated based on their potential to reflect a similar setting, flow rate, and substrate as Ley Creek in the vicinity of the BDA as well as being located outside of the mixing zone of stormwater discharge from properties with State Pollution Discharge Elimination System permits or of known or listed hazardous waste sites. Eight potential background locations were evaluated during this site visit based on NYSDECs desktop pre-screening.

A letter summarizing the observations from the site visit was provided to the NYSDEC on February 2, 2022 (B&B, 2022). As stated in the letter, a background location was identified on the South Branch of Ley Creek between the Carr Street Generating Station and CSX railroad tracks with a similar setting, flow rate, and substrate observed in the vicinity of the BDA. This location is being recommended as an additional background sample location and will be named BCP-SED-ULC-7 (see **Figure 8**). The total number of upstream samples in Ley Creek (n=10) and in Headson's Brook (n=9) was determined using Balduck's Method, as outlined in NYSDEC (2014). Multiple samples will be collected upstream and downstream of the proposed background locations (BCP-SED-UHB-1 and BCP-SED-ULC-7) to augment the existing sediment data and complete the total number of samples needed. Sediment samples will be collected from these background locations for analysis of VOC, SVOC, alcohols, pharmaceuticals, and total organic carbon (TOC) as described in **Section 3.4**, and for PFAS as described in **Section 4**.

3.4. Sediment Sample Collection

Nine sediment sample locations are proposed for Phase 1, and if needed, an additional six sediment sample locations are proposed for Phase 2. At each proposed sediment sampling location, samples will be collected from areas of sediment deposition and from mid-channel areas if sandy or silty sediments are observed. Samples will be collected at the following depth intervals:

- 0- to 6-inch surface sediment;
- 6- to 12-inch sediment;
- 12- to 24-inch sediment; and
- At 12-inch increments until refusal in areas where sediment depth allows.

Samples will also be collected from distinct layers of sediment greater than 6 inches that are identifiable by color, particle size, or other physical characteristics or where free product or non-aqueous phase liquid is observed. A photoionization detector reading will be taken at each sampling interval and recorded in the field log.

Sampling will be performed consistent with previous sampling events, as described in Arcadis (2020) and as detailed in the Quality Assurance Project Plan (QAPP), which is included as **Attachment B**, and in accordance with the sampling-specific Task Hazard Analysis (**Attachment C**).

Beginning at the farthest downstream location for each phase of work and proceeding to each subsequent upstream location, sample locations will be reached by wading through the water; the horizontal coordinates will be documented via a handheld Trimble GeoXT 5000 global positioning system unit. Samples will be collected using 2-inch to 3-inch acetate core tubes (e.g., Lexan tube) that will be hand-driven or driven with the support of a slide-hammer depending on sediment texture and depth to refusal. Each core will be driven into the creek channel sediment until refusal is met and retrieved by slowly pulling the filled sleeve out at an angle. If needed to extract the cores and prevent losing the sediment sample, water may be placed in the core tube above the sample. If this is done, water will be used from the sampling location, preferably from the bottom of the water column if possible. If refusal is met at less than 6 inches, three attempts within a 4-foot area will be made to sample to a greater depth. If a greater depth is not achieved, a 6-inch sample will be collected using a ponar or another comparable grab sampling device. Upon retrieval of the sleeve, cores will be capped and labeled for processing.

Cores will be opened lengthwise and characterized for surface cover, layering, and anoxic layers. Sediment samples will then be collected from discrete depth intervals, as defined above, taking care not to collect sediment from the smear zone. Sediment cores will be processed and sampled in accordance with the QAPP (**Attachment B**). For each sediment sample, a sediment sampling field form will be completed for documentation (an example Sediment Sampling Field Form is provided in **Attachment D**). Field duplicates, equipment blank samples, and other quality assurance and quality control samples will be collected in accordance with the QAPP.

3.5. Chemical Analysis

Laboratory analysis will be performed on sediment samples by Bureau Veritas for the pharmaceutical compounds and by Eurofins for the remaining analyses. A full suite of compounds will be analyzed for each group of analytes listed on **Table 3** (e.g., VOC, SVOC, alcohols, pharmaceuticals, PAH, TAL metals). However, the Indicator Compounds outlined in **Table 4** and discussed below will be used as a key line of evidence for delineation of BDA-specific impacts, if any. The Indicator Compounds were selected based on two primary criteria:

1) BDA-specific compounds, as identified in Table 3 of Arcadis (2020), to consider BMS contributions to Ley Creek, and exclude non-BDA compounds, that may have additional regional sources, to delineate BMS-inputs to Ley Creek.

2) Compounds detected at the most downstream sediment sampling location obtained to date as these compounds may not be fully delineated, and downstream transport of these compounds into the Study Area may occur.

Using this process, the Indicator Compounds include:

- Methanol
- Benzyl Alcohol
- N,N-Dimethylaniline
- Acetone
- Benzene
- Diethyl Ether (Ethyl Ether)
- Xylenes
- Methyl Acetate
- Methyl Ethyl Ketone (2-Butanone)
- n-Butanol
- n-Hexane
- Toluene
- Penicillin V
- Tetracycline

It should be noted that although some of these compounds met the criteria outlined, they are compounds with common regional presence and their use as Indicator Compounds will be carefully considered in the context of available background data when considering delineation of BMS inputs to Ley Creek. Specifically:

- Acetone was detected in upstream sediment samples of both Headson's Brook and Ley Creek, and hypothesis testing indicated that no significant difference was apparent between upstream and distributions of samples in the vicinity of BDA-related outfalls. Acetone is also a common laboratory contaminant. Concentrations of acetone in the downstream portion of Ley Creek will be evaluated in the context of upstream samples prior to its use as an Indicator Chemical.
- Benzene, toluene, and xylenes are common regional contaminants resulting from motor vehicle emissions, among other sources. Both toluene and xylenes were detected in upstream samples of Headson's Brook and Ley Creek, with hypothesis testing that indicated no significant difference between upstream samples and distributions of samples in the vicinity of BDA-related outfalls. Concentrations of these compounds in the downstream portion of Ley Creek will be evaluated in the context of upstream samples and in consideration of chemical ratios as potential source indictors prior to their use as Indicator Compounds.
- Methyl acetate was detected in upstream sediment samples of Ley Creek, with hypothesis testing that indicated no significant difference between upstream samples and distributions of samples in the vicinity of BDA-related outfalls. Methyl acetate sources include both industrial and natural emissions from plants, in particular under drought conditions (Dewhirst et al. 2021). Concentrations of methyl acetate in the downstream portion of Ley Creek will be evaluated in the context of upstream samples prior to its use as an Indicator Chemical.
- Methyl ethyl ketone was detected in upstream sediment samples of both Headson's Brook and Ley Creek, with hypothesis testing that indicated no significant difference between upstream samples and distributions of samples in the vicinity of BDA-related outfalls. Methyl ethyl ketone sources include both industrial and natural sources such as food products (ACC, 2021). Concentrations of methyl ethyl ketone in the downstream portion of Ley Creek will be evaluated in the context of upstream samples prior to its use as an Indicator Chemical.
- N-hexane was detected in upstream sediment samples of Ley Creek, with hypothesis testing that indicated no significant difference between upstream samples and distributions of samples in the vicinity of BDA-related outfalls. N-hexane sources include solvents, cleaning products, glues used in the roofing industry, and gasoline. Concentrations of n-hexane in the downstream portion of Ley Creek will be evaluated in the context of upstream samples prior to its use as an Indicator Chemical.

Analysis methods for sediment samples are outlined below:

- VOC: EPA Method 8260D;
- SVOC: EPA Method 8270E;
- PAHs plus alkylated PAHs: EPA Method 8270;
- TAL metals: EPA Methods 6020 and 7471;
- Methanol: EPA Method 8015D;
- Pharmaceuticals: EPA Method 1694; and
- Total Organic Carbon (TOC): Lloyd Khan Method.

3.6. Data Usability

Analytical data packages generated by Eurofins and Bureau Veritas will be reviewed for completeness and validated by Geosyntec. Field and laboratory quality control sample results will be evaluated, laboratory control problems will be assessed, and data qualifiers will be assigned.

4. PFAS SAMPLING UPSTREAM OF THE STUDY AREA

Sediment samples will be collected from five BDA outfall locations present within Ley Creek or Headson's Brook for the analysis of PFAS. A total of four additional sediment samples will be collected from areas upstream of the BDA 1) two urban stormwater outfalls located upstream of the BDA outfall locations, 2) a background location identified upstream of the BDA within Ley Creek, and 3) a background location upstream of the BDA within Headson's Brook (**Figure 8**). The background location within Headson's Brook (BCP-SED-UHB-1) was sampled in 2015 as part of the FWRIA sediment sampling. The PFAS sampling will be conducted prior to Phase 1 and Phase 2 sediment sampling. The type and concentration of PFAS in sediment at the BDA outfalls will be compared against those reported at the upstream locations to evaluate whether PFAS are present as a result of historical BDA activities.

4.1. Data Quality Objectives

Sampling for PFAS is included as part of DQO #1 (**Section 3.1**). Performing sediment sampling for PFAS at outfalls and background locations is planned to evaluate whether the type and concentrations of PFAS reported in sediment near BDA outfalls is different than those detected in upstream sediment. Should the type and concentrations of PFAS at BDA outfalls differ from those upstream, then PFAS will be included in the analyte list for sediment samples collected during the Phase 1 and, if needed, Phase 2 sampling events to further evaluate its downstream distribution.

4.2. Sample Locations

This section presents the sampling and analysis plan proposed to collect data to evaluate the presence of PFAS in BDA outfalls located in Ley Creek and Headson's Brook which are upstream of the Study Area.

A total of nine (9) sampling locations are proposed (**Figure 8** and **Table 3**):

- Five (5) locations at previously identified BDA outfalls;
- Two (2) locations near urban stormwater outfalls (located near the Burnet Avenue overpass); and
- One (1) background location (BCP-SED-ULC-7) (**Section 3.3**); and
- One (1) background location (BCP-SED-UHB-1) (**Section 4.0**).

4.3. Sediment Sample Collection

The sampling presented in this section will be conducted at the same time as the Study Area Reconnaissance described in **Section 3.2**. Sampling locations at outfalls will be located in similar locations as the FWRIA outfall sediment sampling locations, with samples located at the edge of the outfall mixing zone in order to represent outfall contributions to Headson's Brook and Ley Creek. Locations will be agreed upon with NYSDEC during the Study Area Reconnaissance.

PFAS sampling will be conducted in accordance with the protocol for PFAS sample collection and analysis provided in Appendix B of NYSDEC's guidance document entitled *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS), under NYSDEC's Part 375 Remedial Programs* (PFAS sampling protocol; NYSDEC, 2021). A copy of this protocol is included as **Attachment E**. The sampling will also be performed in accordance with the QAPP (**Attachment B)**, and Task Hazard Analysis (**Attachment C)**.

4.4. Chemical Analysis

In accordance with the NYSDEC 2021 PFAS sampling guidance, the sediment samples will be analyzed for the following PFAS compounds by Eurofins using EPA Method 537 Modified Isotope Dilution.

- PFBS, Perfluorobutanesulfonic acid
- PFHxS, Perfluorohexanesulfonic acid
- PFHpS, Perfluoroheptanesulfonic acid
- PFOS, Perfluorooctanesulfonic acid
- PFDS, Perfluorodecanesulfonic acid
- PFBA, Perfluorobutanoic acid
- PFPeA, Perfluoropentanoic acid
- PFHxA, Perfluorohexanoic acid
- PFHpA, Perfluoroheptanoic acid
- PFOA, Perfluorooctanoic acid
- PFNA, Perfluorononanoic acid
- PFDA, Perfluorodecanoic acid
- PFUA/PFUdA, Perfluoroundecanoic acid
- PFDoA, Perfluorododecanoic acid
- PFTriA/PFTrDA, Perfluorotridecanoic acid

- PFTA/PFTeDA, Perfluorotetradecanoic acid
- 6:2 FTS, 6:2 Fluorotelomer sulfonate
- 8:2 FTS, 8:2 Fluorotelomer sulfonate
- FOSA, Perfluoroctanesulfonamide
- N-MeFOSAA, N-methyl perfluorooctanesulfonamidoacetic acid
- N-EtFOSAA, N-ethyl perfluorooctanesulfonamidoacetic acid

The list of PFAS compounds to be analyzed is also presented in **Table 4**. Corresponding reporting limits are presented in the QAPP (**Attachment B**). NYSDEC has not approved screening levels for PFAS in sediment. For the purpose of this investigation, the type and concentration of PFAS in sediment at the BDA outfalls will be compared against those reported at the upstream locations to evaluate whether PFAS are present as a result of historical BDA activities.

4.5. Data Usability

Analytical data packages generated by Eurofins and Bureau Veritas will be reviewed for completeness and validated by Geosyntec. Field and laboratory quality control sample results will be evaluated, laboratory control problems will be assessed, and data qualifiers will be assigned in accordance with the QAPP.

5. SCHEDULE AND DELIVERABLES

The current project schedule is dependent on final approval of this Work Plan and associated documents. However, a proposed schedule follows:

- NYSDEC Approval of Work Plan - April 2022;
- Provide notification to NYSDEC for Study Area Reconnaissance, Sediment Probing, and PFAS Sampling Upstream of the Study Area – at least 14 days prior to field activities. The notifications will include the planned dates of field activities;
- Study Area Reconnaissance, Sediment Probing, and PFAS Sampling Upstream of the Study Area – May 2022;
- Receipt and validation of PFAS Sampling (Study Area Reconnaissance) analytical data – July 2022;
- Discuss Study Area Reconnaissance analytical results with NYSDEC and verify proposed Phase 1 field activities – July 2022
- Phase 1 Field Work – August 2022;
- Receipt and validation of Phase 1 sediment chemistry data – October 2022;
- Data analysis and discussion of Phase I results with NYSDEC – October 2022;
- Ley Creek Delineation Investigation Report (assuming Phase 2 is not needed) – Q1 2023
- Agreement on Phase 2 Field Work Scope (if any)– October 2022;
- Phase 2 Field Work (if necessary) – November 2022;
- Receipt and validation of Phase 2 sediment chemistry data (if necessary) – January 2023;
- Data analysis and discussion of preliminary Phase 1 and 2 results with NYSDEC – January 2023; and,
- Ley Creek Delineation Investigation Report (including Phase 1 and 2 field events)– Q2 2023.

The Ley Creek Delineation Investigation Report will present the methods and results of the investigations of the BDA-specific compounds conducted in Ley Creek as described in this Work Plan. In addition, the report will include:

- Tables providing sample coordinates, sampling results, and an update of flora or fauna observed or anticipated that was previously not listed in the FWRIA.

- Figures of the investigation area and sampling locations.

- Appendices containing field forms/logs as applicable (e.g., sediment cores, water quality data), laboratory reports (Category B deliverables), data usability summary report(s), documentation regarding the management of investigation-derived waste, and any other pertinent information.

- A point source input identifier will be clearly noted for sediment samples collected at locations with other input pathways.

- Certification as required by DER-10, Section 1.5.

6. REFERENCES

Arcadis. 2014. C734138 Phase 1A Remedial Investigation Work Plan – Fish and Wildlife Resources Impact Analysis Module. September 2014.

Arcadis. 2019. C734138 Phase 1A Remedial Investigation Work Plan – Sediment Sampling Module Addendum. March 2019.

Arcadis. 2020. Fish and Wildlife Resources Impact Analysis Site #C734138 BMS Syracuse North Campus Restoration Area East Syracuse, New York. Revised October 2020.

American Chemistry Council (ACC), 2021. Methyl Ethyl Ketone (MEK), accessed at: https://www.americanchemistry.com/MEK/ June 2021.

B&B Engineers & Geologists of New York, p.c. 2022. Letter to Ms. Anne Locke: Selection of Background Sediment Sample Locations for Ley Creek. Provided to NYSDEC on February 2, 2022.

Dewhirst, R.A.; Lei, J.; Afseth, C.A.; Castanha, C.; Wistrom, C.M.; Mortimer, J.C.; Jardine, K.J. Are Methanol-Derived Foliar Methyl Acetate Emissions a Tracer of Acetate-Mediated Drought Survival in Plants? Plants 2021, 10, 411. https://doi.org/10.3390/ plants10020411

EPA. 2006. Guidance on Systematic Planning Using the Data Quality Objectives Process. EPA/240/B-06/001, February.

EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final. Office of Solid Waste and Emergency Response. EPA 540-R-97-006. June 1997.

NYSDEC (New York State Department of Environmental Conservation). 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS), under NYSDEC's Part 375 Remedial Programs. Department of Environmental Conservation. June 2021.

NYSDEC. 2018. Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State. Division of Water. NYSDEC SOP #208-16. May 1.

NYSDEC. 2014a. Screening and Assessment of Contaminated Sediment. Division of Fish, Wildlife and Marine Resources. Bureau of Habitat. June 24, 2014.

NYSDEC. 2014b. Edinger, G. J., D. J. Evans, S. Gebauer, T. G. Howard, D. M. Hunt, and A. M. Olivero (editors) Ecological Communities of New York State. Second Edition. A revised and expanded edition of Carol Reschke's Ecological Communities of New York State. New York Natural Heritage Program, New York State Department of Environmental Conservation, Albany, NY. March.

NYSDEC. 2010. DER-10 Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. May 2010.

NYSDEC. 2008. The Oswego River Finger Lakes basin waterbody inventory and priority waterbodies list. New York State Department of Environmental Conservation, Division of Water, Bureau of Watershed Assessment and Management, Albany, New York.

O'Brien & Gere Engineers, Inc. 2013. Remedial Investigation Work Plan: BMS Syracuse North Campus Restoration Area Site No. C734138. March 2013.

Tannenbaum, LV. 2005. Two Simple Algorithms for Refining Mammalian Receptor Selection in Ecological Risk Assessments. Integrated Environmental Assessment and Management, 1 (3): 290–298

Table 1: Project Team
Bristol-Myers Squibb Syracuse North Campus
Revised Ley Creek Delineation Work Plan

Name	Affiliation	Role	Phone	Email
Anne Locke	Bristol-Myers Squibb	Project Manager	315-952-2858	anne.locke@bms.com
Rich Mador	Bristol-Myers Squibb	Associate Director | Environment	609-252-4273	Richard.Mator@bms.com
Dr. Jeanmarie Zodrow	Geosyntec	Sediments Task Lead	720-509-8938	jzodrow@geosyntec.com
Dr. Julia Caprio	Geosyntec	Project Chemist & Quality Assurance Manager	865-291-4696	jklenscaprio@geosyntec.com
Joel Conzelmann	Geosyntec	Field Activities Manager	616-914-6976	Jconzelmann@geosyntec.com
Joel Conzelmann	Geosyntec	Health and Safety Officer	616-914-6976	Jconzelmann@geosyntec.com
John Cady	Eurofins	Project Manager/Chemist for Sediment Analysis	832-763-8082	john.cady@eurofinset.com
Michael Rog	Bureau Veritas North America	Project Manager/Chemist for Sediment Analysis	847-726-372	michael.rog@bureauveritas.com

Table 2: Data Quality Objectives
Bristol-Myers Squibb Syracuse North Campus
Revised Ley Creek Delineation Work Plan

DQO STEP:	STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
DQO	**State the Problem**	**Identify the Goals of the Study**	**Identify the Information Inputs**	**Define the Boundaries of the Study**	**Determine the Analytic Approach**	**Specify Performance or Acceptance Criteria**	**Describe the Plan for Obtaining the Data**
DQO #1							
Delineate the extent of BDA-specific chemicals in downstream portions of Ley Creek	The extent of BDA-specific inputs in sediment downstream of the area investigated to date has not been delineated.	Delineate downstream extent of BDA-specific chemicals.	Concentrations of BDA-specific chemicals in Ley Creek sediments downstream of the the area investigated to date.	Ley Creek, downstream of the area investigated to date for 750 feet.	Analysis of BDA-specific indicator chemicals as outlined in the QAPP.	As outlined in the QAPP.	Sediment samples will be collected from multiple depths (0-0.5ft, 0.5-1ft. 1-2ft, 1ft increments to refusal) in two Phases starting with those directly downstream of the area investigated to date and continuing further downstream in Phase 2 pending Phase 1 results.
DQO #2							
Evaluate potential contributions from non-BDA sources to the downstream portion of Ley Creek	Additional non-BDA sources may be contributing to concentrations in Ley Creek which should be quantified to more accurately characterize BDA-specific contributions.	Determine concentrations from non-BDA sources.	Concentrations of chemicals in Ley Creek tributary sediments and near historical sources downstream of the area investigated to date.	Ley Creek, downstream of the area investigated to date for 750 feet, and two tributaries to Ley Creek.	Analysis of the same BDA-specific indicator chemicals as outlined in the QAPP.	As outlined in the QAPP.	Sediment samples will be collected from multiple depths (0-0.5ft, 0.5-1ft. 1-2ft, 1ft increments to refusal) from tributaries to Ley Creek, and near historical sources.
DQO #3							
Obtain data to assist in guiding subsequent investigation activities, which may include toxicity testing	Need to obtain data to be able to differentiate between impacted locations due to BDA inputs and non-impacted locations or areas with non-BDA inputs to the stream.	Delineate downstream extent of BDA-specific chemicals and determine appropriate background concentrations.	Concentrations of BDA-specific chemicals in Ley Creek sediments downstream of the the area investigated to date and regional background concentrations related to urban or industrial sources.	Ley Creek, downstream of the area investigated to date for 750 feet and background location.	Analysis of BDA-specific indicator chemicals as outlined in the QAPP.	As outlined in the QAPP.	Sediment samples will be collected from multiple depths (0-0.5ft, 0.5-1ft. 1-2ft, 1ft increments to refusal) in two Phases starting with those directly downstream of the area investigated to date and continuing further downstream in Phase 2, pending Phase 1 results, as well as background location.

Acronyms and Abbreviations:
BDA - BMS Brownfield Development Area
DQO - Data Quality Objective
SGV - Sediment Guidance Value
QAPP - Quality Assurance Project Plan

Table 3: Sampling Locations and Analyses
Bristol-Myers Squibb Syracuse North Campus
Revised Ley Creek Delineation Work Plan

Location Name	Sampling Phase	Easting [a,c]	Northing [a,c]	Matrix	Sample Depths	Analyses [b]	Sampling Method	Rationale
BCP-SED-ULC-7	Preliminary PFAS	954969	1115681	Sediment	0 - 0.5 ft. 0.5 - 1 ft. 1 - 2 ft. 1 ft. intervals to refusal.	VOC, SVOC, TAL metals, PAHs, Alcohols, Pharmaceuticals, TOC and PFAS	Hand core, or grab sample as outlined in the Work Plan Section 4.3.2	Additional background data including Upstream PFAS Evaluation
BCP-SED-STORM-01	Preliminary PFAS	954207	1116330			PFAS		Upstream PFAS Evaluation
BCP-SED-STORM-02	Preliminary PFAS	954268	1116340					
BCP-SED-OUTFALL-001	Preliminary PFAS	952673	1118230					
BCP-SED-OUTFALL-002	Preliminary PFAS	952956	1118061					
BCP-SED-OUTFALL-003	Preliminary PFAS	953380	1117778					
BCP-SED-OUTFALL-007	Preliminary PFAS	953873	1117247					
BCP-SED-OUTFALL-009	Preliminary PFAS	954061	1117018					
LC-SED-13	Phase 1	953786	1117661			VOC, SVOC, TAL metals, PAHs, Alcohols, Pharmaceuticals and TOC		Downstream delineation of BDA indicator chemicals.
LC-SED-14	Phase 1	953851	1117742					
LC-SED-15	Phase 1	953789	1117800					
LC-SED-16	Phase 1	953728	1117853					
LC-SED-17	Phase 1	953632	1117868					
LC-SED-18	Phase 1	953532	1117906					
LC-SED-19	Phase 1	953486	1117931					
LC-TRIB-SED-01	Phase 1	953827	1117641					
LC-SED-20	Phase 2	953266	1118559					
LC-SED-21	Phase 2	953384	1117976					
LC-SED-22	Phase 2	953294	1118012					
LC-SED-23	Phase 2	953217	1118052					
LC-SED-24	Phase 2	953149	1118098					
LC-SED-25	Phase 2	953141	1118151					Quantify non-BDA chemical inputs
LC-TRIB-SED-02	Phase 2	953085	1118142					

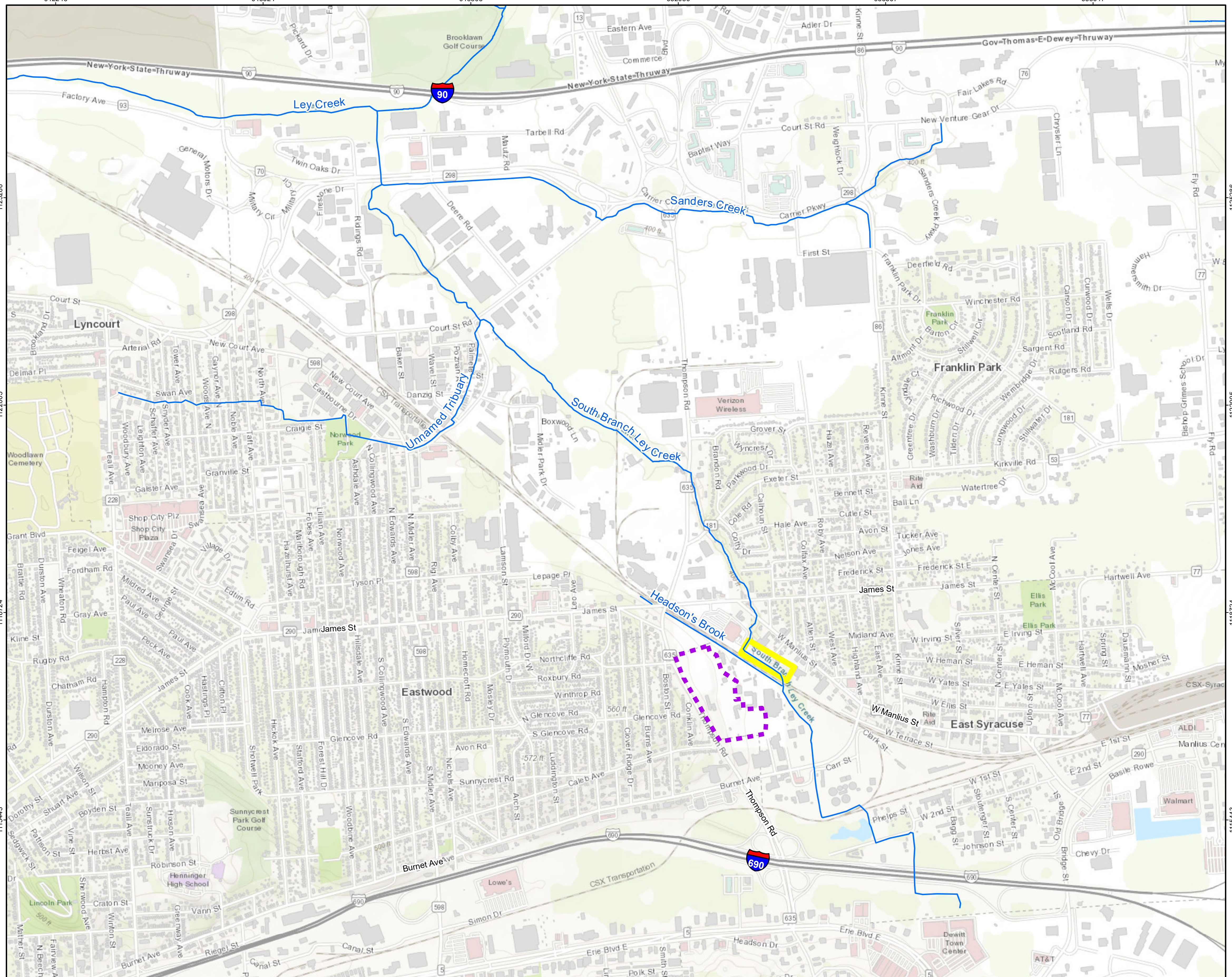
Footnotes:
a: NAD 1983 State Plane New York Central FIPS 3102 Feet
b: See QAPP Tables for Method Detection and Reporting Limits for all parameters and QA/QC samples.
c. The exact sampling coordinates are subject to change pending stream reconnaissance and probing.

Acronyms and Abbreviations:
BDA = Brownfield Development Area
SVOC = Semivolatile Organic Compounds
VOC = Volatile Organic Compounds
PAH = Polycyclic Aromatic Hydrocarbon
TAL = Target Analyte List
TOC = Total Organic Carbon
QAPP = Quality Assurance Project Plan
QA/QC = Quality Assurance & Quality Control

Table 4: Indicator Compounds and PFAS for Sediment Delineation
Bristol-Myers Squibb Syracuse North Campus
Revised Ley Creek Delineation Work Plan

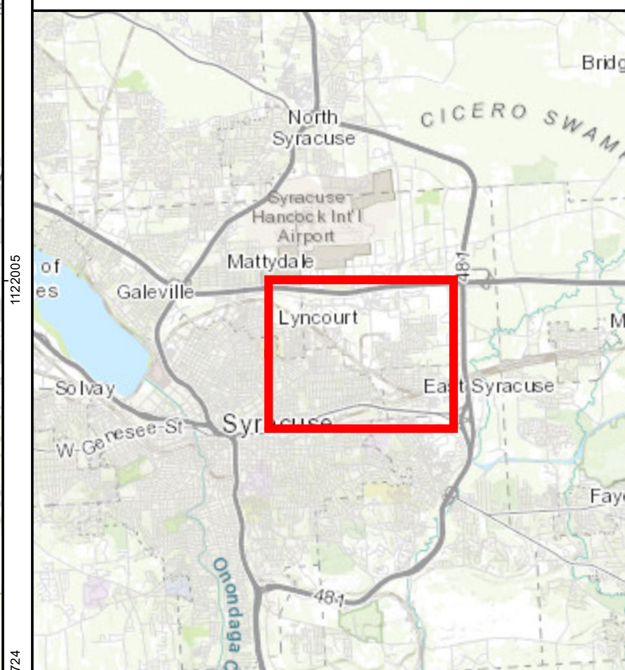
Analyses	Analyte	Process Related	Rationale
SVOC	Benzyl Alcohol	Yes	BDA-specific compounds, detected at the furthest downstream historical sampling locations.
	N,N-Dimethylaniline	Yes	
VOC	Acetone	Yes	
	Benzene	Yes	
	Diethyl Ether (Ethyl Ether)	Yes	
	Xylenes	Yes	
	Methyl Acetate	Yes	
	Methyl Ethyl Ketone (2-Butanone)	Yes	
	N-Butanol	Yes	
	N-Hexane	Yes	
	Toluene	Yes	
PAHs	Napthalene	Unknown	
	Acenaphthylene	Unknown	
	Acenapthene	Unknown	
	Fluorene	Unknown	
	Phenanthrene	Unknown	
	Anthracene	Unknown	
	1-methylnaphthalene	Unknown	
	1-methylphenanthrene	Unknown	
	Fluoranthene	Unknown	
	Pyrene	Unknown	
	Benz(a)anthracene	Unknown	
	Chrysene	Unknown	
	Benzo(b)fluoranthene	Unknown	
	Benzo(k)fluoranthene	Unknown	
	Benzo(a)pyrene	Unknown	
	Dibenz(a,h)anthracene	Unknown	
	Benzo(g,h,i)perylene	Unknown	
	Indeno(1,2,3-cd)pyrene	Unknown	
Metals	Barium	Yes	
	Copper	Yes	
	Lead	Yes	
	Selenium	Yes	
	Silver	Yes	
	Zinc	Yes	
Alcohols	Methanol	Yes	
Pharmaceuticals	Penicillin V	Yes	
	Tetracycline	Yes	
PFAS	PFBS, Perfluorobutanesulfonic acid	Unknown	Upstream PFAS Evaluation
	PFHxS, Perfluorohexanesulfonic acid	Unknown	
	PFHpS, Perfluoroheptanesulfonic acid	Unknown	
	PFOS, Perfluorooctanesulfonic acid	Unknown	
	PFDS, Perfluorodecanesulfonic acid	Unknown	
	PFBA, Perfluorobutanoic acid	Unknown	
	PFPeA, Perfluoropentanoic acid	Unknown	
	PFHxA, Perfluorohexanoic acid	Unknown	
	PFHpA, Perfluoroheptanoic acid	Unknown	
	PFOA, Perfluorooctanoic acid	Unknown	
	PFNA, Perfluorononanoic acid	Unknown	
	PFDA, Perfluorodecanoic acid	Unknown	
	PFUA/PFUdA, Perfluoroundecanoic acid	Unknown	
	PFDoA, Perfluorododecanoic acid	Unknown	
	PFTriA/PFTrDA, Perfluorotridecanoic acid	Unknown	
	PFTA/PFTeDA, Perfluorotetradecanoic acid	Unknown	
	6:2 FTS, 6:2 Fluorotelomer sulfonate	Unknown	
	8:2 FTS, 8:2 Fluortelomer sulfonate	Unknown	
	FOSA, Perfluorooctanesulfonamide	Unknown	
	N-MeFOSAA, N-methyl perfluorooctanesulfonamidoacetic acid	Unknown	
	N-EtFOSAA, N-ethyl perfluorooctanesulfonamidoacetic acid	Unknown	

Acronyms and Abbreviations:
BDA = Brownfield Development Area
SVOC = Semivolatile Organic Compounds
VOC = Volatile Organic Compounds
PAH = Polycyclic Aromatic Hydrocarbon
PFAS = Per- and Polyfluoroalkyl Substances



Legend

- Study Area
- Approximate Brownfield Development Area
- Creek



Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.

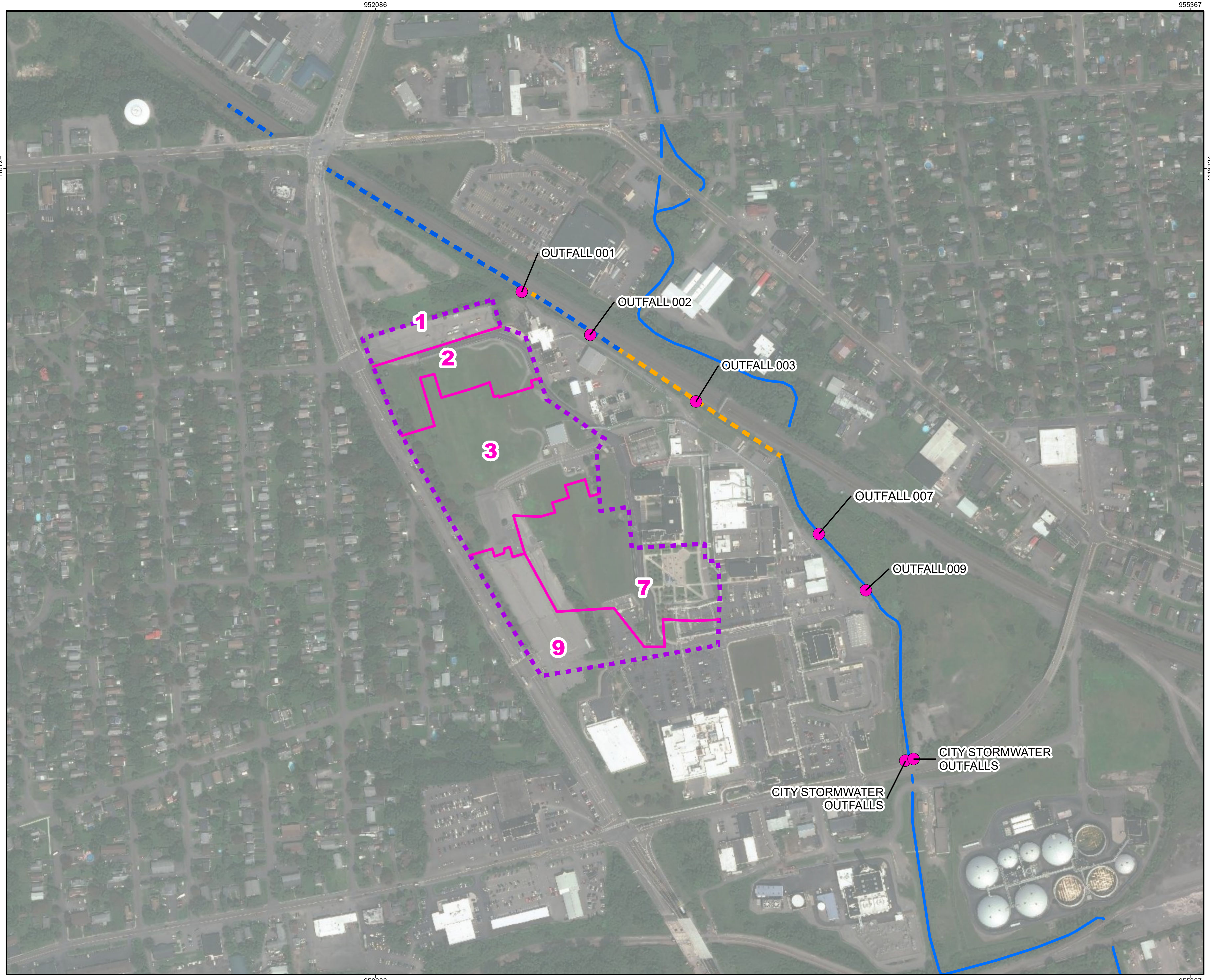
FIGURE 1

BDA AND STUDY AREA LOCATION

REVISED LEY CREEK DELINEATION WORK PLAN,
EAST SYRACUSE, NY

OFFICE LOCATION		REVISION	
GUELPH		01	B&B Engineers & Geologists of new york, p.c. an affiliate of Geosyntec Consultants
DATE PLOTTED	DATE REVISED	REVIEWED	
04-Feb-2022	04-Feb-2022	JZ	
APPROX. SCALE	PAGE SIZE	CHECKED	TRUE NORTH
1:19,200	11 x 17 in	JC	0 800 1,600 Feet
		DRAWN	
		SS	

P:\GIS\MP1886 BMS\Figure 1 - Site Location MP1886.mxd



Legend

- Outfall Location
- Historical Storm Water Drainage (Prior to Transformation Project)
- Approximate Brownfield Development Area (BDA) Boundary
- Headson's Brook (Drainage Ditch)
- Headson's Brook (Dry)
- Ley Creek South Branch (Headwater Stream)

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 2

FEATURES OF INTEREST – BDA

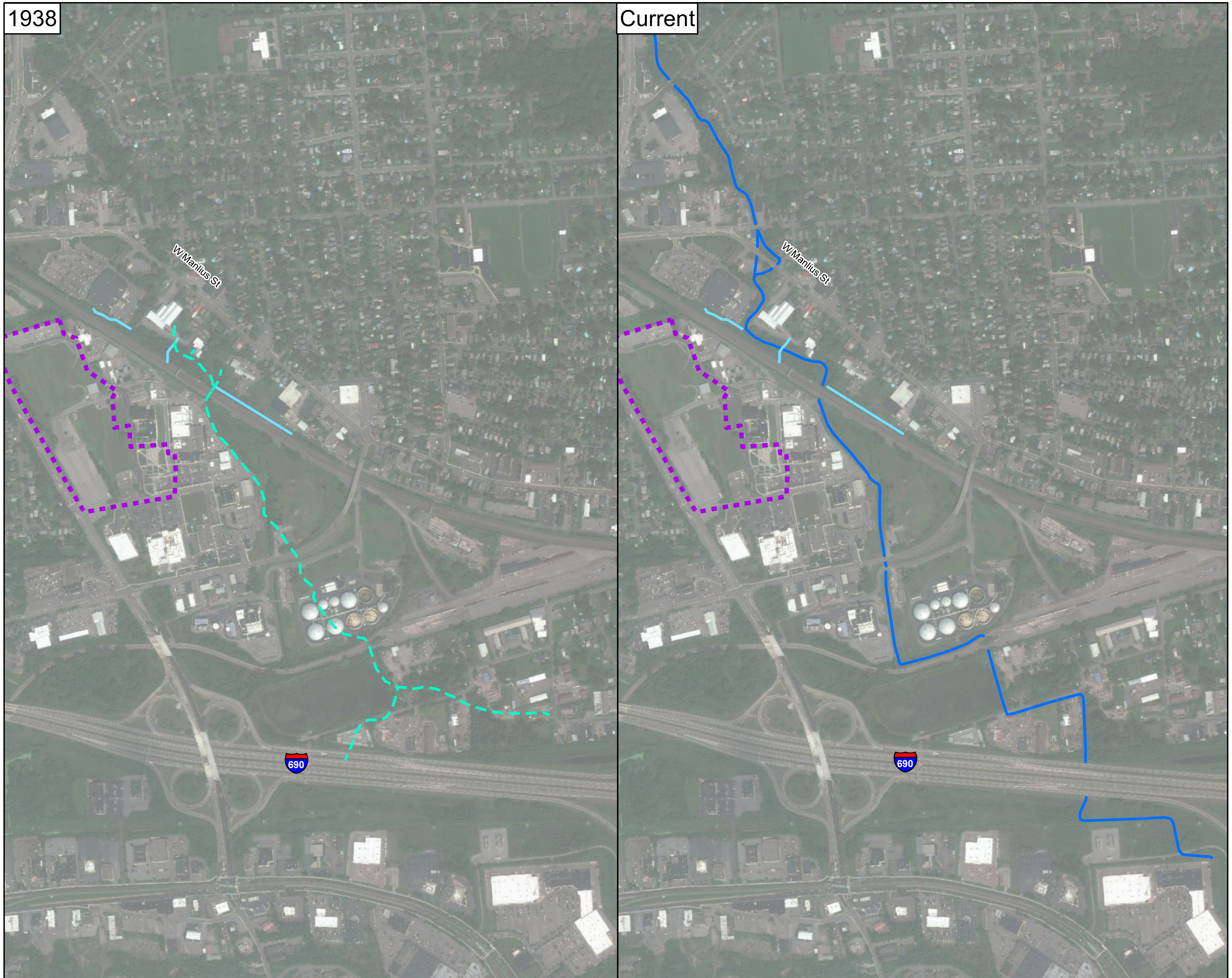
REVISED LEY CREEK DELINEATION WORK PLAN,
EAST SYRACUSE, NY

OFFICE LOCATION		REVISION
GUELPH		01
DATE PLOTTED	DATE REVISED	REVIEWED
04-Feb-2022	04-Feb-2022	JZ
APPROX. SCALE	PAGE SIZE	CHECKED JC
1:4,800	11 x 17 in	DRAWN SS

