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# Revised, Supplemental Remedial Investigation Report

## Former Nepera Harriman Site

## Harriman, New York

**November 2014**
**Revised August 2016**

**Prepared for:**
**Nepera, Inc. and**
**Warner-Lambert Company**

**Corporate Defendants**

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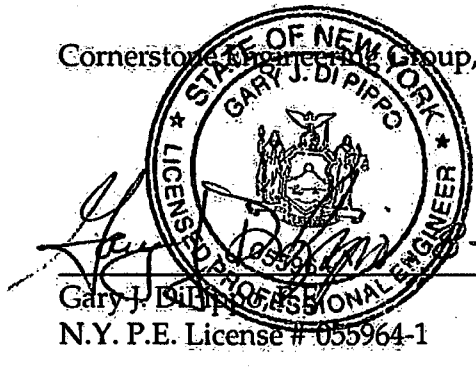
# REPORT CERTIFICATION

**Revised, Supplemental Remedial Investigation Report**

**Former Nepera Harriman Site**
**Harriman, New York**

The material and data in this report were prepared under the supervision and direction of the undersigned.

Cornerstone Engineering Group, LLC




9-22-16

Gary J. DiPippo, P.E.
N.Y. P.E. License # 055964-1

*I, Gary J. DiPippo,* certify that I am currently a NYS registered professional engineer and that this Report was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that activities were performed in full accordance with the DER-approved work plan and DER-approved modifications.

Timothy R. Roeper, PG
Client Manager II

*I, Timothy Roeper,* certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Report was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that activities were performed in full accordance with the DER-approved work plan and DER-approved modifications.

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# 1 INTRODUCTION

## 1.1 Background

The following report presents the results of a Supplemental Remedial Investigation (SRI) completed at the former Nepera Harriman Site (Site) in Harriman, New York. The work was conducted pursuant to the January 24, 2014 Stipulation and Order that was entered into by Nepera, Inc. and Warner-Lambert Company (Corporate Defendants) with the New York State Department of Environmental Conservation (NYSDEC), and the June 2014 Supplemental Remedial Investigation/Feasibility Study Work Plan prepared by Cornerstone Engineering and Land Surveying, PLLC and approved by the NYSDEC by letter dated June 3, 2014.

Appendix B to the Stipulation and Order, and the approved Work Plan, among other things, called for the following activities:

- Additional investigation of surface water and sediments in the West Branch of the Ramapo River in the Site vicinity;
- Additional investigation of the soils on the stream banks of the West Branch of the Ramapo River in the Site vicinity;
- Additional investigation of the soils around the lagoon at the Site (referred to as the State Pollutant Discharge Elimination System (SPDES) lagoon, permitted by the NYSDEC for the current property owner - ELT Harriman);
- Completion of the off-site surficial soils investigation previously started by ELT Harriman's consultant, Brown and Caldwell, on properties for which access had not previously been granted;
- A feasibility study of remedial alternatives for the Parking Lot area (submitted under separate cover).

This Supplemental RI Report was originally issued in November 2014, and at the time it was issued access to the off-site investigation area to the north had not been granted by the adjacent property owner. The NYSDEC assisted with site access which was granted by the off-site property owner on June 9, 2015, and the off-site investigation to the north was completed on June 25, 2015. The NYSDEC in its letter of April 6, 2015, requested that the additional investigation be reported as an addendum to this report. The report of the investigation of the off-site property to the north is provided as Addendum No. 1 to this Revised, Supplemental Remedial Investigation Report, and is attached as Appendix F.

In addition, in its April 6, 2015 letter commenting on the November 2014 Supplemental RI Report, the NYSDEC requested additional sampling in the West Branch of the Ramapo River, beyond the scope of the Stipulation and Order. Through a meeting on May 20, 2015, and

subsequent correspondence and site reconnaissance, the Corporate Defendants agreed to voluntarily perform additional downstream sediments sampling in the West Branch of the Ramapo River. The process of agreeing on and the results of the additional sediment sampling are described in Addendum No. 2 to the Revised, Supplemental Remedial Investigation Report, provided as Appendix G. After submitting the results of the additional sediment sampling, the NYSDEC issued letters dated June 7, 2016 and June 24, 2016, directing the Corporate Defendants to revise the Supplemental RI Report and the Parking Lot Feasibility Study required by the Stipulation and Order. The Corporate Defendants responded in letters dated June 14, 2016 and July 8, 2016, and this Revised, Supplemental RI Report reflects the Corporate Defendants June 14 and July 8 correspondence.

Last, this Revised, Supplemental RI Report addresses the comments in the NYSDEC's April 6, 2015 letter.

Sections 2 and 3 below provide a summary of the site operational history, hydrogeology, and previous investigations completed at the site and detailed in previously submitted and referenced documents. Work completed as part of the Supplemental RI is then discussed in Section 4 followed by a Qualitative Human Health Exposure Assessment (QEA) and Fish and Wildlife Resource Impact Assessment (FWRIA) in Sections 5 and 6, respectively. Section 7 discusses the collected data as it relates to the SRI project goals and data quality objectives, followed by a summary of findings and conclusions in Section 8.

# 2 SITE DESCRIPTION AND HISTORY

## 2.1 Site Description

The Former Nepera Harriman Site is located in the Village of Harriman, Orange County, New York (Figure 1-1 Site Location Map). The southwest portion of the Site is located in the Town of Monroe. The boundaries of the Site include: NYS Route 17 to the northwest, the West Branch of the Ramapo River to the northeast, and an undeveloped parcel of land (the "Avon Parcel") to the south, currently owned by ELT Harriman. The Site encompasses approximately 28 acres and consists of two general areas: (1) approximately 10 acres located to the northeast of Arden House Road, on which the former administrative offices, a parking lot, and the former wastewater, now SPDES lagoon are located, and (2) approximately 18 acres to the southwest of Arden House Road, on which the former manufacturing facilities were located.

## 2.2 Site Historical Information

The Former Nepera Harriman Site is currently owned by ELT Harriman. Briefly, the Site was previously used to manufacture fine and bulk pharmaceutical chemicals from 1942 to 2005. During the period 1945 through 2005 chemical by-products were incinerated on the Site, initially through open pit burning and subsequently in a RCRA Part B permitted incinerator. The on-site incinerator was shut down in 2005. Calcium sulfate material, used as part of the manufacturing processes, was disposed of in the northwestern portion of the Site that now includes the former administration building and the Parking Lot area (See Figure 1-2). Drums were buried in areas near former Buildings 67 and 75, and proximate to the southern boundary of the Site (Area F). These drums were subsequently removed in the mid-1980s. As part of the remedy selected in the Record of Decision (ROD) under the NYSDEC Inactive Hazardous Waste Disposal Site (State Superfund) program (Site No. 336006), additional soil source material and drum fragments were removed from Area F and near former Building 53. In addition, Oxygen Release Compound (ORC) was injected within both Area F and near Building 53 to treat remaining contamination in soil beneath the water table. Surface soil was also removed from Area K (the Avon Parcel). Groundwater impacts were addressed through operation of a groundwater extraction and treatment system and a biosparge system, both of which have been shut-down with approval from NYSDEC.

The former wastewater (SPDES) lagoon was constructed in the 1960s, southeast of the parking lot area. The SPDES lagoon is reportedly lined with compacted clay and has a storage capacity of 5.5 million gallons. The SPDES lagoon had served as a settling pond for aluminum hydroxide and magnesium silicate precipitates generated during the manufacturing process. Additionally, wastewater consisting of boiler blowdown, and non-contact cooling water, storm water runoff and treated groundwater, were also discharged to the SPDES lagoon prior to the plant shutdown. The SPDES lagoon currently stores stormwater runoff and discharges to the West Branch of the Ramapo River under a SPDES permit. The original SPDES permit expired in 2010, and the current property owner, ELT

Harriman, applied for a new SPDES permit which was subsequently issued on August 26, 2011.

Additional details regarding the site history can be found within the "Remedial Investigation - Harriman Site" (RI Report) (Conestoga-Rovers & Associates, July 1995), in the Record of Decision (ROD) issued by the NYSDEC in March 1997, and in the Site-Wide Characterization Summary Report (CSR) (Brown and Caldwell Associates and Cornerstone Engineering and Land Surveying, PLLC, March 2011).

## 2.3 Regional and Site Geology and Hydrology

### 2.3.1 Geology

As presented in the May 16, 2008 document titled Conceptual Site Model and Supplemental Remedial Action Work Plan (HydroQual, May 2008), the Site is underlain by a layer of fill material overlying a complex sequence of glacially derived clay, silt, sand and gravel. Near surface, immediately underlying any fill material, is a fine grained Clay and Sllt with interbedded, discontinuous layers of Silt and fine Sand. This fine grained unit represents a glacial lacustrine or lake deposit that is present throughout the entire Site with the exception of the area near PZ-1 near the west-central portion of the Site. Underlying the Clay and Silt deposits is a glacial outwash or stream deposit that varies across the Site from fine to coarse Sand. Generally speaking, the sand is finer near the southeast end of the Site and coarser and thicker near the central portion. Also within the central portion of the Site, the coarse Sand deposits immediately overlie bedrock. Within the northeast side of the Site, the glacial lacustrine and glacial outwash deposits are underlain by a kame or esker deposit which is characterized by a mix of clay, silt, sand and gravel that is weakly cemented. Glacial till, consisting of a dense silt and clay matrix with lesser amounts of sand and gravel, is present intermittently at various locations immediately overlying bedrock. The entire Site is underlain by fractured dolomite bedrock.

Conceptually, the depositional history can be envisioned as glacial ice moving southward across the region while depositing the glacial till. As the glaciers melted, fast moving water carrying sand and gravel eroded channels into the glacial till, with the deepest channels cutting completely through the glacial till to the underlying bedrock. As the melt waters subsided, the coarse sand carried by these melt water streams fell out of suspension and was deposited within these channels. Over the course of multiple thaw and melt cycles, the melt water would overflow the banks of these channels, and fine sands and silts suspended in the water were deposited along the banks. The thicker glacial outwash deposits underlying the central portion of the Site represents the channel cut into the underlying glacial till by the glacial melt water. Likewise, the observed finer grained sands represent materials deposited to the sides of the channel. The edges of the channel are where the coarse sand deposits abruptly intersect the glacial till deposits between wells R-3D and MW-27D.

The kame deposits, comprised of an unsorted mix of silt, sand and gravel, represent localized deposition of materials immediately adjacent to the edge of a glacier. Finally, as the glaciers

retreated farther to the north, the area was repeatedly flooded by glacial lakes which deposited the fine grained clay and silt deposits that are present over the majority of the Site.

### 2.3.2 Hydrology

The Site location is within the Hudson Highlands portion of the New England physiographic province within a northwest trending glacial valley. The Site is situated within the northeastern limit of a 6,600- acre drainage basin which drains into the West Branch of the Ramapo River. A portion of the Site is within the 100-year floodplain. Surrounding the Site are two ridges, one to the southwest and one to the northeast. A third ridge to the southeast forms the southern hydrologic boundary of the valley. These ridges control surface water and groundwater flow in the valley. The entire drainage basins of both the West and Main Branches of the Ramapo River extend from the northwest and north-northeast directions and converge east of the Site. Groundwater and surface water flow to the southeast and exit the valley to the south where the West Branch of the Ramapo River joins the Main Branch of the Ramapo River. The Ramapo River then flows southwesterly into northern New Jersey.

The topographic relief of the Site is very low, ranging from 515 to 535 feet above mean sea level (msl). Surface drainage of the Site has been altered from its natural flow pattern by plant expansion throughout its operation. The importation of permeable fill materials, the presence of impervious surfaces such as roadways and buildings, and the modification to the natural terrain contribute to the present drainage pattern. Stormwater runoff from precipitation generally flows over the road surfaces in a northerly direction toward Arden House Road or east toward the open field and the West Branch of the Ramapo River. Storm drains intercept a portion of the surface runoff on Site and channel it through the SPDES lagoon and ultimately into the river. Drainage is also directed into storm drains near former Building 1 (in the southwestern corner of the property) and across Arden House Road west of the SPDES lagoon.

The Avon Parcel located southeast of the Site is poorly drained and swampy. Evidence of drainage from the southwestern portion of the Site into the Avon Parcel was observed at the southernmost corner of the Site. The stormwater in this area ultimately empties into drainage ditches in the Avon Parcel.

