Supplemental Work Plan for
Remedial Investigation/Feasibility Study
Coldbrook Creek
Former Sperry Remington Site
Elmira, New York
NYSDEC Site ID #808043

Submitted to

Unisys Corporation

Submitted by

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ACRONYMS AND ABBREVIATIONS

ADD	Average Dietary Dose
ATC	Averaging Time for Carcinogens
ATN	Averaging Time for Non-Carcinogens
AUF	Area Use Factor
BAZ	Biologically Active Zone
bgs	Below Ground Surface
bsi	Below the Sediment-Water Interface
BW	Body Weight
C.F.R.	Code of Federal Regulations
CF	Conversion Factor
cm	Centimeter
COC	Constituent of Concern
COPEC	Constituent of Potential Ecological Concern
CSFo	Oral Cancer Slope Factor
CSM	Conceptual Site Model
DO	Dissolved Oxygen
DER	Division of Environmental Remediation
DFI_{dw}	Daily Food Intake, Dry Weight
DFI_{ww}	Daily Food Intake, Wet Weight
dw	Dry Weight
ECO-SSL	Ecological Soil Screening Level
ED	Exposure Duration
EF	Exposure Frequency
ELCR	Excess Lifetime Cancer Risk
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentration
EPT	Ephemeroptera, Plecoptera, Trichoptera
ERA	Ecological Risk Assessment
ESV	Ecological Screening Values
FC	Fraction of Fish Consumed from Study Area
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FS	Feasibility Study

ACRONYMS AND ABBREVIATIONS (CONTINUED)

F_{diet}	Fraction of Diet for a Give Food/Prey Item
F_{sed}	Incidental Ingestion of Sediment Expressed as a Fraction of Diet
FSP	Field Sampling Plan
ft	Foot/Feet
FWIA	Fish and Wildlife Impact Analysis
Geosyntec	Geosyntec Consultants, Inc.
GPS	Global Positioning System
HASP	Health and Safety Plan
HBI	Hilsenhoff's Biotic Index
HHEA	Human Health Exposure Assessment
HQ	Hazard Quotient
IRF	Ingestion Rate of Fish
LOAEL	Lowest Observed Adverse Effect Level
MDL	Method Detection Limit
NBI	Nutrient Biotic Index
NCO	Non-Chironomidae and Oligochaeta
NOAEL	No Observed Adverse Effect Level
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphenyl
PMA	Percent Model Affinity
ppm	Part Per Million
QAPP	Quality Assurance Project Plan
RfDo	Oral Non-Cancer Reference Dose
RI	Remedial Investigation
RSL	Regional Screening Level
SCO	Soil Cleanup Objective
SGV	Sediment Guidance Values
Site	Former Sperry Remington Site
SPP	Species Richness
SQT	Sediment Quality Triad
SRA	Screening-Level Risk Assessment

ACRONYMS AND ABBREVIATIONS (CONTINUED)

Study Area	Coldbrook Creek
STCC	Southern Tier Commerce Center
SVAP	Stream Visual Assessment Protocol
TAL	Target Analyte List
TOC	Total Organic Carbon
TRV	Toxicity Reference Value
TSCA	Toxic Substances Control Act
Unisys	Unisys Corporation
USDA	United States Department of Agriculture
USGS	United States Geological Survey

SECTION 1

INTRODUCTION

1.1 Overview

On behalf of Unisys Corporation (Unisys), Geosyntec Consultants, Inc. (Geosyntec) and its New York engineering affiliate, Beech and Bonaparte Engineering, P.C. (collectively, Geosyntec) submit this Addendum #6 to the Remedial Investigation/Feasibility Study (RI/FS) Work Plan for the Former Sperry Remington Site in Elmira, New York ("Site"). The Site location is presented in **Figure 1**. Addendum #6 is specific to evaluating Coldbrook Creek ("Study Area"), which is an "Off-Site" Area that historically received discharges from the Site (**Figures 2 and 3**). Overbank soil along Coldbrook Creek is also included within the Study Area, as sediments may be deposited in overbank soil during flooding events. Coldbrook Creek is a highly disturbed system due to historical physical alterations (i.e., being cut off from the Chemung River) and will remain a highly disturbed system due to continuing suburban and agricultural inputs, including high sedimentation and siltation in the upper portions of the creek. Coldbrook Creek provides limited ecological services and primarily functions as a stormwater drainage feature for the suburban and rural/agricultural corridor to the Chemung River.

The New York State Department of Environmental Conservation (NYSDEC) identified polychlorinated biphenyls (PCBs), chromium, copper, lead, nickel, and zinc as constituents of concern (COCs) in Coldbrook Creek. These COCs were identified based on historical Site information, analytical data from the headwater marsh of Coldbrook Creek, and analytical data from downstream portions of Coldbrook Creek (Stage 3b and 3c; **Figure 3**) where some COC metals concentrations are consistent with concentrations reported in the Wetland Area. However, notwithstanding Site-related chemical impacts, large portions of Coldbrook Creek do not provide suitable habitat for supporting a diverse benthic community due to frequent low-flow conditions, extensive siltation, and ongoing inputs from suburban and agricultural runoff, which lessen its ecological service value.

This Work Plan includes an approach to characterize the extent of potential ecological risks and human exposures. The ecological risk assessment (ERA) approach begins with a comparison of Study Area sediment and soil concentrations to ecological screening values and, for sediment, proceeds to a more site-specific analysis that includes sediment toxicity testing, benthic community analysis, and food chain modeling. The Work Plan elements for evaluating ecological risks are focused on chemical hazards; however, a detailed habitat and stream characterization is also proposed as part of this Work Plan because physical and biological stressors are important determinants for the overall health of the ecosystem. The human health exposure assessment (HHEA) approach is primarily qualitative in nature and focuses on identifying potentially complete exposure pathways by which human receptors could be exposed to Site-related constituents in environmental media but also includes a screening-level evaluation of risk based on comparisons of Study Area data to media-specific human health screening levels developed by the State of New York. The investigation findings will be incorporated into the Site RI Report(s) and used to inform decision making in the subsequent FS.

Any risk management decisions based on potential risks should be viewed in the context of 1) overall likelihood of improving the ecological health of the system; and 2) community acceptance (particularly where remedial alternatives could potentially have financial implications for adjacent property owners/businesses, but provide marginal, if any, improvement to the ecological quality and benthic community structure).

1.1.1 Objectives

The overall objectives of the RI/FS are to: (i) determine the nature and extent of constituents that may have been potentially discharged from the Site; (ii) determine if residual sources of COCs still exist; and (iii) identify both current and potential routes of human exposure, if any, to COCs (Advanced GeoServices, 2010). In support of these objectives, the objectives of Addendum #6 are as follows:

- Characterize the nature and extent of potentially Site-related constituents in downstream sediments of Coldbrook Creek, including backwater areas and historical alignments, and overbank soils of Coldbrook Creek that are flood prone and that are human/livestock activity areas;
- Characterize potential risks to ecological receptors potentially exposed to Site-related constituents in Coldbrook Creek using methods from the NYSDEC and the United States Environmental Protection Agency (EPA); and
- Identify potentially complete exposure pathways by which human receptors may come into contact with Site-related constituents in Coldbrook Creek sediment and overbank soil and determine whether further quantitative evaluation is warranted.

Data collected in accordance with Addendum #6 will be submitted to the NYSDEC as a stand-alone Screening-Level Risk Assessment (SRA) report; this report will also include data collected per Addendum #5. Previously collected data were presented in the RI Phase 1 Data Report (Advanced GeoServices, 2011) and RI Phase 2 Data Report (Geosyntec, 2013). If appropriate, the results of the SRA will be used to evaluate the effects (harms and benefits) of remedial actions and support risk management decisions to protect human health and the environment.

1.1.2 Document Organization

This Addendum describes the investigation and evaluation methods that will be used to complete tasks related to achieving creek-specific objectives. The remainder of this Addendum is organized as follows:

- Section 1 presents a description of the Site and Study Area, including a summary of previously collected environmental data;
- Section 2 presents a Work Plan for evaluating potential ecological risks and human exposures associated with Coldbrook Creek;
- Section 3 describes field investigation activities and laboratory analyses to be conducted in support of the risk and exposure assessments;
- Section 4 summarizes the schedule and deliverables associated with the Addendum #6 investigations and evaluations; and
- Section 5 lists the references cited herein.

1.2 Location and Setting

The Site is located at 1051 South Main Street in Elmira, Chemung County, New York (**Figure 1**). The Site is a 185 ft x 65 ft rectangular area (0.28 acres) as shown on **Figure 2**. The Site includes an 8- to 12-foot diameter covered concrete culvert (Site Culvert) which extends from a former holding pond (immediately to the east and adjacent to the Site) to a discharge point to the east-northeast and off-site. The holding pond was historically used by Sperry Remington. Currently, the Site Culvert receives stormwater runoff from the City of Elmira/Town of Southport, which is pumped from a drainage basin in the Southern Tier Commerce Center (STCC) building. The Site Culvert remains connected to the former Remington Rand industrial sewer lines and also receives stormwater runoff from the STCC and the Elmira High School properties.

The Site culvert is approximately 275 feet long and extends beneath a railroad line owned by Norfolk Southern. The Site Culvert discharges into a Drainage Swale that traverses through a 3.5-acre Wetland Area before discharging to Coldbrook Creek at two outfall locations, referred to herein as the northern and southern outfalls. Hence, the creek essentially serves as a stormwater drainage feature for the suburban and rural/agricultural properties along the stream corridor. The Wetland Area, inclusive of the Drainage Swale, and Coldbrook Creek, inclusive of in-stream sediment and overbank soil, comprise the Off-Site Areas. The Site and Off-Site Areas consist of several parcels owned by multiple parties.

The Site itself is bordered to the south and west by a large industrial-use property, to the north by Elmira High School, and to the east by an active railroad owned by Norfolk Southern. Farther east from the railroad is the Wetland Area, followed by a raised access road, and then Coldbrook Creek, which runs approximately parallel to the railroad in the vicinity of the Site.

Coldbrook Creek flows southeast for approximately 2.6 miles where it forms a confluence with the Chemung River (**Figure 3**). The Chemung River also flows southeastwardly for over 20 miles (into Pennsylvania) and is a tributary to the Susquehanna River, which eventually reaches Chesapeake Bay and the Atlantic Ocean. Several other tributaries to the Chemung River are located within Chemung County, including Seeley Creek, which is approximately three quarters of a mile south of the Site.

The National Wetlands Inventory indicates (**Figure 4A**), there are freshwater emergent and forested/shrub wetlands in the vicinity of the Site. There are three (3) palustrine emergent wetland areas near the headwaters of Coldbrook Creek (Advanced GeoServices, 2011); however, most wetlands in the area are associated with Seeley Creek and the Chemung River. Within the vicinity of the Site, there are no Critical Environmental Areas[1] or Wild, Scenic, or Recreational Rivers[2].