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

TRUE NORTH
0 200 400 Feet

P:\GIS\MP1886 BMS\Figure 2 - Features of Interest - Onsite MP1886.mxd



Legend

- Historical Ley Creek Channel
- Ley Creek South Branch (Headwater Stream)
- Historical Drainage Ditch (Approximate)
- pproximate Brownfield Development Area (BDA) Boundary

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Historical Ley Creek Channel is approximate and was interpreted from Cornell University historical map library.
3) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 3

HISTORICAL LEY CREEK

REVISED LEY CREEK DELINEATION WORK PLAN,
EAST SYRACUSE, NY

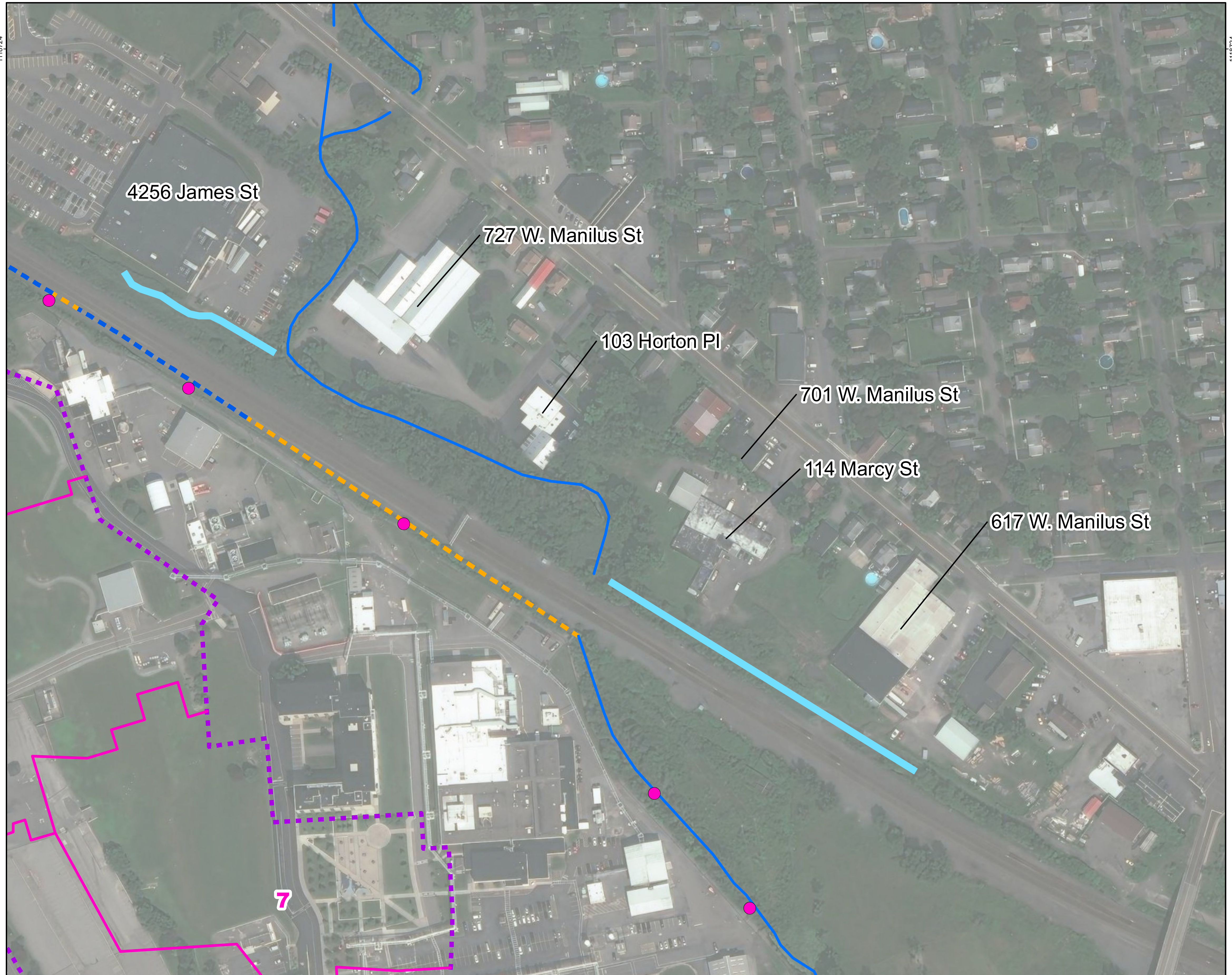
OFFICE LOCATION		REVISION
GUELPH		01
DATE PLOTTED	DATE REVISED	REVIEWED
04-Feb-2022	04-Feb-2022	JZ
APPROX. SCALE	PAGE SIZE	CHECKED
1:9,600	11 x 17 in	JC
		DRAWN
		SS

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

TRUE NORTH

0 400 800 Feet

P:\GIS\MP1886 BMS\Figure 3 - Historical Ley Creek MP1886.mxd



Legend

- Outfall Location
- Drainage Ditch (Approximate)
- Historical Storm Water Drainage (prior to Transformation Project)
- Approximate Brownfield Development Area (BDA) Boundary
- Ley Creek South Branch (Headwater Stream)
- Headson's Brook (Drainage Ditch)
- Headson's Brook (Dry)

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 4A

CURRENT FEATURES OF INTEREST - DOWNSTREAM LEY CREEK

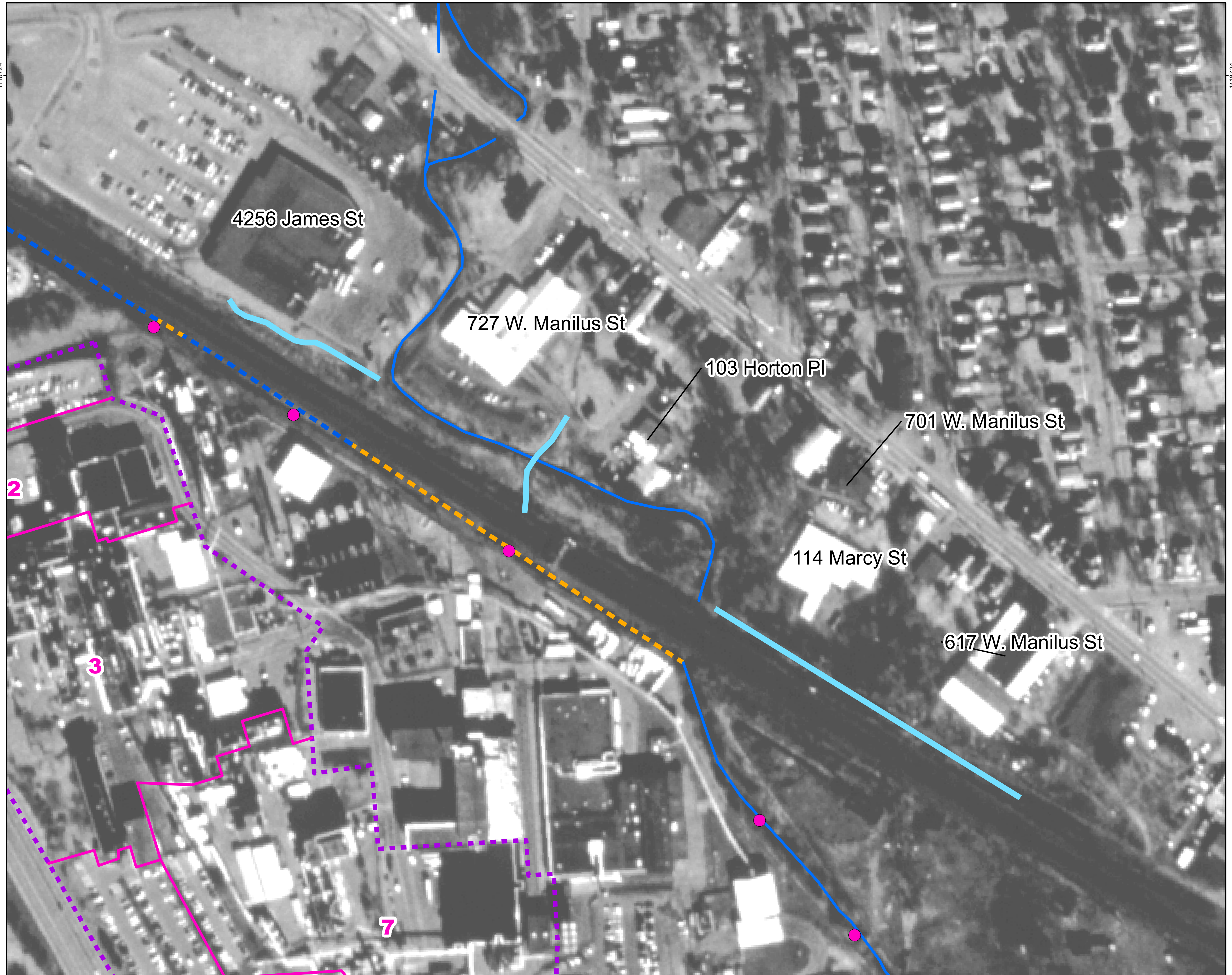
REVISED LEY CREEK DELINEATION WORK PLAN, EAST SYRACUSE, NY

OFFICE LOCATION		REVISION
GUELPH		00
DATE PLOTTED	DATE REVISED	REVIEWED
04-Feb-2022	04-Feb-2022	JC
APPROX. SCALE	PAGE SIZE	CHECKED JA
1:2,400	11 x 17 in	DRAWN SS

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

TRUE NORTH
0 100 200 Feet

P:\GIS\MP1886 BMS\Figure 4a - Features of Interest MP1886.mxd



Legend

- Outfall Location
- Drainage Ditch (Approximate)
- Historical Storm Water Drainage (prior to Transformation Project)
- Approximate Brownfield Development Area (BDA) Boundary
- Headson's Brook (Drainage Ditch)
- Headson's Brook (Dry)
- Ley Creek South Branch (Headwater Stream)

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: USGS. Image date 1995.

FIGURE 4B

HISTORICAL FEATURES OF INTEREST - DOWNSTREAM LEY CREEK

REVISED LEY CREEK DELINEATION WORK PLAN, EAST SYRACUSE, NY

OFFICE LOCATION		REVISION	
GUELPH		01	B&B Engineers & Geologists of new york, p.c. an affiliate of Geosyntec Consultants
DATE PLOTTED	DATE REVISED	REVIEWED	
04-Feb-2022	04-Feb-2022	JA	
APPROX. SCALE	PAGE SIZE	CHECKED	TRUE NORTH
1:2,400	11 x 17 in	JC DRAWN SS	0 100 200 Feet

P:\GIS\MP1886 BMS\Figure 4b - Features of Interest_Historical MP1886.mxd

Legend

- Surveyed CSX Spoil Pile Location
- 2015 Sediment Sample Locations
- 2019 Sediment Sampling Locations
- 2019 Surface Water Sample Locaiton
- Approximate Brownfield Development Area (BDA) Boundary
- Ley Creek South Branch (Headwater Stream)

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.

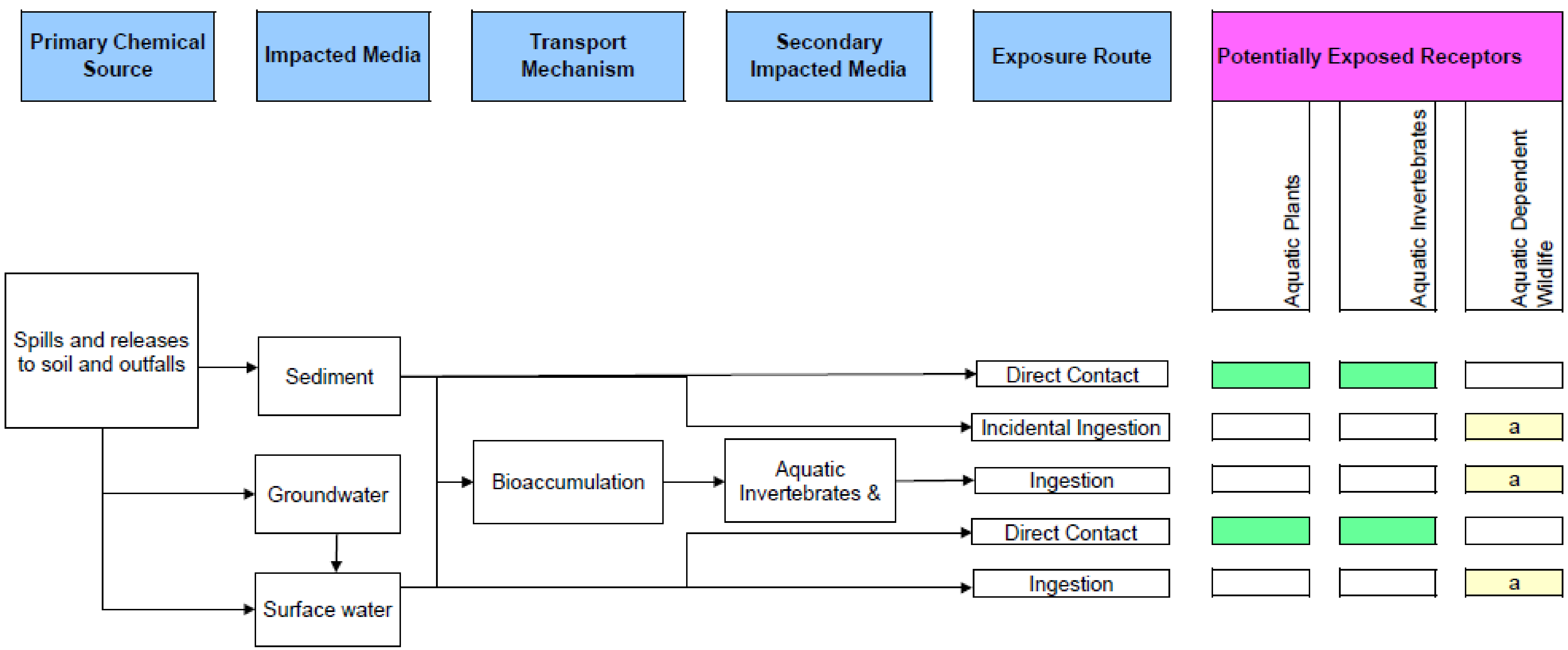
FIGURE 5

HISTORICAL SAMPLING LOCATIONS

REVISED LEY CREEK DELINEATION WORK PLAN, EAST SYRACUSE, NY

OFFICE LOCATION		REVISION	
GUELPH		00	B&B Engineers & Geologists of new york, p.c. an affiliate of Geosyntec Consultants
DATE PLOTTED	DATE REVISED	REVIEWED	
04-Feb-2022	04-Feb-2022	XXX	
APPROX. SCALE	PAGE SIZE	CHECKED	TRUE NORTH
1:4,800	11 x 17 in	JA	0 200 400 Feet
		DRAWN	
		SS	

P:\GIS\MP1886 BMS\Figure 5 - Historic Sample Locations MP1886.mxd



Legend

- Complete exposure pathway
- Potentially complete, but insignificant pathway
- Incomplete exposure pathway

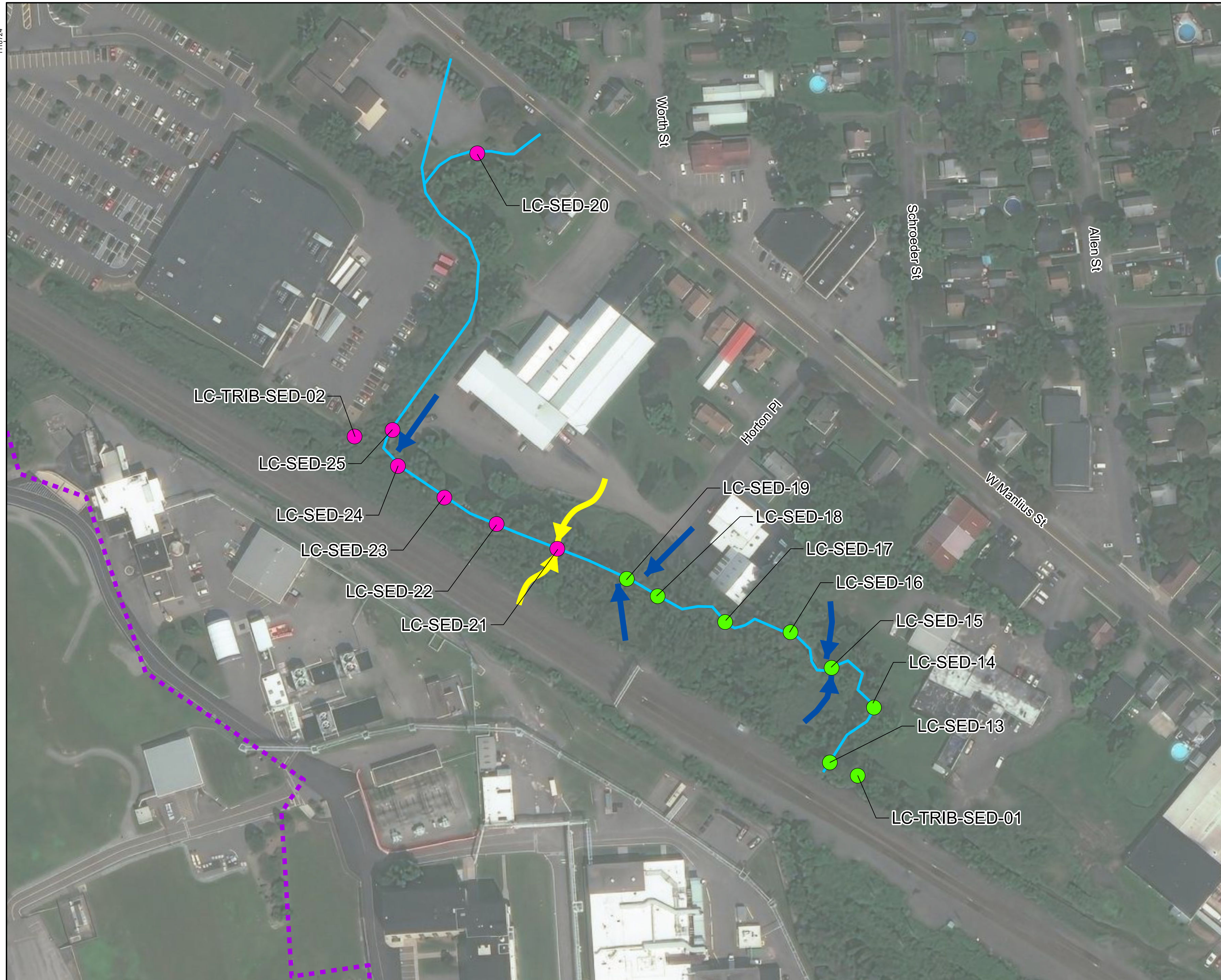
a) Due to the small area of the Site and lack of upland habitat, significant wildlife use is not anticipated

FIGURE 6

ECOLOGICAL CONCEPTUAL SITE MODEL - LEY CREEK

REVISED LEY CREEK DELINEATION WORK PLAN, EAST SYRACUSE, NY

OFFICE LOCATION GUELPH		REVISION 00	B&B Engineers & Geologists of new york, p.c. *an affiliate of Geosyntec Consultants*
DATE PLOTTED 28-Jun-2021	DATE REVISED 28-Jun-2021	REVIEWED XXX	
APPROX. SCALE	PAGE SIZE 11 x 17 in	CHECKED JA	
		DRAWN JK/SS	



Legend

- Phase 1 Sample Location
- Phase 2 Sample Location
- Potential Stormwater Runoff Pathway
- Historical Drainage Ditch
- Creek Sample Area
- Approximate Brownfield Development Area (BDA) Boundary

Sample Location LC-SED-20 will be evaluated as part of the Study Area Reconnaissance and sampled during Phase 1 if no other depositional areas with sufficient sediment thickness are observed upstream within the Phase 1 or Phase 2 reaches.

Notes:
LC = Ley Creek
OFF = Off-site
SED = Sediment
TRIB = Tributary to Ley Creek

1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

DRAFT

The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.

FIGURE 7

PROPOSED PHASE 1 AND 2 SAMPLING LOCATIONS

LEY CREEK DELINEATION WORK PLAN,
EAST SYRACUSE, NY

OFFICE LOCATION		REVISION	
GUELPH		00	
DATE PLOTTED	DATE REVISED	REVIEWED	
06-Feb-2022	06-Feb-2022	JZ	
APPROX. SCALE	PAGE SIZE	CHECKED	
1:1,800	11 x 17 in	JC	
		DRAWN	
		SS	

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

TRUE NORTH

0 75 150 Feet

Legend

- Outfall PFAS Sampling Location
- Additional Background Sampling Location
- Ley Creek South Branch (Headwater Stream)
- Headson's Brook (Drainage Ditch)
- Headson's Brook (Dry)

Notes:
1) Map Projection: NAD 1983 StatePlane New York Central FIPS 3102 Feet
2) Imagery Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

The information and figures reflected in this document were prepared by Geosyntec Consultants, Inc. in relation to a specific scope of work and are the intellectual property of Geosyntec and its Client. Any use of the document or the information reflected therein, except by Geosyntec's Client in accordance with the terms of the agreement between the two, is not authorized.

FIGURE 8

PROPOSED OUTFALL AND BACKGROUND SAMPLING LOCATIONS

REVISED LEY CREEK DELINEATION WORK PLAN,
EAST SYRACUSE, NY

OFFICE LOCATION		REVISION
GUELPH		01
DATE PLOTTED	DATE REVISED	REVIEWED
22-Feb-2022	22-Feb-2022	JZ
APPROX. SCALE	PAGE SIZE	CHECKED JC
1:4,800	11 x 17 in	DRAWN SS

B&B Engineers & Geologists of new york, p.c.
an affiliate of Geosyntec Consultants

TRUE NORTH

0 200 400 Feet

ATTACHMENT A

Project Team Qualifications

Geosyntec
consultants

JOEL CONZELMANN, P.E. **remedial investigation/conceptual site modeling**
remedial design and construction
geoenvironmental engineering

EDUCATION

M.S., Civil Engineering, Colorado State University, Fort Collins, CO, 2017
B.S., Civil Engineering, University of Michigan, Ann Arbor, MI, 2015

REGISTRATIONS AND CERTIFICATIONS

Licensed Professional Engineer (P.E.), State of Illinois, License No. 062.073140

PROFESSIONAL DEVELOPMENT AND TRAINING

OSHA 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training, September 2017
OSHA 8-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) Training Refresher, June 2021
OSHA 10-hour Construction Safety and Health, December 2019
DOT Hazardous Materials Shipping for Environmental Professionals, March 2021
APNGA Portable Nuclear Density Gauge/HAZMAT Safety Training, May 2015
Adult and Pediatric First Aid/CPR/AED, November 2019
Boater Education Certificate of Completion (Illinois), May 2020

CAREER SUMMARY

Mr. Conzelmann is an Engineer at the Chicago, Illinois office in the Great Lakes Remediation Group with 4 years of consulting experience and is a member of Geosyntec's Sediment Action Group (SedAG). In his time at Geosyntec, his project involvement has included remedial design and construction; landfill management; and investigation, data management, and conceptual site modeling at sites with contaminated sediment, soil, and groundwater. Highlights of Mr. Conzelmann's relevant experience are provided in subsequent sections.

Mr. Conzelmann earned his B.S. in Civil Engineering from the University of Michigan in 2015 and his M.S. in Civil Engineering (with a focus in Geoenvironmental Engineering) from Colorado State University (CSU) in 2017. His undergraduate studies focused on environmental and geotechnical engineering with specialized study in sustainable engineering whereas his graduate studies focused on subsurface remediation and waste containment systems.

While at CSU, his Master's thesis investigated hydraulic and chemical properties of geosynthetic clay liners (GCLs) in mine waste containment applications. As a research assistant at CSU's geoenvironmental engineering laboratory he helped develop and validate a safer and more representative method for testing GCLs in mining applications and began a study to investigate how extreme pH mine-waste-leachates affect the hydraulic performance of GCLs. Additionally, while at CSU he taught introductory geotechnical engineering laboratory to undergraduate students, and previously he worked as an intern for a consulting firm in Ann Arbor, Michigan where he conducted field inspection and quality control on geotechnical and concrete construction projects throughout the metro Detroit area.

Remedial Investigation / Conceptual Site Modeling

Ryerson Creek Sediment Investigation and Remedial Design, *TDY Industries, Muskegon, Michigan*. Engineer. Lead the pre-design sediment chemical and geotechnical sampling and supported the feasibility study (FS) and remedial design (RD) efforts. Mr. Conzelmann was part of the project team for the FS and RD at the Ryerson Creek Outfall, a portion of the Muskegon Lake Area of Concern (AOC) under the Great Lakes Legacy Act (GLLA). Drivers for the site include total petroleum hydrocarbons, oil and grease, PAHs, and metals. Geosyntec was tasked with completing the Pre-Design Investigation (PDI), FS, and RD under an aggressive schedule and Mr. Conzelmann was directly involved with each phase of the project.

During the PDI Mr. Conzelmann assisted in and then led sampling efforts including sediment sampling using drive cores and a ponar grab sampler, and geotechnical sampling (CPT and jarred samples) in near-shore uplands and in sediment using amphibious equipment. Throughout both PDI efforts Mr. Conzelmann logged most sediment cores and directed sampling at prescribed intervals for required analyses. While leading a subsequent PDI effort Mr. Conzelmann coordinated with and scheduled a drilling subcontractor, and then directed the subcontractor while on site including conducting daily safety meetings and ensuring quality samples with required recovery were collected at all sampling locations. He also led the coordination of and oversaw hydrographic surveying at the site. The hydrographic surveying used multibeam and side-scan hydrographic surveying technology to generate a bathymetric surface and visualize the presence of timber/debris. He worked closely with the surveying subcontractor to evaluate data quality and ensure all areas were adequately surveyed including the collecting additional manual soundings in shallow and narrow stream areas and in areas with high aquatic vegetation.

After completion of the PDI, Mr. Conzelmann was an integral part of the data evaluation team. He created a 3D conceptual site model using Earth Volumetric Studio (EVS) that allowed for the visualization of bathymetry, sediment thicknesses, and interpreted distributions of contaminants. He also helped generate figures showing extents of contamination with Thiessen polygons at sequential depth intervals using GIS software, and figures showing wetland delineations. During meetings with the Michigan Department of Environment, Great Lakes, and Energy (EGLE), the Environmental Protection Agency (EPA), and the U.S. Army Corps of Engineers (USACE) he presented data and the EVS model to help facilitate FS discussions.

During the RD efforts, Mr. Conzelmann helped facilitate the inclusion of bathymetric data into project drawings; calculated volume estimates of sediment removal for numerous iterative conceptual designs and a final design; wrote a number of project specifications; and assisted in developing multiple calculations packages including calculations of dredge volume and dredge mass balance.

Sediment and Soil Sampling, *Confidential Client.* Engineer. Performed sediment and soil sampling by hand-auger for a variety of potential COCs, including PCBs, in a small stream through wooded and field settings. Mr. Conzelmann conducted environmental soil and sediment sampling using AMS sediment and sludge samplers for a variety of potential COCs, including PCBs, in a small stream through wooded and field settings. The project team overcame challenging stratigraphy and limited site access to complete the project on time and within budget. Site access was limited to trails through dense vegetation created by the project team from a single point of access. Use of the sampling equipment required the development and adaptation of alternative strategies for advancing and recovering sample cores in a range of materials, including both loose silts and dense clays, without the benefit of motorized or powered mechanical equipment.

Coldbrook Creek Overbank Sampling, *Unisys Corporation, Elmira, New York.* Field Engineer. Mr. Conzelmann led hand auguring and composite soil sampling of surface soil (0-ft to 2-ft below ground surface) to evaluate the extent of contaminated soils along the flood banks and flood zone of Coldbrook Creek, a tributary of the Chemung River. Contaminants of concern included PCBs, metals, SVOCs, and cyanide. Exact sample locations were selected in the field based on topography and observed flood zones, and documented using portable GPS equipment.

Ottawa Mill Race Sediment Investigation and Remedial Action, *Nicor Gas, Ottawa, Illinois.* Resident Engineer and Construction Support. Mr. Conzelmann assisted with the PDI and RD, and performed construction management responsibilities during the remediation of sediment and soil at a former manufactured gas plant (MGP) site. He also provided authorship of major sections of the Remedial Action Completion Report (RACR). Contaminants of concern included BTEX VOCs, PAHs, and TPH.

During the PDI phase of the project Mr. Conzelmann assisted with river sediment sampling using sonic drilling equipment within a major river. Mr. Conzelmann also assisted the design team in providing estimates of sediment thicknesses and volumes of contaminated sediment removal based on mudline and bedrock elevation data, and total petroleum hydrocarbon (TPH) data collected in the field. Additionally, he supported the development of dredged material management specifications and mass balance calculations.

During the sediment remediation component of the project Mr. Conzelmann oversaw dredging activities by the subcontractor which included the removal and disposal of sediment contaminated with tar and NAPL, and backfill cover construction with granular backfill and riprap along the Illinois River. He helped review weekly hydrographic surveys and perform field validation to verify the removal of all contaminated sediments to bedrock and the required placement of cover materials. Large amounts of NAPL and strong river currents were encountered requiring implementation of extensive sheen management measures in addition to a custom-made turbidity curtain. Mr. Conzelmann also supported the deployment and servicing of water quality management buoys that monitored turbidity upstream and downstream of the dredging area. Water samples were also taken to correlate laboratory measured total suspended solids (TSS) to field measured turbidity.

Other site responsibilities included oversight of upland excavation of similarly contaminated soil and debris with dewatering and large excavation shoring systems. Throughout the project Mr. Conzelmann also led documentation efforts that included daily notes, photographs, and reports; contractor submittals; stormwater pollution prevention plan (SWPPP) inspections; and data management of ambient air monitoring, vibration monitoring, and wastewater treatment plant (WWTP) data.

After completion of the project Mr. Conzelmann provided authorship and review of numerous sections of the RACR including authorship of text sections, leading reporting of vibration monitoring data and compaction testing data, and reviewing survey data for inclusion in final project figures and drawings.

Site Investigation of a Former MGP Site, *Confidential Client, Decatur, Illinois.* Field Engineer and Task Lead. Mr. Conzelmann currently serves as the field task lead for ongoing remedial investigations at a former MGP site located on an active power transfer station in Decatur, Illinois. The most recent site investigation focused on groundwater

Geosyntec consultants

sampling and Mr. Conzelmann has begun planning for future investigation that will include soil, soil gas, and additional groundwater sampling.

Remedial Investigation/Conceptual Site Modeling, Former MGP Site, *Duke Energy, Greenville, South Carolina.* Engineer and Task Lead. Investigated NAPL impacts and developed conceptual site model using EVS software at a former MGP site.

Mr. Conzelmann served as Geosyntec's field engineer during a remedial investigation at a former MGP site in Greenville, South Carolina. He worked alongside a co-consultant to lead the logging of soil and identification of NAPL impacts from borings collected using sonic drilling equipment. Following the investigation, he led the development of a conceptual site model using GIS and EVS capabilities. In addition to a 3D representation of lithology the model featured visualization of NAPL impacts, additional site features (e.g. an adjacent river and area buildings), and an aerial overlay The EVS model created was using during client presentations and has led to Geosyntec being awarded further phases of work including additional EVS model updates.

Phase II Environmental Site Assessment, *Confidential Client, Illinois.* Field Engineer. Mr. Conzelmann assisted in a Limited Environmental Site Assessment for a Confidential Client expanding their real-estate footprint in the Chicago area. He conducted sub-slab vapor and soil vapor sampling filed work including shut-in and helium tracer leak checking and sample collection using Summa Canisters; installed and utilized Vapor Pin samplers to facilitate sub-slab vapor collection; logged soil and collected soil samples; and collected grab groundwater samples using a peristaltic pump.

Remedial PDI, Former MGP Site, *Confidential Client, Rochelle, Illinois*. Field Engineer. Planned, implemented, and performed data analysis of a combined analytical and geotechnical PDI at a former MGP site. Mr. Conzelmann contributed to the authorship and review of the of the PDI work plan. He provided GIS support for the strategic placement of geotechnical and forensic soil investigation samples for the work plan. He was part also part of the team that conducted the PDI which included soil sampling using direct-push, split spoon, and Shelby tube technologies. Forensic environment sampling and slug testing on groundwater monitoring wells was also conducted. After the PDI was completed he assisted with analyzing bedrock and forensic data to present to the client. He provided GIS support to show bedrock depths and a developed a visualization for summarizing forensic results that was well received by the client.

Former MGP Site, *Confidential Client, Belvidere, Illinois.* Engineer. Assisted with various project tasks including quarterly soil gas and groundwater sampling, remedial alternatives evaluation, and database management. Mr. Conzelmann performed quarterly groundwater and soil gas sampling during 2017 and 2018 for MGP-related (BTEX, PAH,

Geosyntec consultants

and mercury) contamination related to past operations of a MGP site in Belvidere, IL. His current role at the site includes supporting the project team with remedial alternatives evaluation that has involved assessment of past NAPL extraction data and development of dig maps for visualization of potential excavation areas. r. Conzelmann also was part of a team that conducted a complete quality control review of project database that was inherited by Geosyntec from a previous consultant. The team reviewed original laboratory reports from as far back as the early 1990's to correct errors and fill in data gaps in the project database. The team provided correction of some form to over ten percent of the database records providing the client with an accurate database for future remediation decisions.

Remedial Pre-Design Investigation (PDI) Sampling, *Holladay Properties, City of La Porte, Indiana****.*** Engineer. Performed various sampling and measurements in support of the refinement of contaminant nature and extent. Mr. Conzelmann performed soil sampling using direct-push technology in support of an ISS treatability study for waste materials contaminated with high concentrations of lead. The lead concentrations in the waste raised concerns of the potential for cross-contamination to affect delineation boundaries, which was addressed using enhanced decontamination procedures. In addition, Mr. Conzelmann installed shallow groundwater monitoring wells and performed well development and slug testing to refine physical components of the conceptual site model.

Site Investigation and Remedial Action Planning, Former MGP Site, *Confidential Client, Centralia, Illinois.* Engineer and Task Lead. Mr. Conzelmann assisted in the reporting and remedial action planning for a former MGP site within the Illinois Site Remediation Program (SRP), seeking to achieve the client's goal of attaining site closure with minimally-restricted No Further Remediation (NFR) letters while also minimizing the requirement for additional remediation. Mr. Conzelmann led the development of a Supplemental Site Investigation Report (SSIR) and the Remedial Objectives Report (ROR), and assisted in the development of the Remedial Action Plan (RAP). Work included data management and analyses, authorship of report tables and GIS figures, PDI scoping, and authorship of report text sections in accordance with Illinois SRP and Tiered Approach to Corrective Action Objective (TACO) requirements.

Litigation Support, *Confidential Client, Raleigh, North Carolina.* Engineer. Performed forensic analyses to assess the source and fate of chlorinated solvents contributing to groundwater contamination. Mr. Conzelmann assisted in conducting forensic analysis to assess the source and fate of chlorinated solvents contributing to groundwater contamination based on historical site operations. He reviewed received documents to create composite historical building footprints in search of additional potential contamination sources and conducted a review of current and past uses of the chlorinated solvent contaminant. Mr. Conzelmann further assisted in the management of the project database.

Remedial Design and Construction

Risk Management Measures Design, Port Lands Flood Protection Enabling Infrastructure Project, *Toronto, Canada.* Engineer. Mr. Conzelmann was member of the risk management measures design team for the PLFPEI project to help rerouting of the Don River through a former industrial area to mitigate flooding and enable redevelopment in Waterfront Toronto. Mr. Conzelmann assisted in the design of horizontal barrier system to help mitigate dissolved phase and free-product NAPL impacts in native soils outside and beneath the proposed Water Lot boundary from impacting the new proposed River Valley. Major accomplishments of the design team include receiving regulatory approval to change cleanup goals to reflect site-specific conditions and exposure scenarios, site-specific bioassay, and sorption isotherm treatability studies, which have in return saved multi million dollars to the client. Highlights of Mr. Conzelmann's work included leading the preparation of a subaqueous cap design evaluation calculation package and conducting contaminant transport modeling using CAPSIM and POLLUTE software.

Remedial Design Planning, Berry's Creek Study Area, *Bergen County, New Jersey.* Engineer. Mr. Conzelmann assisted with remedial design planning for the Berry's Creek Study Area (BCSA), a USEAP Superfund sediment mega-site. He developed remedial design information for dredging focused on identifying soft sediment thickness within the Phase 1 remedy footprint.

Brownfield Site Remediation Planning, *Holladay Properties, City of La Porte, Indiana.* Engineer. Supported the remedial action planning for a brownfield site located in the city of La Porte, Indiana. Mr. Conzelmann supported the remedial action planning for a brownfield site located in the city of La Porte, Indiana in accordance with the Indiana Brownfield Program (IBP) and Indiana Department of Environmental Management (IDEM) risk-based closure regulations. Remedial planning is being conducted alongside commercial redevelopment including lakefront redevelopment and wetland mitigation. He supported the preparation of design drawings and bid documents for the 30% design. Proposed remedial activities include *in situ* Stabilization/Solidification (ISS), fill recycling and reuse, and excavation and off-site disposal.

Pipeline Release Site Closure, *Confidential Client, Illinois.* Engineer. Assisted with the restoration design and construction at a remediated pipeline release site. Mr. Conzelmann was part of a team that final restoration design and construction at a gasoline pipeline release site in Illinois. Restoration activities included tree clearing, dismantling of treatment buildings, removal of former remediation infrastructure, and site grading. Mr. Conzelmann also assisted the Construction Manager with various tasks including construcion oversight, reviewing contractor submittals, managing daily construction reports, conducting sand cone desnity testing on imported topsoil, and performing SWPPP inspections.

Ongoing Remedial Actions, *Parker Hannifin, Otsego, Michigan.* Engineer. Assisted with groundwater and soil vapor extraction (SVE) reporting and assists with project management. Mr. Conzelmann assists with management on ongoing remedial actions at the site, which exhibits contamination in groundwater from the historical usage of chlorinated solvents in manufacturing processes. The client seeks regulatory acceptance of a remediation approach allowing for the termination of active remedial activities. As a result of project efforts, the groundwater extraction system previously utilized at the site for more than 20 years was shut down with approval from MDEQ. Mr. Conzelmann has assisted with the development of groundwater monitoring reports including performing Mann Kendall and Monitored Natural Attenuation (MNA) analyses, and management of SVE data.

Geomembrane Liner Demarcation, *Cabot - Norit Activated Carbon, Marshall, Texas.* Engineer. Construction oversight of geomembrane liner extent delineation. Mr. Conzelmann represented Geosyntec at a remote site in east Texas to lead a small team of contractors tasked with demarcating the boundary of a geomembrane liner at a wastewater settling lagoon in preparation for repairs. The team used shovels and hand probing to locate and stake the edge of the anchor trench every 100 feet along the over 2-mile lagoon boundary. Throughout the work Mr. Conzelmann had to manage unique safety considerations including working in hot temperatures, in remote overgrown areas, near water, and in venomous snake habitat. The team encountered venomous cottonmouth snakes at multiple instances throughout the work; the snakes were killed with shovels and safety meetings to discuss precautions and preventative measures were conducted to ensure safe working conditions.

Operations and Maintenance, *TransCanada, Saint John, Indiana.* Engineer. Mr. Conzelmann contributed to the authorship and review of the 2018 Site Specific Safety Plan (SSSP) along with the stormwater and process water Operations and Maintenance (O&M) Task Hazard Analyses (THA) and the tank decontamination confined space entry THA. Additionally, Mr. Conzelmann provided GIS support to update the 2018 Site Map which provided improvements for identifying process water, process stormwater, and

Geosyntec consultants

non-process stormwater on the site. He was also on site to perform O&M tasks including sampling and discharge of process and storm water.

Soil Sampling and Construction Oversight, *TransCanada, Defiance, Ohio.* Engineer. Performed soil sampling and construction oversight during remediation of PCB contaminated soils. Mr. Conzelmann performed soil sampling for PCBs using a hand auger at multiple soil boing locations along an excavation trench and using excavation grab sampling techniques at a large open excavation. He also assisted in construction oversight, mitigated sheen on rainwater collected by the excavation, identified potentially contaminated soil for additional removal, and provided field drawings of excavation and soil sampling locations.

Geoenvironmental Engineering

North Sanitary Landfill Superfund Site, *Settling Work Parties, Dayton, Ohio.* Engineer and Task Lead. Mr. Conzelmann assisted in the development of 30% designs for the closure of the North Sanitary Landfill, an existing approximately 100-acre Superfund site. The project involved preparing design, including construction drawings, to upgrade an interim cap that had been installed in the 1990s. Mr. Conzelmann led the preparation of the design report that summarized the proposed remedial design approach. Remedial design included: (i) consolidation of several landfill units; (ii) installation of a composite liner system; (iii) installation of a dual-phase leachate and gas extraction system, and (iv) stormwater management system.

In-situ Stabilization/Solidification Treatability Study, *Kerr McGee Chemical Corporation, Jacksonville, Florida.* Engineer. Performed data analysis of *in-situ* stabilization/solidification (ISS) results. Mr. Conzelmann assisted with the ongoing ISS treatability study for the stabilization of contaminated upland soil material. The treatability study will be used to assess design parameters for the upland ISS treatment of organochlorine pesticides, metals, sulfuric acid, and volatile organic compounds in site groundwater. He helped secure materials to be used for the treatability study and assisted with data analyses on preliminary results.

Master's Thesis, *Colorado State University, Fort Collins, Colorado.* Graduate Research Assistant. Completed master's thesis titled "Hydraulic and Chemical Properties of Geosynthetic Clay Liners in Mining Applications." Mr. Conzelmann developed a thesis to discuss the effects of mine wastes, effective stress, and backpressure saturation on the hydraulic performance GCLs. Through this work he helped develop and validate a safer and more economical testing method that does not require permeation under high backpressures and uses a permeameter constructed from less expensive, chemical-resistant plastic materials. He also demonstrated that the new testing method may be more conservative than existing test methods as the new method revealed the possibility of preferential flow through needle punching fibers bundles for GCLs with higher peel strengths that was not observed using the existing method. Additionally, he helped develop and test synthetic leach solutions representative of typical leach solutions encountered in gold, bauxite, and copper mining.

Block Sampling for Laboratory Hydraulic Conductivity Testing, *Larimer County Landfill, Fort Collins, Colorado.* Graduate Research Assistant. Performed cover material block sampling for hydraulic conductivity testing. Mr. Conzelmann was part of a team that collected block samples of final cover material from the Larimer County Landfill as part of an alternative landfill final cover research project at Colorado State University. The team used hand tools (shovels and pickaxes) to dig through the clay cover material and then used large scale (6 in diameter) sampling equipment to remove undisturbed sections of the clay cover soil at multiple depth increments. Lastly, the team recompacted lifts of existing clay material to restore the disturbed areas of the landfill final cover. He also assisted in the setup of large scale (6 in diameter) permeameters to test the laboratory hydraulic conductivity of the collected samples.

