SITE EVALUATION REPORT

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EXECUTIVE SUMMARY

Based upon a review of pertinent information, Roux Associates, Inc. has concluded with a reasonable degree of scientific certainty:

1. Three current and/or former industrial operations in the South Hill Area of Ithaca, New York have used and/or currently use chlorinated volatile organic compounds (CVOCs):

   (a) CVOCs, including trichloroethylene (TCE) and its breakdown products, were reported as principal site contaminants related to past operations at the former National Cash Register (NCR) facility at 950 Danby Road, and have been detected in groundwater above Class GA groundwater quality standards[1], and in soil vapor samples collected at that property;

   (b) CVOCs have been detected in soil and groundwater at the Emerson Power Transmission (EPT) facility located at 620 Aurora Street; and in soil vapor samples collected along sewer lines to the north of the EPT facility; and

   (c) The Therm facility, located on the Hudson Street Extension, has been a Large Quantity Generator (LQG) of hazardous wastes, including spent tetrachloroethylene (PCE), and has discharged PCE to ambient air as well as to sewers that discharge to the Six Mile Creek. PCE and other CVOCs have also been detected in several groundwater wells on the Therm property.

2. Based upon the sanitary sewer configurations in the South Hill Area:

   (a) The former NCR facility discharged to the Danby Road and South Aurora Street sewers, then to the Columbia Street sewer which in turn, discharged to the Turner Place sewer line;

   (b) The EPT facility never discharged to the Danby Road sewer;

   (c) The EPT facility discharges to both the South Cayuga and Turner Place sewer lines; and

   (d) The Therm facility discharges to the Columbia Street sewer, which in turn, discharges to the Turner Place sewer line.

3. The sanitary sewer configuration also indicates that sanitary sewers from all three facilities (NCR, Therm and EPT) discharged (historically) and/or discharge (currently) to sewers beneath the northern portion of the South Hill residential area in the vicinity of Turner Place, West Clinton Street and North Cayuga Street. Therefore, dissolved phase CVOCs that were discharged into sewers leading from the NCR, Therm and/or EPT facilities would have flowed into the sewers beneath the northern portion of the South Hill residential area.

[1] Class GA groundwater is considered to be a source of potable water supply.

4. There are five distinct soil vapor patterns, or "soil vapor signatures", along sewer lines emanating from the NCR and EPT facilities:

   - The "NCR Soil Vapor Signature" – consisting predominantly of TCE with 1,1,1-TCA as the secondary chemical constituent. The NCR Signature is dominant along the Danby Road/South Aurora Street sewer line and in South Hill area soil vapor samples from beneath South Aurora Street, Columbia Street, Tuner Place north of Columbia Street, and East Spencer Street;

   - The "EPT-South Cayuga Street Soil Vapor Signature" – consisting predominantly of PCE with 1,1,1-TCA as the secondary chemical constituent. The EPT-South Cayuga Street Signature is dominant along South Cayuga Street;

   - The "EPT-Upper Turner Place Soil Vapor Signature" – consisting predominantly of PCE with TCE as the secondary chemical constituent. The EPT-Upper Turner Place Signature is dominant beneath Turner Place south of Columbia Street;

   - The "Therm Soil Vapor Signature" – predominantly PCE (note that TCE greater than 100 $\mu g/m^3$ was detected in only of the three soil vapor samples collected along the sewer line originating from the Therm facility). This finding is consistent with the historical use of PCE in Therm's vapor degreasing operations, and the documented release(s) of PCE and other CVOCs to groundwater on the Therm property; and

   - The "Lower Turner Place Soil Vapor Signature" – similar to the "NCR Soil Vapor Signature", with slightly higher proportions of PCE in some samples. This pattern was interpreted to represent minor contribution of PCE from the EPT-Upper Turner Place Signature and the Therm Soil Vapor Signature, to the predominant NCR Soil Vapor Signature.

5. The CVOC data and sewer configuration indicate that CVOCs in soil vapor originating from discharges or releases related to the former NCR facility have migrated in or along sewer lines downstream from the former NCR facility towards Columbia Street and the South Hill Area sewers because:

   (a) Sanitary and storm water sewer laterals traverse the area of CVOC-impacted groundwater at the former NCR facility. These lines represent both a direct migration pathway for CVOC vapor migration within the sewers as well as a preferential pathway for CVOC migration along the permeable backfill and sewer bedding;

   (b) The former NCR facility is located at a higher elevation than the Danby Sewer which provides a pressure differential for flow;

   (c) Historical use of TCE in facility operations adjacent to the NCR sewers is consistent with the finding of TCE vapors within the sanitary sewer; and

(d) Former NCR facility operations, site conditions, sanitary sewer configuration and soil vapor CVOC data all support the former NCR facility as a source of CVOC vapors to the Danby Road sewer.

6. Alternatively, CVOCs in soil vapor, originating from discharges or releases related to the EPT facility, are *not* migrating within the Danby Road sewer towards the NCR facility along the Danby Road/South Aurora Street sewer line because:

   (a) The EPT facility never discharged to the Danby Road sewer;

   (b) The EPT facility is located at a lower elevation than the Danby Road sewer; and

   (c) There is no CVOC vapor concentration gradient that would facilitate transport of CVOC vapors to the Danby Road sewer.

7. It is Roux Associates' opinion that additional sampling along the sewer line originating from the Therm facility be conducted by NYSDEC and/or Therm to supplement the recently-collected data from soil vapor points SV-13, SV-14 and SV-15.

The bases for each of these conclusions are set forth within this report.

These conclusions are based upon information received and considered by Roux Associates as of the date of this report. Roux Associates reserves the right to amend or supplement conclusions in consideration of any new information.

1.0 INTRODUCTION

This report provides conclusions about (a) the configuration of municipal sewer lines in the South Hill area of Ithaca, New York and (b) potential sources of CVOCs in soil vapor samples collected in and around these municipal sewer lines. For purposes of this report, the South Hill area of Ithaca, New York includes:

(a) The Emerson Power Transmission (EPT) Facility located at 620 Aurora Street;

(b) The former National Cash Register Corporation (NCR) facility located at 950 Danby Road (currently occupied by a commercial office complex) ;

(c) The South Hill Elementary School located at 520 Hudson Street, Ithaca, New York;

(d) Properties located along Danby Road and South Aurora Street;

(e) Residential properties located along South Hill Terrace, Turner Place, Hillview Place, Columbia Street, Pleasant Street, East Spencer Street and South Cayuga Street; and

(f) The Therm Inc. (Therm) facility located on the Hudson Street Extension.

1.1 Purpose and Retention

Roux Associates Inc. (Roux Associates) was retained by Bond, Schoeneck & King, PLLC (Bond Schoeneck or BSK) on behalf of BorgWarner Inc. (Borg Warner) and Burns International Services Company, LLC (Burns), to review technical information about the configuration of municipal sewer lines and soil vapor data that have been collected in the South Hill Area and to identify the potential source(s) of CVOC vapors observed in and along these sewer lines with particular focus on the EPT, Therm and former NCR facilities. Roux Associates also reviewed: (1) the December 2007 S&W Redevelopment Remedial Investigation Report, (2) the S&W Redevelopment Remedial Work Plan, and (3) the February 2008 Arcadis report entitled "Assessment of Recent Soil Vapor Investigations in the South Hill Area of Ithaca, NY". More specifically, these reports were reviewed with respect to statements and conclusions made by the authors of these reports concerning the potential source(s) of vapor observed along the Danby Road sewer.

To accomplish this objective, Roux Associates:

1. Conducted an inspection of the EPT property and surrounding areas;
2. Prepared various figures depicting the sewer lines in the vicinity of the EPT and NCR properties;
3. Prepared figures depicting soil vapor concentrations along sewer lines in the vicinity of the EPT and NCR properties;
4. Reviewed pertinent environmental consulting reports regarding historical releases of CVOCs from the EPT and NCR properties;
5. Reviewed environmental databases for the Therm facility; and
6. Reviewed documents pertaining to the Therm facility that were obtained by WSP Environment and Energy (WSP) and its predecessor companies in 2005 from NYSDEC files.

1.2 Limitations

This report, including the exhibits attached hereto, describes the results of Roux Associates' review of information regarding the South Hill Area. The conclusions stated herein represent the application of a variety of engineering and technical disciplines to material facts and conditions associated with the subject property and to existing and/or historical regulations and laws. The conclusions set forth in this report are based upon the facts, information and data that have been provided to Roux Associates and considered as of the date of this report. Should any of these facts, information, and data change or be amended, then Roux Associates reserves the right to amend its conclusions and conclusions based upon such new information. This report is not intended to satisfy the requirements of the National Contingency Plan or any New York State Department of Environmental Conservation (NYSDEC) regulatory submittals.

2.0 DESCRIPTION OF THE SOUTH HILL AREA

This section provides a brief overview of the three current and/or former industrial facilities located in the South Hill Area: EPT, Therm and the former NCR facility.

2.1 EPT

The EPT facility, located at 620 South Aurora Street in Ithaca, New York, consists of three main buildings flanked by a number of smaller buildings and a series of access roads and parking lots. The facility was built by Morse Industrial Corporation in 1906 to manufacture steel roller chain for the automobile industry. Borg Warner owned the property from approximately 1928 to 1983 where it manufactured automotive components and power transmission equipment. In 1983, Emerson purchased Morse Industrial Corporation and, in the late 1980's, became known as Emerson Power Transmission. Current operations by EPT include manufacture of industrial roller chain, bearings, and clutching. In 1987, groundwater contamination originating from an on-site fire-water reservoir was reported by EPT to the NYSDEC. Further investigation and remediation has been on-going pursuant to a July 1987 Consent Order (Index #A7-0125-87-09). Work, currently being conducted by WSP and WSP Engineering of New York, P.C. and on behalf of Emerson and EPT, has included soil, groundwater, soil vapor and indoor air investigations, soil and groundwater remediation and installation of soil vapor mitigation systems at various residential properties located along South Hill Terrace, West Spencer Street and Turner Place[2].

A Supplemental Remedial Investigation Report (SRI)[3] was completed by WSP in December 2007 based upon a scope of work that WSP had submitted for the EPT facility, dated August 2, 2007. The SRI summarized investigations of: (a) 25 Areas of Concern (AOCs), (b) the fire-water reservoir, (c) structural features within the bedrock both onsite and offsite, (d) potential presence of site-related compounds in soil vapor and (e) potential groundwater discharge areas north of the EPT site. Constituents of potential concern were identified at the following AOCs:

- AOC 1: Former Department 507 Degreaser;

[2] WSP, Supplemental Remedial Program/Alternatives Analysis, April 25, 2008
[3] Supplemental Remedial Investigation Report, EPT, prepared by WSP, December 7, 2007

- AOC 2: Former Solvent Degreaser Building 6A;
- AOC 3: Former Reservoir/Spray Pond;
- AOC 4: Former Open Reservoir;
- AOC 12: Former Quench Oil Pits;
- AOC 15: Former 500 Gallon Gasoline Above Ground Storage Tank; and
- AOC 20: Storm Sewer along South Cayuga Street.

The SRI summarized the investigation that confirmed the presence of a bedding plane fracture at an elevation of about 515 feet above mean sea level (MSL) in borings adjacent to the fire-water reservoir, and provided further characterization of the bedrock formation.

The SRI summarized the basis for the following observations and conclusions by WSP:

- "Results of the soil vapor sampling demonstrate that the sewer extending from the former NCR facility is a source of VOCs to soil gas". This conclusion was based on observations of CVOCs along the sewer line originating from the NCR facility.
- "The EPT facility has never been connected to this [the NCR sewer] sewer line."

Based on the above observations and data evaluation, WSP concluded that, "….releases from the sewer emanating from the NCR sewer are a source of VOC impacts in the Phase VI area"[4].

In April 2008, WSP Engineering of New York submitted a Supplemental Remedial Program/Alternative Analysis report (SRP/AA) to further investigate groundwater in the vicinity of the fire-water reservoir area and to provide a scope for an interim remedial measure (IRM) to enhance the existing groundwater extraction and treatment system. The SRP/AA also identified and screened potentially feasible remediation technologies for several of the AOCs and provided a detailed evaluation of several feasible remediation technologies. Two Site Conceptual Models (SCMs); one for groundwater contamination associated with the fire-water reservoir area, and one for transport of CVOCs associated with the sanitary sewers were also presented.

[4] The Phase VI area is an area within the South Hill residential area investigated for soil gas impacts.

The following elements are included in the sanitary sewer SCM developed by WSP:

1. Historical releases of CVOCs, consisting of solvents that were discharged over a number of years in the late 1970s, occurred from the EPT facility to the sewer lines along Turner Place and South Cayuga Street;

2. The discharged solvent leaked out of the sewers into the surrounding fractured bedrock[5];

3. Solvent released to the fractured bedrock migrated horizontally within open fractures that are parallel to bedding and vertically within the joint sets;

4. The CVOCs migrated within sediment filled bedrock fractures and remain in the pore spaces of the sediment, held by capillary forces; and

5. CVOCs in the sediment filled fractures are currently volatilizing into the gaseous phase and are being transported by diffusion both vertically and laterally.

2.2 NCR

The former NCR facility is located at 950 Danby Road approximately 0.95 miles south of, and at a topographically higher elevation than the EPT facility. The NCR facility is currently occupied by a commercial business complex owned by the South Hill Business Campus, LLC (SHBC). The site currently consists of a split level two- and four-story office and manufacturing building consisting of approximately 265,000 square feet. NCR originally purchased the property from Ithaca College in 1953 to manufacture adding machines and cash registers and to operate a Printer Business Unit. Operations performed at the facility by NCR included: metal painting, heat treatment, plating, soldering, vapor cleaning, plastic molding and tumble barrels. These operations used a variety of chemicals, including oil-based paints, cyanide, nickel, zinc, cadmium, cutting oils, lubricating oils and solvents. From 1992 to 1994, AT&T Global Information Solutions used the facility to manufacture and assemble impact and thermal printers. The facility was acquired by Axiohm IPB, Inc. (Axiohm) in 1994, and operated through July 2003 as a corporate headquarters and for light manufacturing (final assembly of transaction printers using subassemblies)[6].

[5] The Turner Place sewers are constructed within unsaturated fractured bedrock.

[6] Brownfield Cleanup Program Remedial Investigation Report, 950 Danby Road, Ithaca, New York, S&W Redevelopment, December 2007.

The Remedial Investigation (RI) of the former NCR site, completed by S&W Redevelopment in December 2007, presented data to support conclusions by S&W that chlorinated alkenes, specifically TCE and its breakdown products, are the principal site contaminants related to past operations and have been detected in groundwater above Class GA groundwater quality standards. TCE and its breakdown products were also detected in soil vapor samples collected at the former NCR site.

The S&W Redevelopment RI also summarized an evaluation of soil vapor, groundwater seeps and the sanitary sewer originating from the facility. In the December 2007 S&W Redevelopment RI, the following conclusions were presented:

1. Bedrock occurs at depths from about 0 to 15 feet below ground surface with visible rock outcrops present;

2. Site soil is a mixture of native material (consisting of sand, silt and gravel intermixed with weathered shale fragments) and fill;

3. Groundwater occurs in overburden about 10 feet below ground surface under the parking lot west of the former manufacturing building and flows primarily to the northwest, consistent with the steep surface topography;

4. Shallow overburden saturated thickness is less than 5 feet and is underlain by bedrock;

5. Shallow overburden groundwater seeps were observed at numerous locations along the slopes of South Hill; and

6. VOCs were detected in 19 of 20 overburden groundwater samples with the range in VOCs detected above Class GA groundwater standards summarized in the text box that follows:

Volatile Organic Compounds detected in Groundwater at the Former NCR Facility above Class GA Standards (µg/L)	
Compound	**Range detected above Class GA Standards**
Trichloroethylene	5.2 – 340
Cis-1,2-Dichloroethylene	5.2 – 820
Vinyl Chloride	2.5 – 150
1,1-Dichloroethylene	14
1,1,1-Trichloroethane	6.4 - 240
Trans-1,2-Dichloroethylene	28
1,1-Dichloroethylene	15
Choroethane	14

Note: µg/L – micrograms per liter

The S&W Redevelopment RI identified seven potential source areas, of which four (the former Chip Disposal Room; the former Heat Treating/Plating Area; the Former UST Area, and the former Drum Storage Area), were considered source areas for CVOCs. Further, various trench drains were used to drain rinse water containing TCE into two 9,000-gallon underground storage tanks (USTs). A 6,000-gallon UST containing TCE was also located in a tank farm north of the plating area. In 1986, the USTs were reportedly decommissioned. These potential source areas are depicted on **Plate 6**, discussed later in this report. Based on a review of groundwater data, the S&W Redevelopment RI concluded that there were two discrete sources of CVOCs in overburden groundwater:

(a) The former chip disposal room and
(b) The former UST area.

The S&W Redevelopment RI Report also concluded that TCE and cis-1,2 dichloroethene (cis-1,2-DCE) were detected in samples from both the overburden and bedrock groundwater aquifer in monitoring wells located in the former plating/heat treating and UST areas. The report also concluded that, "the sanitary sewer system acts as a preferential migration path for groundwater contamination, based on analysis of soil, soil vapor, and groundwater samples," and that soil vapor contamination exists downgradient (west) of the former plating and UST areas. Soil vapor contaminants include TCE and cis-1,2 DCE (both detected in groundwater) as well as PCE, which was not detected in soil or groundwater samples.