Information on potential flooding was obtained from the Federal Emergency Management Agency (FEMA)[3] and the United States Department of Agriculture (USDA)[4]. Data from FEMA indicates that the land bounded by the Chemung River to the east, Seeley Creek to the south, and Coldbrook Creek to the west, is within a 100-year floodplain. Likewise, the USDA characterizes most of the land within the 100-year floodplain as subject to “occasional” flooding with the exception that the areas in the vicinity of the former creek alignment (i.e., “backwater areas”) are subject to “frequent” flooding. Per the USDA’s definitions, occasional means that flooding occurs infrequently under normal weather conditions, with a 5 to 50% change of flooding within any year whereas frequent means that, under normal weather conditions, the chance of flooding is more than 50% in any year, but less than 50% in all months of the year. Although not specified by either FEMA or the USDA, flood waters are likely to originate from the Chemung River rather than Coldbrook Creek. FEMA indicates that the 100-year floodplain extends west from the Chemung River to approximately the train tracks located west of Coldbrook Creek. Conversely, data from the USDA indicate that except for the areas immediately adjacent to the creek, which are subject to “frequent flooding,” flooding is not probable, occurring less than once in 500 years west of the creek. Flood data from FEMA and the USDA are shown in **Figures 4B and 4C**, respectively.

Within a 0.5-mile corridor (0.25-miles from each bank) of Coldbrook Creek, land cover is disturbed or highly disturbed relative to native conditions. Adjacent properties include numerous residences, industrial operations south of the Site (STCC; **Figure 2**) and on the Hurley property (**Figure 3**), Elmira and Notre Dame High Schools, utility corridors, commercial operations, and large areas of agriculture. Wetlands and wooded areas are present, but to a more limited extent.

As shown on topographic maps presented on **Figure 5** and historical aerial photographs included as **Attachment A**, the alignment of Coldbrook Creek has changed over time. Historically, the headwaters of Coldbrook Creek originated west of South Main Street and Coldbrook Creek traversed the STCC property as shown on the 1895 United States Geological Survey (USGS) map (**Figure 5**). The headwaters were altered by subsequent industrial development and by 1939 (see aerial photograph in **Attachment A**) were solely located at the holding pond on the STCC

[1] http://www.dec.ny.gov/permits/6184.html
[2] http://www.dec.ny.gov/permits/32739.html
[3] https://www.arcgis.com/home/item.html?id=c8402f26fbd9499ebd26f2a566fdd20b
[4] https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

property. Subsequent residential development in the early 1940s added a man-made drainage feature known as Miller Pond and its outfall to the headwaters and alterations to the creek alignment north of Laurentian Place, as shown by the 1948 aerial photograph (**Attachment A**) and the 1953 topographic map (**Figure 5**). The outfall from Miller Pond was located on the east side of Miller Pond until approximately the 1970s after which the outfall was located to its current location at the southern end of Miller Pond.

The Site headwaters have been used for industrial discharge since as early as the 1930s when the holding pond and Site Culvert were constructed by Morrow Manufacturing (Dames and Moore, 1988). Remington Rand occupied the property between 1936 and 1972. Industrial wastewater discharges from the Remington Rand facility contained chromium, copper, nickel, zinc and cyanide. According to the 1958 Industrial Report, plating waste, cooling water, blowdown water from the boiler and drainage for plating and oil storage were discharged to the Site Culvert.

1.3 Study Area Preliminary Habitat Description

The Study Area for this investigation, which is depicted in **Figure 3**, is defined as (i) the sediment associated with Coldbrook Creek between its headwaters near the Site and its confluence with the Chemung River, including the former creek alignment and several other backwater areas; and (ii) overbank soil along Coldbrook Creek where flooding has potentially transported COCs and human activities are occurring. Note that the Coldbrook Creek Study Area is currently defined based on environmental features rather than the nature and extent of Site-related constituents; the downstream, backwater, and overbank Study Area boundaries will be refined based on additional environmental investigations. The concrete Site Culvert adjacent to the former Facility and the Wetland Area were addressed in the RI Phase 1 Data Report (Advanced GeoServices, 2011) and RI Phase 2 Data Report (Geosyntec, 2013). Descriptions of the Study Area are based on previous investigations and reconnaissance by Geosyntec personnel on November 28-30, 2016.

For the purposes of describing Study Area features and sampling locations (historical and/or proposed) in this Work Plan, Coldbrook Creek has been subdivided into three reaches starting at the Miller Pond Outfall and extending to the confluence of the creek with the Chemung River. The Miller Pond Outfall is approximately 550 ft upstream of the Northern Outfall from the Wetland Area, which is the most upstream point associated with stormwater and historical wastewater discharge from the Site and thus given the location designation “0.0 ft”. The historical sediment sample locations in Coldbrook Creek, which are used in the demarcation of the three reaches, are based on the linear upstream and downstream distances measured from the northern outfall. The reaches include:

- Reach 1 (~3,000 ft): Miller Pond Outfall (-550 ft) to Maple Avenue (~2,450 ft)
- Reach 2 (~4,300 ft): Maple Avenue (~2,450 ft) to CBC-6750 (6,750 ft), including the cow pond and former creek alignment backwater area

- Reach 3 (5,930 ft): CBC-6750 (6,750 ft) to CBC-12680 (12,680 ft) including a backwater area near stage 3d sampling location CBC-9820

In its current configuration, the headwaters of Coldbrook Creek include the holding pond and Site Culvert located on the STCC property and Miller Pond, which is located north of the Site in a residential neighborhood (**Figure 6A**). Miller Pond is surrounded by mowed/maintained residential properties and is fed by rainwater and suburban runoff. Based on Study Area observations in November 2016, Miller Pond is relatively stagnant with limited downstream flow; any flow is directed downstream through three (3) metal culverts into Coldbrook Creek. Coldbrook Creek flows south from Miller Pond for approximately 2.6 miles before the confluence with the Chemung River. Properties along Coldbrook Creek are primarily zoned for and appear to be used for agricultural and rural residential purposes. However, field observations in November 2016, including one property with large piles of concrete and other construction/demolition debris immediately adjacent to the creek, indicate some commercial operations may be occurring. The Coldbrook Creek flow path is shown upstream to downstream in **Figures 6A through 6C**.

The current configuration of Coldbrook Creek represents a mix of natural and man-made features. **Figure 5** presents side-by-side topographic maps of Elmira circa 1895 and 1953. It is apparent in **Figure 5**, that the lower portion of Coldbrook Creek (i.e., from about the mid-point of Reach 2 and all of Reach 3) was historically an oxbow of the Chemung River, connected upstream near the current Chemung County Wastewater Treatment Facility and downstream at its current confluence point. The oxbow historically formed Big Island. Moving downstream, the oxbow included what is now known as the "backwater" area and curved south near Redwood Drive. Thus, north of Redwood Drive, Coldbrook Creek appears to be entirely or partially man-made. North of Laurentian Place, the steeply incised slopes and straight path are evidence that this creek is a man-made feature. In its current configuration, the creek essentially serves as a stormwater drainage feature for the suburban/agricultural corridor to the Chemung River.

Thus, Coldbrook Creek inherently represents a disturbed aquatic system relative to native conditions. Of particular importance is the substantial difference in historical and current headwaters. Coldbrook Creek was historically connected to the high-energy Chemung River, but now receives only limited flow from man-made drainage features (i.e., the STCC property holding Site Culvert and Miller Pond) and suburban and agricultural runoff from adjacent properties.

Cutting off this oxbow from the Chemung River substantially reduced flow through Coldbrook Creek and resulted in physical conditions in the upper portions of the creek that are indicative of limited quality habitat. These conditions include a high degree of sediment deposition; a paucity of surficial cobbles and snags crucial for benthic colonization and the bottom substrate dominated by fine silts; few pools are present and nearly all are shallow; water fills only a portion of the channel in most areas; upstream portions of the channel have been altered; and there are limited bends in the stream north of the Travers Property (**Figure 3**). The overbank conditions also reduce the overall quality of the creek, due to the fact that much of the surrounding vegetation is dominated by mowed/maintained grasses as well as open fields with crops and livestock that contribute agricultural runoff to the creek. There is also an unstable concrete/rubble debris pile at the Hurley property that has high, steep slopes immediately adjacent to the creek (**Figure 3**). Human activities occur nearly adjacent to the creek over its entire length. Each of these physical features scores poorly on the NYSDEC stream biomonitoring rapid assessment protocol (NYSDEC, 2018). High levels of silts and fines and a low-velocity system can reduce pore space and lead to clogging of the interstices, making the river bottom substrate too dense to provide living space or to support necessary water exchange (EPA, 2015). Meaning, notwithstanding chemical impacts, Coldbrook Creek has limited value as an ecological resource. Its future configuration (i.e., lack of flowing headwaters) and future surrounding land uses are expected to resemble current conditions. Thus, Coldbrook Creek will continue to function primarily as a drainage feature that receives low-quality runoff from surrounding suburban and agricultural lands.

1.4 Nature and Extent of Potentially Site-Related Constituents

Through the RI process to date and discussions with NYSDEC, PCBs, chromium, copper, lead, nickel, and zinc are the COCs in Coldbrook Creek. The existing sediment dataset for Coldbrook Creek is summarized below, followed by a brief description of the nature and extent of COCs. In addition, analytical data for PCBs and metals in Coldbrook Creek sediment are compared to sediment guidance values (SGVs) and soil cleanup objectives (SCOs) in **Tables 1A and 1B**, respectively. At all sediment sampling locations, surficial sediment (0-0.17 or 0-0.5 feet below the sediment-water interface [ft bsi]) was collected and, at most locations, shallow sediment (0.5-1 ft bsi) was also collected. At all soil sampling locations, surficial soil (0-0.17 or 0-0.5 feet below ground surface [ft bg]) was collected and, at most locations, shallow soil (0.5-1 ft bsi) was also collected. Deeper sediment and soil intervals (1-2 ft bsi/bgs and, less frequently, 2-3 ft bsi/bgs) were sampled at a subset of locations.

- **RI Phase 1**: In March 2011, 23 sediment samples were collected from 11 cross-sections. These samples were composites, consisting of one (1) sample from each bank and one from the centerline. Soils in the vicinity of the Site were also sampled during this event, including five (5) Wetland Area soil samples, 39 Drainage Swale soil samples, 30 samples from the west bank of the creek, and 28 samples from the east bank of the creek. These sediment and soil samples were analyzed for PCB Aroclors, metals, and other organic constituents.
- **RI Phase 2**: In July 2012, nine (9) sediment samples were collected from three (3) additional cross-sections in Coldbrook Creek. These sediment samples were composites collected in the same manner as during Phase 1. Soils in the vicinity of the Site were also sampled during this event, including 21 Drainage Swale soil samples, nine (9) samples from the west bank of the creek, and six (6) samples from the east

bank of the creek. Sediment and soil samples from these locations were analyzed for PCB Aroclors and soil samples were also analyzed for metals.

Additionally, 10 sediment samples were collected from three (3) locations upstream of the northern outfall (CBC-U0200, CBC-U0400, and CBC-U0550). These upstream samples were analyzed for PCB Aroclors and metals.

- **RI Phase 3A**: In May 2015, 20 sediment samples were collected from three (3) transects in Coldbrook Creek and 28 soil samples were collected along the west bank. In each sediment transect, discrete samples were collected from the centerline, left, and right banks of the stream, where left is based on facing in the downstream direction (i.e., generally, east). These sediment and soil samples were analyzed for PCB Aroclors and a subset of soil samples was also analyzed for metals and other organic constituents.
- **RI Phase 3B**: In October 2015, 122 sediment samples were collected from an additional 18 transects in Coldbrook Creek. In each transect, discrete samples were collected from the centerline, left, and right banks of the stream, where left is based on facing in the downstream direction (i.e., generally, east). All samples from this event were analyzed for PCB Aroclors and a subset were analyzed for metals (cadmium, chromium, copper, lead, nickel, silver, and zinc).

