John M. Uruskyj
Senior Project Manager

GE
Global Operations - Remediation
1 River Road – Building 5-7W
Schenectady, NY 12345

T 518 388 4129
John.Uruskyj@ge.com

VIA FEDERAL EXPRESS

February 19, 2018

U.S. Environmental Protection Agency Region II
290 Broadway – 20th Floor
New York, New York 10007

Attention: Isabel Fredricks
Cayuga County Groundwater Contamination Site Remedial Project Manager
(1 hard copy and 1 electronic copy)

Subject: Groundwater and Surface Water Data Summary Report
Cayuga County Groundwater Contamination Superfund Site
Design Order (Index No. CERCLA 02-2013-2021)
Auburn, New York

Dear Ms. Fredricks:

The interim report associated with the Investigation Study being performed for Area 3 of the above-referenced site is enclosed, in hard copy and on compact disk. In accordance with the Investigation Study Work Plan (ISWP), the semi-annual monitoring of groundwater and surface water will continue pending the United States Environmental Protection Agency's (USEPA's) review of this report. As always, please contact me at 518 388 4129 or via email if you have any questions.

Sincerely,

John M. Uruskyj
Senior Project Manager

enclosures

cc: New York/Caribbean Superfund Branch
Office of Regional Counsel
United States Environmental Protection Agency Region II
290 Broadway, 17th Floor
New York, New York 10007-1866

Attention: Argie Cirillo, Esq.
Attorney for Cayuga County Groundwater Contamination Site
(1 electronic copy)

Ms. Jessica LaClair
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233-7013
(1 hard copy and 1 electronic copy)

Joe Mayo, CDM Smith (w/ CD only)
Dave Carnevale, OBG (w/o enclosure)
Paul Hare, OBG (w/o enclosure)
Mark Harkness, GE (w/o enclosure)
Dean Sommer, Esq., Young Sommer (w/ CD only)
Eric Merrifield, Esq., GE (w/ CD only)

OBG

REPORT

Groundwater and Surface Water Data Summary Report

Cayuga County Groundwater Contamination Superfund Site
Cayuga County, New York

General Electric Company
Albany, New York

February 19, 2018

FEBRUARY 19, 2018 | CEP.612 | 65685

Groundwater and Surface Water Data Summary Report

Cayuga County Groundwater Contamination Superfund Site
Cayuga County, New York
Index No. CERCLA-02-2013-2021

Prepared for:

General Electric Company
Albany, New York

DOUGLAS M. CRAWFORD, P.E., VICE PRESIDENT
O'BRIEN & GERE ENGINEERS, INC.

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ACRONYM LIST

BCI	Bioremediation Consultants, Inc.
BVC	bav1 vinyl chloride reductase
BWSP	Bureau of Water Supply Protection
CCDOH	Cayuga County Department of Health and Human Services
cDCE	cis-1,2-dichloroethene
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CSIA	compound-specific stable isotope analysis
DHC	*Dehalococcoides*
DHG	*Dehalogenimonas*
DHGs	dissolved hydrocarbon gas(es)
DO	dissolved oxygen
DSB	*Desulfitobacterium*
DSM	*Desulfuromonas*
DWS	drinking water standard
EISB	enhanced in-situ bioremediation
etnC	ethene monooxygenase
etnE	epoxyalkane transferase
FS	Feasibility Study
ft bgs	feet below ground surface
ft btoc	feet below top of casing
GE	General Electric Company
HHRA	Human Health Risk Assessment
IRM	Interim Remedial Measure
ISR	Investigation Study Report
ISWP	Investigation Study Work Plan
MCL	Maximum Contaminant Level

µg/L	micrograms per liter
mg/L	milligrams per liter
ml/min	milliliters per minute
MNA	monitored natural attenuation
NPL	National Priorities List
NTU	nephelometric turbidity unit
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OBG	O'Brien & Gere Engineers, Inc.
O&M	operation and maintenance
ORP	oxidation reduction potential
PDB(s)	passive diffusion bag(s)
PMMO	particulate methane monooxygenase
‰	per mill
PTWP	Pilot Test Work Plan
PDI	pre-design investigation
POET	point-of entry treatment
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
RA	Remedial Approach
RAWP	Remedial Action Work Plan
RD	Remedial Design
RDR1	Remedial Design Report 1
RI	Remedial Investigation
RDWP1	Remedial Design Work Plan 1
ROD	Record of Decision
SLERA	Screening Level Ecological Risk Assessment
SMMO	soluble methane monooxygenase

SOP	Standard Operating Procedure
SOW	Statement of Work
TCE	trichloroethene
TOGS	Technical and Operational Guidance Series
tDCE	trans-1,2-dichloroethene
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VC	vinyl chloride
VCR	vinyl chloride reductase
VOC(s)	volatile organic compound(s)

1. INTRODUCTION

1.1 GENERAL

This interim *Groundwater and Surface Water Data Summary Report* (Data Summary Report) has been prepared by O'Brien & Gere Engineers, Inc. (OBG) on behalf of the General Electric Company (GE) for Area 3 of the Cayuga County Groundwater Contamination Superfund Site (Site) in Cayuga County, New York (**Figure 1**). This report has been prepared in accordance with the *Investigation Study Work Plan* (ISWP) (OBG, 2014a) approved by the United States Environmental Protection Agency (USEPA) under the Administrative Settlement Agreement and Order on Consent for Remedial Design, Investigation, and Cost Recovery, Index No. CERCLA-02-2013-2021 (Settlement Agreement) entered into by USEPA and GE. The investigative activities and results presented in this Data Summary Report are part of the Investigation Study required by the Statement of Work (SOW) included in Appendix B of the Settlement Agreement.

The initial work under the ISWP included field reconnaissance and two surface water sampling events in and near the Village of Union Springs. Unlike the first surface water sampling event, the second surface water sampling event was performed when the level of Cayuga Lake was low (which occurs each winter) and additional shoreline was exposed. In accordance with the ISWP, three semi-annual groundwater and surface water monitoring events were subsequently conducted in Area 3. The first event consisted of an initial baseline monitoring event, with the groundwater sampling performed using low flow methods (including measurement of field parameters[1]) and laboratory analysis of volatile organic compounds (VOCs) and monitored natural attenuation (MNA) parameters.[2] In addition, samples were collected from select locations for specialty analyses, including compound-specific stable isotope analysis (CSIA) and microbiological analyses. The groundwater sampling during the second event was performed using passive diffusion bag (PDB) samplers, with analysis for VOCs. During the third semi-annual event, the groundwater sampling was again performed using low-flow methods, with analysis for VOCs and MNA parameters.

1.2 PURPOSE

This Data Summary Report provides and discusses the field measurements and laboratory analytical data that have been collected to date pursuant to the approved ISWP. This report is provided to assist USEPA in determining (a) if sufficient information has been collected during the Investigation Study to proceed with preparation of the Investigation Study Report (ISR), (b) whether the Human Health Risk Assessment (HHRA) previously performed by USEPA needs to be supplemented, and (c) whether the Screening Level Ecological Risk Assessment (SLERA) previously performed by USEPA needs to be supplemented. In accordance with the ISWP, if USEPA determines that the data collected to date during the Investigation Study are not sufficient to proceed to the ISR, then two additional semi-annual monitoring events will be completed and another Data Summary Report will be submitted to USEPA for review and data sufficiency determination.

1.3 BACKGROUND INFORMATION

1.3.1 Site Description

The Site includes an area within Cayuga County, New York in which VOCs, primarily cis-1,2-dichloroethene (cDCE) and trichloroethene (TCE), have been detected in bedrock groundwater. To a lesser extent and/or in localized areas, trans-1,2-dichloroethene (tDCE) and vinyl chloride (VC) have also been detected in groundwater. Groundwater with detectable concentrations of these VOCs extends from the southwest corner of the City of Auburn (City) southwestward to the Village of Union Springs (Village), a distance of approximately seven miles, and includes portions of the Towns of Aurelius, Fleming, and Springport. Cayuga County is located

[1] The field parameters measured during purging were conductivity, dissolved oxygen (DO), oxidation-reduction-potential (ORP), pH, temperature, and turbidity.
[2] The MNA parameters were chloride, nitrate, sulfate, sulfide, dissolved iron, potassium, sodium, alkalinity, dissolved organic carbon (DOC) and dissolved hydrocarbon gases (DHGs) (*i.e.*, ethene, ethane, and methane).

in the west central part of New York State, is approximately 694 square miles in area and has a population of 79,526 (U.S. Census, 2009). A location map is provided as **Figure 1**.

The area contains residential properties intermingled with extensive farmland and patches of woodlands, as well as some commercial areas. Two public water supply systems serve residences at the Site. The Village of Union Springs, on the eastern shore of Cayuga Lake, operates two water supply wells and supplies water to the Village and Water District No. 1 in the Town of Springport. Groundwater from these two wells contains low concentrations of cDCE and TCE and is treated using an air stripper.[3] The City of Auburn provides drinking water to the Cayuga County Water and Sewer Authority and the Town of Springport which distribute drinking water to the area south and west of the City in water districts located in the Towns of Aurelius and Fleming, and Water District No. 2 in the Town of Springport. The City of Auburn draws its drinking water from Owasco Lake, which is unaffected by the Site.

The former Powerex, Inc. (Powerex) facility, located at 2181 West Genesee Street, has been identified by USEPA as a source of groundwater contamination to the Site. Between 1951 and 1986, GE owned the facility and manufactured a variety of electrical components, including radar equipment, printed circuit boards for high fidelity equipment, and high-voltage semi-conductors. In January 1986, Powerex, a joint venture between GE, Westinghouse Electric Company and Mitsubishi Electric America, Inc., purchased the facility and continued the manufacture of high-voltage semi-conductors until May 1990, when the plant was closed. GE re-acquired the facility in 1990, largely to facilitate remedial activities; no manufacturing operations are currently conducted.

GE completed the investigation at the former Powerex facility under the oversight of the New York State Department of Environmental Conservation (NYSDEC), and also performed several Interim Remedial Measures (IRMs). The Interim Action ROD issued by NYSDEC in March 1995 has also been implemented. These activities are described in the Feasibility Study (FS) performed for the former Powerex facility (OBG, 2014b). GE is also conducting a large pilot test of enhanced *in situ* bioremediation (EISB) in the two main source areas at the facility. In March 2016, NYSDEC issued a ROD for the former Powerex facility, which includes EISB in the overburden and shallow bedrock in the source areas, and enhanced *in situ* degradation in the deep bedrock upgradient (north-northeast) of the two main source areas. The remedy is now being implemented; the *Remedial Design/Remedial Action (RD/RA) Work Plan* has been approved and the pre-design investigation (PDI) activities were recently initiated.

A large pilot test of enhanced *in situ* degradation is also underway in the deep bedrock along the southern boundary of the former Powerex facility. This is part of the PDI activities that are being performed by GE under the Settlement Agreement to collect the data needed to design the remedy that was selected by USEPA for Areas 1 and 2 of the Cayuga County Groundwater Contamination Superfund Site.

1.3.2 Site History

VOCs have been detected in groundwater samples from the Village of Union Springs to the southwestern limits of the City of Auburn, a distance of approximately seven miles. In 1985, testing of the Village of Union Springs' municipal drinking water reportedly revealed low concentrations of cDCE and TCE. Routine testing of the two supply wells began in late 1988 and is currently performed on a quarterly basis. The results of this sampling document the detection of low concentrations of cDCE and TCE in the two public supply wells. The concentration of TCE has always been less than the federal and state drinking water standard (DWS) of 5 micrograms per liter (μg/L); the concentration of cDCE has always been below the federal DWS of 70 μg/L, but is often slightly above the state DWS of 5 μg/L.

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[3] A backup air stripper and larger backup power supply were recently installed and tested by GE under the Administrative Order for Remedial Action issued by USEPA. This work was part of the remedy selected by USEPA in the Record of Decision (ROD) dated September 29, 2015. The design of the backup air stripper and backup power supply was previously completed by GE under the Settlement Agreement.

NYSDEC began an investigation in 1999 to identify the source(s) of VOCs detected in the Village of Union Springs' supply wells. This investigation ultimately included the sampling of private supply wells and, by April 2001, over 300 supply wells had been sampled. VOCs were found above the federal and/or state DWS in 51 residential wells and three farms with supply wells (54 total properties), with the highest concentrations in the wells located farthest from the Village of Union Springs (USEPA, 2005).

NYSDEC sought assistance from USEPA in December 2000, at which time USEPA commenced a removal action. On June 7, 2001, NYSDEC formally requested that USEPA place the Site on the National Priorities List (NPL). The Site was subsequently proposed for the NPL on September 13, 2001, and the Cayuga County Groundwater Contamination Superfund Site was formally added to the NPL on September 5, 2002.

The removal action performed by USEPA initially included the provision of potable water but was soon expanded to include the installation, maintenance and monitoring of numerous point-of-entry treatment (POET) systems on wells for which Site-related VOCs (primarily cDCE and TCE but also tDCE and VC) were detected above the federal drinking water standards (also known as Maximum Contaminant Levels [MCLs]). By July 2001, USEPA had installed 51 such POET systems on residential wells and three POET systems on agricultural properties. Two large dairy farms in the area had air stripper treatment systems installed; the remaining POET systems had carbon adsorption units installed. In addition to the POET systems installed by USEPA, the New York State Department of Health (NYSDOH), in cooperation with the Cayuga County Department of Health and Human Services (CCDOH), installed POET systems on several additional residential supply wells in which VOCs were not detected at concentrations above the federal MCLs. In May 2001, the Village of Union Springs installed an air stripper to treat the groundwater from its two supply wells.

The City of Auburn's public water supply system was extended by the Cayuga County Water and Sewer Authority by installing water lines on Bluefield Road, Overbrook Drive, Pinckney Road and Experimental Road. Approximately 3.2 miles of new water mains were installed to convey public water to approximately 49 residential homes located along these roads. Thirty of the 51 residences with POET systems installed by USEPA were then connected to the new public water supply lines in January 2002. A few years later the public water supply system was expanded again to serve two new water districts, Water District No. 2 in the Town of Springport and Water District No. 6 in the Town of Fleming. Approximately 49 miles of new water lines were installed within the Towns of Fleming and Springport. The remaining residences with POET systems installed by USEPA were subsequently connected to the public water supply in 2005 and/or 2006, at which time there were only four POET systems installed by USEPA that were still in operation, including three used only for agricultural purposes and one for residential use. Operation of these four POET systems continued.