2.3 Therm

The Therm facility is located on the Hudson Street Extension approximately 1/2 mile east to east-southeast of the EPT facility. The Therm facility provides custom machining to industrial clients using a range of machining processes including; grinding, milling, turning and electrical discharge machining (EDM),[7] as well as special processes including; welding, vacuum heat treat, Fluorescent Penetrant Inspection (FPI) and shot peen[8]. Grinding operations include over 100

[7] EDM is a machining method primarily used for hard metals that cannot be machined with traditional techniques
[8] Shot peen forming is a dieless process performed at room temperature, whereby small round steel shot impact the surface of the work piece.

grinding units for high and low pressure airfoil components for the aerospace and industrial turbine industry[9].

Roux Associates evaluated several environmental databases, available online, to gain a preliminary understanding of environmental conditions at the Therm facility:

(a) The NYSDEC Spill Incidents Database;
(b) The NYSDEC Environmental Site Remediation Database; and
(c) The NYSDEC Bulk Storage Database.

Each of these databases was searched for information regarding the Therm Facility.

In addition, Roux Associates searched several environmental databases on the "right to know" database found at www.rtknet.org.

In addition, Roux Associates reviewed documents provided by WSP that were obtained during a 2005 review of NYSDEC files pertaining to the Therm facility.

Results are provided in the subsections that follow.

2.3.1 NYSDEC Spill Incidents Database Records Related to Therm

The NYSDEC Spill Incidents database identified the following four records of spills at the Therm facility:

NYSDEC Spill Incidents for Therm Facility					
Spill Number	**Spill Date**	**Material Spilled**	**Amount Spilled**	**Resource Affected**	**Date Spill Closed**
8905514	9/5/1989	Waste Oil/Used Oil	0.0000 Gal.	Soil	4/5/1990
9210105	12/01/1992	Non-PCB oil, Zyglo penetrant	0.0000 Gal. 0.0000 lbs.	Surface Water	12/01/1992
9613882	2/26/1997	Unknown Material	0.0000 Gal.	Surface Water, Six Mile Creek	2/27/1997
9702022	5/16/1997	Material not identified	N/A	Not specified	5/30/1997

[9] http://www.therm.com/products.html

2.3.2 NYSDEC Environmental Site Remediation Database Records Related to Therm

The NYSDEC Environmental Site Remediation database contains records of the sites which have been remediated or are being managed under one of the state's remedial programs (State Superfund, Brownfield Cleanup, Environmental Restoration and Voluntary Cleanup). This database also includes the Registry of Inactive Hazardous Waste Disposal Sites. No record of the Therm facility on the Hudson Street Extension was found.

2.3.3 NYSDEC Bulk Storage Database Records Related to Therm

The NYSDEC Bulk Storage database contains records of facilities that are or have been regulated under one of the Bulk Storage Programs. Therm is listed as an unregulated Chemical Bulk Storage Site (Site number 7-000055). The registration or license expired on June 14, 1993. Storage tank information was unavailable in this database.

2.3.4 Right to Know Information Related to Therm

The Therm facility is a Large Quantity Generator (LQG) of hazardous waste, and disposes hazardous waste under identification number NYD002228542. Wastes include, "waste perchlorethylene from vapor degreaser halogenated solvents," that are generated on-site from production processes including vapor degreasing. According to the hazardous waste database, the following tons of PCE were generated by the Therm facility during the years provided in the on-line database.

Tons of Perchloroethylene Generated by Therm Facility	
Year	**Tons PCE**
1990	4.09
1991	2.601
1992	1.49
1993	0.372

As the preceding table indicates, Therm generated between 0.37 to 4.09 tons of PCE during the reporting period 1990 to 1993. The Right to Know "Handler Report" listed several violations for the Therm facility associated with compliance evaluations during on-site inspections, and

generator requirements. The report also indicated that the following waste codes were applicable to Therm: corrosive waste (D002) and PCE (U210).

The Toxic Reporting Inventory (TRI) database identified PCE as the major chemical that has historically been released to the atmosphere from the Therm facility. As shown in the text box that follows, large quantities of PCE were released from the Therm facility during the six year period from 1988 through 1993. Nitric acid was also reported as a compound released to air. It is interesting to note that the amount of PCE released to air increased about fifty fold from 1991 to 1992 and 1993.

PCE released to Air from Therm Facility (in pounds)	
Year	**Amount**
1988	500
1989	500
1990	500
1991	500
1992	26,750
1993	23,621

PCE has also been discharged to Six Mile Creek from the Therm facility via one or more of the four outfalls permitted under Therm's National Pollution Discharge Elimination System (NPDES) permit Identification Number NY0244261 that was issued to Therm on August 18, 1994. During thirteen quarterly reporting periods, Therm was issued forty (40) notices of non-compliance under this permit for either Discharge Monitoring Reporting (DMR) exceedances in its effluent or for non-receipt of the DMR Report. Under this permit, Therm is required to monitor for PCE in their discharge monthly, with the daily maximum PCE concentration not to exceed 0.005 ppm. As noted in the text box that follows, there were two dates identified on which effluent concentrations of PCE exceeded permit requirements. According to the NYSDEC data base, "This [these] measurement violation[s] is [were] linked to an enforcement action;" however, Roux Associates was unable to determine the exact nature of the enforcement

action or actions related to the PCE discharge exceedances. Discharge exceedance for 1,2-cis-DCE and several metals were also reported in the NYSDEC database.

PCE Exceedances of Therm's NPDES Discharge Limits (Limit = 0.005 ppm]	
Date	**Value**
September 30, 1995	0.0074
June 30, 1996	0.0083

Based on the above, Roux Associates concludes that the Therm facility has been a Large Quantity Generator of hazardous wastes including spent PCE and that PCE has been discharged to the air as well as to sewers that discharge to the Six Mile Creek.

2.3.5 Documents Related to Therm Obtained from NYSDEC files

The use and/or discharge of PCE and/or TCE from the Therm facility is referred to in the following documents obtained in 2005 by WSP from NYSDEC files (discussed in chronological order):

1. A March 11, 1976 memorandum from the Tompkins County Health Department indicated that Therm "emits" TCE based upon information provided to the County Health Department in the "AIR100" form. The memo also indicated that Therm, "have switched from trichloroethylene to perchloroethane [*sic*].[10]" The memorandum indicated that the solvent degreaser was installed in June 1977 with a PCE emission rate of 0.156 pounds per hour or ~686 pounds per year[11].

2. A March 21, 1989 NYSDEC Division of Air Certificate to Operate an Air Contamination Source indicated that at that time, Therm had a permit to discharge PCE vapors associated with a vapor degreaser used for degreasing and cleaning operations.

3. A May 15, 1990 letter from the City of Ithaca to Therm described, "a bad chemical smell below Therm, in the vicinity of a small stream that runs from the Therm property and across the old railroad right-of-way."

4. The following information about PCE and/or CVOCs was noted in a February 5, 1992 Phase I Environmental Liability Assessment prepared by O'Brien & Gere for the Therm facility:

   (a) Two, 275-gallon above ground storage tanks are present that store PCE;

[10] More likely perchloroethylene or PCE
[11] Annual emissions based on operating 275 days per year and 16 hours per day

(b) An oily sheen was observed on a creek originating from Therm's storm water drainage conduit, which runs under the main operating buildings of the property. Samples collected from this storm water drainage conduit identified zinc at 0.46 milligrams per liter (mg/L)[12];

(c) Therm, at the time, had two air emission sources and associated air permits: one for a vapor degreaser that emitted PCE; and, another for a nitric acid cleaning tank that emited nitric acid mist; and

(d) According to Therm's 1991 hazardous waste manifest, (USEPA Generator Permit No. NYD002228542), Therm generated approximately 220 gallons of PCE waste annually;

5. An April 1, 1993 New York State Memorandum documented a sheen in the Six Mile Creek that was observed on March 27, 1993 by a local resident. The sheen was determined to be a spill of "Varsol-1", a Stoddard solvent (similar to mineral spirits) that had occurred at the Therm facility.

6. In a May 21, 1993 Interim Order and Agreement between Therm and NYSDEC, Therm acknowledged that alleged releases and/or emission have occurred from the Therm facility including petroleum distillates, PCE, TCE, carbon disulfide, cis-1,2-DCE and acetone and that contamination has been detected in plant site soils and off-site areas. These releases resulted in an emergency response cleanup of contaminated areas off the Therm property. Therm further agreed to provide ongoing response activities and to determine the nature and extent of contamination. This included Therm agreeing to conduct a soil vapor survey to determine the nature and extent of any subsurface vapor plumes in adjacent residential areas as well as indoor air sampling.

7. A July 1993 report by O'Brien & Gere presented the results of indoor air sampling at the Fox/Little residence that identified the following compounds: 1,1,1-TCA; chloroform; xylenes, ethylbenzene, naphthalene, toluene, n-butylbenzene, methylene chloride, 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, all below 10 ppb. The report concluded that none of these compounds were related to the mineral spirits release from the Therm facility.

8. A November 1993 NYSDEC Industrial Chemical Survey form for the Therm facility indicated that, "Phase-out of tetrachloroethylene is underway and complete phase out will be accomplished by January 1, 1994." The form indicated an average annual PCE usage of 2,700 (units not stated).

9. A September 24, 1993 letter report prepared by O'Brien & Gere, summarized the findings of a soil vapor survey performed at three residential properties near Therm. PCE was detected at four soil gas locations (SV-52-5'; SV-53-3'; SV-64-3'; and SV-64D-3')[13]

[12] The sheen may also be related to the sheen that was later determined to be "Varsol 1", a mineral spirits based solvent, as discussed in bullet point #5.

[13] A figure providing sample locations was not included in the letter report.

ranging from 0.211 to 0.838 ppm by volume, and 'other VOCs' were detected at multiple locations. The report concluded that, "PCE and 1,3-5-TMB[14] were detected in samples collected along the Therm, Inc., fence line." The report also concluded that, "PCE, 1,3-5 TMB and 1,2,4-TMB[15] were detected in samples collected from the Fortunato/Gilliland property. No discernable pattern to the detections was evident."

10. A December 13, 1993 letter from the State of New York Department of Law to the law firm of Grossman, Kinney, Dwyer, Reitz & Harrigan, P.C., indicated that the State had reviewed a submittal about "its pending enforcement action against Therm," and deemed the submittal "unacceptable." The Department of Law letter also indicted that TCE was present in groundwater, "at levels over 200 times the State groundwater standard," and further stated that, "Despite documented sediment, soil and groundwater contamination, your client [Therm] refuses to commit to remediate the contamination, only offering to negotiate at some future time."

11. A March 4, 1994 hand written memo and accompanying Draft Work Plan[16] indicated that six monitoring wells were installed at Therm in which PCE (as high as 1,310 µg/L), TCE (as high as 76.6 µg/L) and DCE (as high as 595 µg/L) were detected along with trichlorofluoromethane (Freon-11). The hand written memo also indicated detection of "low level concentrations of PCE at outfalls 001 and 002."

12. Although Roux Associates was unable to obtain a copy of the "Groundwater Investigation Report," referenced in a January 9, 1994 transmittal letter from Therm to various State Representatives, a March 25, 1994 letter from the New York Department of Law regarding the "Therm Work Plans," stated that, "the State believes that evidence of bedrock contamination is clearly indicated given the preliminary groundwater data, the presence of perc and associated contaminants in the soil gas of adjacent residences, the presence of perc and Varsol-related contaminants in on-site and off-site soil samples and the indication of the past use of storm drains from inside facility sources to the outdoor environment." The letter also raised concern about the potential for barrels being present in the fill area behind the Therm plant that may have discharged "industrial contaminants."

13. A December 19, 1994 letter report prepared by Stearns & Wheler provided results of a groundwater investigation of PCE contamination at the Therm property. Two new overburden monitoring wells were installed, "to evaluate the areal extent of PCE impacts to overburden groundwater." Three additional bedrock wells were also installed, "to evaluate potential PCE impacts to the bedrock aquifer." The report concluded that;

    (a) PCE had impacted the overburden groundwater in the vicinity of a concrete pad with PCE concentrations in MW-5S remaining above NYSDEC groundwater standards;

[14] 1,3,5-trimethylbenzene
[15] 1,2,4-trimethylbenzene
[16] This draft work plan appears to be an earlier version of a May 16, 1994 letter from Stearns & Wheler to NYSDEC providing a revised work plan to investigate PCE impacts to groundwater at the Therm facility.

(b) Analytical results from four bedrock wells indicated that PCE was not present in bedrock groundwater;

(c) "PCE-related impacts may have been associated with a residual source area adjacent to the pad;" and

(d) Stearns & Wheler recommended that sampling of monitoring well MW-5S be continued on a biannual basis.

Roux Associates notes that PCE concentrations in MW-3S have, historically, been greater than those in MW-5S (see text box below). Therefore, it is Roux Associates' conclusion that both MW-3S and MW-5S should have been included in any future biannual monitoring program for the Therm site. Roux also notes that at the time of the Stearns & Wheler report, there was no bedrock well at MW-5S and that PCE concentrations at MW-5S were increasing over time. It is Roux Associates' opinion that the bedrock aquifer in the vicinity of MW-5S should be assessed.

PCE concentrations observed in Therm overburden monitoring wells (µg/L)*

Date	MW-3S	MW-5S
April 5, 1993	474	Not sampled
April 12, 1993	1,310	15.1
July 29, 1993	358	9.9
October 1994	1.6	63.2
June 8, 1995	Not sampled	41.1

*PCE Groundwater Standard = 5 µg/L

Note that post-1994 data were obtained from a July 17, 1995 letter from Therm.

14. A February 15, 1995 NYSDEC memorandum summarized a February 14, 1995 facility inspection in which several items were found to be out of compliance including violations of the SPDES Permit's quarterly action level monitoring requirements for several parameters including PCE, 1,1-trans-DCE and 1,2-cis-DCE.

15. A May 21, 1996 letter from Stearns & Wheler noted that PCE and other chlorinated solvents including TCE and 1,2-DCE, have exceeded the discharge limits in Therm's SPDES permit even though PCE was no longer used at Therm. A sampling plan to help identify the potential PCE was proposed.

16. In August 27, 1997, the State of New York brought an Amended Complaint against Therm (Defendant), "to recover costs incurred by the State in connection with the release or discharge of hazardous substances, petroleum, and industrial wastes at the Therm, Inc. manufacturing facility in Ithaca, New York, and their subsequent migration to off-site areas, including the contamination of soils, stream sediments, air, surface water, groundwater and residential property." In addition to restating the release of Varsol that occurred at the Therm facility on March 23, 1993, the Amended Complaint states that:

    (a) "DEC found a storage tank used for perchloroethene ("PERC"), a chemical solvent, in the lower level of the Therm facility," and that PERC is a hazardous substance as that term is defined under CERCLA.

    (b) At times during the period that Therm operated the facility, "certain hazardous substances and petroleum products seeped, leaked, drained, poured, emptied or were discharged into soils, pavement, flooring drains, roof drains, ditches and other discrete conveyances in and about the Therm facility," and that these hazardous substances were discharged to on- and off-site areas including groundwater.

    (c) DEC further stated that the hazardous substances have migrated to the sediment and water column of tributaries of Six Mile Creek and that, "Defendant did not notify DEC of PERC releases to the environment."

    (d) Releases of PCE; TCE; cis-1,2-DCE; trans-1,2-DCE and other compounds have contaminated groundwater and that, "releases from the facility have caused vapors from hazardous substances to enter the indoor air environment of residential properties in the vicinity of the facility."

17. Finally, a December 1, 1997 expert report prepared by Richard Brazell on behalf of the State of New York states that, in the opinion of Mr. Brazell, "Therm has discharged petroleum and other wastes which has caused a violation of State water quality standards, and that Therm has discharged without authorization waste waters contaminated by solvents, petroleum products and/or other pollutants, including but not limited to PERC and Varsol."

Based on the above, Roux Associates concludes, with a reasonable degree of scientific certainty, that:

    (a) The Therm facility used both PCE and TCE in vapor degreasing operations;

    (b) PCE was stored in two, 275-gallon ASTs;

    (c) PCE was discharged to the atmosphere from the Therm facility under a New York State air permit;

(d) PCE, originating from the Therm facility, has been detected in soil gas collected at three residential properties in the vicinity of the Therm facility;

(e) PCE, TCE and other CVOCs have been detected in groundwater at the Therm facility; and

(f) The Therm facility has had several SPDES violations of quarterly action level monitoring requirements for PCE and other CVOCs and has exceeded discharge limits for such chlorinated solvents.

Therefore Roux Associates concludes, with a reasonable degree of scientific certainty, that the detections of PCE and/or other CVOCs in soil gas along sewer lines originating from the Therm facility are related to past or ongoing discharges and/or source areas attributable to the Therm facility.

2.3.6 Dry Cleaners

According to information provided by WSP, the following three dry cleaners in Ithaca are listed as New York State Hazardous Waste Sites:

- HW755014: 315 North Meadow Street – this is an active dry cleaner located 1.27 miles northwest of the EPT facility;
- HW755013: Campagnolo Property – 503-511 North Meadow Street – this is a former dry cleaner (1960-1965) located 1.41 miles northwest of the EPT facility; and
- HW755015: Clinton West Plaza – 609-625 West Clinton Street – this is a shopping plaza that formerly contained the Clinton West Laundry (dry cleaner from 1970-2000) located 0.8 miles west of the EPT facility.