An analysis of water level measurements on both sides of the river found that the West Branch of the Ramapo River, adjacent to the Site, is characterized as both a gaining and losing stream. Groundwater is discharging to the stream along the western portion of the Site, while along the eastern portion of the Site, the stream is losing water to the aquifer. This is a result of the discharge of treated water from the Orange County Sanitation District (OCSD) #1 wastewater treatment plant.

# 3 RESULTS OF PRIOR INVESTIGATIONS

## 3.1 Previous Investigations

As a result of past Site investigations (described below), the nature and extent of contamination at the Site has been extensively evaluated. A detailed summary of the investigations at the Site is presented in the Site-Wide CSR, (Brown and Caldwell and Cornerstone 2011). The following is a summary of previous investigations, presented by area and media, as they relate to the elements of the supplemental work.

### 3.1.1 West Branch of Ramapo River

The West Branch of the Ramapo River borders the northern limit of the Site, and the riverbank has been the subject of various investigations and interim remedial measures (IRMs) at NYSDEC's request.

Surface water and sediment sampling was conducted in the West Branch of the Ramapo River as part of Remedial Investigation (RI) activities (Remedial Investigation/Feasibility Study - Harriman Site, Village of Harriman, Orange County, New York, Conestoga-Rovers Associates, July, 1995). Sampling results indicated that there was no measurable impact from Site compounds of concern (COCs) on water quality within the West Branch of the Ramapo River, as discussed below.

#### 3.1.1.1 Surface Water

Prior investigation of the surface water within the West Branch of the Ramapo River indicates that the upstream concentrations of VOCs, SVOCs and metals are very similar to the downstream concentrations. Data specific to mercury collected during the 1995 RI reported non-detectable concentrations at all sampling locations within the River. Additional work conducted by the NYSDEC in 1995, which used an analytical method for mercury capable of achieving lower detection limits (approximately 1 ppt as compared to 200 ppt during the RI) reported mercury concentrations ranging from 4.66 ppt to 140 ppt. With one exception, the surface water concentrations were within a rather narrow range of 4.66 to 12.5 ppt. Given the current standards, criteria and guidance (SCG) of 0.7 ppt for mercury in surface water, both the background (up-gradient) and down-gradient concentrations found during the 1995 sampling exceed the current SCG, although the down-gradient samples were only marginally higher.

Mercury

A Fish Study of the West Branch of the Ramapo River was also conducted by the NYSDEC, near Harriman, New York in June/July 2001 that included surface water and sediment samples. This study was focused on mercury. The purpose of the study was to assess potential sources contributing mercury to the River, including the OCSD #1 outfall and the former Nepera Site. The results of the fish tissue testing did not indicate levels above the fish consumption advisory level of 1,000 ng/g. Also, all of the concentrations found were well below the current groundwater quality standard for mercury of 700 ppt, and well below the

MCL of 2 ppb (2,000 ppt). The NYSDEC also concluded that while there were no substantial differences in mercury concentrations between up- and down-stream locations (surface water results were within a narrow range of 1.4 to 4.36 ppt), there was insufficient information regarding the downstream mercury levels (e.g., at Sloatsburg) to assess whether the OCSD outfalls, the Site, or other environmental factors were the cause.

Most notably, these data were collected prior to completion of the IRM activities to prevent potential erosion of calcium sulfate containing mercury into the river, while the pumping from the groundwater extraction and treatment system was discharging to surface water, and while the plant was still operating. In comparison to current conditions, the sampling results represent a scenario more likely to result in concentrations of mercury above standards, yet none of the reported concentrations exceeded the ROD-specified SCG of 200 ppt. The data indicated that the potential source of mercury transport from the Site to the river is related to the potential erosion of calcium sulfate at the river bank. Interim measures to control erosion are in place and are inspected quarterly and repaired as necessary.

### 3.1.1.2 Sediment/Soil

The sediment sample results from the July 1995 RI indicate that background concentrations of VOCs, SVOCs, tentatively identified compounds (TICs), pesticides/PCBs and inorganics are generally comparable to and mostly higher than the downstream sample results. Mercury was detected in the sediment in the upstream location at similar, although slightly lower concentrations than those found in the downstream locations. None of the sediment samples from the West Branch of the Ramapo River exceeded the SCG for mercury as presented in the ROD.

As a part of the NYSDEC's supplementary investigation of the river in 2001, additional sediment samples were collected for mercury analysis. These results ranged from 11.2 to 824 ppb and suggested that some localized influence on mercury concentrations may be associated with the Site, although all of the values were below the NYSDEC's ROD prescribed SCG. As described previously, the mercury contributions to sediment from the Site would most likely have been in the form of sediment transport due to erosion of calcium sulfate along the stream bank (due to the absence of dissolved phase mercury transport as evidenced by concentrations of mercury in groundwater being generally below the groundwater quality standard). At the time this study was conducted, erosion control measures had not been implemented.

Since that time, an effective erosion control IRM has been constructed on the stream bank thereby controlling the potential for erosion of mercury containing calcium sulfate material which exists along the stream bank in the area of the parking lot. The NYSDEC's fish study referenced above, concluded that a fish advisory associated with mercury is not necessary, thereby also indicating that, to the extent mercury is present in sediments, it is not propagating through the food chain at levels of concern for fish consumption, although the NYSDEC in a Fact Sheet stated that the fish study indicated a potential risk to birds and wildlife using the river although the NYSDEC also stated "there is not enough information

to tell whether the higher concentrations at the Sloatsburg location [note this location is 11 miles downstream of the Site] are related to the OCSD or the Nepera Chemical plant, or some other environmental factor." During the fish study, the NYSDEC also collected two sediment samples adjacent to the Site and the results were 0.0916 and 0.175 mg/kg.

A test pit investigation program was completed, in September 2005, between NYS Route 17 and the eastern edge of the parking lot area and immediately south of the West Branch of the Ramapo River. The resulting data were used to quantify the volume and delineate the extent of the calcium sulfate material adjacent to the riverbank.

### 3.1.2 SPDES Lagoon

SPDES Lagoon solids samples collected during the RCRA Facility Investigation (RFI) indicated low levels of polynuclear aromatic hydrocarbons (PAHs), and metals. As reported in the RCRA Facility Investigation (RFI) Report (Brown and Caldwell, 2007) low levels of some other Semi-Volatile Organic Compounds (SVOCs) and metals were also detected. No Volatile Organic Compounds (VOCs) or Polychlorinated Biphenyls (PCBs) were detected, and none of the SPDES lagoon solids samples were characterized as hazardous waste. Four SPDES lagoon solids samples were collected from the SPDES lagoon as a part of the Pollutant Minimization Plan work (2002) and analyzed for mercury, the results of which are discussed further below.

A composite water sample collected from the SPDES lagoon during the RI (Conestoga-Rovers Associates, July, 1995), indicated low concentrations of the VOCs acetone and toluene; and detections of various inorganic constituents with concentrations below USEPA and NYSDEC Ambient Water Quality Criteria. There were no detections of SVOCs, pesticides or PCBs.

### 3.1.3 Off-site Soil

A soils investigation of the Mary Harriman Park, located northwest of the Site, across NY Route 17, was conducted by NYSDEC in February through March 2000, to assess whether there were drums possibly buried beneath the area that is now the park's baseball fields. The results of the investigation confirmed that drums were not buried on the property now occupied by the park.

Off-site soil sampling was also conducted as part of a Supplemental RCRA RFI in June 2008 (Brown and Caldwell), in accordance with the NYSDEC-approved Phase II (Supplemental) RFI Work Plan, at adjacent properties to the east of the Site, namely the Avon Parcel and the Village of Harriman property, including the above-noted baseball fields. Samples were collected from the 0-2" and 2"-24" depth intervals for each of the off-site locations. In addition, at the sample locations adjacent to the ballfield property, SB-15 and SB-16, a sample was collected at an additional depth interval of 5 to 6 feet. Off-site soil samples results indicated low mercury concentrations. All detections of mercury in off-site soil samples were below the Commercial and Industrial Soil Cleanup Objectives (SCOs), and PCBs were non-detect. The mercury results on the ballfield property in two instances (SB-15 in the 2"-24" depth sample, and SB-16 in the 0-2" depth sample) were nominally greater than the Restricted

Residential SCO of 0.81 mg/kg (at concentrations of 1.01 and 0.989 mg/kg, respectively). However, the Restricted Residential SCO is based on the presence of elemental mercury and the assumption of inhalation of mercury vapor, whereas the predominant forms of mercury associated with the Site are complexed and minerally-bound forms (e.g., mercury salts), for which the Restricted Residential SCO would be 5.8 mg/kg, which is well above the reported concentrations.

Due to a lack of property access at the time, data gaps remained for off-site soils on properties across the West Branch of the Ramapo River, and at the property situated on the other side of the railroad, to the south and southwest of the Site. Samples from the off-site property across the West Branch of the Ramapo River could not be collected during the Supplemental RFI activities, but samples from the property south of the railroad were collected during activities associated with this Supplemental RI and are discussed subsequently and samples were collected off-site to the north during the activities associated with Addendum No 1 to this Revised, Supplemental RI Report (see Appendix F).

### 3.1.4 Groundwater

Groundwater investigations commenced in 1989 and monitoring has continued since. The 1989 Phase I Hydrogeologic Investigation and Interim Remedial Measures (IRM) described findings with respect to groundwater and addressed a program to pump contaminated groundwater (principal compounds of concern – BTEX and pyridine compounds) from three existing wells and treat the water prior to discharge to the SPDES lagoon that discharges to the West Branch of the Ramapo River under a SPDES permit. Following design and approval, the IRM system was installed in 2001 and operated until September 2004. The IRM included pumping from wells RW-1S, RW-3 and MW-1S. Pumping ceased due to fouling problems at the wells. Well RW-1R was installed to replace well RW-1S but was not put into service based on the groundwater monitoring results (i.e., results indicated groundwater quality consistent with SCGs (Part 703 standards) had been achieved at sentinel wells) and use of the alternative biosparge system.

The 1995 Remedial Investigation Report summarized groundwater investigation findings and presented the chemical fate and transport evaluation. The work performed during the 1995 RI included a comprehensive suite of analyses comprised of VOCs, SVOCs, pesticides/PCBs, and inorganics.

In 2008 a Supplemental Remedial Action Work Plan was implemented with the addition of six monitoring wells installed to collect additional water quality data along projected groundwater flow paths and at additional locations adjacent to the West Branch of the Ramapo River. Since the installation of the new monitoring wells and based on every routine monitoring event since, the analytical data have consistently demonstrated that concentrations of COCs are below SCGs at plume fringe and sentinel wells. The 2008 well installations also provided analytical data in the area of the Site where the coarser grained deposits predominate and groundwater flows preferentially, as described in the 2008 report and work plan (HydroQual, 2008).

The groundwater data collected to date consistently confirm that remaining groundwater impacts are limited to the overburden deposits, and COCs are not impacting the underlying bedrock. Groundwater quality at the Site is well understood.

### 3.1.5 Parking Lot Area

In November 2009 the NYSDEC requested that additional sampling and delineation be conducted for the material in the Parking Lot area (Area B). Area B is defined as the area encompassed by the West Branch of the Ramapo River to the north, Arden House Road to the south, Route 17 to the west and the western berm of the SPDES lagoon to the east. A field investigation was implemented during the period of January 25 through January 29, 2010 with the objective of delineating the vertical and horizontal extent of the calcium sulfate material and to further characterize this material relative to the presence of mercury and VOCs.

Mercury is present within the calcium sulfate material as a byproduct from the manufacture of niacinamide. Total mercury concentrations within individual samples ranged from 1.1 to 1900 mg/kg, while total mercury concentrations in composite samples ranged from 356 to 598 mg/kg. The collective data indicate that the mercury is present principally in an insoluble form and is not a source of dissolved mercury to surrounding soils and groundwater. To illustrate this conclusion, sampling has been performed at monitoring well MW-24S since 2005. Monitoring well MW-24S is a shallow well directly down-gradient of and hydraulically connected to the parking lot area. The monitoring data show concentrations of sulfate (soluble) from 710 to 1782 mg/L while concentrations of mercury with only three exceptions have been below the groundwater quality standard (range from 0.24 to 1.1 ug/L by comparison to the groundwater quality standard of 0.7 ug/L). Also, testing for VOCs indicates that VOCs are not present within the calcium sulfate and the material, therefore, is not a source of VOCs.

The calcium sulfate is currently covered with asphalt within the parking lot area, and an IRM consisting of geotextile and stone is in place along the riverbank to prevent erosion and mitigate potential migration of mercury into the river. The condition of the asphalt and IRM are inspected quarterly and repairs are made if necessary. Based on current conditions at the Site, with the IRM in place and the parking lot pavement maintained, the calcium sulfate is not a source of COCs to groundwater, surface water, or sediment via erosion and sediment transport.