Between 2001 and 2004, USEPA conducted a phased investigation as part of the removal action to identify potential sources of the VOCs in private supply wells. In July 2005, USEPA began a Remedial Investigation (RI) for the Cayuga County Groundwater Contamination Superfund Site. The RI involved gathering geologic and hydrogeologic data and the sampling and analysis of groundwater, surface water, and sediment to evaluate the nature and extent of VOCs. As part of its RI, USEPA also performed a vapor intrusion evaluation, which included the collection of sub-slab soil gas samples for VOC analysis from beneath more than 50 houses located in two areas between the City of Auburn and the Village of Union Springs and one area within the Village. Indoor air samples were subsequently collected in a few of the houses. The vapor intrusion evaluation is documented in three trip reports (Lockheed Martin, 2009, 2010, and 2011). Based on the results of the vapor intrusion evaluation, USEPA determined that no further action or investigation was needed.

The results of the RI performed by USEPA are documented in the *Final Remedial Investigation Report*, prepared by CDM Smith and dated February 24, 2012 (CDM Smith, 2012a). USEPA also performed a FS for the Cayuga County Groundwater Contamination Superfund Site, which is documented in the *Final Feasibility Study Report*, prepared by CDM Smith and dated July 12, 2012 (CDM Smith, 2012b). CDM Smith also prepared a *Final Human Health Risk Assessment Report* and a *Final Screening Level Ecological Risk Assessment Report*, dated May 10, 2011 and March 25, 2011, respectively (CDM Smith, 2011a and CDM Smith 2011b). USEPA released a Proposed Plan for public comment on July 17, 2012, and held a public meeting on August 2, 2012. After addressing the comments received from interested parties, USEPA issued a ROD and associated Responsiveness Summary on March 29, 2013 (USEPA, 2013a).

The groundwater remedy selected by USEPA in the ROD consists of enhanced *in situ* degradation in Area 1 of the Site (located closest to the City of Auburn, immediately south of the former Powerex facility), and monitored natural attenuation (MNA) in Area 2; USEPA deferred selecting a groundwater remedy in Area 3 (located closest to and including the Village of Union Springs), opting instead to perform supplemental groundwater and surface water investigation activities. Areas 1, 2 and 3 of the Site are depicted on **Figures 1, 2, and 3**.

On September 9, 2012, USEPA and GE entered into a Removal Order in which GE agreed to assume responsibility for the four remaining POET systems that USEPA had installed. New POET systems were constructed at two of the dairy farms, and minor improvements were made to the POET system at the third dairy farm. In addition, the one residence that still had a POET system installed by USEPA connected to the public water supply, and GE decommissioned that POET system. Sampling of the inlets to the three agricultural POET systems is conducted on a quarterly basis and the individual wells at one of the dairy farms are sampled on a semi-annual basis.[4]

As summarized in Remedial Design Work Plan 1 (RDWP1), submitted under the Settlement Agreement and approved by USEPA on September 25, 2015, six properties located at or near the Site had residential supply wells in which VOCs were not detected at concentrations above the federal MCLs. NYSDOH, in cooperation with CCDOH, installed POET systems on two of those wells; the owners of the other four properties reportedly refused installation of a POET system. As stated in *Remedial Design Report 1* (RDR1) (OBG, 2015), four of the six properties subsequently connected to the public water supply. Under RDWP1, the residential supply well at one of the two other properties was sampled and the analytical results confirmed the prior data which showed that Site-related VOCs are not present at or above the federal and state DWS. The owner of the remaining property continued to refuse access.

The ROD issued by USEPA in March 2013 also required the installation of backup power and backup treatment for the Village of Union Springs' public water supply. The pre-design and design activities were completed by GE under the Settlement Agreement, and the design was presented in RDR1 (OBG, 2015), which was approved by USEPA on September 25, 2015. USEPA subsequently issued an Administrative Order to implement the design, under which GE prepared a *Remedial Action Work Plan* (RAWP) (OBG, 2016). The RAWP was approved by USEPA on September 2, 2016. Implementation of the approved RAWP began on November 3, 2016, and was substantially complete on June 22, 2017, when USEPA performed its final inspection. NYSDOH's Bureau of Water Supply Protection (BWSP) approved the completed works on July 24, 2017. A final *Remedial Action (RA) Report* (OBG, 2017a) and final *Operations and Maintenance (O&M) Plan* (OBG, 2017b) were submitted to USEPA on September 14, 2017. USEPA approved these final reports on September 21, 2017.

1.3.3 Site Geology, Hydrogeology, and Conceptual Site Model

Site Geology

The Site is located at the northern edge of the glaciated Allegheny Plateau Physiographic Province. The geology of the area is characterized by unconsolidated glacial deposits underlain by carbonate bedrock. The unconsolidated deposits consist of glaciolacustrine clay, silt, and fine sand, and a clay-rich glacial till, with a total thickness ranging from approximately 2 to 77 feet.

The bedrock units consist of a sequence of Devonian and Silurian limestone, dolostone, evaporite deposits, shale, and sandstone formations that dip gradually southward at approximately 40 feet per mile. However, the United States Geological Survey (USGS) identified repeated stratigraphic units within certain units (*i.e.*, Marcellus,

[4] There are multiple pumping wells at one of the three dairy farms. The other two dairy farms have only one pumping well.

Onondaga, and Manlius Formations) in some boreholes, which were attributed to localized thrust faulting (Anderson *et al.*, 2004; Eckhardt *et al.*, 2011).

The youngest rocks identified during previous Site investigations consisted of the Marcellus Subgroup, which includes the East Berne and Cherry Valley Members of the Oatka Creek Formation and the Union Springs Formation. Due to the topography of the Site and the southerly dip of the bedrock, the Marcellus Subgroup only underlies the unconsolidated deposits in part of the Site; the Marcellus Subgroup is not present in the northern or western parts of the Site. The Marcellus Subgroup is comprised of shales and limestones. The lowermost portion of the Marcellus Subgroup is composed of black shales, siltstones and sandstones which function as a cap rock above the carbonates below.

The Marcellus Subgroup is underlain, in descending order, by the following formations: Onondaga Formation (Seneca, Moorehouse, Nedrow, and Edgecliff Members), Manlius Formation (Olney Member), Rondout Formation (Chrysler Member), Cobleskill Formation, Bertie Formation (Oxbow, Forge Hollow, and Fiddlers Green Members), and Camillus Formation. These bedrock units occur throughout most or all of the Site.

The four members of the Onondaga Formation include limestones, argillaceous limestones and some thin interbedded bentonites. The Onondaga Formation overlies the limestone and dolostone of the Manlius Formation (Olney Member).

The Chrysler Member of the Rondout Formation, consisting of grey interbedded dolostone and shale, underlies the Manlius Formation. The Upper Silurian limestones of the Cobleskill Formation underlie the Rondout Formation and overlie the dolostones of the Upper Silurian Bertie Formation. The Bertie Formation, which forms the lowermost units of the carbonate rock sequence, overlies the Upper Silurian shales of the Camillus Formation. The Camillus is the deepest unit penetrated during the RI.

The Bertie Formation consists locally of the Oxbow, Forge Hollow, and Fiddlers Green Members. The upper portion of the Forge Hollow Member is typically about 15 feet thick and is gypsiferous, argillaceous, and has well-developed solution features. The gypsum-rich interval of the Forge Hollow Member is referred to as the D3 monitoring interval.

Site Hydrogeology

Groundwater investigations at the Site and the former Powerex facility (CDM Smith, 2012; OBG, 2013) have documented the presence of at least four hydrogeologic units, consisting of the overburden, shallow bedrock, intermediate bedrock, and deep bedrock. In general, the bedrock units have little primary porosity; secondary porosity, such as fractures and solution features, dominates. The exception is within the D3 interval of the deep bedrock, which exhibits significant matrix porosity in comparison to the other bedrock units, as further discussed below. The deep bedrock is generally more fractured and more transmissive than the shallow and intermediate bedrock. In general, the limestones of the Edgecliff Member of the Onondaga Formation and the interbedded limestones, dolomites, and shales of the middle Manlius Formation and upper Rondout Formation act in concert as a leaky aquitard across portions of the Site.

The overburden hydrogeologic unit consists of glaciolacustrine deposits of clay, silt, and fine sand, and clay-rich glacial till. Where present, groundwater in the overburden flows towards local surface water bodies, storm sewers, and agricultural drains and/or provides recharge to the underlying bedrock units.

The shallow bedrock hydrogeologic unit is composed of the Onondaga Formation, specifically the Seneca, Moorehouse and Nedrow Members. Monitoring wells open to the Moorehouse and Nedrow Members are typically referred to as S wells. The Edgecliff Member of the Onondaga Formation underlies the Nedrow Member and is a more massive limestone that is not targeted due to its lower hydraulic conductivity. The nominal thickness of the Onondaga Formation at the Site is 75 feet. Groundwater flow in the shallow bedrock at the former Powerex facility and Area 1 of the Site is generally northward, from the residential area south of West Genesee Street toward local streams such as Crane Brook and the Owasco Outlet, which serve as groundwater discharge zones. The shallow bedrock can be de-watered locally, suggesting that in some places vertical fractures, sinkholes and/or swallets extend through the underlying intermediate bedrock hydrogeologic unit, allowing groundwater to drain downward into the deep bedrock hydrogeologic unit.

The intermediate bedrock hydrogeologic unit consists of the Manlius Formation, which is typically divided for monitoring purposes into the upper Manlius Formation, which is limestone and referred to as the I1 interval, and the lower Manlius Formations, which is dolostone and referred to as the I2 interval. The nominal thickness of the Manlius Formation at the Site is 36 feet. Groundwater flow in the intermediate bedrock hydrogeologic unit is transitional between the shallow and deep bedrock hydrogeologic units, appears to be largely downward with a flow component in the same horizontal direction as in the deep bedrock, which, at the former Powerex facility and Area 1 of the Site, is generally to the south-southwest.

The Edgecliff Member of the Onondaga Formation, the Manlius Formation (particularly the middle zone, between the I1 and I2 monitoring intervals) and the upper few feet of the Rondout Formation function as a leaky aquitard, separating the shallow and deep hydrogeologic units. However, based on hydraulic information, the leaky aquitard is breached by fractures, faults and/or karst features (*e.g.*, sinkholes, swallets) that appear to connect the shallow and deep bedrock hydrogeologic units in some locations.

The deep bedrock hydrogeologic unit consists of the Rondout, Cobleskill and Bertie Formations, with a combined nominal thickness of about 200 feet. The Rondout Formation is a dolostone and wells in this unit are referred to as D1wells, but do not target the uppermost few feet, which are argillaceous and of lower vertical conductivity. The Cobleskill Formation is a limestone, and wells open to this formation are referred to as D2 wells. The Bertie Formation is dolomitic and divided into three members, in descending order, the Oxbow, Forge Hollow and Fiddlers Green Members. The top of the Forge Hollow Member is gypsiferous, solutioned, highly transmissive, and is targeted for monitoring as the D3 interval. This interval is pitted and occasionally voidal from gypsum dissolution. The hydraulic properties of the gypsum-rich interval are significantly different than the other bedrock strata (*e.g.*, the mean horizontal hydraulic conductivities of the D3 monitoring wells are typically two orders of magnitude higher than the other bedrock units).

The Camillus Formation is a thick shaley unit that occurs below the Bertie Formation and forms the base of the deep bedrock hydrogeologic unit investigated at the Site. At locations where more deep bedrock intervals are monitored than the D1, D2 and D3, the deeper wells target the D4 interval (the lower Forge Hollow Member of the Bertie Formation), the D5 interval (the lower Fiddlers Green Member of the Bertie Formation, including the upper few feet of the Camillus Formation), and D6 interval (the upper Camillus Formation).

Conceptual Site Model

Groundwater migration in the deep bedrock hydrogeologic unit at the former Powerex facility and Area 1 of the Site is to the south-southwest. The deep bedrock receives recharge from overlying units through fractures, fault or karst features (*e.g.*, sinkholes, swallets) that appear to connect the shallow and deep bedrock hydrogeologic units in some locations. As a result of the connection with swallets, water levels in the deep bedrock unit can rise dramatically in response to precipitation and snow melt events, often exceeding 10 feet in response to an individual precipitation event, and occasionally as much as 20 feet.

Groundwater at the former Powerex facility is impacted by VOCs from past waste handling practices, and extends from the overburden and shallow bedrock hydrogeologic units, through the intermediate bedrock hydrogeologic unit and, and into the deep bedrock hydrogeologic unit. Groundwater flow in the deep bedrock is to the south-southwest. From Pinckney Road, which is approximately one-mile south of West Genesee Street, groundwater flow in the deep bedrock hydrogeologic unit is to the southwest, toward the Village of Union Springs located along the eastern shore of Cayuga Lake approximately 5½ miles away.

The RI data show that groundwater contamination occurs primarily in the deep bedrock hydrogeologic unit, most notably in the gypsiferous upper portion of the Forge Hollow Member of the Bertie Formation, which has a greater ability to transmit water (CDM Smith, 2012a). Results for the well clusters located along the southern boundary of the former Powerex facility demonstrate that the overburden, shallow bedrock (S unit) and intermediate bedrock (I1 and I2 units) are not impacted; in addition, little or no VOCs are detected in the D1 and

D2 units of the deep bedrock. However, the results from the D3 wells (which are about 150 feet deep at the former Powerex facility), show elevated concentrations of VOCs, primarily TCE, its degradation products (cDCE and VC) and several other constituents (including acetone and methanol, the presence of which is documented to stimulate biotic degradation).

As groundwater flows downgradient in the D3 unit, contaminant concentrations decrease. The changes in the concentrations and relative proportions of TCE, cDCE, tDCE, and VC are shown in **Figures 4a, 4b, 4c, and 4d**, respectively.[5] The concentrations of VOCs decline dramatically south of West Genesee Street, and the relative proportion of the VOCs also changes due to degradation. In the monitoring wells on "Line 0" along the southern boundary of the former Powerex facility, the maximum concentrations of TCE, cDCE, tDCE, and VC from November 2014 through June 2016 were 490,000, 88,000, 1,400, and 2,900 µg/L, respectively. The maximum concentration of TCE, cDCE, tDCE, and VC in Area 1 monitoring wells located downgradient from the former Powerex facility during this same period were 10,000, 150,000, 2,900, and 4,300 µg/L, respectively, indicating that the reductive dechlorination of TCE and production of daughter products is significant throughout this area. By the southern edge of Area 1, the maximum TCE, cDCE, tDCE, and VC concentrations had further declined to 57, 36,000, 440 J, and 930 µg/L, respectively. The simultaneous decline in cDCE, tDCE and VC suggests that other degradation pathways besides reductive dechlorination may also be operable in this area.