Visibility Study, *Confidential Client*. Engineer. Used civil engineering software to demonstrate the visibility of landfill construction and final improvements from surrounding areas. Mr. Conzelmann led a preliminary visibility study to investigate how a proposed CCR landfill in the southeastern United States will be visible to the surrounding community. He used InfraWorks and GIS software to model the project site including three-dimensional visualization of the proposed landfill and surrounding trees. Through the model and authorship of presentation materials he helped demonstrate that the trees around the project site will likely serve as a good visual barrier and prevent the proposed landfill from being visible at most areas around the site. The visibility study also helped inform landfill designers that the surrounding trees may still provide a good visual barrier even if the proposed height is increased for potential cost savings

MIG DeWane Landfill Superfund Site, *BFI Waste Systems North America, LLC, Boone County, Belvidere, Illinois.* Engineer. Mr. Conzelmann complied and edited the quarterly and annual groundwater monitoring reports during 2018 and 2019 for the MIG DeWane Landfill Superfund Site. He provided authorship of data presentation materials and revised and prepared the final report deliverables.

Organic Material Study, *Confidential Client.* Engineer. Assisted in a desktop study to assess the methane generation from organic material disposed with coal combustion residuals (CCR). Mr. Conzelmann assisted in a white paper study to evaluate the methane generation from organic materials disposed with coal combustion residuals (CCRs). He performed a literature review to determine the methane generation rates and capacities for the various types of organic materials the client expects to encounter. He used these methane generation rates and capacities along with the EPA's LandGEM landfill gas model to evaluate the potential methane emissions from the organic material. He also reviewed federal and state regulations to inform the client of the most current rules and regulations.

Geotechnical Engineering

Transfer Station Retaining Wall Repair, *Allied Waste, Chicago, Illinois.* Field Engineer and Task Lead. Geosyntec was contracted to evaluate the condition of a concrete cantilever retaining wall that was failing at a waste transfer station due to repeated impact of heavy equipment. Mr. Conzelmann served as the field engineer and task lead coordinating a subsurface exploration near the wall in preparation for design of repairs. The subsurface exploration involved safely coordinating the work with a drilling subcontractor to perform Standard Penetration Testing (SPT) at the active transfer station, providing detailed notes of subsurface conditions, and collecting soil samples and a core sample of the concrete slab.

Dam Inspection Review, Kalamazoo River Superfund Site, *Confidential Client, Kalamazoo, Michigan.* Engineer. Reviewed dam inspection reports in litigation support for a dam along the Kalamazoo River Superfund Site. Mr. Conzelmann assisted with technical and litigation support for this confidential client. He reviewed and evaluated inspection reports completed between 2009 and 2017 for a dam along the Kalamazoo river within the Kalamazoo river Superfund site boundary. He then provided authorship of presentation materials and slides to provide the client a summary of the inspection reports.

Geotechnical Data Report, Brownfield Site Remediation Planning, *Holladay Properties, City of La Porte, Indiana.* Engineer. Assisted with the development of a geotechnical data report in support of bid document preparation. Mr. Conzelmann supported the remedial action planning for a brownfield site located in the city of La Porte, Indiana in accordance with the Indiana Brownfield Program (IBP) and Indiana Department of Environmental Management (IDEM) risk-based closure regulations. He supported the preparation of design drawings and bid documents for the 30% design which included the preparation of a geotechnical data report to summarize all geotechnical data collected during site investigations. While preparing the report he authored an excel based database for field (including SPT) and laboratory geotechnical data that has been used as a template on other Geosyntec projects.

Geosyntec consultants

Construction Quality Control, *Various Clients, Michigan.* Engineering Field Technician. Conducted concrete and asphalt testing, nuclear moisture density testing, and steel inspection on various construction projects throughout south east Michigan including projects for the Michigan Department of Transportation, various municipalities, and foundation projects for cellular service providers.

Construction of North American Automotive Headquarters, *Harman International, Novi, Michigan.* Engineering Field Technician. Conducted concrete testing, nuclear moisture density testing, and fireproofing inspection during multiple phases of the construction of Harman International's new North American automotive headquarters.

High School Addition, *University of Detroit Jesuit High School, Detroit, Michigan.* Engineering Field Technician. Conducted concrete testing, nuclear moisture density testing, steel inspection, and foundation inspection on multiple phases of University of Detroit Jesuit High School's science and technology addition.

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Inc., Chicago, Illinois, 2017-present
Colorado State University, Fort Collins, Colorado, Graduate Teaching and Research Assistant, 2015-2017
G2 Consulting Group, Ann Arbor, Michigan, 2015
University of Michigan, Ann Arbor, Michigan, Teaching Assistant (Part Time), 2014

AFFILIATIONS

American Society of Civil Engineers – 2013-Present
Officer, Colorado State University Geotechnical Student Organization (GSO) – 2015-2017

TEACHING EXPERIENCE

Colorado State University – 2015-2016. Introduction to Geotechnical Engineering Laboratory: Taught a one credit introductory geotechnical engineering laboratory to undergraduate students. The course introduced geotechnical laboratory testing and analysis including soil identification, hydraulic conductivity, sieve analysis, consolidation settlement, compaction, direct shear, and unconfined compression.

REPRESENTATIVE PUBLICATIONS

17-02 Conzelmann, J. 2017 Hydraulic and chemical properties of geosynthetic clay

Geosyntec consultants

liners in mine waste containment applications. Unpublished master's thesis. Colorado State University, Fort Collins, Colorado.

17-01 Conzelmann, J. Debelak, A. Gorakhi, M. Fritz, C. 2017. Lessons Learned from GeoLegends: David E. Daniel, PhD, PE, NAE, Dist.M.ASCE. ASCE Geostrata magazine. May/June 2017. 22-29.

INVITED PRESENTATIONS AND CONFERENCE PAPERS

21-06 J. Conzelmann, J.N. Couch, R. Skowron. "Anticipating and Adapting to Riverine Flooding at a Construction Site." Presented during the Illinois Association for Floodplain and Stormwater Management (IAFSM) annual conference. March 2021 (Virtual Conference).

20-05 J. Conzelmann, J.N. Couch, R. Skowron. "Ottawa Mill Race Sediment Remediation." Presented for a Sediment Action Group (SedAG) Webinar Series. December 2020.

17-04 C.A. Bareither, S. Ghazi Zadeh, J. Conzelmann, J. Scalia IV, and C.D. Shackelford. "Evaluation of mechanical and hydraulic properties of geosynthetic clay liners for mining applications." Co-author: Tailings and Mine Waste 2018, Banff, Alberta.

17-03 J. Conzelmann, J. Scalia, and C.D. Shackelford "Effect of Backpressure Saturation on Hydraulic Conductivity of GCLs." Presented at: Geotechnical Frontiers 2017, Orlando, Florida.

17-02 J. Conzelmann, J. Scalia. "Hydraulic Conductivity of Geosynthetic Clay Liners in Mining Applications." Presented at: Colorado State University Hydrology Days 2017, Fort Collins, Colorado.

16-01 J. Conzelmann, J. Scalia. "Method and equipment for hydraulic conductivity measurement of geosynthetic clay liners with mine waste leachates." Presented at: Tailings and Mine Waste 2017, Keystone, Colorado.

SUSAN B. WELT, M.P.H., P.E.

regulatory liaison and stakeholder negotiations
risk communication and community relations
vapor intrusion evaluation and mitigation
soil, groundwater, and sediment investigation and remediation

EDUCATION

M.P.H., Environmental Health, University of Rochester School of Medicine and Dentistry, Rochester, New York, 2001

M.S., Agricultural and Biological Engineering, Cornell University, Ithaca, New York, 1999

B.S., Agricultural and Biological Engineering, Geological Engineering, Cornell University, Ithaca, New York, 1998

Fellow, Centers for Disease Control and Prevention Environmental Public Health Leadership Institute (EPHLI), Atlanta, Georgia, 2010

PROFESSIONAL REGISTRATIONS AND CERTIFICATIONS

Registered Professional Engineer, New York, No. 084913

CAREER SUMMARY

Ms. Welt is a Registered Professional Engineer with over 20 years of experience in environmental consulting and regulatory work. She is a recognized expert in the field of subsurface vapor intrusion to indoor air, having evaluated and mitigated the vapor intrusion pathway at hundreds of major industrial and residential sites. She served as a vapor intrusion expert with the New York State Department of Health (NYSDOH), is a former member of the ITRC vapor intrusion team assisting with the development of their ITRC vapor intrusion guidance document, and has been an invited speaker on vapor intrusion topics.

Ms. Welt is also an experienced manager of soil, groundwater, and sediment investigation and remediation projects at industrial sites, former manufactured gas plants (MGP), and Department of Defense sites across the country. Her MGP experience is broad and includes investigation, evaluation, engineering design, remedial oversight, and site management at many different sites. She has researched various remedial measures to address residual MGP impacts, including development of risk-based remedial goals that incorporate bioavailability for MGP-impacted sediments.

Geosyntec consultants

Ms. Welt has extensive experience in design engineering, stakeholder negotiations, and management of complex environmental projects. She has participated in the dispute resolution process to ensure that responsible parties implement the appropriate measures to reduce exposures from the soil vapor intrusion pathway and impacted groundwater. She has developed and implemented many forums for discussing the status and rationale for environmental work and the associated human health and environmental risks.

Ms. Welt has authored numerous papers and given presentations on a variety of topics including community relations; vapor intrusion sampling, assessment, and mitigation techniques; risk-based management of contaminated sediments; treatment of groundwater; in situ remedial methods for contaminated sediments and soils; health and safety; and building systems. She is also a Fellow of the Centers for Disease Control and Prevention Environmental Public Health Leadership Institute.

In addition, Ms. Welt is co-chair and founding member of Geosyntec's MGP Practice Team and was selected to be a member of Geosyntec Vapor Intrusion Practice Team Steering Committee. These roles entail development of corporate-wide programs, marketing materials, and technology and best practices transfer.

Engineer of Record, Waste Water Treatment System*, Selkirk, New York.* Ms. Welt oversaw design of modifying a waste water treatment facility (WWTF). To improve system efficiency, Ms. Welt worked with the client to modify the current system to include recirculation methods and automation controlling the water that enters the WWTF and discharges to a river under a State Pollutant Discharge Elimination System (SPDES) Permit. Ms. Welt also oversaw modifications to the treatment chain, include pilot studies to select the appropriate ion exchange material, to address the elevated levels of zinc detected in the effluent.

Engineer of Record, Vapor Intrusion Mitigation System*, Camillus, New York.* Ms. Welt prepared venting design drawings and specifications, and oversaw inspections and vacuum testing services for a Cupolex™ aerated floor system to be installed during redevelopment of the Camillus Mills building.

Engineer of Record, Vapor Intrusion Mitigation System*, Bethpage, New York.* Ms. Welt prepared venting design drawings and specifications for a soil vapor extraction (SVE) system installed in a monitoring well to address the potential for chlorinated solvents to impact the indoor air quality of two commercial buildings adjacent to the edge of a chlorinated solvent impacted groundwater plume. With New York State Department of Environmental Conservation (NYSDEC) approval, Ms. Welt oversaw the soil vapor assessment activities, which included using high volume sampling, to delineate the nature and extent of potential areas of concern for vapor intrusion into these buildings. After reviewing the data obtained, Ms. Welt worked with the client and property owner to proactively mitigate the potential for vapor intrusion into the buildings from outside the buildings (i.e., intrusive activities [e.g., installation of holes through the floors] were not conducted in the buildings to meet the property owner's requests and holy nature of the buildings). Ms. Welt also developed the operation, maintenance, and monitoring program for the SVE system to be operated until the source that is posing a vapor intrusion concern is removed, and annual indoor air monitoring program to confirm the SVE system is reducing the potential for vapor intrusion into the occupied buildings.

Engineer of Record, Permit Modification*, Plattsburgh, New York.* Ms. Welt oversaw development of a modification permit application associated with incorporating the ability to manufacture a new series of parts/ products at an active manufacturing facility. As part of this process, Ms. Welt worked with the client to prepare a response to comments letter which included, but was not limited to, process flow diagrams and air emission models.

Engineer of Record, Certification of Visible Emission Compliance*, New York.* Ms. Welt reviewed results and documentation of opacity (visible emission) testing conducted on five emergency generators installed at five different facilities located in New York. Under this role she certified that the air emissions met the applicable emission regulations stipulated by the New York City Department of Environmental Protection.

Strategic Planning and Site Closure*, Caleres, Gowanda, New York.* Ms. Welt serves as Project Manager and technical expert overseeing the assessment and strategic planning associated with closing and delisting a hazardous waste landfill from the New York State Department of Environmental Conservation (NYSDEC) State Superfund Program. Ms. Welt is working with the client and its representatives in negotiating a closure and delisting strategy with the NYSDEC and transfer of the property to another entity.

Vapor Intrusion Assessment*, Newark, New Jersey*. Ms. Welt serves as the Technical Expert and Task Manager for an assessment of the potential for subsurface vapor intrusion to impact the indoor air of an active chemical manufacturing facility. As part of an United States Environmental Protection Agency (EPA) Order on Consent, the potential for vapor intrusion is to be assessed in each of the buildings. Ms. Welt developed, and is negotiating with the EPA, an assessment approach in accordance with the EPA's *Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (VI Guide, EPA 2015) and its companion document *Technical Guide For Addressing Petroleum Vapor Intrusion At Leaking Underground Storage Tank Sites* (EPA 2015) and the NJDEP Technical Rules [N.J.A.C. 7:26E -1.15(a)]. This approach uses a '"worst first" approach, using the results of shallow groundwater samples, to prioritize buildings for investigation. The results of the investigation will be evaluated using a multiple lines of evidence approach to guide what actions are needed to address the VI pathway in these buildings, and to assess if additional buildings should be assessed.

Vapor Intrusion Assessment*, Princeton Junction, New Jersey*. Ms. Welt serves as the Project Director and Technical Expert for an assessment of the potential for subsurface vapor intrusion to impact the indoor air of a manufacturing facility. The facility is being decommissioned and operations are ceasing. As part of the decommissioning process, an environmental assessment was conducted which indicated the presence of chlorinated solvents in shallow groundwater within 100 feet of the manufacturing building. This information triggered the need for a vapor intrusion assessment in accordance with the New Jersey Department of Environmental Protection Technical Requirements for Site Remediation. Due to the changing conditions with the building use, her role is to negotiate an assessment approach that meets the regulatory requirements and provides a safe environment for our client's employees while they remain at the facility.

Vapor Intrusion Assessment*, San Jose, California*. Ms. Welt serves as the Project Director and Technical Expert for an assessment of the potential for subsurface vapor intrusion to impact the indoor air of a commercial properties constructed over a chlorinated solvent impacted groundwater plume. As part of the United States Environmental Protection Agency (EPA) Five-Year review, it was determined by the EPA and the San Francisco Bay Regional Water Quality Control Board (RWQCB) that groundwater near the commercial structures has elevated levels of 1,1-dichloroethene, and that the potential for vapor intrusion needs to be evaluated in buildings within 100 feet of the impacted groundwater plume and near areas of potential migration pathways. Ms. Welt developed San Francisco Bay RWQCB-approved indoor air and soil vapor assessment work plans that would obtain the information necessary to evaluate the potential for vapor intrusion into the buildings of potential concern. Ms. Welt is also assisting the EPA update the next Five-Year review.

Technical Expert*, Vapor Intrusion Mitigation Assessment, East Hanover, New Jersey*. Ms. Welt serves as the Technical Expert and Project Manager peer reviewing and providing guidance to the client on the vapor intrusion assessment and mitigation activities being conducted at six buildings located near or overlying groundwater and soil vapor impacted with chloroform. In addition, due to the presence of 1,3-butadiene, benzene and ethylbenzene in soil vapor, a passive mitigation system was preemptively installed in a newly constructed building where a sensitive population would be present. The review indicated that the monitoring and mitigation measures being conducted are conservative and can be modified in accordance with the NJDEP Vapor Intrusion Guidance.

Technical Expert*, Oil Spill, Worcester, Massachusetts*. Ms. Welt serves as the Technical Expert peer reviewing and providing guidance to the client on the activities conducted and proposed to be conducted to address the environmental impacts from an oil spill. In this role, she reviews and provides insight on the applicability of the activities and costs incurred during the spill response activities, and guides the client with understanding the additional proposed activities and costs to be incurred to meet the Massachusetts Department of Environmental Protection regulatory requirements for clean-up and reporting. She also acts as a liaison between the client and the Licensed Site Professional responsible for the remedial actions being taken on the property.

Human Health Risk Assessment, *Resource Conservation Recovery Act (RCRA) Facility Plainville, Massachusetts.* Ms. Welt serves as the Project Director overseeing response to United States Environmental Protection Agency comments and development of a work plan to obtain the necessary data to complete an assessment of risk associated with the properties adjacent to the RCRA facility. Ms. Welt also oversees updating the human health risk assessments developed for the properties located adjacent to the facility.

Technical Expert*, North Loop, Pennsylvania*. Ms. Welt serves as the Project Director and Technical Expert peer reviewing and providing guidance to the client on the reasonableness of costs associated with the activities conducted to support management of unanticipated inadvertent fluid return generated during the first days of drilling at the Site. Ms. Welt also provided the client with results of a health and safety audit which she conducted while observing drilling operations.

Develop and Support Closure Strategy*, Former Manufacturing Facility, Bridgeport, Connecticut.* Ms. Welt serves as the Project Manager overseeing the activities necessary to achieve regulatory closure under Connecticut's Voluntary Remediation Program at a property formerly used for manufacturing. Under this role, she develops and ensures implementation of activities needed to aid in advancing site characterization and development of remedial approaches and costs necessary to address impacts to soil, groundwater, and non-aqueous phase liquid present on the property.

Compliance Activities*, Southeastern Massachusetts.* Ms. Welt serves as the Project Manager overseeing the activities necessary to achieve regulatory closure under the Massachusetts Contingency Plan (MCP) and confirm compliance with the conditions of the closure at three different sites. Under this role, she ensures site reconnaissance activities are conducted to confirm compliance with the Activity and Use Limitation and Agreement & Restriction documents imposed on each property, (2) responds to questions

Geosyntec consultants

from the Massachusetts Department of Environmental Protection, Town officials, or the property owners, as needed, (3) coordinates with the new property owners regarding redevelopment, and (4) manages decommissioning of on-Site monitoring wells, as appropriate. She also acts as the liaison between the Licensed Site Professional, and representatives of the client and property owners.

***Vapor Intrusion Assessment**, Meijer, Inc., Albany, New York.* Ms. Welt serves as the Project Manager and Technical Expert for an assessment of the potential for subsurface vapor intrusion to impact the indoor air of a leased space. The space is located within a strip mall that is listed as a New York State Department of Environmental Conservation (NYSDEC) State Superfund Program Site. Because the recommended remedy under the NYSDEC-issued Record of Decision has not been implemented, her role includes assessing the current indoor air quality and the potential for vapor intrusion to impact indoor air quality in order to assure a safe environment for our client's employees and customers.

***Support Property Transfer,** Marx Realty, New York, New York.* Ms. Welt serves as the Project Manager and Technical Expert supporting successful purchase of a property where a potential recognized environmental condition was documented by others. Under this role, she supported the client work the bank to identify a path forward which included, reviewing Phase I Environmental Site Assessments and files housed at the Manhattan Department of Buildings, coordinating ground penetrating radar services to locate a presumed underground storage tank, and communications with the bank representatives.

***Support Property Transfer,** Marx Realty, Seattle, Washington.* Ms. Welt serves as the Project Manager and Technical Expert supporting successful transfer of a property where a potential recognized environmental condition associated with a former auto repair shop was identified by others. Under this role, she reviewed documents and guided proposed Phase II activities with the client and the potential buyer. Ms. Welt also developed cost estimates for potential remedial alternatives to prevent the potential of vapor intrusion into the building and addressing groundwater impacted with petroleum-related compounds and trichloroethene.

***Assess Potential for Vapor Intrusion to Support Property Transfer,** Marx Realty, New York, New York.* Ms. Welt serves as the Project Manager and Technical Expert supporting successful transfer of a mixed-use property where the potential for vapor intrusion was identified by others. Under this role, Ms. Welt reviewed a Phase I Environmental Site Assessment, indoor air sample results, and documents associated with a historic gasoline release that was properly addressed in accordance with New York State Department of Environmental Conservation regulations.

Geosyntec consultants

Soil Vapor Assessment, *FMC Corporation, South Charleston, West Virginia.* Ms. Welt serves as Project Manager and technical expert overseeing development, implementation, and evaluation of a soil vapor assessment. The evaluation was conducted to assess whether vapor intrusion mitigation controls would be required to protect indoor air quality should development occur in portions of the Site, and to assess whether the current passive vapor intrusion control measure installed in an occupied building was adequate. In addition, the soil vapor assessment evaluated whether further vapor intrusion investigation activities were needed in adjacent off-Site residential properties. Based on the analytical results obtained around the occupied Site building, Ms. Welt, coordinated, evaluated, and communicated the results of an indoor air assessment.

Site Investigation, Remediation, and Compliance Activities*, Confidential Client, Waterbury, Connecticut.* Ms. Welt serves as the Project Manager and Technical Expert for a former laundering and dry-cleaning facility. In this role, to assist the client achieve Site Closure under the Connecticut (CT) Property Transfer Program and address a notice of violation associated with polychlorinated biphenyls and an underground storage tank, she oversees the planning and implementation of site investigation and remediation activities; regulatory negotiations with the CT Department of Energy and Environmental Protection and United States Environmental Protection Agency, and assists with property transfer requirements including developing an Environmental Land Use Restriction.

Site Investigation, Remediation, and Strategic Planning, *Confidential Client, Illinois.* Ms. Welt serves as a Technical Expert and Project Manager for manufactured gas plant sites located throughout Illinois. As technical expert she oversees the planning and implementation of site investigation and remediation activities, which include development of work plans, air monitoring plans, feasibility studies, and technical specifications. She also evaluates and reports on the data obtained to the Illinois Environmental Protection Agency (IEPA); participates in client planning meetings, develops overall company approaches to managing the portfolio of sites, and reviews all documents associated with site work conducted by others prior to submittal to the IEPA.

Site Characterization, Remediation, and Strategic Planning, *Shiels Obletz Johnsen, Inc., Amherst, New York.* Ms. Welt serves as the Project Manager and Technical Expert for two properties undergoing property transactions. She provides independent and peer review consulting services assessing other consultant's reports and proposed work to evaluate environmental impacts associated with historic operations on these properties. She also negotiates between the New York State Department of Environmental Conservation (NYSDEC), property buyers and sellers, legal counsel, financial institutions, and other consultants and subcontractors when developing appropriate remedial measures - including vapor intrusion mitigation, groundwater treatment, soil removal - necessary to obtain NYSDEC site closure and enable sale of the properties. Once the negotiations are complete, Ms. Welt writes NYSDEC and stakeholder approved work plans and reports, as well as oversees implementation of the work conducted and supports sale of the properties.

Site Investigation, Remediation, and Compliance Activities*, Wrenn Bender McKown & Ring LLL, Bland Farms, New York, LLC, Cato, New York.* Ms. Welt serves as the Project Manager and technical expert overseeing the assessment, removal, and proper disposal of buried pesticides and surrounding impacted soils. She participated in negotiations with representatives of the New York State Department of Environmental Conservation (NYSDEC) Bureau of Pesticide Management (BPM), Spills Division, and Environmental Conservation Police Officers to develop and implement a NYSDEC-approved investigation and remediation work plan necessary to achieve site closure. She also participated in a NYSDEC BPM audit and follow-up activities including annual pesticide reporting; conducted an environmental assessment of the farm and farm operations and assisted the farm comply with the NYSDEC petroleum bulk storage regulations and chemical use and storage requirements; and provided training on pesticide/herbicide use/management to farm personnel. In addition, she prepared and submitted the NYSDEC required progress reports.

Strategic Planning and Risk Communication, *Confidential Client, Residential Property, Pittsfield, Massachusetts.* Ms. Welt serves as Technical Advisor and Project Manager overseeing selection of appropriate remedial measures, human health evaluations, and community relations. She provides independent and peer review consulting services assessing other consultant's reports and proposed work to evaluate the off-gassing and potential vapor intrusion impacts, if any, associated with a fuel oil spill which impacted building and sub-surface materials. In addition, Ms. Welt, assisted the client negotiate appropriate cost allocation for the selected remedial actions.

Vapor Intrusion Mitigation, *New Hampshire Ball Bearings, Inc., Peterborough, New Hampshire.* Ms. Welt serves as the Project Manager and technical expert overseeing the assessment, design, construction, and operation, maintenance and monitoring of a vapor intrusion mitigation system in an active manufacturing facility.

Regulatory Negotiation and Remedial Design*, Gowanus Canal Superfund Site, Brooklyn, New York.* Ms. Welt serves as a Technical Advisor overseeing refinement of the conceptual site model, development of pre-design investigations, providing regulatory support, and performing remedial design activities. Her focus is on the mobility of manufactured gas plant related dense non-aqueous phase liquids from upgradient sites into the canal sediments.

***Technical Oversight**, Newtown Creek Superfund Site, Brooklyn, New York.* Ms. Welt serves as a Technical Advisor assisting with remedial investigation/ feasibility study field scoping and data interpretation. Her focus is on forensic analysis of source materials impacting creek sediments.

Vapor Intrusion Evaluation and Mitigation, *MEW Superfund Site, Mountain View, California.* Ms. Welt serves as the Technical Director overseeing the assessment and mitigation, if needed, of the potential for vapor intrusion to impact the indoor air of commercial properties overlying a chlorinated solvent impacted groundwater plume. She develops building-specific sampling plans and sampling events, and vapor intrusion control system designs; evaluates and reports on the data obtained to the United States Environmental Protection Agency (EPA); participates in stakeholder meetings; develops community relations materials; and reviews all documents associated with the vapor intrusion evaluations conducted by others. In addition, she reviews and develops appropriate mitigation measures to prevent vapor intrusion into the buildings. As Technical Director she also prepares and submits the monthly and annual progress reports, and works with the potentially responsible parties and associated consultants to develop a remedial strategy that is protective of public health, in the current and future building residential and commercial scenarios, and the environment.

Vapor Intrusion Evaluation and Human Health Risk Assessment, *Confidential Client, Brazil.* Ms. Welt served as the Project Manager and technical expert for an assessment of the potential for vapor intrusion to impact the indoor air of current buildings and future construction on an industrial site where fractured bedrock and NAPL underlying the buildings is present. She evaluated the potential and associated health risks with exposure to all impacted (groundwater, soil vapor) environmental media under the current and future on- and off-site land use scenarios to develop appropriate site management and redevelopment plans. Ms. Welt also assessed and discussed appropriate remedial measures and controls with the regulatory agency and future property owners, and developed deed restrictions and institutional controls to limit future exposure. To mitigate the potential for vapor intrusion into any on and off-site current or future buildings, Ms. Welt is evaluating appropriate remedial measures to address impacted vadose zone soils and groundwater underlying the site.

Development of Groundwater Remedial Action Levels, *Confidential Client, Brazil.* Ms. Welt evaluated the potential for vapor intrusion into on-site and off-site commercial buildings using multiple lines of evidence and model results. Based on the vapor intrusion potential pathway, the only exposure pathway, As Project Manager and technical expert, Ms. Welt developed and negotiated with the regulatory agency groundwater remedial action and monitoring levels that would be protective of human health.

Development of Soil Clean-Up Levels, *Confidential Client, New York.* Using forensic evidence and a review of historic fill and other background sources of contamination, Ms. Welt managed the project that determined the areal extent of potential contamination from a former battery manufacturing operation. Coordinating with many stakeholders and technical experts, she also developed soil clean-up levels that were protective of public health and the environment.

Development of Compliance Management System*, Arch Coal Inc. (ACI), United States of America Operations.* Developed a compliance management system (CMS) to provide ACI a set of environmental standards and practices by which to operate. The CMS is designed to standardize and formalize the practices and programs used to maintain, track, and improve environmental performance throughout the company. The CMS includes a corporate-level policy that establishes ACI's commitment to environmental performance; a high level document that presents the processes ACI will use to manage its environmental programs; written procedures that define how the company manages its environmental programs from a systems standpoint; written documents that describe an interpretation of each applicable regulatory requirements; operation-specific procedures detailing how the operation will comply with the each of the applicable regulatory programs. As a result of implementing the CMS, ACI has seen marked improvement in environmental performance throughout its operations. In addition, this project has resulted in EnviroGroup, a Geosyntec company, being named as the CMS consultant in a Consent Decree with EPA to address water quality matters at these operations.

Forensic Evaluation of Benzene in Outdoor Air*, Roxanna, Illinois.* Ms. Welt conducted a forensic analysis of outdoor air and shallow soil vapor samples collected and analyzed for volatile organic compounds to assess whether the detections of benzene in outdoor air are caused by the subsurface petroleum hydrocarbon impacts detected in the investigation area within the village. The forensic analysis included evaluating the temporal and spatial variability of benzene in outdoor air and soil vapor; evaluating the relative concentrations of select petroleum-related hydrocarbons detected in soil vapor and outdoor air; and modeling to provide an upper-bound estimate of the potential migration of VOCs from soil vapor to outdoor air.

Vapor Intrusion Mitigation System Design*, Jacobs Engineering, Alaska.* Ms. Welt served as the Project Manager and technical expert overseeing the design and implementation of pilot-scale sub-slab soil vapor intrusion mitigation system designs to determine which design would most efficiently mitigate the potential for vapor intrusion in bunkers overlying drum storage areas. Ms. Welt negotiated the work plan approach and selected designs with the Department of Defense.

Vapor Intrusion Evaluation, North Penn 12 NPL Site, *Schlumberger Technology Corporation, Worcester Township, Pennsylvania.* As part of a five-year review response, Ms. Welt served as the Project Manager and technical expert who developed, negotiated, and implemented a phased soil vapor intrusion evaluation at a USEPA Region 3 National Priority List. Due to the history of the site, obtaining access and community relations was a key component of completing the work. Collaborating with the Agency and providing constant communication (e.g., development and implementation of phone calls, letters, fact sheets) throughout the evaluation process, Ms. Welt selected and assessed "worst case" buildings over the contaminated groundwater plume resulting in a no further action and protectiveness of public health determination.

Vapor Intrusion Evaluation*, Schlumberger Technology Corporation, Mt. Holly, New Jersey.* Using a multiple lines of evidence approach, as the technical expert and Project Manager, Ms. Welt assessed whether site-related chlorinated volatile organic compounds could impact the indoor air quality of buildings overlying the groundwater plume. She conducted community relations activities including development of fact sheets, obtaining access, and development and transmittal property owner result letters; and negotiated the approach with the regulatory agency which led to sampling only five of the 100 buildings and a No Further Evaluation determination.

V*apor Intrusion Evaluation,* *Holland & Knight LLP, Odenton, Maryland.* Using a multiple lines of evidence approach, Ms. Welt assessed whether residual concentration of tetrachloroethene in soil vapor could impact indoor air of newly constructed apartment buildings via the vapor intrusion pathway or if mitigation measures are necessary. As Project Manager and technical expert, she also participated in regulatory negotiations and development of a site management plan.

Dispute Resolution, Industrial Facility*, New York.* Ms. Welt assisted the State of New York negotiate and win a dispute resolution case where OSHA Permissible Exposure Limits were deemed not applicable in commercial or industrial settings where people may be exposed involuntarily to chemicals from soil vapor intrusion. This case is a landmark case and is referenced in many other vapor intrusion cases within New York as the Administrative Judge determined that OSHA standards are deferred to only when the chemical(s) in soil vapor are routinely used as part of regular operations in the building.

Feasibility Study for a Manufactured Gas Plant Site, *Niagara Mohawk, New York.* Ms. Welt authored a Feasibility Study for the $18 million remediation of a former MGP site located along a major river in New York. She evaluated remedial alternatives for soil including excavation, in-situ solidification using soil auger mixing, and in-situ chemical oxidation and groundwater including DNAPL extraction and in-situ chemical oxidation. Ms. Welt developed a pre-design investigation work plan necessary to delineate impacts and extent of the in-situ stabilization area, type of shoring needed during excavation activities, installation of DNAPL recovery wells, and pilot-scale studies associated with in-situ stabilization slurry mixture and in-situ chemical oxidation methods.

Assessment of Vapor Intrusion Mitigation Measures*, Chevron, California* Ms. Welt authored a report that presents the available mitigation measures and controls being used in the United States to address vapor intrusion issues in existing commercial and residential buildings. The report presents a description of available control options, including retrofit controls or controls installed during construction; a qualitative evaluation of the effectiveness of identified options and supporting data; the expected cost and time ranges for complete implementation of options; and historical regulatory acceptance of various options for specific contaminant mitigation efforts. The report aids in selecting appropriate controls based on site-specific information.

Soil Gas Sampling Plan*, Confidential Utility, Florida*. Ms. Welt authored a soil-gas sampling plan to assess the potential for vapor intrusion at a former MGP site regulated under an Administrative Order on Consent with the USEPA.

Evaluation and Mitigation of Vapor Intrusion Pathway*, Confidential Client, New York*. Ms. Welt managed development, implementation, and evaluation of a $0.5 million annual soil vapor intrusion sampling program necessary to assess the potential for vapor intrusion into multiple buildings (footprint of over 1.1 million square feet) overlying an impacted groundwater plume. She also assessed potential control measures and as appropriate designed and implemented some engineering controls to reduce indoor air concentrations.

Regulatory Guidance Document Review*, Confidential Client, New York*. Ms. Welt reviewed and commented on the New York State Department of Health's draft Guidance for Evaluating Soil Vapor Intrusion in the State of New York (February 2005).

Evaluation of Controls to Vapor Intrusion Pathway*, Confidential Client, New York.* Ms. Welt managed the development, implementation, and evaluation of soil vapor intrusion sampling program conducted to assess the potential for vapor intrusion into a 1 million square foot commercial building overlying an impacted groundwater plume. She also assessed use of active soil vapor extraction system to mitigate the potential risks associated with this impacted groundwater plume.

Vapor Intrusion Assessment, *Confidential Client, New York.* Ms. Welt managed the assessment of potential risks associated with an underlying impacted groundwater plume and development of a conceptual vapor intrusion mitigation system design to reduce these potential risks.

***In-Situ Solidification Pilot Scale Study**, FMC, Ayer, Massachusetts*. Ms. Welt managed and provided technical guidance on a Massachusetts Contingency Plan (MCP) pesticide site that was being remediated under an Administrative Consent Order regulated by the Massachusetts Department of Environmental Protection. She conducted additional site delineation, preparation, observation, and documentation of in-situ solidification/stabilization pilot study; prepared the MCP-required documents and necessary permits; negotiated access agreements; and served as the community relations manager.

***Pond Sediment and Wetland Rehabilitation,** FMC, Wrentham, Massachusetts.* Ms. Welt managed a dig-and-haul sediment remediation with wetland restoration in the permitting phase for an MCP site. Activities associated with this work include permitting at the federal (i.e., 401 Water Quality Certifications and a USACE Individual Permit) and local (i.e., Order of Conditions) levels, negotiating access agreements, community relations, and working with the client's environmental contractors.

***Vapor Intrusion Evaluation**, Confidential Client, New York.* Ms. Welt managed the assessment of potential risks to indoor air at a commercial facility and surrounding residential neighborhood by developing a conceptual site model to determine if the vapor intrusion pathway exists, developing and implementing a sampling work plan to evaluate this potential exposure pathway, and confirming the conceptual site model.

***Passive Groundwater Treatment System, Manufactured Gas Plant Site**, Niagara Mohawk, New York.* Ms. Welt served as the Task Manager and Design Lead for a passive groundwater treatment system to be installed at a former MGP site. She developed and assessed a groundwater model; evaluated groundwater treatment system design alternatives based on the site-specific conditions and constraints (e.g., limited treatment area, floodplain issues) effecting cost, timing, permitting, and constructability; designed the groundwater treatment system and appropriate treatment media; assessed the chosen treatment media to meet state-determined clean-up guidance criteria and determine the schedule and costs associated with operation, maintenance, and monitoring of the system; and assessed the designed system for permit requirements.

***Technical Framework Authorship**, New York Gas Group, New York.* Ms. Welt served as the Project Manager and author of the design of a technical framework for managing contaminated sediments in New York. The framework is based on Federal and New York State regulatory guidance.

Sediment Assessment Protocols Authorship*, New York Gas Group, New York.* Ms. Welt served as the Project Manager and author of the application of sediment assessment protocols with the purpose of defining environmentally acceptable concentrations of hydrocarbons in sediment.

Topical Report Authorship*, Gas Research Institute, New York.* Ms. Welt served as the project Manager and author of a topical report evaluating the in-situ bioremediation of sediments.

Topical Report Authorship*, Gas Research Institute, New York.* Ms. Welt served as the Project Manager and author of a topical report evaluating in situ soil treatment using the contained recovery of oily wastes (CROW©) process.

Sediment Dredging and Capping of Manufactured Gas Plant Wastes*, Atlanta Gas Light Company, Macon, Georgia.* Ms. Welt managed and designed a $2 million sediment dredging and capping remediation. She prepared permit applications and designs, and authored technical specifications for sediment remediation. Ms. Welt also authored the community air monitoring and water quality monitoring plans as well as site work plan and closeout reports including the final engineering report and the operation and maintenance plan. During field work, she managed field operations, including meetings with the Georgia Environmental Protection Division and local water authority; oversaw water treatment operations and water monitoring program of river and treated waste; and established and maintained community relations during the remedial activities.

Soil Remediation in a Residential Area*, NiSource, Portsmouth, Virginia*. Ms. Welt designed and managed a $1.4 million soil remediation project. She authored the pre-design sampling program, site work plan, bidding documents, final engineering report, and health and safety plan and all applicable amendments and additional plans. During field work, she oversaw field operations and was responsible for meeting with the Virginia Department of Environmental Quality, personnel management, client relations, and field engineering. Ms. Welt developed engineering controls to minimize neighborhood disturbance and management of noise and fugitive emissions; and developed and oversaw plans for vibration and soil density testing and site restoration including drainage, landscaping, and hardscaping. She managed all environmental, health, and safety during field activities including community and work zone air monitoring and served as the company and client representative during Virginia Occupational Safety and Health auditing, citation, and informal conference procedures. Ms. Welt also established and maintained community relations during the remedial activities through meetings with homeowners and neighborhood.

Vapor Intrusion Evaluations and Industrial Hygiene, Manufactured Gas Plant Sites, *Consolidated Edison, New York.* Ms. Welt served as the Project Manager and developed and authored work plans and health and safety plans to assess the indoor air quality within multiple residential and commercial structures built on top of or adjacent to former manufactured gas plants in urban and residential areas. She managed the budget, client relations, field activities, and reporting of these indoor air quality assessments. Ms. Welt also authored and provided evaluations of these indoor air analyses compared with soil gas surveys in technical assessment reports and oversaw industrial hygiene monitoring during field activities.

Vapor Intrusion Evaluation at Manufactured Gas Plant Site, *Jersey Central Power and Light, New Jersey.* Ms. Welt developed and authored work plans and health and safety plans to assess the indoor air quality within multiple commercial structures built on top of a former manufactured gas plant in an urban area. She managed the budget, client relations, and reporting associated with these evaluations of potential sub-surface vapor intrusion; and evaluated and reported upon the air and soil gas analyses in a technical assessment report.

Assessment of Mercury Indoor Air Impacts*, State Educational System, Texas*. Ms. Welt developed and authored work plans and health and safety plans to assess the indoor air quality within a university building impacted with elemental mercury. She managed and evaluated all field sampling activities, health and safety, the budget, client relations, and reporting associated with this indoor air quality assessment. Ms. Welt also developed and authored the necessary access permits and abatement plans to enable re-use of the building.

Assessment of Mercury Indoor Air Impacts, *Confidential Client, New York.* Ms. Welt developed and authored work plans and health and safety plans to assess the indoor air quality within a former business impacted with elemental mercury. She managed and assessed porous material sampling and air results associated with these plans and authored the technical assessment report associated with these activities and findings.

Air Monitoring Plan*s, Confidential Railroad Company, Minnesota*. Ms. Welt developed community and work zone specific air monitoring plans for arsenic-impacted soil remediation. The plans were based on human-health risk assessments, State and Federal regulations, and government negotiations.

Technical Specifications*, Columbia Gas of Pennsylvania, Pennsylvania*. Ms. Welt authored technical specifications and bidding documents associated with the installation of a DNAPL Recovery System along a creek.

Site Restoration and Water Management Plans, *Confidential Utility Client, Exeter, New Hampshire*. Ms. Welt designed a site restoration plan and site groundwater and stormwater management plans.

Site Management Plan, *Ingersoll Rand, Olean, New York.* Ms. Welt developed a site management plan, a required element of the New York State (NYS) Spill Response Program administered by New York State Department of Environmental Conservation (NYSDEC). The plan presents a detailed description of all procedures required to manage remaining contamination at the site after completion of the Remedial Action, including media monitoring, to be conducted under a NYSDEC approved Monitoring Plan, and appropriately managing any soils to be excavated.an approach to monitor and handle residual soil and groundwater contamination. The plan also includes a description of Periodic Review Reports for the periodic submittal of data, information, recommendations, and certifications to NYSDEC.

Due Diligence Support, *Ropes and Gray LLP, New York, New York.* Ms. Welt reviewed environmental investigation reports and provided environmental due diligence services in connection with contemplated investment in the redevelopment of a property in New York, New York. In particular, she assessed all documents and provided guidance to the property buyer and its respective legal and insurance teams on how the redevelopment plans would need to meet the regulatory requirements of the New York State Department of Environmental Conservation Brownfield Cleanup Program.

Manufactured Gas Plan Site Remediation, *National Fuel Gas, New York*. Ms. Welt managed the excavation, rendering, and capping of 12 acres of MGP-impacted soils and sediments. She monitored personnel and community health and safety and functioned as a liaison between field personnel and client with daily site progress and developments, and as the field engineer. Ms. Welt also authored final reports and site-specific field guide for field technician's daily activities.

PROFESSIONAL HISTORY

Geosyntec Consultants, Acton, Massachusetts; Albany, New York, 2012-present

EnviroGroup Ltd. (a Geosyntec company), Albany, New York, 2010-2012

New York State Department of Health, Albany, New York, 2006-2010

Blasland, Bouck & Lee, Inc., Syracuse, New York, 2004-2006

The RETEC Group, Inc., Ithaca, New York, 2000-2004

Geosyntec consultants

PUBLICATIONS AND PRESENTATIONS

19-10 Welt, S.B. October 7, 2019. Panel Discussion "Improving Community Relations" at the MGP Conference, Philadelphia, PA.