## 3.2 Site Compounds of Concern (COC)

As a result of past site investigations and the evaluation of the nature and extent of contamination at the Site, the COCs related to the elements of the supplemental work have been established.

Presented below is a summary of COCs at the Site by medium.

### 3.2.1 Surface and Subsurface Soil

The results from testing of 150 samples from the RI and RFI sampling are discussed in detail in the Site-Wide CSR and should be referenced for additional information. In general, the data indicate that exceedences of the applicable SCGs (6 NYCRR Part 375 Cleanup Levels) for mercury are distributed in shallow soils over most of the Site. Exceedances for other compounds and metals, including PAHs, PCBs, arsenic and copper have been identified in more localized areas of the Site.

The results of subsurface sampling (total of 202 samples) indicate that benzene is the only VOC detected in subsurface samples at concentrations above its Commercial or Industrial SCG. A number of SVOCs (all PAH compounds) exceeded their respective Commercial or Industrial SCGs at five locations, including the warehouse/water filtration facility in the northwest corner of the Site, the wastewater tank farm, the engineering offices and the truck scale. The concentrations of the site-specific SVOCs alpha-picoline, beta-picoline and pyridine in the subsurface samples were generally non-detect to less than 1 mg/kg, and exceeded 10 ppm at no more than three locations. The PCB Aroclor 1254 was detected in subsurface soil samples; its concentration exceeded the Commercial SCG at five locations. As with the shallow soil samples the only metal with widespread exceedances of the SCGs was mercury. Arsenic, barium, cadmium, copper and lead were the only other metals detected in subsurface soil at concentrations above their respective SCGs, with exceedances occurring in relatively few, localized areas.

Speciation for mercury was performed during the RFI for further characterization of the form of mercury predominant at the Site. For the soils at the Site, the predominant forms of mercury were the highly complexed and minerally-bound forms (F4 and F5 fractions), indicating a high level of immobility. Methyl mercury was found in very low proportions (maximum of 0.035%).

### 3.2.2 Parking Lot – Area B (Calcium Sulfate)

The investigations of the parking lot area (Cornerstone, April 2010) and adjacent riverbank area (Arcadis 2001) delineated the lateral and vertical extent of calcium sulfate material. Based on the delineation work, the volume of calcium sulfate material underlying the parking lot and the adjacent riverbank is calculated at approximately 22,000 cubic yards. The calcium sulfate contains mercury at concentrations ranging from 1.1 to 1,900 mg/kg. VOCs were not evidenced in the data. Based on the data collected during these investigations and based on the groundwater monitoring, mercury is present primarily in an insoluble form and the groundwater data (i.e., generally less than the groundwater quality standard) indicates it is not a significant source of dissolved mercury to surrounding soils, groundwater, or surface water.

### 3.2.3 SPDES Lagoon

Samples of SPDES lagoon solids collected during the RFI indicate that the solids contain low levels of PAHs and metals. Mercury speciation performed on one sample of the SPDES lagoon sediment indicated the predominant fraction was F3, organic, although methyl mercury represented only 0.009% of the total mercury measured. Water samples have been collected from the SPDES lagoon for compliance with the SPDES permit, and ELT Harriman has implemented both temporary and permanent treatment systems for compliance with the SPDES permit.

### 3.2.4 Groundwater

COCs consisting of benzene, toluene, ethylbenzene, xylene (collectively identified as BTEX compounds), chlorobenzene, pyridine, alpha-picoline, 2-aminopyridine and mercury were detected in certain on-site groundwater samples. Benzene is present at various sampling locations which define the groundwater plume, and at the highest concentrations. Benzene has, therefore, been routinely used as a groundwater surrogate at the Site. Concentrations above groundwater quality standards remain in the area of the former main plant operations as a result of contamination present in the low-permeability soils. However, both the groundwater extraction and treatment IRM and the biosparging system have been shut down with NYSDEC approval, and groundwater testing since 2008 has consistently demonstrated that down-gradient groundwater quality meets standards due to natural degradation of residual contamination.

### 3.2.5 Surface Water (West Branch of the Ramapo River)

Surface water has been characterized as a part of the RI, and a supplemental investigation performed by the NYSDEC specifically focused on any mercury impacts to surface water. The RI did not indicate differences in upstream and downstream water quality and concluded that the Site had no measurable impact on water quality within the West Branch of the Ramapo River. The mercury investigation by NYSDEC generally indicated similar findings, however, the highest concentration of mercury, albeit below the then selected SCG, was reported at the outfall to the Site's groundwater treatment system discharge (no longer present). As a result, the NYSDEC also conducted a fish study within the West Branch of the Ramapo River and concluded that concentrations of mercury detected in the fish samples were below the fish consumption advisory level of 1,000 ng/g, but potentially present a risk to birds and wildlife in the river, although the source of the mercury could not be defined.

### 3.2.6 Sediment

Sediment sample characterization performed for the RI and in the NYSDEC's supplemental mercury investigation generally indicate comparable if not generally higher concentrations of SVOCs, metals, and TPH upstream in the West Branch of the Ramapo River than were detected in samples collected from the downstream sampling locations. Mercury was detected in the sediment in the upstream and downstream locations at similar levels,

although slightly less in the upstream locations. The highest detected concentration adjacent to the Site suggested the possibility of some localized influence on mercury concentrations, although all of the values are below the NYSDEC's ROD selected SCG.

### 3.2.7 Off-Site Soil

The results of off-site soil samples collected and analyzed for mercury and PCBs on the adjacent Avon Parcel and Village of Harriman property indicate that only mercury was detected at low levels as previously discussed. PCBs were not detected during the off-site soil investigation.

## 3.3 Previous Remedial and Response Actions

The Site has been subject to the implementation of various remedial and response actions under the New York State Inactive Hazardous Waste Disposal Site program, including IRMs and final remedies described below, as well as certain other remedial actions.

An IRM was implemented at the Site starting in 1990, which consisted of groundwater extraction and treatment. After documenting declining VOC concentrations within the extracted groundwater, as well as decreased well efficiencies and pumping rates from the recovery wells, operation of the IRM was suspended in 2004 in favor of on-going operation of an alternative biosparge system, with the approval of the NYSDEC.

A biosparge system was installed in October 2002, and was operated until September 2008. This system was shut down in accordance with the NYSDEC-approved Supplemental Remedial Action Work Plan (HydroQual 2008). Groundwater sampling and analyses performed as part of the approved work plan and continuing to date, consistently demonstrate that groundwater impacts are restricted to the Site and that samples collected from perimeter sentinel wells meet SCGs.

Remedial actions, in accordance with the selected remedy detailed in the ROD that was issued by the NYSDEC in March 1997, have also been implemented at the Site. Work included drum and contaminated soil source materials removal, and the injection of Oxygen Release Compound (ORC) as further described in the Site-Wide CSR (2011).

Over the years 2002 through 2005, a number of activities were completed on the northern side of the SPDES lagoon, including the installation and sampling of monitoring wells and soil borings and a biosparge system that was operated for two years. In addition, an IRM for erosion control was installed along the stream bank of the West Branch of the Ramapo River, consisting of stapled geotextile with an overlying gravel cover. The IRM serves as a control measure against the potential for erosion of calcium sulfate material and to further prevent any migration of mercury into the river. The IRM was enhanced by replacing portions of the gravel layer with heavier rip-rap material following a flooding event in April 2007. The IRM is subject to routine inspections and maintenance and has performed effectively, including weathering several extreme events since 2007.

# 4 SUPPLEMENTAL REMEDIAL INVESTIGATION

## 4.1 Investigation Activities

The Supplemental RI included the collection of additional soil, sediment, and surface water samples as called for in the NYSDEC approved Supplemental RI/FS Work Plan. This work is described in the following sections based on the areas and media where the work was performed.

### 4.1.1 Ramapo River Stream Bank Soil, Surface Water and Sediment

Additional investigation of surface water, sediments, and stream bank soils has been conducted in the vicinity of the Site in and along the West Branch of the Ramapo River.

Sediment, surface water, and riverbank soil sample locations were set along seven (7) transects to provide co-located data for comparative purposes. Each transect was planned to consist of sample locations along each side of the stream bank (2 samples designated by the prefix RBN-X or RBS-X representing river bank north and south, respectively), a sample location for the stream sediment (1 sample designated RRX-S) and a co-located surface water sample (1 sample designated RRX-W), with "x" representing the transect number. Transects were established generally at 200 foot intervals, starting from the northwest corner of the Site, downstream of the point at which the effluent from the OCSD #1 wastewater treatment plant discharges to the West Branch of the Ramapo River (which is approximately 20 feet upstream of the Site boundary), to approximately 1,200 feet downstream of that point, as shown on Figure 4-1.

As indicated on Figure 4-1 by shaded symbols, stream bank samples on the north side of the creek (sample locations RBN-2 through RBN-7), as well as off-site sample locations OPN-2 through OPN-4, discussed further below, were not collected as a part of the initial Supplemental RI activities. Despite repeated requests by the Corporate Defendants for access, access to these off-site sampling locations was denied by the property owner. The NYSDEC was notified and was asked to assist in facilitating access to these off-site locations. The NYSDEC provided assistance and access was granted on June 9, 2015. The off-site investigation to the north was then completed on June 25, 2015, and the results are provided in Addendum No. 1 to this Revised, Supplemental Remedial Investigation Report (see Appendix F). Locations RBN-1 and OPN-1 were collected as these locations were within the NYSDOT right-of-way.

Other changes relative to the sample locations included shifting the proposed locations of RBN-1 and RBS-1 to locations near the bridge abutment due to the suspected presence of structural fill and no easy access for a GeoProbe rig, and shifting of transect 7 approximately 80 feet to the west of the originally proposed location due to the presence of wetlands, a fence, and heavy vegetation. These changes were confirmed in the field, and via a subsequent July 16, 2014 email, with the NYSDEC representative who was present at the site on July 15, 2014 to discuss soil boring locations and to kick-off the field activities. Sampling locations

were located in the field with a hand held GPS unit and the final locations are illustrated in Figure 4-1. Soil samples were collected on July 15 and 16, 2014.

Riverbank soil samples were generally collected, at 0-2", 2"-6", and 18"-24" intervals below ground surface (bgs), as feasible, using a GeoProbe rig. Samples for laboratory analyzes were obtained in disposable acetate sleeves and composited from the intervals identified above into glassware or Encore samplers provided by the laboratory. Per agreement with the NYSDEC representative in the field, and confirmed via email dated July 16, 2014, the samples at RBN-1 and RBS-1 were collected with a hand auger as the GeoProbe rig could not access these locations.

The collection of sediment and stream samples was postponed until July 23, 2014 to allow the water depth and velocity of the stream to diminish following rain events. A representative of the NYSDEC was on-site during the sampling and the following changes were made based upon the Site conditions:

- Consistent with the RBS7 relocation, the surface water/sediment sample location RR7 was shifted approximately 80 feet west (upstream) of the originally proposed location to maintain the location within the transect with the other correlating riverbank locations.

- Sampling location RR4 was shifted approximately 30 feet east (downstream) of the originally intended location due to safety reasons. The water in the stream was above the waists of the sampling crew and getting deeper as they approached the intended location from downstream, moving upstream. After assessing alternatives, it was agreed that the safest approach was to collect the sample at the agreed upon location.

- Due to the coarse nature of the stream bed (large cobbles and stones generally underlain by coarse to medium sand, little f - m gravel), the difficulty of sample collection increased with depth. The sediment sampler was driven between the larger cobbles (or they were pushed aside) in order to collect the sample. Three to five attempts were made at each location in order to obtain four samples at 6 inch intervals to the intended depth of 24 inches. At location RR3, three samples were possible to a depth of 18" below the stream bed. After five attempts at location RR5, only one sample was obtained from 0-6" interval. With the exception of RR1 (bottom depth of the second sample reached 8"), two samples were obtained from the remaining locations to a depth of 12" below the stream bed.

It was agreed that samples collected per the changes above would meet the intended purpose (sampling objective) and the agreed upon changes were summarized in a July 25, 2014 email to NYSDEC.

No additional areas of sediment deposition were identified during the July 23, 2014 site visit with NYSDEC and no additional sampling locations were identified. In accordance with procedures described in the Supplemental RI/FS Work Plan, sampling within the West Branch of the Ramapo River began at the downstream locations and continued upstream

with surface water samples collected first (from the upstream side of the field technician collecting the sample), followed by sediment sampling. Surface water samples were collected from the mid-depth of the water column at the corresponding locations of the sediment samples. Surface water samples were collected directly into the glassware provided by the laboratory.