TCE concentrations are uniformly low throughout Area 2, with a maximum concentration of 5.8 J ug/L observed during the November 2014 through June 2016 period (**Figure 4a**). cDCE concentrations are generally higher than TCE, with a maximum concentration of 1,200 µg/L (**Figure 4b**). Concentrations of tDCE and VC are generally lower than cDCE, with maximum concentrations of 21 and 48 µg/L, respectively (**Figures 4c and 4d**). The maximum concentration of VC was 56 µg/L, and occurred in well EPA-24D3, located at near the boundary of Areas 2 and 3.

1.3.4 Groundwater Use and Public Water Supplies

The City of Auburn obtains its potable water from Owasco Lake (which is unaffected by the Site) and its public water supply system serves approximately 27,000 customers within the City of Auburn through 8,800 service connections. Through water supply agreements, the City also supplies potable water to the Towns of Sennett, Fleming, Throop, Brutus, Montezuma, Springport, and Aurelius, the Villages of Port Byron and Weedsport, the Cayuga County Water and Sewer Authority, and the New York State Thruway Authority. Overall, the City of Auburn's public water supply system serves approximately 45,000 people in Cayuga County with their drinking water.

Although the City of Auburn supplies potable water to many water districts within Cayuga County, there are several water districts that obtain water from other sources, including portions of the Towns of Aurelius and Fleming, and the Village of Union Springs. The Town of Aurelius obtains potable water from both Owasco Lake (via the City of Auburn) and Cayuga Lake (via the Village of Cayuga). The Town of Fleming obtains potable water from Owasco Lake via the Town of Owasco. The Village of Union Springs obtains its water from two drilled bedrock wells located on Route 90 across from the Union Springs High School. Groundwater from these two wells contains VOCs (specifically, cDCE, and TCE), and is treated via air stripping prior to distribution.

The majority of the property owners at the Site currently obtain potable water from the public water supply system. There are three dairy farms that still use groundwater; in each case the house is connected to the public water lines and groundwater from the supply well(s) is treated prior to use for agricultural purposes. Maintenance and monitoring of these three POET systems is currently being performed by GE under the Administrative Order issued by USEPA.[6]

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[5] These figures are from the Enhanced Degradation Pilot Test Work Plan (PTWP) approved by USEPA under the Settlement Agreement.

[6] This work was previously performed by GE under a Removal Order with USEPA, but was transitioned to the Administrative Order, which became effective on September 29, 2015.

2. SUMMARY OF INVESTIGATION STUDY WORK PLAN IMPLEMENTATION ACTIVITIES

2.1 SURFACE WATER EVALUATION

2.1.1 Access

As summarized in an October 30, 2014 letter to USEPA, OBG attempted to obtain access on behalf of GE to ten properties in the Village of Union Springs prior to the surface water reconnaissance. OBG obtained access to seven of the ten properties prior to the surface water reconnaissance. Alternate access routes through public property were later identified for two surface water locations (US-12 and US-13). Multiple attempts were made to obtain access to USEPA surface water locations US-03 and US-04, but access was denied by the property owner (LPW Development, LLC).

2.1.2 Surface Water Field Reconnaissance

Field reconnaissance was completed by OBG on October 2 and 3, 2014 to verify the location and accessibility of surface water sample locations in the ISWP and to identify additional potential surface water sample locations within the Village. The results of the surface water reconnaissance were summarized in a letter to USEPA dated October 30, 2014 (provided in **Appendix A**).

2.1.3 Baseline Surface Water Sampling

Following the surface water reconnaissance, the baseline surface water sample locations shown in **Figure 2** were selected with approval from USEPA. The baseline surface water sampling was completed by OBG on December 2 and 3, 2014 with oversight by CDM-Smith. In addition to the 18 stream and five lake samples, one groundwater sample (GW-18) was collected from an artesian well located downstream from US-01 and immediately west of State Route 90.

Water quality parameters including temperature, pH, conductivity, and turbidity were measured at each sampling location using a Horiba U-52 water quality meter and recorded on a sampling log (see **Appendix B**). Spatial coordinates for each of the surface water sampling locations were collected using a Trimble 6000 Series GeoXH handheld global positioning system (GPS).

Each surface water sample was collected in appropriate laboratory-supplied bottleware in accordance with Standard Operating Procedure (SOP) 008 in the *Quality Assurance Project Plan* (QAPP) (OBG, 2014c) approved by USEPA. After collection, each sample was placed on ice in a dedicated cooler. Samples, including the necessary quality assurance/quality control (QA/QC) samples, were shipped under chain-of-custody procedures by FedEx to TriMatrix Laboratories, Inc (TriMatrix) in accordance with SOP 001 for analysis by USEPA Method 8260C. Following receipt of the baseline surface water sampling results from the laboratory, data validation was completed by OBG in accordance with Appendix C of the QAPP. The analytical laboratory report and data validation memorandum is provided in **Appendix F**.

2.1.4 Cayuga Lake Low Level Reconnaissance and Sampling

Cayuga Lake low level sampling was included in the approved ISWP on the basis of verbal accounts purporting the presence of lakebed springs and seeps that are exposed during periods of low lake level. Stage data for USGS station 04233500 were reviewed prior to scheduling field reconnaissance activities. A hydrograph of Cayuga Lake levels [in feet above the National Geodic Vertical Datum of 1929 [NGVD29]) from January 1, 2009 through December 31, 2014 was prepared to evaluate when the lowest Cayuga Lake stage might occur during the winter of 2015; this hydrograph is provided on **Figure 5**.

As depicted in the hydrograph, Cayuga Lake stages below 380 feet above NGVD29 were regularly observed in the first quarter of each calendar year (January through mid-March). In addition to reviewing the available data from USGS, low lake conditions and the location of potential springs/seeps were discussed with local residents during the surface water field reconnaissance.

Low Level Reconnaissance

The Cayuga Lake low level reconnaissance was conducted on January 13, 2015. Personnel walked the Cayuga Lake shore and exposed lakebed from approximately 1,000 feet south of Frontenac Harbor to the northwestern point of Springport Cove. The reported lake elevation was 379.8 feet above NGVD29, and portions of the lakebed were exposed to the elements and partially covered by snow and ice. Observations of water discharging from and across the lakebed were located using a Trimble 6000 Series GeoXH handheld GPS and photographed. Water quality parameters (temperature and conductivity) were collected from the discharging water using a Hanna HI 991301 water quality meter and recorded on the field form (see **Appendix B**).

During the reconnaissance, focused discharge to the lake was observed at three lakebed seeps and one bank seep as depicted on **Figure 2**. The field team also observed four drain pipes and two areas of diffuse seepage that were also discharging to the lake near Frontenac Park and Frontenac Marina. Observation from the low level reconnaissance are provided in **Appendix B**.

Sampling Methodology

The Cayuga Lake low level sampling was conducted on January 15, 2018. Samples were collected from four lake seeps (SP-01 through SP-04) and one stream that was observed to be discharging to Springport Cove (US-21). A 2-foot, 10-slot, 1-inch diameter polyvinyl chloride screen was driven into seeps SP-01 through SP-03 to facilitate the sample collection at these locations.

Each surface water sample was collected in appropriate laboratory-supplied bottleware in a manner consistent with SOP 008 in the approved QAPP. Water quality parameters including temperature, pH, and conductivity were measured at each sampling location using a YSI 63 water quality meter and recorded on a sampling log (see **Appendix B**). After collection, each sample was placed on ice in a dedicated cooler. Samples were shipped under chain-of-custody procedures by FedEx to TriMatrix Laboratories, Inc (TriMatrix) in accordance with SOP 001 for analysis by USEPA Method 8260C. Following the receipt of the Cayuga Lake low level sampling results from the laboratory, data validation was completed by OBG in accordance with Appendix C of the QAPP. The analytical laboratory report and data validation memorandum is provided in **Appendix F**.

2.1.5 Semi-Annual Surface Water Sampling

In accordance with the approved ISWP, three surface water samples were collected in conjunction with the semi-annual groundwater sampling events in November 2016, May 2017, and November 2017. During each sampling event, water quality parameters and surface water samples were collected from locations US-05, US-06, and US-08. As depicted in **Figure 2**, sample locations US-05 and US-06 are located within and at the outlet of Howland Pond, respectively. Sample location US-08 is located at the outlet of Mill Pond.

Consistent with the baseline sampling, water quality parameters including temperature, pH, conductivity, and turbidity were measured at each surface water sampling location and recorded on a sampling log (see **Appendix B**). Each surface water sample was collected in appropriate laboratory-supplied bottleware in accordance with SOP 008 of the approved QAPP. After collection, each sample was placed on ice in a dedicated cooler. Samples, including necessary QA/QC samples, were shipped under chain-of-custody procedures by FedEx to Pace Analytical Services, Inc (Pace, formerly TriMatrix) in Grand Rapids, Michigan in accordance with SOP 001 for analysis by USEPA Method 8260C. Following the receipt of the laboratory results from each sampling event, data validation was completed by OBG in accordance with Appendix C to the QAPP. The analytical laboratory report and data validation memorandum is provided in **Appendix F**.

2.2 GROUNDWATER EVALUATION

The groundwater evaluation for Area 3, under the approved ISWP included (a) conversion of some unused residential wells into long-term monitoring wells, after an evaluation and approval by USEPA, (b) semi-annual groundwater monitoring (three sampling events to date) for VOC analysis, (c) measurement of field parameters and laboratory analysis of MNA parameters for initial/baseline and third/annual sampling event, and (d) analysis of samples from select locations for carbon isotopes and microbiological targets. For comparison purposes, the latter included some monitoring wells at the former Powerex facility and/or in Area 1 of the Site.

2.2.1 Use of Residential Wells as Long-Term Monitoring Wells

In accordance with the ISWP, access was requested to evaluate ten unused residential wells in Area 3.[7] Access agreements were executed between GE and three residential well owners. The evaluation included a well location and condition survey, borehole video logging, borehole geophysical logging, and packer testing was summarized in the *Residential Well Evaluation Report* that was submitted to USEPA on March 15, 2016 and subsequently revised to address comments from USEPA. The revised report is included in **Appendix C**.

Following acceptance of the *Residential Well Evaluation Report*, two Area 3 residential wells (located in geographic zones M and O, as shown in **Figure 2**) were modified, developed and surveyed for long-term use as groundwater monitoring wells (RESWELL-5 and RESWELL-7). Due to a property foreclosure, the modification of the residential well in geographic zone P was delayed. Following the sale of the property, GE executed an access agreement with the new owner and the well was modified, developed and surveyed for use as a long-term monitoring well (RESWELL-6). The well construction for RESWELL-5, RESWELL-6, and RESWELL-7 is summarized in **Table 1;** the well completion and development logs for these three wells are provided in **Appendix D**.

2.2.2 Semi-Annual Groundwater Monitoring Program

In accordance with the ISWP, semi-annual groundwater monitoring events were completed in Fall 2016 (October 31, 2016), Spring 2017 (April 27 and May 1, 2017), and Fall 2017 (October 31, 2017). The scope of these events is summarized in **Table 2**. VOCs were analyzed during each sampling event to characterize groundwater contamination and provide data for trend analysis. Additionally, field parameters were measured and samples were analyzed for MNA parameters during the Fall 2016 and Fall 2017 events to provide information on geochemical conditions (which can impact natural attenuation processes).

Low-flow and PDB samples were collected in accordance with SOP 006 and SOP 005, respectively. Each sample was collected in appropriate laboratory-supplied bottleware. Water quality parameters measured during low-flow sampling included conductivity, DO, ORP, pH, temperature, and turbidity); these were recorded during purging on sampling logs (see **Appendix E**). The field sampling log for the PDB sampling event is also provided in **Appendix E**. After collection, each groundwater sample along with the necessary QA/QC samples was placed on ice in a dedicated cooler and shipped under chain-of-custody procedures by FedEx to Pace in accordance with SOP 001 of the approved QAPP.

Following the receipt of the laboratory data for each semi-annual sampling event, data validation was completed by OBG for the VOC analyses in accordance with Appendix C of the QAPP. The analytical laboratory report and data validation memorandum is provided in **Appendix F**.

2.2.3 Compound-Specific Stable Isotope and Microbiological Sampling

Compound-Specific Isotope Sampling

Samples were collected for CSIA from the influent of the POET system at two dairy farms (Property 2 and Property 3) and the southern Village of Union Springs water supply well on November 2, 2016. These three sampling locations are shown on **Figure 2**. Each CSIA sample was collected using tap sampling methods presented in SOP 010 of the approved QAPP. Prior to sampling, water quality measurements (including conductivity, pH, and temperature) were collected during the tap sampling process and recorded on field sampling logs (see **Appendix E**).

Upon collection, each sample was labelled and placed on ice in a dedicated cooler. The Property 2 and Property 3 CSIA samples were collected in conjunction with the VOC sampling performed by ARCADIS U.S., Inc. (ARCADIS) under the Removal Order. Additionally, a VOC sample (for analysis by USEPA Method 8260C) was also collected by OBG in conjunction with the CSIA sample from the Village's south well. To support the CSIA, the results of the

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[7] A similar evaluation was performed for unused residential wells in Area 2. That evaluation was performed pursuant to RDWP1, and is not summarized in this Data Summary Report for Area 3.

VOC analyses were provided to Pace Analytical Energy Services, LLC (PAES), the laboratory contracted to perform the CSIA.

All CSIA samples were shipped under chain-of-custody procedures by FedEx in accordance with SOP 001. The CSIA samples were submitted to PAES (formerly Microseeps) for analysis of the carbon isotopes (^{13}C, ^{12}C) associated with TCE, cDCE, and vinyl chloride by Method AM-24. The VOC sample from the Village's southern well was submitted with a trip blank to Pace for analysis of VOCs by USEPA Method 8260C.