15-01 Welt, S.B., and C.P. Raymond, "Aerated Floors for Green and Sustainable Mitigation of Vapor Intrusion to Indoor Air". High Profile. October 14, 2015. http://www.high-profile.com/aerated-floors-for-green-and-sustainable-mitigation-of-vapor-intrusion-to-indoor-air

14-01 Welt, S.B., December 8 – 10, 2014. Taught three-day course on "Environment Health & Safety Issues" to Capital Region Building Owners and Managers Association. Course provides information necessary to develop and manage proactive environmental/occupational health and safety programs, comply with regulatory standards and guidelines, and assess when to obtain technical assistance. Albany, NY

14-02 Welt, S.B., April 8, 2014. "Vapor Intrusion at MGP Sites: Is it a Complete Exposure Pathway?" Presentation at the Fifth International Symposium and Exhibition on the Redevelopment of Manufactured Gas Plant Sites, Destin, FL

14-03 Welt, S.B., March 10 – 12, 2014. Taught three-day course on "Design, Operation, and Maintenance of Building Systems" to Capital Region Building Owners and Managers Association. Course provides information necessary to increase occupant safety and comfort while facilitating building efficiency to meet the business goals of an organization. Albany, NY

13-01 Putnam, R, and S. Welt, March 19, 2013. "Treatment of 1,4-Dioxane in Groundwater" manuscript and presentation at the Association for Environmental Health and Sciences 23rd Annual Meeting and West Coast Conference on Soils, Sediments, and Water, San Diego, CA

13-02 Welt, S.B, March 19, 2013. "The Value of Open Communication," poster at the Association for Environmental Health and Sciences 23rd Annual Meeting and West Coast Conference on Soils, Sediments, and Water, San Diego, CA

13-03 Welt, S.B., and E. Lovenduski, May 8, 2013. "Sustainable Mitigation for Vapor Intrusion" presentation at the Air and Waste Management Meeting, Albany, NY

13-04 Welt, S.B., May 8, 2013. "Update on Vapor Intrusion Pathway and USEPA Guidance Documents" presentation at the Air and Waste Management Meeting, Albany, NY

13-05 McAlary, T., R. Ettinger, S. Welt, J. Kurtz, D. Folkes, and W. Wertz, May 31, 2013. "Update on the USEPA OSWER Guidance for Vapor Intrusion" presentation at the University Consortium for Field-Focused Groundwater Contamination Research Program for Annual Progress Meeting: May 30&31, 2013 The Arboretum, University of Guelph, Guelph, CA

12-01 Welt, S.B., F. Legall, and M. Singer., October 3, 2012. "Developing Groundwater Clean-Up Levels Based on the Vapor Intrusion Pathway" presentation at Air & Waste Management Association's Vapor Intrusion Conference & Exhibition, Denver, CO

12-02 Welt, S.B., and L. Sigler, October 3, 2012. "The Value of Open Communication," poster at Air & Waste Management Association's Vapor Intrusion Conference & Exhibition, Denver, CO

10-01 Welt, S.B., September 7 – 9, 2010. Taught three-day course on "Environment Health & Safety Issues" to Capital Region Building Owners and Managers Association. Course provides information necessary to develop and manage proactive environmental/occupational health and safety programs, comply with regulatory standards and guidelines, and assess when to obtain technical assistance. Albany, NY

10-02 Shearer, S.B. February 23, 2010. "Effective Communication" Demonstrating the Need for Open, Honest, and Timely Responses to Stakeholder Concerns". EPHLI Thesis, Centers for Disease Control and Prevention Environmental Public Health Leadership Institute, Atlanta, GA, 2010

06-01 Shearer, S. B., and G. Wroblewski. June 14, 2006. "Vapor Intrusion: Data Evaluation". Presentation at the New Jersey Water Environment Association and New Jersey Department of Environmental Protection Technical and Regulatory Update Seminar, East Brunswick, NJ

06-02 Welt, S. B. March 15, 2006. "Vapor Intrusion Mitigation Engineering Controls: Comparison of Methods, Costs, and Implementation". Presentation at Association for Environmental Health and Sciences 16th Annual Meeting and West Coast Conference on Soils, Sediments, and Water, San Diego, CA

05-01 Welt, S. B., and G. Wroblewski. October 21, 2005. "Indoor Air Sampling Methods: Why, How, and What Can Go Wrong". Presentation at the New Jersey Water Environment Association and New Jersey Department of Environmental Protection Technical and Regulatory Update Seminar, East Brunswick, NJ

05-02 Babyak, A., and S.B. Welt. June 2005. Vapor Intrusion Mitigation Engineering Controls: Comparison of Methods, Costs and Implementation. Air &Waste Management Association – Paper #1298

05-03 Welt, S.B. June 24, 2005. "Vapor Intrusion Mitigation Engineering Controls: Comparison of Methods, Costs, and Implementation". Presentation at Air & Waste Management Association's 98th Annual Conference &Exhibition, Minneapolis, MN

03-01 Leuschner, A., Welt, S.B., Contained Recovery of Oily Wastes Brodhead Creek NPL Site, Stroudsburg, Pennsylvania, GRI Report, September 2003

03-02 Leuschner, A., Welt, S.B., Greacen, J., in Situ Bioremediation of Intertidal Zone Sediments, Salem Massachusetts, GRI Report, September 2003

03-03 Welt, S.B., "How to Handle a Regulatory Inspection", Pittsburgh, PA, April 26, 2003

02-01 Welt, S.B., "Sediment Remediation", Salt Lake City, UT, March 15, 2002

02-02 Welt, S.B., "Risk-Based Management of Sediments", Salt Lake City, UT, March 14, 2002

02-03 Welt, S.B., "How Can We Incorporate Bioavailability to Determine Risk When Managing MGP-Impacted Sediments?" Salt Lake City, UT, March 14, 2002

01-01 Welt, S.B., "The Environmental Risks Associated with Bladder Cancer in Monroe County", Master's Thesis, University of Rochester School of Medicine and Dentistry, Rochester, NY, 2001

99-01 Welt, S.B., "Colloidal Transport of Heavy Metals via Preferential Flow Paths", Master's Thesis, Cornell University, Ithaca, NY, 1999

ADDITIONAL TRAINING

Agency for Toxic Substance & Disease Registry (ATSDR)'s Basic Course for Health Assessment Consultation

National Incident Management System Incident Command System 100, 200, 300, 400, 700, 800

OSHA Certification in HAZWOPER Supervisor Training

NUCA Excavation Competent Person

OSHA Certification in Electrical Safety (General Industry)

OSHA Certification in 10-Hour Construction

Certified in 4-Hour DOT Basic HAZMAT (#1058)

OSHA Certification in HAZWOPER 40-Hour with Annual 8-Hour Refreshers

On-Track Railroad Safety Certification with Annual Refreshers

CSX Roadway Worker Protection Contractor Safety Certification (2015)

Adult and Pediatric First Aid/ Cardiopulmonary Resuscitation (CPR) / Automated External Defibrillator (AED)

CURRENT PROFESSIONAL AFFILIATIONS

National Society of Professional Engineers

National Association of Professional Women – VIP Woman of the Year (2015)

Continental Who's Who Lifetime Member

Oxford Who's Who Tier of Excellence Lifetime Achievement Award (2015)

JEANMARIE ZODROW, Ph.D.

toxicology
ecological risk assessment
ecotoxicology
metals/mining risk assessment

EDUCATION

Ph.D., Toxicology, University of Colorado Health Sciences Center, Denver, CO, 2003
M.S., Environmental Sciences, University of Colorado Denver, Denver, CO, 1996
B.S., Biology, University of Colorado Denver, Denver, CO 1993

REGISTRATIONS AND CERTIFICATIONS

Society of Environmental Toxicology and Chemistry, member (2012-Present)
HAZWOPER 40-hour
MSHA surface miner 24-hour

CAREER SUMMARY

Dr. Jean Zodrow has more than 15 years of experience in environmental toxicology, ecological risk assessment, bioaccumulation and bioavailability of environmental contaminants, biological assessments, and water quality criteria review. Dr. Zodrow began her career at U.S. EPA in the Integrated Risk Information System (IRIS) program as a chemical manager. Following a move to U.S. EPA Region 10 in Seattle, WA, Jean developed Biological Evaluations for Endangered Species Act Consultation for NPDES permitting, biological assessments for NEPA environmental impact statements (EISs)/supplemental EISs, and was a lead Ecological Risk Assessor for a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund mine site in Idaho. Most recently, Jean has experience providing technical expertise for ecological risk assessments to clients with multi-stakeholder contaminated sites involving PCBs, metals, and PFAS in Idaho, Alabama, Michigan, Ohio, and California. She was the project lead for one of the Strategic Environmental Research and Development Program's projects developing risk-based screening criteria for per- and polyfluoroalkyl substances (PFASs).

PROJECT EXPERIENCE

<u>Technical Project Examples</u>

Ecological Risk Assessment of Metals, *Confidential Client, Caribou County, ID.* Evaluated environmental fate and ecological risk associated with metals at five former phosphate mine sites in Idaho. Developed work plans for data collection, reviewed terrestrial and aquatic ecological data, derived Conceptual Site Models for ecological receptor exposure, conducted bioaccumulation and toxicity assessments for ecological risk assessment for multiple sites. Developed alternative toxicity reference values for selenium in birds and mammals. Prepared numerous documents for client including a Screening Level Ecological Risk Assessment, Preliminary Baseline Problem Formulation Technical Memorandum, Background Evaluation Report, and Baseline Ecological Risk Assessment.

Ecological Risk Assessment of Chromium, *Confidential Client, Jefferson County, OH.* Evaluated environmental fate and ecological risk associated with metals at a former ferrochrome alloy site. Developed work plans to determine field-based site-specific bioaccumulation of metals from soil for ecological receptors. Reviewed terrestrial and aquatic ecological data, derived Conceptual Site Models for ecological receptor exposure, and conducted bioaccumulation and toxicity assessments. Prepared Baseline Ecological Risk Assessment for metals at the site focusing on chromium.

Ecological Risk Assessment of PCBs, *Kalamazoo Superfund Site, Kalamazoo, MI.* Evaluated environmental fate and ecological risk associated with PCBs at a former paper mill. Reviewed terrestrial and aquatic ecological data, provided technical expertise in developing the Alternatives Screening Technical Memorandum (ASTM) document for Kalamazoo PCB Site Area 1 and BERA document for Kalamazoo PCB Site Area 2.

Ecological Risk Assessment of PCBs, *Anniston PCB Superfund Site*, *Anniston, AL*. Evaluated environmental fate and ecological risk associated with PCBs at a former chemical site located in EPA Region 4. Provided technical expertise in developing the Streamlined Ecological Risk Assessment (SERA) for OU-1/OU-2 Portion of Snow Creek for the Anniston PCB Site. Providing technical expertise for development of the Anniston OU-4 Baseline Ecological Risk Assessment.

Ecological Risk Assessments, *U.S. EPA Region 10, Eastern Michaud Flats Superfund Site, Power and Bannock Counties, ID*. Regional ecological risk assessor on a former phosphate fertilizer manufacturer mine site. Reviewed and assisted with reanalysis of ecological risk assessment, determining ecological impacts of contaminants to terrestrial and aquatic species at the site and provided briefing memos to the Office of Regional Council and the Regional Project Manager. Involved in development of RI/FS and identifying environmentally protective areas for remediation. Served as the agency resource on ecological risk concerns in public meetings.

Biological Evaluations, NEPA EIS, and Section 7 Consultation, *USEPA Region 10, Seattle, WA*. Developed Biological Evaluations for triennial review of water quality criteria for the states of Oregon and Idaho, Alaska's Residue and Mixing Zone Criteria, NEPA EIS documents for Alaska offshore oil and gas facilities, and NPDES permits granted to oil and gas, mining, wastewater and hatchery facilities in Washington, Oregon and Idaho as well as Alaska's offshore seafood processing facilities as required under Section 7 of the Endangered Species Act. Biological Evaluations included assessment of potential effects of water quality on aquatic life as well as potential effects of discharges from permitted facilities on terrestrial wildlife, aquatic receptors including fish, benthic macro invertebrates, and aquatic wildlife including marine mammals. Worked with NOAA, NMFS, and USFWS to complete Section 7 Consultation for permits and water quality criteria development.

Aquatic Toxicologist for Expert Panel, *Seattle Public Utilities, Seattle, WA.* Toxicologist on expert panel assisting Seattle Public Utilities in developing an integrated plan looking at storm water and CSO controls to meet water quality standards for the city of Seattle.

Approach for Assessing PFAS Risk to Threatened and Endangered Species, *Strategic Environmental Research and Development Program.* Developed comprehensive risk-based approach for evaluating potential ecological impacts on threatened and endangered (T&E) species associated with Aqueous Film-Forming Foam (AFFF) use at military installations. Standard risk assessment approaches were used to develop risk-based screening criteria for PFASs. Ecological receptors, including representative T&E species and surrogate receptors were selected based on consideration of PFAS specific risk factors (e.g., biomagnification and trophic level exposures, and species-specific toxicity).

PROFESSIONAL EXPERIENCE

Geosyntec Consultants, Greenwood Village, CO 2020-present
Arcadis-U.S., Inc., Highlands Ranch, CO, 2012-2020
Blue SKyZ, LLC., Denver, CO, 2011-2012
U.S. Environmental Protection Agency Region 10, Seattle, WA, 2004-2011
U.S. Environmental Protection Agency, Washington, D.C., 2003-2004

AWARDS AND RECOGNITIONS

National Honor Award Silver Medal - awarded to the Multimedia Portneuf River Orthophosphate Team, U.S. EPA - 2011

Individual Bronze Medal - Continuing support to the Office of Water for assistance with development of Biological Evaluations and involvement in consultation requirements for Section 7 of the Endangered Species Act, U.S. EPA Region 10 – 2010.

National Notable Achievement Award - awarded to the scientific team for the Eastern Michaud Flats superfund site, U.S. EPA – 2010

Office of Water Bronze Medal - awarded to the Oregon Aquatic Life Toxics Criteria Team, U.S. EPA - 2010

AFFILIATIONS

Society of Environmental Toxicology and Chemistry, 2011-present

Society of Toxicology, 2001-2009

Chair, Society of Women Environmental Professionals, 2016-present

REPRESENTATIVE PUBLICATIONS

21-01 Zodrow, J., Frenchmeyer, M., Dally, K., Osborn, E., Anderson, P., and Divine, C. Development of Per and Polyfluoroalkyl Substances (PFAS) Ecological Risk Based Screening Levels (RBSLs). Environ Toxicol Chem 40(3):921-936.

21-02 Conder, J., Zodrow, J., Arblaster, J., Kelly, B., Gobas, F., Suski, J., Osborn, E., Frenchmeyer, M., Divine, C., and Leeson A. Strategic Resources for Assessing PFAS Ecological Risks at AFFF Sites. Integr Environ Asses. In press.

21-03 Zodrow, J., Arblaster, J. and Conder, J. State of the Science for Risk Assessment of PFAS at Contaminated Sites. In: D. Kempisty (Ed.). Forever Chemicals: Environmental, Economic, and Social Equity Concerns with PFAS in the Environment, In Press.

18-01 DeForest, D.K., R.W. Gensemer, J.W. Gorsuch, J.S. Meyer, R.C. Santore, B.K. Shephard, and J.M. Zodrow. 2018. Effects of Copper on Olfactory, Behavioral, and Other Sublethal Responses of Saltwater Organisms: Are Estimated Chronic Limits Using the Biotic Ligand Model Protective? Environ Toxicol Chem. 37(6): 1515-1522.

14-01 Pascoe, G.A., J. Zodrow and E. Greutert. 2014. Evaluating Risks to Terrestrial Wildlife from Environmental Fluoride, Human and Ecological Risk Assessment: An International Journal, 20:4, 941-961.

13-01 Anderson, R.H., D.B. Farrar and J.M. Zodrow. 2013. Terrestrial Metals Bioavailability: A Comprehensive Review and Literature-Derived Decision Rule for Ecological Risk Assessment. Human and Ecological Risk Assessment: An International Journal, 19: 1488-1513.

04-01 Zodrow, J.M., J.J. Stegeman, and R.L. Tanguay. 2004. Histological Analysis of Acute Toxicity of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) in Zebrafish. Aquatic Tox., 66, 25-38.

03-01 Zodrow, J.M. 2003. Effects of 2,3,7,8-Tetrachlorodibenzo-p-dioxin on Zebrafish Caudal Fin Regeneration. Ph.D. Thesis. University of Colorado Health Sciences Center, Denver, Colorado.

03-02 Zodrow, J.M. and R.L. Tanguay. 2003. 2,3,7,8-Tetrachlorodibenzo-p-dioxin Inhibits Zebrafish Caudal Fin Regeneration. Tox. Sci., 76, 151-161.

INVITED PRESENTATIONS

Zodrow, J.M. 2020. Ecological Screening Levels to Assess Per- and Polyfluoroalkyl Substances Risk to Threatened and Endangered Species. 41st Annual Society of Environmental Toxicology and Chemistry North America Conference.

Shephard, B and J. Zodrow. 2012. A Review of Copper Effects on Fish Behavior. 142nd Annual Meeting of the American Fisheries Society, Minneapolis-St. Paul, MN.

Zodrow, J.M., B. Shephard and D. Keenan. 2007. Biological Evaluation of Oregon's Water Quality Criteria: New Approaches in Analyzing Protection of Endangered Species. TMDL 2007 Specialty Conference, Bellevue, WA.

Zodrow, J.M. 2004. Acute Toxicity of 2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) in Adult Zebrafish. National Marine Fisheries Service, Northwest Fisheries Science Center, Seattle, WA.

ATTACHMENT B

Quality Assurance Project Plan (QAPP)

Prepared for

Bristol-Myers Squibb
Syracuse North Campus Restoration Area
3551 Burnet Avenue
East Syracuse, NY

Ley Creek Delineation Quality Assurance Project Plan

NYSDEC Site ID #C734138

Prepared by

B&B Engineers & Geologists of new york, p.c.

an affiliate of Geosyntec Consultants

Geosyntec consultants

engineers | scientists | innovators

5313 Campbells Run Rd #150
Pittsburgh, PA 15205

Project Number MP1886

April 2022

TABLE OF CONTENTS

LIST OF TABLES

ABBREVIATIONS AND ACRONYMS

BDA	BMS Brownfield Development Area
BMS	Bristol-Myers Squibb
BSI	Below Sediment-Water Interface
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
DER	Division of Environmental Remediation
DQO	Data Quality Objectives
EDD	Electronic Data Deliverable
EIMS	Environmental Information Management System
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FT	Foot, Feet
FWRIA	Fish and Wildlife Resources Impact Assessment
Geosyntec	Geosyntec Consultants, Inc. and its New York engineering affiliate, B&B Engineers & Geologists of New York, P.C.
GPS	Global Positioning System
ID	identifier
IDW	Investigation-Derived Wastes
LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
LIMS	Laboratory Information Management System
MDL	Method Detection Limit
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NELAP	National Environmental Laboratory Accreditation Program
NYSDEC	New York State Department of Environmental Conservation
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PAH	Polycyclic Aromatic Hydrocarbon
PFAS	Per- and Polyfluoroalkyl Substances
PPE	Personal Protective Equipment
QA	Quality Assurance

ABBREVIATIONS AND ACRONYMS (CONTINUED)

QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QC	Quality Control
%R	Percent Recovery
RI	Remedial Investigation
RL	Reporting Limit
RPD	Relative Percent Difference
Site	Bristol-Myers Squibb Syracuse North Campus Brownfield Development Area
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound(s)
TAL	Target analyte list
THA	Task Hazard Analysis
TOC	Total Organic Carbon
VOC	Volatile Organic Compound(s)

SECTION 1

PROJECT MANAGEMENT

1.1 Introduction

This Quality Assurance Project Plan (QAPP) was prepared by B&B Engineers & Geologists of New York, P.C., an affiliate of Geosyntec Consultants, Inc. (collectively, Geosyntec) using the guidelines presented in United States Environmental Protection Agency (EPA), *Requirements for Quality Assurance Project Plans*, EPA *Quality Assurance/R-5* (EPA, 2001) and the guidance presented in the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10 *Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010).

This QAPP provides direction for Ley Creek delineation field activities associated with the BMS Syracuse North Campus Restoration Area Brownfield Development Area (BDA) Site No. C734138, which include sediment sampling for chemistry analysis. The Study Area includes the South Branch of Ley Creek from its emergence at the northern side of the CSX railroad overpass extending for approximately 750 feet downstream in Ley Creek along with tributaries to this section of Ley Creek. This QAPP provides the quantitative data quality objectives (DQO) for the sampling and analysis program. This QAPP is meant as the framework under which the sampling and analysis will be performed and supplements the BMS Syracuse Ley Creek Delineation Work Plan. This QAPP will be reviewed and updated as needed.

This QAPP will be required reading for all members of the project team participating in sediment sample collection, will be in the possession of all field teams, and will be distributed to laboratories performing analytical work associated with the BMS Syracuse Ley Creek Delineation. This document has been developed to ensure that data acquired during the BMS Syracuse Fish and Wildlife Resources Impact Assessment (FWRIA) are thoroughly documented, verifiable, and defensible, and that the quality of the data meets the requirements for its intended use. Project quality assurance (QA) objectives and quality control (QC) requirements have been used to develop the DQO described herein for acquiring valid, usable data. Criteria for data quality were established in terms of the precision, accuracy, representativeness, comparability, completeness, and sensitivity (PARCCS) parameters.

1.2 Project Objectives/Problem Definition

This QAPP pertains to Ley Creek Delineation-related investigation activities described in the BMS Syracuse Ley Creek Delineation Work Plan. The overall objectives of the BMS Syracuse Remedial Investigation (RI)/Feasibility Study (FS) are to: (i) determine the nature and extent of constituents that may have been potentially discharged from the BDA; (ii) determine if residual sources of constituents of concern still exist; and (iii) identify both current and potential routes of human exposure, if any, to constituents of concern. In support of these objectives, the objectives of the Ley Creek Delineation are to:

- Characterize the nature and extent of BDA-related constituents in downstream Ley Creek sediments, including backwater areas and other historical alignments, potentially impacted during the period of industrial operations at the BDA.

1.3 Project Organization

The primary project team assembled to oversee, direct, and complete the Ley Creek Delineation investigation activities for BMS Syracuse consists of personnel from Geosyntec. Geosyntec will be responsible for development of the project's technical direction, supervision, and implementation of investigation activities, including oversight of subcontractors, data management, and data quality assessment. The project team and corresponding projects roles are summarized below, and contact information is provided in **Table 1**.

- BMS Project Director, Richard Mator. Mr. Mator is primarily responsible for the project direction and decisions concerning technical issues and strategies.
- BMS Project/Task Manager, Anne Locke. Ms. Locke is the primary contact for the Syracuse Site with primary responsibilities for project execution including coordination of site access, contracting, scheduling and financial tracking.
- Sediments Task Manager, Jennifer Arblaster, Geosyntec. Ms. Arblaster has responsibility for technical, financial, and scheduling matters and overall management of the FWRIA-related activities.
- Field Activities Manager, Joel Conzelmann, Geosyntec. The Field Activities Manager has the overall responsibility for completion of field activities in accordance with the Work Plan and QAPP and is the communication link between the Geosyntec Project and Task Managers and the field team.
- Quality Assurance Manager (QAM), Julia Caprio, Geosyntec. Ms. Caprio will have the overall responsibility for QA. Ms. Caprio or her designee will communicate directly to the Geosyntec Project Manager and Laboratory Manager on matters pertaining to QA, data validation, and laboratory analyses.
- Health and Safety Officer, Joel Conzelmann, Geosyntec. The Health and Safety Officer will be responsible for safely implementing field activities and ensuring that they comply with the site-specific Task Hazard Analysis (THA).
- Eurofins Lancaster Laboratories Environmental LLC at Lancaster, Pennsylvania. Eurofins Lancaster Laboratories Environmental LLC will be responsible for the volatile organic compound (VOC), semivolatile organic compound (SVOC), polycyclic aromatic hydrocarbon (PAH), target analyte list (TAL) Metals, methanol, total organic carbon (TOC), and Per- and Polyfluoroalkyl Substances (PFAS) analyses of the sediment samples for the project. The laboratory will ultimately be responsible for the data produced and will ensure that laboratory data are generated in compliance with this QAPP, NYSDEC Analytical Services Protocols, internal laboratory procedures, and other applicable guidance.

- Bureau Veritas North America at Lake Zurich, Illinois. Bureau Veritas North America will be responsible for the pharmaceutical analyses of the sediment samples for the project. The laboratory will ultimately be responsible for the data produced and will ensure that laboratory data are generated in compliance with this QAPP, NYSDEC Analytical Services Protocols, internal laboratory procedures, and other applicable guidance.

1.4 QAPP Revision or Amendment

It is expected that the procedures outlined in this QAPP will be followed. However, procedural modifications may be warranted depending on field conditions, equipment limitations, or limitations imposed by the procedure(s). Modification to this QAPP will be approved in advance by the BMS Project/Task Manager, Sediments Task Manager and the QAM. Deviations from the QAPP will be documented.

SECTION 2

DATA QUALITY OBJECTIVES AND CRITERIA

DQO are qualitative and quantitative statements that clarify the project objectives, specify the most appropriate type of data for the project decisions, determine the most appropriate conditions from which to collect data, and specify tolerable limits on decision errors. The DQO process is a series of planning steps based on scientific methods that are designed to ensure that the type, quantity, and quality of environmental data used for decision-making are appropriate for the intended application. In addition to the project objectives, the DQO specify data collection boundaries and limitations, the most appropriate type of data to collect, and the level of decision error that will be acceptable for the decision. This section describes the outcome of the DQO process for data collection activities to be conducted in support of the BMS Syracuse Ley Creek Delineation.

2.1 Data Quality Objectives for Measurement Data

The overall quality objective of the Ley Creek Delineation is to provide valid data of known and documented quality from environmental media (sediment) to adequately delineate downstream concentrations of BDA-related chemicals.

Additionally, PFAS sampling and analysis is being proposed to ascertain if PFAS is present in sediments as a result of the BDA and, if so, to determine its downstream distribution.

Table 2 summarizes the environmental screening criteria for chemical concentrations in sediment that will be used as the basis for evaluating analytical chemistry data. The Ley Creek Delineation Work Plan outlines the rationale for Indicator Chemicals that will be used to delineate the extent of potential BDA-related contaminants in sediment.

2.2 Project Quality Assurance/Quality Control Objectives

Chemistry testing data from certified laboratory analyses of field samples will be used as one line of evidence in the Ley Creek Delineation. Analytical chemistry data will be derived through standard methods and will be assessed against the PARCCS parameters listed below using appropriate methods and field and laboratory QC samples to determine their usability for meeting the DQO in this QAPP. The QC criteria are defined in this section, along with analytical methods and project-required reporting limits (RL).

2.2.1 Precision

Precision refers to the reproducibility or degree of agreement among duplicate measurements of a single analyte. The closer the numerical values of the measurements, the more precise the measurement. Poor precision stems from random errors (i.e., mechanisms that can cause both high and low measurement errors at random). Precision is usually stated in terms of standard deviation, but other estimates, such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum values), and relative range are common and may be used pending review of the data.

Precision will be determined through the collection of field duplicates and the analysis of laboratory duplicates, matrix Spike (MS)/matrix spike duplicate (MSD) and laboratory control sample (LCS)/laboratory control sample duplicate (LCSD) pairs for the work performed at the Study Area. The overall precision of measurement data is a mixture of sampling and analytical factors. Sampling precision will be measured through the laboratory analysis of field duplicate samples. Laboratory precision will be measured through the analysis of laboratory duplicates and MS/MSD and LCS/LCSD pairs.

Precision will be determined from replicate samples and will be expressed as the relative percent difference (RPD) between replicate/duplicate sample results, computed as follows:

$$RPD = \frac{X_1 - X_2}{(X_1 + X_2)/2} \times 100$$

where X_1 and X_2 are reported concentrations for each replicate sample and subtracted differences represent absolute values. For field duplicates, the precision goals for this project is an RPD of 50 percent if both results are greater than five times the quantitation limit.

RPD values are shown in Tables 2 and 3 for MS/MSD and LCS/LCSD results. For laboratory duplicate analysis, the default laboratory RPD goals will be used.

2.2.2 Accuracy

Accuracy refers to the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement. The converse of accuracy is bias, in which a systematic mechanism tends to consistently introduce errors in one direction or the other. Bias in environmental sampling can occur in one of three ways; these mechanisms and their associated diagnostic and management methods are as follows:

- High bias, which can stem from cross-contamination of sampling, packaging, or analytical equipment and materials. Cross-contamination is monitored through blank samples, such as equipment blanks, field blanks, and method blanks. These samples assess the potential for cross-contamination from, respectively, sampling equipment, ambient conditions, packaging and shipping procedures, field filters, and laboratory equipment. Data validation protocols described in Section 5 present a structured approach for data qualification based on blank samples.
- Low bias, which can stem from the dispersion and degradation of target analytes. The effects of these mechanisms are difficult to quantify. Sampling accuracy can be maximized, however, by the adoption and adherence to a strict field QA program. Specifically, sampling procedures will be performed following standard protocols

described in Section 3. Through regular review of field procedures, deficiencies will be documented and corrected in a timely manner.

- High or low bias, due to poor recoveries, poor calibration, or other system control problems. The effects of these mechanisms on analytical accuracy may be expressed as the percent recovery of an analyte that has been added to the environmental sample at a known concentration before analysis. Analytical accuracy and bias in the laboratory will be determined through the analysis of method blanks, LCS and MS/MSD, and surrogates as applicable. As with blank samples, data validation protocols provide a structured formula for data qualification based on erroneously high or low analyte recoveries.

Accuracy, when potentially affected by high or low recoveries, as described in the third bullet above, is presented as percent recovery (%R), defined as:

$$\%R = \frac{Measured\ Value}{True\ Value} \times 100\%$$

Laboratory control limits will be used to evaluate accuracy and are shown in Tables 2 and 3.

2.2.3 Representativeness

Representativeness qualitatively expresses the degree to which the sample collection and analytical protocols adequately reflect the environmental conditions present at the sampling location. If the results are reproducible, the data obtained can be said to represent the environmental condition. Representativeness is ensured by collecting sufficient numbers of samples of an environmental medium, properly chosen with respect to place and time. The sampling plan is expected to provide data representative of sediment conditions in BMS Syracuse. Representativeness in the laboratory is ensured by using the proper analytical procedures, attaining the quantitative DQO, and meeting sample holding times.

2.2.4 Comparability

Comparability expresses the confidence with which one data set can be compared to another data set measuring the same property. Comparability is ensured using established and approved sampling and analytical methods, consistency in the basis of analysis (e.g., wet weight, volume, etc.), consistency in reporting units, and analysis of standard reference materials. By using standard sampling and analytical procedures, data sets will be comparable.

2.2.5 Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid measurements. The completeness goal is essentially the same for all data uses in that sufficient amounts of valid data are to be generated. There are limited historical data on the completeness achieved by individual methods. However, the EPA Contract Laboratory Program (CLP) data have been found to be 80 to 85 percent complete on a nationwide basis. The percent completeness for each set of samples will be calculated as follows:

$$\%Completeness = \frac{Valid\ Data}{Total\ Data\ Planned} \times 100\%$$

The QA objective for completeness for all parameters will be 90 percent.

2.2.6 Sensitivity and Reference Limits

Sensitivity is the capability of a test or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) or a variable interest. Reference limits for analyses conducted by the certified laboratory include method detection limits (MDL) and RL.

- The MDL is a statistically determined concentration using a specific number of spiked samples, and in some cases, a specific number of method blanks as well. It is the minimum concentration of a substance (analyte) that can be measured and reported with 99 percent confidence that the analyte is present at a concentration greater than zero, as determined from the analysis of a sample in a given matrix containing the analyte and incorporating method blank analysis to account for the impact of background. The MDL is generally lower than the concentration at which the laboratory can quantitatively report. Accordingly, sample results greater than the MDL but less than the RL will be laboratory qualified as "estimated."

- The RL is the minimum concentration of an analyte or category of analytes in a specific matrix that can be identified and quantified within specified limits of precision and bias during routine analytical operating conditions. The laboratory uses a concentration greater than or equal to the lowest value on the calibration curve as the RL and then adjusts the MDL to be approximately within 3 to 8X below the RL but at or above the calculated MDL value. Frequently, RL for specific samples are adjusted for dilution, changes to sample volume/size and extract/digestate volumes, percentage solids, and cleanup procedures. The MDL and RL for this project are presented in Tables 2 and 3.

2.2.7 Analytical Methods – Sediment Chemistry

The analytical laboratory selected for chemical analysis of sediment for the FWRIA will be the Eurofins Lancaster Laboratories Environmental LLC at Lancaster, Pennsylvania, which is certified by New York State through the National Environmental Laboratory Accreditation Program (NELAP) for all sediment analytical methods required for the project. Laboratory analytical methods used to analyze field samples will include the following analyses, as listed in Table 4.

- VOC: EPA Method 8260D;
- SVOC (including PAH): EPA Method 8270E;
- TAL Metals: EPA Method 6020B (EPA Method 7471B for Mercury)
- Methanol: EPA Method 8015D;
- Pharmaceuticals: EPA Method 1694;

- Total Organic Carbon (TOC): Lloyd Khan Method; and
- PFAS: EPA Method 537 Modified Isotope Dilution (NELAP accreditation is only offered for PFOS and PFOA in drinking water).

SECTION 3

DATA GENERATION AND ACQUISITION

3.1 Overview

This section describes the sampling strategies and field procedures that will be implemented to support the FWRIA to provide data required to meet the DQO described in Section 2. Environmental measurements to be obtained during implementation of the Ley Creek Delineation include the following:

- Visual observations of sediment samples collected for chemical analysis;
- Water quality measurements co-located with sediment sampling locations; and
- Data from chemical analysis of sediment.

In addition, the following activities will be conducted in support of the Ley Creek Delineation:

- work necessary to clear planned sampling locations for underground utilities;
- decontaminating of field equipment; and
- sampling (if necessary) and managing investigative-derived wastes (IDW).

The strategy and procedure for each item are addressed in the remainder of this section. In addition, analytical parameters, field and laboratory QC strategies, equipment testing, inspection and maintenance, inspection and acceptance of supplies and consumables, and non-direct measurements are discussed in this section.

3.2 Special Training and Certification

3.2.1 Health and Safety Training

All field activities will be performed by individuals with appropriate training (i.e., Code of Federal Regulations [CFR] 1910.120) and in accordance with the site-specific THA). Before field activities commence, the site-specific THA shall be reviewed and signed by all Geosyntec personnel conducting field work.

3.2.2 Subcontractor Training

All subcontractors performing work during the investigation will be required to conduct all activities in accordance with applicable health and safety regulations (e.g., CFR 1910.120) and site-specific requirements. A copy of the THA will be provided to each subcontractor. However, subcontractors will be responsible for the health and safety of their personnel while working at the Study Area. Each day before work commences, a tailgate health and safety meeting shall be conducted by the contractor field team lead.

3.3 Sampling Process Design

The basis for the development of the Ley Creek Delineation scope of work is described in the BMS Syracuse Ley Creek Delineation Work Plan.

3.4 Field Methods and Procedures for Data Collection

For all activities, a handheld Trimble GeoXT 5000 global positioning system (GPS) unit will be used to record the horizontal coordinates (locations) of sample collection. Water quality parameters (temperature, pH, dissolved oxygen, etc.) will be collected at sediment sampling stations prior to the collection of sediment samples.

3.4.1 Sediment Sampling

Sediment sampling will be conducted by Geosyntec personnel. Chemical analysis of sediment samples will be conducted by Eurofins Lancaster Laboratories Environmental LLC at Lancaster, Pennsylvania, and Bureau Veritas North America at Lake Zurich, Illinois.

To obtain the required sediment samples, the following procedures shall be used:

- For samples where analysis for PFAS compounds is required, sampling will be conducted in accordance with NYSDEC Sampling, Analysis, and Assessment of PFAS, under NYSDEC's Part 375 Remedial Programs (NYSDEC, 2021), that includes a sampling protocol for PFAS in soils, sediment and solids (**Attachment E)**.
- Obtain appropriate laboratory-prepared sample containers prior to sampling and don appropriate level of personal protective equipment (PPE) according to the approved HASP.
- Mobilize to general sampling area and identify a secured area on the overbanks for sample processing. Processing will be done on a plastic-covered, designated table that is underlaid by low-permeability (e.g., polyethylene) sheeting. A decontamination station consistent with that described in Section 3.5.4 of this QAPP should also be established in the processing area.
- Mobilize to sampling location, starting at the farthest downstream location and proceeding to each additional upstream location. Depending on field conditions, sediment may be collected by wading on foot or by use of a small, flat-bottom boat.
- Obtain location coordinates from hand-held GPS instrument and mark location on enlargement of sampling Study Area map.
- Collect sediment samples using a slide-hammer with a 2-inch or 3-inch acetate macro-core sleeve. Each sleeve will be hand driven as far as possible and the slide-hammer will be used until the sampler hits refusal into the stream channel and retrieved by slowly pulling the filled sleeve out at an angle.

- If sediment texture and depth to refusal require, sampling may be supported using a slide-hammer to provide additional force to drive the sediment core. If using a slide hammer, refusal shall be defined as more than 25 blows required to penetrate 1-inch
- If refusal is met at less than 6 inches, three attempts within a 4-foot radius will be made for additional depth. If a greater depth is not achieved, a 6-inch sample will be collected using a Ponar or another comparable grab sampling device.
- Target core recovery will be 75% or greater based on the measured penetration into the sediment. If recover of the first sample core at a location is less than 75%, the core will be held, but a second core will be advanced after offsetting a short distance from the original location. If the second core exhibits recovery less than 75%, the core will be held, and a third core will be advanced after offsetting a short distance from the second location. If the third core also exhibits recovery less than 75%, the “best” core (based on field judgement of core quality including recovery, penetration to target depth, surface disturbance, etc.) will be retained for processing.
- Assign an identifying, temporary label to each core that indicates the station, if from erosional or depositional areas, and top of core. Transport each sediment core vertically to the processing station for logging and sampling.
- Complete field forms and enter sampling and location information in the bound field book, as outlined in Section 3.8.5 in this document.
- Cores will be opened lengthwise, and a geologist, engineer or their designee will be responsible for geologic logging of all sediment to maintain consistency. Sediment will be visually inspected to record details of the color, texture, moisture, density, cohesion, plasticity, and any indication of staining or obvious odor, and digital photographs will be taken. Core logs will also include water depth at the sampling location, an indication of whether the location appears to be a depositional area or scour area, an indication of whether the location is intended to characterize a suspected source/contributor unrelated to the BDA, core penetration, total sediment recovery, grain size, sediment type, and photoionization detector (PID) readings, as determined prior to homogenization.
- Subdivide sediment samples by discrete depth intervals of 0 to 0.5 feet (ft) below the sediment-water interface (bsi), 0.5 to 1 ft bsi, and 1 to 2 ft bsi, and 1-ft intervals to full depth.
- Collect samples for VOC analysis from the undisturbed sediment core from each depth interval prior to homogenizing.
- Place sediment sample from each depth interval in a mixing container (decontaminated stainless-steel bowl or new zipper-locked bags) taking care not to collect sediment from the smear zone (the sediment in contact with the edges of the core). Homogenize the sample with decontaminated stainless-steel spoons, a gloved hand, or other appropriate mixing device. If a discrete zone is identified that appears to be impacted (e.g., odor, staining, elevated PID readings) from non-natural sources, that interval will be sampled

rather than compositing/homogenizing the entirety of the planned interval. (e.g., if an impacted zone is identified at 1.1 to 1.4 feet below the top of the sediment, that interval will be sampled rather than the entire 1.0 to 2.0 foot interval).

- Once homogenized, each depth will be characterized for moisture, color, sediment type, odor, sheen, debris, and other notable features.
- Place sediment in laboratory-supplied sample containers and immediately place on ice for shipment to the fixed-base laboratory for analysis.
- Follow the sample handling and labeling procedures outlined in Sections 3.7 and 3.8 of this QAPP.
- Decontaminate sampling equipment, as outlined in Section 3.5.4.
- Manage IDW, as outlined in Section 3.5.2.

3.5 Field Methods and Procedures for Other Project and Support Activities

3.5.1 Utility Location Procedures

Geosyntec will place a utility location request with Dig Safely New York prior to mobilizing to the Study Area for sediment sampling. If a utility is identified, minor adjustments to the sampling plan will be made and documented in the field. If significant changes to the sampling locations described in the Work Plan are necessary, NYSDEC will be notified.

3.5.2 Management of Investigation-Derived Waste

IDW generated during sediment sampling activities will include excess sediment, disposable PPE, disposable sampling equipment, and decontamination water. Excess sediment during sediment core collection can be returned to Ley Creek at the sample location. Excess sediment generated during sediment core processing will be collected and placed in 55-gallon Department of Transportation-approved drums for characterization (if necessary) and offsite disposal at an approved appropriate facility. PPE, and disposable sampling equipment will be managed as general trash. Liquid IDW (decontamination water) will be collected and disposed of in the BMS sanitary sewer.

3.5.3 Field Instrument Calibration and Operation

Instruments and equipment used during sampling and analysis (e.g., water quality meters) will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations. Operation, calibration, and maintenance will be performed by trained personnel daily. Calibration will be performed at the beginning, middle, and end of each sampling day. If instruments appear to be reading incorrectly, additional calibration may be required. All maintenance and calibration information will be documented and will be available upon request.

Appropriate corrective actions will be taken if a field instrument fails the instrument-specific calibration QC criteria. Corrective action steps will be as follows:

- Check the instrument;
- Investigate the cause of failure;
- Recalibrate the instrument;
- If the instrument recalibration still fails, call the instrument manufacturer or rental company technical support for assistance;
- If the problem persists, send the instrument for service;
- If the instrument is a rental, contact the rental office for immediate replacement of the instrument; and
- If practicable, keep a backup instrument at the Study Area.

3.5.4 Field Equipment Decontamination

Decontamination of non-dedicated and non-disposable sediment sampling equipment will be performed prior to sampling and between sampling locations to prevent the introduction of extraneous material into samples and to prevent cross-contamination between sample locations. Sediment sampling equipment will be decontaminated as described below. Examples of relevant items include equipment, stainless-steel spoons and bowls, and other small items.