As described above, the stream sediment was typically coarse grained and did not vary from location to location or with depth. The only exception to this observation was the presence of a gray, very fine sand and clay layer observed at locations RR3 and RR6 at the bottom of the lowest sample interval. This gray fine sand and clay appears to represent the bottom of the stream deposits (i.e., appears to be glacially deposited). Samples were collected at the top of this layer for laboratory analysis. Sediment samples were collected with a core sampler equipped with disposable acetate sleeves and the aliquot for analysis was placed into glassware, or Encore samplers for VOCs, provided by the laboratory.

Following collection, each sample was labeled with the location prefix and transect number (as described above), the sample depth (as applicable) and sample date. The samples were stored on ice pending delivery under chain of custody to Accutest Laboratories, via courier.

#### 4.1.1.1 Analytical Parameters

In accordance with the approved work plan, sediment and surface water samples collected from the upstream (RR1-S and RR1-W), two mid-point (RR3-S & RR3-W and RR5-S & RR5-W) and downstream (RR7-S and RR7-W) transect locations were analyzed for Target Compound List (TCL) VOCs/SVOCs and Target Analyte List (TAL) metals. The remaining samples, both sediment (RR2-S, RR4-S, and RR6-S) and surface water (RR2-W, RR4-W, and RR6-W), were analyzed for mercury.

Riverbank soil samples obtained from the upstream (RBN1-S and RBS1-S), two midpoint (RBS3-S and RBS5-S), and downstream (RBS7-S) transect locations were analyzed for TCL VOCs/SVOCs and TAL metals. The remaining samples (RBS2-S, RBS4-S and RBS6-S) were analyzed for mercury.

### 4.1.2 SPDES Lagoon Berm

An investigation of the soils in the areas around and adjacent to the SPDES lagoon was conducted to evaluate the effectiveness of the SPDES lagoon in preventing mercury from entering the West Branch of the Ramapo River.

Soil samples were taken on an approximate 50-foot grid along the area between the SPDES lagoon berm and the West Branch of the Ramapo River, as shown on Figure 4-2. The sample intervals are targeted to assess potential contaminant transport from surface water runoff, seepage, or subsurface flow. As such, surficial soil samples were collected from each of the sampling locations along the length of the SPDES lagoon's berm, approximately 1/3rd of the way down, where the phreatic surface would be anticipated to develop when the SPDES lagoon is at capacity. In addition, a set of samples were taken at the toe of the berm, where

seepage from the SPDES lagoon would have most likely manifested, if it were to have occurred.

Soil samples collected at the base of the SPDES lagoon berm were obtained with a Geoprobe rig at the target depth intervals: 0-2" bgs (after removal of obvious organic matter [e.g., grass] or other non-soil material [e.g., pavement]), 6"-12" bgs, and at depth 6" above the groundwater table. Samples obtained approximately 1/3rd of the way down the berm were collected from the 0-2" interval with a decontaminated stainless steel trowel. No waste/source material was identified during sampling. Samples for laboratory analysis were placed in glassware or Encore samplers provided by the laboratory and held on ice pending delivery to the laboratory.

The SPDES lagoon sample nomenclature identifies the samples by type (LS for SPDES lagoon soil), location number, depth of sample, and the date sample was taken.

#### 4.1.2.1 Analytical Parameters

The samples collected from the SPDES lagoon berm were analyzed for TCL VOCs/SVOCs and TAL metals.

### 4.1.3 Off-Site Soil

Soil samples were collected from the off-site area to the south of the site, and one location to the north of the site, as depicted on Figure 4-3. The objective was to complete the off-site surficial soils investigation as originally called for within the NYSDEC-approved "Phase II RCRA Facility Investigation Work Plan," (Brown and Caldwell, November, 2007), on properties for which access had not previously been granted. Samples were obtained from location OPN1 as it was located within the NYSDOT right-of-way and a right-of-way permit was obtained from the NYSDOT to collect these samples. Sampling was completed previously on the Avon Parcel to the southeast, and the Village of Harriman property to the northwest, and no additional sampling was required. As noted previously, obtaining access to property north of the West Branch of the Ramapo River was delayed, and locations OPN2 through OPN4 (see Figure 4-1) could not be sampled as part of the initial Supplemental RI. The NYSDEC assisted with obtaining access, which was granted on June 9, 2015, and the investigation of the off-site property to the north was completed on June 25, 2015. The results of the off-site investigation to the north are provided in Addendum No. 1 to this Revised, Supplemental Remedial Investigation Report provided in Appendix F.

Two soil samples were collected at each available off-site sampling location. The samples were taken at two intervals, 0-2" and 2"-24" bgs. Soil sampling was then performed in a continuous manner, to the top of the water table, and a third sample was collected from the 6" interval above the water table. Finally, one additional sample was collected at OPN-1 at a depth just below the water table where black staining and a petroleum odor were noted. No other visible or odor evidence of contamination was noted at any of the sample locations.

The off-site soil sample nomenclature identifies the samples by location number, position (OPN for the northern off-site property, and OPS for southern off-site properties), depth of sample, and the date sample was taken.

Sampling was completed using a GeoProbe® drill rig and disposable acetate sleeves. Samples for laboratory analysis were obtained from the designated intervals described above, placed in laboratory provided glassware, and stored on ice pending delivery under chain of custody to Accutest Laboratories, via courier.

#### 4.1.3.1 Analytical Parameters

In accordance with the NYSDEC approved work plan, off-site soil samples were analyzed for PCBs and mercury.

## 4.2 Results of the Supplemental Remedial Investigation

### 4.2.1 Ramapo River Stream Bank Soil, Surface Water and Sediment

#### 4.2.1.1 Surface Water

Surface water samples were collected from 7 locations along the West Branch of the Ramapo River. Samples collected at 4 locations (RR1, RR3, RR5 and RR7) were analyzed for TCL VOCs, SVOCs and TAL Metals, and samples collected from the 3 remaining locations (RR2, RR4 and RR6) were analyzed for mercury. The surface water results are summarized in Table 4-1.

With the exception of low levels of bromodichloromethane, chloroform, and dibromochloromethane, VOCs were non-detect in the surface water samples. The detected VOCs are byproducts associated with the addition of chlorine for disinfection and are most likely originating from the wastewater treatment plant located upstream as these are not Site related constituents.

One SVOC, bis(2-ethylhexyl)phthalate, was detected in upstream location RR1. No other SVOCs were detected in the surface water samples. This one detection was above the Part 703 SCG, but is likely an artifact of the sewage treatment plant discharge as it is not a Site related constituent.

With the exception of calcium, copper, iron, lead, magnesium, manganese, sodium, and zinc detected in one or more samples, metals were non-detect in the surface water samples. Copper and lead were detected slightly above the applicable Part 703 Surface Water Criteria (calculated based on conservative hardness values, see Table 4-1c for details) of 7.0 ug/l and 2.8 ug/l, respectively. Copper was found in one upstream location (and its duplicate sample) at concentrations of 12.8 ug/l (and 14.3 ug/l) and lead was found at a concentration of 3.1 ug/l at location RR5. These two metals are not Site related and are likely attributable to fill materials used along Route 17 and/or discharge from the upstream wastewater treatment plant.

Upstream concentrations of the detected VOCs and metals are similar to the downstream concentrations, with downstream concentrations being generally lower than those observed upstream. Consistent with the 1995 RI (data collected in 1991), data specific to mercury collected during this RI also reported non-detectable concentrations at all sampling locations within the River. Surface water samples collected during the NYSDEC's fish study showed consistent results upstream and downstream of the Site with results in a narrow range of 1.04 to 4.36 ppt. The current analytical results support prior conclusions that the surface water quality data indicates no significant impact of the Site on the water quality of the West Branch of the Ramapo River.

#### 4.2.1.2 Sediment

Similar to the surface water samples, sediment samples were collected from 7 locations along the West Branch of the Ramapo River. Samples collected at 4 locations (RR1, RR3, RR5 and RR7) were analyzed for TCL VOCs, SVOCs and TAL Metals, and samples collected from the 3 remaining locations (RR2, RR4 and RR6) were analyzed for mercury. Analytical results of the sediment sampling were compared to Class A, B and C sediment guidance values (SGVs) published in the draft NYSDEC document "Screening and Assessment of Contaminated Sediment" and are summarized in Table 4-2. In accordance with the Guidance document, sediment with concentrations below the Class A threshold pose little risk of harm to aquatic life. Concentrations within the range of values applicable to Class B sediments are considered to potentially result in chronic toxicity, although additional data would be necessary to assess potential risk. Finally, concentrations above the Class C thresholds imply that the concentrations are likely high enough to result in chronic toxicity to aquatic life.

The reported VOC concentrations were below the applicable Class A SGVs with low to trace levels of acetone, carbon disulfide, chloroform, methylene chloride, toluene, and xylenes, all reported at laboratory estimated values (J-qualified). Similarly, the reported SVOC concentrations were also below the applicable Class A SGVs with several PAHs reported at low concentrations.

Arsenic, copper, lead, mercury, nickel, and zinc, were detected at concentrations applicable to Class B in one or more samples and three metals were detected at concentrations applicable to Class C: zinc in one sample, lead in two samples and nickel in three samples.

Mercury concentrations were reported at concentrations applicable to Class B (0.2 - 1 mg/kg) in RR6-S/0"-6" at 0.22 mg/kg and RR7-S/0"-6" and 6"-12" at 0.24 and 0.48 mg/kg, respectively. Mercury concentrations at the individual sample locations are illustrated on Figure 4-4.

The low to non-detectable concentrations of VOCs and SVOCs characterize the sediment as Class A and no further assessment is required. Concentrations of one or more metals characterize the sediment as Class C. However, the metal concentrations are typically highest at the RR1 and RR3 upstream locations and considerably lower at the RR5 and RR7 downstream locations. In addition, the downstream most samples are only marginally above the Class B criteria. In addition, the metals zinc, lead, and nickel are not characteristic of the

Site. This distribution leads to the conclusion that the elevated metals are not Site related and are likely attributable to fill materials used along Route 17 and/or discharge from the upstream wastewater treatment plant.

Mercury concentrations at RR6-S/0"-6" (0.22 mg/kg) and RR7-S/0"-6" and 6"-12" at 0.24 and 0.48 mg/kg, respectively, are higher than those observed in the upstream samples and are above Class A criteria (0.2 mg/kg) and within the range applicable to Class B sediments (0.2 - 1 mg/kg).

The sediment sample results are consistent with observations reported in the July 1995 RI (see Table T22 of the Site Wide Characterization Summary Report, March 2011) and indicate that background (up-stream) concentrations of VOCs, SVOCs, and inorganics are generally comparable to and mostly higher than the downstream sample results. VOC and SVOC concentrations are all below the Class A SGVs indicating no toxicity to aquatic life. With the exception of mercury, the metals concentrations applicable to Class B or C sediment are generally higher upstream than downstream and are likely attributable to fill material used along Route 17 or discharge from the upstream treatment plant, and are not attributable to the Site. Mercury concentrations are comparable, but slightly higher in the downstream samples as compared to the upstream samples and are above the Class A criteria and within the range applicable to Class B sediments.

The NYSDEC's fish study concluded that a fish advisory associated with mercury is not necessary, thereby also indicating that, to the extent mercury is present in sediments, it is not propagating through the food chain at levels of concern for fish consumption but the NYSDEC also concluded that the sediments potentially present a risk to birds and wildlife in the river, although the source of the mercury could not be defined. The two sediment samples collected by the NYSDEC as a part of the fish study, which were located adjacent to the Site, had low (i.e., Class A sediment) concentrations of mercury (0.0916 and 0.175 mg/kg). Additional discussion of the sediment results in the context of the previously completed fish studies, habitat, ROD SCGs, etc. is provided in Section 6.

The sediment mercury concentrations of 0.24 and 0.48 mg/kg at the downstream limit of the initial Supplemental RI prompted the NYSDEC to request additional downstream sediments sampling in its comment letter of April 6, 2015, following review of the initial submittal of the Supplemental RI Report in November 2014. Through a meeting on May 20, 2015, and subsequent correspondence and site reconnaissance, the Corporate Defendants agreed to voluntarily perform additional downstream sediments sampling in the West Branch of the Ramapo River. The process of agreeing on and the results of the additional sediment sampling are described in Addendum No. 2 to this Revised, Supplemental Remedial Investigation Report, provided as Appendix G.