It is not possible to reach a definitive conclusion regarding the potential for these dry cleaners sites to have contributed PCE to soil gas in the South Hill area without reviewing further information on these dry cleaner sites. However, since all of these dry cleaner sites are located on the other side (north) of the Six Mile Creek relative to the South Hill area, it is more likely than not that any solvent releases from these dry cleaner sites have not contributed to PCE in soil gas that is impacting the South Hill area south of Six-Mile Creek.

3.0 METHODS OF SOIL VAPOR DATA INTERPRETATION

This section describes the methodology used by Roux Associates to:

1. Understand and evaluate the current and historical configuration of the municipal sewer lines traversing the South Hill Area; and

2. Evaluate soil vapor and manhole vapor data that have been collected from the South Hill Area.

3.1 Sewer Line Locations and Soil Vapor/Manhole Sample Locations

Most of the locations for the sanitary sewers in the South Hill Area were obtained from various sewer maps published by the City of Ithaca Water and Sewer Division. [Drawings: R-17, S-17, S-18, T-18, T-19, U-20, V-19, 154A, 178, 199, 203B and Y-14]. Locations for sewers that were not included in these sewer maps were obtained as follows:

- The location of the sewer line to the north of the NCR facility and the lateral line from Ithaca College were obtained from Contract Drawings - Town of Ithaca, New York Sanitary Sewer Main Replacement, South Hill, April 1994 obtained from the City of Ithaca Water and Sewer Division;

- The location of the sewer line on South Hill Terrace and any remaining gaps in sewer locations were provided by information obtained from personal communications with Mark Fuller (Utility System Location Technician) at City of Ithaca Water and Sewer Division[17]; and from a figure provided by Mr. Carl Cuipylo of the NYSDEC[18].

- Soil vapor sample locations were obtained from (a) CAD drawings provided by WSP, (b) Figure 1 of the February 2008 Arcadis report,[19] (c) two figures provided by Karen Cahill of the NYSDEC (for locations SV-01, SV-02[20], SV-09 and SV-10[21]), and (d) Figure 5-13 from the S&W Redevelopment Remedial Investigation Report (for locations SV-1 through SV-5A).

[17] Personal communications on April 2, 15, and 24, 2008.

[18] Figure attached to an April 3, 2008 email noting that: Green=EPT, Blue=Therm, Yellow=NCR/Axiohm, and Magenta=overflow. This configuration is Mr. Cuipylo's understanding of the pre November 2007 sewer system. Sewer system changes after November 2007 included the South Aurora Street and Therm sewer systems flowing north on South Aurora Street and the Columbia Street sewer connected as an overflow.

[19] Arcadis, "Assessment of Recent Soil Vapor Investigations in the South Hill Area of Ithaca, New York, February 2008.

[20] EA Project Number:14386.19 – NCR Sewer Ithaca NY. Figure: Soil Vapor Sampling Locations, South Aurora Street.

[21] EA Project Number:14386.19 – NCR Sewer, Immediate Investigation Work Assignment, Ithaca NY. Figure: Soil Vapor and Outdoor Air Sampling Locations.

3.2 Soil Vapor Data

The following soil vapor data collected adjacent to various sewer lines and from within sewer manholes were obtained from a total of 78 sample locations:

- Data from 58 locations provided by the WSP;
- Data from 8 locations (SV-1, SV-2, SV-3, SV-4, SV-5, SV-5A, SV-6 and SV-7) taken from laboratory reports that were included in the December 2007 Remedial Investigation Report prepared by S&W Redevelopment;
- Data from 10 locations (SV-06 through SV-15) from laboratory reports provided by Karen Cahill of the NYSDEC;
- Data from 4 locations (SV-01, SV-02, SV-03 and SV-04) taken from laboratory reports posted on ERIMS web site managed by WSP; and
- Data from the vicinity of the former NCR facility taken from Figure 1 of the February 2008 Arcadis report.[22]

Table 1 summarizes soil vapor and manhole data obtained from these sources for the following compounds: PCE; TCE; cis-1,2-DCE; and 1,1,1-trichloroethane (1,1,1-TCA). These constituents were selected because they were the most prevalent, and were present at the highest concentrations in the soil vapor samples from the South Hill Area.

All data were imported into ArcGIS Version 9, a Geographical Information System (GIS). GIS is a relational database that allows direct visual comparison of geographically referenced features with analytical data. Various site information that was compiled and imported into the GIS included but was not limited to:

(a) The location of sewer lines taken from the sources previously described;

(b) Location of the EPT facility was taken from a WSP drawing, and the former NCR and Therm buildings taken from Figure 1 of the February 2008 Arcadis report and confirmed using a 2002 aerial photograph; and

(c) Street locations and Six Mile Creek digitized from a 2002 aerial photograph.

[22] Arcadis, "Assessment of Recent Soil Vapor Investigations in the South Hill Area of Ithaca, New York, February 2008.

PCE, TCE, cis-1,2-DCE and 1,1,1-TCA data in the GIS were then posted on maps at each sampling location as color-coded pie chart symbols using the following thematic mapping regime:

- the size of each pie chart symbol was proportional to the sum of the CVOCs detected at that particular location;
- Color coding was used within each pie chart symbol to represent the relative proportion of the individual CVOCs in the sum: PCE (shown in blue), TCE (shown in red), cis-1,2-DCE (shown in green), and 1,1,1-TCA (shown in yellow); and
- Sample location designations and the sum of PCE, TCE, cis-1,2-DCE and 1,1,1-TCA were also posted on the GIS figures. [Note that the sum for the four CVOCs were posted only at those locations where the sum exceeded 200 $\mu g/m^3$.]

4.0 RESULTS OF SOIL VAPOR DATA INTERPRETATION

Current and historical sewer line configuration and associated CVOC soil vapor data distribution are discussed in this section.

4.1 Sewer Lines

Plate 2 shows all current and historical sewer lines within the South Hill Area originating from the former NCR facility and the EPT and Therm properties. **Plate 1A** shows these sewer lines along with all of the manhole and soil vapor samples collected along the sewer lines using the thematic mapping regime discussed above. **Plate 2** depicts the identical sewer system, with the following color-coding based upon where each of the sewer lines originates:

- Solid Black: Main sewer originating from EPT;
- Sold Blue: Main sewers originating from Therm;
- Solid Red: Main sewers originating from NCR;
- Solid Grey: Other main sewers; and
- Dashed: Overflow sewers from EPT (black) or a combination of source properties (shown in various colors).

Arrows indicate the direction of flow within each of these sewer lines.

4.1.1 Sewers originating from the Therm property

As shown by the blue-colored lines in **Plate 2**, the sewer line from the Therm facility runs in a northwest direction parallel to Crescent Street. The sewer line then intersects Hudson Street northeast of South Hill Elementary School and runs north on Hudson Street and then west onto Columbia Street to Manhole-6 (MH-6) where it joins the Danby Road sewer. Historically, the main flow from both the former NCR facility (shown by the red-colored lines) and the Therm property continued from MH-6 along Columbia Street (west) to the intersection of Columbia and Turner Place, while overflows continued north along South Aurora Street. In 2007, the historical overflow pipe in South Aurora Street was replaced with a new pipe to provide the main flow

from MH-6[23]. Current flows are now reversed from those which occurred historically, with the main flow now continuing from MH-6 north to South Aurora Street, and overflows going west into the Columbia Street sewer.

4.1.2 Former NCR facility

As shown by the red-colored lines in **Plate 2**, four laterals from the former NCR facility discharge into a main sewer that runs northeast parallel to Danby Road and then along Danby Road to MH-6 where it joins flows originating from the Therm facility. As discussed in section 4.1.1, main flows from MH-6 historically discharged west along Columbia Street to Turner Place, while overflows discharged north to South Aurora Street. Note that both sewer laterals from South Hill Elementary School also ultimately discharge to the Danby Road sewer line.

4.1.3 EPT Facility

As shown by the black-colored lines in **Plate 2**, there are two sewer lines originating on the EPT facility: (1) the South Cayuga Street sewer line and (2) the Turner Place sewer line. These sanitary sewer lines were identified as "AOC-21" in WSP's December 13, 2005 "Onsite Assessment of the Former Borg Warner-Morse Chain Facility." According to that report, EPT discharges sanitary wastewater, process wastewater, non-contact cooling water, boiler blow-down and miscellaneous wastewater to the Turner Place municipal sewer at Turner Place, and wastewater and non-contact cooling water to the South Cayuga Street sanitary sewer.

<u>South Cayuga Street sewer</u>

Figures 3 and 4 of WSP's December 7, 2007 Supplemental Remedial Investigation Report depict the following laterals from the EPT facility connecting to the South Cayuga Street sewer:

- Two laterals originating in Building 34 (location of PCB transformers); and
- One lateral originating in Building 13A and Building 8 (former cyanide and cadmium plating room and traversing over a storm sewer line that originates at the former solvent degreaser, identified by WSP as Area of Concern number 2 (AOC 2) where a solvent degreaser was formerly located[24].

[23] City of Ithaca Water and Sewer drawing S-17 and confirmation with Mark Fuller at City of Ithaca Water and Sewer Division.

[24] AOC 2, identified in the WSP December 2007 Supplemental Remedial Investigation Report, was a solvent degreaser formerly located on the main floor of Building 6A within the chain assembly area.

These laterals all flow into the South Cayuga Street sewer. As **Plate 2** indicates, the South Cayuga Street sewer also receives overflow from the sewer line on East Spencer Street and direct flows from the Turner Place sewer.

Turner Place sewer

Figures 3 and 4 of WSP's December 7, 2007 Supplemental Remedial Investigation Report depict the following laterals from the EPT facility connecting to the Turner Place sewer:

- Two laterals originating at Building 9 (location of former quench oil pit) and flowing northwest towards Buildings 3 and 4 (Building 4 is the location of AOC 1 where solvent degreasing and recovery operations were formerly located)[25] and then joining a sewer line running northeast along western side of the main building;
- One lateral from Building 10 (formerly housing coke operations) running northeast through Buildings 10 and 11 and then joining the sewer line noted in the above bullet; and
- One sewer lateral from Building 21.

These laterals all lead to the Turner Place sewer. As depicted by the black lines in **Plate 2**, the main Turner Place sewer flows north on the eastern side while an overflow line runs along the western side of Turner Place. Both of these lines discharge into the manhole at the intersection of Columbia Street and Turner Place, where they join sewer lines originating from the Therm and NCR properties.

The flow path within the Turner Place sewer line has changed over time as described below:

Pre-1970s

Main Flow: Intersection of Turner Place and Columbia Street → East Spencer Street → North Cayuga Street

Overflow: There was no overflow capacity prior to the 1970s.

[25] Degreasing operations, conducted in Department 507, formerly located on the main floor of Building 4, included two conveyor type vapor degreasers and a solvent distillation and recovery unit.

Post-1970s

Main Flow: Intersection of Turner Place and Columbia Street → MH-4 → West Clinton Street → North Cayuga Street

Overflow[26]: Intersection of Turner Place and Columbia Street → East Spencer Street → North Cayuga Street

4.1.4 Summary

Based on the sewer configurations discussed in sections 4.1.3, the following can be concluded about the various properties discharging into these City of Ithaca sanitary sewers:

a. **The former NCR facility** discharged directly into the Danby Road and South Aurora Street sewer, which in turn, discharged to the Turner Place sewer;

b. **The EPT facility** has never discharged directly into the Danby Road sewer;

c. **The Therm facility** discharges to the Columbia Street sewer, which in turn, discharges to the Turner Place sewer;

d. **The EPT facility** discharges to both the South Cayuga and Turner Place sewers; and

e. **The South Hill Terrace sewer** does not receive any flows from either the South Cayuga Street or Turner Place sewer lines. Flow within the South Hill Terrace sewer discharges only to the Turner Place sewer.

Based on the above, Roux Associates concludes that sewer lines originating from all three facilities (NCR, Therm and EPT) discharged (historically) and discharge (currently) to the northern portion of the South Hill residential area in the vicinity of Turner Place, East Spencer Street, West Clinton Street and North Cayuga Street. Therefore, any chemical discharges from the NCR, Therm and/or EPT facilities into the municipal sewers from these facilities would have flowed toward the northern portion of the South Hill residential area.

Roux Associates also concludes that *none* of the sanitary wastewater, process wastewater, non-contact cooling water, boiler blow-down and/or miscellaneous wastewater aqueous-phase and/or non-aqueous phase chemicals from the EPT facility flowed or flows to the Danby Road sewer because the former NCR facility (located at about 850 feet MSL) and Danby Road sewer

[26] This line provides overflow capacity for discharge from the manhole at the intersection of Columbia Street and Turner Place; however, it collects all discharge from homes along the east side of Turner Place, as well as all homes on East Spencer Street.

(located from about 850 feet MSL to 750 feet MSL) are located at higher elevations[27] than the flows originating from the EPT facility which is located at a lower elevation of about 600 feet feet MSL.[28]

4.2 Soil Vapor Data

Plates 3, 4 and 5 depict soil vapor and manhole vapor data collected from the South Hill Area as follows:

Plate 3: All data including the results from two duplicate samples collected on August 30, 2007 from MH-4;

Plate 4: All data except the value shown for the duplicate samples collected on August 30, 2007 from MH-4 is the average concentration of the two duplicates samples; and

Plate 5: All data except that only the lower concentration of the two duplicate samples collected on August 30, 2007 from MH-4 is presented.

Review of the laboratory data sheets from Centek Laboratories indicates that for both the 1,1,1-TCA and the TCE in the original MH-4 sample, a 2,560-times dilution factor was applied to the analysis of these two compounds. The MH-4 Duplicate sample had no dilution factor applied.

The WSP report[29] stated that the large discrepancy between the TCE and 1,1,1-TCA results from the original and duplicate samples could not be explained and that the data deliverables complied with NYSDEC Analytical Services Protocol B (2005). Based on the wide range in TCE and 1,1,1-TCA results between the two MH-4 duplicate samples collected on August 30, 2007, Roux Associates presented these data in **Plate 3**, **Plate 4** and **Plate 5** using both data sets, the average value and the lower (as reported in sample MH-4 Duplicate) of the two TCE and 1,1,1-TCA values, respectively.

As noted earlier, CVOC data are shown on these Plates as color-coded pie charts with the size of each pie proportional to the sum of PCE (shown in blue) TCE (shown in red), cis-1,2-DCE (shown in green) and 1,1,1-TCA (shown in yellow). In interpreting these results, Roux

[27] 7.5 Minute Series Topographic Quadrangle, Ithaca East, New York, Photorevised 1990 Scale 1:24,000.
[28] WSP, Interim Remedial Measure Design Report, EPT Facility, Ithaca New York, 2008.
[29] Supplemental Remedial Investigation, WSP, December 7, 2007.

Associates relied upon the data depicted in **Plate 5** (showing the lower of the two TCE and 1,1,1-TCA values collected on August 30, 2007, from MH-4) because:

- TCE and 1,1,1-TCA values in the MH-4-duplicate sample were 372 and 2,115 times lower, respectively, than the values observed for these compounds in the original MH-4 sample;
- The higher TCE and 1,1,1-TCA values in the original MH-4 sample are inconsistent with all of the other soil vapor data collected from the South Hill Area; and
- Resampling of MH-4 on October 17, 2007 yielded soil vapor results consistent with the lower of the two MH-4 duplicate samples that were collected in August 2007.

Plate 6 depicts additional features along the sewer lines to aid in interpreting soil vapor data:

- The approximate locations of the two overburden TCE plumes identified on the former NCR property;
- Portions of storm sewers on the former NCR property; and
- Historical operations at the former NCR and EPT that used and/or stored chlorinated solvent.

Sections 4.2.1 through 4.2.4 describe the interpretation of the following five soil vapor patterns (hereinafter termed "soil vapor signatures") that are evident from the distribution of concentrations and chemical compositions of CVOCs depicted in **Plate 5**:

- NCR Soil Vapor Signature;
- EPT-South Cayuga Street Soil Vapor Signature;
- EPT-Upper Turner Place Soil Vapor Signature;
- Therm Soil Vapor Signature; and
- Lower Turner Place Soil Vapor Signature.

4.2.1 NCR Soil Vapor Signature

TCE is the dominant compound (proportionally by concentration) in soil vapor samples that were collected behind (i.e., northwest of) the former NCR facility and the along the sewer line emanating from that facility (Danby Road sewer). With the exception of soil vapor sample SV-

4, 1,1,1-TCA was present in the second highest proportion. In most of the other soil vapor samples, cis-1,2-DCE and/or PCE were present in much smaller proportions. Only soil vapor sample SV-1 had a proportionally significant detection of cis-1,2-DCE. The observed soil vapor concentration pattern of predominately TCE followed by 1,1,1-TCA is hereinafter called "the NCR Soil Vapor Signature" due to the close proximity of the soil vapor samples to known NCR sources with similar compound proportions (predominantly TCE, 1,1,1-TCA and cis-1,2-DCE), or their presence in sewer lines immediately downgradient of the NCR facility. The only exceptions to the NCR Soil Vapor Signature along the Danby road sewer were at locations SV-5 and SV-5A where PCE was the predominant compound, however, the total CVOC concentrations at these two locations were negligible (equal to 5.9 $\mu g/m^3$ and 8 $\mu g/m^3$, respectively), compared to the totals at the other soil vapor locations along this sewer line in the vicinity of the former NCR facility (ranging from 6,402 $\mu g/m^3$ (at SV-3) to 162 $\mu g/m^3$ (at SV-1) $\mu g/m^3$) on the former NCR property. The TCE-dominant NCR Soil Vapor Signature can then be traced along the entire length of the Danby Road sewer to its confluence with the Columbia Street sewer, and further along Columbia Street, Turner Place and East Spencer Street.