  Additionally, as part of Phase 3B, 19 sediment samples were collected from eight (8) backwater sampling locations: four (4) locations in the “cow pond” (BW-4, BW-5, BW-6, BW-7); three (3) locations within the former creek alignment (BW-1, BW-2, BW-3) (**Figure 3**); and one (1) Reach 3 downstream location near CBC-9820 (BW-8). Because these areas are generally not “stream-like,” sediment was collected as discrete samples rather than along transects. All backwater sediment samples were analyzed for PCB Aroclors and a subset was analyzed for metals.

  No overbank soil samples were collected in October 2015.

In total, excluding upstream samples, 203 sediment samples and 166 overbank soil samples have been collected from Coldbrook Creek Study Area to date. Of these, 147 are surficial (0 to 0.5 ft bsi) or shallow sediment (0.5-1 ft bsi); 69 are surficial or shallow overbank soil.

Figure 7A presents existing analytical data for PCBs in Wetland Area sediment and Coldbrook Creek surficial and shallow sediment. PCB concentrations in the figure are characterized based on comparisons to NYSDEC (2014) SGVs for ecological receptors, where Class A sediments are defined as those having PCB concentrations less than 0.1 part per million (ppm) and Class C sediments are defined as having PCB concentrations greater than 1 ppm. These thresholds were derived by the NYSDEC from a review of the literature, including paired chemistry-toxicity test data at other sites. Hence, these thresholds are not site-specific and do not account for physical stressors. Nonetheless, these thresholds are useful for providing a preliminary evaluation of potential ecological risks from COC exposure.

As shown in **Figure 7A**, the highest PCB concentrations occur adjacent to the Site and concentrations generally attenuate with distance from the Site. Study Area PCB concentrations relative to SGVs are summarized below. Note that Class A and Class C SGVs are equivalent to NYSDEC SCOs for unrestricted and residential use, respectively.

- PCB concentrations upstream of the northern outfall (CBC-U0550, CBC-U0400, and CBC-U-200) are less than the Class A SGV.
- The majority of PCB concentrations reported in sediment samples collected between the northern outfall and CBC-3000 (just downstream of Maple Avenue) exceed 1 ppm; average surficial (0 to 0.5 ft bsi) and shallow (0.5 to 1 ft bsi) sediment PCB concentrations in this stretch of the creek are 9.3 ppm and 2.6 ppm, respectively.
- One surficial (0 to 0.5 ft bsi) sample (CBC-1770-L) was identified as containing PCBs at a concentration (71.4 ppm) that exceeds the Toxic Substances Control Act (TSCA; 40 C.F.R. §761.61) limit of 50 ppm. PCB concentrations in the center and right surficial samples of this transect are substantially lower (5.73 and 2.98 ppm) as are concentrations in surficial sediment of the left, center, and right samples from CBC-2040, which is the nearest downstream transect (1.08, 2.46, and 10.9 ppm). Delineation sampling will be conducted near CBC-1770 as part of the field investigation proposed herein (see Section 3.3.3).
- Between CBC-3550 and sampling transect CBC-6150, most, but not all, PCB concentrations are less than 1 ppm; average surficial (0-0.5 ft bsi) and shallow (0.5-1 ft bsi) sediment PCB concentrations in this stretch of the creek are 0.49 ppm and 0.51 ppm, respectively.
- In the backwater area referred to herein as the cow pond (BW-4, BW-05, BW-06, and BW-7; **Figure 6B**), PCB concentrations are less than the Class A SGV.
- In the backwater areas that was part of the former creek alignment, near the confluence with Coldbrook Creek, PCB concentrations marginally (<2x) exceed the Class C SGV. These sampling locations, BW-1, BW-2, and BW-3, are shown on **Figure 6B**.
- In the Reach 3 downstream backwater area near CBC-9820 (**Figure 6C**), PCB concentrations are less than the Class A SGV. This sampling location, BW-8, is shown in **Figure 6C**.
- At sampling transect CBC-6750 and further downstream, all PCB concentrations are less than 1 ppm and the majority are less than 0.1 ppm; average surficial (0 to 0.5 ft bsi) and shallow (0.5 to 1 ft bsi) sediment concentrations in this stretch of the creek are 0.019 ppm and 0.023 ppm, respectively.

Thus, there is a clear indication that PCBs attenuate with distance from the Site and there has not been significant migration into the backwater areas or upstream toward Miller Pond.

Figures 7B through 7F compare existing analytical data for COC metals (chromium, copper, lead, nickel, and zinc) concentrations in sediment to SGVs. **Figures 8B through 8F** compare these data to NYSDEC SCOs. Overall, similar to PCBs, metals concentrations in sediment show an overall attenuation with distance from the Site. However, the distance between samples is much larger and represents a potential data gap in characterizing the nature and extent of these metals. Study Area COC metals concentrations are summarized below.

- Chromium concentrations upstream of the northern outfall (CBC-U0550, CBC-U0400, and CBC-U-200) are less than the Class A SGV and the unrestricted use SCO. Concentrations of the other COC metals consistently exceed the Class A SGVs and, in some cases, the Class C SGVs; concentrations are generally above the unrestricted use SCOs but below the residential SCOs. As noted above, PCBs are below the Class A SGV and unrestricted use SCO in upstream samples, indicating that COC metals concentrations may be at least partially attributable to non-Site sources, including natural and anthropogenic background.
- The majority of COC metals concentrations reported in sediment samples collected between the northern outfall and CBC-6150 (inclusive of CBC-6150) exceed Class A SGVs and many also exceed Class C SGVs. These concentrations also frequently exceed unrestricted use SCOs and, for chromium and nickel, frequently exceed residential SCOs. The highest concentrations were measured at CBC-00, CBC-3000, and CBC-6150, with lower concentrations measured between these stations, possibly indicating these are depositional areas.
- Downstream of CBC-6150 (i.e., Reach 3), in surficial sediment, chromium and copper concentrations are less than Class A SGVs and copper and zinc concentrations only exceed Class A SGVs at one transect (CBC-7350), and the exceedances are minor (approximately 1.1x). Copper and lead concentrations are less than unrestricted SCOs and chromium and zinc concentrations exceed unrestricted SCOs in a limited number of samples by a marginal amount (approximately 1.2x). Nickel concentrations in surficial sediment remain elevated above the Class A SGV at the farthest downstream transect where metals analysis was conducted (CBC-10220) and above the unrestricted use SCO at CBC-9820. No COC concentrations in Reach 3 surficial sediment exceed residential SCOs.
- Downstream of CBC-6150 (i.e., Reach 3), in shallow and deep sediment, copper and lead concentrations exceed Class A SGVs and chromium, nickel, and zinc concentrations exceed Class C SGVs as far downstream as CBC-8500. Relative to SCOs, shallow and deep lead concentrations are less than unrestricted use SCOs, and copper and zinc concentrations are lower than residential SCOs. Chromium and nickel concentrations in shallow and deep Reach 3 sediment exceed residential SCOs as far downstream as CBC-8500. COC metals concentrations in shallow sediment sample CBC-10220 are lower than Class A SGVs and unrestricted SCOs.

- Near the confluence of the former alignment backwater area and Coldbrook Creek, lead exceeds the Class A SGV and the other COC metals concentrations exceed Class C SGVs. Sediment samples from the cow pond and the Reach 3 backwater area (near CBC-9820) were not analyzed for metals.

Figures 9A through 9F compare existing analytical data for COC metals in Study Area soil to SCOs. The nature and extent of contamination is summarized below. In addition, analytical data for PCBs and metals in Coldbrook Creek overbank soil are compared to SCOs in **Table 1C**. Note that the discussion below focuses on the east and west bank soil samples, as these are more useful in informing overbank soil sampling than data from the Wetland Area and Drainage Swale, which were impacted primarily via direct discharge rather than secondary transport mechanisms, such as flooding.

- Along the east bank of Coldbrook Creek, in the vicinity of the Site, most COC concentrations are below unrestricted, residential, and ecological SCOs. Concentrations of PCBs, chromium, and nickel exceed the residential SCO in one location (CBC-05-50-E); this is also the only east bank location with shallow or deep exceedances of SCOs.
- Lead and zinc concentrations exceed unrestricted and ecological SCOs along the west bank, but are below residential SCOs. Total PCBs, chromium, and nickel exceed unrestricted, residential, and ecological SCOs in several samples, with the highest concentrations frequently showing co-location.

Overall, impacts to the east bank appear to be spatially limited. SCO exceedances are more frequent along the west bank than east bank, which is expected given the continuity of the west bank with the Wetland Area.

Soil and sediment concentrations were also compared to the default criteria for hazardous waste determination based on leachability (**Figure 10**). The default criteria are calculated by multiplying the EPA's chemical-specific toxicity characteristic leaching procedure (TCLP) limits by a factor of 20. Referred to as the "Rule of 20" criteria, exceedances indicate that leachate from the material could classify the material as hazardous waste. Of the Study Area COCs, Rule of 20 criteria are available for chromium and lead, and both criteria correspond to 100 mg/kg. The Rule of 20 comparison is presented in **Figure 10** and, based on bulk chemistry data, indicates these materials could be hazardous waste based on chromium and lead concentrations. However, it is important to note that many site-specific conditions, including the soil composition (e.g., pH, carbon content) and age of contamination affect the potential for leaching and these are not accounted for by the Rule of 20 comparison.

SECTION 2

SCREENING-LEVEL RISK ASSESSMENT WORK PLAN

2.1 Overview

This section presents the rationale and approach for conducting the SRA, which will evaluate potential exposures of both ecological receptors and humans to Site-related constituents. Note that this section describes data interpretation/evaluation methods; Section 3 describes field and laboratory methods.

2.2 Ecological Work Plan Elements

2.2.1 Ecological Risk Assessment Process

The ERA process is predicated on a sequential series of activities that increase in complexity and site-specificity depending on the results of previous evaluations. The ERA process in New York primarily follows the *Fish and Wildlife Impact Analysis (FWIA) for Inactive Hazardous Waste Sites* (NYSDEC, 1994), which consists of the following steps:

- Step I – Site Description
- Step II – Contaminant-Specific Impact Assessment (includes Steps IIA-IIC)
- Step III – Ecological Effects of Remedial Alternatives
- Step IV – FWS Requirements for Implementation of Remedial Actions
- Step V – Monitoring Program

Steps I and II are relevant to the RI process whereas the subsequent steps are relevant to post-RI activities, including the FS, and Remedial Design/Remedial Action. Steps III-V are not discussed herein. The elements presented in this Work Plan specifically address Steps I, IIA, and IIB of the FWIA guidance.

In addition to the FWIA guidance, NYSDEC has also released guidance titled *Screening and Assessment of Contaminated Sediment* (NYSDEC, 2014), which provides SGVs and a framework for their use in the ERA process. This more recent guidance states that the “EPA Ecological Risk Assessment Framework should be observed,” and cites the EPA’s *Guidelines for Ecological Risk Assessment* (1998).