Of note is that since 1995, a stream bank stabilization IRM has been constructed on the stream bank and with routine inspections and maintenance has been controlling the potential for migration of mercury containing calcium sulfate material (which exists along the stream bank in the area of the Parking Lot). The non-detectable to low levels of mercury along this portion of the Site (i.e., locations RR2 and RR3), and more particularly at RR4, where the stream

deepens and the velocity declines (i.e., an area where sediment deposition is more likely to occur), provides evidence that the river bank stabilization methods are effective. This area is further evaluated as part of the Feasibility Study for the Parking Lot area presented under separate cover.

#### 4.2.1.3 Riverbank Soil (on-site)

Similar to the surface water and sediment samples, soil samples were collected from 7 locations along the south bank of the West Branch of the Ramapo River. Samples were collected from 0"-2", 2"-6" and 18"-24" intervals at on-site locations RBS-1, RBS-3, RBS-5 and RBS-7, and analyzed for TCL VOCs, SVOCs, and TAL Metals. Samples were also collected from 0"-2", 2"-6" and 12"-24" at locations RBS-2, RBS-4 and RBS-6 and analyzed for mercury. The analytical results are presented in Tables 4-3 (a, b and c).

With the exception of J-qualified concentrations of acetone and methylene chloride (common laboratory contaminants), VOCs were non-detect with all results below the Subpart 375-6 Soil Cleanup Objectives (SCO).

Two PAHs (dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene) were reported above the Restricted Residential SCOs in two samples (RBS-1/2"-6" and RBS-1/18"-24"), and only one PAH (benzo(a)pyrene) was reported above all SCOs (Restricted Residential, Commercial and Industrial), in three samples (RBS-1/2"-6", RBS-1/18"-24", and RBS-3/2"-6"). All other detected SVOCs were below SCOs.

VOCs and metals other than mercury are either not-detectable or below applicable SCO's and no further assessment is required for these compounds. The PAHs present in the two deeper samples collected at RBS-1 (see paragraph above) are likely related to fill material associated with construction of Route 17 and are therefore unrelated to the Site. The single PAH, benzo(a)pyrene, detected in the 2"-6" interval at RBS-3, with a concentration of 1,130 ug/kg, is marginally above the Commercial SCO of 1,000 ug/kg and the Industrial SCO of 1,100 ug/kg. The presence of this compound is likely related to the pile of asphalt from the parking lot placed near this location and is within the area addressed as part of the Feasibility Study for the parking lot area in any event.

Mercury was detected at each of the seven sampling locations (see Figure 4-4) with 9 out of 21 samples above the Part 375 published Industrial SCO of 5.7 mg/kg. The highest concentrations were reported at the RBS-2 location ranging from 51.6 to 414 mg/kg and the RBS-3 location ranging from 27.6 to 30.9 mg/kg (calcium sulfate was not observed in these samples). Concentrations then decreased at locations RBS-4 and RBS-5 with concentrations ranging from 0.1 to 5.5 mg/kg (below the Industrial SCO). Concentrations then increased at RBS-6 location to between 8 and 28 mg/kg and then dropped off again at location RBS-7 below the Part 375 published Restricted Residential SCO of 0.81 mg/kg. The remaining metals were either at non-detectable concentrations or reported at concentrations below applicable SCOs. As discussed above, comparison of the mercury concentrations within this report has been made to the Part 375 published commercial/industrial SCOs of 2.8 mg/kg and 5.7 mg/kg, respectively, because of the industrial nature of the Site. However, the

published SCOs for mercury are based on elemental mercury. Table 375-6.8(b) notes that the mercury cleanup objective is "...the lower of the values for mercury (elemental) or mercury (inorganic salts). See TSD Table 5.6-1." The reference to TSD Table 5.6-1 is to "New York State Brownfield Cleanup Program, Development of Soil Cleanup Objectives Technical Support Document" (NYSDEC and NYSDOH, 2006). Table 5.6-1 provides additional detail on mercury soil cleanup objectives categorized by elemental mercury and inorganic mercury salts. As noted above, the site data indicate that the mercury is present as a salt for which the relevant commercial or industrial SCG would be 47 mg/kg and 220 mg/kg, respectively, as shown in TSD Table 5.6-1.

The riverbank sample locations are a part of the ecological habitat along the West Branch of the Ramapo River. Therefore, the soil concentrations were also compared to the Part 375 published ecological SCOs. None of the detected VOCs or SVOCs were found in concentrations above the ecological SCOs. Of the metals other than mercury, copper, lead, nickel, and zinc were detected in various samples at concentrations above the ecological cleanup levels. These metals are naturally occurring (e.g., lead) or otherwise not associated with the Site (copper, nickel, zinc). As noted above, mercury was detected at each of the seven sampling locations with 19 (including one duplicate) of the 24 total samples (including 3 duplicates) tested above the Part 375 ecological cleanup level.

Mercury results found along the riverbank during the July 2014 sampling event confirm the conclusions derived from prior investigations that soils containing mercury concentrations in excess of the applicable SCOs are distributed across the Site in shallow and deeper soils. More specifically, mercury concentrations from 150 samples collected from the 0-2 foot interval during the RFI averaged 40.61 mg/kg, while 201 samples at depths greater than 2.0 feet averaged 40.60 mg/kg. Likewise, the average mercury concentration reported as part of the RI was 30.0 mg/kg. With the exception of the mercury concentrations at RBS-2 and RBS-3, the reported mercury concentrations in the river bank samples were below the site wide average mercury values reported in the RFI and RI, as well as the relevant commercial SCG of 47 mg/kg as discussed below. Based on data generated during the RI, sampling events at other locations within the Village of Harriman, and a review of the process chemistry in which mercury was used, the Record of Decision (ROD) for the Site noted that mercury present at the Site exists in a relatively immobile form. This was further confirmed by the results of a mercury speciation study completed as part of the RFI, which indicate that the mercury exists primarily in a form of highly insoluble and immobile mercuric sulfide. This form of mercury limits its ability to migrate in groundwater or surface water. Therefore, the relevant direct contact commercial/industrial SCO for inorganic salts of mercury would be 47 mg/kg and 220 mg/kg, respectively, as opposed to the 2.8 mg/kg and 5.7 mg/kg SCOs for elemental mercury. The ecological SCO is the rural background level for total mercury.

### 4.2.2 SPDES Lagoon Berm

Samples of soils within the SPDES lagoon berm were collected from a single interval, 0"-2" at 8 locations (LS-1 through LS-8) and from three intervals: 0"-2", 6"-12" and 6" above the water table at 8 additional locations (LS-9 through LS-16). Samples were analyzed for TCL

VOCs, SVOCs, and TAL Metals. The analytical results are presented in Tables 4-3 (d, e and f) and Figure 4-5.

VOCs results were below the Subpart 375-6 Soil Cleanup Objectives with only acetone and benzene reported at J-qualified concentrations. Similarly, with the exception of low levels of PAHs generally reported at J-qualified values, SVOCs were also non-detect in the SPDES lagoon berm soil samples and reported SVOC concentrations were below the applicable SCOs.

Arsenic was reported at 19.6 mg/kg (above the Restricted/Commercial/Industrial SCO of 16 mg/kg) in one sample (LS-11/6"-12"), while other analyzed metals, with the exception of mercury discussed below, were below the applicable SCOs. Mercury was detected in 27 out of the 32 samples collected from the SPDES lagoon berm (at concentrations up to 107 mg/kg), and was present above the Industrial SCO of 5.7 mg/kg in 16 out of 32 samples. Only 3 out of 32 samples exceeded the relevant mercury salt commercial SCG of 47 mg/kg and none of the samples exceeded the relevant mercury salt industrial SCG of 220 mg/kg, as discussed below. The highest concentrations were found at locations LS-15 and LS-16 near the northwest end of the SPDES lagoon.

Mercury concentrations within samples collected from locations LS-1 through LS-14 (i.e., excluding locations LS-15 and LS-16 discussed above) ranged from not detectable to 28.2 mg/kg. These concentrations are below the site wide average mercury concentration of 40.6 and 30.0 mg/kg reported in the RFI and RI reports as presented above, as well as below the relevant mercury salt commercial/industrials SCGs.

As discussed above, mercury present at the site is principally present in an insoluble form and there is no evidence to indicate that the SPDES lagoon or subsurface soils beneath the SPDES lagoon are impacting groundwater. Therefore, the relevant direct contact commercial/industrial SCO for inorganic salts of mercury would be 47 mg/kg and 220 mg/kg, respectively, as opposed to the 2.8 mg/kg and 5.7 mg/kg SCOs for elemental mercury.

### 4.2.3 Off-Site Soil

The analytical results of the off-site soil sampling are presented in Tables 4-4 and mercury results are also depicted on Figure 4-6.

#### 4.2.3.1 Sampling North of the Site

##### *4.2.3.1.1 Off-Site Property – North (OPN-1)*

Due to a lack of property access during the initial work on the Supplemental RI, only one off-site sampling location north of the West Branch of the Ramapo River (OPN-1) was completed, as this location was within the right of way for Route 17. Since the initial Supplemental RI work was completed, as previously noted, access was granted, and the additional investigation for the off-site property to the north was completed and the results are reported

in Addendum No. 1 to this Revised, Supplemental Remedial Investigation Report provided in Appendix F.

Samples were collected from three intervals: 0-2", 2"-24" and from the interval 6" above the water table. A duplicate sample (DUP-1/071714) was collected from 0" - 2" interval. These samples were analyzed for PCBs and mercury. In addition, an extra sample was collected from 9.5' to 9.7' interval (roughly 6" below water table) based upon an observed oily layer and petroleum odor. This sample was analyzed for TCL VOCs, SVOCs, TAL Metals, diesel range organics (DRO) and gasoline range organics (GRO).

The duplicate sample taken from the OPN-1/0"-2" location reported two PCBs: Arochlor 1254 and 1260. Arochlor 1254 was detected above the Unrestricted Use SCO (0.1 mg/kg) at a concentration of 0.227 mg/kg, but below other Subpart 375-6 SCOs. Also, this duplicate sample reported mercury at 19.7 mg/kg which is above the SCOs. However, the parent sample did not contain any PCBs and mercury was reported at 0.21 mg/kg, which is above the Unrestricted Use and Protection of Ecological Resources SCOs but below the other SCOs. The reason behind the discrepancy between the parent sample and its duplicate is unclear. However, it may be related to matrix interference and/or sample inhomogeneity. PCBs were not detected in any of the other sample intervals collected from location OPN-1.

Mercury was detected below the SCOs in the 2"-24" interval and in the additional interval of 9.5'-9.7', and was reported at 0.27 mg/kg in the 8.5'-9.0' interval (above the Unrestricted Use and Protection of Ecological Resources SCOs of 0.18 mg/kg but below the other SCOs). The depth of the detected mercury concentrations, and the presence within fill materials as opposed to in-place soils, suggest that these concentrations are related to the fill material.

The additional sample collected from 9.5' to 9.7' based upon the presence of an oily sheen and petroleum odor, contained pentachlorophenol (PCP) at 7,280 ug/kg, which is above the SCOs. In addition, gasoline range organics (GROs) were not detected but diesel range organics (DRO) were reported at 2,220 mg/kg. The data thus suggest a petroleum product containing diesel range organics that is unrelated to the Site.

#### *4.2.3.1.2 Riverbank Sample North (RBN-1)*

Similar to the OPN sample location reported in the above section, and due to a lack of property access (access approval referred to NYSDEC and additional results provided in Appendix F), only one northern riverbank sample location (RBN-1) was completed within the right of way for Route 17 (see Figure 4-6) during the initial phase of the Supplemental RI.

Samples were collected from three intervals: 0-2", 2"-6" and 18"-24", for analysis of TCL VOCs, SVOCs, and TAL Metals.

No VOCs were detected in any of the sample intervals and the reported SVOC concentrations were below applicable SCOs. As shown in Table 4-4, several PAHs were reported at low concentrations, but were below applicable SCOs.

Lead, mercury and zinc were reported above one or more applicable SCOs in one or all three sample intervals. Zinc was reported at 127 mg/kg, slightly above the Unrestricted Use and Protection of Ecological Resources SCOs of 109 mg/kg in the 0"-2" interval sample. Lead was reported at 126 and 110 mg/kg in the 2"-6" and 18"-24" intervals, respectively, above the Unrestricted Use and Protection of Ecological Resources SCOs of 63 mg/kg. Mercury was reported at 0.24, 0.3 and 0.92 mg/kg in each of the three samples, above the Unrestricted Use and Protection of Ecological Resources SCOs of 0.18 mg/kg and the deepest interval (18"-24") slightly above the Residential and Restricted Residential SCOs of 0.81 mg/kg (see Figure 4-6).