Total CVOCs in soil vapor along the Danby Road sewer were greatest immediately behind the former NCR facility, with a general decline, with some variability, downstream from the NCR facility along the Danby Road sewer. One exception is SV-51, located at the junction of the NCR and Ithaca College sewer lines where total CVOCs equaled 2,368 $\mu g/m^3$. However, soil vapor concentrations upstream of SV-51 along the Ithaca College sewer line were negligible, indicating that Ithaca College is not the source of CVOCs detected at SV-51. Thus the CVOCs observed at SV-51 are attributable to vapor migration from the NCR facility.[30]

4.2.2 EPT Soil Vapor Signatures

In contrast to the NCR Soil Vapor Signature (i.e., predominantly TCE with secondary 1,1,1-TCA), two distinctly different soil vapor signatures were observed along sewer lines downgradient of the EPT facility:

[30] See Section 4.3, item No. 6 and Section 5.3, Response #4 providing the basis for concluding that vapors in the Danby Road sewer do not originate from the EPT property or South Hill residential area.

1. Predominantly PCE and 1,1,1-TCA – the "EPT-South Cayuga Street Soil Vapor Signature"; and

2. Predominantly PCE and TCE – the "EPT-Upper Turner Place Soil Vapor Signature".

In addition, the "fire-water reservoir signature" was observed in soil vapor sample SV-20B, with TCE (66% of the CVOCs) and cis-1,2-DCE (24% of the CVOCs) representing the primary and secondary CVOCs, respectively, observed in this soil vapor sample. This signature closely resembles the assemblage of CVOCs in groundwater in the area of the fire-water reservoir where TCE was also the primary CVOC, as shown in the table which follows. Note that this signature was observed only in soil vapor sample SV-20B located in close proximity to the fire-water reservoir and is not discussed further with respect to the South Hill Area.

Groundwater CVOCs (µg/L) in vicinity of Fire Water Reservoir					
Location	**CIS-1,2-DCE**	**PCE**	**TRANS-1,2-DCE**	**TCE**	**TCA**
EXB-06	13000	7.8	130	17000	<1
EXB-08	8100	2.8	5.2	7200	<1
MW-07B	1200	1.5	7.2	1900	<1
EXB-01	8200	3.4	56	12000	<1
EXB-02	2500	5.6	8.5	4500	<1
EXB-05	5800	5.7	63	17000	<1
EXB-07	3100	0	26	2700	<1
SUM	41900	27	296	62300	0
AVERAGE	5238	3	37	7788	0
PERCENTAGE	40%	<1%	<1%	60%	<1%

Therefore, Roux Associates concludes that the presence of TCE and cis-1,2-DCE at SV-20B is attributable to off-gassing from CVOCs in soil and groundwater in the fire-water reservoir source area, while the CVOCs in the soil vapor sampling locations along South Cayuga Street and Upper Turner Place are attributable to the historic transport of solvents within or along sewer lines, as discussed previously in WSP's Site Conceptual Model that was discussed in section 2.1.

EPT Soil Vapor Signature: South Cayuga Street

Compounds observed in soil vapor samples collected along the South Cayuga Street sewer line consisted predominantly of PCE and 1,1,1-TCA. [This pattern is hereinafter called, "the EPT-South Cayuga Street Soil Vapor Signature"]. This soil vapor signature is evident at VP-4, VP-6, VP-7, VP-8 and VP-9, all located along the South Cayuga Street sewer.

EPT Soil Vapor Signature: Upper Turner Place

The predominant compound in soil vapor samples collected along the upper portion (closest to the EPT facility) of the Turner Place sewer line is also PCE; with TCE present in the second highest proportion. [This pattern is hereinafter called, "the EPT-Upper Turner Place Soil Vapor Signature]. This soil vapor signature is evident at SV-21H, SV21I, and SV-36R. Note that samples collected at MH-1 and MH-2 had distinctly different proportions and include 1,1,1-TCA, but also had significantly lower total CVOC concentrations.

4.2.3 Therm Soil Vapor Signature

Three soil vapor samples were collected along the sewer line originating from the Therm facility: (1) SV-15 located near the intersection of Crescent Place and Hudson Street; (2) SV-14 located on Columbia Street downstream of Hudson Street; and, (3) SV-13 located on Columbia Street approximately equidistant from Hudson Street and South Aurora Street. The CVOC distribution in these soil vapor samples (herein after called, "the Therm Soil Vapor Signature") showed PCE as the predominant compound with the exception of SV-15, which exhibited approximately equal proportions of PCE and TCE (equal to 120 $\mu g/m^3$ and 150 $\mu g/m^3$, respectively). 1,1,1-TCA was observed at a very low concentration in only one of these three soil vapor samples (SV-15 equal to 1.2 $\mu g/m^3$) These findings are consistent with the historical use of both TCE and PCE in Therm's vapor degreasing operations[31], and the documented release PCE and other CVOCs to groundwater on the Therm property.

[31] In 1976, Therm switched from TCE to PCE (March 11, 1976 memorandum from the Tompkins County Health Department).

4.2.4 Columbia Street, Pleasant Street and Lower Turner Place Soil Vapor Signature

The CVOC distribution in soil vapor samples collected along sewers beneath South Aurora Street, Columbia Street, Turner Place between Columbia and Pleasant Streets, and East Spencer Street [hereinafter called, "the Lower Turner Place Soil Vapor Signature] showed TCE as the predominant compound, similar to the NCR Soil Vapor Signature, with slightly higher proportions of PCE in some samples. This pattern was interpreted to represent minor contribution of PCE from the EPT-Upper Turner Place Soil Vapor Signature and/or Therm Soil Vapor Signature to the predominant NCR Soil Vapor Signature (which is predominantly TCE).

A summary of the five CVOC soil vapor signatures along the sewer lines is presented in the text box that follows.

Occurrence of CVOCs in Soil Vapor Signatures as Primary or Secondary Components

Soil Vapor Signature	PCE	TCE	1,1,1-TCA
NCR		Primary	Secondary
EPT-South Cayuga Street	Primary		Secondary
EPT-Upper Turner Place	Primary	Secondary	
Therm	Primary	Secondary only in (SV-15)	
Lower Turner Place	Secondary	Primary	Secondary

Note: 'Primary' and 'Secondary' refer to the relative percentages of the indicated CVOC in the soil vapor samples.

4.3 Conclusions About Sewer Lines and Soil Vapor Data in the South Hill Area

Based upon the sewer line configuration and soil vapor data collected from the NCR, EPT and South Hill Area, Roux Associates concludes the following:

1. Five distinct soil vapor patterns are shown by the data along sewer lines emanating from the NCR and EPT facilities:

    - The "NCR Soil Vapor Signature" – predominantly TCE with secondary 1,1,1,-TCA. The NCR Soil Vapor Signature is dominant along the Danby Road/South Aurora Street sewer line and in South Hill area soil vapor samples from beneath South

Aurora Street, Columbia Street, Tuner Place north of Columbia Street, and East Spencer Street.

- The "EPT-South Cayuga Soil Vapor Signature" – predominantly PCE with secondary 1,1,1-TCA. The EPT-South Cayuga Street Soil Vapor Signature is dominant along South Cayuga Street;

- The "EPT-Upper Turner Place Soil Vapor Signature" – predominantly PCE with secondary TCE. The EPT-Upper Turner Place Soil Vapor Signature is dominant beneath Turner Place south of Columbia Street;

- The "Therm Soil Vapor Signature" – predominantly PCE with TCE greater than 100 $\mu g/m^3$ in only one of the three soil vapor samples collected along the sewer line originating from the Therm facility;

- The "Lower Turner Place Soil Vapor Signature" – similar to the "NCR Soil Vapor Signature", with slightly higher proportions of PCE in some samples. This pattern was interpreted to represent minor contribution of PCE from the EPT-Upper Turner Place Soil Vapor Signature and the Therm Soil Vapor Signature to the predominant NCR Soil Vapor Signature.

2. CVOCs originating from the former NCR facility have migrated in or along sewer lines downstream from the former NCR facility towards Columbia Street and the South Hill residential sanitary sewers. This conclusion is supported by the following:

   (a) Four laterals from the NCR facility are directly connected to the Danby Road/South Aurora Street sewer immediately northwest of the former NCR facility in an area of known soil and groundwater contamination attributable to former NCR operations;

   (b) Two of the four NCR laterals pass directly through historical areas of TCE usage by NCR, including the former chip and disposal room and the former UST area where TCE was used and/or stored;

   (c) Two of the four NCR laterals also pass directly through the historic groundwater CVOC (predominantly TCE) source areas;

   (d) A storm water line is also co-located in the area of the impacted TCE groundwater at the NCR facility;

   (e) These utilities (storm water and sanitary sewer lines) act or acted as preferential pathways for CVOC migration within the sewers and/or along sewer bedding;

   (f) A TCE/1,1,1-TCA soil vapor signature, unique to the NCR facility, originates at the NCR facility and continues along and into the Danby Road/South Aurora Street sewer; and

(g) The NCR facility is located at a higher elevation relative to the EPT facility and Columbia Street, which would facilitate chemical migration from the NCR facility along the Danby Road sewer lines toward Columbia Street.

3. CVOCs originating from the EPT facility are not migrating towards the NCR facility along the Danby Road/South Aurora Street sewer line. This conclusion is supported by the following:

   (a) The Danby Road/South Aurora Street sewer does not currently--nor has it historically--received any discharges from the EPT facility;

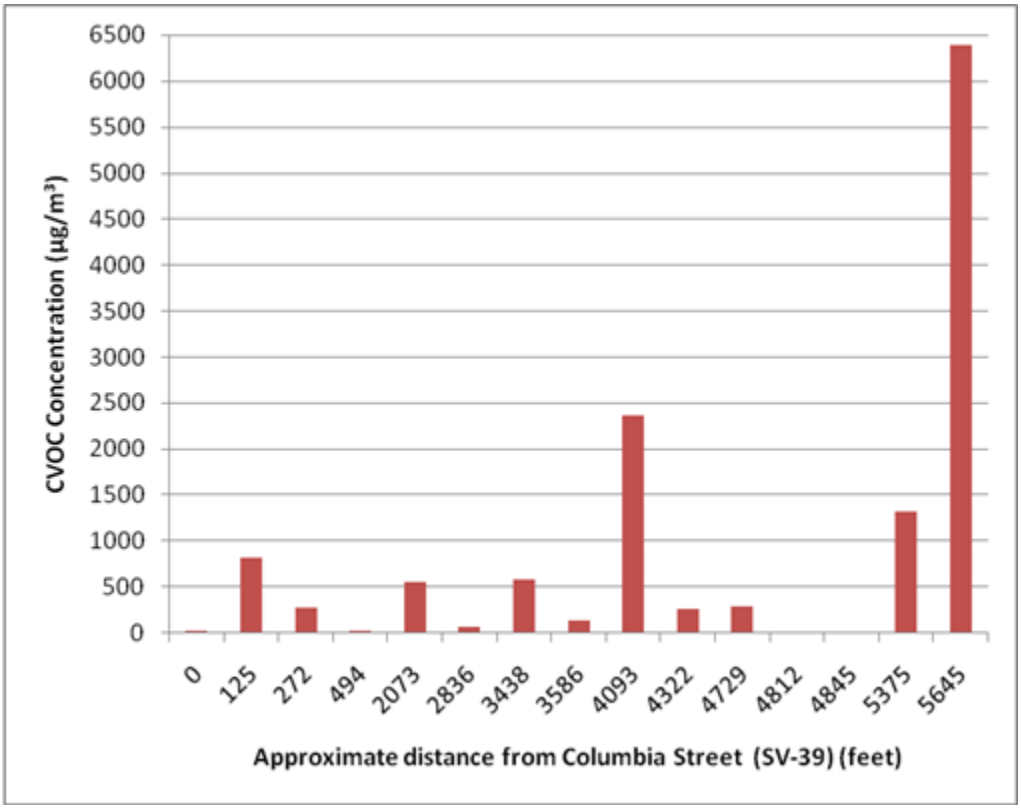
   (b) The only connection between the EPT facility and the Danby Road/South Aurora Street sewer lines occurs at the intersection of South Aurora Street and Columbia Street, with flow within these sewer lines going *towards* the South Hill residential area. Therefore, it is unreasonable to conclude that vapors would migrate from the EPT facility, down Turner Place and then 90-degrees east (uphill) along Columbia Street) and another 90-degrees south (uphill) along South Aurora Street;

   (c) It is even more unreasonable to conclude that vapors would migrate from the EPT facility to the Danby Road/South Aurora Street sewer via transport along the South Cayuga Street sewer, given that the South Cayuga Street is further from the South Aurora Street sewer than the Turner Place sewer.

   (d) The CVOC soil vapor signatures originating from the EPT facility are distinct from those observed at the NCR facility and along the Danby Road/South Aurora Street sewer downgradient of the NCR facility;

   (e) The South Hill area sewers are located at lower elevations relative to the NCR facility and the Danby Road/South Aurora Street sewers; therefore, there is no pressure gradient to transport soil vapor upstream from the South Hill area to the Danby Road/South Aurora Street sewer; and

   (f) Further, as shown in the histogram that follows (depicting total CVOC vapor concentration along the sewer line vs. distance from Columbia Street), a concentration gradient does <u>not</u> exist between the Columbia Street sewer line and NCR that would support vapor transport from the Columbia Street sewer line along the South Aurora Street/Danby road sewer towards the NCR facility.



4. It is Roux Associates' opinion that the additional samples should be collected by NYSDEC, or that Therm be required to collect additional soil gas samples along the sewer line originating from the Therm facility to supplement the recently-collected data from soil vapor points SV-13, SV-14 and SV-15.

5.0 ROUX ASSOCIATES' REVIEW OF REPORTS PREPARED BY ARCADIS AND S&W REDEVELOPMENT

Roux Associates reviewed the following reports pertaining to the former NCR site[32]:

- December 2007, S&W Redevelopment, "Brownfield Cleanup Program Remedial Investigation, 950 Danby Road, Ithaca, New York, BCP Site #C755012 (the "S&W Remedial Investigation or S&W RI");
- December 2007, S&W Redevelopment, "Brownfield Cleanup Program, 950 Danby Road, Ithaca, New York, Remedial Work Plan, BCP Site #C755012 (the "S&W Remedial Work Plan"); and
- February 2008, Arcadis, "Assessment of Recent Soil Vapor Investigations in the South Hill Area of Ithaca, New York (the "Arcadis Soil Vapor Investigation Report").

Each of these reports was reviewed with respect to statements and conclusions made by the authors of these reports concerning the source(s) of vapors observed along the Danby Road sewer. These statement/conclusions are summarized in this section along with Roux Associates' evaluation and conclusions.

As noted in Section 2.3.2, the Therm facility is not listed in the NYSDEC Environmental Site Remediation Database; indicating that the Therm facility is not currently being regulated or managed under any of the state's remedial programs (State Superfund, Brownfield Cleanup, Environmental Restoration and Voluntary Cleanup). Therefore, this section is limited to a discussion of the three reports associated with the former NCR facility.

5.1 S&W December 2007 Remedial Investigation Report

Information and conclusions presented in the December 2007 S&W Redevelopment RI were previously discussed in Section 2.2 The S&W Redevelopment RI presents data for CVOCs collected from six locations at the property (SV-1 through SV-6), shown in Figure 5-13 of the S&W Redevelopment RI. Three of these locations (SV-3, SV-4 and SV-5/5A) are immediately

[32] These reports indicate that earlier reports were completed for the former NCR property including: (a) a 1994 Phase I Environmental Site Assessment report prepared by Dames & Moore; a 1998 Phase I Environmental Site Assessment prepared by Environmental Products and Services, Inc.; (c) a May 2003 Phase II Environmental Assessment prepared by Environmental Products and Services, Inc.; (d) a January 2004 Source Investigation prepared by Environmental Resources Management, Inc.; (e) a March 2004 Supplemental Bedrock Investigation prepared by ERM; and (f) a May 2007 Remedial Investigation Report prepared by S&W Redevelopment.

proximate to the sanitary sewer line located behind the NCR building. Roux Associates' notes that the configuration of the sanitary sewer line and soil vapor sample locations shown in the S&W Redevelopment RI is different from the sanitary sewer line configuration and SV-1 through SV-5 locations depicted in the February 2008 Arcadis Soil Vapor Investigation Report. This discrepancy is discussed further in section 5.3 (Arcadis Soil Vapor Investigation Report).

In addition, Roux Associates notes that the figure included in the S&W Redevelopment RI report entitled, "Figure 5-13: Chlorinated Organic Ratios in Soil Vapor", does not include a complete depiction of the configuration of the NCR sewer system. According to City of Ithaca figure Y-14, there are four laterals that connect the former NCR building to the main sewer line. This configuration is properly depicted on all of the plates included within this (Roux Associates) report.