2.2.2 ERA Objectives and Approach

Consistent with the FWIA guidance, the steps and objectives of the ERA process are as follows:

- **Step I – Site Description**. The objectives of Step I are to identify the fish and wildlife resources that presently exist and that existed before contaminant introduction and provide information necessary for the design of an RI. This step is akin to the Screening Level Problem Formulation step of the EPA's 8-Step ERA paradigm (EPA, 1997). This step considers environmental characteristics of the Study Area, chemicals present and their physical/chemical and toxicological characteristics, potential fate and transport processes, and the types of ecological receptors potentially present. Ecological screening values (ESVs), which are the metric for identifying analytical results that could potentially pose risk to ecological receptors, are also identified during Step I.

- **Step IIA – Pathway Analysis.** Using the information gathered in Step I, a preliminary ecological conceptual site model (CSM) is developed, which identifies likely categories of receptors with anticipated complete exposure pathways. If an exposure pathway is incomplete or insignificant, further analysis in the ERA is not warranted; otherwise, the ERA should proceed to Step IIB.

- **Step IIB – Criteria-Specific Analysis.** In Step IIB, analytical data from the Study Area are quantitatively evaluated to identify if there is a potential for ecological risk. Maximum detected concentrations and the ESVs identified in Step I are the primary metric for characterizing risk in Step IIB.

- **Step IIC – Toxic Effect Analysis.** Step IIC involves the conduct of site-specific empirical assessments including sediment toxicity tests, benthic macroinvertebrate community analyses, and fish tissue analyses to evaluate the potential for harm to ecological receptors that could result from constituents that exhibit significant exceedances of the criteria identified in Step IIB.

Based on previous observations, a general site description is available (Step I), potentially complete exposure pathways have been identified (Step IIA), and existing data have also been compared to ESVs (Step IIB). Each of these elements has been used to inform the development of this Work Plan to complete Step IIC. These Steps will be updated, as necessary, based on additional information collected per this Work Plan (e.g., new sediment and overbank soil chemistry data will be incorporated into the existing dataset and compared to SGVs [sediment] and/or SCOs [sediment and soil] per the Step IIB requirements). The results of Steps IIA, IIB, and IIC, including sediment toxicity tests, benthic community analyses, and fish tissue analyses, will be used to define the nature and extent of contamination and ecological risk within the Study Area.

2.2.3 Step IIA Pathway Analysis

The ecological CSM identifies potentially complete exposure pathways for ecological receptors. A complete exposure pathway consists of a source and mechanism of release, a transport mechanism for the released chemicals, a point of contact, a receptor, and a point of entry into the receptor. If any of these elements is missing, the exposure pathway is incomplete. Components of the CSM are summarized below and diagrammatically presented in **Figure 11**. The CSM will be updated, as appropriate, based on information collected per this Work Plan.

2.2.3.1 Sources and Transport Mechanisms

Once deposited in sediment, constituents may remain adsorbed as part of bottom or suspended sediments or desorb into the water column. Hydrophobic chemicals, such as PCBs, tend to adsorb to the organic fraction and fine-grained sediment particles. The primary metals detected in sediment are not highly soluble in water and, therefore, will also likely bind to sediments. Thus, both PCBs and metals are likely to be adsorbed to sediment rather than dissolved in the water column. As a result, data on sediment physical characteristics (e.g., TOC) and areas of sediment deposition can describe the physical transport methods. Sediments containing bound chemicals may also be physically transported downstream via surface water flow or transported to overbank areas during flooding events. Although biological degradation of PCBs is possible, PCBs typically persist in the environment for long periods of time. Because metals do not readily degrade, they are also likely to persist in the environment.

Relative to other mechanisms, bioavailability is the key fate and transport parameter affecting ecological exposure to PCBs and metals in Coldbrook Creek sediment and overbank soil. Aged constituents, mineralized metals, and constituents that are bound to organic material may not be fully available for biological uptake (i.e., bioavailability less than 100%). EPA and others have suggested that bioavailability should be considered in assessing direct and food web exposures. For nickel and divalent metals in general, the sequestration of metals with sulfide complexes has been demonstrated an important factor in controlling metal toxicity in anoxic and suboxic sediments (EPA, 2005). Other factors including, organic carbon, suspended solids, pH, oxygen, and iron/manganese hydroxides can also affect bioavailability. Further, the biouptake and toxicokinetics of metals are typically species-specific and governed by highly specific biochemical processes that alter the metal form and involve facilitated or active transport. For example, some organisms take up metals and sequester them in chemical forms that have little toxicological potency, whereas other organisms actively excrete excess metals (EPA, 2007).

2.2.3.2 In-Stream Sediment Exposure Points, Receptors, and Routes

Potential ecological receptors for in-stream sediment include aquatic-dependent receptors, such as benthic invertebrates, aquatic plants, and fish, as well as upper trophic level receptors, such as birds and mammals, that may utilize the creek as a food source. The sediment horizon where the bulk of organisms reside is referred to as the “biologically active zone” (BAZ) and is the relevant exposure point for benthic and aquatic ecological receptors. EPA (2015) has stated that, in the case where contaminated sediments are capped with clean substrate, it may not be prudent to consider zones deeper than where the bulk of organisms reside. As such, EPA (2015) has developed practical default values for the depth of biotic zones in various habitat to be used for decisions related to ecological assessment or remediation in aquatic scenarios. In freshwater systems, depths range from 15 to 35 centimeters (cm) (6 to 14 inches), with the deepest BAZ occurring in streams with coarse grain and sand. Of the default freshwater categories, Coldbrook Creek most closely resembles the "Stream Coarse Grained/Sand with Fines" category, where fines constitute >20% of the substrate; the default BAZ for this category is 25 cm (approximately 10 inches).

In its April 6, 2011 comments on the draft Work Plan, NYSDEC noted that it requires sediment sampling data characterizing the top 24 inches of sediment to support remedial action planning. In the letter, NYSDEC cited state-specific guidance[5] that addresses burrowing species that can "reach and exceed" the depth of the BAZ described in the previous paragraph. In addition, the NYSDEC letter cited the potential for "flushing flows" to erode, aerate, and redistribute existing surficial sediments. Regarding the first issue (sediment depth and burrowing species), Geosyntec notes that the guidance cited in the NYSDEC comment states that it is "*restricted to terrestrial soils and should not be applied to submerged soils or aquatic sediments; however, it may be applicable to hydric soils in some cases*" (NYSDEC, 2006).

Nevertheless, this Work Plan includes the collection of surficial (0 to 0.5 ft bsi), shallow (0.5 to 1 ft bsi), and deep (1 to 2 ft bsi, or to refusal) sediment samples to evaluate potential ecological risk in Coldbrook Creek. The surficial and shallow depth intervals are the most appropriate for evaluating benthic receptors directly exposed to sediment as well as fish that consume benthos and potentially bioaccumulate Site-related constituents. These depth intervals are also the most relevant exposure point for human receptors exposed via direct pathways (i.e., incidental ingestion, dermal contact) as well as indirect pathways (i.e., fish consumption). The deep samples will be used primarily to assess nature/extent of COC impacts and to inform potential remedial actions, where appropriate.

2.2.3.3 Overbank Soil Exposure Points, Receptors, and Routes

Potential ecological receptors for overbank soil include terrestrial plants, invertebrates, birds, and mammals. Similar to sediment, the exposure point for ecological receptors is the BAZ, which is generally defined as the top 1-foot of soil (EPA, 2015) for most ecological receptors but some burrowing species may be exposed to deeper soils (NYSDEC, 2006). Terrestrial receptors are potentially exposed to overbank soil directly via ingestion and dermal contact and, for birds and mammals, indirectly via consumption of food/prey items that have bioaccumulated or bioconcentrated Site-related constituents

[5] NYSDEC staff provided a copy of a technical memo entitled "Ecological Exposure to Soil Contamination" (NYSDEC, 2006) via email to Unisys on September 13, 2018.

2.2.4 Step IIB Chemical-Specific Analysis

ESVs for Step IIB are the NYSDEC (2016) SGVs and ecological SCOs. ESVs and their primary sources for target analyte list (TAL) metals and PCBs are summarized in **Table 2**. If PCBs are detected in fish tissue, concentrations will be compared to the fish flesh criterion of 0.11 mg/kg (NYSDEC, 2005). The basis of these values and their interpretation will be discussed further in the SRA Report; however, it is important to note that these values are not site-specific and, in most cases, represent consensus-based values. Hence, higher or lower concentrations may be protective at a given site depending on its unique conditions.

2.2.5 Step IIC Evaluation of Benthic Risks

Potential risks to benthic receptors will be evaluated using the sediment quality triad (SQT) approach, which consists of bulk sediment chemistry, laboratory toxicity testing, and microbenthic community surveys. Field collection and laboratory procedures for these lines of evidence are described in Section 3.3. This section describes the data evaluation techniques for each line-of-evidence. These lines of evidence will be combined in the SRA Report to make a location-specific determination about the potential for ecological risk.

Twelve (12) SQT stations are proposed for an initial sampling event scheduled for June 2019. Unisys acknowledges that with this initial (n=12) SQT dataset, there may be limitations with respect to: (i) extrapolating the results beyond the specific sampling locations; (ii) combining data collected from different seasons, (iii) calculating alternative SGVs. However, there are also uncertainties regarding the utility of the SQT data, including whether observed effects, if any, can be attributed to chemical concentrations and whether cleanup requirements based on the protection of human health will preclude application of site-specific SGVs. Therefore, a phased-approach for SQT sampling is proposed, which is scheduled to begin in June 2019 with 12 stations. If supported by the June 2019 findings, Unisys is prepared to conduct a second SQT sampling event in September 2019[6]. The June 2019 SQT findings will be presented to NYSDEC prior to making a determination as to how to proceed with the ERA process. The interpretation methods for SQT data are described below.

Bulk sediment chemistry results will be used as a line-of-evidence to evaluate potential risks to benthic invertebrates. Detected constituent concentrations will be compared to NYSDEC Class A and Class C SGVs, as well as concentrations from a reference creek. Concentrations in individual samples and averaged across a reasonable exposure area will be presented.

Toxicity testing results will be statistically evaluated to determine if the outcomes for organisms exposed to Study Area sediment are statistically significantly different from the outcomes for

[6] A Work Plan addendum for this field event will be provided, if necessary. Briefly, Unisys will identify 18 additional sampling stations for collection of one surficial sediment sample for chemical analysis and toxicity testing and a co-located macroinvertebrate kick-sample.

organisms exposed to reference creek sediment or laboratory controls. The null hypothesis is that no difference exists among the mean responses for the Study Area and mean responses for the reference creek/control. The specific statistical tests will be dictated by the distribution of the data; however, the evaluation will generally follow methods described by the guidance document, *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-associated Contaminants with Freshwater Invertebrates* (EPA, 2000; Section 16). An alpha level of $p<0.05$ will be used to assess statistical significance.