- Place three wash basins in an established decontamination area that has a low-permeability liner (e.g., polyethylene) and secondary containment. The decontamination area must be of sufficient size to allow placement of the five plastic wash bins in a line and provide an air-drying area for equipment.
- Fill the first wash basin with potable water. Add sufficient soap powder or solution to cause suds to form in the basin. Do not use an excessive amount of the soap or rinsing the soap off the equipment will be difficult. Periodic changing of the water is required.
- Using a clean coarse scrub brush, wash the sampling equipment in the soap solution in the first basin, removing all visible residues. Be sure to wash inside surfaces of equipment as well as the exterior surfaces. Allow excess soap to drain off the equipment when finished.
- Fill the second basin with potable water (first rinse) and rinse the equipment. A coarse scrub brush or pressure sprayer may be used to aid in the rinse, if necessary. Periodic changing of the water is required.
- Rinse the equipment with distilled/deionized water in the third basin. Periodic changing of the water is required.
- Allow the equipment to air-dry in a clean area or blot with chemical-free paper towels before reuse. Wrap the equipment in aluminum foil with the shiny side out if it will not be reused immediately.

3.6 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables will be inspected and approved by the onsite project manager or field team leader to ensure that products meet project requirements. Those items not meeting project requirements should be returned immediately for replacement or refund.

3.7 Sample Handling Procedures

Samples will be stored between 0 and 6 degrees Celsius (°C) from the time of collection to the time of analysis. Collected samples will be stored together with any MS/MSD, blind field duplicate, and equipment blank samples collected during that sampling event on ice in a cooler. Samples will be stored together in an area known to be free of contamination.

3.7.1 Sample Containers and Preservatives

The laboratory will be responsible for supplying the proper containers for chemical analysis to ensure sample integrity. The laboratory will provide new and/or pre-cleaned containers from an outside supplier. Table 4 details the bottle type, quantity, preservative, and holding time for each parameter analyzed in sediment. All sample preservation additives will be verified as being in the appropriate sample containers by the laboratory prior to sampling.

3.7.2 Sample Designations

Each separate sample will be identified using a sample label with a unique sample identifier (ID).

The nomenclature for sediment sample IDs is as follows:

Creek Area-Field ID-Matrix-Top Depth-Bottom Depth-Date

The nomenclature for sediments collected for MS/MSD analysis is as follows:

Creek Area-Field ID-Matrix-Top Depth-Bottom Depth-Date-Spike Sample

where:

- Creek Area: LC (Ley Creek) or LC-TRIB (Ley Creek tributary);
- Field ID: two-digit numeric Station ID;
- Matrix: SED;
- Depth From: Upper depth of sample interval in feet;
- Depth To: Lower depth of sample interval in feet; and
- Date: yyyymmdd.
- Spike Sample: MS (Matrix Spike) or MSD (Matrix Spike Duplicate)

The nomenclature for field QC sample IDs is as follows:

QC Type-Sequence Number-Date

where*:*

- QC Type: DUP (Field Duplicate), EB (Equipment Blank) or TB (Trip Blank);
- Sequence Number: unique sequential two-digit number;
- Date: yyyymmdd.

3.7.3 Sample Labeling

Each separate sample will be identified using a sample label. The sampler will complete all information using waterproof ink with the following information:

- Sample ID in accordance with Section 3.7.2;
- job name and identification number;
- date and time of sample collected;
- preservative;
- analytical method requested; and
- name of sampler.

The sample label contains the authoritative information for the sample. A chain-of-custody shall reflect the same information as the label and be kept with the samples at all times.

3.7.4 Sample Packaging and Shipment

When all samples have been collected at the end of the day, samples will be packaged for shipment. The following procedures will be followed during sample packing.

- Place plastic bubble wrap matting or other suitable packing material over the base of each cooler or shipping container as needed.
- Insert a clean trash bag into the cooler to serve as a liner.
- Bag cubed ice in heavy duty zipper-lock plastic bags, close the bags, and distribute the bagged ice in a layer over the bottom of the cooler. Loose ice should not be used. Cold packs should be used only if the samples are chilled before being placed in the cooler.
- Check that each sample container is sealed, labeled legibly, and is externally clean. Relabel and/or wipe bottles clean if necessary. If needed, clear tape should be placed over the labels to protect them and keep them from falling off the container. To protect each bottle from breakage during shipment, each glass sample bottle should be wrapped

individually with bubble wrap and secured with tape or rubber bands. Alternate bottle protection procedures such as placing glass jars back in the cardboard shipping box in which they arrived, using cardboard dividers in the cooler, or placing in an appropriate foam holder may also be used. Bottles should be placed into the cooler in an upright single layer with approximately one inch of space between each bottle. Do not stack bottles or place them in the cooler lying on their side. If plastic and glass sample containers are used, alternate the placement of each type of container within the cooler so that glass bottles are not placed side by side.

- Insert the cooler temperature blank supplied by the laboratory into each cooler (if any).
- If space allows, place bagged ice in voids between sample containers. Other packing materials such as bubble wrap and/or Styrofoam pellet packing material may be used as a substitute to fill voids between sample containers within each cooler to a level that meets the approximate top of the sample containers. Packing material may require tamping by hand to reduce the potential for settling.
- Bag cubed ice in heavy duty zipper-lock plastic bags, close the bags, and distribute the bagged ice in a layer over the top of the samples. Loose ice should not be used. Cold packs should be used only if the samples are chilled before being placed in the cooler.
- Add additional bubble wrap/Styrofoam pellets or other packing materials to fill the balance of the cooler or container, if necessary.
- Sign and date a custody seal as discussed in Section 3.8.3 and enter the custody seal numbers in the appropriate place on the chain-of-custody form.
- Complete the chain-of-custody form as discussed in Section 3.8.1. If shipping the samples involves use of a third-party commercial carrier service, sign the chain-of-custody record, thereby relinquishing custody of the samples. Shippers should not be asked to sign chain-of-custody records. If a laboratory courier is used, or if samples are transported to the laboratory by field personnel, the receiving party should accept custody and sign the chain-of-custody records. Keep a copy of the chain-of-custody for the project file. Place the original in a zipper-lock plastic bag and tape the bag to the inside lid of the cooler or shipping container.
- Close the lid of the cooler or the top of the shipping container.
- Place the custody seal across the cooler or container lid opening and overlap with transparent packaging tape.
- Packaging tape should be placed entirely around the sample shipment containers. A minimum of three full wraps of packaging tape will be placed on at least two places on the cooler/container.
- Place a shipping label on the outside of the shipping container that indicates the point of origin and destination.
- Repeat the above steps for each cooler or shipping container.

- Following sample packing, the cooler/container containing the samples will be transported to the laboratory overnight via a package delivery service or laboratory courier under executed chain-of-custody. The appropriate shipping form or air bill will be filled out and affixed to the cooler/container. Some courier services may use multi-package shipping forms where only one form needs to be filled out for all packages going to the same destination. If not, a separate shipping form should be used for each cooler/container. The receipt for package tracking purposes should be kept in the project files, in the event a package becomes lost.

3.8 Sample Custody and Documentation

An overriding consideration for data resulting from laboratory analyses is the ability to demonstrate that the data are legally defensible (i.e., that the samples were obtained from the locations stated and that they reached the laboratory without alteration). To accomplish this, evidence of collection, shipment, laboratory receipt, and laboratory custody until disposal will be documented through the chain-of-custody record. A sample is considered to be in custody if the following applies to the sample:

- It is in actual possession or in view of the person who collected the samples;
- It is locked in a secure area;
- It is placed in an area restricted to authorized personnel; or
- It is placed in a container and secured with an official custody seal, such that the sample cannot be reached without breaking the seal.

If sample preservation requires temperature control, then samples will be stored in iced coolers or a refrigerator in an access-controlled area. Sample custody will be the responsibility of the field manager or onsite designee from the time of sample collection until the samples are accepted by the courier service for delivery to the laboratory. Thereafter, the laboratory performing the analysis will maintain custody.

3.8.1 Chain-of-Custody

Chain-of-custody records will be filled out for all samples to establish the documentation necessary to trace sample possession from the time of collection. In addition to providing a custody exchange record for the samples, the chain-of-custody record serves as a formal request for sample analyses. The chain-of-custody record lists each sample and the individuals performing the sample collection, shipment, and receipt. The following information will be recorded on the chain-of-custody record:

- Project name;
- Project location;
- Geosyntec project number;
- Geosyntec project manager;
- Geosyntec project manager contact information;

- Sample numbers;
- Date (of sample collection);
- Time (of sample collection to the nearest minute, military time);
- Sample type (composite or grab);
- Sample description (matrix);
- Number of sample containers;
- Analysis required;
- Project specific QC samples (e.g. MS/MSD)
- Remarks (including special instructions to the laboratory);
- Type of data deliverable;
- Preservative information;
- Date/time (of custody transfer);
- Laboratory name;
- Turnaround time required;
- Custody seal information; and
- Sampler's signature.

The chain-of-custody records will be completed, signed, and distributed as follows:

- one copy will be retained by the sample coordinator for inclusion in the project files; and
- the original will be sent to the analytical laboratory with the sample shipment, as described in Section 3.7.3 of this document.

3.8.2 Field Sample Custody

Prior to mobilizing to the Study Area, all necessary sample containers will be shipped by the laboratories for sediment chemistry. The field personnel and/or Geosyntec QAM will determine the sample containers needed for a specific sampling task, check the integrity of the containers, and ensure that the proper containers are assigned to the task to be conducted.

The chain-of-custody record will be the controlling document to ensure that sample custody is maintained. The chain-of-custody record will be initiated in the field by sampling personnel when a sample is collected. Each time the sample custody is transferred, the former custodian will sign the chain-of-custody in the "Relinquished By" line, and the new custodian will sign the chain-of-custody in the "Received By" line. The date and time will accompany each signature.

3.8.3 Custody Seals

Custody seals are used to prevent unauthorized tampering with samples from the time of sample collection through the time of laboratory analysis. The seals will be signed and dated by sampling personnel and then placed on the shipping containers in such a way that they must be broken to open the containers. Seals will be affixed to the sample containers before the samples leave the custody of the sampling personnel. It is recommended that clear packing tape be placed over the custody seal to ensure that it is securely affixed to the shipping container. The laboratory will immediately notify Geosyntec personnel upon receipt in the event that the custody seal indicates that the container has been tampered with.

3.8.4 Laboratory Sample Custody and Documentation

Samples will be delivered to laboratory personnel authorized to receive samples, also referred to as the "sample custodian." The custodian, upon receipt of a sample, will inspect the condition of the sample (including temperature of the cooler) and the custody seal, reconcile the information on the sample label against that on the chain-of-custody record, assign a laboratory number, log the sample in the laboratory information management system (LIMS), and store the sample in a secured sample storage area. The custodian will record all pertinent observations and measurements on the chain-of-custody record and sign the chain-of-custody record.

Upon receiving the samples, the laboratory personnel will note on the original chain-of-custody record any discrepancy in the number of samples, temperature within the cooler, or broken samples. The Geosyntec QAM or designated representative will be notified immediately of any problems identified with shipped samples. The Geosyntec QAM or designated representative will, in turn, notify the project manager and together they will determine the appropriate course of action.

If the laboratory sample custodian judges sample custody to be invalid (e.g., custody seals have been broken), the Geosyntec QAM or designated representative will be immediately notified. The Geosyntec QAM or designated representative will, in turn, notify the project manager. The project manager will decide, in consultation with the client, as to the fate of the sample in question on a case-by-case basis. The sample will either be processed "as-is" with custody failure noted along with the analytical data, or rejected with resampling scheduled, if necessary. The laboratory will initiate an internal chain-of-custody that will track the sample within the various areas of the laboratory. Custody of the samples is transferred with the relinquishing signature of the sample custodian and the custody acceptance signature of the laboratory personnel. This procedure is followed each time a sample change hands. The laboratory will archive the samples and maintain their custody, as required by the contract, or until further notification from the Geosyntec QAM or designated representative, at which time the samples will either be returned to the project for disposal or disposed of by the laboratory.

3.8.5 Field Documentation

All information pertinent to field sampling will be recorded in a permanently bound or electronic field logbook or field forms to maintain the integrity and traceability of samples. Detailed field data will be recorded on activity-specific field forms. All entries will be recorded in black indelible ink.

At a minimum, the logbook and/or corresponding field forms will contain the following information as applicable to the sample type collected:

- Project name and location (on the front page of the logbook);
- Personnel at the Study Area, including visitors;
- Signature of field sampler;

- Date and time of collection for each sample;
- Sample identification number;
- Sample location (sampling point);
- Weather (rain, sunny, approximate temperature, etc.);
- Requested analysis;
- If prudent, a drawing of or a copy of a map with the sample locations;
- Field analyses performed, including results, instrument checks, problems, and calibration records for field instruments;
- Descriptions of deviations from this QAPP;
- Problems encountered and corrective action taken;
- Identification of field QC samples; and
- Any other events that may affect the samples.

Field documentation will be stored in the project files for future use or reference, if necessary.

3.8.6 Document Corrections

Changes or corrections on any project documentation will be made by crossing out the item with a single line. The person performing the correction must initial and date the correction. The original item, although erroneous, must remain legible. The new information will be written above the crossed-out item. Corrections will be written clearly and legibly.

SECTION 4

QUALITY ASSURANCE/QUALITY CONTROL MEASURES

4.1 Field Quality Control

QC samples will be collected and analyzed to assess the precision and accuracy/bias of sampling activities. Field QC samples for this project will include field duplicates, MS/MSD, equipment rinsate, source blanks when necessary, and temperature blanks. Table 5 describes the field QC samples per matrix and their frequencies.

4.1.1 Field Duplicates

Field duplicates are two samples (an original and a duplicate) of the same matrix, collected at the same time and location and using the same sampling techniques, to the extent practicable. Field duplicate samples are used to evaluate the precision of the overall sample collection process. Field duplicates for sediment will be collected at a frequency of 1 per 10 regular samples and will be analyzed for the full set of analyses used for the regular samples collected. Field duplicates receive unique sample numbers; therefore, the identities of the duplicate samples are "blind" to the analytical laboratory. Exact locations of duplicate samples and sample identifications will be recorded in the field logbook.

4.1.2 Matrix Spike/Matrix Spike Duplicate

MS/MSD pairs will be collected at a frequency of 1 per 20 sediment samples collected. Field personnel will collect triple the amount of the volume of the sample matrix for the designated MS/MSD sample. The MS/MSD sample will be used to determine the precision and accuracy of the sample preparation and analytical methods for a given matrix.

4.1.3 Equipment Rinsate Blank and Field Blank

Equipment rinsate samples will be collected at a frequency of one per day for each matrix for which non-disposable or non-dedicated sampling equipment is used. Equipment rinsate samples are laboratory-certified clean water collected from the final rinse of the decontamination process. Equipment rinsate samples will be collected from the decontaminated sediment sampling equipment, placed in appropriate containers supplied by the analytical laboratory, and analyzed for the full set of analyses used for the samples collected that day. Equipment rinsate samples are used to evaluate the effectiveness of the decontamination procedure and the potential for cross-contamination during sampling events. One field blank will be collected per event by pouring laboratory-certified clean water directly into the appropriate sample containers while at a sampling location and under the same sampling conditions as the environmental samples.

4.1.4 Temperature Blanks

Each cooler will be shipped with a temperature blank. A temperature blank is a sample container filled with tap water and stored in the cooler during sample collection and transportation. The laboratory will record the temperature of the temperature blank immediately upon receipt of the samples. If samples are received at the laboratory less than 8 hours after collection, they may not have had sufficient time to cool to the required 0 to ≤6ºC, however sample preparation and analysis should proceed and data are still considered valid should this occur.

4.2 Laboratory Quality Control/Quality Assurance

4.2.1 Laboratory Qualifications

The analytical laboratory selected for chemical analysis of sediment samples for this project is Eurofins Lancaster Laboratories Environmental LLC at Lancaster, Pennsylvania, which is certified by New York State through the NELAP for the analytical methods required for the project. The pharmaceutical analytes for this project will be analyzed by Bureau Veritas North America, Lake Zurich, Illinois.

4.2.2 Quality Control Samples

Eurofins Lancaster Laboratories Environmental LLC and Bureau Veritas North America have QC programs in place to ensure the reliability and validity of the analysis performed by the laboratory. All analytical procedures are documented in writing as a standard operating procedure (SOP) and each SOP includes a QC section that addresses the minimum QC requirements for the procedures.

The internal QC checks differ slightly for each individual procedure, but in general, the QC requirements include the following:

- Method blanks;
- Reagent/preparation blanks (inorganic parameters);
- Instruments blanks;
- MS/MSDs;
- Surrogate spikes;
- Laboratory duplicates;
- LCS;
- Internal standards;
- Mass tuning;
- Serial dilutions; and
- Interference check samples.

4.2.3 Calibration

Laboratory instruments will be calibrated, and the calibration acceptance criteria met before samples are analyzed. Calibration standards will be prepared with National Institute for Standards and Testing traceable standards and analyzed according to method requirements. Initial calibration acceptance criteria documented in the laboratory SOP will meet those of applicable guidance documents. The initial calibration will meet one of the following requirements:

- The lowest concentration of the calibration standard is less than or equal to the RL based on the final volume of extract or sample; or
- For each target analyte, at least one of the calibration standards will be at or below the regulatory limit (action level) as shown in Tables 2 and 3.

Initial calibration will be verified, before samples are analyzed, with a second source standard prepared at the mid-point of the calibration curve. Initial calibration verification will meet the acceptance criteria that are expressed in the laboratory SOP. Daily calibration verification will be conducted at the method-prescribed frequencies and will meet the acceptance criteria of applicable guidance documents. Daily calibration verification will not be used for quantitation of target analytes. Calibration data (calibration tables, chromatograms, instrument printouts, and laboratory logbooks) will be clearly labeled to identify the source and preparation of the calibration standard, and will therefore be traceable to the standard preparation records.

4.2.4 Preventive Maintenance

The primary objective of a preventive maintenance program is to help ensure the timely and effective completion of a measurement effort by minimizing the downtime of crucial analytical equipment caused by expected or unexpected component failure. In implementing this program, efforts are focused in three primary areas: maintenance responsibilities; maintenance schedules; and adequate inventory of critical spare parts and equipment.

Maintenance responsibilities for laboratory equipment are assigned to the respective laboratory managers. The laboratory managers then establish maintenance procedures and schedules for each major equipment item. These are contained in the maintenance logbooks assigned to each instrument.

The effectiveness of a maintenance program depends, to a large extent, on adherence to specific routine maintenance for each major equipment item. Other maintenance activities may also be identified as requiring attention on an as-needed basis. The manufacturer’s recommendations or sample throughput provide the basis for the established maintenance schedules, and the manufacturers’ service contracts provide primary maintenance for many major instruments (e.g., gas chromatography instruments, atomic absorption spectrometers, analytical balances, etc.). Maintenance activities for each instrument are documented in a maintenance log.

Along with a schedule for maintenance activities, an adequate inventory of spare parts is required to minimize equipment downtime. This inventory emphasizes those parts (and supplies) that are subject to frequent failure, have limited useful lifetimes, or cannot be obtained in a timely manner should failure occur.

The laboratory manager is responsible for maintaining an adequate inventory of necessary spare parts. Sufficient equipment will be on hand to continue analyses in the event that an instrument encounters a problem. In addition to backup instrumentation, a supply of spare parts, such as fittings, septa, atomic absorption lamps, mirrors, diaphragms, graphite furnace tubes, and other ancillary equipment, will be maintained.

4.2.5 Training

The laboratory will have an established policy and procedure on training and documenting of the analyst's competency. As described in SW-846 (EPA, 2014), each staff member who performs sample preparation and analysis will demonstrate their proficiency through preparation and analysis of four LCS. An analyst will be considered proficient if the acceptance criteria for method accuracy and precision are met. The laboratory will maintain all training records on file.

4.2.6 Supplies and Consumables

The laboratory will inspect supplies and consumables before their use in analysis. The materials specifications in the analytical methods will be used as a guideline for establishing the acceptance criteria for these materials. Purity of reagents will be monitored by analysis of solvent blanks. An inventory and storage system for materials and supplies will ensure use before manufacturers' expiration dates and storage under safe and chemically compatible conditions.

SECTION 5

DATA MANAGEMENT, VALIDATION, AND USABILITY

5.1 Data Management

Data management operations include data recording, validation, transformation, transmittal, reduction, analysis, tracking, storage, and retrieval.

Data will be managed by an ESdat® Database System powered by a Microsoft Access database®. Upon receipt from the laboratory, the analytical report and electronic data deliverable (EDD) will be entered into the project's data validation tracking system, which allows the data to be tracked from receipt, through validation, to data loading and storage. The electronic data will be imported into the database system concurrent with the data validation process. The database will be updated with validated data after validation of the laboratory data is complete.

The data will be considered final when data validation is complete and any required data qualifiers have been added to the database. Any changes made to the database after finalization will be documented, including a description of the change, date of change, person responsible, and reason for change.

Once all data quality checks are performed, the data will be exported to a variety of formats to meet project needs. Crosstab tables showing concentrations by sample location will be prepared. Data can be accessed by a variety of mapping and visualization tools.

The project database will be maintained on a secure network drive that is backed up regularly to both on-site and off-site servers. Access to the database will be limited to authorized and trained project personnel.

An EDD meeting the requirements of the NYSDEC EDD Manual (NYSDEC, 2018) will be submitted with the BMS Syracuse Ley Creek Delineation Report so that the data can be uploaded to the NYSDEC Environmental Information Management System (EIMS). The EIMS uses the database software application EQuISTM from EarthSoft® Inc.

5.2 Data Reduction, Review, Verification, and Validation

This section addresses the stages of data quality assessment by the laboratory and by Geosyntec after data have been generated and received (i.e., data reduction, review, verification, and validation). It also sets procedures for evaluating the usability of data with respect to the DQO set forth in Section 2. Data validation pertinent to the BMS Syracuse Study Area chemistry results will be performed in general accordance with the following data validation guidance documents, where applicable:

- EPA, Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review, most current version;
- EPA, Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, most current version; and
- DER-10/Technical Guidance for Site Investigation and Remediation, NYSDEC May 3, 2010.

5.2.1 Data Reduction

Raw analytical data generated in the laboratory are collected from the instruments and associated data system or are manually recorded into bound notebooks. Analysts review data as they are generated to determine that the instruments are performing within specifications. This review includes calibration checks, surrogate recoveries, blank checks, retention time reproducibility, and other QC checks as specified in the SOP. If any problems are noted during the analytical run, corrective action is taken by the laboratory and documented. Each analytical run is reviewed by the laboratory for completeness prior to interpretation and data reduction.

5.2.2 Data Review

Data review is an initial and relatively non-technical step of data assessment that primarily addresses issues of completeness and data handling integrity. In data review, the reviewer will ensure that all necessary reporting components have been included in laboratory reports, such as necessary fields (e.g., collection/analysis dates, units, etc.) as well as the presence of (but not implications of) QC data components (e.g., LCS records, surrogate results, etc.).

5.2.3 Data Verification

Data verification is a more technical process than data review in that the core technical aspects of data quality (e.g., precision, accuracy) are evaluated through a review of the results of QA/QC measures, such as LCS and surrogates.

Following interpretation and data reduction by an analyst, data are transferred to the laboratory sample management system either by direct data upload from the analytical data system or manually. The data are reviewed by the group leader or another analyst and marked on the sample management system as being verified. The person performing the verification reviews all data, including QC information, prior to verifying the data. If data package deliverables have been requested, the laboratory will complete the appropriate forms summarizing the QC information and transfer copies of all raw data (e.g., instrument printouts, spectra, chromatograms, etc.) to the data packages group. This group will combine the information from the various analytical groups and the analytical reports from the laboratory sample management system into one package. This package is reviewed by the laboratory project manager for conformance with the SOP and to ensure that project QC goals have been met. Any analytical problems are discussed in the case narrative, which is also included with the data package deliverables.

5.2.4 Data Validation and Usability Determination

Following data verification by the laboratory, data validation will be coordinated and/or conducted by Geosyntec's QAM or designee. Validation documentation will be stored in the project file. Validation will be conducted on 100 percent of the laboratory data by an entity independent of the laboratory. This validation will be done on the hard copy (or PDF version) data with electronic data screening as a component of the validation.

While data verification is a technical process in which the data's adherence to core PARCCS elements is evaluated, it still does not answer the final question of the usability of the data and the implications of any departures from data expectations. The data validation process is designed to answer these questions through: (i) the assignment of data qualifiers based on the data validation results; and (ii) a case-by-case review of data quality issues with respect to project DQO to render a final assessment of data usability.

5.3 Data Evaluation Roles and Responsibilities

The following components of data evaluation will be performed by certain entities as noted:

- data reduction will be performed by the analytical laboratory;
- data review will be performed both by the laboratory and by Geosyntec;
- data verification will be performed both by the laboratory and by Geosyntec; and
- data validation and usability determination will be performed by Geosyntec.

5.4 Data Reporting

The laboratory data package receipt schedules will be based on the laboratory standard turnaround time. The laboratory will provide hard copy data packages that consist of several components, as well as an EDD for each set of samples (i.e., each work order). The data package deliverables from the laboratory will be specific to each type of data collected; at a minimum they will consist of Level 4 data packages (referred to as Category B by NYSDEC). The components of a Level 1 through Level 4 data package are as follows:

- Level 1– Signed cover sheet, narrative, data results, and copy of the chain-of-custody;
- Level 2 – Signed cover sheet, narrative, data results, QC sample results, and copy of the chain-of-custody;
- Level 3 – Signed cover sheet, narrative, data results, raw data result information, QC sample results, raw data QC information, calibration and continuing calibration information; and
- Level 4, Full, or CLP-like – All of the above, plus all raw data and supporting information for the data results.

The reporting scheme from collection of raw data through document storage is as follows:

- Raw data collected by laboratory technical personnel;
- Data reviewed/checked by laboratory supervisor;
- Data receive QA/QC review by laboratory project manager;
- Data deliverable undergoes data validation as per project requirements; validation qualifier codes are applied to the data (as applicable) and incorporated into the EDD (with follow-up QC check). The EDD is checked against the hardcopy results during the validation process. Minor errors are corrected in-house. Resubmittal of the hardcopy or the EDD may be required if major errors are observed; and
- If data are found to be incorrect, then corrective action procedures are implemented, and the data review process is reinitiated.

The validation process for laboratory data will include a review of laboratory QC results and comparison against EPA validation limits and/or project specific criteria that could affect the quality of sample results. Specific QC components to be evaluated in the review include the following:

- Case narrative;
- Data completeness check;
- Holding times;
- Sample preservation;
- Blank results (instrument blanks, method blanks, field blanks, equipment blanks (as applicable);
- Surrogate recoveries;
- Internal standard recoveries (as applicable);
- Calibrations;
- Initial and Continuing calibration;
- Analytical run sequence;
- Chromatograms;
- Raw data files;
- Internal Standard and Retention Time Summary;
- Instrument tune (as applicable);
- Serial dilution;
- Laboratory duplicates (as applicable);
- MS/MSD results;

- Field duplicates;
- Laboratory control sample results; and
- Other specific information as described in the most current NYSDEC Analytical Services Protocols.

Based on validation results, qualifiers will be added to reported analytical results to indicate uncertainty or potential bias or interferences. Specific data qualifiers that will be applied to sample concentration include the following:

- J - The results are considered estimated. The analyte was detected above the MDL, but the associated reported concentration is approximate and is considered estimated because it is below the RL (also referred to as reporting limit), or because there was a QC issue identified and associated with the analytical result.
- J- - The results are considered estimated with low bias. The analyte was detected above the RL, but the associated reported concentration is approximate and is considered estimated and the numerical value is likely to be lower than the concentration of the analyte in the sample due to QC issue identified with negative bias associated with the analytical result.
- J+ - The results are considered estimated with high bias. The analyte was detected above the RL, but the associated reported concentration is approximate and is considered estimated and the numerical value is likely to be higher than the concentration of the analyte in the sample due to QC issue identified with positive bias associated with the analytical result.
- R - The reported analyte concentration is rejected due to a serious deficiency with the associated quality control result(s). The presence or absence of the analyte cannot be confirmed.
- U - The analyte was not detected above the MDL or RL, as applicable.
- UJ - The analyte was not detected above the MDL or RL, as applicable. However, due to quality control results that did not meet acceptance criteria, the RL is uncertain and may not accurately represent the actual limit.

5.5 Data Usability and Reconciliation with Project Quality

The following sections describe the performance criteria and data usability for the investigation program. In general, if issues with data quality are found in the various data sets, they will be discussed with the project team, including the laboratory and NYSDEC. Data sets will be assessed with regard to the PARCCS parameters described below.

5.5.1 Precision

Field and laboratory duplicates have been incorporated into the program to assess the precision of the measurement system. If duplicate results indicate matrix heterogeneity greater than anticipated, qualifiers will be added to reported concentrations and a description of validation actions will be documented.

5.5.2 Accuracy

Accuracy is a measure of how a concentration is in agreement with a reference concentration. Calibrations, matrix spikes, surrogate spikes, internal standards, and laboratory control sample results will be used to assess accuracy. Non-compliant results will be identified, and the impact to reported results documented, as necessary. Data qualifiers will be applied to sample concentrations based on a comparison of quality control results to laboratory or method specified performance criteria.

5.5.3 Representativeness

Sample representativeness will be assessed through an analysis of the blank results. The concentrations and frequencies of target analytes detected in blanks will provide an indication of data representativeness. Issues concerning representativeness based on a review of these data will be documented. Qualifiers will be applied to data that do not meet the specified laboratory or method criteria of these measurement parameters.

5.5.4 Comparability

Comparability between data sets will be made qualitatively and quantitatively to determine the extent to which different measurements of the same quantity will yield valid conclusions. Comparability performance will be assessed on the basis of duplicate results from samples of the same media collected from the same location at the same time compared against measurement performance criteria, as discussed in Section 2. Field parameters can provide another means of assessing the comparability of data points within a data set. Parameters, including pH, turbidity, and specific conductivity, are generally similar among like samples, within certain limits. Should laboratory data appear anomalous, field parameters will be checked to assess the potential that a sample may not have been representative of general conditions for a particular location at a particular time.

5.5.5 Completeness

A data set for a specific medium will be considered complete if at least 90 percent of the results have all the associated quality control results and are accepted as valid data to meet the DQO provided in this QAPP. Completeness will be documented, and corrective action(s) recommended, as appropriate.

SECTION 6

REFERENCES

EPA (United States Environmental Protection Agency), 2014. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. SW-846. July.

EPA, 2001. Requirements for Quality Assurance Project Plans. EPA QA/R-5. March.

EPA, 2020. National Functional Guidelines for Organic Superfund Methods Data Review. OLEM 9240.0-51. EPA 540-R-20-005. November 2020.

EPA, 2020. National Functional Guidelines for Inorganic Superfund Data Review. OLEM 9240.1-66. EPA 542-R-20-006. November 2020.

NYSDEC (New York State Department of Environmental Conservation), 2021. Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS), under NYSDEC's Part 375 Remedial Programs. Department of Environmental Conservation. June 2021.

NYSDEC, 2010. DER-10 Technical Guidance for Site Investigation and Remediation. May 2010.

NYSDEC, 2018. NYSDEC Electronic Data Deliverable Manual. NYSDEC EDD Format v.4. November 2018.

Table 1
Project Team
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Name	Affliation	Role	Phone	Email
Anne Locke	Bristol-Myers Squibb	Project Manager	315-952-2858	anne.locke@bms.com
Rich Mador	Bristol-Myers Squibb	Associate Director | Environment	609-252-4273	Richard.Mator@bms.com
Jeanmarie Zodrow	Geosyntec	Sediments Task Lead	720-509-8938	jzodrow@geosyntec.com
Julia Caprio	Geosyntec	Project Chemist & Quality Assurance Manager	865-291-4696	jklenscaprio@geosyntec.com
Joel Conzelmann	Geosyntec	Field Activities Manager	616-914-6976	Jconzelmann@geosyntec.com
Joel Conzelmann	Geosyntec	Health and Safety Officer	616-914-6976	Jconzelmann@geosyntec.com
John Cady	Eurofins	Project Manager/Chemist for Sediment Analysis	832-763-8082	john.cady@eurofinset.com
Michael Rog	Bureau Veritas North America	Project Manager/Chemist for Sediment Analysis	847-726-372	michael.rog@bureauveritas.com

Table 2
Analytical References Limits and Screening Values - Sediment Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	Lower SGV	Higher SGV	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
VOCs (8260D)	1,1,1-Trichloroethane	71-55-6	µg/kg	5.00	0.600	--	--	69-123	30	69-123	30
	1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	5.00	0.400	2800	5400	69-125	30	69-125	30
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	µg/kg	10.0	0.600	--	--	64-135	30	64-135	30
	1,1,2-Trichloroethane	79-00-5	µg/kg	5.00	0.500	--	--	80-120	30	80-120	30
	1,1-Dichloroethane	75-34-3	µg/kg	5.00	0.500	--	--	79-120	30	79-120	30
	1,1-Dichloroethene	75-35-4	µg/kg	5.00	0.500	520	4700	73-129	30	73-129	30
	1,2,3-Trichlorobenzene	87-61-6	µg/kg	10.0	5.00	230	2800	57-131	30	57-131	30
	1,2,4-Trichlorobenzene	120-82-1	µg/kg	10.0	5.00	35000	55000	56-130	30	56-130	30
	1,2,4-Trimethylbenzene	95-63-6	µg/kg	5.00	0.500	3400	30000	73-120	30	73-120	30
	1,2-Dibromo-3-Chloropropane	96-12-8	µg/kg	5.00	0.500	--	--	48-134	30	48-134	30
	1,2-Dibromoethane	106-93-4	µg/kg	5.00	0.400	--	--	76-120	30	76-120	30
	1,2-Dichlorobenzene	95-50-1	µg/kg	5.00	0.500	280	2500	76-120	30	76-120	30
	1,2-Dichloroethane	107-06-2	µg/kg	5.00	0.600	--	--	71-128	30	71-128	30
	1,2-Dichloroethene, Total	540-59-0	µg/kg	10.0	1.00	--	--	80-126	30	80-126	30
	1,2-Dichloropropane	78-87-5	µg/kg	5.00	0.500	428[њ]	876[ђ]	80-120	30	80-120	30
	1,3,5-Trimethylbenzene	108-67-8	µg/kg	5.00	0.500	164[њ]	354ђ	73-120	30	73-120	30
	1,3-Dichlorobenzene	541-73-1	µg/kg	5.00	0.500	1800	7100	75-120	30	75-120	30
	1,4-Dichlorobenzene	106-46-7	µg/kg	5.00	0.400	720	3300	80-120	30	80-120	30
	1,4-Dioxane	123-91-1	µg/kg	250	37.0	--	--	--	--	--	--
	2-Butanone (MEK)	78-93-3	µg/kg	10.0	2.00	7604[њ]	22707[ђ]	57-128	30	57-128	30
	2-Hexanone	591-78-6	µg/kg	10.0	1.00	--	--	54-140	30	54-140	30
	2-Nitropropane	79-46-9	µg/kg	10.0	2.00	--	--	27-183	30	27-183	30
	4-Isopropyltoluene	99-87-6	µg/kg	5.00	2.00	184[њ]	242[ђ]	72-120	30	72-120	30
	4-Methyl-2-pentanone (MIBK)	108-10-1	µg/kg	10.0	1.00	73њ	8165[ђ]	67-128	30	67-128	30
	Acetone	67-64-1	µg/kg	20.0	6.00	65[њ]	38133[ђ]	41-150	30	41-150	30
	Acetonitrile	75-05-8	µg/kg	100	25.0	--	--	--	--	--	--
	Benzene	71-43-2	µg/kg	5.00	0.500	530	1900	80-120	30	80-120	30
	Bromoform	75-25-2	µg/kg	10.0	5.00	--	--	51-127	30	51-127	30
	Bromomethane	74-83-9	µg/kg	5.00	0.700	--	--	45-140	30	45-140	30
	Carbon disulfide	75-15-0	µg/kg	5.00	0.600	--	--	64-133	30	64-133	30
	Carbon tetrachloride	56-23-5	µg/kg	5.00	0.500	1070	9600	64-134	30	64-134	30
	Chlorobenzene	108-90-7	µg/kg	5.00	0.500	200	1700	80-120	30	80-120	30
	Chlorobromomethane	74-97-5	µg/kg	5.00	0.600	--	--	72-124	30	72-124	30
	Chlorodibromomethane	124-48-1	µg/kg	5.00	0.500	--	--	69-125	30	69-125	30
	Chloroethane	75-00-3	µg/kg	5.00	1.00	--	--	43-135	30	43-135	30
	Chloroform	67-66-3	µg/kg	5.00	0.600	87[њ]	3352[ђ]	80-120	30	80-120	30
	Chloromethane	74-87-3	µg/kg	5.00	0.600	--	--	56-120	30	56-120	30
	cis-1,2-Dichloroethene	156-59-2	µg/kg	5.00	0.500	432[њ]	1,135[ђ]	80-125	30	80-125	30
	cis-1,3-Dichloropropene	10061-01-5	µg/kg	5.00	0.400	--	--	66-120	30	66-120	30
	Cyclohexane	110-82-7	µg/kg	5.00	0.500	--	278[ђ]	58-126	30	58-126	30
	Cyclohexanone	108-94-1	µg/kg	250	25.0	--	--	--	--	--	--
	Dichlorobromomethane	75-27-4	µg/kg	5.00	0.400	--	--	70-120	30	70-120	30
	Dichlorodifluoromethane	75-71-8	µg/kg	5.00	0.600	--	--	21-127	30	21-127	30
	Ethyl acetate	141-78-6	µg/kg	5.00	1.00	--	--	--	--	--	--
	Ethyl ether	60-29-7	µg/kg	5.00	1.00	--	--	59-135	30	59-135	30
	Ethylbenzene	100-41-4	µg/kg	5.00	0.400	430	3700	78-120	30	78-120	30
	Isobutyl alcohol	78-83-1	µg/kg	250	38.0	--	--	--	--	--	--
	Isopropylbenzene	98-82-8	µg/kg	5.00	0.400	210	1800	77-120	30	77-120	30
	Methyl acetate	79-20-9	µg/kg	5.00	1.00	--	--	67-128	30	67-128	30
	Methyl tert-butyl ether	1634-04-4	µg/kg	5.00	0.500	--	--	72-120	30	72-120	30
	Methylcyclohexane	108-87-2	µg/kg	5.00	0.600	--	--	61-124	30	61-124	30
	Methylene Chloride	75-09-2	µg/kg	5.00	2.00	18[њ]	2404[ђ]	76-122	30	76-122	30
	m-Xylene & p-Xylene	179601-23-1	µg/kg	5.00	1.00	--	--	80-120	30	80-120	30
	Naphthalene	91-20-3	µg/kg	5.00	2.00	34.6[‡]	391[¥]	48-130	30	48-130	30
	n-Butanol	71-36-3	µg/kg	250	56.0	--	--	--	--	--	--
	n-Butylbenzene	104-51-8	µg/kg	8.00	3.00	--	--	71-121	30	71-121	30
	n-Heptane	142-82-5	µg/kg	8.00	3.00	--	--	50-141	30	50-141	30
	n-Hexane	110-54-3	µg/kg	5.00	0.500	0.94[њ]	186[ђ]	50-132	30	50-132	30
	o-Xylene	95-47-6	µg/kg	5.00	0.400	820	7240	75-120	30	75-120	30
	sec-Butylbenzene	135-98-8	µg/kg	5.00	2.00	--	--	72-120	30	72-120	30
	Styrene	100-42-5	µg/kg	5.00	0.400	126[њ]	1621[ђ]	76-120	30	76-120	30
	tert-Butyl alcohol	75-65-0	µg/kg	100	15.0	--	--	74-121	30	74-121	30
	tert-Butylbenzene	98-06-6	µg/kg	5.00	0.800	--	--	68-120	30	68-120	30
	Tetrachloroethene	127-18-4	µg/kg	5.00	0.500	16000	57000	73-120	30	73-120	30
	Tetrahydrofuran	109-99-9	µg/kg	8.00	1.00	--	--	71-127	30	71-127	30
	Toluene	108-88-3	µg/kg	5.00	0.600	930	4500	80-120	30	80-120	30
	trans-1,2-Dichloroethene	156-60-5	µg/kg	5.00	0.500	1200	11000	80-126	30	80-126	30
	trans-1,3-Dichloropropene	10061-02-6	µg/kg	5.00	0.500	--	--	68-122	30	68-122	30
	Trichloroethene	79-01-6	µg/kg	5.00	0.500	1800	8600	80-120	30	80-120	30
	Trichlorofluoromethane	75-69-4	µg/kg	5.00	0.700	--	--	55-134	30	55-134	30
	Vinyl chloride	75-01-4	µg/kg	5.00	0.600	482[њ]	1178[ђ]	52-120	30	52-120	30
	Xylenes, Total	1330-20-7	µg/kg	10.0	1.40	590	5200	75-120	30	75-120	30