The S&W Redevelopment RI includes several conclusions about soil vapor data and the associated sanitary sewer system leading from the NCR property. Each of these conclusions is restated in the paragraphs that follow, along with Roux Associates' evaluation and conclusion.

1. *S&W Redevelopment Conclusion/Statement: The sanitary sewer system does not act as a preferential migration path for groundwater contamination.*

   Roux Associates' Response:

   Roux Associates agrees with this conclusion based upon the configuration of dissolved-phase CVOCs and the direction of groundwater flow depicted in the S&W Redevelopment RI.

2. *S&W Redevelopment Conclusion/Statement: With the exception of SV-5 and SV-6, TCE is the principal soil vapor chemical of potential concern (COPC) along with its degradation by products.*

   Roux Associates' Response:

   Roux Associates disagrees with this conclusion. S&W Redevelopment presumably reached this incorrect conclusion based upon Figure 5-13 of the RI, which depicts the relative amounts of TCE, PCE, cis-12,-DCE and trans-1,2-DCE at SV-1 through SV-6. However, 1,1,1-TCA was not included in the data depicted in this figure even though 1,1,1-TCA vapor data were included in Table 1 of the S&W Redevelopment RI report. Table 1 of the S&W Redevelopment RI indicates 1,1,1-TCA was present in SV-1, SV-2, SV-3 and SV-4 at 1.4 $\mu g/m^3$, 1,500 $\mu g/m^3$, 810 $\mu g/m^3$ and 700 $\mu g/m^3$, respectively. In fact, 1,1,1-TCA concentrations at SV-4 (700 $\mu g/m^3$) exceeded the TCE concentration at

this location (610 µg/m^3). Therefore, the associated conclusions made by S&W about the relative proportions of the COPCs and their associated signatures[33] are incorrect.

3. *S&W Redevelopment Conclusion/Statement: PCE is the principal soil vapor COPC at SV-5 and SV-6, comprising 90% of the alkenes present at these locations. These data are believed to represent conditions unrelated to site groundwater contamination because PCE was not detected in RI groundwater samples.*

   Roux Associates' Response:

   While it is true that PCE is the principal soil vapor constituent at SV-5 (equal to 5.9 µg/m^3) and SV-6[34] (equal to 9.2 µg/m^3), the S&W Redevelopment RI fails to note that the total CVOC concentrations at these two monitoring points are just 0.1% to 6% of those observed at the other four soil vapor points reported in the S&W Redevelopment RI. Total CVOCs at SV-1, SV-2, SV-3 and SV-4 were equal to 162 µg/m^3, 4,586 µg/m^3, 6,402 µg/m^3, and 1,319 µg/m^3, respectively compared to only 6.8 µg/m^3; 9.1 µg/m^3 and 10.2 µg/m^3 for SV-5, SV-5A, and SV-6, respectively [35]. Further, S&W Redevelopment misrepresented these data in Figure 5-13 of their December 7, 2007 RI report by showing all six pies to be of equal size (diameter). As shown in Roux **Plates 3, 4** and **5**, when the size of the pies are adjusted to be proportional to total concentrations, the soil vapor detections at SV-5 and SV-6 are negligible compared to data obtained at other sampling locations along the sewer lines. Therefore, data from SV-5 and SV-6 either should not be used or afforded minimal weight when reaching conclusions about CVOCs vapor transport within the sewers.

4. *S&W Redevelopment Conclusion/Statement: There is a strong spatial correlation between TCE vapors and groundwater impacts.*

   Roux Associates' Response:

   S&W Redevelopment provides little information to support their position that TCE vapors are spatially correlated to groundwater impacts. On page 52 of their report, S&W states that, "Figure 5-12 shows TCE soil vapor data at the site, and reveals a strong spatial correlation between TCE vapors and groundwater impacts." However, Figure 5-12 only shows TCE vapor concentrations at each of the six soil vapor points, with no groundwater data presented to demonstrate any correlation. Overlaying the TCE isopleths depicted in S&W Redevelopment's Figure 5-10 with the soil vapor data depicted in S&W Redevelopment Figure 5-12, reveals that SV-3 and SV-4 are directly within the TCE-impacted groundwater while SV-2 is not. Yet TCE vapors in SV-2 (3,000 µg/m^3) are greater than those observed in SV-4 (610 µg/m^3).

   The S&W Redevelopment RI states that, "Soil vapor contamination in samples SV-2, SV-3 and SV-4 is derived primarily from groundwater contamination directly underlying

[33] A 'signature' refers to the relative composition of chemical constituents that are consistently observed at different locations indicating that they are derived from a common or similar source.

[34] The S&W Redevelopment report only mentions SV-5 and SV-6; however SV-5A (presumably a duplicate sample of SV-5) also exhibited low soil vapor PCE concentrations, equal to 8 µg/m^3).

[35] Range based on 10.8/162 to 6.8/6402.

it." However, as the text box that follows indicates, the high soil vapor concentrations at SV-2 cannot be attributed primarily to the TCE in underlying groundwater because this sample is not located directly within the footprint of the groundwater TCE plume (see **Plate 6**). Further, the TCE concentration at SV-2 (equal to 3,000 µg/m^3) located at the fringe of the TCE groundwater plume is higher than that observed at SV-4 (equal to 610 µg/m^3) located within the TCE plume.

Location	TCE in Soil Vapor (µg/m^3)	TCE in Groundwater contour (µg/L)
SV-2	3,000	<5
SV-3	5,300	>100
SV-4	610	~25

Roux Associates recognizes that the highest soil vapor concentration (5,300 µg/m^3) was observed at SV-3 in the vicinity of the highest groundwater TCE concentrations. However, TCE vapor contributions originating directly from within the sewer lines or associated sewer bedding may explain the high TCE soil vapor concentration observed at SV-2 where low TCE groundwater concentrations are present.

5. *S&W Redevelopment Conclusion/Statement: Offsite migration of soil vapor COPCs is insignificant and there is no measureable indication of off-site vapor migration associated with the sanitary sewer line.*

   Roux Associates' Response:

   To support their position that off-site vapor migration along the sanitary sewer line is not measureable, S&W Redevelopment compares soil vapor data at SV-4 (closer to the building) and SV-5 (northeast of the building), both collected along the sewer line, and exhibiting TCE concentrations of 610 µg/m^3 and 0.87 µg/m^3, respectively. As discussed earlier, the SV-5 and SV-5A soil vapor results should not be used to render conclusions about vapor transport within the sewers because, (a) PCE was the predominant compound detected at SV-5/SV-5A and (b) total CVOC concentrations at this location were negligible compared to other sampled locations.

   Further, S&W Redevelopment did not consider other pertinent data collected along the sewer line. For example, soil vapor data collected from SV-49, located about 100 feet further down-flow along the sewer exhibited TCE concentration of 232 µg/m^3. This value is consistent with downgradient offsite TCE vapor migration within that sewer.

6. *S&W Redevelopment Conclusion/Statement: Soil vapor data indicate that soil vapor COPCs are degrading outside the area of groundwater contamination further suggesting limited soil vapor migration.*

Roux Associates' Response:

S&W Redevelopment provides only one data point to support this conclusion. Only data from SV-1 shows a higher percentage of cis-1,2-DCE (a breakdown product of TCE) compared to SV-2, SV-3 and SV-4. While Roux Associates agrees that the cis-1,2-DCE at SV-1 is likely derived from the breakdown of TCE, one data point (SV-1) is insufficient to draw conclusions about the extent of TCE migration along the sewer line. One cannot conclude that TCE has not migrated simply based on the presence of cis-1,2-DCE at a single location.

5.2 S&W Redevelopment Remedial Work Plan

In the S&W Redevelopment Remedial work plan, S&W noted that previous investigations completed as part of a Brownfield Cleanup Agreement (BCA) for the former NCR property concluded that the principal groundwater contaminants are CVOCs, including TCE, DCE and vinyl chloride. TCE-containing rinse water from former plating and heat treatment processes, transferred via trench drains, was stored in two 9,000-gallon USTs located outside the southwest corner of the building. These two USTs were decommissioned in place in 1986 when the heat treating and plating facilities were dismantled. A third 6,000-gallon UST that also contained TCE, formerly located just north of the heat treating/plating area, was removed in 1986. Figures 4-1 through 4-6 of the S&W Remedial Work Plan depict the extent of TCE, DCE, and vinyl chloride in overburden groundwater and bedrock. The CVOC's detected in the overburden groundwater are located downgradient from (a) the former heating and plating area and associated former 9,000-gallon USTs; and, (b) the former chip disposal room. CVOC's in the bedrock aquifer are only located downgradient from the former 9000-gallon USTs.

The location of these former NCR operational areas and CVOC-impacted groundwater areas are shown in **Plate 6**.

The S&W Redevelopment Remedial Work Plan includes the following summary and conclusions regarding site conditions:

1. CVOCs are being naturally attenuated in groundwater by degradation reactions;
2. There is no evidence of a dense non-aqueous phase liquid (DNAPL);

3. The orientation of the groundwater plume indicates that the two decommissioned 9,000-gallon USTs and the removed 6,000-gallon UST were potential sources of contamination; and

4. CVOCs in soil vapor are derived from the dissolved phase groundwater plume. This conclusion was based upon observations that soil vapor samples collected laterally away from the groundwater plume, and adjacent to a sanitary sewer line, contained lower levels of CVOCs than soil vapor samples collected from directly above the groundwater plume.

Roux Associates' responses to item #4 above were discussed previously in Section 5.1.

The S&W Redevelopment Remedial Work Plan presents two remedial action elements: (1) Removing the two 9,000-gallon decommissioned USTs (that formerly stored TCE-containing rinse-water from the former plating and heating operations) along with any associated impacted soil; and, (2) in-situ chemical oxidation (ISCO) for treatment of CVOC-impacted groundwater. Table 4-1 of the Work Plan provides calculations of estimated CVOC mass in the groundwater plume. This mass estimate was for determining the amount of potassium permanganate required for the ISCO treatment. These mass estimates are summarized below:

S&W Redevelopment Estimated Dissolved CVOC Mass in Overburden and Bedrock Groundwater at the former NCR Site (pounds)		
	Overburden Groundwater	**Bedrock Groundwater**
TCE	0.81	25.2
DCE	1.2	17.9
Vinyl Chloride	0.2	1.4

As indicated by the data summarized above, both overburden and bedrock groundwater is contaminated with CVOCs arising from historic operations at the former NCR facility. Given the close proximity of the sanitary sewer lines to the facility and the finding of solvent vapors within these lines, it is reasonable to conclude that the sewer line is not only acting as a direct pathway for solvent vapor migration from the facility within the sewer, but as discussed later, the sewer line and associated bedding and trench is likely acting as a preferential pathway for CVOC migration.

5.3 February 2008 Arcadis Soil Vapor Investigation Report

The Arcadis Soil Vapor Investigation Report was prepared on behalf of NCR in response to a January 11, 2008 letter issued by the NYSDEC. In the letter, the NYSDEC alleged that elevated TCE in soil vapor samples collected in the vicinity of the Danby Road sewer was from past discharges of TCE from the former NCR facility to the sanitary sewer system.[36] Disputing the allegation, Arcadis concluded that, "it is highly unlikely that NCR is responsible for elevated levels of soil vapor offsite of 950 Danby Road." The Arcadis Soil Vapor Investigation Report provided their bases for their conclusion, which are re-stated below, along with Roux Associates' response.

Roux Associates notes that the figure included in the Arcadis Soil Vapor Investigation Report entitled, *"Figure 1: South Hill Soil Vapor Sampling Results"*, incorrectly depicts the configuration of the NCR sewer system. Arcadis' Figure 1 depicts four sewer laterals connecting to the main sewer line. However the southern-most lateral shown in the Arcadis figure is not depicted as being connected to the NCR building. According to the City of Ithaca sewer drawing Y-14, all four sewer laterals connect to the former NCR facility. The Y-14 sewer drawing also shows the northern-most lateral from the NCR building in a different configuration than that shown in the Arcadis figure. Roux Associates also notes that Figure 1 of the Arcadis Soil Vapor Investigation Report fails to include the locations of the storm sewer located behind the NCR building.

The correct configuration of the NCR sewers is depicted on all of the plates included within this (Roux Associates) report. The storm sewer is included on **Plate 6** of this report.

The following are Roux Associates' responses to the conclusions provided in the Arcadis Soil Vapor Investigation Report.

1. *Arcadis Statement/Conclusion: The discharge of TCE by NCR via the sanitary sewer system has not been established.*

[36] Roux Associates was not provided with a copy of the January 11, 2008 NYSDEC letter.

Roux Associates' Response:

This statement uses faulty logic to suggest a conclusion that no discharge of TCE by NCR occurred simply because there is no direct evidence (i.e. testimony or documentation of solvent discharges to the NCR sewer) of the discharge having occurred. Given the lack of direct evidence of such discharges, environmental professionals typically evaluate secondary information such as facility operations, site conditions, sewer configuration and soil vapor CVOC data to assess whether such information is consistent with historical solvent discharges to the NCR sewer.

Roux Associates did evaluate such secondary information and data, and reached the same conclusion as the NYSDEC: that the CVOC data observations and historic record are consistent with historical solvent discharges to the NCR sewer for the reasons that follow:

Facility Operations:

As discussed earlier, NCR operations included two historical manufacturing areas where TCE was used and released to the environment: (a) the former heat treating/plating area; and, (b) the UST area. However, the Arcadis Soil Vapor Investigation Report makes no mention of these historical areas where TCE was used. The historical use of TCE in facility operations adjacent to the NCR sewers is consistent with the finding of TCE vapors within the sanitary sewer.

Site Conditions:

The S&W Redevelopment RI Report confirmed that TCE is present in both overburden and bedrock groundwater in the area of the former USTs and heat treating/plating area, indicating that releases from these areas occurred. Roux Associates' **Plate 6** depicts the TCE plume in overburden groundwater in relation to both the sanitary and storm sewers. The finding of TCE vapors within the sanitary sewer proximal to TCE-impacted groundwater is consistent with TCE migration from an onsite source to the sewer line.

Sewer configuration:

It is well known by environmental professionals that utility bedding often represents a preferential pathway for contaminant migration because of the higher permeability of the utility backfill compared to native soils. However, no mention of such preferential pathways is included or was evaluated in the Arcadis report; in fact the storm sewer is not even discussed. The omission of this potential migration route in the evaluation of TCE migration at the NCR facility is further exacerbated by inconsistent or missing depictions of sewers in Arcadis maps.

- Figures 1, 2 and 3 of the Arcadis report depict a sanitary sewer configuration behind the former NCR facility that is different from the configuration depicted in both the S&W Redevelopment Remedial Investigation Report and the S&W Redevelopment Remedial Work Plan. The sewer configuration depicted in all of these reports is incorrect. More specifically, the sewer lines shown in the Arcadis figures are not properly geo-referenced in the Arcadis figures in that one of the

laterals is not depicted as being connected to the NCR facility when, in fact, it should be connected. As discussed earlier, figures in the S&W Redevelopment report failed to include the sewer laterals.

- The Arcadis figures fail to depict the locations of the storm sewers that are shown on figures presented by S&W Redevelopment reports and on Roux Associates **Plate 6**. This is an omission on the part of Arcadis, since both the sanitary and storm sewer lines run adjacent to known TCE source areas (the former heating and plating area and the former UST area).

Soil Vapor CVOC Data:

As discussed in Section 5.1, the groundwater and soil vapor data are inconsistent regarding the spatial relationship between TCE concentrations in groundwater and those in soil vapor. More specifically, the TCE concentration at SV-2 (3,000 µg/m^3) located at the fringe of the TCE groundwater plume is higher than that observed at SV-4 (610 µg/m^3) located directly over the TCE plume. This strongly suggests that TCE vapor migration from groundwater to the sewer is not the only migration pathway.

2. *Arcadis Conclusion/Statement: No information supports the theory that the bedding along the Danby Road Sewer Line is contaminated with residual TCE.*

Roux Associates' Response:

Although no samples have been collected directly from the bedding along the Danby Road sewer line, the sewer bedding as a potential preferential flow path may be inferred from the presence of CVOC vapors within this line, together with the common knowledge that sewers leak and sewer bedding can be a preferential flow path for migration. Converse to Arcadis' contention, there are no data to suggest that this pathway is not present along the Danby Road sewer. The conceptual model presented earlier for the EPT facility includes a migration pathway in which CVOCs migrated out of the sewers to the surrounding bedrock fractures where they continue to volatilize. In summary, lack of an evaluation or lack of data do not eliminate a potential migration pathway from consideration.

3. *Arcadis Conclusion/Statement: Multiple existing sewer laterals, including Emerson and Therm, are connected to the Danby Road Sewer Line and may have historically conveyed chemicals into the Danby Sewer Line.*

Roux Associates' Response:

This statement, while factually correct, does not eliminate NCR as a source of CVOCs to the sanitary sewer line. Moreover, this statement was presented without any supporting evidence or critical evaluation of information.

4. *Arcadis Conclusion/Statement: The most likely source of TCE in soil vapor along the Danby Sewer Line originates on the Emerson property or is due to the off-site migration of TCE northwards from the Emerson property*.