Macroinvertebrate community data (i.e., the number and types of species) collected from 12 stations within Coldbrook Creek via kick-sampling (see Section 3.3.7) will be evaluated using the eight (8) metrics described below and used by NYSDEC (2018) for water quality assessments. These are:

1. **Species richness (SPP)**, where greater richness is indicative of a higher quality stream;

2. **EPT (Ephemeroptera, Plecoptera, Trichoptera) Richness**, where EPT taxa are considered "clean water" organisms and their presence is indicative of a higher quality stream;

3. **Hilsenhoff's Biotic Index (HBI)**, which considers the pollution tolerance of individual organisms, and a higher number of tolerant organisms is indicative of a lower quality stream;

4. **Percent Model Affinity (PMA)** for taxonomic and feeding group composition, where the distribution of invertebrates within seven (7) major taxonomic groups and five (5) feeding groups is compared to an expected composition in a high-quality stream, and similarity is indicative of a higher quality stream;

5. **Species Diversity**, where the Shannon-Wiener index is used to evaluate species richness and evenness, where diverse and balanced communities are indicative of a higher quality stream;

6. **Dominance**, where dominance by only a few species is indicative of lower quality stream;

7. **NCO (Non-Chironomidae and Oligochaeta) Richness**, where dominance by these pollutant-tolerant taxa is indicative of a lower quality stream; and

8. **Nutrient Biotic Index (NBI),** which considers the tolerance of individual organisms to phosphorus and nitrate, and a higher number of phosphorus- or nitrate-tolerant organisms is indicative nutrient enrichment (i.e., agricultural impacts).

Consistent with NYSDEC (2018) guidance, five of the above numeric expressions of community structure (SPP, EPT, HBI, PMA, and NBI-phosphorous) will be normalized to a common sale and averaged to calculate a Biological Assessment Profile for each sampling station. The normalized results range from 0 to 10, where 0 indicates very poor water quality and 10 indicates very good water quality. Under the Stream Biomonitoring program, these absolute scores are interpreted as: 0 to 2.5 is a severely impacted stream; 2.5 to 5 is moderately impacted stream; 5 to 7.5 is a slightly impacted stream; and 7.5 to 10 is a non-impacted stream. These absolute rankings will be presented in the SRA Report; however, individual metrics and normalized averages will also be interpreted relative to a reference creek.

2.2.6 Step IIC Evaluation of Upper Trophic Level Risks

Potential risks to wildlife (birds and mammals) that may forage in the Study Area and livestock that may consume feedstock grown in the study area will be evaluated using food chain models. Food chain models estimate the dose of COCs to wildlife receptors by combining measured COC concentrations in environmental media with receptor-specific life history data. The estimated average dietary dose (ADD) is compared to a dietary effect level (toxicity reference value; TRV) to yield a quantitative estimate of risk, expressed as a hazard quotient (HQ), as follows:

$$HQ = \frac{ADD}{TRV}$$

The general equation for quantifying avian and mammalian dietary ADDs is as follows;

$$ADD = \frac{[(EPC_{sed} \times DFI_{dw} \times F_{sed}) + (EPC_{diet} \times DFI_{ww} \times F_{diet})]}{BW} \times AUF$$

where:

- EPC_{sed} = Exposure point concentration, sediment (mg/kg – dry weight [dw])
- DFI_{dw} = Daily food intake (kg/day, dw)
- F_{sed} = Incidental ingestion of sediment expressed as a fraction of diet (unitless)
- EPC_{diet} = Exposure point concentration, diet (mg/kg, wet weight [ww])
- DFI_{ww} = Daily food intake (kg/day, ww)
- F_{diet} = Fraction of diet for a given food/prey item (unitless)
- AUF = Area use factor (unitless)
- BW = Receptor body weight (kg)

Livestock (cattle) and two piscivorous wildlife species (one bird and one mammal) will be evaluated using food chain modeling. Wildlife species will be selected based on the findings of the habitat characterization and discussed with NYSDEC. Exposure point concentrations used in the food chain models will be measured COC concentrations in surficial sediment and/or overbank soil, and forage fish tissue (whole body). Exposure assumptions will be primarily obtained from the EPA's, *Wildlife Exposure Factors Handbook* (EPA, 1993).

No effect and low effect dietary TRVs will be identified for each assessment endpoint to provide a bounded estimate of potential risks. No effect benchmarks correspond to a no observed adverse effect level (NOAEL), which is the highest dose at which no adverse effects are exposed to occur. A receptor could be exposed at a level that exceeds the NOAEL and still not experience an adverse effect; thus, NOAELs are conservative and have the potential to overestimate risk. Low effect benchmarks correspond to a lowest observed adverse effect level (LOAEL), which adverse effects have been detected. While typically less conservative than NOAELs, LOAELs are generally more representative of natural toxicological response with meaningful ecological ramifications NOAEL TRVs will be primarily obtained from the EPA's Ecological Soil Screening Level (Eco-SSL) documents, which have developed NOAEL TRVs for both birds and mammals based on a review of a large number of toxicological studies. Eco-SSL TRV will be supplemented with TRVs from the primary literature.

2.3 <u>HHEA Work Plan</u>

2.3.1 HHEA Process

The human health assessment will qualitatively evaluate hypothetical human exposure scenarios for Coldbrook Creek in-stream sediment and overbank soil. The HHEA also includes a comparison of Study Area sediment and overbanks soil analytical results to NYSDEC (2010) unrestricted use and residential SCOs and a risk-based evaluation of fish filet analytical results.

2.3.2 HHRA Objectives and Approach

The overall purposes of the qualitative HHEA is to evaluate and document how people might be exposed to COCs, and to identify and characterize the potentially exposed populations now and under the reasonably anticipated future use of the Study Area.

2.3.3 Preliminary Human Health Conceptual Site Model

Per Appendix 3B of the NYSDEC Division of Environmental Remediation (DER)-10 Technical Guidance (NYSDEC, 2010), the HHEA must evaluate the following five elements:

- a description of constituent source(s) including the location of the release to the environment or, if the original source is unknown, a description of the nature and extent of constituents in the environmental medium at the point of exposure;
- an explanation of the constituent release and transport mechanisms to the exposed population;

- identification of all potential exposure point(s) where actual or potential human contact with the media of interest may occur;
- description(s) of the route(s) of exposure; and
- a characterization of the receptor populations who may be exposed to constituents at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway are documented; a potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway is not known. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and can reasonably be anticipated to never exist in the future. The five CSM elements are described in greater detail below.

2.3.3.1 Sources and Transport Mechanisms

As described in Section 1.2, the Site is located at 1051 South Main Street in Elmira, New York. The Site is a 0.28-acre rectangular area (**Figure 2**). An 8- to 12-foot diameter Site Culvert extends east-northeast from a former holding pond (immediately to the east and adjacent to the Site), beneath a railroad line owned by Norfolk Southern, and discharges into a Drainage Swale that traverses through a 3.5-acre Wetland Area before discharging to Coldbrook Creek at the northern and southern outfall locations. Coldbrook Creek flows southeast for approximately 2.6 miles where it forms a confluence with the Chemung River.

The Site headwaters were used for industrial discharge since as early as the 1930s when the holding pond and Site Culvert were constructed by Morrow Manufacturing (Dames and Moore, 1988). Remington Rand occupied the property between 1936 and 1972. Industrial wastewater discharges from the Remington Rand facility contained arsenic, cadmium, chromium, copper, lead, mercury, nickel, silver, zinc and cyanide as well as other (oil, solvent, paint) metal finishing wastes and sludges (industrial waste/Lancy operations). Based on a 1967 waste treatment proposal by Lancy, metal finishing waste flow from Remington Rand was 250 gallons per min over a 16-hour operational day. Waste flow during other operational periods is not documented. According to the 1958 Industrial Report, plating waste, cooling water, blowdown water from the boiler and drainage for plating and oil storage were discharged to the Site Culvert. Three oil skimmers were also connected to the Site Culvert. A man-made drainage feature known as Miller Pond located approximately 800 ft to the northeast of the Site was added in the early 1940s to accommodate stormwater from residential development in that area. Since that time Miller Pond and its drainage area contribute headwaters to Coldbrook Creek.

Currently, the Site Culvert receives stormwater runoff from the City of Elmira/Town of Southport, which is pumped from a drainage basin in the STCC building. The Site Culvert remains connected to the former Remington Rand industrial sewer lines and also receives stormwater runoff from the STCC and the Elmira High School properties. Coldbrook Creek continues to receive flow from the Miller Pond outfall located approximately 550 ft upstream from the northern outfall (0.0 ft). The former industrial infrastructure and marsh sediments also remain a potential source of contaminants to Coldbrook Creek. Elevated levels of metals (cadmium, chromium, copper, lead, nickel, and zinc) consistent with headwater marsh (source) have been documented in Coldbrook Creek Stage 3b and 3c sampling (CBC-3000 to CBC-8500).

Once deposited in sediment, constituents may remain adsorbed as part of bottom or suspended sediments or desorb into the water column. Hydrophobic chemicals, such as PCBs, tend to adsorb to the organic fraction and fine-grained sediment particles. The primary metals detected in sediment are not highly soluble in water and, therefore, will also likely bind to sediments. Thus, both PCBs and metals are likely to be adsorbed to sediment rather than dissolved in the water column. As a result, data on sediment physical characteristics (e.g., TOC) and areas of sediment deposition can describe the physical transport methods.

Sediments containing bound chemicals may also be physically transported downstream via surface water flow or transported to overbank areas during flooding events.

Although biological degradation of PCBs is possible, PCBs typically persist in the environment for long periods of time. Because metals do not readily degrade, they are also likely to persist in the environment.

2.3.3.2 Human Exposure Points, Receptors, and Routes

Coldbrook Creek traverses a developed area that includes properties zoned for and that appear to have rural residential and agricultural uses as well as at least one property (the Hurley property) that appears to have a commercial use based on the stockpiles of construction and other debris. Therefore, potential receptors include residents, farmers, and workers. Exposure potential for each group is described below.

The creek is generally too narrow and/or shallow to support boating, canoeing, or swimming. The low water levels, low flow, lack of pools, and limited stream bends are also likely to limit the types, numbers, and size of fish in the creek. However, residents from the surrounding areas may periodically wade into the stream and possibly fish for recreational purposes. Such events are likely to be infrequent but are plausible. Thus, residents may potentially be exposed to Site-related constituents via incidental ingestion of and dermal contact with sediment in Coldbrook Creek. Residents may also potentially be exposed to Site-related constituents via consumption of fish that have bioconcentrated or bioaccumulated constituents from sediment; however, in the recent years of creek sampling, field technicians have not observed fishing in the creek. As noted above, flooding may transport Site-related constituents to overbank soil of the adjacent residential lots. Residents could potentially be directly exposed to constituents in soil via incidental ingestion and dermal contact or indirectly exposed via consumption of livestock or produce that have bioconcentrated/ bioaccumulated Site-related constituents.