Microbiological Sampling

Groundwater samples were collected for analysis by Microbial Insights, Inc. (Microbial Insights) for the QuantArray-Chlor® suite of microbiological targets using a quantitative polymerase chain reaction (qPCR) methodology. The QuantArray-Chlor® suite includes quantification of microbes capable of, and enzymes associated with, the reductive dechlorination and aerobic metabolic/cometabolic processes that can degrade chlorinated VOCs (such as TCE, cDCE, and VC). Microbiological samples were collected from monitoring well B-33D3 (located along the southern boundary of the former Powerex facility), monitoring wells B-44D3 and B-58D3 (both located in Area 1 of the Site), the influent to POET systems at the three dairy farms in Area 3 (Property 1, Property 2, and Property 3), and the discharge from the Village's south supply well. These sampling locations are shown on **Figure 2**. The POET system at Property 1 treats several supply wells; the microbiological sample from Property 1 was collected from the Main Well.

The microbiological samples from B-33D3, B-44D3, and B-58D3 were collected using low-flow sampling methods consistent with SOP 006 of the approved QAPP, while the samples collected from the POET systems and the Village's south supply well were collected using tap sampling methods consistent with SOP 010. Water quality measurements collected during the low-flow and tap sampling were recorded on their respective logs (see **Appendix E**).

Each microbiological sample was collected in the appropriate, laboratory-provided bottleware, labelled and placed on ice in a dedicated cooler. Consistent with SOP 001, each sample was shipped by FedEx under chain-of-custody procedures to Microbial Insights.

3. ANALYTICAL DATA SUMMARY

3.1 SURFACE WATER

3.1.1 Baseline Sampling Event

The validated baseline surface water sampling results are provided in **Table 3**, with comparison to the relevant standards, criteria, or guidance values from NYSDEC's Technical and Operational Guidance Series (TOGS) 1.1.1. The surface water samples were collected from three different classes of surface water bodies (Class AA, Class A, and Class C), as mapped by NYSDEC's Division of Water. No VC was detected in any of the surface water samples. The other three Site-related constituents (TCE, cDCE, and tDCE) were detected in the surface water samples collected from several locations (*i.e.*, US-02, US-05, US-06, US-07, US-08, US-09, US-10, US-11, US-15, US-16, US-18, US-19, and US-21), but all detections were below the relevant standards, criteria, or guidance values. The detections at locations US-02, US-05, US-06, US-07, US-08, US-09, and US-11 are most likely related to the discharge of groundwater from known and/or suspected springs in Howland and Mill Ponds. However, the detections of TCE, cDCE and/or tDCE at locations US-18 and US-19 were considerably higher than the detections at upstream location US-10, and are probably the result of discharge from an artesian well (designated GW-18) that was observed next to the stream channel immediately upstream from locations US-18 and US-19.

In addition to detected Site-related constituents, concentrations of bromodichloromethane, bromoform, chloroform, and dibromochloromethane were detected in one or more surface water samples. These four compounds are all trihalomethanes, which are often associated with chlorinated drinking water. While minor concentrations of chloroform were detected at several locations (*i.e.*, US-02, US-06, US-09, US-11, US-15, and US-16), bromodichloromethane, bromoform, and dibromochloromethane were only detected at locations US-15, US-16, and US-21. Locations US-15 and US-16 were downstream of a pipe discharging into the stream channel, while location US-21 was downstream from a lakeside residence, which is located downstream of location US-20 at which no bromodichloromethane, bromoform, and dibromochloromethane were detected.

3.1.2 Cayuga Lake Low Level Sampling Event

The validated Cayuga Lake low level sampling results are provided in **Table 4**. cDCE was the only VOC detected in the samples, and was detected at an estimated concentration of 0.27 µg/L the surface water sample from location SP-02. No other VOCs were detected in the low lake level samples.

3.1.3 Semi-Annual Surface Water Monitoring Events

The validated semi-annual surface water sampling results for locations US-05, US-06, and US-08 are provided in **Table 3,** with comparison to the relevant standards, criteria, or guidance values from TOGS 1.1.1. The semi-annual sampling results are also shown spatially on **Figure 6**. No VC was detected in any of the semi-annual surface water samples. Trans-1,2-DCE was only detected at location US-5, and only during the first semi-annual monitoring event. Concentrations of the other two Site-related constituents (TCE and cDCE) were consistently detected at US-05, US-06, and US-08. Although the number of sampling events is presently limited, trend graphs of the results for the Site-related VOCs at locations US-05, US-06, US-08 are provided on **Figures 7a, 7b, and 7c**, respectively.

3.2 GROUNDWATER

As discussed in **Section 2.2**, groundwater samples were collected for analysis of VOCs on a semi-annual basis (*i.e.*, Fall 2016, Spring 2017 and Fall 2017). In addition, during the first and third events, the sampling was performed using low-flow methods with field measurements (including pH, DO and ORP) and laboratory analysis of MNA parameters to obtain the data needed to assess the geochemical conditions in Area 3 groundwater. During the first event, samples were also collected for analysis of carbon isotopes and microbiological targets. The results of the field measurements and laboratory analyses are discussed in the following sections.

3.2.1 VOCs

Data from RESWELL-5, RESWELL-6 and RESWELL-7

During the three semi-annual monitoring events, TCE and cDCE were detected in Area 3 groundwater samples, as summarized in **Table 5** and **Figure 6**. The detections of TCE ranged from an estimated 0.26 μg/L to an estimated 0.87 μg/L, with all of the detected concentrations well below the federal and state DWSs. The detections of cDCE ranged from 1.3 μg/L to 6.9 μg/L, with the highest concentration from RESWELL-7. Although the cDCE concentrations did not exceed the federal MCL, they did exceed NYSDEC's Class GA groundwater standard and the state DWS in samples collected from RESWELL-6 and RESWELL-7.

Trend graphs depicting the concentrations of TCE and cDCE through time at RESWELL-5, RESWELL-6, and RESWELL-7 are provided in **Figures 8a, 8b, and 8c**, respectively. No trends are apparent, which is as expected given that results are only available for three semi-annual sampling events since being converted into monitoring wells.

Data from Influents to POET Systems at Dairy Farms

The influent to POET system at each of the three dairy farms is currently sampled on a quarterly basis for VOC analysis pursuant to the Administrative Order. The systems at Properties 2 and 3 each treat groundwater from a single production wells, and cDCE is the dominant VOC at these properties. The POET system at Property 1 treats groundwater from multiple production wells, the operation of which varies through time. Property 1 is located in a northeast-southwest trending zone where VC is the dominant VOC.

Site-related constituent concentrations from the influent of the POET system at Property 1 were dominated by VC until May 2015, when a new supply well located farther north than the other supply wells was installed and put into service. Site-related constituent detections from the new well are dominated by cDCE, resulting in a shift in the influent concentrations, as shown in **Figure 9a**.

The Site-related constituent concentrations in the influent to the POET systems at Properties 2 and 3 are shown in **Figures 9b and 9c**. The concentrations of TCE are trending downward through time at both properties, while the concentration of cDCE is also trending downward at Property 3. **Figure 9d** shows the ratio of cDCE to TCE in the influent to the POET systems at Properties 2 and 3 over the same period. The trend in the cDCE:TCE ratio at both properties is upward, suggesting that (a) the source of the contamination is degrading over time and/or (b) that the degradation of TCE to cDCE downgradient from the source is increasing through time.

Data from Village of Union Springs' Supply Wells

The Village of Union Springs has collected samples from its two supply wells on a quarterly basis for VOC analysis for almost 30 years. cDCE is the dominant VOC detected in the supply wells. The maximum concentration of cDCE detected in either well has been 17 μg/L, which is less than the federal MCL of 70 μg/L but higher than the state DWS of 5 μg/L. The concentration of cDCE in the supply wells is typically between 5 and 10 μg/L. TCE is also often reported in the two supply wells, but at much lower concentrations. The maximum concentration of TCE detected in either well has been 4 μg/L, which is less than the federal and state DWS of 5 μg/L; TCE is typically detected in the supply wells at less than 1 μg/L. Despite the analysis of quarterly samples for almost 30 years, no tDCE or VC have ever been detected in the two supply wells.

Figure 10a shows the concentrations of cDCE and TCE in the Village of Union Springs' two supply wells. The concentrations of both VOCs are relatively stable over time, but there is a slight downward trend for TCE. This is reinforced in **Figure 10b**, which shows an upward trend in the ratio of cDCE to TCE over the same period. The trend in the ratio data suggests that (a) the source of the contamination is degrading over time and/or (b) that the degradation of TCE to cDCE downgradient from the source is increasing through time.

3.2.2 Geochemistry

As indicated in **Section 2.2.2**, groundwater samples were collected via low-flow sampling methods from RESWELL-5, RESWELL-6, and RESWELL-7 during the Fall 2016 and Fall 2017 sampling events, with measurement of field parameters during purging and laboratory analysis for MNA parameters. The stabilized values for pH, DO and ORP and the laboratory results for the MNA parameters are summarized in **Table 5**.

The water quality parameters provided in **Table 5** show that the Area 3 groundwater is generally aerobic and oxidizing, which is quite different from the conditions in the deep bedrock at the former Powerex facility and in Area 1 of the Site. The DO readings in the RESWELLs ranged from 1.87 to 5.10 mg/L and the ORP readings ranged from 54.8 to 125.3 mV. This is consistent with the lack of VC in RESWELL-5, RESWELL-6, and RESWELL-7 (and the lack of VC in the POET system influent at Properties 2 and 3 and in the Village of Union Springs' supply wells), as VC is degraded rapidly under these conditions.

As expected given the nature of the bedrock, the pH values for the Area 3 groundwater were near neutral. The pH ranged from 6.88 to 7.28 SU in RESWELL-5, RESWELL-6, and RESWELL-7. These near-neutral pH readings are within the range deemed favorable for microbial activity.

Based on the results shown in **Table 5** for the major cations and anions, the groundwater in Area 3 is consistent with a calcium-magnesium bicarbonate groundwater type, which is as expected based on the nature of the bedrock. Nitrate was detected in all of the RESWELL samples, at concentrations ranging from 2.9 to 6.4 mg/L, and the dissolved iron measurements were low. Sulfate was also detected in all samples at concentrations ranging from 35.1 to 110 mg/L. Nitrite and sulfide were not detected in most of the RESWELL samples; nitrite and sulfide were reported at low concentrations in the few samples with detections (nitrate ranging from 0.047 to 0.054 mg/L, and sulfide ranging from an estimated 0.0079 mg/L to an estimated 0.014 mg/L). Collectively, these results support the geochemical conditions based on the field measurements.

3.2.3 Dissolved Hydrocarbon Gases

Samples collected from RESWELL-5, RESWELL-6, and RESWELL-7 in Fall 2016 and Fall 2017 were analyzed for DHGs. No ethene or ethane were detected in any of the RESWELL samples, which is consistent with the DO readings, as these gases are easily degraded and very labile. Methane was either not detected in some of the RESWELL samples or was detected at low concentrations, ranging from an estimated 0.33 µg/L to 1.6 µg/L. Once again, this is consistent with generally oxidizing conditions in the groundwater.

3.3 EVALUATION OF DEGRADATION PROCESSES

3.3.1 Compound-Specific Stable Isotope Analysis

During the first semi-annual sampling event, groundwater and surface water samples were collected at four Area 3 locations for compound-specific isotope analysis (CSIA) of the TCE, cDCE, and VC carbon isotopes (*e.g.*, ^{12}C and ^{13}C). These isotopes were analyzed to assess the impact of biotic and/or abiotic degradation processes on the Site-related VOCs. The CSIA samples were collected from: the influent to the POET systems located at two of the dairy farms (*i.e.*, Properties 2 and 3); the Village of Union Springs' southern supply well; and, at surface water sampling location US-05. The results of the CSIA analyses are shown in **Table 6**.[8] For comparison purposes, the CSIA results for deep groundwater samples collected from four Line 0 monitoring wells at the former Powerex facility are also provided in **Table 6**. These data are also presented graphically on **Figures 11a, 11b, and 11c**.

The delta ^{13}C data indicate that there is variability in the amount of degradation observed in the monitoring wells along Line 0, with the amount of degradation increasing from west to east (*e.g.*, from B-31D3 to B-33D3). An increase in degradation is indicated by the CSIA signature of any compound becoming more positive (less negative), which reflects the fact that it contains more of the heavier ^{13}C isotope due to the fractionation that occurs during biotic and abiotic degradation.

Based on the literature, delta ^{13}C values for virgin TCE range from -34 to -23 per mill (‰, parts per thousand), with values typically in the -32 to -28 ‰ range (Hunkeler *et al.*, 2008). As shown in **Table 6** and **Figure 11a**, the

[8] Note that for some samples an insufficient concentration was present to perform the CSIA. This was particularly true for VC.

average delta ^{13}C values for TCE in the Line 0 samples from the former Powerex facility is -17.2 ‰, reflecting significant degradation from the parent material.

The average delta ^{13}C values for TCE in the influent samples from the two POET systems in Area 3 is approximately -13.3 ‰, which is considerably less negative than observed from Line 0 samples and indicates that additional degradation of TCE has occurred downgradient of the former Powerex facility. The delta ^{13}C value for TCE in the surface water sample from location US-05 was approximately -14.3 ‰, which is not significantly different from the delta ^{13}C values for TCE in the POET system influent samples.[9] While these data do not show that the TCE is being degraded further after Properties 2 and 3, it is worth noting that the concentration of TCE at and downgradient from these two dairy farms is quite low, and the reduction of TCE concentrations downgradient from Properties 2 and 3 may be occurring by other natural attenuation mechanisms that do not cause isotopic fractionation.

When TCE is degraded to cDCE, the delta ^{13}C for the cDCE that is produced is more negative than the original TCE. This also occurs when cDCE degrades to VC, and when VC degrades to ethene. However, once formed the delta ^{13}C for these compounds also become progressively less negative over time as they undergo degradation. Thus, the evaluation of delta ^{13}C values can be more complicated for daughter products, as they are both produced from degradation and further degraded into other compounds.

In the deep bedrock wells along Line 0 at the former Powerex facility, the average delta ^{13}C value for cDCE is approximately -26.3 ‰ (**Figure 11b**), which is significantly more negative than the average delta ^{13}C value for TCE (-17.2 ‰). Further, the average delta ^{13}C value for VC is approximately -29.3 ‰ (**Figure 11c**), which is slightly more negative than the average delta ^{13}C value for cDCE (-26.3). These results suggest that more cDCE and VC are being produced by degradation than are being degraded at and upgradient from Line 0.