Roux Associates' Response:

Based upon the CVOC data and sewer configuration, Roux Associates concludes, with a reasonable degree of scientific certainty that CVOCs in soil vapor along the Danby Road sewer line originates from the former NCR facility because:

(a) Sanitary and storm water sewer laterals traverse the area of CVOC-impacted groundwater at the former NCR facility. These lines represent both a direct migration pathway for CVOC vapor migration within the sewers as well as a preferential pathway for CVOC migration along the permeable backfill and sewer bedding;

(b) The former NCR facility is located at a higher elevation than the Danby Sewer which provides a pressure differential for flow;

(c) Historical use of TCE in facility operations adjacent to the NCR sewers is consistent with the finding of TCE vapors within the sanitary sewer; and

(d) Former NCR facility operations, site conditions, sanitary sewer configuration and soil vapor CVOC data all support the former NCR facility as a source of CVOC vapors to the Danby Road sewer.

Further, the Arcadis Soil Investigation Report does not provide any substantive data or reasoning to support the conclusion that TCE soil vapor is migrating northwards from the Emerson property. A review of data and site conditions indicates that it is more likely that TCE is *not* migrating north towards and into the Danby road sewer from EPT because neither pressure nor concentration gradients exist to promote such northerly liquid and/or vapor flows. The Danby road sanitary sewer is topographically higher than the sanitary sewers at both the EPT facility and along Turner Place and Columbia Street. Further, the only sanitary sewer pathway linking the EPT facility to the Danby road sewer is the Columbia Street sewer. Also, the data do not support TCE migration in the vapor phase from EPT to the Danby Road sewer by concentration gradients because, as discussed in Section 4.1 and summarized in the table that follows, a CVOC concentration gradient does not exist between Columbia Street and NCR that would support vapor transport from the Columbia towards along the South Aurora Street/Danby road sewer and towards the NCR facility.

CVOC soil vapor concentrations measured along the South Aurora St./Danby Road Sewer		
Location	**Distance (ft) from Columbia St. (SV-39)**	**CVOC Concentration (µg/m^3)**
SV-39	0	29
SV-40	125	823
SV-41	272	268
SV-22	494	20
VP-18	2073	559
VP-19	2836	61
VP-20	3438	577
VP-21	3586	138
SV-51	4093	2368
SV-50	4322	255
SV-49	4729	285
SV-5	4812	7
SV-5A	4845	9
SV-4	5375	1319
SV-3	5645	6395

Aracadis also apparently ignores the elevated TCE observed at soil vapor location SV-51, (2,010 µg/m^3). TCE vapor concentrations in both the down-flow and up-flow sides of this location exhibit lower TCE concentrations. Therefore, these data do not support Arcadis' conclusion that TCE is migrating northwards from the Emerson property towards the NCR property.

5. *Arcadis Conclusion/Statement: A shared bedding plane between a potable water supply line and the Danby Sewer line at the northwest side of the Emerson property presents a potential pathway for TCE-contaminated soil vapor to migrate to the Danby Sewer line bedding.*

   Roux Associates' Response:

   Roux Associates contacted Mark Fuller at the City of Ithaca Water and Sewer Division on June 9, 2008 to evaluate Arcadis' statement that the potable water supply shares bedding with the Danby Sewer line on the northwest side of the Emerson Property. Mr. Fuller indicated that, in fact, the potable water supply does *not* share the bedding with the Danby Sewer line. More specifically, according to Mr. Fuller:

- The water main on South Cayuga Street (northwest side of the Emerson property) runs along the west side of the road, and the sewer main is in a separate trench, located approximately eight to ten feet away, on the east side of the road; and

- Similarly, the water main on Turner Place (directly north of the EPT property) runs under the sidewalk on the western side of the road, while the sewer line runs along the center of the street.

Mr. Fuller maintained that throughout the City of Ithaca, water and sewer mains do not share bedding or trenches.

6. *Arcadis Conclusion/Statement: The northern Emerson sewer lateral connects to the Danby Road Sewer lateral at Columbia Street where TCE containing vapors, including from groundwater, can migrate along preferential pathways created by sewer trenches.*

   Roux Associates' Response:

   As previously discussed in item #4, neither pressure nor concentration gradients exist to promote any such northerly liquid and/or vapor flows.

7. *Arcadis Conclusion/Statement: Spills from various other properties identified in the NYSDEC Spill Incidents Database for South Aurora Street, Hudson Street and Danby Road, "could have been composed of TCE or materials that contain TCE."*

   Roux Associates' Response:

   This statement is pure conjecture and not supported by any data or evaluation of information. Moreover, the potential occurrence of TCE in spills from other properties along South Aurora Street, Hudson Street and Danby Road does not eliminate NCR as a source of CVOCs to the sanitary sewer line along Danby Road.

Roux Associates notes that in their "Summary and Conclusion" section, Arcadis states that, "Based on the information reviewed by Arcadis it is highly unlikely that NCR is wholly (or partially) responsible for potential vapor intrusion concerns alleged by the NYSDEC". As stated above in a careful evaluation of existing information, Arcadis based this conclusion on faulty logic and incorrect or missing presentation and evaluation of relevant facts, such as the close proximity of known source areas at the NCR Site to sewers.

In addition to the above, the Arcadis report discusses what they believe to be the inadequacies of the investigations conducted at the EPT facility. Regardless of these allegations, the adequacy or inadequacy of the EPT investigation does not negate the factual information presented in this report, which supports the conclusion that CVOCs observed in on the former NCR property are a potential source of impacted soil vapor migration in and along South Hill Area sewers.

6.0 CONCLUSIONS

Based upon a review of pertinent information, Roux Associates concludes, with a reasonable degree of scientific certainty, which CVOCs originating from the former NCR facility have migrated in or along sewer lines downstream from the former NCR facility towards Columbia Street and the South Hill residential sewers. This conclusion is based on the following:

(a) Sanitary and storm water sewer laterals traverse the area of CVOC-impacted groundwater at the former NCR facility. These lines represent both a direct migration pathway for CVOC vapor migration within the sewers as well as a preferential pathway for CVOC migration along the permeable backfill and sewer bedding;

(b) The former NCR facility is located at a higher elevation than the Danby Sewer which provides a pressure differential for flow;

(c) Historical use of TCE in facility operations adjacent to the NCR sewers is consistent with the finding of TCE vapors within the sanitary sewer;

(d) Former NCR facility operations, site conditions, sanitary sewer configuration and soil vapor CVOC data all support the former NCR facility as a source of CVOC vapors to the Danby Road sewer; and

It can also be concluded with a reasonable degree of scientific certainty that CVOCs originating from the EPT facility are not migrating towards the NCR facility along the Danby Road/South Aurora Street sewer line, because:

(a) The EPT facility never discharged to the Danby Road sewer;

(b) The EPT facility is located at a lower elevation than the Danby Road sewer; and

(c) There is no CVOC vapor concentration gradient that would facilitate transport of CVOC vapors to the Danby Road sewer.

Finally, recently collected soil vapor data along sewer lines downstream of the Therm facility (between Hudson Street and Crescent Place and along Columbia Street) indicate a Therm Soil Vapor Signature consisting of, for the most part, PCE. This finding is consistent with the historical use of PCE in Therm's vapor degreasing operations, and the documented releases of PCE and other CVOCs to soil and groundwater on the Therm property. It is Roux Associates' opinion that additional sampling be performed along the sewer line originating from the Therm facility to supplement the recently-collected data from soil vapor points SV-13, SV-14 and SV-15.

Table 1: CVOCs in manhole and soil vapor samples								
Location	Date Sampled	Report	111-TCA (µg/m³)	CIS,12-DCE (µg/m³)	PCE (µg/m³)	TRANS,12-DCE (µg/m³)	TCE (µg/m³)	Total* (µg/m³)
MH-1	8/30/2007	ERIMS05/06/08	37.7	7.13	10.5	0	49.7	105.03
MH-2	8/30/2007	ERIMS05/06/08	21.6	4.07	9.17	0	41	75.84
MH-3	8/30/2007	ERIMS05/06/08	10.3	1.05	10.4	0	41.5	63.25
MH-4	8/30/2007	ERIMS05/06/08	22000	66.1	31.7	0	18900	40997.8
MH-4	10/17/2007	ERIMS05/06/08	4.22	1.13	3.65	0	39.3	48.3
MH-4D	8/30/2007	ERIMS05/06/08	10.4	0	11.4	0	50.8	72.6
MH-5	8/30/2007	ERIMS05/06/08	31.6	0	7.03	0	80.3	118.93
MH-5	10/17/2007	ERIMS05/06/08	3.33	1.29	12.5	0	55.7	72.82
MH-6	10/26/2007	ERIMS05/06/08	2.55	1.69	22.1	0	31.7	58.04
MH-12	2/28/2008	ERIMS 06/10/08	0.89	7.6	3.8	0	22	34.29
MH-13	2/28/2008	ERIMS 06/10/08	0	1.5	1.1	0	5.3	7.9
MH-14	2/28/2008	ERIMS 06/10/08	0	1.8	1.4	0	6.5	9.7
MH-14D	2/28/2008	ERIMS 06/10/08	0	1.8	1.8	0	6.4	10
SV-01	9/20/2007	EA, 11/19/2007	0	0	0	0	0.54	0.54
SV-02	9/20/2007	EA, 11/19/2007	0.56	0	0	0	0	0.56
SV-04	9/20/2007	EA, 11/19/2007	0.6	0	0.75	0	0.59	1.94
SV-05	9/20/2007	EA, 11/19/2007	0.53	0	0.66	0	0.53	1.72
SV-06	12/6/2007	EA, 03/05/08	0	0	0	0	0	0
SV-07	12/6/2007	EA, 03/05/08	0	0	0	0	0	0
SV-08	12/6/2007	EA, 03/05/08	0	0	0	0	0	0
SV-09	12/6/2007	EA, 03/05/08	0	0	0.68	0	0	0.68
SV-1	7/11/2006	ARCADIS	1.4	46	2.2	14	99	148.6
SV-10	12/6/2007	EA, 03/05/08	1.1	0	0	0	0	1.1
SV-11	4/18/2008	EA, 04/18/08	1.2	0	4	0	13	18.2
SV-12	4/18/2008	EA, 04/18/08	0	0	0	0	0	0
SV-13	4/18/2008	EA, 04/18/08	0	0	88	0	0.52	88.52
SV-14	4/18/2008	EA, 04/18/08	0	0	2200	0	37	2237
SV-15	4/18/2008	EA, 04/18/08	1.2	2.1	120	0	150	273.3
SV-2	7/11/2006	ARCADIS	1500	57	29	0	3000	4586
SV-20B	8/22/2007	ERIMS 05/07/08	209	1110	237	6	3010	4566
SV-21F	8/22/2007	ERIMS 05/07/08	57.1	8.26	129	0	1950	2144.36
SV-21G	8/22/2007	ERIMS 05/07/08	93.2	6.93	232	0	2480	2812.13
SV-21H	8/23/2007	ERIMS 05/07/08	56.6	0.685	3690	0	239	3986.285
SV-21I	8/23/2007	ERIMS 05/07/08	28.8	1.25	695	0	644	1369.05
SV-22	8/28/2007	ERIMS 05/07/08	4.77	0	4.9	0	10.2	19.87
SV-23	8/29/2007	ERIMS 05/07/08	0	0	2	0	2.08	4.08
SV-26	8/28/2007	ERIMS 05/07/08	4.05	0	0	0	2.46	6.51
SV-27	8/22/2007	ERIMS 05/07/08	199	0	26.2	0	457	682.2
SV-28	8/29/2007	ERIMS 05/07/08	0	0	0	0	1.09	1.09
SV-3	7/11/2006	ARCADIS	810	260	25	7	5300	6395

Table 1: CVOCs in manhole and soil vapor samples								
Location	Date Sampled	Report	111-TCA (µg/m³)	CIS,12-DCE (µg/m³)	PCE (µg/m³)	TRANS,12-DCE (µg/m³)	TCE (µg/m³)	Total* (µg/m³)
SV-30	8/29/2007	ERIMS 05/07/08	0	0	146	0	1.09	147.09
SV-32	8/22/2007	ERIMS 05/07/08	22.2	0	36.5	0	3040	3098.7
SV-33	8/23/2007	ERIMS 05/07/08	4.05	0.685	52.4	0	511	568.135
SV-36R	8/30/2007	ERIMS 05/07/08	77.1	41.1	2890	0	1130	4138.2
SV-37_S	7/18/2007	ERIMS 05/07/08	0	0	2.76	0	0.492	3.252
SV-38	8/29/2007	ERIMS 05/07/08	63.8	0.604	28.3	0	1820	1912.704
SV-38_S	7/18/2007	ERIMS 05/07/08	2.05	0	8.48	0	1.91	12.44
SV-39	10/26/2007	ERIMS 05/07/08	0	4.39	1.59	0	23.2	29.18
SV-39_S	7/18/2007	ERIMS 05/07/08	0	0	4.69	0	0.819	5.509
SV-4	7/11/2006	ARCADIS	700	1.6	7.9	0	610	1319.5
SV-40	10/26/2007	ERIMS 05/07/08	63.2	0.766	29	0	730	822.966
SV-41	10/26/2007	ERIMS 05/07/08	49.9	1.73	105	0	111	267.63
SV-42	10/26/2007	ERIMS 05/07/08	22.2	0.927	32.4	0	264	319.527
SV-46A	7/18/2007	ERIMS 05/07/08	0	2.86	0	0	9.34	12.2
SV-47A	7/18/2007	ERIMS 05/07/08	0	0	1.03	0	0.874	1.904
SV-49	7/18/2007	ERIMS 05/07/08	49.9	0	3.93	0	232	285.83
SV-5	7/11/2006	ARCADIS	0	0	5.9	0	0.87	6.77
SV-50	7/18/2007	ERIMS 05/07/08	17.2	0.645	23.4	0	214	255.245
SV-51	7/18/2007	ERIMS 05/07/08	291	0	66.9	0	2010	2367.9
SV-5A	8/1/2007	ARCADIS	0	0	8	0	1.1	9.1
SV-6	7/11/2006	ARCADIS	0	0	9.2	0	0.98	10.18
SV-7	11/13/2007	ARCADIS	0	2.1	4.6	0	8.7	15.4
VP-1	6/17/2004	ERIMS05/06/08	0	0	0	0	0	0
VP-10	7/28/2005	ERIMS05/06/08	9.5	0	0	0	0	9.5
VP-11	7/28/2005	ERIMS05/06/08	8.3	0	3.2	0	0.76	12.26
VP-12	7/28/2005	ERIMS05/06/08	0	0	0	0	0	0
VP-13	7/28/2005	ERIMS05/06/08	2.9	0	6.4	0	1.1	10.4
VP-14	7/28/2005	ERIMS05/06/08	0	0	2.1	0	0	2.1
VP-15	7/28/2005	ERIMS05/06/08	0	0	0	0	0	0
VP-16	7/28/2005	ERIMS05/06/08	0	0	1.3	0	0	1.3
VP-17	7/28/2005	ERIMS05/06/08	1	0	2.7	0	0.66	4.36
VP-18	11/18/2005	ERIMS05/06/08	67.7	3.26	10.9	0	477	558.86
VP-19	11/18/2005	ERIMS05/06/08	5.71	0	15.9	0	39.3	60.91
VP-2	6/17/2004	ERIMS05/06/08	1.2	0	0.32	0	0	1.52
VP-20	11/18/2005	ERIMS05/06/08	27.7	11.3	2.28	2	536	577.28
VP-21	11/18/2005	ERIMS05/06/08	5.21	0	0	0	133	138.21
VP-3	6/17/2004	ERIMS05/06/08	3.2	0	1.1	0	0	4.3
VP-4	6/17/2004	ERIMS05/06/08	15	1.1	6.3	0	8.2	30.6
VP-5	6/17/2004	ERIMS05/06/08	0.32	0.32	0.32	0	0.32	1.28
VP-6	6/17/2004	ERIMS05/06/08	310	9.6	400	9	61	780.6
VP-7	6/17/2004	ERIMS05/06/08	22	0	0	0	0	22
VP-8	6/1/2004	ERIMS05/06/08	220	0	650	0	80	950
VP-9	6/17/2004	ERIMS05/06/08	310	3.2	49	3	23	385.2