Table 2
Analytical References Limits and Screening Values - Sediment Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	Lower SGV	Higher SGV	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
SVOCs (8270E)	1,1'-Biphenyl	92-52-4	µg/kg	36.7	16.7	198[њ]	1494[ѣ]	62-100	30	62-100	30
	1,2,4,5-Tetrachlorobenzene	95-94-3	µg/kg	36.7	16.7	3000	14000	60-102	30	60-102	30
	1,4-Dioxane	123-91-1	µg/kg	167	33.3	--	--	26-48	30	26-48	30
	2,2'-oxybis[1-chloropropane]	108-60-1	µg/kg	43.3	20.0	--	--	48-90	30	48-90	30
	2,3,4,6-Tetrachlorophenol	58-90-2	µg/kg	167	66.7	--	--	59-109	30	59-109	30
	2,4,5-Trichlorophenol	95-95-4	µg/kg	36.7	16.7	--	--	61-111	30	61-111	30
	2,4,6-Trichlorophenol	88-06-2	µg/kg	36.7	16.7	--	--	59-113	30	59-113	30
	2,4-Dichlorophenol	120-83-2	µg/kg	43.3	20.0	--	--	62-103	30	62-103	30
	2,4-Dimethylphenol	105-67-9	µg/kg	36.7	16.7	39[њ]	1437[ѣ]	65-101	30	65-101	30
	2,4-Dinitrophenol	51-28-5	µg/kg	1000	167	--	--	44-109	30	44-109	30
	2,4-Dinitrotoluene	121-14-2	µg/kg	167	33.3	--	--	68-108	30	68-108	30
	2,6-Dinitrotoluene	606-20-2	µg/kg	36.7	16.7	--	--	67-113	30	67-113	30
	2-Chloronaphthalene	91-58-7	µg/kg	33.3	6.67	--	--	61-100	30	61-100	30
	2-Chlorophenol	95-57-8	µg/kg	36.7	16.7	--	--	59-97	30	59-97	30
	2-Methylnaphthalene	91-57-6	µg/kg	16.7	5.00	--	--	63-101	30	63-101	30
	2-Methylphenol	95-48-7	µg/kg	50.0	20.0	--	--	63-100	30	63-100	30
	2-Nitroaniline	88-74-4	µg/kg	50.0	16.7	--	--	64-111	30	64-111	30
	2-Nitrophenol	88-75-5	µg/kg	50.0	20.0	--	--	55-104	30	55-104	30
	3,3'-Dichlorobenzidine	91-94-1	µg/kg	167	33.3	--	--	19-95	30	19-95	30
	3-Nitroaniline	99-09-2	µg/kg	167	33.3	--	--	31-97	30	31-97	30
	4,6-Dinitro-2-methylphenol	534-52-1	µg/kg	500	167	--	--	59-106	30	59-106	30
	4-Bromophenyl phenyl ether	101-55-3	µg/kg	36.7	16.7	--	--	65-106	30	65-106	30
	4-Chloro-3-methylphenol	59-50-7	µg/kg	50.0	20.0	--	--	67-102	30	67-102	30
	4-Chloroaniline	106-47-8	µg/kg	167	33.3	--	--	10-83	30	10-83	30
	4-Chlorophenyl phenyl ether	7005-72-3	µg/kg	36.7	16.7	--	--	64-99	30	64-99	30
	4-Nitroaniline	100-01-6	µg/kg	167	33.3	--	--	59-101	30	59-101	30
	4-Nitrophenol	100-02-7	µg/kg	500	167	--	--	58-109	30	58-109	30
	Acenaphthene	83-32-9	µg/kg	16.7	3.33	--	--	61-104	30	61-104	30
	Acenaphthylene	208-96-8	µg/kg	16.7	4.00	--	--	69-117	30	69-117	30
	Acetophenone	98-86-2	µg/kg	50.0	16.7	--	--	54-88	30	54-88	30
	Anthracene	120-12-7	µg/kg	16.7	3.33	--	--	75-114	30	75-114	30
	Atrazine	1912-24-9	µg/kg	167	66.7	--	--	63-127	30	63-127	30
	Benzaldehyde	100-52-7	µg/kg	167	33.3	--	--	25-95	30	25-95	30
	Benzo[a]anthracene	56-55-3	µg/kg	16.7	3.33	--	--	73-114	30	73-114	30
	Benzo[a]pyrene	50-32-8	µg/kg	16.7	3.33	--	--	61-111	30	61-111	30
	Benzo[b]fluoranthene	205-99-2	µg/kg	16.7	3.33	--	--	63-110	30	63-110	30
	Benzo[g,h,i]perylene	191-24-2	µg/kg	16.7	3.33	--	--	77-114	30	77-114	30
	Benzo[k]fluoranthene	207-08-9	µg/kg	16.7	3.33	--	--	68-110	30	68-110	30
	Benzyl alcohol	100-51-6	µg/kg	500	167	**3.7**[њ]	6729[ѣ]	44-109	30	44-109	30
	Bis(2-chloroethoxy)methane	111-91-1	µg/kg	36.7	16.7	--	--	55-93	30	55-93	30
	Bis(2-chloroethyl)ether	111-44-4	µg/kg	36.7	16.7	--	--	49-94	30	49-94	30
	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	167	66.7	360000	360000	65-116	30	65-116	30
	Butyl benzyl phthalate	85-68-7	µg/kg	167	66.7	100[њ]	481[ѣ]	66-111	30	66-111	30
	Caprolactam	105-60-2	µg/kg	167	33.3	--	--	54-103	30	54-103	30
	Carbazole	86-74-8	µg/kg	36.7	16.7	69[њ]	4561[ѣ]	74-117	30	74-117	30
	Chrysene	218-01-9	µg/kg	16.7	3.33	--	--	66-111	30	66-111	30
	Dibenz(a,h)anthracene	53-70-3	µg/kg	16.7	6.67	--	--	72-120	30	72-120	30
	Dibenzofuran	132-64-9	µg/kg	36.7	16.7	510[њ]	2313[ѣ]	68-101	30	68-101	30
	Dicyclohexylamine	101-83-7	µg/kg	2000	667	--	--	49-141	30	49-141	30
	Diethyl phthalate	84-66-2	µg/kg	167	66.7	--	--	65-104	30	65-104	30
	Dimethyl phthalate	131-11-3	µg/kg	167	66.7	--	--	67-101	30	67-101	30
	Di-n-butyl phthalate	84-74-2	µg/kg	167	66.7	--	--	65-115	30	65-115	30
	Di-n-octyl phthalate	117-84-0	µg/kg	167	66.7	--	--	60-125	30	60-125	30
	Fluoranthene	206-44-0	µg/kg	16.7	3.33	--	--	71-108	30	71-108	30
	Fluorene	86-73-7	µg/kg	16.7	3.33	--	--	68-102	30	68-102	30
	Hexachlorobenzene	118-74-1	µg/kg	16.7	6.67	--	--	58-105	30	58-105	30
	Hexachlorobutadiene	87-68-3	µg/kg	50.0	20.0	1200	12000	48-95	30	48-95	30
	Hexachlorocyclopentadiene	77-47-4	µg/kg	500	167	810	8100	43-118	30	43-118	30
	Hexachloroethane	67-72-1	µg/kg	167	33.3	--	--	48-86	30	48-86	30
	Indeno[1,2,3-cd]pyrene	193-39-5	µg/kg	16.7	4.00	--	--	71-122	30	71-122	30
	Isophorone	78-59-1	µg/kg	66.7	16.7	--	--	62-100	30	62-100	30
	Methylphenol, 3 & 4	106-44-5	µg/kg	50.0	16.7	93[њ]	260[ѣ]	56-100	30	56-100	30
	n,n'-Dimethylaniline	121-69-7	µg/kg	167	33.3	--	--	32-133	30	32-133	30
	Naphthalene	91-20-3	µg/kg	16.7	6.67	34.6[‡]	391[¥]	60-94	30	60-94	30
	Nitrobenzene	98-95-3	µg/kg	36.7	16.7	--	--	56-94	30	56-94	30
	N-Nitrosodi-n-propylamine	621-64-7	µg/kg	50.0	23.3	--	--	55-92	30	55-92	30
	N-Nitrosodiphenylamine	86-30-6	µg/kg	36.7	16.7	110[њ]	370[ѣ]	71-109	30	71-109	30
	Pentachlorophenol	87-86-5	µg/kg	167	66.7	14000	19000	41-119	30	41-119	30
	Phenanthrene	85-01-8	µg/kg	16.7	4.00	--	--	74-112	30	74-112	30
	Phenol	108-95-2	µg/kg	36.7	16.7	175[њ]	210[ѣ]	57-93	30	57-93	30
	Pyrene	129-00-0	µg/kg	16.7	3.33	--	--	70-103	30	70-103	30
	Triethylamine	121-44-8	µg/kg	5000	1670	--	--	70-130	30	70-130	30
	Total PAH	-	µg/kg	4000	35000	--	--	--	--	--	--

Table 2
Analytical References Limits and Screening Values - Sediment Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	Lower SGV	Higher SGV	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
TAL Metals	Aluminum	7429-90-5	mg/Kg	10.0	4.37	--	--	80-120	20	75-125	20
	Antimony	7440-36-0	mg/Kg	0.100	0.0632	--	--	80-120	20	75-125	20
	Arsenic	7440-38-2	mg/Kg	0.200	0.0669	10	33	80-120	20	75-125	20
	Barium	7440-39-3	mg/Kg	0.200	0.0915	--	--	80-120	20	75-125	20
	Beryllium	7440-41-7	mg/Kg	0.0500	0.0119	--	--	80-120	20	75-125	20
	Cadmium	7440-43-9	mg/Kg	0.0500	0.0252	1	5	80-120	20	75-125	20
	Calcium	7440-70-2	mg/Kg	20.0	7.49	--	--	80-120	20	75-125	20
	Chromium	7440-47-3	mg/Kg	0.200	0.0769	43	110	80-120	20	75-125	20
	Cobalt	7440-48-4	mg/Kg	0.100	0.0292	--	--	80-120	20	75-125	20
	Copper	7440-50-8	mg/Kg	0.200	0.0878	32	150	80-120	20	75-125	20
	Iron	7439-89-6	mg/Kg	10.0	3.75	--	--	80-120	20	75-125	20
	Lead	7439-92-1	mg/Kg	0.100	0.0252	36	130	80-120	20	75-125	20
	Magnesium	7439-95-4	mg/Kg	5.00	1.57	--	--	80-120	20	75-125	20
	Manganese	7439-96-5	mg/Kg	0.200	0.106	--	--	80-120	20	75-125	20
	Nickel	7440-02-0	mg/Kg	0.200	0.0814	23	49	80-120	20	75-125	20
	Potassium	7440-09-7	mg/Kg	20.0	9.52	--	--	80-120	20	75-125	20
	Selenium	7782-49-2	mg/Kg	0.200	0.0652	--	--	80-120	20	75-125	20
	Silver	7440-22-4	mg/Kg	0.0500	0.0203	1	2.2	80-120	20	75-125	20
	Sodium	7440-23-5	mg/Kg	25.0	13.4	--	--	80-120	20	75-125	20
	Thallium	7440-28-0	mg/Kg	0.0500	0.0196	--	--	80-120	20	75-125	20
	Zinc	7440-66-6	mg/Kg	15.0	0.535	120	460	80-120	20	75-125	20
	Vanadium	7440-62-2	mg/Kg	0.400	0.0429	--	--	80-120	20	75-125	20
	Mercury	7439-97-6	mg/Kg	0.0600	0.0250	0.2	1	80-120	20	80-120	20
Methanol (8015D)	Methanol	64-56-1	µg/kg	1000.00	200	--	--	76-119	20	76-119	20
Pharmaceuticals	Tetracycline	60-54-8	ng/g	0.10	NA	--	--	10.6-10.8	1.18	10.6-10.8	1.18
	Penicillin V	87-08-1	ng/g	1.0	NA	--	--	6-180	30	6-180	30
TOC	Total Organic Carbon (TOC)	7440-44-0	mg/Kg	300	100	--	--	47-143	20	47-143	20
PFAS	Perfluorooctanoic acid	335-67-1	ng/g	0.200	0.0220	--	--	59-131	30	59-131	30
	Perfluorononanoic acid	375-95-1	ng/g	0.200	0.0230	--	--	61-134	30	61-134	30
	Perfluorooctanesulfonic acid	1763-23-1	ng/g	0.200	0.0350	--	--	61-126	30	61-126	30
	Perfluorobutanesulfonic acid	375-73-5	ng/g	0.400	0.362	--	--	54-130	30	54-130	30
	Perfluorobutanoic acid	375-22-4	ng/g	0.200	0.0240	--	--	60-128	30	60-128	30
	Perfluorodecanesulfonic acid	335-77-3	ng/g	0.200	0.0210	--	--	57-132	30	57-132	30
	Perfluorodecanoic acid	335-76-2	ng/g	0.200	0.0240	--	--	56-133	30	56-133	30
	Perfluorododecanoic acid	307-55-1	ng/g	0.200	0.0230	--	--	60-135	30	60-135	30
	Perfluoroheptanesulfonic acid	375-92-8	ng/g	0.200	0.0200	--	--	59-132	30	59-132	30
	Perfluoroheptanoic acid	375-85-9	ng/g	0.200	0.0240	--	--	59-137	30	59-137	30
	Perfluorohexanesulfonic acid	355-46-4	ng/g	0.200	0.0190	--	--	59-129	30	59-129	30
	Perfluorohexanoic acid	307-24-4	ng/g	0.200	0.0190	--	--	59-132	30	59-132	30
	Perfluoropentanoic acid	2706-90-3	ng/g	0.200	0.0240	--	--	58-134	30	58-134	30
	Perfluorotetradecanoic acid	376-06-7	ng/g	0.200	0.0240	--	--	62-134	30	62-134	30
	Perfluorotridecanoic acid	72629-94-8	ng/g	0.200	0.0210	--	--	53-143	30	53-143	30
	Perfluoroundecanoic acid	2058-94-8	ng/g	0.200	0.0560	--	--	60-134	30	60-134	30
	6:2 Fluorotelomer sulfonate	27619-97-2	ng/g	0.200	0.0490	--	--	59-135	30	59-135	30
	8:2 Fluorotelomer sulfonate	39108-34-4	ng/g	0.200	0.0170	--	--	55-133	30	55-133	30
	Perfluorooctanesulfonamide	754-91-6	ng/g	0.200	0.0210	--	--	47-149	30	47-149	30
	N-methyl perfluorooctanesulfonamideoacetic acid	2355-31-9	ng/g	0.200	0.0310	--	--	60-134	30	60-134	30
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	ng/g	0.200	0.0220	--	--	57-127	30	57-127	30

Notes
Italicized Analytes are Polycyclic Aromatic Hydrocarbons
Bolded SGV are lower than the laboratory MDL
1. Lower SGV and higher SGV are the NYSDEC Class A and Class C SGV from NYSDEC's Screening and Assessment of Contaminated Sediment (CP-60; June 2014), except as indicated by the symbols below:
2. All reporting limits for PFAS shown are based on dry weight and 100% solids. Most sediments are closer to 50% solids so the reporting limits reported for PFAS will be elevated based on the actual percent solids for each sample.

њ = Value is the ESV from USEPA Region 4 Ecological Risk Assessment Supplement Guidance, updated March 2018.

ѣ = Value is the RSV from USEPA Region 4 Ecological Risk Assessment Supplement Guidance, updated March 2018.

‡ = Value is the TEL from NOAA SQuiRT.
¥ = Value is the PEL from NOAA SQuiRT.

Acronyms and Abbreviations:
-- not applicable
µg/kg - micrograms per kilogram
ng/g - nanograms per gram
CAS - Chemical Abstracts Service
ESV - Ecological Screening Value
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MDL - Method Detection Limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
NOAA - National Oceanic and Atmospheric Administration
NYSDEC - New York Department of Environmental Conservation
PEL - Probable Effects Level
RPD - Relative percent difference
RSV - Refining Screening Value
SGV - Sediment Guidance Value
SVOC - Semivolatile Organic Compounds
TEL - Thresholds Effects Level
USEPA - United States Environmental Protection Agency
VOC - Volatile Organic Compounds
TAL - Targer Analyte List
TOC - Total Organic Carbon
PFAS - Per- and Polyfluoroalkyl Substances

Table 3
Analytical References Limits and Screening Values - Water Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
VOCs (8260D)	1,1,1-Trichloroethane	71-55-6	µg/L	0.500	0.0600	78-126	30	78-126	30
	1,1,2,2-Tetrachloroethane	79-34-5	µg/L	0.500	0.0700	75-123	30	75-123	30
	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	µg/L	0.500	0.0600	75-133	30	75-133	30
	1,1,2-Trichloroethane	79-00-5	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,1-Dichloroethane	75-34-3	µg/L	0.500	0.0700	74-120	30	74-120	30
	1,1-Dichloroethene	75-35-4	µg/L	0.500	0.0600	80-131	30	80-131	30
	1,2,3-Trichlorobenzene	87-61-6	µg/L	0.500	0.0500	68-125	30	68-125	30
	1,2,4-Trichlorobenzene	120-82-1	µg/L	0.500	0.0600	68-122	30	68-122	30
	1,2,4-Trimethylbenzene	95-63-6	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,2-Dibromo-3-Chloropropane	96-12-8	µg/L	0.500	0.100	56-148	30	56-148	30
	1,2-Dibromoethane	106-93-4	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,2-Dichlorobenzene	95-50-1	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,2-Dichloroethane	107-06-2	µg/L	0.500	0.0500	69-122	30	69-122	30
	1,2-Dichloroethene, Total	540-59-0	µg/L	1.00	0.110	80-121	30	80-121	30
	1,2-Dichloropropane	78-87-5	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,3,5-Trimethylbenzene	108-67-8	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,3-Dichlorobenzene	541-73-1	µg/L	0.500	0.0600	80-120	30	80-120	30
	1,4-Dichlorobenzene	106-46-7	µg/L	0.500	0.0700	80-120	30	80-120	30
	1,4-Dioxane	123-91-1	µg/L	100	20.0	--	--	--	--
	2-Butanone (MEK)	78-93-3	µg/L	5.00	0.600	59-141	30	59-141	30
	2-Hexanone	591-78-6	µg/L	5.00	0.600	52-140	30	52-140	30
	2-Nitropropane	79-46-9	µg/L	5.00	1.00	30-165	30	30-165	30
	4-Isopropyltoluene	99-87-6	µg/L	0.500	0.0500	80-120	30	80-120	30
	4-Methyl-2-pentanone (MIBK)	108-10-1	µg/L	5.00	0.700	55-140	30	55-140	30
	Acetone	67-64-1	µg/L	5.00	0.900	60-146	30	60-146	30
	Acetonitrile	75-05-8	µg/L	20.0	3.00	--	--	--	--
	Benzene	71-43-2	µg/L	0.500	0.0500	80-120	30	80-120	30
	Bromoform	75-25-2	µg/L	1.00	0.300	49-144	30	49-144	30
	Bromomethane	74-83-9	µg/L	0.500	0.0700	60-136	30	60-136	30
	Carbon disulfide	75-15-0	µg/L	1.00	0.0600	67-130	30	67-130	30
	Carbon tetrachloride	56-23-5	µg/L	0.500	0.0700	64-141	30	64-141	30
	Chlorobenzene	108-90-7	µg/L	0.500	0.0600	80-120	30	80-120	30
	Chlorobromomethane	74-97-5	µg/L	0.500	0.0500	80-120	30	80-120	30
	Chlorodibromomethane	124-48-1	µg/L	0.500	0.0700	64-138	30	64-138	30
	Chloroethane	75-00-3	µg/L	0.500	0.0700	63-120	30	63-120	30
	Chloroform	67-66-3	µg/L	0.500	0.0900	80-120	30	80-120	30
	Chloromethane	74-87-3	µg/L	0.500	0.0600	56-124	30	56-124	30
	cis-1,2-Dichloroethene	156-59-2	µg/L	0.500	0.0500	80-122	30	80-122	30
	cis-1,3-Dichloropropene	10061-01-5	µg/L	0.500	0.0500	67-121	30	67-121	30
	Cyclohexane	110-82-7	µg/L	0.500	0.0500	69-120	30	69-120	30
	Cyclohexanone	108-94-1	µg/L	25.0	1.80	--	--	--	--
	Dichlorobromomethane	75-27-4	µg/L	0.500	0.0500	73-124	30	73-124	30
	Dichlorodifluoromethane	75-71-8	µg/L	0.500	0.0500	43-123	30	43-123	30
	Ethyl acetate	141-78-6	µg/L	0.500	0.200	--	--	--	--
	Ethyl ether	60-29-7	µg/L	0.500	0.0500	72-121	30	72-121	30
	Ethylbenzene	100-41-4	µg/L	0.500	0.0600	80-120	30	80-120	30
	Isobutyl alcohol	78-83-1	µg/L	25.0	3.60	--	--	--	--
	Isopropylbenzene	98-82-8	µg/L	0.500	0.0500	80-120	30	80-120	30
	Methyl acetate	79-20-9	µg/L	1.00	0.100	59-143	30	59-143	30
	Methyl tert-butyl ether	1634-04-4	µg/L	0.500	0.0500	69-120	30	69-120	30
	Methylcyclohexane	108-87-2	µg/L	0.500	0.0500	80-120	30	80-120	30
	Methylene Chloride	75-09-2	µg/L	0.500	0.0700	80-120	30	80-120	30
	m-Xylene & p-Xylene	179601-23-1	µg/L	0.500	0.100	80-120	30	80-120	30
	Naphthalene	91-20-3	µg/L	0.500	0.0500	64-122	30	64-122	30
	n-Butanol	71-36-3	µg/L	50.0	16.0	--	--	--	--
	n-Butylbenzene	104-51-8	µg/L	0.500	0.0500	74-123	30	74-123	30
	n-Heptane	142-82-5	µg/L	0.500	0.0500	63-124	30	63-124	30
	n-Hexane	110-54-3	µg/L	0.500	0.0500	60-126	30	60-126	30
	o-Xylene	95-47-6	µg/L	0.500	0.0500	80-120	30	80-120	30
	sec-Butylbenzene	135-98-8	µg/L	0.500	0.0600	80-120	30	80-120	30
	Styrene	100-42-5	µg/L	0.500	0.0500	80-120	30	80-120	30
	tert-Butyl alcohol	75-65-0	µg/L	10.0	1.10	62-138	30	62-138	30
	tert-Butylbenzene	98-06-6	µg/L	0.500	0.0700	79-120	30	79-120	30
	Tetrachloroethene	127-18-4	µg/L	0.500	0.0600	80-120	30	80-120	30
	Tetrahydrofuran	109-99-9	µg/L	5.00	0.800	67-137	30	67-137	30
	Toluene	108-88-3	µg/L	0.500	0.0700	80-120	30	80-120	30
	trans-1,2-Dichloroethene	156-60-5	µg/L	0.500	0.0600	80-122	30	80-122	30
	trans-1,3-Dichloropropene	10061-02-6	µg/L	0.500	0.0600	61-129	30	61-129	30
	Trichloroethene	79-01-6	µg/L	0.500	0.0600	80-120	30	80-120	30
	Trichlorofluoromethane	75-69-4	µg/L	0.500	0.0500	62-136	30	62-136	30
	Vinyl chloride	75-01-4	µg/L	0.500	0.100	60-125	30	60-125	30
	Xylenes, Total	1330-20-7	µg/L	1.00	0.150	80-120	30	80-120	30

Table 3
Analytical References Limits and Screening Values - Water Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
SVOCs (8270E)	1,1'-Biphenyl	92-52-4	µg/L	1.00	0.500	50-110	30	50-110	30
	1,2,4,5-Tetrachlorobenzene	95-94-3	µg/L	2.00	0.500	32-113	30	32-113	30
	1,4-Dioxane	123-91-1	µg/L	2.00	0.500	21-64	30	21-64	30
	2,2'-oxybis[1-chloropropane]	108-60-1	µg/L	5.00	2.00	41-118	30	41-118	30
	2,3,4,6-Tetrachlorophenol	58-90-2	µg/L	2.00	0.500	64-130	30	64-130	30
	2,4,5-Trichlorophenol	95-95-4	µg/L	5.00	1.00	59-126	30	59-126	30
	2,4,6-Trichlorophenol	88-06-2	µg/L	2.00	0.500	59-129	30	59-129	30
	2,4-Dichlorophenol	120-83-2	µg/L	2.00	0.500	51-123	30	51-123	30
	2,4-Dimethylphenol	105-67-9	µg/L	2.00	0.500	64-107	30	64-107	30
	2,4-Dinitrophenol	51-28-5	µg/L	10.0	3.00	30-143	30	30-143	30
	2,4-Dinitrotoluene	121-14-2	µg/L	30.0	14.0	52-128	30	52-128	30
	2,6-Dinitrotoluene	606-20-2	µg/L	5.00	1.00	61-121	30	61-121	30
	2-Chloronaphthalene	91-58-7	µg/L	2.00	0.500	43-110	30	43-110	30
	2-Chlorophenol	95-57-8	µg/L	1.00	0.400	46-109	30	46-109	30
	2-Methylnaphthalene	91-57-6	µg/L	2.00	0.500	45-108	30	45-108	30
	2-Methylphenol	95-48-7	µg/L	0.500	0.100	41-113	30	41-113	30
	2-Nitroaniline	88-74-4	µg/L	2.00	0.500	60-123	30	60-123	30
	2-Nitrophenol	88-75-5	µg/L	5.00	1.00	53-123	30	53-123	30
	3,3'-Dichlorobenzidine	91-94-1	µg/L	5.00	1.00	42-107	30	42-107	30
	3-Nitroaniline	99-09-2	µg/L	10.0	4.00	54-112	30	54-112	30
	4,6-Dinitro-2-methylphenol	534-52-1	µg/L	5.00	2.00	49-138	30	49-138	30
	4-Bromophenyl phenyl ether	101-55-3	µg/L	21.0	8.00	54-121	30	54-121	30
	4-Chloro-3-methylphenol	59-50-7	µg/L	2.00	0.500	52-126	30	52-126	30
	4-Chloroaniline	106-47-8	µg/L	5.00	1.00	45-93	30	45-93	30
	4-Chlorophenyl phenyl ether	7005-72-3	µg/L	10.0	4.00	47-121	30	47-121	30
	4-Nitroaniline	100-01-6	µg/L	2.00	0.500	49-107	30	49-107	30
	4-Nitrophenol	100-02-7	µg/L	3.00	0.900	23-89	30	23-89	30
	Acenaphthene	83-32-9	µg/L	30.0	10.0	52-114	30	52-114	30
	Acenaphthylene	208-96-8	µg/L	0.500	0.100	55-117	30	55-117	30
	Acetophenone	98-86-2	µg/L	0.500	0.100	51-119	30	51-119	30
	Anthracene	120-12-7	µg/L	5.00	1.00	61-117	30	61-117	30
	Atrazine	1912-24-9	µg/L	0.500	0.100	71-133	30	71-133	30
	Benzaldehyde	100-52-7	µg/L	5.00	1.00	39-119	30	39-119	30
	Benzo[a]anthracene	56-55-3	µg/L	5.00	1.00	61-126	30	61-126	30
	Benzo[a]pyrene	50-32-8	µg/L	0.500	0.100	60-116	30	60-116	30
	Benzo[b]fluoranthene	205-99-2	µg/L	0.500	0.110	61-119	30	61-119	30
	Benzo[g,h,i]perylene	191-24-2	µg/L	0.500	0.100	54-120	30	54-120	30
	Benzo[k]fluoranthene	207-08-9	µg/L	0.500	0.100	69-122	30	69-122	30
	Benzyl alcohol	100-51-6	µg/L	0.500	0.100	56-115	30	56-115	30
	Bis(2-chloroethoxy)methane	111-91-1	µg/L	10.0	4.00	51-120	30	51-120	30
	Bis(2-chloroethyl)ether	111-44-4	µg/L	2.00	0.500	50-110	30	50-110	30
	Bis(2-ethylhexyl) phthalate	117-81-7	µg/L	2.00	0.500	50-127	30	50-127	30
	Butyl benzyl phthalate	85-68-7	µg/L	5.00	2.00	11-125	30	11-125	30
	Caprolactam	105-60-2	µg/L	5.00	2.00	12-40	30	12-40	30
	Carbazole	86-74-8	µg/L	7.00	3.00	64-127	30	64-127	30
	Chrysene	218-01-9	µg/L	2.00	0.500	65-121	30	65-121	30
	Dibenz(a,h)anthracene	53-70-3	µg/L	0.500	0.100	57-124	30	57-124	30
	Dibenzofuran	132-64-9	µg/L	0.500	0.100	60-112	30	60-112	30
	Dicyclohexylamine	101-83-7	µg/L	2.00	0.500	28-140	30	28-140	30
	Diethyl phthalate	84-66-2	µg/L	20.0	10.0	19-121	30	19-121	30
	Dimethyl phthalate	131-11-3	µg/L	5.00	2.00	10-134	30	10-134	30
	Di-n-butyl phthalate	84-74-2	µg/L	5.00	2.00	43-118	30	43-118	30
	Di-n-octyl phthalate	117-84-0	µg/L	5.00	2.00	48-129	30	48-129	30
	Fluoranthene	206-44-0	µg/L	11.0	5.00	63-122	30	63-122	30
	Fluorene	86-73-7	µg/L	0.500	0.100	56-115	30	56-115	30
	Hexachlorobenzene	118-74-1	µg/L	0.500	0.120	55-123	30	55-123	30
	Hexachlorobutadiene	87-68-3	µg/L	0.500	0.110	20-108	30	20-108	30
	Hexachlorocyclopentadiene	77-47-4	µg/L	2.00	0.500	10-82	30	10-82	30
	Hexachloroethane	67-72-1	µg/L	11.0	5.00	22-88	30	22-88	30
	Indeno[1,2,3-cd]pyrene	193-39-5	µg/L	5.00	0.500	52-121	30	52-121	30
	Isophorone	78-59-1	µg/L	0.500	0.110	55-122	30	55-122	30
	Methylphenol, 3 & 4	106-44-5	µg/L	2.00	0.500	41-109	30	41-109	30
	n,n'-Dimethylaniline	121-69-7	µg/L	2.00	0.500	59-114	30	59-114	30
	Naphthalene	91-20-3	µg/L	1.00	0.500	51-102	30	51-102	30
	Nitrobenzene	98-95-3	µg/L	0.500	0.100	52-119	30	52-119	30
	N-Nitrosodi-n-propylamine	621-64-7	µg/L	2.00	0.500	52-123	30	52-123	30
	N-Nitrosodiphenylamine	86-30-6	µg/L	2.00	0.500	60-126	30	60-126	30
	Pentachlorophenol	87-86-5	µg/L	2.00	0.500	54-131	30	54-131	30
	Phenanthrene	85-01-8	µg/L	5.00	1.00	65-113	30	65-113	30
	Phenol	108-95-2	µg/L	0.500	0.110	22-69	30	22-69	30
	Pyrene	129-00-0	µg/L	2.00	0.500	65-115	30	65-115	30
	Triethylamine	121-44-8	µg/L	0.500	0.100	10-88	30	10-88	30

Table 3
Analytical References Limits and Screening Values - Water Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Method Description	Analyte	CAS Number	Units	Analytical RL	Analytical MDL	LCS Recovery	LCS/LCSD RPD	MS/MSD Recovery	MS/MSD RPD
TAL Metals	Aluminum	7429-90-5	ug/L	25.0	19.7	87-119	20	75-125	20
	Antimony	7440-36-0	ug/L	1.00	0.406	80-120	20	75-125	20
	Arsenic	7440-38-2	ug/L	2.00	0.680	85-120	20	75-125	20
	Barium	7440-39-3	ug/L	2.00	0.746	80-120	20	75-125	20
	Beryllium	7440-41-7	ug/L	0.500	0.119	90-112	20	75-125	20
	Cadmium	7440-43-9	ug/L	0.500	0.151	86-113	20	75-125	20
	Calcium	7440-70-2	ug/L	100	73.6	85-120	20	75-125	20
	Chromium	7440-47-3	ug/L	2.00	0.334	90-115	20	75-125	20
	Cobalt	7440-48-4	ug/L	0.500	0.156	90-113	20	80-125	20
	Copper	7440-50-8	ug/L	1.00	0.362	80-120	20	75-125	20
	Iron	7439-89-6	ug/L	50.0	22.8	88-119	20	75-125	20
	Lead	7439-92-1	ug/L	0.500	0.0710	90-115	20	75-125	20
	Magnesium	7439-95-4	ug/L	50.0	10.4	90-112	20	75-125	20
	Manganese	7439-96-5	ug/L	2.00	0.634	89-120	20	75-125	20
	Nickel	7440-02-0	ug/L	1.00	0.604	90-114	20	75-125	20
	Potassium	7440-09-7	ug/L	200	107	90-112	20	75-125	20
	Selenium	7782-49-2	ug/L	1.00	0.278	80-120	20	75-125	20
	Silver	7440-22-4	ug/L	0.500	0.170	88-113	20	75-125	20
	Sodium	7440-23-5	ug/L	200	50.0	89-112	20	75-125	20
	Thallium	7440-28-0	ug/L	0.500	0.130	80-120	20	75-125	20
	Zinc	7440-66-6	ug/L	10.0	6.18	90-115	20	75-125	20
	Vanadium	7440-62-2	ug/L	4.00	0.794	90-115	20	75-125	20
	Mercury	7439-97-6	ug/L	0.200	0.0790	80-118	20	80-120	20
Methanol (8015D)	Methanol	64-56-1	µg/L	1000	220	79-120	30	79-120	30
Pharmaceuticals	Tetracycline	60-54-8	µg/L	0.10	NA	10.6-10.8	1.18	10.6-10.8	1.18
	Penicillin V	87-08-1	µg/L	1.0	NA	6-180	30	6-180	30
TOC	Total Organic Carbon (TOC)	7440-44-0	mg/L	1.00	0.500	91-113	10	91-113	20
PFAS	Perfluorooctanoic acid	335-67-1	ng/L	2.00	0.500	51-145	30	51-145	30
	Perfluorononanoic acid	375-95-1	ng/L	2.00	0.500	61-139	30	61-139	30
	Perfluorooctanesulfonic acid	1763-23-1	ng/L	2.00	0.500	45-150	30	45-150	30
	Perfluorobutanesulfonic acid	375-73-5	ng/L	2.00	0.500	53-138	30	53-138	30
	Perfluorobutanoic acid	375-22-4	ng/L	5.00	2.00	59-136	30	59-136	30
	Perfluorodecanesulfonic acid	335-77-3	ng/L	2.00	0.500	55-137	30	55-137	30
	Perfluorodecanoic acid	335-76-2	ng/L	2.00	0.500	56-138	30	56-138	30
	Perfluorododecanoic acid	307-55-1	ng/L	2.00	0.500	59-143	30	59-143	30
	Perfluoroheptanesulfonic acid	375-92-8	ng/L	2.00	0.500	56-140	30	56-140	30
	Perfluoroheptanoic acid	375-85-9	ng/L	2.00	0.500	59-145	30	59-145	30
	Perfluorohexanesulfonic acid	355-46-4	ng/L	2.00	0.500	58-134	30	58-134	30
	Perfluorohexanoic acid	307-24-4	ng/L	2.00	0.500	58-139	30	58-139	30
	Perfluoropentanoic acid	2706-90-3	ng/L	2.00	0.500	57-141	30	57-141	30
	Perfluorotetradecanoic acid	376-06-7	ng/L	2.00	0.500	62-139	30	62-139	30
	Perfluorotridecanoic acid	72629-94-8	ng/L	2.00	0.500	58-146	30	58-146	30
	Perfluoroundecanoic acid	2058-94-8	ng/L	2.00	0.500	60-141	30	60-141	30
	6:2 Fluorotelomer sulfonate	27619-97-2	ng/L	5.00	2.00	28-173	30	28-173	30
	8:2 Fluorotelomer sulfonate	39108-34-4	ng/L	3.00	1.00	55-138	30	55-138	30
	Perfluorooctanesulfonamide	754-91-6	ng/L	2.00	0.500	43-167	30	43-167	30
	N-methyl perfluorooctanesulfonamideoacetic acid	2355-31-9	ng/L	2.00	0.600	59-140	30	59-140	30
	N-ethyl perfluorooctanesulfonamidoacetic acid	2991-50-6	ng/L	3.00	0.500	55-134	30	55-134	30

Notes
Italicized Analytes are Polycyclic Aromatic Hydrocarbons

Acronyms and Abbreviations:
-- not applicable
µg/L - micrograms per liter
CAS - Chemical Abstracts Service
LCS - Laboratory Control Sample
LCSD - Laboratory Control Sample Duplicate
MDL - Method Detection Limit
MS - Matrix Spike
MSD - Matrix Spike Duplicate
RPD - Relative percent difference
SVOC - Semivolatile Organic Compounds
VOC - Volatile Organic Compounds
TAL - Targer Analyte List
TOC - Total Organic Carbon
PFAS - Per- and Polyfluoroalkyl Substances

Table 4
Analytical Methods, Containers, Preservatives and Holding Time
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Matrix	Analytical Group	Method	Container	Preservation	Maximum Holding Time
Sediment	Volatile Organic Compounds	8260D	3 Terracores	2 water and 1 methanol preserved 0-6°C	48 hours from sample collection to frozen 14 days from collection to analysis
	Semivolatile Organic Compounds	8270E	4 oz wide mouth glass with PTFE-lined lids	0-6°C	14 days from collection to extraction 40 days from extraction to analysis
	Methanol	8015D	4 oz wide mouth glass with PTFE-lined lids	0-6°C	14 days from collection to analysis
	Tetracycline	NAT-2001-01109	8 oz wide mouth glass with PTFE-lined lids (100 grams)	NA	NA
	Penicillin V	NAT-2006-15103	8 oz wide mouth glass with PTFE-lined lids (100 grams)	NA	NA
	Tal Metals	6020B 7471B (Mercury)	4 oz wide mouth glass with PTFE-lined lids (includes Mercury)	0-6°C	180 days from collection to analysis (28 days for Mercury)
	TOC	Lloyd Khan	4 oz wide mouth glass with PTFE-lined lids	0-6°C	14 days from collection to analysis
	PFAS	EPA 537 Modified Isotope Dilution	4 oz plastic jar (100 grams)	0-6°C	14 days from collection to analysis
Water	Volatile Organic Compounds	8260D	3 VOA vials	No headspace 1:1 HCL to pH < 2 0-6°C	14 days from collection to analysis
	Semivolatile Organic Compounds	8270E	1 liter glass amber with PTFE-lined lids	0-6°C	7 days from collection to extraction 40 days from extraction to analysis
	Methanol	8015D	3 VOA vials	No headspace 0-6°C	14 days from collection to analysis
	Tetracycline	NAT-2001-01109	500 mL sample in 1 liter glass amber	frozen (dry ice), 4.5 g NaCl	ASAP
	Penicillin V	NAT-2006-15103	500 mL sample in 1 liter glass	NA	NA
	Tal Metals	6020B 7471B (Mercury)	250 mL HDPE bottle	Nitric Acid	180 days from collection to analysis (28 days for Mercury)
	TOC	Lloyd Khan	2 VOA vials	Phosphoric Acid	14 days from collection to analysis
	PFAS	EPA 537 Modified Isotope Dilution	2 x 250 mL HDPE bottle	0-6°C	14 days from collection to analysis

Acronyms and Abbreviations:
ASAP = As soon as possible
NA = Not applicable
PTFE = Polytetrafluoroethylene
SVOC = Semivolatile Organic Compounds
VOC = Volatile Organic Compounds
TOC = Total Organic Carbon
TAL = Targe Analyte List
PFAS = Per- and Polyfluoroalkyl Substances
QAPP = Quality Assurance Project Plan

Table 5
Summary of Field Quality Control Samples
Bristol-Myers Squibb Syracuse North Campus
Ley Creek Delineation Work Plan QAPP

Matrix	Analytical Group	Field Duplicate	Matrix Spike/ Matrix Spike Duplicate*	Equipment Blanks	Trip Blanks	Temperature Blanks	Field Blank
Sediment	VOC	1 per 10 field samples	1 per 20 field samples	One per day for non-dedicated equipment	One per cooler	One per cooler	One per sampling event
Sediment	SVOC						
Sediment	TAL Metals						
Sediment	Methanol						
Sediment	Pharmaceuticals						
Sediment	TOC						
Sediment	PFAS						

*collect triple the required sample amount

Acronyms and Abbreviations:
SVOC = Semivolatile Organic Compounds
VOC = Volatile Organic Compounds
TAL = Target Analyte List
TOC = Total Organic Carbon
PFAS = Per- and Polyfluoroalkyl Substances
QAPP = Quality Assurance Project Plan

ATTACHMENT C

Task Hazard Analysis

Geosyntec consultants — B&B Engineers & Geologists of new york, p.c. — *an affiliate of Geosyntec Consultants*

Geosyntec H&S Procedures referenced herein are available on Geosyntec's H&S SharePoint site and should be consulted, as appropriate, to ensure requirements are met. This THA has been prepared per "*HS-204-Work-Specific Hazard and Risk Assessment, Written Safety Plans.*"

TASK HAZARD ANALYSIS

(Ver. 3.1, 1-4-2021)

Part A – PROJECT/TASK INFORMATION

Project/Site Name:	BMS East Syracuse (Ley Creek Delineation)	**Project Number/Org.:**	MP1886/1770
Site Address:	3551 Burnet Ave, East Syracuse, NY 13057 (near 6000 Thompson Rd, East Syracuse NY 13057)		
Task & Worksite Description:	Sediment probing and sampling within Ley Creek using hand equipment		
Geosyntec Personnel:	**Name**	**Office Phone**	**Cell Phone**
Site Safety Lead/Officer	Joel Conzelmann	(312) 416-3927	(616) 914-6976
Task Technical Lead	Jennifer Arblaster	(949) 295-5458	(949) 295-5458
Project Manager	Ron Arcuri	(412) 275-8004	(724) 719-8781
Project Director	Daniel Elliott	(609) 493-9011	(609) 462-9022
Local H&S Coordinator	Ashwin Ranna	(412) 275-8007	(412) 552-4758
Regional H&S Manager	Mark Malchik	(978) 206-5777	(781) 392-5440)
Corporate H&S Director	Bob Poll	(831) 379-4420	(813) 240-9231
On-Site Subcontractor(s): ☒ Not Applicable	☐ Applicable; provide company name, work task and contact information for each Geosyntec subcontractor below:		
Client, Contact(s):	Ann Locke	(315) 432-2660	--
	BMS Security Desk	(315) 432-2121	--
	BMS Emergency Number	(315) 432-2300	--
ETHICS POINT HOTLINE	US & Canada: 844-231-3371 UK: 800-89-0011 or 800-89-0011	Australia: 800-551-155 or 800.811.011 Ireland: 800-222-55288 or 800-500-000	

Part B - EMERGENCY RESPONSE and FIRST AID

IMPORTANT: After initial emergency response actions and incident stabilization, contact appropriate project and H&S personnel listed in Part A

Site-Specific Notes, Clarifications: Consider relevant risk factors & response procedures *(fire/explosion, medical, chemicals/spills, security, site factors, weather, communications)*, **as well as client/regulatory requirements and available of onsite/offsite emergency services (and the possible need for emergency contact numbers other than 911)**:

Emergency Communication / Alerting	☒ Verbal ☒ Cell Phone ☐ Land Line ☐ 2-Way Radio ☐ Satellite Phone ☐ On-site alarm/signal system ☐ Other:
To Summon Police, Fire, Ambulance	☒ **DIAL 911**, for external responders ☐ **Other**:
WorkCare *(for non-emergency injuries)*	**24/7: 888-449-7787**
Other Emergency Contacts *(such as security, spill responder, utility-related):*	811 for Utility Emergencies
Nearest EMERGENCY ROOM Medical Services	Hospital Name: Upstate University Hospital Address: 750 East Adams Street, Syracuse, NY 13210 Phone #: (315) 464-5540 ☒ See Attached Directions
Emergency Evacuation - Route, Rally/Muster Point, Shelter Location(s)	Site emergency assembly area shown on attached figure.