For the POET system influent samples (northeast end of Area 3), the average delta ^{13}C value for cDCE is approximately -18.8 ‰, which is significantly less negative that the average delta ^{13}C value for cDCE along Line 0 (-26.3 ‰). Furthermore, the average delta ^{13}C value for cDCE for the samples from the Village of Union Springs is -16.0 ‰ (**Figure 11b**), which is significantly less negative that the average delta ^{13}C value for cDCE in the two POET system influent samples (-18.8 ‰). These CSIA data suggest that additional degradation of cDCE occurs between the former Powerex facility and Properties 2 and 3, and between Properties 2 and 3 and the Village of Union Springs. The degradation of cDCE occurs under a variety of redox conditions, including via cometabolic and direct aerobic pathways. The latter pathways are not dependent on the presence of electron donors or more deeply reducing conditions that are required for reductive dechlorination.

The delta ^{13}C values for VC in the POET system influent sample from Property 2 is -30.0 ‰ (**Figure 11c**), which is not significantly different than the average delta ^{13}C value for VC in the Line 0 monitoring wells (-29.3 ‰).[10] VC was not detected in the samples from the Village or Union Springs' southern well and surface water location US-05, so no determination of the delta ^{13}C values for VC could be performed. The sparsity of data (due to insufficient concentrations of VC for analysis) makes it difficult to draw any conclusions from the delta ^{13}C values for VC.

3.3.2 Microbiological Analyses

Microbiological analyses were performed for the QuantArray-Chlor® suite of targets to evaluate the presence of microbes responsible for, and enzymes associated with reductive dechlorination and aerobic metabolic/cometabolic degradation processes in Area 3 groundwater. The QuantArray-Chlor® analyses were performed by Microbial Insights. Groundwater samples for microbiological analysis were collected from the POET system at each of the three dairy farms (at Properties 1, 2 and 3) and Village of Union Springs'

[9] The concentration in the sample from the Village of Union Springs' southern supply well was too low to determine a delta ^{13}C value for TCE.

[10] The concentration in the POET system influent sample from Property 3 was too low to determine a delta ^{13}C value for VC.

southernmost supply well. These locations are in Area 3, as shown on **Figure 2**. The POET systems at Properties 2 and 3 each treat groundwater from a single supply wells, so the POET system influent was sampled for microbiological analysis. As noted previously, the POET system at Property 1 treats the groundwater from multiple supply wells which are operated on a variable basis; the sample for microbiological analysis was collected from the "Main" supply well, which is located at the south end of the primary milking barn and is dominated by VC.

In addition, for comparison, groundwater samples were collected from monitoring well B-33D3 (located along Line 0 at the former Powerex facility) and monitoring wells B-58D3 and B-44D3 (located in Area 1 of the Site). Wells B-33D3 and B-58D3 are both located in an area where reductive dechlorination of TCE and its daughter products is known to be occurring. Well B-44D3 is constructed similarly but is located to the west of the area of VOC impacts; this well was selected to represent background conditions.

The results for the QuantArray-Chlor® target are presented in **Table 7** and shown graphically in **Figures 12a, 12b, and 12c**. The biological markers shown represent either counts of specific bacteria, counts of specific functional enzymes, or in some cases counts of larger bacterial groups (*i.e.*, total eubacteria [which is a surrogate for total bacteria], sulfate reducing bacteria, and methanogens). **Figure 12a** shows the results for the anaerobic bacteria that participate in reductive dechlorination. Enumeration of *Dehalococcoides* (DHC) is of particular interest, because these bacteria are capable of reducing TCE, through cDCE and VC to ethene. **Figure 12b** shows the results for enzymes that are associated with the reduction of chlorinated VOCs, three of which are associated with the dechlorination of TCE and its daughter products (*i.e.*, tceA reductase [TCE], vinyl chloride reductase [VCR], and bav1 vinyl chloride reductase [BVC]). **Figure 12c** shows the results for the enzymes associated with metabolic and cometabolic degradation, including the cometabolic degradation of TCE, cDCE, and VC under microaerophilic or aerobic geochemical conditions. The counts in **Table 7** are color-coded to facilitate review; pale red shading represents counts greater than or equal to $1.0x10^2$ cells or cell equivalents per milliliter (cells/mL), yellow represents counts greater than or equal to $1.0x10^0$ cells/mL and less than $1.0x10^2$ cells/mL, while unshaded cells represent counts less than $1.0x10^0$ cell/mL and non-detects.

As expected, the QuantArray-Chlor® analyses for wells B-33D3 and B-58D3 along Line 0 at the former Powerex facility show high concentrations of bacteria and enzymes responsible for reductive dechlorination, including high levels of DHC, BVC, and VCR. The presence of DHC and the functional genes BVC and VCR indicates the bacterial population is capable of dechlorinating TCE all the way to ethene. Other bacteria known to be responsible for at least the partial reductive dechlorination of TCE are also present in high numbers, including *Dehalogenimonas* (DHG), *Desulfitobacterium* (DSB), and *Desulfuromonas* (DSM). DHG is the only bacteria besides DHC that is known to be able to degrade chlorinated compounds all the way to ethene (Manchester, *et al*., 2012).

There is also evidence of cometabolic functionality in the Area 1 wells, including the presence of high levels of soluble methane monooxygenase (SMMO), particulate methane monooxygenase (PMMO), ethene monooxygenase (etnC), and epoxyalkane transferase (etnE). The latter two enzymes have also been implicated in the direct oxidation of VC without the presence of co-substrates (Mattes, *et al.*, 2010). A previous bench-scale study commissioned by GE also demonstrated the presence of methanotrophs and ethanotrophs in Area 1 groundwater that are capable of using methane or ethene as growth substrates and biodegrading TCE, cDCE, and VC to carbon dioxide (CO_2) under aerobic conditions; this study was performed by Bioremediation Consultants, Inc. (BCI, 2012) and was previously provided to USEPA, but is included in **Appendix G** for completeness. Full aerobic conditions are not necessary for this activity, as even small amounts of oxygen can support these pathways.

Monitoring well B-44D3, the background well in Area 1, does not show the same high levels of DHC, BVC, and VCR as wells B-33D3 or B-58D3. This is consistent with the lack of chlorinated ethenes at this location, since DHC and its enzymes require the presence of chlorinated ethenes for growth. Other anaerobic bacteria involved in reductive dechlorination are present, but these bacteria are known to grow using a broader variety of electron acceptors. There is some indication of the potential for cometabolic activity in the B-44D3 groundwater, but the counts are lower than for the wells located inside the area of VOC impacts. This is also consistent with lower levels of methane, ethene, and chlorinated ethenes at and near well B-44D3.

The QuantArray-Chlor® results for the POET system samples from Area 3 exhibit lower levels of DHC and its associated enzymes than do results for the wells at/near the former Powerex facility. This may be due to lower concentrations of chlorinated ethenes in the Area 3 groundwater and/or the higher redox conditions in this area. With the exception of DSM, other anaerobic bacteria associated with reductive dechlorination are also lower in the POET system samples. Excluding the sample from the POET system at Property 3, the cometabolic capacity appears to also be lower in Area 3 than observed in Area 1. However, several of the important enzymes for cometabolic biodegradation are still present in Area 3 groundwater, including SMMO. This suggests cometabolic activity may still occur in Area 3, particularly for cDCE and VC.

The bacteria and enzymes associated with reduction dechlorination and cometabolic biodegradation of chlorinated ethenes are both low in the Village of Union Springs' southern supply well. This is likely due to the more oxidized state of the groundwater and the very low concentrations of TCE and cDCE that are present. Total eubacteria, sulfate reducing bacteria, and to a lesser extent methanogens are equally present throughout all of the sampled areas. This suggests the subsurface environment is generally supportive of bacterial growth, and that the variability in the microbiological results is primarily a function of the groundwater geochemistry (*e.g.*, redox conditions) and the concentration of chlorinated ethenes.

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Table 1
Residential Well Modification Summary
Cayuga County Groundwater Contamination Superfund Site

Location ID:	RESWELL-5		RESWELL-6		RESWELL-7	
Total Depth:						
	Depth/Interval ft btoc	*Length ft*	*Depth/Interval ft btoc*	*Length ft*	*Depth/Interval ft btoc*	*Length ft*
2-inch, Sch40, PVC, 0.030-Slot Well Screen	154.90 - 169.90	15.00	151.9 - 176.9	25	119.90 - 129.90	10.00
Shale Trap	N/A - N/A	N/A	N/A - N/A	N/A	118.40	N/A
2-inch PVC Riser	-0.84 - 154.90	155.74	0.6 - 151.9	151.3	0.10 - 119.90	119.8
No. 4 Filter Pack	152.00 - 169.90	17.90	151.90 - 176.90	25.00	N/A - N/A	N/A
No. 3 Filter Pack	N/A - N/A	N/A	148.90 - 151.90	3.00	N/A - N/A	N/A
Bentonite Seal[2]	139.00 - 152.00	13.00	138.00 - 148.90	10.90	108.50 - 118.40	9.90
Bentonite-Grout Seal	1.16 - 139.00	137.84	1.00 - 138.00	137.00	1.00 - 108.50	107.50

Notes:
ft - Feet.
btoc - Below top of casing.
N/A - Not applicable.
PVC - Polyvinyl chloride.

Table 2
Semi-Annual Groundwater Monitoring Summary
Cayuga County Groundwater Contamination Superfund Site

	Fall 2016[1]		Spring 2017			Fall 2017		
SAMPLE DATE	10/31/16	10/31/16	4/27/17	5/1/17	4/27/17	10/31/17	10/31/17	10/31/17
WELL ID	RESWELL-5	RESWELL-7	RESWELL-5	RESWELL-6	RESWELL-7	RESWELL-5	RESWELL-6	RESWELL-7
SAMPLING METHOD	Low-flow	Low-flow	PDB	Low-flow	PDB	Low-flow	Low-flow	Low-flow
Water Level	X	X	X	X	X	X	X	X
Water Quality Parameters[2]	X	X		X		X	X	X
VOCs	X	X	X	X	X	X	X	X
Dissolved Gases[3]	X	X		X		X	X	X
Dissolved Iron, Potassium, and Sodium	X	X		X		X	X	X
Chloride, Nitrate, Sulfate	X	X		X		X	X	X
Sulfide	X	X		X		X	X	X
Dissolved Organic Carbon	X	X		X		X	X	X

Notes:

[1] The RESWELL-6 modification could not be completed prior to the Fall 2016 semi-annual sampling event due to the foreclosure of the property. The RESWELL-6 modification and development was completed on April 27, 2017.

[2] Water quality parameters include conductivity, dissolved oxygen, oxidation reduction potential, pH, temperature, and turbidity.

[3] Dissolved gases quantified include methane, ethane, and ethene.

Table 3
Surface Water Quality Summary
Cayuga County Groundwater Contamination Superfund Site

Analyte	TOGS[1] Class AA	TOGS[1] Class A	TOGS[1] Class C	Units	US-01	US-02	US-05	US-05	US-05	US-05	US-05	US-05	US-05	US-06	US-06	US-06	US-06
Sample ID					US-01-120214	US-02-120214	US-05-120214	US-05-103116	103116-FD1	US-05-042717	IS-042717-FD2	US-05-103117	IS-103117-FD2	US-06-120214	US-06-103116	US-06-042717	US-06-103117
Sample Date					12/2/2014	12/2/2014	12/2/2014	10/31/2016	10/31/2016	4/27/2017	4/27/2017	10/31/2017	10/31/2017	12/2/2014	10/31/2016	4/27/2017	10/31/2017
Sample Type					N	N	N	N	FD	N	FD	N	FD	N	N	N	N
Surface Water Body Classifications					C	C	C	C	C	C	C	C	C	C	C	C	C
Detected Volatile Organic Compounds (VOCs)																	
Bromodichloromethane	50[2]	50[2]	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	50[2]	50[2]	NC	µg/L	1.0 U	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	1.0 U
Chloroform	7	7	NC	µg/L	1.0 U	0.18 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.20 J	1.0 U	1.0 U	0.31 J
Dibromochloromethane	50[2]	50[2]	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	5	5	NC	µg/L	1.0 U	4.5	15	13	14	7.6	8.1	11	11.1	6.2	7.3	4.1	4.2
trans-1,2-Dichloroethene	5	5	NC	µg/L	1.0 U	1.0 U	0.29 J	0.31 J	0.30 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	5	5	40	µg/L	1.0 U	0.40 J	1.2	1.2	1.2	0.9 J	0.89 J	1.1	1.1	0.55 J	0.66 J	0.42 J	0.43 J
Water Quality Parameters																	
Temperature				°C	5.09	6.68	10.00	9.40	9.40	9.80	9.80	9.90	9.90	6.78	8.40	15.50	9.50
pH				S.U.	7.29	7.57	7.42	6.95	6.95	6.96	6.96	7.16	7.16	7.37	7.31	7.38	7.67
Conductivity				µS/cm	1590	1180	1180	1273	1273	1211	1211	1474	1474	1160	1498	1207	1481
Turbidity				NTU	0.00	0.00	0.00	0.00	0.00	0.77	0.77	2.63	2.63	0.00	0.62	2.07	1.05

Notes:

- All results have been validated.
- Surface water body classifications were identified as mapped by the New York State Department of Environmental Conservation Division of Water.

[1] New York State Department of Environmental Conservation, Technical and Operational Guidance Series (1.1.1), Standards and Guidance Values, revised June 1998.

[2] Guidance value; a standard has not yet been adopted.

NC - No criteria, standard or guidance value.

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J - Estimated value between the laboratory detection limit and the laboratory reporting limit.

S.U. - Standard unit

NTU - Nephelometric Turbidity Unit

µg/L - Micrograms per liter.

µS/cm – Microsiemens per centimeter.