Based on the location of the RBN-1 sample upstream of the site and adjacent to the Route 17 bridge abutment, the reported metals concentrations described above are likely indicative of fill materials placed for construction of Route 17. Likewise, the mercury concentration of 0.92 mg/kg reported in the deepest (18'-24") riverbank sample, suggest that concentrations of mercury on the order of 1 mg/kg may also be related to and/or indicative of fill materials used along Route 17.

#### 4.2.3.2 Sampling South of the Site

Off-site samples were collected from 7 locations south of the Site. Samples were collected from three intervals: 0"-2", 2"-24" and the interval 6" above the water table, and were analyzed for PCBs and mercury.

No PCB's were detected at any location or depth.

Mercury was detected at concentrations of 0.20, 0.28 and 0.19 mg/kg in the 0-2" sampling interval at locations OPS-1, OPS-2 and OPS-4, respectively (see Figure 4-6). These concentrations are above the Unrestricted Use and Protection of Ecological Resources SCOs of 0.18 mg/kg. Mercury concentrations were either non-detect or below SCOs in the underlying sample interval (2"-24") at each location and results from the samples were below the Residential and Restricted Residential SCOs of 0.81 mg/kg. As a point of comparison, mercury results from off-site samples collected as part of the 2008 Supplemental RFI (Brown and Caldwell, August 2008) ranged from 0.018 to 1.01 mg/kg.

Collectively, the sporadic detection of mercury at levels only marginally above the Unrestricted Use and Protection of Ecological Resources SCOs in 3 out of 18 samples, coupled with the concentrations of mercury observed within the fill materials adjacent to Route 17 discussed above, indicates that there are no adverse impacts to off-site soils. In addition, it is possible that these limited detections are associated with air deposition associated with traffic on Route 17 and/or the fill material used along Route 17, or regional background conditions as indicated by the NYSDEC's mercury data for soils in the Hudson Valley region (NYSDEC, 2003, revised 2006).

# 5 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

## 5.1 Introduction

A qualitative exposure assessment was conducted per DER-10 Section 3.3(c)4.

Per DER-10, the qualitative human health exposure assessment evaluates the five elements associated with exposure pathways, and describes how each of these elements pertains to the Site. The exposure pathway elements that have been addressed in the following sections include:

1) A description of the contaminant source(s) including the location of the contaminant release to the environment (waste disposal area or point of discharge) or if the original source is unknown, the contaminated environmental medium (soil, indoor or outdoor air, biota, water) at the point of exposure;
2) An explanation of the contaminant release and transport mechanisms to the exposed population;
3) Identification of potential exposure point(s) where actual or potential human contact with a contaminated medium may occur;
4) Description(s) of the route(s) of exposure (i.e., ingestion, inhalation, dermal absorption); and
5) A characterization of the receptor populations who may be exposed to contaminants at a point of exposure.

Land use within a half-mile radius of the Site is shown on Figure 5-1 which shows the Site's proximity to sensitive human or ecological receptors, including residences, parks and surface water bodies. Identified wetlands are shown on the U.S. Fish and Wildlife National Wetlands Inventory (NWI) Map, Figure 5-2. No water supply wells are located within a half-mile of the Site.

## 5.2 Selection of Chemicals of Potential Concern

Data collected during the Supplemental RI and presented in the previous sections was used to provide additional information upon which to further evaluate the risk to potential human receptors due to Site COCs. A qualitative exposure assessment was previously conducted in 2011, and presented in the March 2011 Site-Wide CSR (Brown and Caldwell Assoc., Cornerstone Engineering and Land Surveying), which assessed human health exposure due to Site Chemicals of Potential Concern (COPCs) from previous Site investigations. Table 7-1 of the Site-Wide CSR presents an overview of human exposure based on data collected prior to the Supplemental RI. For reference, Table 7-1 is presented in Appendix A of this report.

The results of the most recent Site investigation (Supplemental RI) are used to supplement the previous qualitative exposure assessment, and evaluate whether this new information identifies additional contaminant sources, exposure routes or receptor populations.

### 5.2.1 Soil

From Sections 4.2.1.3 and 4.2.2, based on the Industrial SCO, mercury exceeded the Site SCG for soil of 5.7 mg/kg in 9 out of 21 riverbank south soil samples, and 16 out of 32 SPDES lagoon berm soil samples. No other contaminants from the Supplemental RI sampling exceeded Industrial SCOs. However, the published SCO for mercury is based on elemental mercury and the Site data indicate that the mercury is present as a salt for which the relevant commercial or industrial SCO would be 47 mg/kg and 220 mg/kg, respectively. Comparison of the data to the relevant inorganic salt SCO indicates that only locations RBS-2, LS-15 and LS-16 contain mercury concentrations above the commercial SCO.

### 5.2.2 Sediments

As presented in Section 4.2.1.2, sediment samples were compared to the sediment criteria presented in the draft NYSDEC document "Screening and Assessment of Contaminated Sediment". With respect to human exposure through ingestion or dermal contact, the SCG for the sediments would be the Residential SCO, assuming it may be possible for human exposure to the sediments. However, mercury concentrations in the sediment samples were below the Residential SCO of 0.81 mg/kg.

As discussed above, sediment data was also compared to criteria published in the draft NYSDEC document "Screening and Assessment of Contaminated Sediment". These criteria would be appropriate in evaluating contaminants with respect to potential risks to aquatic life. This would have potential impact on the route of exposure through the consumption of fish. As presented in Table 1a of the draft sediment screening document:

- Class A sediments are considered to be low risk to aquatic life;
- Class B sediments are slightly to moderately contaminated and additional testing is required to evaluate the potential risks to aquatic life; and
- Class C sediments are considered to be highly contaminated and likely to pose a risk to aquatic life.

As presented in Section 4.2.1.2, arsenic, copper, lead, mercury, nickel and zinc are reported above Class B criteria in one or more sediment samples. Lead, nickel and zinc are reported in one or more samples above Class C criteria. Excluding mercury, based on the distribution of metals in the samples, higher concentrations are typically found at the RR1 (upstream location) and decrease moving downstream. Therefore, elevated metals concentrations are likely not Site related and are attributable to fill materials used along Route 17 and/or due to discharge from the upstream wastewater treatment plant.

The Ramapo River Fish Sampling conducted by NYSDEC in April 2001 found that none of the mercury concentrations detected in the fish samples exceeded NYSDOH fish

consumption advisories. This indicates that, to the extent mercury is present at low levels in the sediments, it is not propagating through the food chain at levels of concern for fish consumption.

Given the above, there are no human health risks due to Site COCs in the sediments adjacent to the Site. Mercury concentrations in the sediment samples were below the Residential SCO of 0.81 mg/kg, and there are no fish consumption advisories in the West Branch of the Ramapo River due to mercury concentrations in fish.

### 5.2.3 Surface Water

As presented in Section 4.2.1.1 surface water results for the samples collected as part of the Supplemental RI are below Part 703 surface water quality criteria and there are no Site related impacts. Low levels of chloromethanes are indicative of upstream discharge from the wastewater treatment plant. Therefore, there are no human health risks due to Site COCs in the surface water adjacent to the Site.

## 5.3 Exposure Setting and Identification of Potentially Exposed Populations

The objective of the exposure assessment is to estimate the type of and potential for human exposure to the COPCs that are present in, or may migrate from, the impacted media. The exposure assessment considers human populations that may be exposed to COPCs at the Site, currently and in the future, and evaluates the pathways by which these receptors may be exposed.

The potential for human exposure was considered under both current and future land use scenarios based on the current and anticipated Site uses. The current use of the Site is inactive industrial. The anticipated future use of the Site is commercial and/or industrial.

Based on the analysis of the supplemental data with respect to human health exposure presented in Section 5.2, only mercury detected above Industrial SCOs in the SPDES lagoon berm soil samples and the riverbank south soil samples represent a potential Site COC with possible routes of exposure to humans.

### 5.3.1 Current Scenarios

The current closed facility is non-operational and would remain vacant until after any Site remedial actions are completed.

Currently, the Site is surrounded by a chain link fence, with access by a locked gate along Route 17. Therefore, it is not expected that trespassers would be able to obtain access to the Site. Access to the riverbank along the Site would be possible from adjacent private property and then crossing the river.

### 5.3.2 Future Scenarios

Construction workers who may perform future work at the Site would be provided access to the Site. They would potentially be exposed to surface and subsurface soils along the SPDES lagoon berm, and to riverbank south soils, only if the latter were to be disturbed by the remediation or construction activities performed at the Site. Their exposure frequency would be during a typical 8-hour work day.

Adults, adolescents, children, and infants would be receptors under future use conditions if the property were developed for commercial use. Under an industrial future use scenario, adults and adolescents would be potential receptors. As any future exposure scenario for occupants of the property would be following any Site remediation to address the contamination above Commercial or Industrial SCOs, there would not be any anticipated exposure pathway and/or COPCs to humans on the Site.

## 5.4 Identification of Exposure Pathways for Current and Future Scenarios

Exposure of current trespassers to COPCs in surface soil and, to a limited extent, subsurface soils, would be through dermal contact with and incidental ingestion of soils with contaminant concentrations above Industrial SCOs. As any future exposure would be following any Site remediation, there would not be any anticipated exposure pathway and/or COPCs to humans on the Site in the future.

Exposure of future construction workers to COPCs found in surface and subsurface soils would be through dermal contact and incidental ingestion of soils. However, a Site-Specific Health and Safety Plan would be required for Site remedial/construction activities, and appropriate personal protective equipment would be required for individuals working on the Site under both current and future scenarios. Therefore, the exposure pathway would be incomplete or controlled through appropriate health and safety measures, and there would be little potential for adverse human health effects from Site soil on future construction workers.

## 5.5 Summary

Based upon the current use of the Site, the potential for trespasser exposure to COPCs (mercury) found in Site soils above Industrial SCOs by dermal contact or incidental ingestion is possible.

It is assumed that future use of the Site as a commercial and/or industrial property would be following any remedial action. Therefore, there would not be any anticipated exposure pathway and/or COPCs to humans on the Site.

Per DER-10 Appendix 3B, an overview of the human exposure assessment based on the results of the Supplemental RI and from the Site-Wide CSR is presented in Table 5-1.

# 6 FISH AND WILDLIFE RESOURCE IMPACT ANALYSIS

## 6.1 Introduction

A fish and wildlife resource impact analysis (FWRIA) is required to be completed during the RI in accordance with DER-10 sections 3.3(c) 3. The FWRIA includes assessment of the potential impacts Site COCs may have, if any, on various media (ground/surface water, soil, soil vapor, ambient air and biota). Ecological exposure impacts have been assessed as outlined in DER-10 Section 3.10.1 Fish and Wildlife Resources Impact Analysis Part 1: Resource Characterization.

A resource characterization was conducted to identify potential risks of impact to fish or wildlife residing on and near the Site from chemicals potentially migrating from the Site. The analysis focuses on risks associated with Site related chemicals detected in soil, sediment, and surface water. This analysis contains:

- Description and a characterization of fish and wildlife resources,
- Description of fish and wildlife resource values,
- The identification of Chemicals of Potential Ecological Concern (COPEC) and their comparison to the applicable regulatory standards and criteria,
- Evaluation of potential exposure pathways to fish and wildlife from Site related chemicals of potential ecological concern,
- Conclusions regarding the potential of exposure and possible risks to fish and wildlife on or near the Site.

The following sections detail the ecological resources on and in the vicinity of the Site. Informational sources include a Fish Study prepared by the NYSDEC (May 2001), a "Site-Wide Characterization Summary Report" prepared by Brown and Caldwell Associates in conjunction with Cornerstone, and the reports entitled "*Ramapo River Biological Assessment,*"1998 and "*Current Human Exposure Under Control, Environmental Indicator, RCRA Corrective Action,*" 2005, prepared by the NYSDEC.

## 6.2 Description and Characterization of Resources

### 6.2.1 Terrestrial Resources

As shown on Figure 5-1, surrounding properties to the northwest are mainly residential in nature whereas the southeast properties are mostly unkept, open fields. The residential areas typically consist of mowed lawns interspersed with trees and shrubs.

### 6.2.2 Aquatic Resources

The West Branch of the Ramapo River is located north of the Site, and north of and parallel to Arden House Road, turns southeast after it passes the SPDES lagoon, and turns south when it reaches the highway I-87. The West Branch of the Ramapo River adjacent to the Site is classified by the NYSDEC as a Class C surface water. Title 6, Chapter X, Part 701 of the NYSDEC Water Quality Regulations defines this classification as follows:

Class C surface waters:

> "The best usage of Class C waters is fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes."