EMERGENCY and FIRST AID EQUIPMENT required for this work task is listed in **PART C.2. – SAFETY EQUIPMENT LIST**

PART C – TASK / HAZARD / CONTROL SUMMARY and EQUIPMENT LIST

C.1 SUMMARY OF TASKS, HAZARDS AND CONTROLS

1. TASKS / WORK ASPECTS	2. HAZARDS / RISKS	3. CONTROLS
Mobilize to site	• Driving safety	• Review D.1-Routine Hazard Preparedness • Wear face covers and maintain social distancing

	• COVID-19 safety in airports or other public area	• Review D.13-Infections/Allergenic Biohazards
Certification and Training	• Accidents related to not being aware of proper procedures	• Ensure that copies of certifications are on-site, up-to date and understood by project personnel
Sediment Probing and Sampling • Sediment probing will be conducted with hand equipment • Sediment cores will be advanced by hand or using a slide hammer to assist	• Heat Stress • Slips, trips, and falls including in wet work areas • Pinch points, crush injuries, cuts/lacerations • Manually conducted probing, potential hand, foot, and back injuries • Biohazards: bees, spiders, ticks, brush, possible snakes • Contaminant Exposure • Water and Boating Hazards • Underground Utilities	• Review Section D.1-Routine Hazard Preparedness • Review Section D.1-Routine Hazard Preparedness • Review Section D.5-Hand Tools • Wear cut resistant heavy work gloves when probing, when using landscaping equipment to clear areas, and when opening sample cores • Review Section D.5-Hand Tools • Review Section D.1-Routine Hazard Preparedness. • Use insect repellent and have tick removal kit with equipment • Review Section D.15-Site Contaminants, Chemical Wastes • Review Section D.3-Water Hazards • Schedule 811 utility clearance and review and marked utilities prior to beginning work. • Review D.11-Utility Related Hazards

C.2. SAFETY EQUIPMENT LIST (Gear to be brought to the worksite by Geosyntec personnel, or availability confirmed)

Site-Specific Notes, Clarifications:

- Face covers for COVID-19 prevention will not be required for personnel who self-report a COVID-19 vaccination to project manager if social distancing can be maintained during work tasks.

☒	**WEATHER, CLIMATE, SEASONAL**	☒ Project-provided drinking water ☒ Canopy for shade, weather protection	☒ Sunscreen ☐ Ice creepers (boot attachments)	☐ Rock salt, traction sand ☐ Portable heater (electric or kerosene)
		☐ Other:		
☒	**HYGIENE PROVISIONS**	☐ Hand washing equipment (soap & wash water)	☒ Hand sanitizer, disinfectant supplies	☐ Sanitary facility, porta-toilet
		☒ Other: Restrooms available for contractor use within the site		
☒	**BASIC PPE**	☒ Standard work clothes appropriate for task ☒ Hard-toed boots/shoes ☐ Hardhat	☒ Safety glasses ☒ Work gloves appropriate for task ☒ Noise/hearing protection	☒ High-visibility/reflective vest/apparel ☒ Nuisance dust mask (voluntary use)

☒	BIOLOGICAL HAZARDS	☒ Insect control (permethrin, repellant, wasp spray, other) ☒ Poison ivy protection (Ivy Block skin cream, Tecnu skin wash) ☒ Tick removal kit ☐ Pant-leg "blousing"/gaiters (tick safe) ☐ Snake chaps/gaiters	☐ Animal warning device (for bears/cougars/wolves/large animals) ☒ Hand sanitizer (for general hygiene or COVID-19) ☒ Disinfectant supplies (for general hygiene or COVID-19) ☒ Face covers for COVID-19 prevention	
		☐ Other:		
☒	SPECIAL HAZARD CONTROLS	☐ Portable GFCI(s) for shock protection ☐ Electrical-hazard-rated boots, gloves ☐ Arc-resistant (AR) protection PPE for arc flash ☐ Flame-resistant (FR) clothing ☐ Work-area delineation supplies	☐ Lockout/tagout equipment ☐ Portable lighting ☐ Tripod/winch ☐ Ventilation equipment (fan, blower) ☐ Traffic control devices	☐ Personal fall protection apparatus ☒ Personal flotation device ☐ Ring buoy & rope ☐ Marine survival suit
		☐ Other:		
☒	CHEMICAL PPE and CHEMICAL SAFETY GEAR	☐ Goggles and/or face shield ☐ Chemical protective gloves ☐ Coveralls (Tyvek, or other) ☐ Outer boots, boot covers	☐ Disposable N95 respirator ☐ Half-face respirator (APR), cartridges ☐ Full-face respirator (APR), cartridges ☐ Exclusion Zone delineation supplies	☒ Decon solution, related supplies ☒ Receptacle for disposable PPE ☐ **Chemical hazard emergency gear – listed in "EMERGENCY EQUIPMENT" below**
		☒ Air monitoring equipment, worker exposure monitoring device(s): PID		
		☐ Other:		
☐	**EMERGENCY EQUIPMENT**	☐ **Air horn, alarm, alerting equipment** ☐ **2-Way radios; other communication device** ☐ **First aid kit(s) – onsite and/or in vehicles** ☐ **Fire extinguisher – onsite and/or in vehicles**	☐ **Eyewash bottle(s)** ☐ **15-min. eyewash station** ☐ **Emergency deluge shower** ☐ **Chemical spill kit/supplies**	**Vehicle emergency preparedness:** ☐ **Fire extinguisher, first aid kit** ☐ **Flares, lights, reflective device** ☐ **Roadside assistance service**
		Other:		

PART D – HAZARD ANALYSIS AND CONTROLS

D.1. ROUTINE HAZARD PREPAREDNESS (This section required for all Tasks)

Site-Specific Notes & Clarifications:

Routine Driving Hazards

☒ **Routine work travel** – Use routine safe/defensive driving practices (seat belts, safe speeds, eyes ahead, no tailgating, limit distractions, safe cell phone use, no texting, clear windows, account for weather/road conditions, adequate sleep, other measures as appropriate).

☒ **Unfamiliar location** – Plan travel route before driving in roadway: view map, plot your route and/or enter destination and activate navigation device.

☒ **Fatigue** – Minimize fatigue during long drives: frequent rest breaks, eat light snacks-avoid heavy meals, stay hydrated, fresh air, no loud music, keep windshield clean; avoid/minimize long distance driving during your ordinary sleep hours; total *work time* and *drive time* should not exceed 14 hours per day.

☒ **Unfamiliar vehicle** – Become familiar with vehicle operational controls and handling characteristics before operating vehicle.

Geosyntec Procedures: *HS-105-Driver and Vehicle Safety*; *HS-211-Fatigue Management Plan*

General Safety

☒ **General site hazards** – Prevent slips/trips/falls (resulting from rough terrain, trip hazards, steep slope, slippery surfaces); maintain good housekeeping.

☒ **Musculoskeletal hazards** – Prevent strains/sprains from strenuous tasks, overexertion, repetitive motion/ergonomic/lifting (seek help/lift-aids over 49 lbs.)

☒ **Weather/climate-related hazards** – Prevent heat/cold-related illness, use sunscreen, monitor weather, i.d. shelter/refuge, use "30/30 rule" for lightning.

☒ **Plant/insect/animal hazards** – Use precautions: poison ivy blocker/wash; insect repellant; tick checks; wasp spray; animal precautions.

☒ **Common unsanitary/allergenic hazards** – Use routine hygienic measures/precautions; hand washing/sanitizer, food hygiene, PPE, disinfectant cleaning.

☒ **Infectious/Pathogenic** - For COVID-19, and other non-typical/potentially high-risk pathogenic hazards, see **D.13 "Infectious/Pathogenic Biohazards."**

☒ **Worksite traffic hazards** – Implement measures to protect personnel (high-visibility/reflective clothing, on-person lighting, traffic control measures).

☒ **Hazardous energy** – Use caution near electrical equipment/wet locations, machinery/physical hazards, stay out of hazard zone/line-of-fire, don't touch.

☐ **Illumination hazards/night work** – Illuminate work areas and/or access routes, use high-visibility and reflective clothing or on-person lighting, as appropriate.

☐ **Security, potential crime/violence, urban/industrial zones** – Complete the *Assessment for Specific Risk: Working in Urban and Industrial Zones*

☐ **Working alone** - Develop a project-specific plan/procedure on limitations for lone work, and specify a plan for periodic communication/contact.

Geosyntec Procedures: *HS-124-Heat Stress*, *HS-125-Cold Stress*, *HS 212- Biting/Stinging Arthropods and Poisonous Plants*, *HS-207-Working Alone*, *HS-208-Housekeeping*, *HS-210-Walking and Working Surfaces*, *HS-401-Back Injury Prevention*, *HS-517-Traffic Safety*, *Assessment for Specific Risk: Working in Urban and Industrial Zones*

Basic Personal Protection

☒ **Head protection from overhead hazards** – Wear hardhat or "bump cap" as appropriate for hazard.
☒ **Hand protection** – Wear protective work gloves appropriate for the hazard and work tasks.
☒ **Eye protection** – Wear safety glasses (with side shield or wrap around, either clear or shaded for sun protection), or other appropriate eye protection.
☒ **Foot protection, rough terrain** – Wear work boots/shoes with hard toes, ankle support, puncture resistance, traction, as appropriate for conditions.
☒ **Hearing protection** – use earplugs or earmuffs (or both) as appropriate for conditions; at a minimum where noise levels exceed 85 dBA.
☒ **Protective clothing/nuisance dust mask** – For general protection against dust, dirt, oily residues, unsanitary conditions, as needed.
☐ Other personal safety gear required for the task(s) covered in this THA is described above in Site-Specific Notes & Clarifications

Geosyntec Procedures: *HS 109-Hearing Conservation, HS 112-Respiratory Protection, HS 113-Personal Protective Equipment*

D.2. SPECIAL DRIVING / TRAFFIC / TRANSPORTATION HAZARDS ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**SPECIAL DRIVING HAZARDS** Off-Road Driving or use of non-typical vehicle, heavy vehicle, van, UTV/ ATV Hazards: Worker injury due to vehicle collision, rollover	☐ For off-road driving, do not exceed capability of vehicle, beware of wet conditions, keep speed low, avoid unsafe orientation on slopes. ☐ UTV/ATV-specific procedures for training, use roll-bar or helmet, operate per manufacturer's instructions. ☐ Special Skills Required for Vehicle type – For vehicles requiring special skills (such as windowless van, heavy work vehicle, utility vehicle, similar) ensure operator is provided training and/or has appropriate operator skills through experience. ***Geosyntec Procedure(s):*** *HS-510-All Terrain Vehicles*
☐	**ROADWAY TRAFFIC HAZARDS** Where the worksite is located in/near vehicle thoroughfare (road, highway, parking lot, etc.). Hazards: Worker injury from being struck by vehicle traveling in thoroughfare.	☐ Prepare Management of Traffic (MOT) Plan (address location hazards / client and regulatory requirements). ☐ Wear DOT-approved reflective vests where exposed to traffic hazards. ☐ Where possible, park vehicles as protective shield from oncoming traffic. ☐ Configure work area and support vehicles to minimize worker exposure to traffic hazards. ☐ Use DOT signal devices and/or signage to re-route vehicles around work area, site entrances/exits. ☐ Use DOT-trained flaggers or police detail where appropriate or required. ***Geosyntec Procedure(s):*** *HS-517-Traffic Safety*
☐	**TOWING/HAULING LOADS** Hazards: Vehicle accident, occupant injury from shifting load, unsafe equipment, un-roadworthiness of trailer.	☐ Ensure load within vehicle is firmly secured (rope, straps, load configuration) to prevent shifting during travel. ☐ Slings, chains, strap, rope and related equipment used for towing, hauling, load-securing shall be appropriate for use, and used in a manner as to prevent an unsafe condition. ☐ For trailer use, verify tow-hitch components are compatible, hitch/safety chains secure, signal/braking lights operational, rear-view mirrors effective, tires inflated to proper pressure and tread acceptable.
☐	**RAILROAD HAZARD** Hazard: Worker injury from being struck by train in R.R. right-of-way	☐ Coordinate with rail company or on-site host facility and implement required safety and security measures. ☐ Site workers to receive safety training for railroad work. **Geosyntec Procedure(s):** *HS-305-Rail Operations*
☐	**TRANSPORTATION BY WATER**	☐ See **D.3., "Water Hazards."** **Geosyntec Procedure(s):** *HS-312-Water Transportation Safety*
☐	**AIRPORT HAZARDS** Worker injury when working on/near airport runway, or use of helicopter, light aircraft	☐ Coordinate safety requirements with airport personnel and implement required safety measures. ☐ Site workers to receive safety training for airport work. ***Geosyntec Procedure(s):*** *HS-310-Helicopter Safety, HS 311-General Aviation (Small Aircraft) Safety*
☐	**TRAFFIC/VEHICLE HAZARDS RELATED TO HEAVY EQUIPMENT, CONSTRUCTION SITE ACTIVITIES**	☐ See **D.8., "Construction, Heavy Equipment, Lift Equipment"**

D.3. WATER HAZARDS (Working Over/Near Water, Ash Ponds, Quicksand) ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☒	**WATER HAZARDS** **Work/travel in watercraft or on equipment over water or over coal ash impoundment/pond:** ☐ Workboat, barge ☐ Water transportation ☐ Hazardous currents (river, tidal/riptide) ☐ Ash pond ☐ Towing, trailer, roadway ☐ Other – describe above	**General water-safety measures for all work near water:** ☒ Wear regulatory-approved personal flotation device (PFD) where drowning hazard is present. ☒ Bring emergency rescue and/or signaling equipment (ring buoy and rope, reaching device, flares) ☒ For fall protection over water, see **D.4. "Fall Hazards."** ☐ For electrical hazards associated with water/wet locations, see **D.10. "Electrical Work Tasks."** **Boating-specific:** ☐ Use fuel safety practices, fire extinguisher present in boat. ☐ Develop/follow float plan, monitor weather, navigate/communicate as planned. ☐ Confirm navigation/communication equipment operable before heading onto water.

	Walking into water/wetland, on shoreline, riverbank, dock, bulkhead, abutment, coal ash: ☒ Work on-foot near, or on ice over, waterbody ☒ Wading into water, wetland ☐ Hazardous tidal zone or surf ☐ Water release, flash flood ☐ Coal ash pond, quicksand ☐ Open culvert, arroyo, drainage/irrigation ditch ☐ Diving Hazards (as applicable): - Drowning, cold immersion - Boating collision, navigation, fog, darkness - Fire/fuel hazards - Entrapment (mud/silt/coal ash/quicksand) - Slip/fall hazards – ice, mud, silt, wet surfaces - Weather, heat/cold stress	☐ For work over very cold water, have immersion survival suit available. ☐ For tidal, flash flood, dam release hazards, plan/locate work accordingly. ☐ For towing a boat trailer, see **D.2. "Special Driving/Traffic/Transportation Hazards."** **Work-entering water or along shore/bank or on dock/pier/abutment:** ☐ For ice/slip hazards, wear ice creepers, sand work area, use tether, other appropriate measures. ☐ For work on ice over water, verify safe thickness, have ring buoy & rope available ☒ For unsure/slippery footing in water, use wading staff, high-traction soles on waders. ☐ Have lifesaving skiff/boat available in circumstances where other rescue means are inadequate. ☒ Monitor hazardous tides, weather for flash floods, know water release schedule. **For ash ponds, quicksand:** ☐ Wear regulatory-approved personal flotation device (PFD). ☐ Bring emergency rescue equipment (ring buoy and rope, reaching device) ☐ If walking on ash/quicksand, provide stable walking/working surface (4'x8' plywood, or similar) ***Geosyntec Procedure(s):*** *HS-306-Working on/near Water and Ice, HS-312-Water Transportation Safety*

D.4. FALL HAZARDS (Falls to Lower Levels) ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**WORKING AT HEIGHTS (GENERAL)** Hazards: - Injury from falls onto lower surface or falls into hazardous equipment, chemicals, water - Overhead utilities/obstructions - Impalement hazard (such as from falling onto unprotected rebar and similar surface projections) - Hazard posed to ground personnel from falling tools, equipment, materials	***Fall protection "trigger heights":*** ***Built environment** – US & CAN: 4 ft. (1.2 m.); **Construction:** US: 6 ft., 10 ft. for scaffolds; CAN: 10 ft. (3 m)* Protect from ***primary*** (fall) hazards: ☐ Restrict access to hazard (barriers, tape, sign) ☐ Ensure safe access to height (ladder, stair, lift) ☐ Ensure guardrails/stair-rails/handrails present ☐ Ensure covers in place over holes ☐ Use designated "watch person/monitor" ☐ Use tether or positioning device ☐ Use personal fall apparatus (PFA) ☐ Use fall protection net Protect from ***secondary*** (collateral) hazards: ☐ Protect site ground personnel from falling objects (restrict access, toe-boards, tether tools) ☐ Install caps on protruding rebar and similar ☐ Working over water; see **D.3, "Water Hazards"** ☐ Working over hazardous machinery/equipment; see **D.5, "Power-Tools/Powered Equipment"** ☐ Overhead electrical; See **D.11. "Utility-Related Hazards"** ☐ Working over chemical hazards; See **D.14 and/or D.15 for chemical and/or contaminant hazards.** ***Geosyntec Procedure(s):*** *HS-120-Fall Protection, HS-210-Walking and Working Surfaces, HS-304-Overhead/Underground Utility Hazards*
☐	**LADDER / STAIRS** ☐ Extension/straight ladders ☐ Step ladders ☐ Fixed/installed ladders ☐ Portable/mobile stairs ☐ Job-made or scaffold stairs Hazards: - See general fall hazards, above.	☐ Follow safe work practices: • Use ladders according to safe practices and manufacturer's instructions. • Maintain 3 points of contact at all times on ladder; keep center of gravity within side rails. • Do not use metal (conductive) ladder near electrical hazard. • Extension/straight ladders shall be properly footed, secured, angled, extend above upper work surface. • Stepladders are set on level ground or properly shimmed, spreaders locked; do not climb/stand on top step, top cap, or rear non-climbing side; use step ladder of sufficient length for work. • Equip stairs with stair handrails where more than 4 steps, and for stairway height of 4' or more. • Ensure portable stairs are stable, plumb. ***Geosyntec Procedure(s):*** *HS-120-Fall Protection; HS-501-Ladders*
☐	**SCAFFOLD** ☐ Supported scaffold ☐ Suspended scaffold ☐ Free-standing/mobile scaffold Hazards: - See general fall hazards, above - Equipment collapse	☐ Follow safe work practices: • Identify/coordinate operations with the scaffolding "Competent Person." • Supported scaffold level, stable, proper attachments, tiebacks, planking, • Suspended scaffolds anchored properly. • Guardrails or personal fall apparatus required above 10 feet. • Proper means of accessing scaffold (proper ladders, stair tower). • Total height of free-standing scaffold not to exceed four times the minimum base dimension. • Do not exceed load limits; store/stage materials in quantities sufficient for immediate use. ***Geosyntec Procedure(s):*** *HS-507-Scaffolds*
☐	**AERIAL BOOM/SCISSOR LIFT** Hazards: - See general fall hazards, above - Struck-by, run-over, tip over - Caught between (pinch points) - Fluid leaks/fuel hazards or battery-related hazards	☐ Follow safe work practices: • Operators to be trained and certified. • Equipment is inspected after mobilization and is in good condition. • Harness & lanyard worn whenever operating the lift. • Overhead hazards and surface obstructions to be reviewed with operators prior to use. ***Geosyntec Procedure(s):*** *HS-509-Aerial Lifts*
☐	**WARNING!** Confirmed or possible close proximity to **OVERHEAD ELECTRICAL UTILITY LINES.**	☐ Follow safe work practices per **D.11., "Utility-Related Hazards"** ***Geosyntec Procedure(s):*** *HS-304-Overhead/Underground Utility Hazards*

D.5. HAND TOOLS (Manual, Hand-Powered) ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:
Other manual hand tools may include landscaping equipment such as shovels, loppers, pruning shears, or small wood saws to access and work around sampling areas. Cut-resistant heavy work gloves will be worn when landscaping equipment is used.

☒	**MANUAL HAND TOOL INJURIES** ☒ Struck by ☒ Pinch points/crushing injuries ☒ Puncture ☒ Cutting blade/laceration risk ☒ Flying objects, eye hazards ☒ Other, describe above	☒ Proper tool for the job, maintain in good condition, use vise/clamp to hold work piece, proper follow through, stay clear of "line of fire," appropriate work gloves, keep blades sharp, use wrist strap when dropped tool poses a hazard. ☒ Utility/folding/collapsible knives and fixed open-bladed knives/cutting tools are *not* permitted, unless specifically authorized. Cutting tools with auto-retracting blades, or with enclosed/guarded blades are permitted. Use cut-resistant heavy work gloves, as applicable. ☒ Ground surface penetration – requires utility clearance; see **D.11. "Utility-Related Hazards"** ***Geosyntec Procedures:*** *HS-502-Manual Hand Tools*
☒	**MUSCULOSKELETAL (MSK) HAZARDS** ☐ Risk of acute physical MSK trauma (strains, sprains, soft tissue injuries) ☒ Risk of cumulative/chronic MSK trauma, repetitive motion injuries	☒ For tools requiring high exertion (shovel, hand auger, sledgehammer, pickaxe, slide hammer, similar): do stretching exercises to prepare, clear hazard zone, use stable body position, take rest breaks, rotate tasks between workers, avoid overexertion.

D.6. POWERED TOOLS & EQUIPMENT (For Drilling & Heavy Equipment, see D.7 & D.8) ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**Type of powered tools/equipment:** ☐ "Power tools" ☐ Powered portable equipment ☐ Powered fixed equipment **Energy/power source:** ☐ Battery-operated ☐ Electric-powered ☐ 120V ☐ 240V ☐ 480V ☐ Extension/flexible cords ☐ Fuel-powered (gas or liquid) ☐ Pneumatic ☐ Hydraulic ☐ Gunpowder-actuated **Hazards of Power Tools and Powered Equipment:** ☐ Eye/hand/body injury ☐ Point-of-operation hazards ☐ Pinch points, moving parts ☐ Line-of-fire hazards, struck by ☐ Fire/explosion, ignition sources ☐ Burns from hot surfaces, steam ☐ Noise ☐ Inhalation/atmospheric hazards ☐ Working at heights, falls ☐ Overhead obstruction(s) ☐ Musculoskeletal hazards ☐ Potential (stored) energy ☐ Illumination	☐ General safe work practices for operation of powered tools and equipment: • Inspect before each use to ensure safe operating condition. • Clear personnel from hazard zone; keep personnel out of the "line-of-fire;" heed warning labels/signage. • Arrange worksite for safe access to equipment and safe use of tool; confirm no overhead obstructions. • Secure long hair/loose clothing/hanging jewelry near moving/rotating parts. • Ensure point-of-operation, mechanical power transmission, other moving parts are guarded with protective devices (as applicable); do not override interlocks, guards, protective devices. • Do not make any equipment modifications that create a greater hazard or bypass safety design features. • Use tool/equipment in accordance with manufacturer's use and safety instructions. • Use PPE and/or other safety protections, as appropriate, for eye/hearing/hand/head/body protection. • Provide training or verify operator competency for use of power tool/equipment. • Use ventilation, wet methods, respirators, other applicable means to mitigate inhalation hazard. • Move power cords/pressurized hoses to protect from damage during tool/equipment use. • For spark/heat generating tool/equipment, have fire extinguisher available, remove combustible/flammable materials, or use other means to control fire hazard. • Use safe lifting practices and/or lift aids for moving heavy portable equipment, and use safe operating procedures to protect from acute strains/sprains, overexertion, and cumulative trauma injuries. • Implement safe work practices for compressed air, pressurized systems (pneumatic/hydraulic), stored energy. ☐ Additional requirements for power tools: • Use vise/clamp/work bench or other means to hold/secure a portable/moveable work piece. • Don't carry electrical tools/equipment by the power cord; don't carry pneumatic tools by hoses. • Disconnect tool/equipment from power source before changing bits, blades or making adjustments. ☐ Additional requirements for fixed powered equipment: • Implement lockout/tagout controls for repairs/adjustments/tooling changes. • Equip pneumatic hoses with whip checks; ensure factory fittings are used for high-pressure hose connections. ☐ For climbing/fall hazards associated with large equipment, see **D.4. "Fall Hazards."** ☐ For electrical hazards, see **D.10. "Electrical Work Tasks."** ☐ For ground surface penetration, see **D.10. "Utility-Related Hazards."** ☐ For fuel-safety practices, see **D.14. "Commercial Chemical Products."** ☐ For air monitoring of atmospheric hazards, see **Part E, "Air Monitoring, Worker Exposure Monitoring."** ***Geosyntec Procedure(s):*** *HS-109-Hearing Conservation, HS-113-Personal Protective Equipment, HS-119-Lockout/Tagout, HS-121-Electrical Safety, HS-503-Powered Hand Tools, Others as applicable*

☐	**WELDING, CUTTING, HOT WORK** ☐ Arc-welding (electrical arc) ☐ Gas-welding/cutting (fuel gases) Hazards: - UV/IR light-eye/skin burns - hot-work hazards/fire - toxic metal welding fumes - compressed gases - electrical shock	☐ General safe work practices for operators of welding equipment: • Hot work permit system to be implemented. • Operator properly protected (eye protection, clothing, apron, etc.). • Fire hazard controls (watcher, fire extinguisher, water, remove combustibles from work area). • Protect nearby personnel from hazardous UV, IR light (shielding, curtain); see **D.16. "Radiation Hazards."** ☐ For welding gas cylinders, secure them upright with caps on when stored or not in use; protect cylinders from damage; NEVER secure gas cylinders to metal welding bench used for electrical arc welding); see **D.14. "Commercial Chemical Products."** ☐ For arc welding, follow electrical safe work practices; see **D.10. "Electrical Work Tasks."** ☐ For inhalation hazards from welding fumes (toxic metals) and gases (asphyxiant, flammable), see **D.14. "Commercial Chemical Products."** ***Geosyntec Procedure(s):*** *HS-511-Welding, Cutting and Other Hot Work*
☐	**PORTABLE ELECTRIC GENERATOR** Hazards: - Electrical shock - Carbon monoxide in exhaust - Fuel-related fire hazard - Injury from mechanical or lifting hazard - Burns from hot surfaces	☐ Follow general safe work practices for Powered Tools & Equipment (above), and as follows: • Use in accordance with manufacturer's instructions, including instructions for grounding the generator. • Keep generator and work area dry. • Never use indoors, or near building air intake vents due to carbon monoxide hazard. • Provide for ventilation and/or air monitoring where hazardous accumulation of exhaust emissions is possible. • Use hearing protection in close proximity to operating generator, as needed. • Use power cords/extension cords specified by instructions. • Use ground-fault circuit interrupters (GFCIs) in accordance with manufacturer's instructions; see **D.10. "Electrical Work Tasks."** • Shut down equipment before refueling; see safe practices for flammable/combustible liquids in **D.14. "Commercial Chemical Products."** ***Geosyntec Procedures:*** *HS-109-Hearing Conservation*, *HS-111-Air Monitoring*, *HS-115-Hazard Communication* *(for fuel)*, *HS-121-Electrical Safety*, *Others as applicable*
☐	**PNEUMATIC / HYDRAULIC HAZARDS** ☐ Air compressor ☐ Compressed air system ☐ High-pressure liquid ☐ Pressurized steam (For compressed gas cylinders, see **D.14. "Commercial Chemical Products")**	☐ Never direct outlet nozzle toward body; use guards, restraints, engineering controls as appropriate. ☐ Never use compressed air for cleaning clothes you are wearing. ☐ If compressed air is used for cleaning, restrict pressure to 30 psi or below, equip nozzle with chip guard. ☐ Use PPE for eye (goggles or face shield)/hand/head/hearing/skin protection, as appropriate for the hazard. ☐ Ensure tank, hoses, fittings are in good repair using factory fittings, equipped with whip-checks. ☐ If pressure relief device poses a hazard to workers, reconfigure or shield device or restrict access by workers.
☐	**PORTABLE HEATER** ☐ electric ☐ fuel powered Hazards: - Shock (electrical) - Carbon monoxide emissions and fuel-related fire hazards (fueled) - Fires/burns from hot surfaces.	☐ Follow general safety practices for Operation of Equipment/Machinery (above), and as follows: • Keep heater dry and locate heater on level surface away from high traffic areas to prevent tipping. • Never use fuel-powered heaters indoors, or near air intake vents, due to carbon monoxide hazard. • Provide ventilation and/or air monitoring where hazardous accumulation of exhaust emissions is possible. • Keep combustible materials at least 3 feet from hot surfaces. • Do not use an extension cord or power strip to power an electric heater. • For electric heaters, see **D.10., "Electrical Work Tasks."** • Shut down fuel-powered equipment before refueling; see safe practices for flammable/combustible liquids and/or compressed gases in **D.14. "Commercial Chemical Products."** ***Geosyntec Procedures:*** *HS-111-Air Monitoring*, *HS-115-Hazard Communication* *(for fuel)*, *HS-121-Electrical Safety*, *Others as applicable*
☐	**LOCKOUT/TAGOUT (LO/TO) OF HAZARDOUS ENERGY** To prevent unplanned equipment start-up or release of energy when under maintenance/repair.	☐ Prepare site-specific written LO/TO *program*, and equipment-specific written LO/TO *procedures* (as applicable); implement control procedures for hazardous energy sources, provide locks/tags, train workers, designate "authorized" personnel, notify "affected" personnel. ***Geosyntec Procedure(s):*** *HS-119-Lockout Tagout*, *HS-121-Electrical Safety*

D.7. DRILLING (Test Boring, Direct Push, Construction Drilling) ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**DRILLING & DIRECT PUSH** Includes hazards posed by drilling rig and associated equipment, heavy support vehicles, trailer/towing hazards, and similar mobile equipment. Hazards: - Struck-by equipment - Run over, roll over - Caught between (pinch points) - Manual lifting, musculoskeletal - Fuel/fluid leaks, fuel hazards	☐ Follow safe work practices, as applicable: • Non-drilling personnel to stay clear of drilling work zone when drill rig in operation. • Equipment maintained in good repair, inspected daily upon mobilization; backup alarms and emergency stop operational, machine guards in place, whip checks on high pressure lines. • Leaks or defective safety equipment should be repaired before use. • Establish eye contact with operator and use hand signals prior to approaching the rig. • Use PPE near operating rig (eye/head/hearing/hand/foot protection, high visibility vests or equivalent). • Arrange personal/support vehicles to protect drill team and not obstruct travel lanes or other operations. • Operators/helpers maintain safe distance from moving parts; secure loose hair, loose clothing, equipment. • Drill rigs will only be moved with masts lowered. • Maximum safe slope for rig will be followed, drill rig leveled, appropriate blocking/cribbing as needed. • Use safe practices for fuel handling/storage/transport; spill equipment available for fuel/fluid leaks.

	- Suspended equipment - Roadway hazards.	• Ventilate exhaust and conduct air monitoring, as appropriate, when drilling indoors. • Never climb drill mast without appropriate fall protection. • Use precautions for overhead and underground utilities ***Geosyntec Procedure(s):*** *HS-403-Drilling, HS-304-Overhead/Underground Utility Hazards, Others as applicable*
☐	**MECHANICAL LIFTING, RIGGING** Applies to lifting truck-mounted boom rig (e.g., drill rig), and all other drilling-related mechanical/electrical hoist equipment. Hazards: - Mechanical hazards - Elevated loads	☐ In addition to general drilling & direct push safety practices (above), as applicable: • Slings, chains, rope, wire rope, as well as sheaves, boom, and attachments used for lifting/hoisting shall be maintained in good condition, inspected daily, and used/stored in a manner as to protect from damage. • Do not exceed loading limits of lifting equipment; perform work in accordance with equipment load chart. • Hooks will be equipped with safety latches. • Ensure anchor points for winch or other lift device are engineered for intended use. • Ensure personnel are not positioned beneath elevated loads. ***Geosyntec Procedure(s):*** *HS-506-Cranes*
☐	**WARNING!** Confirmed or possible close proximity to **OVERHEAD or UNDERGROUND UTILITIES.**	☐ Follow safe work practices per **D.11. "Utility-Related Hazards."** ***Geosyntec Procedure(s):*** *HS-304-Overhead/Underground Utility Hazards*

D.8. CONSTRUCTION, HEAVY EQUIPMENT, LIFT EQUIPMENT ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**WORKING NEAR MOBILE HEAVY EQUIPMENT, ON-SITE VEHICLES** Hazards: - Struck-by - Caught between - Run over, roll over - Overhead hazards/obstructions - Elevated loads	☐ For personnel on-foot/on-the-ground near operating heavy equipment, follow safe work practices: • High visibility vests for all personnel in construction vehicle work area, on-site roadways and travel lanes. • Maintain unobstructed vision: wear shaded eyewear only in bright sun; don't wear hoods. • Erect barriers and post signs to identify and isolate the equipment hazard zone, if possible. • Stay out of swing radius of equipment, both in front and operating end, as well as at the back of equipment. • Stay out of the travel path of operating heavy equipment. • When crossing vehicle pathway behind moving equipment, cross at a distance not less than 30 feet. • When approaching equipment, always be able to see operator so he/she can see you. • Make eye contact with operator and use hand signals or make radio contact prior to approaching equipment. • Operator to provide "all off" hand signal when it is safe to approach within swing radius of equipment.
☐	**OPERATION OF MOBILE HEAVY EQUIPMENT** Hazards: - Struck-by - Run over, roll over - Caught between (pinch points) - Fluid leaks/fuel-/fire-hazards - Overhead hazards/obstructions - Potential for body entrapment/crushing - Rotating equipment, moving parts.	☐ Operators to follow safe work practices for operation of heavy equipment: • Only trained/qualified persons allowed to operate heavy equipment. • Wear seatbelts; roll-over protection system present/deployed; do not exceed maximum safe slope. • No passengers on moving/operating equipment except where passenger seat/restraint is present. • Equipment inspected daily upon mobilization; maintained in good repair, backup alarms. • Leaks or defective safety equipment should be repaired before use; fire extinguisher present. • Maintain eye contact with ground personnel and use hand signals to direct their approach near equipment. • High visibility vests for all personnel in construction vehicle work area, on-site roadways and travel lanes. • Cease operation if personnel enter swing radius, travel path or hazard zone of moving parts, elevated loads. • Use safe practices for fuel handling/storage/transport; spill equipment available for fuel/fluid leaks. • Equipment locked, secured, brakes set, buckets/forks lowered, when not in use. • Shut down/lock out equipment to prevent crush situation beneath or between moving parts of equipment. • Ensure personal/support vehicles are parked/located not to obstruct equipment travel lanes/operating zones. • Mark temporary roadways clearly, provide berms/stops where needed. ***Geosyntec Procedure(s):*** *HS-504-Heavy Equipment, HS-132-Competent Persons*
☐	**TRENCHING/EXCAVATION** Hazards: - Cave-in, entrapment - Hazardous atmosphere - Water accumulation - Falls into excavations - Utility-related hazards - Undermining structures & foundations	☐ Safe work practices when personnel will enter trenches/excavations: • Activities under supervision/oversight of Competent Person, conduct daily inspection of excavation. • Excavated materials placed at least 2' from trench sidewall. • Prevent water accumulation in trench. • Sloping & shoring for trenches/excavations >20' deep must be approved by a Professional Engineer. • Sloping/shoring/trench box for excavations >5' when persons enter trench/excavation. • Sloping/shoring/trench box for shallow (<5') trench/excavation with cave-in hazard. • Workers in trenches to be within 25 feet of ladder or sloped entryway. • Excavations to be protected by perimeter fencing (not barricade tape), if potential for personnel to fall into. • If potential for atmospheric hazard, see **D.12. "Confined/Enclosed Spaces"** ***Geosyntec Procedure(s):*** *HS-402-Excavation and Trenching, HS-132-Competent Persons*
☐	**FORKLIFT** Hazards: - Struck-by - Run over/roll over/tip over - Overhead utilities/obstructions - Caught between (pinch points) - Unstable/falling loads - Elevated forks	☐ In addition to general safety practices for heavy equipment (above), as applicable: • Qualified operator, per established forklift training (certificate is required); Geosyntec operator must be approved by Director of Health and Safety. • Equipment inspected daily and documented on Forklift Preoperational Inspection Checklist. • Do not exceed lifting load limits. • Forklift shall not be moved/driven with empty forks in raised position. • When not in use, forks lowered, brake set, controls in neutral, key removed.

	- Fluid leaks	***Geosyntec Procedure(s):*** *HS-505-Safe Operation of Forklifts*, *HS-132-Competent Persons*
☐	**AERIAL BOOM/SCISSOR LIFT** Hazards: - Falls from basket - Overhead utilities/obstructions - Struck-by, run over, tip over - Caught between (pinch points) - Tip over - Fluid leaks.	☐ Follow safe work practices: • Operators to be appropriately trained and certified. • Equipment is inspected after mobilization and is in good condition. • Harness & lanyard worn whenever operating the lift. • Overhead hazards and surface obstructions to be reviewed with operators/riders prior to use. ***Geosyntec Procedure(s):*** *HS-509-Aerial Lifts*
☐	**CRANES** Hazards: – electrocution by overhead utility – injury in swing radius – injury from falling load – crane tipping over due to overbalancing, high winds, unstable ground, unsafe slope, bad placement of outriggers – injury from mechanical hazards	☐ In addition to general safety practices for Operation of Heavy Equipment (above), as applicable: • Only qualified persons operate cranes (certificate required). • Critical Lift Plan & Checklist prepared/executed (See HS 506-Cranes) prior to mobilization. • Equipment to be inspected prior to mobilization and daily by crane operator. • Crane operator will remain at the controls at all times during operation. • Crane operation must be performed under the direction of an appointed signal person at all times using hand signals and/or voice/radio communication. • Crane to be level and stable (solid ground or crane mats/timbers, outriggers if present, cribbing); over-reaching or exceeding load limits is prohibited. • Keep area beneath suspended loads clear of personnel; tag lines used to maneuver load. • Rigging procedures – see Mechanical Lifts with Rigging, below. ***Geosyntec Procedure(s):*** *HS-506-Cranes*, *HS-132-Competent Persons*
☐	**MECHANICAL LIFTS WITH RIGGING** Applies to lifting by rigging attached to crane, truck-mounted boom rig (e.g. drill rig), heavy equipment, mechanical/electrical hoist, similar equipment. Hazards: – Mechanical hazards, – Elevated loads	☐ In addition to general safety practices for Operation of Heavy Equipment and Cranes (above), as applicable: • Slings, chains, rope, wire rope, as well as sheaves, boom and attachments used for lifting/hoisting shall be maintained in good condition, inspected daily, and used/stored in a manner as to protect from damage. • Coordinate lifting operations with competent person. • Do not exceed loading limits of lifting equipment; perform work in accordance with equipment load chart. • Hooks will be equipped with safety latches. • Ensure anchor points for winch or other lift device (such as davit arm) are engineered for intended use. • Ensure personnel are not positioned beneath elevated loads and that tag lines are used where appropriate. ***Geosyntec Procedure(s):*** *HS-506-Cranes*
☐	**WARNING!** Confirmed or possible close proximity to **OVERHEAD or UNDERGROUND UTILITIES.**	☐ Follow safe work practices per **D.11. "Utility-Related Hazards"** ***Geosyntec Procedure(s):*** *HS-304-Overhead/Underground Utility Hazards*
☐	**DEMOLITION**	☐ Develop/implement a demolition safety plan. ***Geosyntec Procedure(s):*** *HS-132-Competent Persons*
☐	**BLASTING, UNEXPLODED ORDNANCE**	☐ Develop/implement safety plan for blasting, unexploded ordnance, as applicable. ***Geosyntec Procedure(s):*** *HS-307-Blasting and Use of Explosives*, *HS-132-Competent Persons*
☐	**PUBLIC AT RISK, SITE SECURITY**	☐ During site operations protect public (overhead protection, fencing, barriers, warning signs). ☐ During off hours, protect public with fencing, barriers, warning signs/lights, other measures as appropriate. ☐ Lock/secure hazardous materials and/or equipment.

D.9. STORAGE/HANDLING OF BULK MATERIALS (for *Chemical* Storage, see D.14 & 15) ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:		
☐	**BULK STORAGE HAZARDS:** Collapse/movement of stacked/stored bags, blocks, containers, pipe, boxes, equipment, and similar. ☐ Stack/pallet/rack/shelf ☐ CONEX-box storage, or similar	☐ Store materials in stable manner (stacked, racked, blocked, interlocked, tied, wrapped, or otherwise secured) to prevent tipping, sliding, rolling, falling or collapse. ☐ Do not exceed load limits and ensure storage structure is stable, robust, secure for intended load. ☐ Ensure stored materials do not block aisles, passageways, electrical panels, emergency equipment, emergency access/egress routes, vehicle routes.
☐	**LIFTING/MANUAL MATERIAL HANDLING HAZARDS**	☐ During manual handling of materials and equipment, use safe lifting practices and/or lift aids; do stretches and use safe postures to protect from acute strains/sprains, overexertion, and cumulative trauma injuries.