Table 3
Surface Water Quality Summary
Cayuga County Groundwater Contamination Superfund Site

				Location ID	US-07	US-08	US-08	US-08	US-08	US-09	US-10	US-11	US-12	US-13	US-14	US-15	US-16
				Sample ID	US-07-120214	US-08-120214	US-08-103116	US-08-042717	US-08-103117	US-09-120214	US-10-120214	US-11-120214	US-12-120214	US-13-120214	US-14-120214	US-15-120214	US-16-120214
				Sample Date	12/2/2014	12/2/2014	10/31/2016	4/27/2017	10/31/2017	12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/2/2014
				Sample Type	N	N	N	N	N	N	N	N	N	N	N	N	N
	Surface Water Body Classifications				AA	AA	AA	AA	AA	C	C	C	C	C	C	C	C
Analyte	**TOGS[1]**			**Units**													
	Class AA	*Class A*	*Class C*														
Detected Volatile Organic Compounds (VOCs)																	
Bromodichloromethane	50[2]	50[2]	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.38 J	0.48 J
Bromoform	50[2]	50[2]	NC	µg/L	1.0 UJ	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	0.48 J	0.69 J
Chloroform	7	7	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.18 J	1.0 U	0.14 J	1.0 U	1.0 U	1.0 U	0.58 J	0.58 J
Dibromochloromethane	50[2]	50[2]	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.54 J	0.74 J
cis-1,2-Dichloroethene	5	5	NC	µg/L	3.2	2.8	4.3	2.8	3.2	6.3	0.30 J	1.8	1.0 U	1.0 U	1.0 U	1.1	1.4
trans-1,2-Dichloroethene	5	5	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	5	5	40	µg/L	0.33 J	0.29 J	0.47 J	0.34 J	0.40 J	0.57 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Water Quality Parameters																	
Temperature				°C	7.95	8.55	9.50	13.40	10.00	7.53	5.15	5.69	2.80	3.47	3.32	6.03	9.98
pH				S.U.	7.42	7.34	7.22	7.11	7.07	7.53	6.88	7.80	8.07	8.17	8.33	8.10	7.96
Conductivity				µS/cm	1530	1490	1493	1665	1926	1170	1690	1170	759	856	819	1030	1120
Turbidity				NTU	9.10	0.00	0.31	1.24	2.98	0.00	6.90	0.00	0.00	0.00	0.00	0.00	0.00

Notes:
- All results have been validated.
- Surface water body classifications were identified as mapped by the New York State Department of Environmental Conservation Division of Water.

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µg/L - Micrograms per liter.

µS/cm – Microsiemens per centimeter.

Table 3
Surface Water Quality Summary
Cayuga County Groundwater Contamination Superfund Site

Analyte	TOGS[1] Class AA	TOGS[1] Class A	TOGS[1] Class C	Units	US-16	US-17	US-18	GW-18	US-19	US-20	US-21	SW-01	SW-02	SW-03	SW-04	SW-05	SW-05
Sample ID					120214-FD	US-17-120214	US-18-120214	GW-18-120214	US-19-120214	US-20-120314	US-21-011515	SW-01-120314	SW-02-120314	SW-03-120314	SW-04-120314	SW-05-120314	120314-FD
Sample Date					12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/2/2014	12/3/2014	1/15/2015	12/3/2014	12/3/2014	12/3/2014	12/3/2014	12/3/2014	12/3/2014
Sample Type					FD	N	N	N	N	N	N	N	N	N	N	N	FD
Surface Water Body Classifications					C	C	C	C	C	A	A	A	A	C	C	A	A
Detected Volatile Organic Compounds (VOCs)																	
Bromodichloromethane	50[2]	50[2]	NC	µg/L	0.48 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.48 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Bromoform	50[2]	50[2]	NC	µg/L	0.72 J	1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 UJ	6.2	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ	1.0 UJ
Chloroform	7	7	NC	µg/L	0.61 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.31 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Dibromochloromethane	50[2]	50[2]	NC	µg/L	0.78 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	4.5	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
cis-1,2-Dichloroethene	5	5	NC	µg/L	1.4	1.0 U	11	11	9	1.0 U	0.28 J	1.0 U	1.0 U	1.2	0.20 J	1.0 U	1.0 U
trans-1,2-Dichloroethene	5	5	NC	µg/L	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Trichloroethene	5	5	40	µg/L	1.0 U	1.0 U	0.94 J	0.88 J	0.72 J	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Water Quality Parameters																	
Temperature				°C	9.98	3.07	10.38	8.40	9.01	5.71	0.40	5.59	5.28	5.80	4.86	4.51	4.51
pH				S.U.	7.96	8.25	6.84	7.40	6.50	6.42	8.15	6.78	7.02	7.55	7.67	7.80	7.80
Conductivity				µS/cm	1120	745	1200	1240	1290	970	599	5650	640	1060	769	459	459
Turbidity				NTU	0.00	0.00	1.90	0.00	0.00	0.00	NM	0.00	0.00	0.00	0.00	0.00	0.00

Notes:

- All results have been validated.
- Surface water body classifications were identified as mapped by the New York State Department of Environmental Conservation Division of Water.

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S.U. - Standard unit

NTU - Nephelometric Turbidity Unit

µg/L - Micrograms per liter.

µS/cm – Microsiemens per centimeter.

Table 4
Low Level Lake Quality Results
Cayuga County Groundwater Contamination Superfund Site

			Location ID	SP-01	SP-01	SP-02	SP-03	SP-04
			Sample ID	SP-01-011515	011515-FD	SP-02-011515	SP-03-011515	SP-04-011515
			Sample Date	1/15/2015	1/15/2015	1/15/2015	1/15/2015	1/15/2015
			Sample Type	N	FD	N	N	N
Analyte	TOGS CLASS GA [1]	USEPA MCLs [2]	Units					
Detected Volatile Organic Compounds (VOCs)								
cis-1,2-Dichloroethene	5	70	µg/L	1.0 U	1.0 U	0.27 J	1.0 U	1.0 U
Water Quality Parameters								
Temperature (celcius)			°C	6.7	6.7	10.7	4.9	0.5
pH (S.I. Units)			S.U.	7.36	7.36	7.36	7.94	7.78
Conductivity			µS/cm	2747	2747	1624	2354	1389

Notes:
- Analyte units expressed in micrograms per liter (µg/L).

[1] New York State Technical and Operational Guidance Series (TOGS) 1.1.1 Class GA Water Quality Standards and Guidance Values.

[2] United States Environmental Protection Agency (USEPA) Drinking Water Maximum Contaminant Levels (MCLs).

N - Normal sample.

FD - Field duplicate sample.

S.U. - Standard unit

U - Not detected above the laboratory detection limit; the value shown is the laboratory reporting limit.

J - Estimated value between the laboratory detection limit and the laboratory reporting limit.

µS/cm – Microsiemens per centimeter.

Table 5
Groundwater Quality Results
Cayuga County Groundwater Contamination Superfund Site

			Location ID	RESWELL-5	RESWELL-5	RESWELL-5	RESWELL-6	RESWELL-6
			Sample ID	IS-RESWELL-5-103116	IS-RESWELL-5-PB-042717	IS-RESWELL-5-103117	IS-RESWELL-6-051117	X-1-051117
			Sample Date	10/31/2016	4/27/2017	10/31/2017	5/11/2017	5/11/2017
			Sample Type	N	N	N	N	FD
	TOGS	USEPA						
Analyte	*Class GA* [1]	*MCL* [2]	Units					
Detected Volatile Organic Compounds (VOCs)								
Trichloroethene	5	5	µg/L	0.28 J	0.27 J	0.38 J	0.49 J	0.61 J
cis-1,2-Dichloroethene	5	70	µg/L	3.1	1.3	2.8	**5.30**	**5.30**
Dissolved Gases								
Ethane	NC	NC	µg/L	1.0 U	NS	0.46 U	1.0 U	1.0 U
Ethene	NC	NC	µg/L	1.0 U	NS	0.86 U	1.0 U	1.0 U
Methane	NC	NC	µg/L	0.5 U	NS	0.33 J	1.3	1.6
Dissolved Metals								
Calcium	NC	NC	mg/L	110	NS	110	110	110
Iron	0.3[3]	0.3[5]	mg/L	0.022	NS	0.028	0.036	0.027
Magnesium	35[4]	NC	mg/L	24.0	NS	26.6	28.0	28.0
Manganese	0.3[3]	50[5]	mg/L	0.01 U	NS	0.01 U	0.01 U	0.01 U
Potassium	NC	NC	mg/L	2.1	NS	2.6	4.8	4.9
Sodium	20	NC	mg/L	22	NS	25.1	29.0	30.0
Anions								
Alkalinity, Bicarbonate	NC	NC	mg/L	310	NS	307	290	300
Alkalinity, Carbonate	NC	NC	mg/L	2.0 U	NS	20 U	2 U	2 U
Alkalinity, Total	NC	NC	mg/L	310	NS	307	290	300
Chloride	250	250[5]	mg/L	48	NS	47.3	49	50
Dissolved Carbon	NC	NC	mg/L	0.88 J	NS	1.0 U	3.0	3.1
Nitrogen, Nitrate	10	NC	mg/L	6.2	NS	4.80	3.1	3.1
Nitrogen, Nitrite	1	NC	mg/L	0.05 U	NS	0.007 BJ	0.1 U	0.1 U
Sulfate	250	250[5]	mg/L	67	NS	81.2	81	80
Sulfide	0.05[4]	NC	mg/L	0.02 U	NS	0.02 U	0.02 U	0.02 U
Water Quality Parameters								
Temperature			°C	13.30	NS	14.6	12.0	12.00
pH			S.U.	7.19	NS	6.88	7.28	7.28
Conductivity			µS/cm	913	NS	1187	849	849
Dissolved Oxygen			mg/L	5	NS	3	3	3
ORP			mV	65	NS	82	66	66
Turbidity			NTU	3.63	NS	3.69	NS	NS

Notes:

[1] New York State Department of Environmental Conservation (NYSDEC), Technical and Operational Guidance Series (TOGS) 1.1.1, standards and guidance values, revised June 1998.

[2] United States Environmental Protection Agency (USEPA) drinking water Maximum Contaminant Levels (MCLs).

[3] TOGS Class GA standard for total iron and manganese concentration is 500 µg/L.

[4] TOGS Class GA guidance value; currently no standard.

[5] USEPA secondary drinking water MCLs.

Bold values exceed TOGS Class GA standards or guidance values.

Yellow highlighted cells indicate values exceed USEPA drinking water MCLs.

FD - Field duplicate sample.

mV - Millivolts.

µg/L - Micrograms per liter.

mg/L - Milligrams per liter

µS/cm – Microsiemens per centimeter.

N - Normal sample.

NC - No criteria, a standard or guidance value has not yet been adopted.

NS - Not sampled.

NTU - Nephelometric Turbidity Unit.

U - Not detected above the laboratory detection limit; the value shown is the laboratory reporting limit.

J - Estimated value between the laboratory detection limit and the laboratory reporting limit.

S.U. - Standard unit.

Table 5
Groundwater Quality Results
Cayuga County Groundwater Contamination Superfund Site

Analyte	TOGS Class GA [1]	USEPA MCL [2]	Units	RESWELL-6	RESWELL-7	RESWELL-7	RESWELL-7	RESWELL-7
Sample ID				IS-RESWELL-6-103117	IS-RESWELL-7-103116	103116-FD2	IS-RESWELL-7-042717	IS-042717-FD1
Sample Date				10/31/2017	10/31/2016	10/31/2016	4/27/2017	4/27/2017
Sample Type				N	N	FD	N	FD
Detected Volatile Organic Compounds (VOCs)								
Trichloroethene	5	5	µg/L	0.26 J	0.87 J	0.69 J	0.62 J	0.66 J
cis-1,2-Dichloroethene	5	70	µg/L	1.3	**6.9**	**6.8**	4.2	4.5
Dissolved Gases								
Ethane	NC	NC	µg/L	0.46 U	1.0 U	1.0 U	NS	NS
Ethene	NC	NC	µg/L	0.86 U	1.0 U	1.0 U	NS	NS
Methane	NC	NC	µg/L	0.43 U	0.5 U	0.50 U	NS	NS
Dissolved Metals								
Calcium	NC	NC	mg/L	62.6	110	110.0	NS	NS
Iron	0.3[3]	0.3[5]	mg/L	0.021	0.013 J	0.012 J	NS	NS
Magnesium	35[4]	NC	mg/L	15.6	25.0	26.0	NS	NS
Manganese	0.3[3]	50[5]	mg/L	0.01 U	0.01 U	0.01 U	NS	NS
Potassium	NC	NC	mg/L	6.3	2.6	2.7	NS	NS
Sodium	20	NC	mg/L	17.1	31.0	31.0	NS	NS
Anions								
Alkalinity, Bicarbonate	NC	NC	mg/L	178	270	270	NS	NS
Alkalinity, Carbonate	NC	NC	mg/L	20 U	2.0 U	2.0 U	NS	NS
Alkalinity, Total	NC	NC	mg/L	178	270	270	NS	NS
Chloride	250	250[5]	mg/L	35.2	65.0	66.0	NS	NS
Dissolved Carbon	NC	NC	mg/L	4.0	1.3	1.2	NS	NS
Nitrogen, Nitrate	10	NC	mg/L	5.7	5.8	2.9	NS	NS
Nitrogen, Nitrite	1	NC	mg/L	0.009 BJ	0.05 U	0.05 U	NS	NS
Sulfate	250	250[5]	mg/L	35.1	110	54.0	NS	NS
Sulfide	0.05[4]	NC	mg/L	0.014 J	0.02 U	0.02 U	NS	NS
Water Quality Parameters								
Temperature			°C	9.2	13.3	13.3	NS	NS
pH			S.U.	6.97	7.06	7.06	NS	NS
Conductivity			µS/cm	772	1168	1168	NS	NS
Dissolved Oxygen			mg/L	9.49	3.26	3.26	NS	NS
ORP			mV	56.8	68.3	68.3	NS	NS
Turbidity			NTU	26.20	1.91	1.91	NS	NS

Notes:

[1] New York State Department of Environmental Conservation, Technical and Operational Guidance Series (1.1.1) Class GA Standards and Guidance Values, Revised June 1998.

[2] United States Environmental Protection Agency (USEPA) Drinking Water Maximum Contaminant Levels (MCLs).

[3] TOGS Class GA standard for total iron and manganese concentration is 500 µg/L.

[4] TOGS Class GA Guidance Value; currently no standard.

[5] USEPA Secondary Drinking Water MCLs.

Bold values exceed TOGS Class GA standards or guidance values.

Yellow highlighted cells indicate values exceed USEPA Drinking Water MCLs.

FD - Field duplicate sample.

mV - Millivolts

µg/L - Micrograms per liter.

mg/L - Milligrams per liter

µS/cm – Microsiemens per centimeter.

N - Normal sample.

NC - No criteria, a standard or guidance value has not yet been adopted.

NS - Not sampled.