While the Site water quality has improved in recent years, other sources of urban pollution still exist throughout the West Branch of the Ramapo River watershed, apart from any potential impacts from the Site. Urbanization along the watershed represents a conduit for the transport of off-site pollutants to the West Branch of the Ramapo River. The importation of fill material and the installation of paved surfaces in the areas around the Site, as well as operation of the Orange County wastewater treatment plant that discharges into the West Branch of the Ramapo River immediately upstream from the Site, are examples of potential pollution sources.

### 6.2.3 Freshwater Wetlands

Wetlands have been identified on the U.S. Fish and Wildlife National Wetlands Inventory (NWI) Map and are presented on Figure 5-2. Freshwater emergent wetland has been identified in the proximity of the Site and is located sidegradient and downgradient from the Site. A freshwater pond has also been identified upgradient from the Site, on the other side of NYS Route 17. There are no direct migration pathways from the Site to these wetlands.

### 6.2.4 Fish and Wildlife Resources

The NYSDEC maintains a list of animal species that are endangered, threatened, rare, or of special concern. A search of New York Natural Heritage Program's Environmental Resource Mapper and the New York Nature Explorer's database for the area of Village of Harriman, for mammals, birds, and fish that are on the State's Endangered, Threatened or Rare list did not identify any rare plants, animals or significant natural communities.

The Site is 90 percent developed into parking lots or buildings (since razed) and only pockets of vegetation exist. The limited vegetation within the Site is mostly enclosed by a chain link fence and therefore is mostly inaccessible to terrestrial fauna. The current and potential future use of the site as industrial/commercial property further limits the potential for wildlife habitat. As such on the Site proper, no significant habitat exists for food, cover, bedding, breeding, etc.

A narrow band of vegetation exists along the West Branch of the Ramapo River and forms part of the ecological habitat of the stream corridor. This narrow band of vegetation is bordered by the former Nepera Site and the other bordering commercial and residential properties. So, the habitat is not extensive adjacent to the Site. As noted above, there are no endangered, threatened, or rare plants, animals, or natural communities identified at the Site; however, the narrow band of vegetation along the stream corridor would be expected to provide habitat for common, local flora and fauna.

## 6.3 Value of the Resources

### 6.3.1 Observation of Stress

No signs of stress to vegetation (e.g., poor coverage, wilting, dead or browning vegetation) along the banks of the SPDES lagoon or the West Branch of the Ramapo River were observed during Cornerstone's Supplemental RI field activities.

### 6.3.2 Value of Habitat to Associated Fauna

As discussed above, there are no significant communities or rare animals identified by the NYSDEC databases within the area around the West Branch of the Ramapo River. In addition, the area is 90 percent developed into parking lots, buildings, or former industrial infrastructure and only limited pockets of vegetation exist and these are enclosed by a chain link fence. The former buildings and industrial infrastructure have been decommissioned and removed from the site, and the site is currently largely vacant and covered in recycled concrete and stone/soil. Finally the current and future property use is industrial/commercial. Therefore, the Site and habitat along the West Branch of the Ramapo River would be expected to support common, local flora and fauna in the areas where the vegetative habitat exists.

### 6.3.3 Value of Resources to Humans

Portions of the Ramapo River south of the Site are classified as Public Fishing Rights (PFR) by the NYSDEC giving fishermen the right to fish along the banks of the river in the specified locations. However, the West Branch of the Ramapo River at the Site is not one of the listed designated fishing locations as depicted on the NYSDEC Public Fishing Rights Maps (Map 3). In addition, access to the West Branch of the Ramapo River in the vicinity of the Site is restricted by fencing on the Site and private property to the north. In addition, the Orange County Sewer District No. 1 (OCSD #1) wastewater treatment plant discharge is located immediately upstream of the Site and at times is the majority of the flow in the stream (i.e., during dry weather flows and when the West Branch of the Ramapo River is a losing stream).

The West Branch of the Ramapo River runs through Mary H Harriman Memorial Park forming a small pond (discharge point for the wastewater treatment plant identified above) which is located adjacent to the Site, northwest across NYS Route 17. This park encompasses recreational areas including baseball fields and basketball courts as well as the pond. The

park is of recreational value to humans; however it is located upgradient from the Site and therefore, the Site has no impact on this park.

The Site is currently isolated utilizing a chain link fence and does not allow for uncontrolled human access. The Site is of no ecological value to humans under the current conditions of a former industrial facility or anticipated future conditions under the assumption of commercial or industrial use. The limited area of stream corridor ecological habitat and relative inaccessibility (i.e., steep stream banks, overgrown vegetation), also limit the ecological value of the habitat to humans for recreational or other uses.

## 6.4 Identification of Chemicals of Potential Ecological Concern

A number of compounds were detected in the Site's surface soil, and nearby surface water and sediment. Data collected during the Supplemental RI and presented in the previous sections was used to provide additional information upon which to evaluate the potential ecological concern. Chemicals of potential ecological concern (COPECs) were selected to aid in the FWRIA.

Various constituents have been detected in Site soils including mercury, the primary COPEC which is distributed in shallow soils over much of the Site, along with PAHs, metals, and PCBs in localized areas of the Site.

As presented previously, New York State Part 703 surface water criteria were used for comparison to the most recent surface water samples collected in 2014. The results of the most recent sampling event were below the Part 703 surface water quality criteria. The compounds detected in surface water are therefore not considered COPECs.

Sediment samples from the West Branch of the Ramapo River were compared to the NYSDEC Class A, B, and C sediment criteria. The concentrations of mercury detected in several samples were within the Class B criteria, therefore designating mercury as a COPEC. Other metals (e.g., lead) reported above Class B or C criteria are likely attributable to fill materials used for construction of Route 17 or related to the wastewater treatment plant discharge or regional, urban soil characteristics, and are not Site related. Of note is that the presence of mercury in off-site soils associated with fill along Route 17 suggests that mercury in the sediments may also be associated with off-site sources. In addition, the NYSDEC data presented in the report entitled Background Levels of Heavy Metals in Soils of the Lower Hudson Valley (2003, revised 2006), shows that soils in the Hudson Valley region have mercury concentrations consistent with those found in the fill along Route 17 and off-site to the north, and are also comparable to the concentrations of mercury in the sediments. For example, the statistics for mercury in Hudson Valley soils as reported by the NYSDEC with comparison to sediments within the West Branch of the Ramapo River are as follows (See Appendix G for additional discussion):

| Statistic | W. B. Ramapo Sediments** | Hudson Valley Soils |
|---|---|---|
| Mean | 0.18 | 0.20 |
| Median | 0.15 | 0.13 |
| Std. Dev. | 0.13 | 0.18 |
| 90% UCL, normal distribution | 0.23 | 0.24* |
| 90% UCL, t distribution | 0.23 | 0.24* |
| Maximum | 0.59 | 0.92 |
| Minimum | <0.036 | 0.04 |

Notes: *The NYSDEC report does not specify the distribution.
**Calculated using ½ the detection limit for non-detect values.
Values in mg/kg.

The above data also include the additional sediments sampling voluntarily performed by the Corporate Defendants, which is presented in detail in Appendix G of this report.

Off-Site soil samples were compared to the Unrestricted and Ecological Resources SCOs. Mercury was detected in a few samples above the SCOs, thereby designating mercury as a COPEC.

In summary, mercury is identified as a COPEC for sediment and off-site soils, but is also viewed in the context of regional conditions. Various constituents are COPECs in the on-Site soils and are further evaluated below.

## 6.5 Ecological Receptors and Exposure Pathways Analysis

As previously noted, the Site is largely developed/barren and offers limited areas of ecological habitat, and to the extent the habitat exists it supports common, local flora and fauna. As such, the potential for impacts to terrestrial ecological receptors from exposure to CPOECs via the soil pathway would be expected to be limited.

Analysis of the surface water samples did not show Site related impacts or complete exposure pathways.

Analysis of the off-Site soil data collected to the south of the Site indicate that mercury was found at concentrations above the Protection of Ecological Resources SCO at 50% of the locations. However, both the mean and the geometric mean concentrations, calculated based on the highest mercury concentrations detected in the upper interval (0–2"), were below the Protection of Ecological Resources SCO. The mean and geometric mean are relevant to evaluation of protection of ecological resources consistent with the *Technical Support Document* for development of the Part 375 cleanup levels, as this document notes that."...to meet the requirement of a hazard index of one, the ***overall*** [emphasis added] concentration of a contaminant in soils at a site must be equal to or less than the ESCO value." In addition, the detected mercury levels are lower than those reported in other off-site soils collected as

part of the Supplement RFI (Brown and Caldwell, 2008) and may be related to traffic or fill materials associated with Route 17. Further, the concentrations of mercury found in the off-site soils are consistent with the NYSDEC's data on background levels of mercury in Hudson Valley soils. Given the above, the exposure pathway is not considered complete for off-site soils south of the Site.

Analysis of the West Branch of the Ramapo River sediments indicated that mercury concentrations were found within the Class B SGVs in three samples collected downstream from the Site. However, the NYSDEC biological assessment of the West Branch of the Ramapo River generally showed conditions similar upstream of, adjacent to, and downstream of the Site, indicating that site related impacts, if present, are not distinguishable from other off-site discharges to the stream. The NYSDEC also concluded from its fish study data that the concentrations of mercury found in fish from the West Branch of the Ramapo River are comparable to other water bodies throughout New York State, again indicating the inability to distinguish potential impacts from the Site from other contaminant contributions to the stream whether from urban sources in general or other individual potential sources such as the upstream wastewater treatment plant.

Based on input from a representative of the NYSDEC Division of Fish, Wildlife and Marine Resources, the NYSDEC's fish study data were further evaluated based on fish type (e.g., bottom feeding v. other fish) and location, including data from locations remote and upstream of the site, and absolute values of mercury in fish tissue as opposed to comparison to the fish consumption advisory. The results of this analysis show that there is no discernable impact from the Site. The fish study data analysis is provided in Appendix H.

Overall, the collective data from the site-specific sediments characterization, the NYSDEC's biological assessment, the NYSDEC's fish study, and the NYSDEC's data on soils in the Hudson Valley demonstrate that it is not possible to distinguish potential impacts from the Site, other sources, or urban background conditions.

The sediments, therefore, do not represent a distinguishable complete exposure pathway associated with the Site when the relatively low-level mercury detections in sediment are coupled with the NYSDEC's conclusions from the fish study, Hudson Valley soils survey, and biological assessment results. Of note, because of the nature of the stream bed in the West Branch of the Ramapo River (turbulent) there is limited fine-grained sediment in which mercury or other metals can accumulate, which is also reflective of the results of the fish study and biological assessment.

## 6.6 Conclusions

As presented previously, the surface water quality in the West Branch of the Ramapo River meets the New York Part 703 surface water criteria. These data thus continue to support prior conclusions that the Site has no measurable impact on the water quality of the West Branch of the Ramapo River.

Sediment assessments did not indicate distinguishable complete exposure pathways from the Site when the low-level mercury detections in sediment are coupled with the NYSDEC's conclusions from the fish study, further analysis of the fish study data, biological assessment results, comparable off-site impacts, and NYSDEC's Hudson Valley soils data. Of note, because of the nature of the stream bed in the West Branch of the Ramapo River (turbulent) there is limited fine-grained sediment in which mercury or other metals can accumulate, which is also reflective of the results of the fish study and biological assessment.

Samples collected from off-site soils south of the Site documented only a few locations at which mercury concentrations were marginally above unrestricted/Ecological SCOs, these concentrations are also consistent with Hudson Valley background soils concentrations, and the mean concentration (representative of potential terrestrial exposure) was below the unrestricted/ecological SCO. Therefore, the exposure pathway for off-site soils to the south of the Site is incomplete.

Finally, the limited areas of ecological habitats at the Site and adjacent to the West Branch of the Ramapo River, and the current and future industrial/commercial use of the Site do not indicate a complete exposure pathway of significance with respect to on-site soils.

# 7 QUALITY ASSURANCE/QUALITY CONTROL

## 7.1 Project Scope and Goals

The Supplemental Remedial Investigation for the Site included soil, sediment and surface water sampling. The data collected during this field investigation was used for characterizing the quality of the soil adjacent to the West Branch of the Ramapo River, the SPDES lagoon berm and adjacent properties, as well as sediment and surface water of the West Branch of the Ramapo River; defining the horizontal and vertical extent of Site related constituents, assessing potential human health and ecological risks, and supporting remedial planning.