*Total is equal to the sum of 1,1,1-TCA; CIS,1-2-DCE; PCE and TRANS,1-2DCE

Legend

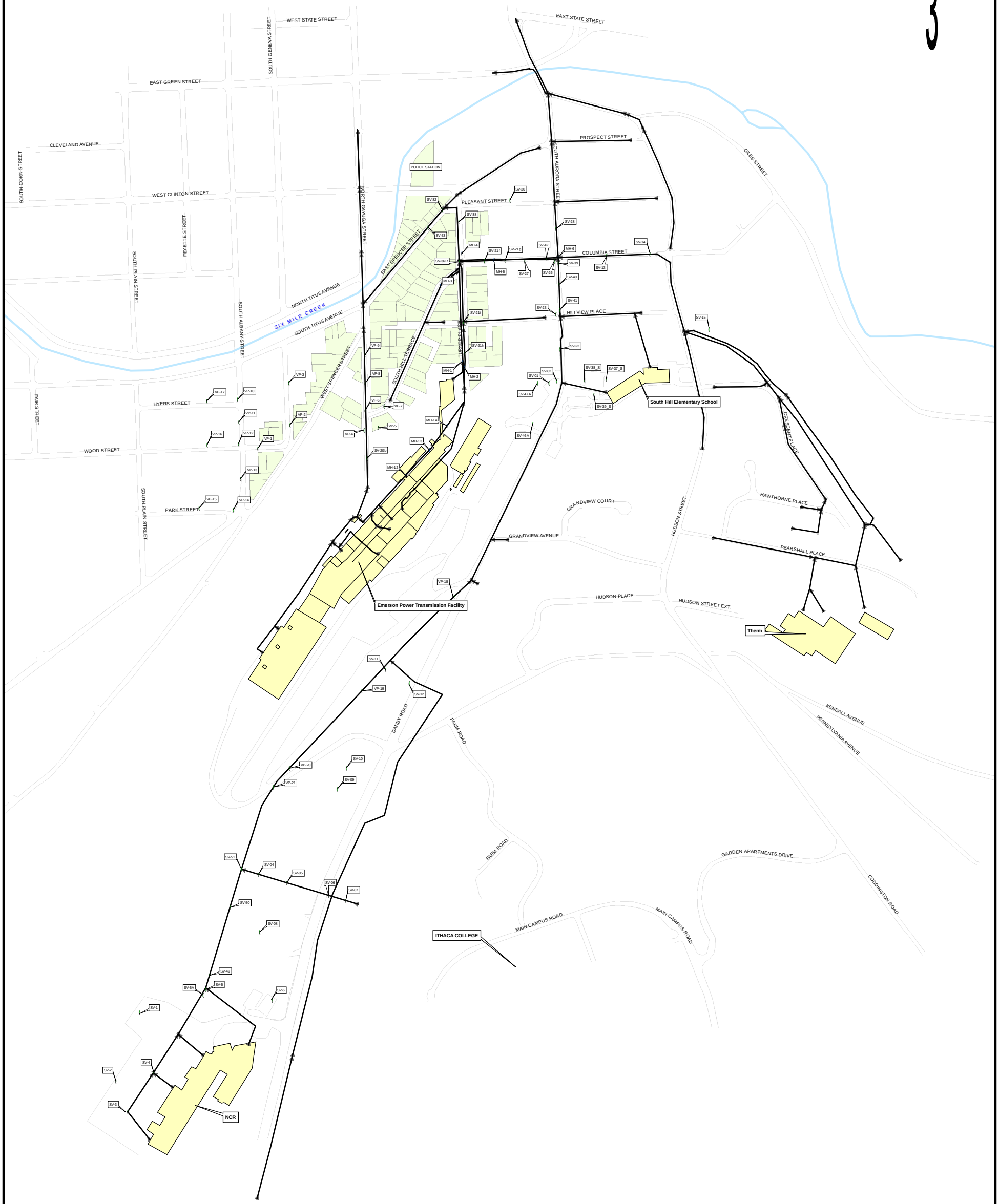
- HISTORICAL SANITARY SEWERS
- RESIDENTIAL INDOOR AIR STUDY AREA

Title:
EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS HISTORICAL SANITARY SEWERS
620 SOUTH AURORA STREET
ITHACA, NEW YORK

Prepared For:
BSK - BWI/Burns

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled By: LP		Date: 06/09/08	PLATE
Prepared By: LP		Scale: AS SHOWN	1
Project Mgr.: DK		Office: MA	
File No.: BSK1312511		Project: 130004M	



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Legend

- MANHOLES
- SOIL VAPOR WELLS
- HISTORICAL SANITARY SEWERS
- RESIDENTIAL INDOOR AIR STUDY AREA

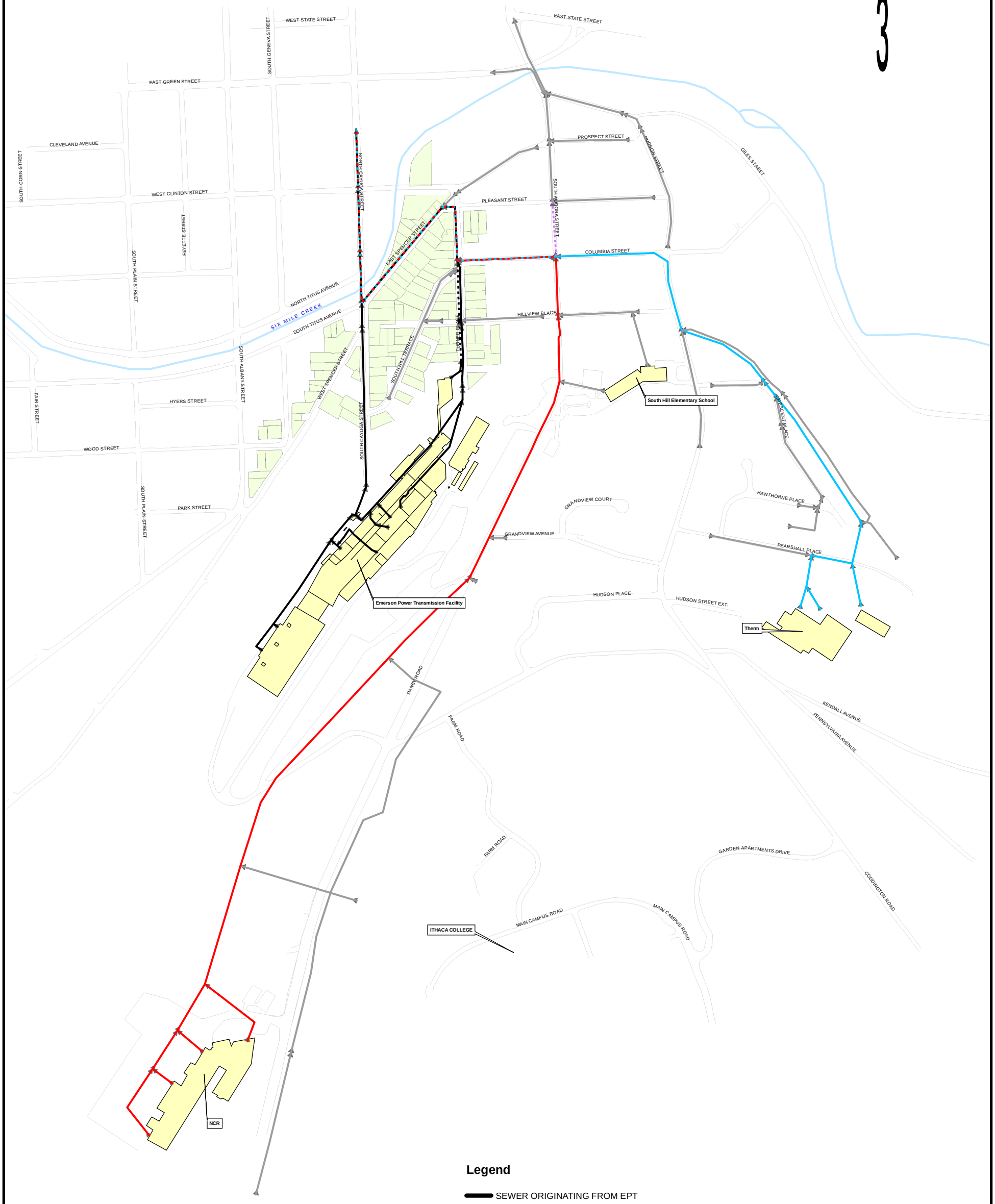
Title: **EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS HISTORICAL SANITARY SEWERS AND SOIL VAPOR AND MANHOLE SAMPLE LOCATIONS**

620 SOUTH AURORA STREET
ITHACA, NEW YORK

Prepared For:
BSK - BWI/Burns

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled By: LP		Date: 06/09/08	PLATE
Prepared By: LP		Scale: AS SHOWN	1A
Project Mgr.: DK		Office: MA	
File No.: BSK1312512		Project: 130004M	



NOTES:

(1) HOMES ON THE WEST SIDE OF TURNER PLACE DISCHARGE TO THE OLDER (circa 1800s) SEWER. THIS SEWER ALSO PROVIDES OVERFLOW CAPACITY FROM EPT.

(2) HOMES ON THE WEST SIDE OF TURNER PLACE DISCHARGE TO THE OLDER (circa 1800s) SEWER. THIS SEWER ALSO PROVIDES OVERFLOW CAPCITY FROM EPT, THERM, AND NCR.

(3) IN 2007 THE HISTORICAL OVERFLOW PIPE WAS REPLACED WITH A NEW PIPE TO PROVIDE THE MAIN FLOW FROM THE COLUMBIA STREET/SOUTH AURORA STREET INTERSECTION.

Legend

- SEWER ORIGINATING FROM EPT
- SEWER ORIGINATING FROM THERM
- SEWER ORIGINATING FROM NCR
- OTHER SEWER
- OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT. (1)
- OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT, THERM, AND NCR. (2)
- HISTORICAL OVERFLOW LINE. COLLECTS DISCHARGE FROM THERM AND NCR (3)
- RESIDENTIAL INDOOR AIR STUDY AREA

0 100 200 400 Feet

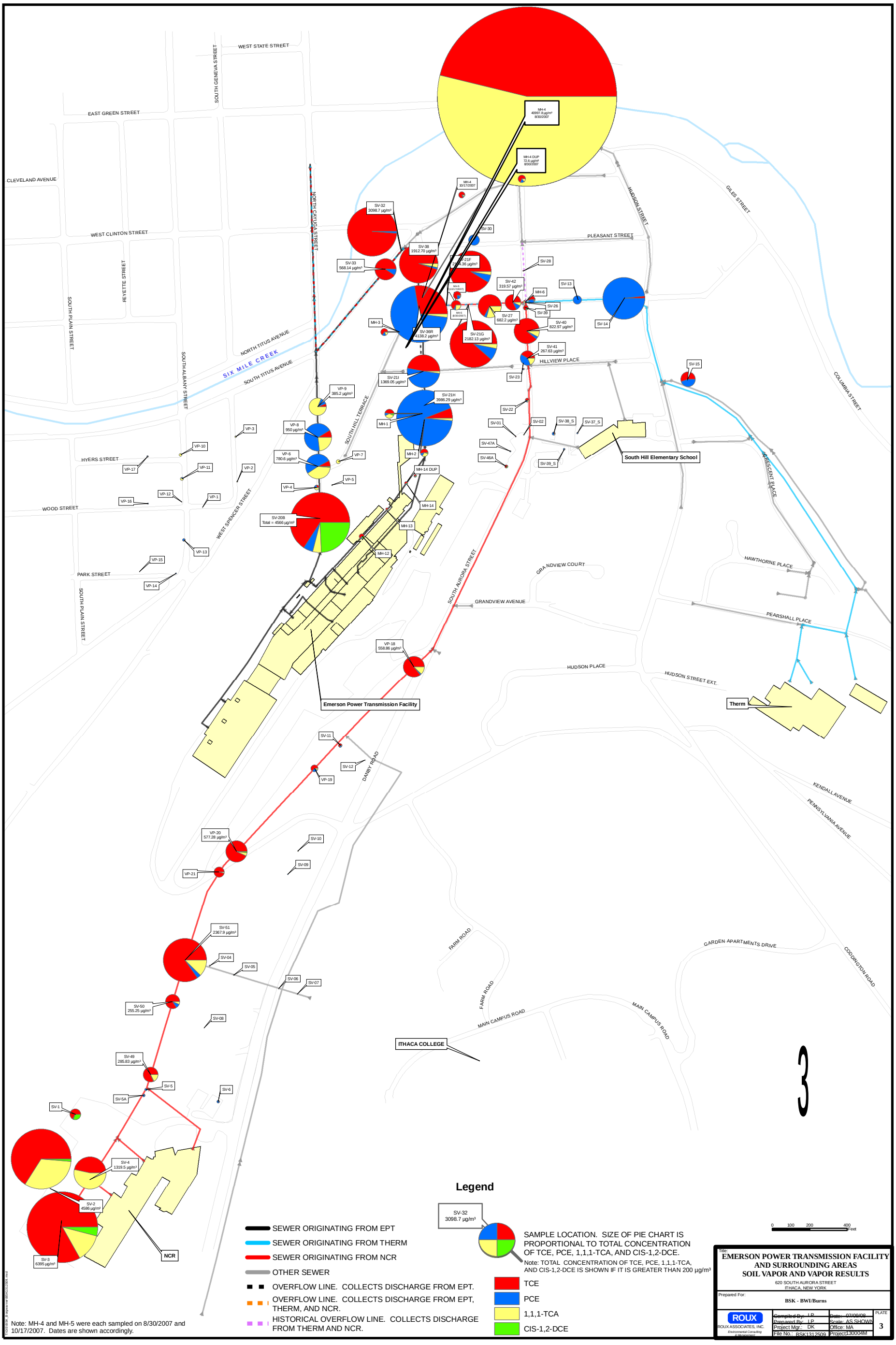
Title:
EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS CODED HISTORICAL SANITARY SEWERS
620 SOUTH AURORA STREET
ITHACA, NEW YORK

Prepared For:
BSK - BWI/Burns

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled By:	LP	Date:	06/10/08
Prepared By:	CRS	Scale:	AS SHOWN
Project Mgr.:	DK	Office:	MA
File No.:	BSK1312608	Project:	130004M