NTU - Nephelometric Turbidity Unit

U - Not detected above the laboratory detection limit; the value shown is the laboratory reporting limit.

J - Estimated value between the laboratory detection limit and the laboratory reporting limit.

S.U. - Standard unit

Table 5
Groundwater Quality Results
Cayuga County Groundwater Contamination Superfund Site

			Location ID	RESWELL-7	RESWELL-7	VUS-Southwell
			Sample ID	IS-RESWELL-7-103117	IS-103117-FD1	IS-VUS-110216
			Sample Date	10/31/2017	10/31/2017	11/2/2016
			Sample Type	N	FD	N
	TOGS	USEPA				
Analyte	Class GA [1]	MCL [2]	Units			
Detected Volatile Organic Compounds (VOCs)						
Trichloroethene	5	5	µg/L	0.76 J	0.42 J	0.81 J
cis-1,2-Dichloroethene	5	70	µg/L	**5.2**	**5.4**	**7.6**
Dissolved Gases						
Ethane	NC	NC	µg/L	0.46 U	0.46 U	NS
Ethene	NC	NC	µg/L	0.86 U	0.86 U	NS
Methane	NC	NC	µg/L	0.43 U	0.43 U	NS
Dissolved Metals						
Calcium	NC	NC	mg/L	105	112	NS
Iron	0.3[3]	0.3[5]	mg/L	0.033	0.026	NS
Magnesium	35[4]	NC	mg/L	26.9	28.5	NS
Manganese	0.3[3]	50[5]	mg/L	0.0053 J	0.0053 J	NS
Potassium	NC	NC	mg/L	2.6	2.8	NS
Sodium	20	NC	mg/L	29.6	31.7	NS
Anions						
Alkalinity, Bicarbonate	NC	NC	mg/L	274	278	NS
Alkalinity, Carbonate	NC	NC	mg/L	20 U	20 U	NS
Alkalinity, Total	NC	NC	mg/L	274	278	NS
Chloride	250	250[5]	mg/L	59.4	59.4	NS
Dissolved Carbon	NC	NC	mg/L	0.57 J	0.62 J	NS
Nitrogen, Nitrate	10	NC	mg/L	4.2	4.2	NS
Nitrogen, Nitrite	1	NC	mg/L	0.054	0.047	NS
Sulfate	250	250[5]	mg/L	109	106	NS
Sulfide	0.05[4]	NC	mg/L	0.0079 J	0.0089 J	NS
Water Quality Parameters						
Temperature			°C	12.8	12.80	10.0
pH			S.U.	7.13	7.13	7.15
Conductivity			µS/cm	1269	1269.00	1155
Dissolved Oxygen			mg/L	1.87	1.87	2.25
ORP			mV	54.8	54.80	125.3
Turbidity			NTU	5.70	5.70	0.21

Notes:

[1] New York State Department of Environmental Conservation, Technical and Operational Guidance Series (1.1.1) Class GA Standards and Guidance Valu

[2] United States Environmental Protection Agency (USEPA) Drinking Water Maximum Contaminant Levels (MCLs).

[3] TOGS Class GA standard for total iron and manganese concentration is 500 µg/L.

[4] TOGS Class GA Guidance Value; currently no standard.

[5] USEPA Secondary Drinking Water MCLs.

Bold values exceed TOGS Class GA standards or guidance values.

Yellow highlighted cells indicate values exceed USEPA Drinking Water MCLs.

FD - Field duplicate sample.

mV - Millivolts

µg/L - Micrograms per liter.

mg/L - Milligrams per liter

µS/cm – Microsiemens per centimeter.

N - Normal sample.

NC - No criteria, a standard or guidance value has not yet been adopted.

NS - Not sampled.

NTU - Nephelometric Turbidity Unit

U - Not detected above the laboratory detection limit; the value shown is the laboratory reporting limit.

J - Estimated value between the laboratory detection limit and the laboratory reporting limit.

S.U. - Standard unit

Table 6
Compound Specific Stable Isotope Analysis
Cayuga County Groundwater Contamination Superfund Site

Location ID	Sample Date	Sample Matrix	$\delta^{13}C$ - TCE ‰	$\delta^{13}C$ - cDCE ‰	$\delta^{13}C$ - VC ‰
Area 1					
B-33D3	8/2/2017	Groundwater	-11.47	-26.58	-27.06
B-53D3	8/2/2017	Groundwater	-17.12	-25.63	-34.80
B-32D3	8/2/2017	Groundwater	-19.66	-26.78	-23.49
B-31D3	8/2/2017	Groundwater	-20.55	-26.35	-31.93
		Average $\delta^{13}C$:	**-17.20**	**-26.34**	**-29.32**
Area 3					
Property-2	11/2/2016	Groundwater	-13.06	-19.25	-30.00 J
Property-3	11/2/2016	Groundwater	-13.58	-18.27	U
		Average $\delta^{13}C$:	**-13.32**	**-18.76**	**-30.00**
VUS South Well	11/2/2016	Groundwater	U	-16.17	U
US-05	10/31/2016	Surface Water	-14.27 J	-15.84	U
		Average $\delta^{13}C$:	**-14.27**	**-16.01**	**U**

Notes:

TCE - Trichloroethene

cDCE - cis-1,2-Dichloroethene

VC - Vinyl chloride

‰ - Permill or parts per thousand

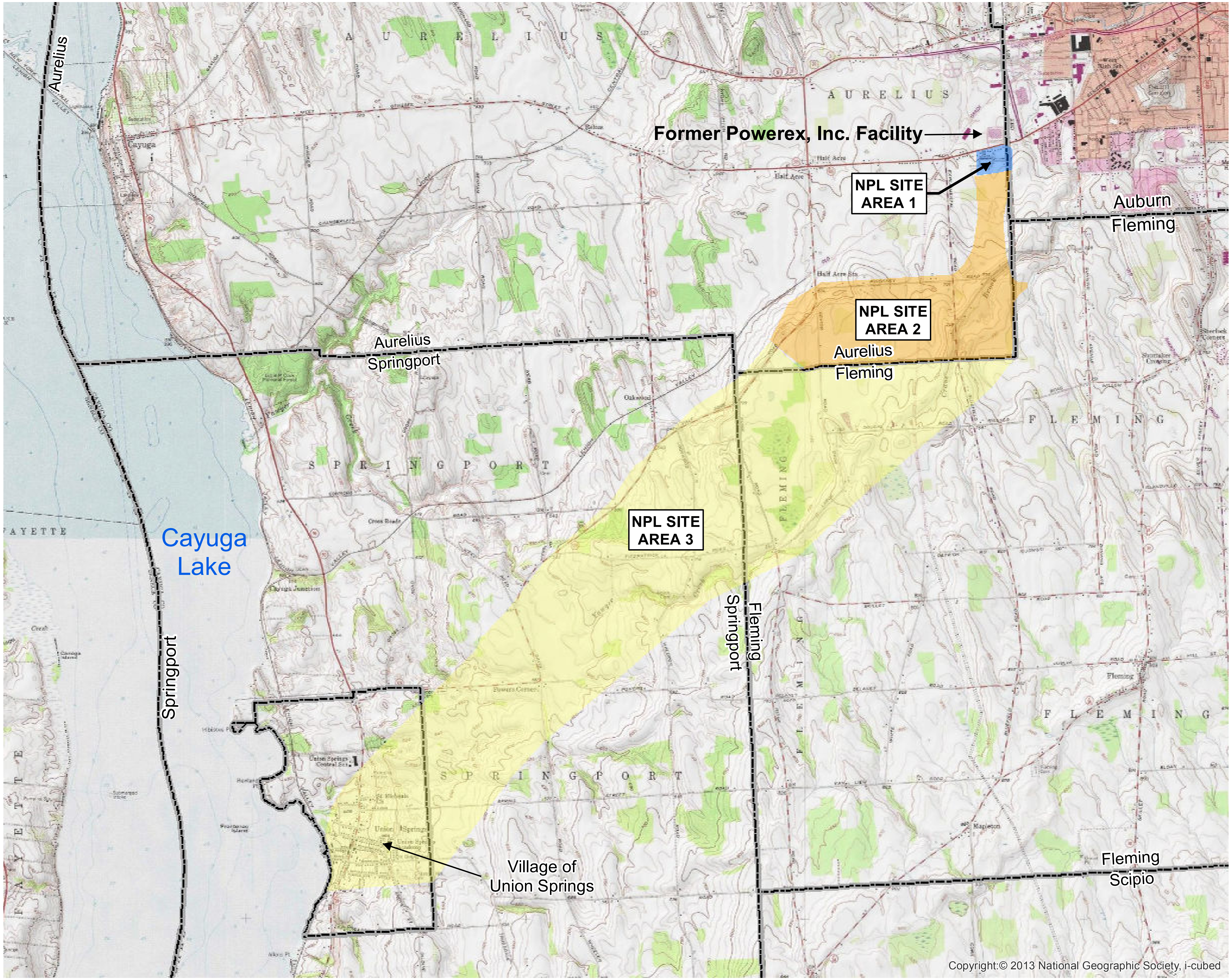
U - Not detected above the laboratory detection limit

J - Estimated value between the laboratory detection limit and the laboratory reporting limit

Table 7
Microbiological Analysis Results
Cayuga County Groundwater Contamination Superfund Site

Location ID:		B-33D3	B-58D3	B-44D3	Property-1 Main Well	Property-2 POET Influent	Property-3 POET Influent	VUS Southwell
Sample ID:		IS-B-33D3-102616	IS-B-58D3-110216	IS-B-44D3-110216	IS-POET-A-110216	IS-POET-B-110216	IS-POET-C-110216	IS-VUS-110216
Sample Date:		10/26/2016	11/2/2016	11/2/2016	11/2/2016	11/2/2016	11/2/2016	11/2/2016
NPL Area:		Line 0	Area 1	Area 1	Area 3	Area 3	Area 3	Area 3
ANALYTE	UNITS							
REDUCTIVE DECHLORINATION								
Dehalococcoides spp. (DHC)	Cells/mL	1.26E+04	1.62E+04	6.80E+00	4.03E+01	1.23E+01	4.90E+00	5.00E-01 J
tceA Reductase (TCE)	Cells/mL	5.00E-01 U	5.00E-01 U	5.00E-01 U	5.00E-01 U	5.00E-01 U	5.00E-01 U	5.00E-01 U
BAV1 Vinyl Chloride Reductase (BVC)	Cells/mL	4.80E+03	8.26E+03	2.30E+00	1.00E+00	2.00E+00	6.00E-01	5.00E-01 U
Vinyl Chloride Reductase (VCR)	Cells/mL	4.10E+00	7.61E+02	5.00E-01 U	4.00E-01 J	2.00E-01 J	5.00E-01 U	5.00E-01 U
Dehalobacter spp. (DHBt)	Cells/mL	3.84E+02	1.80E+02	1.01E+03	2.57E+01	2.35E+01	2.92E+02	1.86E+01
Dehalobacter DCM (DCM)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	2.36E+01	4.50E+00 U
Dehalogenimonas spp. (DHG)	Cells/mL	7.17E+03	1.77E+04	8.31E+01	8.31E+02	7.00E+01	4.60E+00 U	4.50E+00 U
Desulfitobacterium spp. (DSB)	Cells/mL	1.59E+03	5.18E+02	2.51E+02	5.00E+00	4.50E+00 U	3.47E+01	8.49E+01
Dehalobium chlorocoercia (DECO)	Cells/mL	1.31E+03	1.21E+02	1.53E+02	1.20E+02	4.46E+01	7.86E+01	4.50E+00 U
Desulfuromonas spp. (DSM)	Cells/mL	7.89E+04	1.51E+04	6.26E+03	1.18E+03	1.77E+02	1.18E+03	4.50E+00 U
Chloroform reductase (CFR)	Cells/mL	4.60E+00 U	3.13E+01	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
1,1 DCA Reductase (DCA)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
1,2 DCA Reductase (DCAR)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
AEROBIC (CO)METABOLITIC								
Soluble Methane Monooxygenase (SMMO)	Cells/mL	4.42E+02	2.37E+02	1.62E+01	3.83E+02	2.57E+01	5.41E+01	4.50E+00 J
Particulate Methane Monooxygenase (PMMO)	Cells/mL	4.38E+02	6.53E+01	3.19E+01	9.00E+01	4.30E+00 J	1.50E+01	5.00E-01 J
Toluene Dioxygenase (TOD)	Cells/mL	9.76E+01	3.37E+01	2.43E+01	5.47E+01	1.40E+00 J	3.78E+01	6.10E+00
Phenol Hydroxylase (PHE)	Cells/mL	4.60E+00 U	3.44E+02	3.18E+02	1.70E+01	4.50E+00 U	1.31E+02	1.12E+01
Trichlorobenzene Dioxygenase (TCBO)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
Toluene Monooxygenase 2 (RDEG)	Cells/mL	1.20E+00 J	4.50E+00 U	5.64E+01	4.50E+00 U	4.41E+01	2.12E+02	7.10E+00
Toluene Monooyxgenase (RMO)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
Ethene Monooxygenase (EtnC)	Cells/mL	4.60E+00 U	2.41E+02	2.87E+01	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
Epoxyalkane Transferase (EtnE)	Cells/mL	4.60E+00 U	5.06E+02	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
Dichloromethane dehalogenase (DCMA)	Cells/mL	4.60E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.50E+00 U	4.60E+00 U	4.50E+00 U
OTHER								
Total Eubacteria (EBAC)	Cells/mL	4.12E+05	2.07E+05	1.55E+05	2.73E+05	2.08E+05	5.62E+05	3.66E+04
Sulfate Reducing Bacteria (APS)	Cells/mL	1.53E+05	1.26E+05	1.45E+05	2.54E+05	1.14E+05	4.82E+04	2.47E+04
Methanogens (MGN)	Cells/mL	8.09E+01	5.77E+01	3.80E+00 J	4.64E+01	1.00E+00 J	2.70E+00 J	6.90E+00
WATER QUALITY PARAMETERS								
Temperature	C	11.7	12.8	13.4	11.2	11.1	11.9	10.0
pH	S.I.	6.82	7.01	7.13	7.33	7.29	7.06	7.15
Conductivity	µS/cm	2078	1744	1473	1496	592	906	1155
Dissolved Oxygen	mg/L	0.17	0.05	0.37	0.57	NS	4.59	2.12
ORP	mV	-356.6	-302.2	-251.7	-174.7	NS	151.7	124.9

Notes:
Microbiological samples were analyzed by Microbial Insights for the QuantArray-Chlor suite of targets.
N = Normal sample.
U = Analyte was not detected above the method detection limit (MDL) shown.
J = Analyte was detected; estimated concentration is greater than the MDL and less than the reporting limit (RL).
NS = Parameter was incompatible with the sampling methodology and was not collected.