D.10. ELECTRICAL WORK TASKS ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☒	**USE OF BATTERIES, BATTERY-POWERED EQUIPMENT <50 V, OR OTHER DC EQUIPMENT < 50 V** Potential fire hazard (if terminals are shorted), eye/skin hazards (when electrolyte is replenished), inhalation hazard in enclosed spaces.	☐ Follow safe work practices to control hazards of voltage, shock, arcing, overheating, hazardous gases, irritant electrolytes, secondary hazards. ☒ Prevent short-circuiting of terminals when battery is in use (segregated from tools, metal objects) and during transport (use battery transport container or install guard/cover on positive terminal). ☐ For batteries requiring replenishment of electrolyte, use PPE for eye and skin protection, and have eyewash equipment at hand; see discussion of *acids/caustics/corrosives* in **D.14. "Commercial Chemical Products."** ***Geosyntec Procedure(s):*** *HS-121-Electrical Safety*
☐	**"NORMAL OPERATION" OF ELECTRICAL EQUIPMENT CONNECTED TO AC OR DC POWER SOURCE ≥ 50 V:** Electrically powered tools, equipment, machinery, extension cords, portable generators, working near electrical equipment. Hazards: – Electrical shock – Secondary hazards (falls, other injuries).	☐ Follow "normal operation" requirements: • All electrical enclosures/guards/covers must be in place/closed/secured. • Electrical equipment maintained per codes/standards/manufacturer's recommendations. • Ensure no indication of damage or impending failure (heat, smoke, buzzing, odors, arcing, melting). • Operate equipment in accordance with manufacturer's standard operating procedures. ☐ Follow general electrical safety work practices to minimize shock hazard and secondary hazards: • Control water-related/wet-location hazards in a manner appropriate for the job tasks/equipment/tool. • Never touch electrical equipment if you are wet or standing/kneeling in water or on wet surfaces. • Use extension cords/power cords properly, rated for use conditions and current draw, prevent damage. • Inspect tool/equipment/extension cords/power cords before each use; remove from use if damaged. • Use GFCI-protected outlet or portable GFCI in wet/moist locations, outdoors, basements, concrete floors. • Do not enter any space delineated by an electrical approach boundary. ***Geosyntec Procedure(s):*** *HS-121-Electrical Safety*
☐	**HANDS-ON DIAGNOSTICS/REPAIR ON CIRCUIT(S) CONNECTED TO POWER SOURCE < 50 V:** ☐ AC ☐ DC ☐ Battery and/or solar power ☐ Capacitor(s) ☐ Stray voltage from soil electrodes	☐ Implement electrical safe work practices pertaining to: • Workers trained appropriately for the task. • Shock prevention measures. • Eye/skin protection for arcing hazards. • Protection from secondary hazards. ***Geosyntec Procedure(s):*** *HS-121-Electrical Safety*
☐	**WORK WITHIN *"APPROACH BOUNDARY"* OF EXPOSED, ENERGIZED (OR POTENTIALLY ENERGIZED) CONDUCTORS AND/OR CIRCUIT PARTS CONNECTED TO POWER SOURCE 50-600 V*:** ☐ AC ☐ DC ☐ 3-phase ☐ Battery and/or solar power ☐ Capacitor(s) ☐ Induced voltage ☐ Stray voltage ≥50V from soil electrodes *** Working on >600 V not permitted for Geosyntec personnel**	☐ Prepare project-specific written "Electrical Safety Program" addressing (at a minimum): • Workers trained/designated as "Qualified Electrical Workers" per NFPA 70E (US)/CSA Z462 (CAN) • Assess risks of electrical shock (voltage levels and sources), arc flash hazard and secondary hazards. • Affix electrical hazard warning label to electrical enclosure(s) to be accessed. • Physically delineate arc flash- or limited approach boundary, whichever is farthest from hazard source. • Only "qualified" workers allowed within approach boundaries; prevent entry by non-qualified personnel. • Establish electrically safe working condition; work on live circuits prohibited (except for diagnostic testing). • Use PPE for shock/arc flash protection, as required. • Use other safe procedures/equipment required for the task, such as lockout/tagout. ***Geosyntec Procedure(s):*** *HS-121-Electrical Safety*, *HS-129-High Voltage Electricity Safety*
☐	**LOCKOUT/TAGOUT (LO/TO) OF ELECTRICAL ENERGY** To prevent unplanned start-up or release of energy when equipment is under maintenance/repair.	☐ Prepare site-specific written LO/TO *program*, and equipment-specific written LO/TO *procedures* (as applicable); implement control procedures for hazardous energy sources, provide locks/tags, train workers, designate "authorized" personnel, notify "affected" personnel. ***Geosyntec Procedure(s):*** *HS-119-Lockout Tagout*, *HS-121-Electrical Safety*
☐	**WARNING!** Confirmed or possible close proximity to **OVERHEAD ELECTRICAL UTILITY LINES.**	☐ Follow safe work practices per **D.11. "Utility-Related Hazards."** ***Geosyntec Procedure(s):*** *HS-304-Overhead/Underground Utility Hazards*

D.11. UTILITY-RELATED HAZARDS ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**OVERHEAD, ABOVE-GROUND UTILITIES**	☐ Arrange for power company/utility owner to de-energize power line. ☐ Do not cross approach boundaries with personnel or equipment; employ other appropriate precautions for the conditions (specify above). ☐ Use additional controls, as applicable: shielding, flagging, observer/monitor. ***Geosyntec Procedure(s):*** *HS 304-Overhead/Underground Utility Hazards*

☒	**UNDERGROUND UTILITIES**	☒ Confirm appropriate underground utility clearance procedures have been completed prior to ground penetrations, and employ other utility clearance/locator practices, as appropriate for conditions. ☐ Hand digging/augering or vacuum post-holing within 3' of utility locations or other high-risk condition. ***Geosyntec Procedure(s):*** *HS 304-Overhead/Underground Utility Hazards*

D.12. CONFINED / ENCLOSED SPACES (Including Hazardous Indoor Spaces)

☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

☐	**Type of CONFINED/ENCLOSED/ HAZARDOUS INDOOR Workspace:** ☐ Indoors (occupied) ☐ Indoors (abandoned, vacant) ☐ Basement, crawl space, attic ☐ Tunnel, shaft, inspection gallery ☐ Storage bin, locker ☐ Culvert, catch basin, sewer ☐ Well vault, utility vault, manhole ☐ Tank, vessel, silo, vat, hopper ☐ Trench, excavation ☐ Machine/equipment pit ☐ Transportation container, railcar ☐ Other – describe above **Confirmed or potential hazards:** ☐ Flammable/explosive ☐ Oxygen deficiency ☐ Hydrogen sulfide ☐ VOCs ☐ Carbon monoxide ☐ Combustible dust ☐ Combustion/exhaust emissions ☐ Welding/cutting fumes ☐ Electrical ☐ Mechanical equipment ☐ Entrapment, engulfment, drowning ☐ Building-related hazards ☐ Other – describe above	**REQUIREMENTS:** 1. **Contact Corp. H&S Department** to determine applicability of confined space entry regulations, and to determine safe work practices for entry into any confined, enclosed or hazardous indoor spaces. 2. **Classify the work task** by checking **one** of the following: ☐ **CONFINED SPACE** classified **by U.S. OSHA as a "Permit-Required Confined Space;"** ensure OSHA requirements are met in OSHA jurisdictions. ☐ **CONFINED/ENCLOSED/INDOOR/CONFINED space NOT classified as an OSHA Permit-Required Confined Space**; develop site-specific entry procedure **per applicable regulations and Geosyntec requirements**. 3. **Delineate tasks, hazards and controls** associated with the work in **Section C.1. "Summary of Tasks, Hazards and Controls,"** and in applicable sections in **Parts C, D and E of this THA**; incorporate applicable safety provisions such as, but not limited to, the following: • Risk assessment; entry plan, entry permit system/safety checklist. • Air monitoring for atmospheric hazards. • Entry roles (supervisor, entrant, attendant), buddy system, regulatory training requirement. • Protect non-entry personnel from unauthorized entry (labels, signage, barriers) • Ingress/egress (stairway, ramp, ladder, tripod/winch, harness/lifeline, etc.). • Communication/alerting/rescue/emergency plan. • Entry hazard controls: - Isolation, cleaning, purging, lockout/tagout, fire protection. - *Dilution* ventilation to introduce fresh air - *Exhaust* ventilation to control point source of emissions. - Duct/stack to direct hazardous emissions away from work area. - Respiratory protection. - PPE and safety gear to protect from chemical/physical/biological hazards. - Fall protection. - Traffic control. ***Geosyntec Procedure(s):*** *HS-111-Air Monitoring, HS-112-Respiratory Protection, HS-113-Personal Protective Equipment, HS-118-Confined Space Entry, Others as applicable to the specific work*

D.13. INFECTIOUS / PATHOGENIC BIOHAZARDS

☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

Project Specific COVID-19 interventions:

- Follow the BDA Program Field Activities, COVID-19 Preparedness, Response, and Continuity Plan (Arcadis, 2020)
- Face covers for COVID-19 prevention will not be required for personnel who self-report a COVID-19 vaccination to project manager if social distancing can be maintained during work tasks.
- Geosyntec personnel will use separate vehicles for all transportation and use separate tools and equipment where practicable.

☒	**HAZARD TYPE:** ☒ COVID-19 ☒ Wastewater, sewer ☐ Bird guano ☐ Mold, fungi, valley fever ☐ Bloodborne pathogens ☐ Discarded syringes ☐ Medical waste ☐ Other (describe above)	☒ Follow ***Field Work COVID 19 General Prevention Measures*** (as applicable); **list project specific COVID interventions above, communicate/coordinate with project team prior to initiation of work.** ☐ Use "Universal Precautions" as applicable for potential exposures to infectious/pathogenic hazards. ☒ Low hazard – use basic hygiene practices, protective gloves, provide for hand washing. ☐ More severe hazard – add protective clothing, respirator/dust mask, decon, as appropriate. ☐ For bloodborne human pathogens follow Bloodborne Pathogen Program. ☐ Arrange with Human Resources for project-specific immunization. ☐ Implement remedial actions (remove syringes, clean up guano, decon/disinfect surfaces, etc.) as appropriate for the scope/scale of work. ***Geosyntec Procedure(s):*** *HS-133-Bloodborne Pathogens, COVID-19 Considerations and Mitigations for On-Going Business Operations, Field Work Covid-19 General Prevention Measures*

D.14. COMMERCIAL CHEMICAL PRODUCTS (per HAZCOM or WHMIS)

☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications: Isobutylene calibration gas cylinders for a PID (if needed)

☐	**PRODUCTS REGULATED BY HAZCOM[1] (US) or WHMIS[2] (CAN)**	☐ Safety Data Sheets (SDSs) available, either on site or readily available within same work shift, containers labelled properly, workers trained/oriented on hazards. ☐ For subcontractor/contractor use of chemical products, confirm SDS availability for affected onsite workers.
	[1] OSHA Hazard Communication Standard (United States); [2] Workplace Hazardous Material Information System (Canada)	

☐	**GENERAL SAFE WORK PRACTICES FOR FIELD USE OF CHEMICALS**	☐ Consult SDS for H&S hazards, symptoms of exposure; ensure workers have been apprised of safe practices. ☐ Handle with care, maintain good housekeeping, provide adequate illumination in work area. ☐ Pour/dispense/transfer liquid chemicals on stable work surface. ☐ Use chemicals in well ventilated area; use fans/blowers/exhaust for active ventilation, as appropriate. ☐ Have eyewash bottles, eyewash station, deluge capabilities, commensurate for the hazard, readily available. ☐ Have spill/neutralization equipment, appropriate for the chemicals, readily available. ☐ Conduct air monitoring as appropriate; see **Part E, "Air Monitoring, Worker Exposure Monitoring."**
☐	**STORAGE/TRANSPORT OF CHEMICALS/HAZMAT** ☐ **Non-Emergency (Routine) Chemical Storage** Risk of personal contact and/or incidental release ☐ **HAZMAT Transport** ☐ **Risk of Emergency Spill/Release** ☐ **CFTAS (Chemical Facility Anti-Terrorism Standards) Applicability:** On-site overnight storage of non-waste chemical product at quantity ≥25 gal(115L) or ≥250 lbs. (115 kg)	☐ Transport chemicals only in sealed containers, secured to prevent shifting/breakage during travel. ☐ Store chemicals only in sealed containers; overnight storage in squirt/spray bottles prohibited. ☐ Store flammable/combustible liquids in chemical storage cabinets, or other appropriate storage arrangement. ☐ For liquids, provide secondary containment during storage. ☐ Segregate incompatible chemicals during storage. ☐ For *incidental release/spill;* maintain spill kit suitable for low flammability/toxicity/quantity/volatility release. ☐ DOT/TDG/IATA-Regulated transport: see **D.17. "Hazmat/Dangerous Goods Shipping/ Transportation.** ☐ For *emergency spills*: describe spill/release hazard and response plan/procedure above, and indicate emergency response contact in Part B, "Emergency Response and First Aid." ☐ Locate emergency gear (eyewash, fire extinguisher, spill kit, safety signage) near storage area, as applicable. ☐ For CFTAS-applicable chemical storage, a safety and chemical management plan must be prepared and reviewed by a H&S Professional before bringing material to the site. (Does not apply to materials brought on to the site for daily work purposes and transported away at the end of each day)
☒	**COMPRESSED GAS CYLINDERS** ☒ Flammable ☐ Non-flammable ☐ Toxic ☐ Asphyxiant ☐ Oxygen	☒ Secure cylinders upright, caps on when not in use. ☒ Handle with care; use and store cylinders in a manner and location to prevent damage. ☐ Propane cylinders not in use must be stored outdoors in a cage or similar secure ventilated enclosure. ☐ Ensure acetylene cylinders are NOT secured to steel arc welding bench. ☐ Segregate oxygen and fuel gases by distance (20') or fire-rated barrier. ☐ Control ignition sources. ☐ "No smoking" signage at cylinder storage area for flammable gases.
☐	**FLAMMABLE/COMBUSTIBLE LIQUIDS**	☐ Use proper fuel safety can (metal fuel container with self-closing spout and flame arrestor preferred). ☐ Control/remove ignition sources near storage and use areas. ☐ Grounding and bonding where appropriate. ☐ Ensure a Type B or ABC fire extinguisher is readily available.
☐	**ACIDS, CAUSTICS, OTHER CORROSIVES**	☐ Use appropriate protection for eyes/face (goggles/face shield) and skin (gloves, sleeves, apron). ☐ Use eyewash, deluge shower, drench hose, hand washing (with water), as appropriate. ☐ For severe eye hazards (due to high corrosivity, large quantity), 15-min. eyewash required.
☐	**TOXIC**	☐ For toxic substances, use/store in a manner to control exposure hazards (inhalation, ingestion, skin contact, skin absorption); use active ventilation and/or PPE as appropriate.
☐	**EMISSIONS FROM FUEL COMBUSTION, HOT PROCESSES** ☐ Gasoline ☐ Diesel ☐ Propane/Natural Gas ☐ Welding/cutting/hot work ☐ Vehicle/equipment exhaust ☐ Other	☐ Position outdoor personnel upwind of exhaust source. ☐ Avoid "idling" of equipment when not in use. ☐ Use *passive ventilation* (air infiltration/air currents) to disperse atmospheric hazards in breathing zone. ☐ Use *dilution ventilation* (blowers/fans) to provide fresh air to work area and dissipate atmospheric hazards. ☐ Use *exhaust ventilation* (hood/duct/exhaust stack/blower) to capture/divert exhaust from work area. ☐ Use respiratory protection for high levels of smoke, exhaust particulates, soot. ☐ Conduct air monitoring as appropriate; see **Part E," Air Monitoring, Worker Exposure Monitoring."**
☐	**OTHER HAZARDS**	☐ Describe other hazardous substances and safety measures under "Site-Specific Notes & Clarifications," above.

Geosyntec Procedures: *HS-115-US-Hazard Communication, HS-115-CA-WHMIS, HS-111-Air Monitoring, HS-112-Respiratory Protection, HS-113-Personal Protective Equipment, HS-114-Safety Training Programs, Others as applicable*

D.15. SITE CONTAMINANTS, CHEMICAL WASTES ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:

- Other = Methanol, penicillin V, tetracycline.
- Liquid IDW will be stored in sealed buckets or containers and placed within secondary containment to avoid spillage during transport to site.

CHECK ALL THAT APPLY. Provide site-specific notes/clarifications above.

☒ Soil/groundwater contaminants (historical release)	☐ Explosive dust	☐ Potential for flammable gas (methane)
☐ Recent release, known high concentrations	☐ Oxygen deficiency	☐ Corrosive, acids/caustics, strong irritants
☐ Former chemical disposal site, landfill	☐ Chlorinated volatile organic compounds (VOCs)	☐ Asbestos abatement work
☒ Urban fill, residual contaminants	☒ BTEX, petroleum derived VOCs	☐ Pesticides, herbicides, fungicides
☐ Containerized waste (drums, process equipment)	☐ Fuel oils, petroleum, waste oil, lubricants	☐ Sensitizers
☐ Buried drums (known or potential)	☒ Metals, metal compounds, metal dusts	☐ Radioactive contaminants

☐ Large containers, potential for spills ☐ Contaminated building surfaces ☐ Unexploded ordnance	☐ Elemental mercury ☒ Polyaromatic hydrocarbons (PAHs) ☐ Potential for flammable vapors	☐ Controlled substances, drugs ☒ Other - describe above
NOTE: For sites with one or more **"high-risk contaminants"** (below) designated/recognized as a contaminant of concern, or exceeding an environmental reporting threshold, or representing a potential exceedance of an action level or exposure limit, the THA must be reviewed by the H&S Dept. before initiating the work:		
☐ Asbestos ☐ Arsenic/arsenic compounds ☐ Benzene (except as trace constituent of petroleum fuel) ☐ Beryllium	☐ Cadmium ☐ Chromium VI (Hexavalent chromium) ☐ Dioxins ☐ Reactives – Cyanides/sulfides (HCN, H_2S)	☐ Lead ☐ Methylene chloride ☐ Polychlorinated biphenyls (PCBs) ☐ Vinyl chloride

☐	**FOR WORK CONSISTING OF CLEANUP OPERATIONS, CORRECTIVE ACTIONS, PRELIMINARY INVESTIGATIONS at an "UNCONTROLLED HAZ. WASTE SITE" (per HAZWOPER, 29 CFR 1910.120 or equivalent), delineate procedures in "Site-Specific Notes and Clarifications" (or attachments) addressing the following, as applicable to the work:** – Workers attend **pre-work orientation** on hazards, risks, onsite safety measures, emergency contingencies. – Implement **site control plan** - delineate Exclusion Zone(s), Contaminant Reduction Zone(s), Support Zone (aka EZ, CRZ, SZ). – Include **site map/figure** depicting work locations and other relevant site-specific information. – Site workers in EZ or CRZ to have 40-hour **HAZWOPER training**, current 8-hour refresher, 3 days supervised field experience. – Site supervisor(s) required to have 8-hour **Supervisor training**. – Site workers in EZ or CRZ to participate in **medical monitoring** program, as applicable. – Implement **site-specific procedures** for worker protection via engineering controls, work practices, personal protective equipment (PPE), air monitoring, decontamination procedures, spill containment, emergency preparedness and response. – Conduct **air monitoring**, as appropriate; see **Part E," Air Monitoring, Worker Exposure Monitoring."** – **PPE program: S**pecify **Levels of Protectio**n and specific PPE to be used for applicable tasks; ○ **Level D**: No respirator, no chemical protective clothing, standard work clothes, basic PPE; (COVID-19 face covers allowed) ○ **Modified Level D**: No respirator, chemical protective clothing as appropriate; (COVID-19 face covers allowed) ○ **Level C**: Air-purifying respirator, chemical protective clothing as appropriate; **consult with Corp. H&S Dept. required**. ○ **Level B**: Air-supplied respirator, chemical protective clothing/suit as appropriate; **consult with Corp. H&S Dept. required**. ○ **Level A**: Fully encapsulating suit, self-contained breathing apparatus (SCBA); **Level A prohibited for Geosyntec personnel.** ***Geosyntec Procedures:*** *HS-301-HAZWOPER, HS-108-Medical Monitoring Surveillance, HS-111-Air Monitoring, HS-112-Respiratory Protection, HS-113-Personal Protective Equipment, HS-114-Safety Training Programs, HS-115-Hazard Communication, HS-405-Drum Sampling, Others as applicable*	
☐	**FOR SITE WITH CHEMICAL CONTAMINANTS OR WASTE BUT NOT REGULATED BY HAZWOPER** – Workers to be knowledgeable/aware of chemical hazards thru safety training/orientation and availability of hazard information. – Implement controls to minimize worker exposure through engineering controls, work practices, PPE, decon, as appropriate. – Evaluate worker exposure via air monitoring/sampling, as applicable; see **Part E, "Air Monitoring, Worker Exposure Monitoring."** ***Geosyntec Procedures:*** *HS-111-Air Monitoring, HS-112-Respiratory Protection, HS-113-Personal Protective Equipment, HS-114-Safety Training Programs, HS-115-Hazard Communication, Others as applicable*	
☒	**STORAGE/TRANSPORT OF IDW*** **Spill/Release Risk:** ☒ Risk of *incidental spill/release* ☐ Risk of *emergency spill/release* ** Investigation-Derived Waste*	☒ Describe site-specific procedures above for spill containment, container handling, as applicable. ☒ For liquids, provide secondary containment during storage. ☐ Segregate incompatible chemicals during storage. ☐ Locate emergency gear (eyewash, fire extinguisher, spill kit, safety signage) near storage area, as applicable. ☐ For *incidental spills*; spill kit on-site for low-hazard releases (low-flammability/toxicity/quantity/volatility) ☐ For *emergency spills*: describe spill/release hazard and response plan/procedure above, and indicate Emergency response contact in Part B, "Emergency Response and First Aid." ☐ DOT/TDG/IATA-Regulated transport: see **D.17. "Hazmat/Dangerous Goods Shipping/Transportation."** ***Geosyntec Procedures***: *HS-406-Unknown Hazardous Waste Drum Handling*
☐	**OFF-SITE MIGRATION OF AIRBORNE CONTAMINANTS**	☐ Implement controls to minimize hazard migration (dust suppression, covers, foam, etc.). ☐ Community/perimeter air monitoring to be conducted per perimeter air monitoring plan; see **E.3 "Fence Line/Perimeter Air Monitoring."**

D.16. RADIATION HAZARDS (Other than Sunlight) ☐ Applicable ☒ Not Applicable, Not Anticipated

Site-Specific Notes & Clarifications:		
☐	**IONIZING RADIATION**	Potential hazard sources may include nuclear density gauges, host-facility X-ray equipment, radioactive contaminants (α, β, γ), medical or laboratory waste. Describe hazards & safety measures above in Site-Specific Notes & Clarifications. Conduct exposure monitoring, as appropriate; see **Part E, "Air Monitoring, Worker Exposure Monitoring."** ***Geosyntec Procedures:*** *HS-126-Radiation Safety Program, HS-128-Ionizing and Non-Ionizing Radiation*
☐	**NON-IONIZING RADIATION**	Potential hazard sources may include lasers, UV/IR sources, microwaves & high-frequency radio waves from cell-phone transmitter, high-intensity visible light. Describe hazards & safety measures above in Site-Specific Notes & Clarifications. Conduct exposure monitoring, as appropriate; see **Part E, "Air Monitoring, Worker Exposure Monitoring."** ***Geosyntec Procedures:*** *HS-128-Ionizing and Non-Ionizing Radiation*

D.17. HAZMAT/DANGEROUS GOODS SHIPPING/TRANSPORTATION ☐ Applicable ☒ Not Applicable, Not Anticipated

MODE(S) OF TRANSPORT:	☐ Road	☐ Rail	☐ Air	☐ Sea	☐ Inland Waterway	☐ International

IMPORTANT: Ensure that each individual who will be involved in shipping/transportation of hazardous material is current with required training (awareness, function-specific, safety, security) in accordance with applicable regulatory authority (DOT, FAA, IATA, TDG), and ensure adherence to applicable regulations. ***Geosyntec Procedures:*** *HS-135-Hazardous Materials Procedures*
Site-Specific Notes & Clarifications:

PART E – AIR MONITORING, WORKER EXPOSURE MONITORING

E.1. AIR MONITORING ☒ Applicable ☐ Not Applicable, Not Anticipated

Site-Specific Notes, Clarifications:

AIR-TESTING PARAMETERS - Select site-specific testing parameters; list associated equipment in Part C.2, Safety Equipment List.		
☒ VOCs ☒ Photoionization detector (PID): **10.6** eV ☐ Flame ionization detector (FID) ☐ Colorimetric indicator tubes – describe above	☐ Oxygen (O_2) – oxygen meter ☐ Lower Explosive Level (LEL) - LEL meter ☐ Hydrogen sulfide (H_2S) – H_2S detector ☐ Carbon monoxide (CO) – CO detector	☐ Particulates - total dust meter ☐ % Methane – methane meter ☐ Calibration kit for each parameter ☐ Other:

SUBSTANCE-SPECIFIC (PRE-SET) ACTION LEVELS - Sustained breathing zone action levels (sustained general work-area levels for LEL).

☐ **O_2** (Oxygen)	**19.5-23%**	Acceptable to continue work without O_2-focused respiratory protection.
	<19.5%	STOP WORK, ventilate to raise O_2 to >19.5% for re-entry. For persistent hazard, contact Corp. H&S Dept.
	>23.0%	STOP WORK, ventilate to lower O_2 to <23% for re-entry. For persistent hazard, contact Corp. H&S Dept.
☐ **LEL** (Lower Explosive Limit)	IMPORTANT:	Confirm sufficient oxygen is present (min. 8-12%) to ensure accurate LEL readings.
	<10% LEL	Acceptable to continue working in work area; continue to monitor LEL.
	≥10% LEL	STOP WORK. Implement controls (reposition workers, ventilate, contain/eliminate source, etc.); resume work ONLY when LEL readings are <10%, sustained.
☐ **H_2S** (Hydrogen Sulfide)	**< 1 ppm**	Acceptable to continue work without H_2S-focused respiratory protection.
	1-10 ppm	Implement controls (reposition workers, ventilate, contain/eliminate source, scheduling, etc.) to limit exposures to <1ppm, or use APR* with *VOC/acid-gas* cartridges (yellow); do not exceed MUC* for respirator type; confirm acceptability of respirator usage with Corp. H&S Dept.
	> 10 ppm	Implement controls (reposition workers, ventilate, contain/eliminate source, scheduling, etc.) to limit exposures to <10ppm (with respirator), or <1ppm (without respirator). For persistent levels >10 ppm, STOP WORK, contact Corp. H&S Dept.
☐ **CO** (Carbon Monoxide)	**< 25 ppm**	Acceptable to continue work without CO-focused respiratory protection.
	≥ 25 ppm	Implement controls (reposition workers, ventilate, contain/eliminate source, scheduling, etc.) to limit exposures to <25ppm. For persistent levels >25ppm, STOP WORK, contact Corp. H&S Dept.
☐ **WILDFIRE SMOKE** (AQI for PM 2.5)	**≤150**	In this **Air Quality Index (AQI)** range, it's acceptable to continue work without respiratory protection.
	151-500	Voluntary use of N95 respirator is appropriate.
	>500	STOP WORK, or use APR* with approval of Corp. H&S Dept.
☐ **<OTHER>**		

SITE-DERIVED ACTION LEVELS – Sustained breathing zone action levels; derived based on site contaminants; REVIEW WITH CORP. H&S DEPT. REQUIRED.

☐ **VOCs** (Volatile Organic Compounds)	**< X ppm**	Acceptable to continue work without VOC-focused respiratory protection.
	> " ppm	Implement controls (reposition workers, ventilation, containment, eliminate source, etc.) to lower VOC exposures to less than specified action level, or use APR* with approval of Corp. H&S Dept.
	X to X ppm	Use APR* with *VOC* cartridges (yellow or black); do not exceed MUC** for respirator type; confirm procedures for respirator usage with Corp. H&S Dept.
	> X ppm	STOP WORK. Implement controls, for persistent levels greater than action contact Corp H&S Dept.
☐ **AIRBORNE DUST** (Total Particulates)	**< X mg/m³**	Acceptable to continue work without particulate-focused respiratory protection.
	> " mg/m³	Implement controls (water spray, reposition workers, ventilation, containment, etc.) to lower dust levels to less than specified action level, or use APR* with approval of Corp. H&S Dept.
	X to X mg/m³	Use APR* with particulate cartridges appropriate for the hazard; do not exceed MUC** for respirator type; confirm procedures for respirator usage with Corp. H&S Dept.
	> mg/m³	STOP WORK. Implement controls. For persistent levels greater than action level, contact Corp H&S Dept.
☐ **<OTHER>**		

* Air-purifying respirator ** Maximum use concentration

Geosyntec Procedures: *HS-111-Air Monitoring*, *HS-602-Lead*, *HS-605-Hydrogen Sulfide*, *Wildfire Smoke THA Addendum*

E.2. OTHER WORKER EXPOSURE MONITORING / SAMPLING ☐ Applicable ☒ Not Applicable, Not Anticipated

☐ Heat/Cold Stress Testing/Monitoring ☐ Air Sampling *(sample collection, passive dosimeter)* ☐ Wipe/Bulk Sampling *(to evaluate worker exposure)*	☐ Wildfire Smoke – Tracking AQI (Air Quality Index) ☐ Ionizing or Non-ionizing Radiation Testing ☐ Noise Testing	☐ <Other> ☐ <Other>

Site-Specific Notes, Clarifications:

Geosyntec Procedures: *HS-109-Hearing Protection, HS-111-Air Monitoring, HS-124-Heat Stress Prevention, HS-125-Cold Stress Prevention, HS-126-Radiation Safety Program, HS-128-Ionizing and Non-ionizing Radiation, HS-601-Asbestos, HS-602-Lead, HS-604-Respirable Crystalline Silica, HS-605-Hydrogen Sulfide*

E.3. FENCELINE / PERIMETER AIR MONITORING ☐ Applicable ☒ Not Applicable, Not Anticipated

Fence line/perimeter air monitoring to be conducted in accordance with a separate **"Perimeter Air Monitoring Plan"** for this work; results from *fence line/perimeter* air monitoring shall NOT be used as the sole basis for determining *work zone* atmospheric hazards.

Site-Specific Notes, Clarifications:

PART F – APPROVALS, ACKNOWLEDGEMENTS

F.1. THA PREPARATION, REVIEW/APPROVAL SIGNATURES A THA is typically prepared by project staff, often with input from an HSC, with review/approval, at a minimum, by PM or PD. Corporate H&S staff must be consulted as required or otherwise deemed appropriate*.

	Printed Name	*Signature*	*Date*
THA PREPARED BY:	Joel Conzelmann	Joel Conzelmann	8/12/2021
THA REVIEWED/ APPROVED BY: (Project Manager or Project Director, at a minimum)	***Printed Name***	***Signature***	***Date***
	Jennifer Arblaster	Jennifer Arblaster	8/18/2021
	Ron Arcuri	Ron Arcuri	8/18/2021

* At a minimum, Corp. H&S **must** review/approve the THA review when Geosyntec staff will encounter "high hazards/high risks," or perform critical tasks, such as (but not limited to):

- Climb ladders to heights >10'
- Use a personal fall apparatus
- Self-perform tasks classified as construction labor
- Climb ladders to heights >10'
- Tow a trailer on roadway
- Oversee a hot-work permit system
- Enter a permit-required confined space
- Operate a UTV/ATV, aerial lift or fork-lift
- Use of unmanned aerial vehicle (drone)
- Implement lockout/tagout controls
- Enter a trench/excavation >5' deep
- Work near heavy equipment or crane
- Function as a construction "Competent Person"
- Operate a pneumatic or powder-actuated tool
- Electrical testing & maintenance (<50 V excluded)
- Work at height near overhead electrical utility lines
- Derive action levels for VOCs or toxic dusts
- Instrument monitoring for critical exposure risks
- Wear a respirator
- Presence of "high-risk" contaminant(s)
- Sustained exposure to wildfire smoke $AQI_{PM\,2.5}$ >150
- Enter EZ/CRZ during HAZWOPER cleanup activities
- Exposure to radioactive isotopes (α, β, γ)
- Onsite risk of emergency chemical spill
- Applicability of Chemical Anti-Terrorism Standards

Corporate H&S **must** also be consulted when Geosyntec subcontractors (*under Geosyntec's oversight*) perform high hazard/high risk work (such as demolition, blasting, crane lifts, confined space entry, testing/maintenance of electrical systems, lockout/tagout, HAZWOPER cleanup activities), **OR** when supplemental written H&S programs are required for a project (such as Electrical Safety Program, Lockout Program, Confined Space Entry Program, Emergency Response Plan), **OR** when a written safety plan must be submitted to a public agency. Consultation with Corp. H&S is encouraged for all questions/concerns regarding worker safety, regulatory compliance, risk/liability aspects, or project-specific safety requirements.

Geosyntec H&S Procedure: *For more information, see HS-204-Work-Specific Hazard and Risk Assessment, Written Safety Plans.*

F.2. GEOSYNTEC FIELD CREW ACKNOWLEDGEMENTS

Please sign below to acknowledge you reviewed and understand this THA, participated in project safety briefing and had an opportunity to ask questions about the information herein.

Printed Name	Signature	Employee No.	Date

F.3. SUBCONTRACTOR'S FIELD CREW ACKNOWLEDGEMENTS

☐ Applicable ☒ Not Applicable

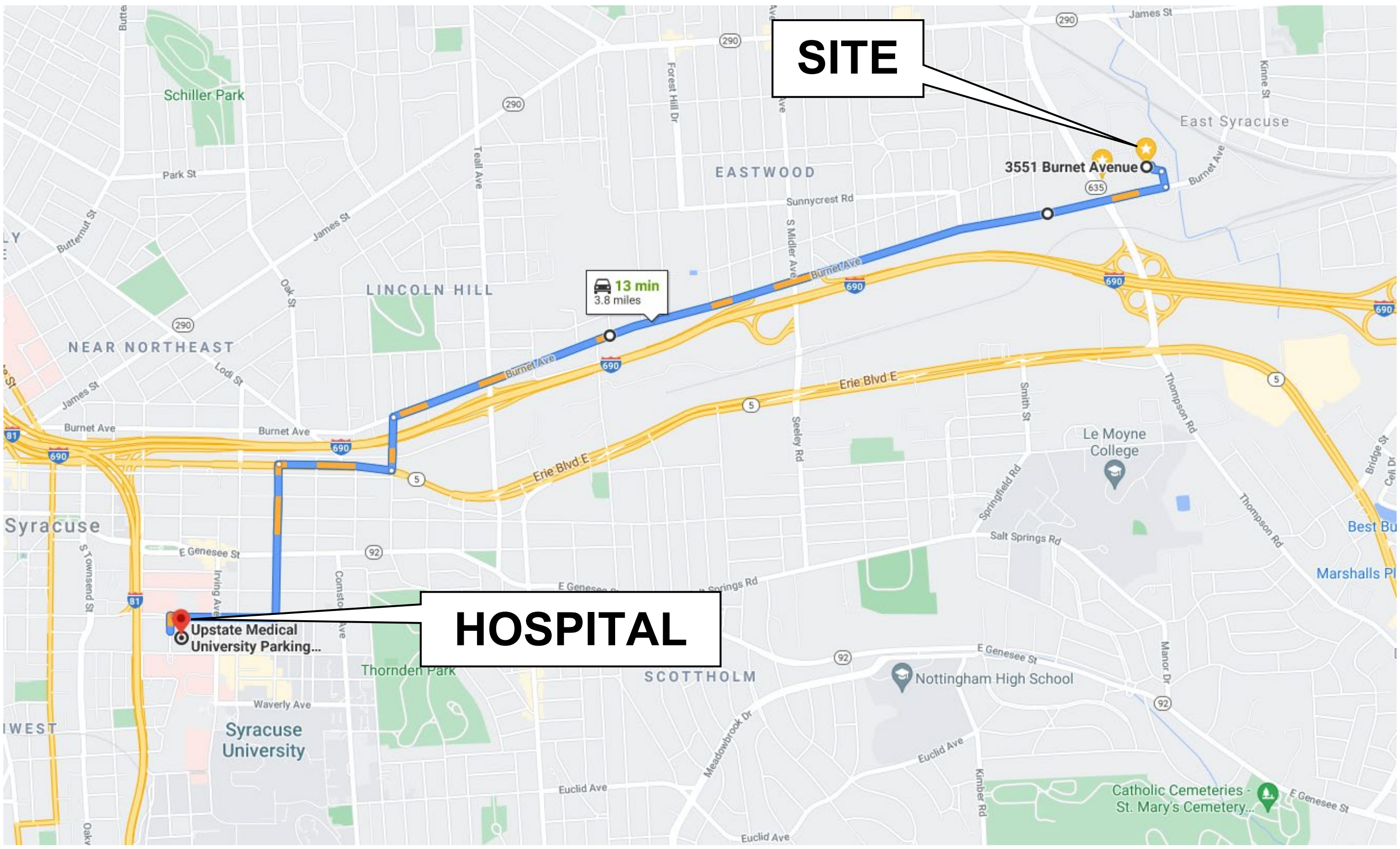
Please sign below to acknowledge this THA was made available to you, and you had an opportunity to ask questions about the information herein.

Printed Name	Signature	Company Name	Date

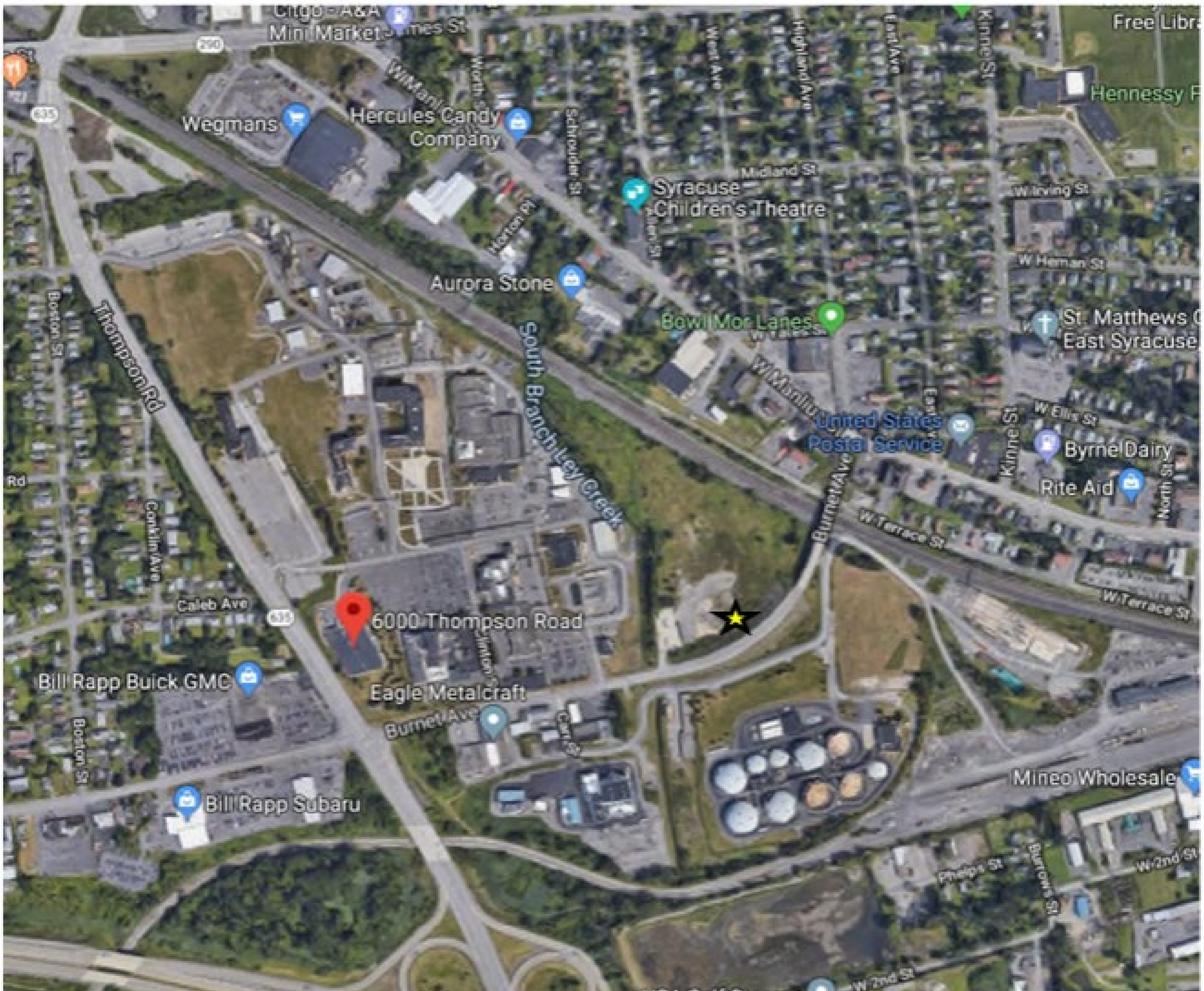
ROUTE TO HOSPITAL EMERGENCY ROOM

Hospital Name: Upstate University Hospital
Address: 750 East Adams Street, Syracuse NY, 13210
Phone Number: (315) 464-5540
Driving Directions to Local Hospital

From the Site turn right (West) on Burnett Ave, travel West for 2.4 miles (from proposed sample locations turn right on W Manlius St before turning right onto Burnett Ave). Turn left (South) onto N Beech St and travel 0.2 miles. Turn right (West) onto Erie Blvd E and travel 0.3 miles. Turn left (South) onto University Ave and travel 0.5 miles. Turn right (West) onto right Harrison ST and travel 0.3 miles. Hospital entrance will be on the left.



Site Map Showing Assembly Areas



Assembly Area

ATTACHMENT D

Sediment Sampling Field Forms

Sediment Sampling Field Log

Job: ______________________ Core Location: ______________________

Job No: ______________________ Date: __________ Time: __________

Field Reps: ______________________ Sample Method: ______________________

Contractor: ______________________ Proposed Coordinates: ______________________

Water Depth ______________________

Penetration ______________________

Core # ______________________

Confirmed Coordinates (datum) ______________________

Notes: ______________________

Start Depth	End Depth	Sample ID	Notes	Sample Accept (Y/N)	Descripton:

Sediment Core Description: e.g.: surface cover, (density), moisture, color, minor modifier, MAJOR modifier, other constituents, odor, sheen, layering, anoxic layer, debris, plant matter, shells, biota)

Sample Containers: ______________________

Analyses: ______________________

Geosyntec consultants

Daily PFAS Sampling Checklist

Date: ___________________

Site Name: _____________________________________

Weather (*temperature/precipitation*): ____

Please check all boxes that apply and describe any exceptions in the notes section below along with QA/QC methods used to assess potential sample cross-contamination as a result.

Field Clothing and PPE:

- No water- or stain-resistant boots, waders, or clothing (e.g., GORE-TEX®)
- Field boots (or overboots) are made of polyurethane, PVC, rubber, or untreated leather
- Waders or rain gear are made of neoprene, polyurethane, PVC, vinyl, wax-coated or rubber
- Clothing has not been recently laundered with a fabric softener
- No coated HDPE suits (e.g., coated Tyvek® suits)
- Field crew has not used cosmetics, moisturizers, or other related products today
- Field crew has not used sunscreen or insect repellants today, other than products approved as PFAS-free

Field Equipment:

- Sample containers and equipment in direct contact with the sample are made of HDPE, polypropylene, silicone, acetate or stainless steel, not LDPE or glass
- Sample caps are made of HDPE or polypropylene and are not lined with Teflon™
- No materials containing Teflon™, Viton™, or fluoropolymers
- No materials containing LDPE are in direct contact with the sample (e.g., LPDE tubing, Ziploc® bags)
- No plastic clipboards, binders, or spiral hard cover notebooks
- No waterproof field books
- No waterproof or felt pens or markers (e.g., certain Sharpie® products)
- No chemical (blue) ice, unless it is contained in a sealed bag
- No aluminum foil
- No sticky notes (e.g., certain Post-It® products)

Decontamination:

Reusable field equipment (e.g., dip sampler) decontaminated prior to reuse

"PFAS-free" water is on-site for decontamination of field equipment

Alconox®, Liquinox® or Luminox® used as decontamination detergent

Food and Drink:

No food or drink on-site, except within staging area

Food in staging area is contained in HDPE or stainless-steel container

Notes:

____

____

____

____

____

Field Team Leader Name (Print): ___________________________

Field Team Leader Signature: ______________________________

Date/Time: ____________________________

ATTACHMENT E

PFAS Sampling Protocol

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

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

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.