## 7.2 Data Quality Objectives

Data collected under the Supplemental RI/FS Work Plan should be suitable for the purpose of characterizing the media (soil, sediment and surface water), assessing the presence of COC concentrations above applicable criteria and delineation of areas of contamination. In order to meet these data needs, the data quality objectives may be summarized as follows.

Data submitted for laboratory analysis should be collected, handled, and analyzed in accordance with consistent, standardized procedures. Detection limits for soil samples should be capable of meeting the soil SCOs listed in 6NYCRR Subpart 375-6.8. Detection limits for sediment samples should be capable of meeting the Freshwater Sediment Guidance Values listed in Table 1a of the Screening and Assessment of Contaminated Sediment (Draft dated January 24, 2013). Detection limits for surface water samples should be capable of being compared to NYSDEC Part 703.5 Water Quality Standards for Surface Water Class C.

## 7.3 Laboratory Analytical Procedures and Reporting Requirements

Samples were analyzed by Accutest laboratories of Dayton, NJ; an accredited laboratory pursuant to the NYSDOH Environmental Laboratory Accreditation Program (ELAP) for the parameters analyzed. Sampling analytical details were presented in the Quality Assurance and Quality Control section of the Supplemental RI/FS Work Plan (Tables 4-1 through 4-3).

Analytical results were reported according to Category B laboratory data deliverable reporting requirements (see Appendix E). The Category B deliverable package includes a formal assessment of the quality of the data and undergoes an internal data validation procedure. A case narrative /conformance summary is supplied with the Category B deliverables package. This is filled out by the laboratory manager/director as he/she reviews the report in its entirety, utilizing supervisor reviewed data submissions from the various departments. This summary assists in the assessment of the usability of the data in light of analytical performance and whether project data quality objectives have been met by the reported data. The data was evaluated for usability and applicability to the data quality objectives, and per DER-10, Data Usability Summary Reports (DUSRs) were prepared for each analytical data set and are attached in Appendices B through D.

## 7.4 Data Usability

### 7.4.1 Surface Water and Sediment Sample Results

The surface water and sediment sampling data usability results are presented in Appendix B. In general, the DUSR found that all laboratory analyses were method compliant. Some QC parameters were outside criteria; associated sample results were qualified accordingly. Data qualified as estimated (J/UJ) are usable and included in the analysis for project decisions.

### 7.4.2 SPDES Lagoon Berm Soil Sample Results

The data usability results for the SPDES lagoon berm soil sampling are presented in Appendix C. In general, the DUSR found that all laboratory analyses were method compliant. Some QC parameters were outside criteria; associated sample results were qualified accordingly. The data qualifiers identified in the laboratory reports are determined to be correct, no changes or additions to the data qualifiers have been applied.

### 7.4.3 On-Site and Off-Site Soil Sample Results

The data usability results for the on-site and off-site soil sampling are presented in Appendix D. In general, the DUSR found that all laboratory analyses were method compliant. Some QC parameters were outside criteria; associated sample results were qualified accordingly. The data qualifiers identified in the laboratory reports are determined to be correct, no changes or additions to the data qualifiers have been applied.

# 8 CONCLUSIONS

The conclusions based on results collected as part of this Supplemental RI are described in the Sections below.

## 8.1 West Branch of the Ramapo River

Analytical results of the supplemental sampling conducted within the West Branch of the Ramapo River confirm the results of prior investigations and indicate that there is no measurable impact from Site COCs on water quality within the West Branch of the Ramapo River. Data for the sediments indicates effects consistent with the urban character of the region, and it is not possible to distinguish potential effects from the Site, other sources, or background soils, or all three, based on the overall urban character of the impacts.

Surface water sample results were below Part 703 standards. The reported low level concentrations of chloroform and other related VOCs are attributable to discharge from the wastewater treatment plant located directly upstream of the Site.

With respect to sediment, the most recent sample results are consistent with observations reported in the July 1995 RI and indicate that background (upgradient/upstream) concentrations of VOCs, SVOCs, and inorganics other than mercury are generally comparable to and mostly higher than the downstream sample results. This distribution leads to the conclusion that the elevated metals are not Site related and are likely attributable to fill materials used along Route 17 and/or discharge from the wastewater treatment plant located upstream from the Site.

Mercury was detected in the sediment in the upstream location at similar, although slightly lower concentrations, than the downstream locations. However, the NYSDEC biological assessment of the West Branch of the Ramapo River generally showed conditions similar upstream of, adjacent to, and downstream of the Site, indicating that site related impacts, if present, are not distinguishable from other off-site discharges to the stream. The analysis of the NYSDEC fish study data also indicates that the concentrations of mercury found in fish from the West Branch of the Ramapo River are comparable to other water bodies in New York State, again indicating the inability to distinguish potential impacts from the Site from other contaminant contributions to the stream whether from urban sources in general or other individual potential sources such as the upstream wastewater treatment plant. Finally, the NYSDEC's mercury data for background soils in the Hudson Valley are also consistent with the concentrations of mercury in the sediments, further contributing to the inability to distinguish impacts from a specific source. Overall, therefore, it is not possible to conclude whether the Site, other sources, or both are contributing to the urban impacts evidenced in the data.

The above analysis indicates that no further investigation or study of surface water or sediments is recommended or needed.

## 8.2 On-Site Soils

The most recent VOC results from both the SPDES lagoon berm and river bank soils, and SVOC results from the SPDES lagoon berm soil samples (mostly non-detect) were below the SCGs. These data confirm that VOCs/SVOCs are not compounds of concern for this area of the Site.

PAHs present in the two deeper river bank samples collected at the RBS-1 location are likely related to fill material associated with construction of Route 17 and are unrelated to the Site. The single PAH (benzo(a)pyrene) detected in the 2"-6" interval at RBS-3 is marginally above the Commercial and Industrial criteria, and is likely related to the pile of asphalt from the parking lot present near this location.

With exception of a single arsenic exceedance of the Restricted/Commercial/Industrial SCOs during the most recent SPDES lagoon soil sampling event (LS-11-6"-12"), other analyzed metals (other than mercury) were below the applicable SCOs. None of the river bank soils were reported above the Restricted/Commercial/Industrial SCOs. Various metals both naturally occurring (e.g., lead) and unrelated to the Site (e.g., copper) were detected in soils above the Part 375 Ecological SCOs.

Other than locations LS-11 and LS-12, mercury was detected at the SPDES lagoon soil sampling locations with concentrations up to 107 mg/kg. Mercury was present above the part 375 published Industrial SCO of 5.7 mg/kg in 16 out of 32 samples in total, out of which 11 samples were collected from the 0"-2" interval. The highest concentrations were found at locations LS-15 and LS-16 near the northwest end of the SPDES lagoon. The highest concentrations of mercury found in the river bank soils were at RBS-2 and RBS-3, although no visible calcium sulfate was observed at these locations.

With the exception of the sample areas identified above (LS-15, LS-16, RBS-2 and RBS-3), the remainder of the reported mercury concentrations ranged from not-detected to 28.2 mg/kg. Mercury concentrations throughout the former Nepera Harriman Site based on the RCRA RFI averaged 40.6 mg/kg, and based on the RI, averaged 30.0 mg/kg. Therefore, mercury concentrations in soils, other than those referenced above, are similar to and less than site-wide concentrations.

The restricted residential, commercial and industrial Part 375 SCOs for mercury are 0.81 mg/kg, 2.8 mg/kg and 5.7 mg/kg respectively, and these values were used for comparison of the sampling results on Site within this report. However, the published SCOs for mercury are based on elemental mercury and the site data indicate that the mercury is present as a salt for which the relevant commercial or industrial SCOs would be 47 mg/kg and 220 mg/kg, respectively. Comparison of the mercury data to the relevant commercial/industrial criteria, therefore, do not indicate any concentrations above these SCOs for any samples other than locations RBS-2, LS-15 and LS-16.

Comparison of the on-site soil data to unrestricted/ecological SCOs, other than in the riverbank, is not applicable given the limited areas of habitat and current/future use of the

Site for industrial/commercial purposes. The riverbank soils results, however, were compared to the ecological SCOs and exceedences of the SCOs were indicated for naturally occurring metals, metals unrelated to the Site, and mercury.

## 8.3 Off-Site Soils

Off-site soil samples collected during the most recent sampling event to the north (RBN-1 and OPN-1) are indicative of fill materials placed for construction of Route 17 and petroleum related impacts unrelated to the Nepera Site. Not including the petroleum impacted soil, concentrations above the Unrestricted Use SCOs are present for zinc, lead, mercury and possibly PCBs (as discussed in Section 4.2.3.1.1, duplicate sample results do not correlate well). Mercury concentrations range from 0.064 mg/kg to 0.92 mg/kg, with a high concentration of 19.7 mg/kg in a duplicate sample for which the parent sample had a reported mercury concentration of 0.21 mg/kg. The mercury concentration of 0.92 mg/kg reported in the deepest (18"-24") river bank sample suggests concentrations of mercury on the order of 1 mg/kg are related to fill materials used along Route 17, and these data are also consistent with the NYSDEC's data on mercury in Hudson Valley soils. Comparison of the mercury data to the relevant commercial/industrial criteria (i.e., inorganic salt) as discussed above, do not indicate any concentrations above these SCOs.

Off-site samples to the south were non-detect for PCBs with detectable mercury concentrations ranging from 0.19 to 0.28 mg/kg at three locations (OPS-1, OPS-2 and OPS-4) within the 0-2" samples. These concentrations are consistent with the NYSDEC's regional background data on mercury in Hudson Valley soils, and only slightly above the Unrestricted Use/Protection of Ecological Resources SCOs but below the Residential SCOs. However, the mean concentration of all six 0-2" sample results is below the most stringent criteria. Mercury concentrations are either non-detect or below SCOs in the underlying sample interval (2"-24") at all locations. Collectively, the sporadic detection of mercury at levels consistent with regional background and only marginally above the Unrestricted Use/Protection of Ecological Resources SCO in 3 out of 18 samples, and a mean concentration below the most stringent SCO, coupled with the concentrations of mercury observed within the fill materials adjacent to Route 17 discussed above, leads to the conclusion that there is no adverse impact to off-site soils.

## 8.4 Qualitative Exposure Assessment and Fish and Wildlife Resources impact Assessment

Based upon the current use of the Site, the Qualitative Human Health Exposure Assessment found that there is a potential for trespasser exposure to COPCs found in Site soils (e.g. mercury) through dermal contact or incidental ingestion. Comparison of the mercury data to the relevant inorganic salt SCOs, however, limits potential exposure scenarios to three areas associated with sample locations RBS-2, LS-15 and LS-16.

It is assumed that future use of the Site as a commercial and/or industrial property would be following any remedial action. Therefore, there would not be any anticipated exposure

pathway and/or COPCs to humans (adults, adolescents and children) on the Site, other than potential construction workers who would be performing the work under a health and safety plan.

The Fish and Wildlife Resource Impact Assessment (FWRIA) concluded that although mercury concentrations indicate the West Branch of the Ramapo River sediments are identified as Class B, Class C sediments exist unrelated to the Site, and potential impacts whether from the Site, other sources, or both are not distinguishable. Therefore, it is not possible to conclude whether the Site, other sources, or both are contributing to the urban impacts evidenced in the data as supported by the NYSDEC's fish study, the NYSDEC's regional background mercury data and biological assessment, and the additional sediments data presented in this report.

The FWRIA further concluded that there are no significant natural communities or rare, endangered, or threatened flora or fauna identified by the NYSDEC databases within the area around the West Branch of the Ramapo River. In addition, the Site area is 90 percent developed into parking lots, with former buildings and industrial infrastructure now razed, and only limited pockets of natural vegetation/ecological habitat exist, most of which are enclosed by a chain link fence, and would generally provide only localized habitat for common flora and fauna.

# LIMITATIONS

The work product included in the attached was undertaken in full conformity with generally accepted professional consulting principles and practices and to the fullest extent as allowed by law we expressly disclaim all warranties, express or implied, including warranties of merchantability or fitness for a particular purpose.

The work product herein (including opinions, conclusions, suggestions, etc.) was prepared based on the situations and circumstances as found at the time, location, scope and goal of our performance and thus should be relied upon and used by our client recognizing these considerations and limitations. Cornerstone shall not be liable for the consequences of any change in environmental standards, practices, or regulations following the completion of our work and there is no warrant to the veracity of information provided by third parties, or the partial utilization of this work product.