Coldbrook Creek traverses through agricultural properties, including a field used for cattle grazing, located east of the creek. In this area, the creek's flow pattern has been modified to create a small ponded area of water. A small number (<4) of beef cattle, raised for personal consumption, are free to enter and drink from this area of ponded water. PCBs potentially present in the overbank soil (due to flooding), sediment, or surface water may be taken up by the cattle and stored in their tissues/fats. Thus, farmers may be exposed to Site-related constituents via consumption of livestock that have bioconcentration/bioaccumulated constituents from Coldbrook Creek. Concerns over this pathway were raised by local farmer as well as the New York State Department of Health (NYSDOH). As such, NYSDEC, NYSDOH, Unisys, and Geosyntec met via teleconference on August 18, 2016 to discuss an appropriate evaluation strategy. On December 5, 2016, Geosyntec, on behalf of Unisys, submitted a Livestock Exposure Work Plan to NYSDEC, which was approved on December 19, 2016. Per the Livestock Exposure Work Plan, Geosyntec retrieved frozen beef samples from a property owner and submitted them to Pace Analytical Laboratory for analysis of PCB Aroclors using EPA Method 8082a. The lab extracted and analyzed the fat portion. PCBs were not detected above the method detection limit (MDL) of 0.342 ppm. The U.S. Food and Drug Administration (FDA) has established an action level of 3 ppm PCB residues in red meat on a fat basis. This sampling effort will be summarized in the SRA and the PCB analytical results discussed.

Finally, Coldbrook Creek traverses under several roads and through several man-made culverts. Thus, it is reasonable to assume that maintenance workers may periodically enter Coldbrook Creek to conduct repairs. Given that Coldbrook Creek is the subject of an environmental investigation, trained personnel involved in field investigations may also access the creek. Workers would potentially be exposed to Site-related constituents via incidental ingestion of and dermal contact with Coldbrook Creek sediment. Aside from maintenance and environmental workers, Unisys is not aware of other in-water work along Coldbrook Creek. SCOs used to evaluate residential receptors are protective of workers.

In summary, there is a potential for receptors along the creek, including farmers, residents, and workers, to be exposed to Site-related constituents in sediment and overbank soil via incidental ingestion and dermal contact. Receptors that consume fish from the creek could be indirectly exposed to Site-related constituents in fish tissue, if bioaccumulation is occurring. Additionally, if sediment or overbank soil are used for growing produce or raising livestock and bioaccumulative constituents are present, there is a potential for receptors that consume these foods to be indirectly exposed to Site-related constituents.

2.3.4 HHEA Study Design

Given that potentially complete exposure pathways were identified for human receptors exposed to Coldbrook Creek sediment and overbank soil, additional evaluation of exposure potential is proposed. The evaluation methods are presented below.

2.3.4.1 Sediment

As described in Section 1.4, the existing Coldbrook Creek sediment data collected between 2011 and 2015 consists of 203 samples (147 within the top 1 ft bsi) predominantly collected from a series of transects situated perpendicular to the creek channel. In the Phase I and II sampling events (2011 and 2012), composite samples consisting of sediment from the left bank, right bank, and channel center were collected at multiple transects. In the Phase III sampling events (July and October 2015), discrete samples were collected from the centerline, left, and right banks of the creek at multiple transects. Note that left and right banks are defined based on facing downstream such that along most areas of the creek, left refers to the east bank and right refers to the west bank.

The additional investigation scope proposed in this Work Plan includes the collection of sediment samples from multiple depth intervals at 19 transects of Coldbrook Creek and 14 point-locations in the backwater area that corresponds to the former creek alignment. In addition, 40 overbank soil samples are proposed to assess the presence of Site-related constituents in low-lying areas that may be prone to flooding.

For the HHEA, sediment and overbank soil concentrations will be compared to 6 NYCRR Part 375 unrestricted use and residential SCOs.

2.3.4.2 Edible Fish Tissue

The type, number, and size of fish able to inhabit Coldbrook Creek is likely limited by its low water levels, low flow, lack of pools, and limited stream bends. Given these habitat conditions, it is unlikely that fish consumption represents a complete and significant exposure pathway for human receptors. Fishing has never been observed by field technicians involved in sampling Coldbrook Creek. If there is no exposure, there is no risk. Nonetheless, this pathway will be quantitatively evaluated in the SRA using Study Area tissue data.

Although fish tissue data are not currently available to characterize human health risks, sediment concentrations can provide a preliminary indication of risk potential. A PCB sediment concentration 1 ppm has been used as a remedial goal at several Superfund sites where fish consumption is a pathway of concern. Most of these Superfund sites are large, fishable rivers and the assessments assume regular consumption of whole-body fish. Consumption of fish from Coldbrook Creek, if it occurs at all, is likely to be infrequent, and most surficial sediment concentrations are less than 1 ppm. However, there are PCB concentrations greater than 1 ppm near the Site and, thus, uncertainty regarding biouptake and consumption risks. And, as discussed in Section 3.3.4, edible fish tissue will be collected for PCB and TAL metals analysis and used to update or remove the advisory signs. If PCBs are detected in fish tissue, concentrations will be compared to the fish flesh criterion of 0.11 mg/kg (NYSDEC, 2005). If other constituents are detected in fish tissue, risks will be estimated using the following equations:

$$ELCR = \left(IRF \times EF \times ED \times FC \times CF \times \frac{1}{BW} \times \frac{1}{ATC}\right) \times CSF_o$$

$$HQ = \left(IRF \times EF \times ED \times FC \times CF \times \frac{1}{BW} \times \frac{1}{ATN}\right) \div RfD_o$$

Where:

- ELCR = Excess Lifetime Cancer Risk (unitless)
- HQ = Noncancer Hazard Quotient (unitless)
- IRF = Ingestion Rate of Fish (grams/day)
- EF = Exposure Frequency (days/year)
- ED = Exposure Duration (years)
- FC = Fraction of Fish Consumed from Study Area (fraction)
- CF = Conversion Factor (1,000 mg/gram)
- BW = Body Weight (kg)
- ATC = Averaging Time for Carcinogens based on 70-year lifetime (25,550 days)
- ATN = Averaging Time for Noncarcinogens (ED x 365 days/year)
- CSFo = Oral Cancer Slope Factor (1/[mg/kg-day])
- RfDo = Oral Noncancer Reference Dose (mg/kg-day)

Fish consumption rates for recreational scenarios will be obtained from the Exposure Factors Handbook (EPA, 2011), in consideration of the availability of edible fish. Other receptor-specific inputs will be based on EPA default residential assumptions (EPA, 2014), with the total dose adjusted based on a Study Area-specific FC term that will be determined based on fish availability and size and national consumption data. Toxicity values will be obtained from the most recent version of the Regional Screening Level (RSL) Tables (EPA, 2018).

2.3.4.3 Livestock

Unlike for PCBs in sediment, there is limited precedent for setting sediment remediation goals based on livestock consumption. Given the unique nature of this pathway, direct empirical data were developed to address the potential for exposure. Frozen beef samples were collected from the cattle that grazed on property (**Figure 3**) adjacent to Coldbrook Creek. The Work Plan for this sampling and analysis was approved by NYSDEC on December 19, 2016. As discussed in Section 2.3.3, no PCBs were detected above the MDL in a fat sample from the beef, and the MDL was below the FDA's action level. These results will be incorporated into the HHEA section of the SRA Report.

SECTION 3

FIELD INVESTIGATION

3.1 Overview

This section presents the sampling and analysis plan proposed in support of completing the SRA for Coldbrook Creek. This plan describes (i) the rationale for sampling; (ii) the field investigation and sampling strategy, including methods and proposed sampling locations; and (iii) target analytes, analytical methods, and analysis frequency.

3.2 Sampling Rationale

The objective of the Addendum #6 field investigation is to collect sufficient data to complete Step IIC of the FWIA and conduct an HHEA for the Coldbrook Creek Study Area, including the in-stream sediments and overbank soils.

For the FWIA/HHEA, the following additional data collection is proposed:

- stream characterization data to identify the depositional areas of the sediment and flood-prone areas of overbank soil and, in turn, refine (as necessary) the selection of sediment and soil sampling locations;
- habitat characterization data to refine the CSM, identify physical and biological stressors that may also be important determinants for characterizing the overall health of the ecosystem, and support selection of sampling locations within the Study Area and at a comparable reference creek;
- fish tissue chemistry to evaluate potential food-chain risks and hazards to residents (assuming recreational angling) and to piscivorous wildlife;
- overbank soil chemistry samples to characterize the nature and extent of PCBs and TAL metals in flood-prone areas where human activities occur (0 to 2 ft bgs); and
- SQT samples, which consist of the following co-located analyses, to characterize potential risks to benthic receptors (NYSDEC, 2014):
  - sediment chemistry analysis for PCBs and TAL metals (0 to 2 ft bsi);
  - chronic, 28-day sediment toxicity testing for growth and survival using the freshwater amphipod *Hyalella azteca*; and
  - benthic community analysis using kick sampling, laboratory enumeration, and interpretation methods developed by NYSDEC (2018) for stream biomonitoring.

3.3 Field Investigation Methods

This section presents an overview of the procedures for stream and habitat characterization, sediment sampling, overbank soil sampling, biota (fish) sampling, toxicity testing, and benthic community analysis. For all activities, a handheld Trimble GeoXT 5000 global positioning system (GPS) unit will be used to collect horizontal. As discussed below, stream and habitat characterization will be conducted prior to and to inform sediment and overbank soil sampling. Potential sediment and overbank soil sampling locations will be flagged during the stream characterization survey along the western stream bank so as not to disturb sediments within the channel; coordinates will also be loaded into the GPS system to aid in identifying these locations. Flags will be removed once sampling is complete.

Sampling will be conducted in accordance with approved RI/FS Work Plan and supporting plans (Advanced GeoServices. 2010), including the approved Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP). Procedures for sampling, sample handling and analyses and management of investigation-derived materials will be conducted in accordance with the QAPP and FSP. Procedures for quality assurance and quality control for sample collection and analysis will be in accordance with the QAPP. An addendum to the site-specific health and safety plan (HASP) is provided in **Attachment B**.

3.3.1 Stream Characterization

The proposed stream characterization survey will be conducted in May 2019, concurrent with the habitat characterization (Section 3.3.2). The stream characterization will be conducted in general accordance with the Stream Visual Assessment Protocol (SVAP, version 2) developed by the USDA (2009). The SVAP includes a preliminary assessment step, which is a desktop review of regional and local watershed data, and then proceeds to a field assessment step. The field assessment will be conducted by personnel with relevant regional experience. The SVAP guidance includes a standardized form for recording information and data collected during the preliminary and field assessments. This form and relevant scoring charts are included in **Attachment C** of this Work Plan and will be used to document the stream characterization findings and included in the SRA Report. As indicated in **Attachment C**, the SVAP evaluates up to 16 elements, which are summarized below including examples relevant data:

- **Channel condition,** which provides a general overview of the creek, including the shape, elevation, stability, incision, aggradation, width, depth;
- **Hydrologic alteration**, which describes the flow relative to expected natural flow patterns;
- **Bank condition**, which describes observations of potential erosion, stabilizing vegetation, human use effects;
- **Riparian area quantity**, which quantifies the extent of contiguous vegetation;

- **Riparian area quality**, which documents the diversity of vegetation and notes any invasive species;
- **Canopy cover,** which quantifies the aerial extent of the canopy as a percentage;
- **Water appearance,** which describes the clarity, turbidity, and any observed sheens on the water;
- **Nutrient enrichment**, which documents any algae, green-colored water, odor, or other indicators of enrichment;
- **Manure or human waste**, which documents the proximity of livestock and sewage discharges to the creek;
- **Pools**, which describes the number and depth of pools to provide resting, hiding, and feeding habitat for fish;
- **Barriers to aquatic movement,** which identifies barrier such as culverts, weirs, and water withdraws, that may affect movement of aquatic species upstream or downstream;
- **Fish habitat complexity**, which describes the number and quality of features that are desirable to fish, such as pools and cobbles;
- **Aquatic invertebrate habitat**, which describes the number and quality of features that are desirable to invertebrates, such as wood and riffles;
- **Aquatic invertebrate community**, which enumerates the invertebrate taxa present but will be conducted as part of the SQT rather than during the stream characterization survey;
- **Riffle embeddedness**, which is an indicator of siltation; and
- **Salinity**, which is not applicable to the freshwater Coldbrook Creek.