PLATE 2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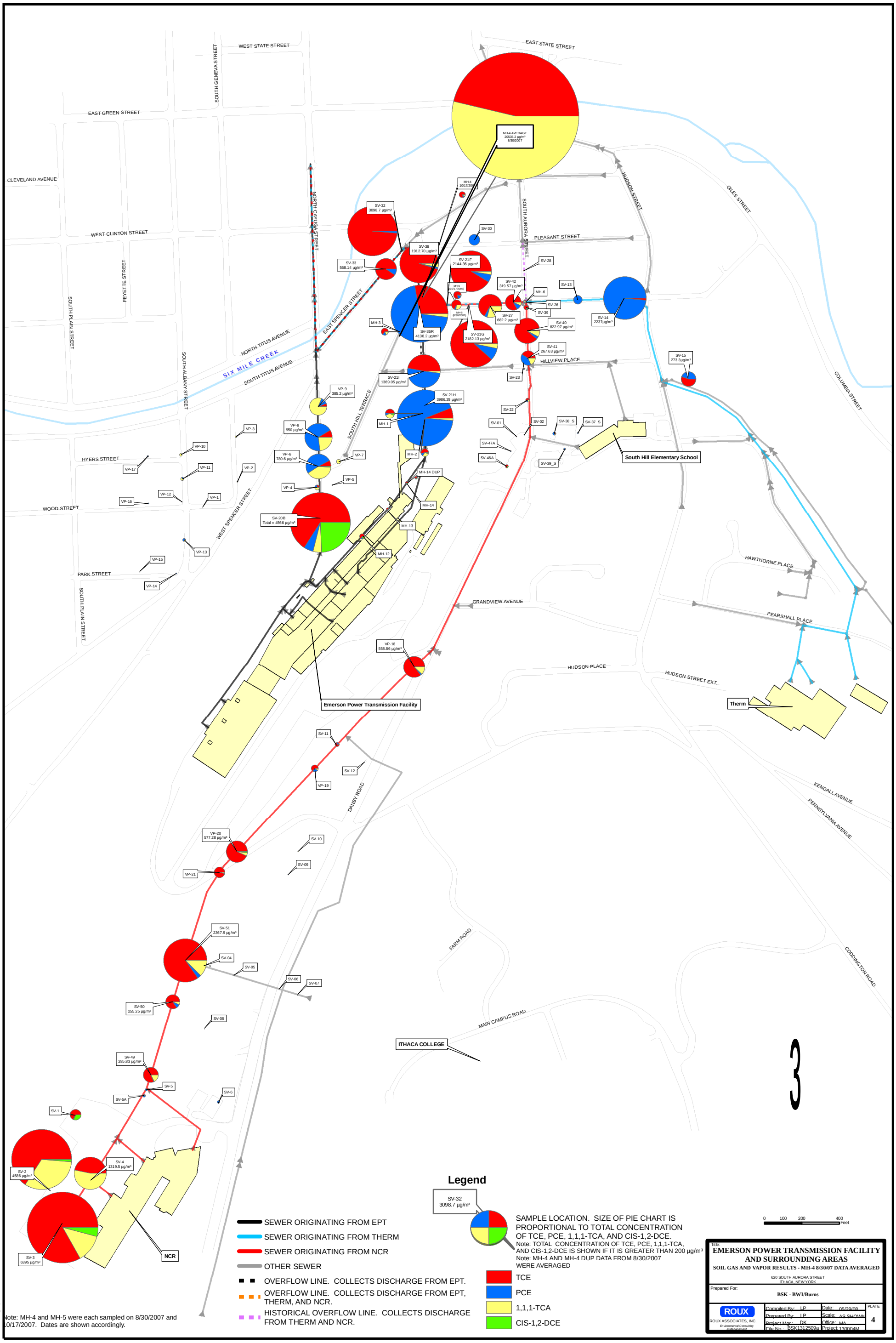
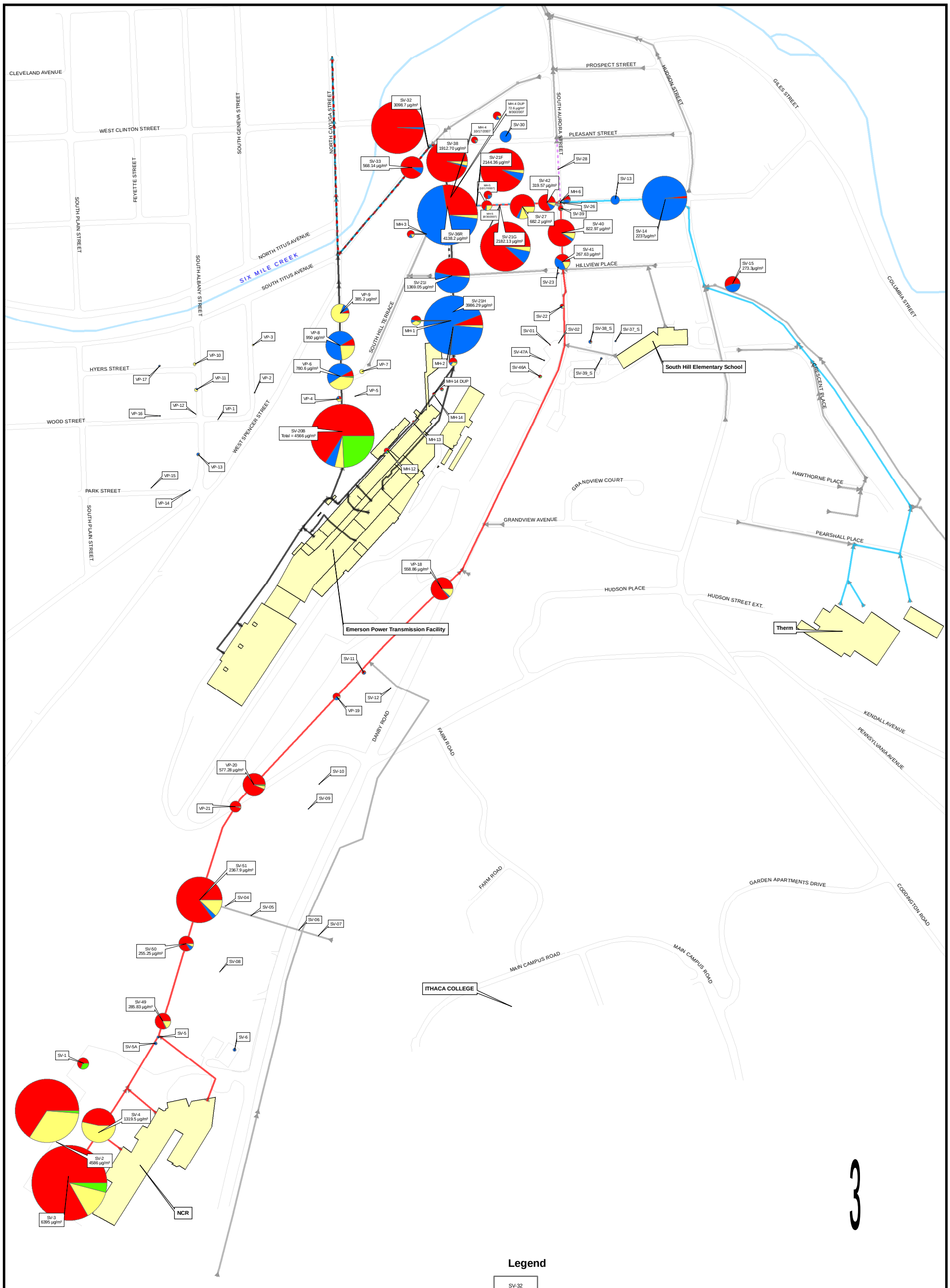
SOUTH GENEVA STREET
EAST GREEN STREET
CLEVELAND AVENUE
WEST CLINTON STREET
NORTH CAYUGA STREET
FEYETTE STREET
SOUTH PLAIN STREET
SOUTH ALBANY STREET
NORTH TITUS AVENUE
SOUTH TITUS AVENUE
SIX MILE CREEK
HYERS STREET
WOOD STREET
PARK STREET
WEST SPENCER STREET
SOUTH HILL TERRACE
PLEASANT STREET
HUDSON STREET
GILES STREET
HILLVIEW PLACE
COLUMBIA STREET
CRESCENT PLACE
South Hill Elementary School
SOUTH AURORA STREET
GRANDVIEW COURT
GRANDVIEW AVENUE
HAWTHORNE PLACE
PEARSHALL PLACE
HUDSON PLACE
HUDSON STREET EXT.
Therm
Emerson Power Transmission Facility
DANBY ROAD
KENDALL AVENUE
PENNSYLVANIA AVENUE
FARM ROAD
GARDEN APARTMENTS DRIVE
CODDINGTON ROAD
MAIN CAMPUS ROAD
ITHACA COLLEGE
NCR
MH-4 40997.8 µg/m³ 8/30/2007
MH-4 DUP 72.6 µg/m³ 8/30/2007
MH-4 10/17/2007
SV-32 3098.7 µg/m³
SV-38 1912.70 µg/m³
SV-33 568.14 µg/m³
SV-30
SV-21F 2138.36 µg/m³
SV-28
SV-42 319.57 µg/m³
SV-13
MH-6
SV-26
SV-39
SV-27 682.2 µg/m³
SV-40 822.97 µg/m³
SV-14
MH-3
SV-36R 4138.2 µg/m³
SV-21G 2182.13 µg/m³
SV-41 267.63 µg/m³
SV-15
SV-23
SV-21I 1369.05 µg/m³
SV-21H 3986.29 µg/m³
SV-22
SV-01
SV-02
SV-38_S
SV-37_S
SV-47A
SV-46A
SV-39_S
MH-1
MH-2
MH-14 DUP
MH-14
MH-13
MH-12
VP-9 385.2 µg/m³
VP-8 950 µg/m³
VP-6 780.6 µg/m³
VP-7
VP-5
VP-4
VP-3
VP-10
VP-17
VP-11
VP-2
VP-16
VP-12
VP-1
VP-13
VP-15
VP-14
SV-20B Total = 4566 µg/m³
VP-18 558.86 µg/m³
SV-11
SV-12
VP-19
VP-20 577.28 µg/m³
VP-21
SV-10
SV-09
SV-51 2367.9 µg/m³
SV-04
SV-05
SV-06
SV-07
SV-50 255.25 µg/m³
SV-08
SV-49 285.83 µg/m³
SV-5
SV-5A
SV-6
SV-1
SV-4 1319.5 µg/m³
SV-2 4586 µg/m³
SV-3 6395 µg/m³
Legend
SEWER ORIGINATING FROM EPT
SEWER ORIGINATING FROM THERM
SEWER ORIGINATING FROM NCR
OTHER SEWER
OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT.
OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT, THERM, AND NCR.
HISTORICAL OVERFLOW LINE. COLLECTS DISCHARGE FROM THERM AND NCR.
SV-32 3098.7 µg/m³
SAMPLE LOCATION. SIZE OF PIE CHART IS PROPORTIONAL TO TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE.
Note: TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE IS SHOWN IF IT IS GREATER THAN 200 µg/m³
TCE
PCE
1,1,1-TCA
CIS-1,2-DCE
0 100 200 400 Feet
Note: MH-4 and MH-5 were each sampled on 8/30/2007 and 10/17/2007. Dates are shown accordingly.
Title:
EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS
SOIL VAPOR AND VAPOR RESULTS
620 SOUTH AURORA STREET
ITHACA, NEW YORK
Prepared For:
BSK - BWI/Burns
ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management
Compiled By: LP
Prepared By: LP
Project Mgr.: DK
File No.: BSK1312509
Date: 07/09/08
Scale: AS SHOWN
Office: MA
Project:130004M
PLATE
3
3


WEST STATE STREET
EAST STATE STREET
SOUTH GENEVA STREET
EAST GREEN STREET
CLEVELAND AVENUE
WEST CLINTON STREET
NORTH CAYUGA STREET
SOUTH AURORA STREET
HUDSON STREET
GILES STREET
PLEASANT STREET
FEYETTE STREET
SOUTH PLAIN STREET
EAST SPENCER STREET
NORTH TITUS AVENUE
SIX MILE CREEK
SOUTH TITUS AVENUE
SOUTH ALBANY STREET
HILLVIEW PLACE
SOUTH HILL TERRACE
COLUMBIA STREET
HYERS STREET
WOOD STREET
WEST SPENCER STREET
PARK STREET
South Hill Elementary School
HAWTHORNE PLACE
PEARSHALL PLACE
GRANDVIEW AVENUE
HUDSON PLACE
HUDSON STREET EXT.
Therm
Emerson Power Transmission Facility
DANBY ROAD
KENDALL AVENUE
PENNSYLVANIA AVENUE
FARM ROAD
CODDINGTON ROAD
MAIN CAMPUS ROAD
ITHACA COLLEGE
NCR
MH-4 AVERAGE 20535.2 µg/m³ 8/30/2007
MH-4 10/17/2007
MH-5 (10/17/2007)
MH-5 (8/30/2007)
SV-32 3098.7 µg/m³
SV-38 1912.70 µg/m³
SV-33 568.14 µg/m³
SV-30
SV-21F 2144.36 µg/m³
SV-28
SV-42 319.57 µg/m³
MH-6
SV-13
SV-26
SV-39
SV-27 682.2 µg/m³
SV-14 2237µg/m³
MH-3
SV-36R 4138.2 µg/m³
SV-21G 2182.13 µg/m³
SV-40 822.97 µg/m³
SV-41 267.63 µg/m³
SV-15 273.3µg/m³
SV-21I 1369.05 µg/m³
SV-23
SV-21H 3986.29 µg/m³
SV-22
SV-01
SV-02
SV-38_S
SV-37_S
SV-47A
SV-46A
SV-39_S
MH-1
MH-2
MH-14 DUP
MH-14
MH-13
MH-12
VP-9 385.2 µg/m³
VP-8 950 µg/m³
VP-6 780.6 µg/m³
VP-7
VP-4
VP-5
SV-20B Total = 4566 µg/m³
VP-3
VP-10
VP-17
VP-11
VP-2
VP-16
VP-12
VP-1
VP-13
VP-15
VP-14
VP-18 558.86 µg/m³
SV-11
SV-12
VP-19
VP-20 577.28 µg/m³
SV-10
SV-09
VP-21
SV-51 2367.9 µg/m³
SV-04
SV-05
SV-06
SV-07
SV-50 255.25 µg/m³
SV-08
SV-49 285.83 µg/m³
SV-5
SV-5A
SV-6
SV-1
SV-2 4586 µg/m³
SV-4 1319.5 µg/m³
SV-3 6395 µg/m³
Legend
SV-32 3098.7 µg/m³
SAMPLE LOCATION. SIZE OF PIE CHART IS PROPORTIONAL TO TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE.
Note: TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE IS SHOWN IF IT IS GREATER THAN 200 µg/m³
Note: MH-4 AND MH-4 DUP DATA FROM 8/30/2007 WERE AVERAGED
TCE
PCE
1,1,1-TCA
CIS-1,2-DCE
SEWER ORIGINATING FROM EPT
SEWER ORIGINATING FROM THERM
SEWER ORIGINATING FROM NCR
OTHER SEWER
OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT.
OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT, THERM, AND NCR.
HISTORICAL OVERFLOW LINE. COLLECTS DISCHARGE FROM THERM AND NCR.
0 100 200 400 Feet
Note: MH-4 and MH-5 were each sampled on 8/30/2007 and 10/17/2007. Dates are shown accordingly.
Title:
EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS
SOIL GAS AND VAPOR RESULTS - MH-4 8/30/07 DATA AVERAGED
620 SOUTH AURORA STREET
ITHACA, NEW YORK
Prepared For:
BSK - BWI/Burns
ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management
Compiled By: LP
Prepared By: LP
Project Mgr.: DK
File No.: BSK1312509a
Date: 05/29/08
Scale: AS SHOWN
Office: MA
Project: 13000AM
PLATE 4
3



3

Legend

SV-32 3098.7 µg/m³

SAMPLE LOCATION. SIZE OF PIE CHART IS PROPORTIONAL TO TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE.

Note: TOTAL CONCENTRATION OF TCE, PCE, 1,1,1-TCA, AND CIS-1,2-DCE IS SHOWN IF IT IS GREATER THAN 200 µg/m³

- SEWER ORIGINATING FROM EPT
- SEWER ORIGINATING FROM THERM
- SEWER ORIGINATING FROM NCR
- OTHER SEWER
- OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT.
- OVERFLOW LINE. COLLECTS DISCHARGE FROM EPT, THERM, AND NCR.
- HISTORICAL OVERFLOW LINE. COLLECTS DISCHARGE FROM THERM AND NCR.

- TCE
- PCE
- 1,1,1-TCA
- CIS-1,2-DCE

0 100 200 400 Feet

Note: MH-4 and MH-5 were each sampled on 8/30/2007 and 10/17/2007. Dates are shown accordingly.

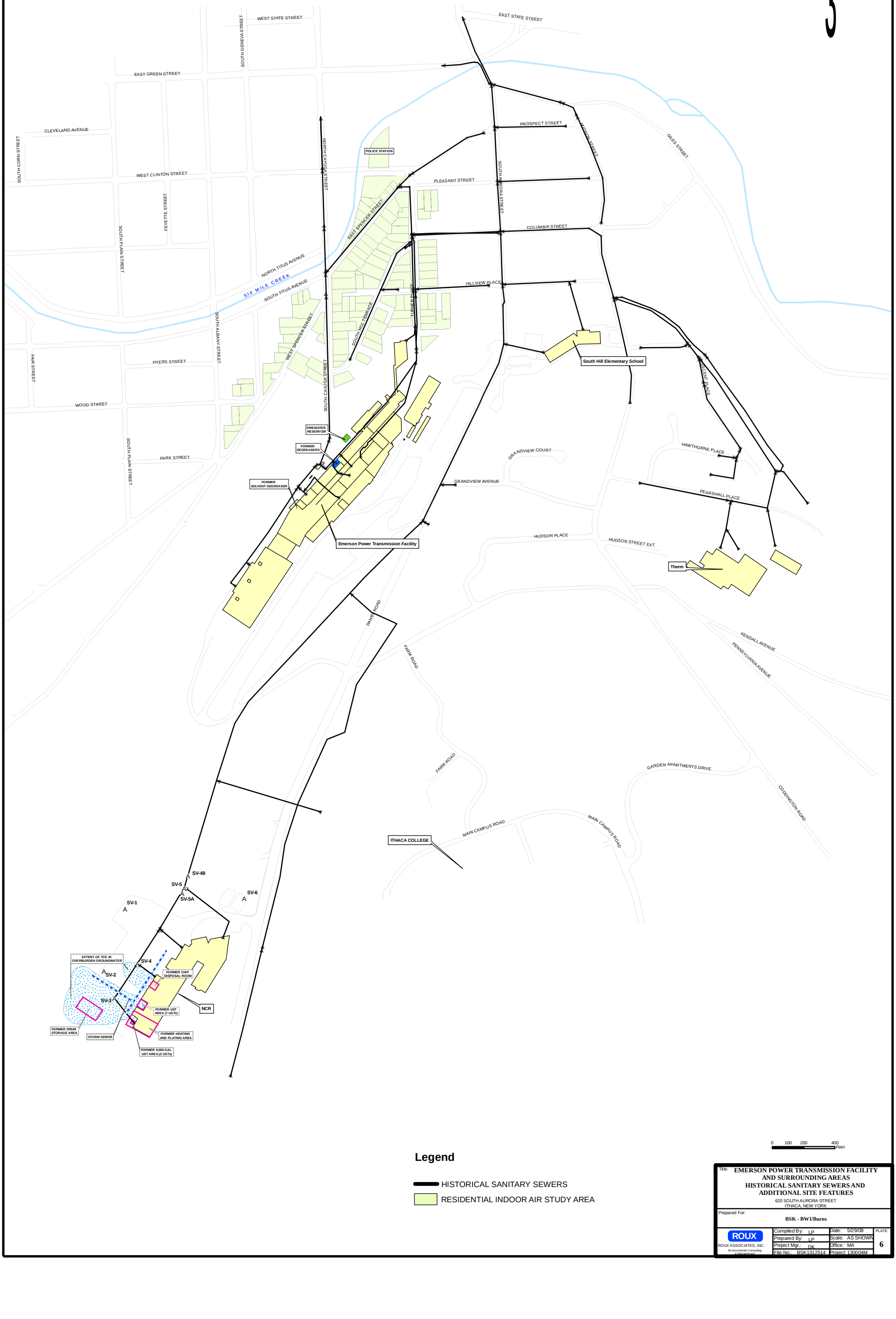
Title:
EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS SOIL VAPOR AND VAPOR RESULTS - MH-4 8/30/07 LOWER VALUE USED

620 SOUTH AURORA STREET
ITHACA, NEW YORK

Prepared For:
BSK - BWI/Burns

ROUX ASSOCIATES, INC. Environmental Consulting & Management

Compiled By: LP	Date: 07/09/08	PLATE	
Prepared By: LP	Scale: AS SHOWN		5
Project Mgr.: DK	Office: MA		
File No.: BSK121509	Project:120004M		



Legend

- HISTORICAL SANITARY SEWERS
- RESIDENTIAL INDOOR AIR STUDY AREA

Title: **EMERSON POWER TRANSMISSION FACILITY AND SURROUNDING AREAS HISTORICAL SANITARY SEWERS AND ADDITIONAL SITE FEATURES**

620 SOUTH AURORA STREET
ITHACA, NEW YORK

Prepared For: **BSK - BWI/Burns**

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled By: LP	Date: 5/29/08	PLATE
Prepared By: LP	Scale: AS SHOWN	6
Project Mgr.: DK	Office: MA	
File No.: BSK1312514	Project: 130004M	

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