One of the primary goals of this survey is to identify depositional areas within the creek and flood-prone areas along the banks to inform sediment and overbank soil field sampling efforts. However, consistent with the SVAP and as described above, information will also be collected to describe the general stream pattern, channel slope, width to depth ratio, bed material, entrenchment, sinuosity, depth to sediment, sediment thickness, sediment type, and water quality parameters (temperature, pH, dissolved oxygen, etc.). This data can be used to predict future sediment transport capacity which is a critical element to understanding the overall ecological capacity of Coldbrook Creek given its lack of headwaters and continuous suburban and agricultural inputs.

3.3.2 Habitat Characterization

The habitat characterization is proposed to be conducted in June 2019, concurrent with the stream characterization (Section 3.3.1) and prior to the fish, sediment overbank soil, and SQT sampling.

Previous investigations have documented the habitat conditions, including the types of vegetation, land use, and surface water features as well as the presence/absence of wetlands, threatened and endangered species, and critical habitats. To date, however, these habitat characterizations have focused on the Site itself and immediately surrounding areas. Downstream areas of Coldbrook Creek and its in-water habitat have not been characterized. These descriptions are important to completing Step I of the FWIA and necessary for completing Step IIC. Specifically, interpretation of Study Area SQT data collected as part of Step IIC relies upon comparisons to SQT data collected from a reference creek of comparable habitat. Finally, the habitat assessment also is useful for guiding risk management decisions; although the Work Plan elements for evaluating ecological risks are focused on chemical hazards, physical and biological stressors are also important determinants for the overall health of the ecosystem. Information gathered from this reconnaissance will be documented in maps and described in the SRA Report. Species-specific surveys are not proposed as part of habitat characterization at this time; however, relevant observations of species observed will be documented.

Characterization of the creek itself will be conducted by a field biologist/ecologist with relevant regional experience. Consistent with NYSDEC Standard Operating Procedure 208-16, the attributes listed below will be described and scored in support of completing the FWIA. These features are particularly relevant to Step IIC as inadequate habitat conditions can obscure the assessments made regarding the effects of pollution (NYSDEC, 2018).

- **Epifaunal substrate/available cover**, where a greater extent of substrate supporting epifaunal colonization and fish cover (e.g., i.e., stable cobbles, submerged logs, snags) scores higher;
- **Pool substrate characterization**, where a mixture of substrate materials and the presence of root mats and submerged vegetation scores higher;
- **Pool variability**, where the presence of pools of various sizes and depths scores higher;
- **Sediment deposition**, where less deposition of fine-grained material scores higher;
- **Channel flow status**, where water filling more of the available channel scores higher;
- **Channel alteration**, where less channelization, dredging, or other man-made improvements scores higher;
- **Channel sinuosity**, where bends increasing the stream length, relative to if it was straight, score higher;
- **Bank stability**, where stable banks score higher;

- **Vegetative protection**, where the presence of native vegetation along the riparian corridor, rather than maintained or disturbed vegetation, scores higher; and
- **Riparian vegetative width**, where increased width of the riparian zone and an absence of human activities in that zone scores higher.

The full checklist is provided as **Attachment C** of this Work Plan.

3.3.3 Study Area Sediment Sample Collection

Previously collected surficial and shallow sediment sampling locations are shown in **Figures 6A through 6C**. Additional sediment samples are proposed per this Addendum #6 Work Plan to address data gaps, to complete FWIA Step IIC (i.e., SQT sampling), and for delineation. Proposed sampling locations are summarized below and tabulated in **Table 3**. Additionally, proposed sampling stations are overlain on previous PCB and nickel analytical results in **Figures 12A and 12B**, respectively. Note the term "transect sampling," as used in the summary bullets below indicates that a sampling station (e.g., CBC-1800) will be sampled at three locations (left, right, center) and at three depths (0 to 0.5 ft bsi, 0.5 to 1 ft bsi, and 1 to 2 ft bsi, or to refusal). At stations where SQT sampling is proposed, the surficial sediment aliquot for toxicity testing and chemical analysis will be collected from the transect location (left, right, center) with the greatest quantity of depositional material.

- Reach 1 – Upstream of Maple Avenue (~3,000 ft): Transect sampling for sediment chemistry will be conducted at four (4) transects in Reach 1. Sediments will be analyzed for PCBs and TAL metals. Two transects were selected for sampling based on proposed co-location with a fish sampling reach and, for one of these transects, to reduce uncertainties associated with the distribution of metals. Transect CBC-1800 is proposed for sampling to delineate CBC-1770, where the total PCB concentration in the surficial, left sample exceeded the TSCA limit. Additionally, SQT sampling will be conducted at Transect CBC-2430, which was previously sampled for PCBs and classified as Class C based on the surficial concentrations.
- Reach 2 – Maple Avenue to CBC-6750 (~4,300 ft): In this stretch of the creek, transect sampling for sediment chemistry will be conducted at eight (8) transects. Sediments will be analyzed for PCBs and TAL metals. SQT sampling will be conducted at five (5) of these transects within this reach. Transects were selected based on co-location with proposed fish tissue sampling reaches and in consideration of sediment Class designations based on PCBs and COC metals concentrations.
- Reach 3 – CBC-6750 to CBC-12680 (5,930 ft): Beyond CBC-6750, total PCB concentrations are less than the NYSDEC Class A SGV. While PCBs have previously been identified as the sentinel compound for characterizing the extent of Site-related COCs, additional downstream samples to further characterize the nature and extent of TAL metals will be collected. In this stretch of the creek, seven (7) transects will be

sampled for sediment chemistry. SQT sampling will be conducted at four (4) of these transects within this reach. Transects were selected based on co-location with proposed fish tissue sampling reaches and in consideration of sediment Class designations based on PCBs and COC metals concentrations.

- Backwater: Additional samples will be collected from the backwater areas that were formerly part of the oxbow to the Chemung. Based on existing data, PCB concentrations in samples collected nearest Coldbrook Creek are marginally elevated above the Class C SGV. Study Area observations indicate limited flow into the backwater such that substantial sediment transport is unlikely. As such, a phased analysis approach is proposed in which the "A" samples will be analyzed first and, only if necessary, the "B" samples will analyzed. Consistent with previous backwater sampling events, and in consideration of its more ponded (rather than stream-like) nature, backwater sediments will be collected as discrete samples rather than along a transect. Nine (9) "A" locations and five (5) "B" locations are proposed for sediment chemsitry. Three (3) depths will be collected per location (0 to 0.5 ft bsi, 0.5 to 1 ft bsi, and 1 to 2 ft bsi, or to refusal). As shown in **Figures 12A and 12B,** no additional samples are proposed for the "cow pond" area (i.e. near BW-4 through BW-7) or the downstream Reach 3 backwater areas (i.e., near BW-8). SQT sampling will be conducted at two (2) locations within this area.

Depending upon field conditions, sediment may be collected by wading on foot or by use of a small, flat-bottom boat. Consistent with previous sampling events, samples will be collected using a hand-driven acetate macro-core sleeve. Sampling will begin at the farthest downstream location and proceed to each additional upstream location. Each sleeve will be driven approximately 1.5 feet into the stream channel sediment and retrieved by slowly pulling the filled sleeve out at an angle. Upon retrieval of the sleeve, sediment samples will be collected from discrete depth intervals of 0 to 0.5 ft bsi, 0.5 to 1 ft bsi, and 1 to 2 ft bsi. In accordance with the QAPP, each sample will be homogenized, transferred to a properly labeled, laboratory-supplied sample container, and immediately placed on ice for shipment to the fixed-base laboratory for analysis.

Study Area and reference area sediment samples will be analyzed for PCBs and TAL metals. Sample analysis methods are discussed in Section 3.4.

Preliminary sediment sampling locations are shown in **Figure 12A and 12B**; However, as noted in Section 3.3.1, field conditions may require adjustment of sampling locations within the creek. Specifically, field personnel will be instructed to give preference to depositional areas identified by the stream characterization investigation (see Sections 3.3.1 and 3.3.2). Significant modifications to the proposed sampling plan will be communicated to NYSDEC in a timely manner and, if feasible, prior to sampling.

3.3.4 Study Area Overbank Soil Sample Collection

As discussed previously, this Work Plan proposes the collection of soil samples in overbank locations to assess low-lying areas along Coldbrook Creek that may be prone to flooding. Based on flood maps obtained from Chemung County and the USGS, the areas east of the creek (located between Coldbrook Creek and the Chemung River) have the highest potential for flooding. Except for areas immediately adjacent to the creek, there is limited potential for overbank flooding along the west bank within Reaches 1 and 2. Near the transition from Reach 2 to Reach 3, where the creek curves from generally north-to-south flowing to generally west-to-east flowing, the topography flattens and both banks of Coldbrook Creek are described by the USDA as prone to occasional flooding. In this area, the properties are zoned and appear to be used for agricultural purposes and as a riding area for horses kept in stables on the Travers property.

Forty (40) overbank sampling locations are proposed. As shown in Figure 13C, the sampling density is highest in the more upstream areas of the Site, where COC concentrations are also highest.

- Reach 1: Nine (9) overbank soil samples are proposed, four (4) along the left bank and five (5) along the right bank. One left and right bank sample are upstream of Laurentian place, the remainder are proposed between Laurentian Place and Maple Avenue.
- Reach 2/Former Creek Alignment Backwater Area: Eighteen (18) overbank soil samples are proposed, 7 along the left bank and 11 along the right bank. The topography on the left bank at the Hurley property precludes overland deposition and many of the backwater areas are not used for human activities; as such, the sampling density in these areas is lower. A higher density of samples is proposed in the vicinity of residential properties along the right bank.
- Reach 3: Thirteen (13) overbank samples are proposed, seven (7) along the right bank and six (6) along the left bank. Based on field observations, human activities are occurring near the non-agriculturally developed areas of the Travers property and, hence, a higher sampling density is proposed in this area.

Overbank soil samples will be collected from locations approximately 15-20 feet perpendicular to the right and left channel edges to assess horizontal and vertical extent of PCBs and metal COCs in overbank upland areas. Three (3) discrete soil samples will be collected at each soil sampling location from 0 to 0.17 ft (upper 2 inches), 0.5 to 1 ft, and 1 to 2 ft bgs, excluding the vegetative cover in accordance with Section 3.5.1 of DER-10.

Consistent with previous upland soil sampling events, the overbank soil samples will be collected using a hand auger. In accordance with the QAPP, each sample will be homogenized, transferred to a properly labeled, laboratory-supplied sample container, and immediately placed on ice for shipment to the fixed-base laboratory for analysis. Overbank soil samples will be analyzed for PCB Aroclors and TAL metals. Sample analysis methods are discussed in Section 3.4.

3.3.5 Study Area Biota Sampling

The objective of this sampling is to characterize PCB and COC metals concentrations in (i) forage fish that are representative of prey for piscivorous wildlife that may forage in Coldbrook Creek and (ii) larger fish (>6 inches) that are representative of edible species that may be consumed by recreational anglers. Wildlife risks will be integrated with the SQT data to characterize the nature and extent of potential ecological risks. Edible fish tissue risks will be used by NYSDOH to evaluate the need for fish advisories.

3.3.5.1 Fish Sampling Methods

Fish sampling will be conducted in accordance with NYSDEC (2018) guidance. Proposed sampling methods may be adapted in the field; however, based on field reconnaissance, fish will likely be collected using a backpack electro-shocker. Sampling will be conducted using a single pass through each reach, moving downstream to upstream with each pass. Collected fish will be identified to species, counted, weighed to the nearest gram, examined for external anomalies, and kept on ice until all proposed reaches have been sampled. After the final reach is electro-fished, the most common forage and edible species among all sampling reaches will be processed for laboratory analysis. The target sample size for each reach is 10 fish, consisting of five (5) forage and five (5) edible fish samples, where >6 inches is considered edible. If there are no individual species that can complete the sample number requirements, the next most common species will be used to achieve the target sample size for each reach. If individual forage fish specimens do not meet analytical mass requirements, multiple individuals of the same species may be composited into a single sample or other biota, such as crayfish, frogs, or macroinvertebrates may be hand-collected; non-fish data will not be considered relevant for human health endpoints. Fish retained for chemical analysis will be placed directly into clean air-tight Ziploc baggies, labeled, placed in a cooler with dry ice to be shipped to the laboratory. Fish tissue samples will be analyzed for PCB Aroclors, TAL metals, lipid content, and moisture content. Forage fish will be analyzed as whole-body samples. Edible fish will be analyzed as filets. Laboratory analysis methods are discussed in Section 3.4.

3.3.5.2 Fish Sampling Reaches

Sampling reaches (i.e., segments of the creek in which the fish for an individual sample location are to be collected) were selected based on previous sediment chemistry data, preliminary observations of habitat conditions (i.e., areas where fish are most likely to be present), and the potential for ecological and human exposure (i.e., areas where evidence of piscivorous wildlife has been observed or areas accessible to anglers).

Based on previous Study Area reconnaissance, electro-shocking will be conducted in the seven locations listed below and shown in **Figures 12A and 12B**.

- Adjacent to the Site.
- Upstream of Laurentian Place.
- Centered on the 90-degree bend near CBC-3000.
- Centered on the confluence of the former oxbow backwaters with Coldbrook Creek.
- The backwater area that was within the former creek alignment.
- Adjacent to the Travers Property.
- A reference creek (location to be determined).

Consistent with NYSDEC (2018) guidance, the proposed reaches are approximately 20x the stream wetted width, with a minimum length of 75 meters and a maximum of 250 meters. The reaches listed above may be adjusted based on field conditions. Prior to field sampling, the literature will be reviewed to identify expected species such that field sampling methods can be tailored to the Study Area (e.g., based on species' preferred habitats). Information collected during the stream and habitat characterization field event will also be used to optimize tissue sampling.

A reference creek has not been identified for the Study Area. Based on the proposed June 2019 stream and habitat characterization, Unisys will identify up to three candidate reference creeks for consideration by NYSDEC. Maps, photographs, and narrative descriptions of these creeks will be provided to NYSDEC for concurrence.

3.3.6 Sediment Toxicity Testing

A direct means of characterizing the response of benthic invertebrates to cumulative constituent exposure is to employ sediment toxicity testing. Whole sediment toxicity testing is designed to predict whether chemical or physical properties of the sediments may adversely affect benthic or sediment-associated organisms. In a toxicity test, a test organism is exposed to field-collected sediment under controlled laboratory conditions, and specific biological endpoints (e.g., growth) are monitored to assess the response of the test organism to chemical exposure. As the effects assessed are the response of exposure to all constituents present in the sediment sample, whole sediment toxicity testing can be limited in its ability to specifically identify the constituents(s) responsible for the observed effects (if any).

As discussed during the April 3, 2019 teleconference with NYSDEC, toxicity testing will be conducted on Coldbrook Creek sediments using a chronic, 28-day test with the freshwater amphipod *H. azteca*. *H. azteca* is an epibenthic detritus consumer that burrows into surface sediment. This behavior, coupled with the prevalence of this organism in many aquatic ecosystems, and its role as a significant food source for many benthivorous fish species, suggests it is suitable for toxicity testing (Pennak, 1989). Further advantages to conducting toxicity testing with *H. azteca* include: 1) the ready ability to culture them under laboratory conditions; 2) the adoption of standardized methods for both culturing and toxicity testing; 3) the physiological effects defining exposure endpoints (e.g., survival, growth) may be monitored for a range of exposure times; 4) the relative insensitivity of the organism to sediment grain size (Ankley et al., 1994); and 5) the fact that chronic exposures (28 or 42 days) can be used to identify sublethal responses for sediment that may not demonstrate acutely toxicity in shorter duration exposures (<10 days).

Large volume (~4 liters) sediment samples from total of twelve (12) locations in Coldbrook Creek as well as up to eight (8) locations in a reference creek(s) will be collected for toxicity testing as described in Section 3.3.3 and summarized in **Table 3**.

Chronic 28-day toxicity testing for growth and survival with *H. azteca* will be conducted based on Method 100.4 of the *Methods for Measuring the Toxicity and Bioaccumulation of Sediment-Associated Contaminants in Freshwater Invertebrates* (EPA, 2000). Method 100.4 is a 42-day test that measures survival, growth, and reproduction; thus, the primary deviations from the protocol will be the shortened duration and the exclusion of reproduction as a measurement endpoint. The 28-day study duration was selected based on discussions NYSDEC. The table below (adopted from EPA, 2000) summarizes the toxicity testing methods.

Parameter	**Condition or Regimen**
Test Type	whole-sediment toxicity test with renewal of overlying water
Test Duration	28 days
Endpoints Measured	survival and growth
Test Temperature	23 ± 1 degrees centigrade (°C)
Illuminance	about 100 to 1000 lux
Photoperiod	16 hours of light to 8 hours of dark
Test Chamber	300 milliliter (mL) high-form lipless beaker
Test Sediment Volume	100 mL
Overlying Water Volume	175 mL
Renewal of Overlying Water	2 volume additions per day

Parameter	Condition or Regimen
Overlying Water Quality	• hardness – day 0, 28 • alkalinity – day 0, 28 • ammonia – day 0, 28 • conductivity – day 0, 28, and 1x per week • temperature – daily • dissolved oxygen (DO) – day 0 and 28, and 3x per week • pH – day 0 and 28, and 3x per week
Age of Organism	7 to 8 days old at the start of test
Organisms per Chamber	10
Number of Replicates	8
Feeding	1.0 mL of yeast/trout chow/alfalfa suspension daily
Aeration	none, unless overlying water DO <2.5 mg/L *increase monitoring if DO drops more than 1 mg/L
Test Acceptability	Minimum mean control survival ≥ 80% on day 28; and Measurable growth of control test organisms (surviving adults)

3.3.7 Benthic Community Analysis

Benthic community structure analysis evaluates potential adverse effects of site-related constituents at the community level rather than organism-level effects. The use of this endpoint is consistent with EPA (2003) opinion that community-level assessment endpoints are more clearly linked to management goals than are organism-level assessment endpoints. Whereas community-level attributes can be more challenging to measure than organism-specific attributes, this complication is readily addressed through use of appropriate sampling density, adherence to consistent sampling conditions, and selection of an appropriate reference creek(s).

Benthic macroinvertebrate community samples will be co-located with the sediment samples for the *H. azteca* toxicity testing described in Section 3.3.6. Thus, samples are proposed at 12 Coldbrook Creek locations, and up to eight (8) locations in a reference creek(s).

Macroinvertebrates will be collected using kick sampling, which entails disturbing the bottom sediments and catching the dislodged organisms downstream with an aquatic net (9” x 18” net with 0.8 millimeter [mm] x 0.9 mm opening). Consistent with SOP-208-18, kick sampling at each location will be conducted for five (5) minutes for a distance of five (5) meters, preferably along a diagonal transect of the stream. The contents of the net will be emptied into a pan, sieved with a no. 25 standard sieve, and transferred to a quart jar and preserved by adding 95% ethyl alcohol. Subsampling and organism enumeration will be conducted in the laboratory in accordance with SOP-208-18.

3.4 Chemical Analysis

Laboratory analysis will be performed on sediment, overbank soil, and fish tissue samples by TestAmerica. Analysis methods are as follows:

- PCB Aroclors in sediment, overbank soil, and fish tissue: EPA Method 8082A
- TAL Metals in sediment, overbank soil, and fish tissue: EPA Method 6010C and, for mercury, EPA Method 7471A; and
- Total organic carbon (TOC) in sediment: Lloyd Kahn Method.
- Grain size in SQT sediment samples: sieve and hydrometer

Note that edible fish samples will be fileted by the laboratory in accordance with NYSDEC recommendations[7]. The laboratory will be instructed to thoroughly homogenize both whole body forage fish and edible filet samples prior to chemical analysis. Moisture and lipid content of each fish sample will also be measured. In addition, the laboratory will follow the quality assurance/quality control, holding time, and reporting requirements as defined in the NYSDEC Analytical Services Protocol of June 2000. Laboratory analytical data will be reported using Category B deliverables and the standard electronic data deliverable.

3.5 Data Usability

Analytical data packages generated by TestAmerica will be validated by Geosyntec. Analytical data packages will be reviewed for completeness, field and laboratory quality control sample results will be evaluated, significant laboratory control problems will be assessed, and data qualifiers will be assigned.

[7] https://www.youtube.com/watch?v=HYMgXRCGSi4&feature=youtu.be

SECTION 4

SCHEDULE AND DELIVERABLES

A preliminary project schedule is presented in **Figure 14** and summarized below. A formal schedule will be provided to NYSDEC upon approval of this Work Plan. Unisys would like to commence the field activities described herein no later than June 2019, weather permitting.

- Work Plan Addendum #6 Submittal – May 2019
- Stream and Habitat Characterization – May-June 2019
- Field Sampling, including SQT sampling – June 2019
- Present SQT findings to NYSDEC – August 2019
- Supplemental Field Sampling, including SQT sampling (if necessary) – September 2019
- Submit Recommendations for Fish Advisories to NYSDEC/NYSDOH – November 2019
- Agency review draft SRA Report Submittal to NYSDEC – March 2020
- Agency review draft RI Report to NYSDEC – March 2020

The SRA Report will present the methods and results of the investigations and evaluations described in this Addendum. The SRA Report will be prepared as a companion document to the RI Report. As with previous submittals, the SRA Report will be submitted to NYSDEC with final version copies issued to the document repository at the Central Library (Elmira) of the Chemung County Library District (formerly Steele Memorial Library) in Elmira, New York in accordance with the Citizen Participation Plan. Electronic submittals will be complete in accordance with the NYSDEC electronic documents system (eDocs) requirements effective October 3, 2005.

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SECTION 5

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