N

LEGEND

National Priorities List (NPL) SITE AREAS [1]

- NPL SITE AREA 1
- NPL SITE AREA 2
- NPL SITE AREA 3
- LOCAL GOVERNMENT BOUNDARY

NOTE:
[1] AREAS SHOWN ARE APPROXIMATE.

CAYUGA COUNTY GROUNDWATER CONTAMINATION SUPERFUND SITE
CAYUGA COUNTY, NEW YORK

SITE LOCATION

0 2,000 4,000 8,000
Feet

GE-CEP.612/65685
JANUARY 2018

O'BRIEN & GERE ENGINEERS, INC.

PLOTDATE: 01/08/18 10:03:56 AM newtonjm

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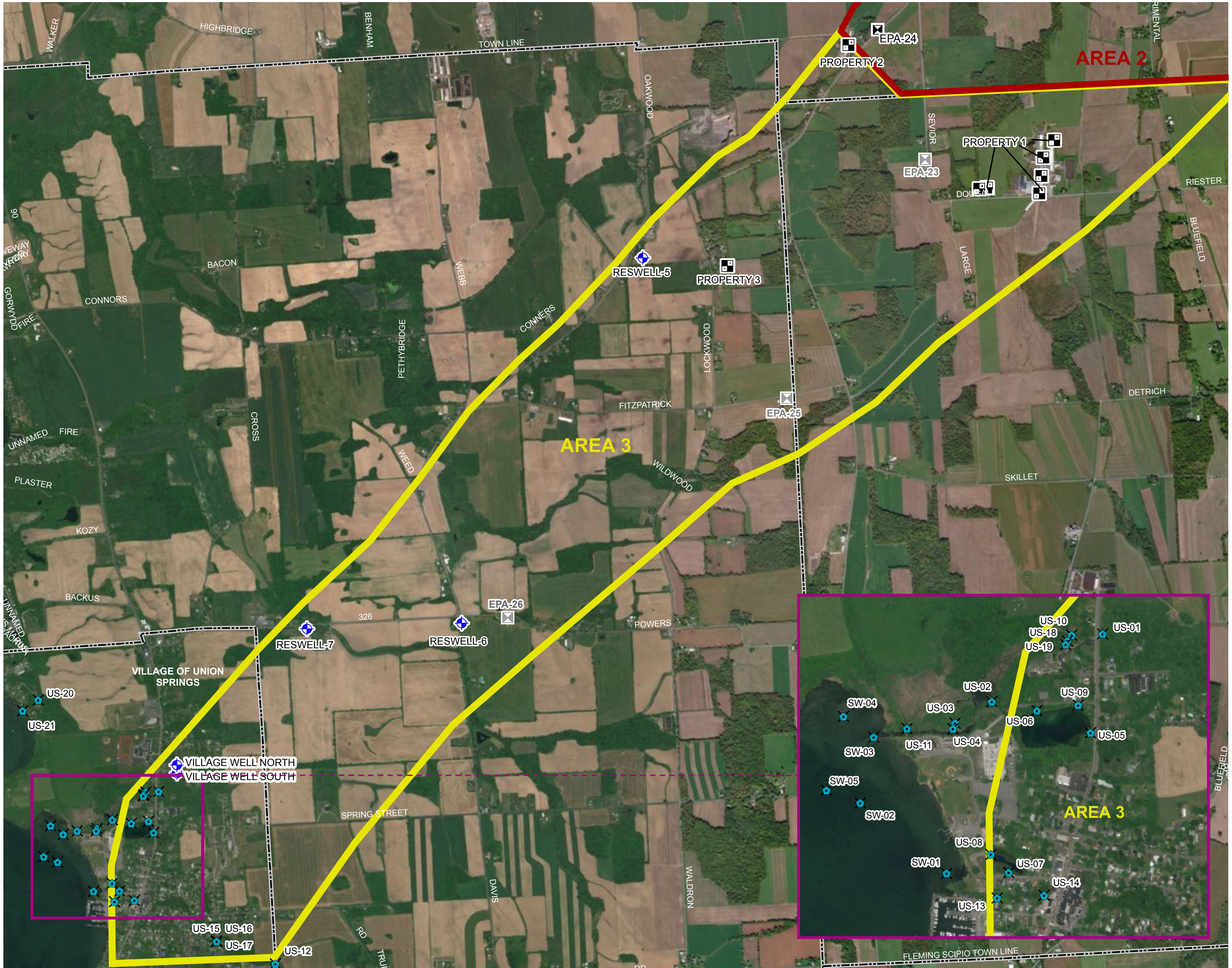
FIGURE 2



N

LEGEND

- USEPA MONITORING WELL LOCATION
- AGRICULTURAL WELL WITH POET SYSTEM
- MONITORING WELL
- SURFACE WATER SAMPLE LOCATION

NATIONAL PRIORITY LIST (NPL) SITE AREAS (Areas Shown are Approximate)

- AREA 2
- AREA 3

CAYUGA COUNTY GROUNDWATER CONTAMINATION SUPERFUND SITE
AUBURN, NEW YORK

NPL AREA 3
SURFACE WATER AND GROUNDWATER SAMPLE LOCATIONS

0 1,200 2,400 4,800
Feet

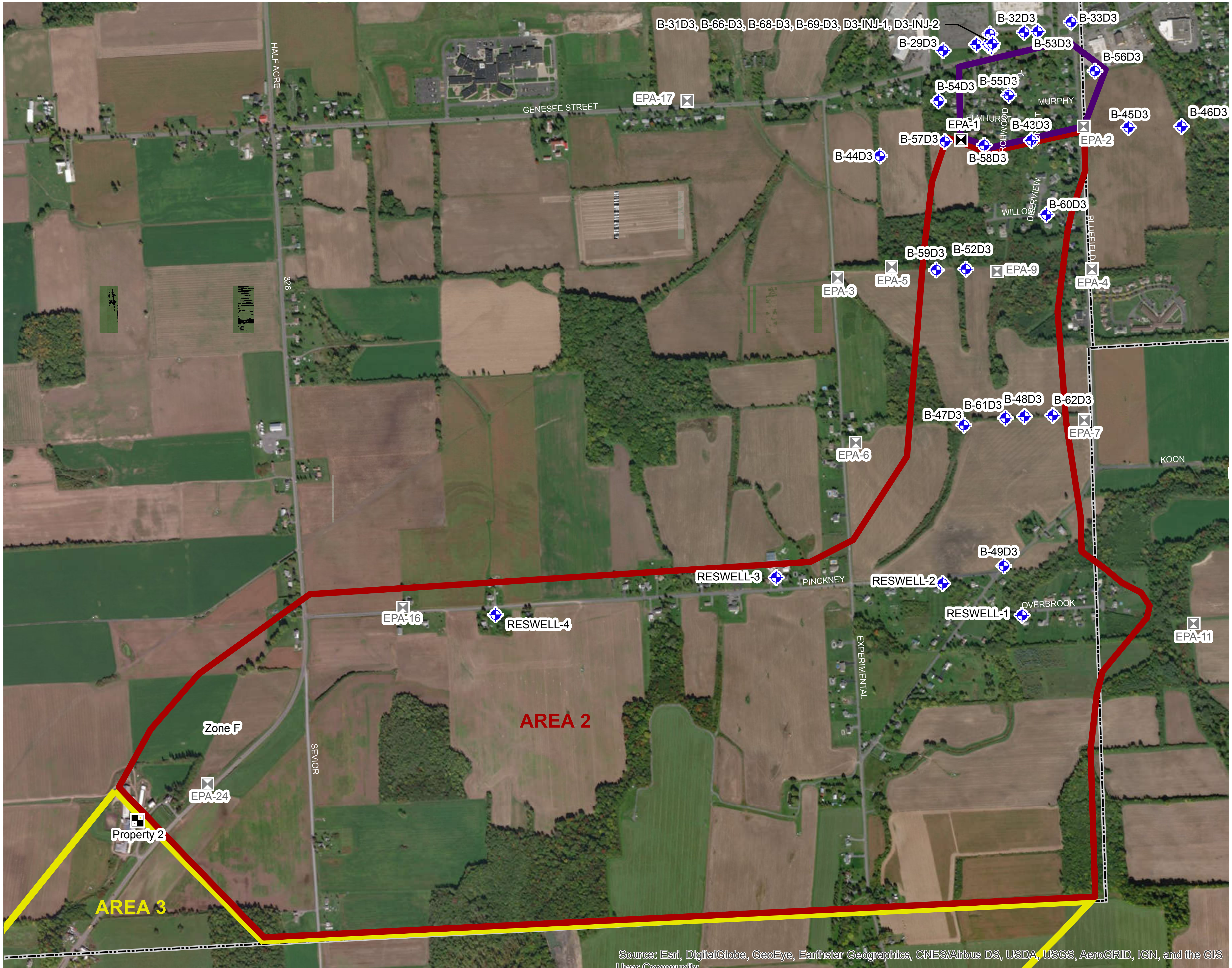
CEP.612/65685
FEBRUARY 2018

O'BRIEN & GERE ENGINEERS, INC.

PLOTDATE: 02/16/18 9:47:54 AM Freyerpa

\\syracusesvr\projects\Ge-Cep.612\STDS\GIS\Cayuga-Site\MXD\GW_SW_Summary_Rpt\NPL_AREA_3_SAMPLE_LOCATIONS.mxd

FIGURE 3



N

LEGEND

- MONITORING WELL LOCATION
- AGRICULTRUAL WELL WITH POET SYSTEM
- USEPA MONITORING WELL LOCATION

NATIONAL PRIORITY LIST (NPL) SITE AREAS (Areas Shown are Approximate)

- AREA 1
- AREA 2
- AREA 3

CAYUGA COUNTY GROUNDWATER CONTAMINATION SUPERFUND SITE
AUBURN, NEW YORK

NPL AREA 1 AND 2 SITE FEATURES

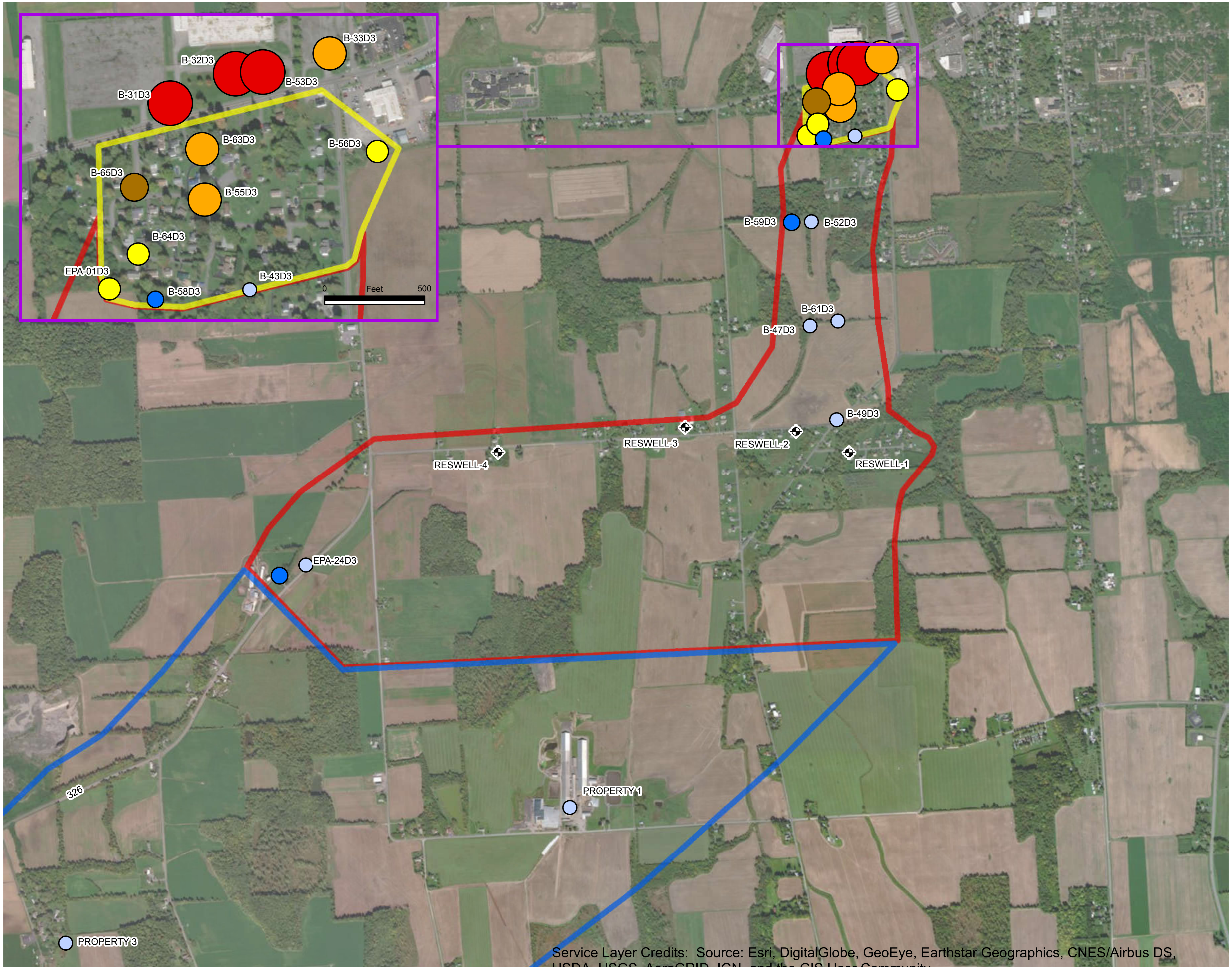
0 500 1,000 2,000
Feet

CEP.612/65685
FEBRUARY 2018

O'BRIEN & GERE ENGINEERS, INC.

PLOTDATE: 02/15/18 1:55:41 PM Freyerpa

\\syracusesvr\projects\Ge-Cep.612\STDS\GIS\Cayuga-Site\MXD\GW_SW_Summary_Rpt\NPL_AREA_1n2_SITE_FEATURES.mxd



N

LEGEND

MAXIMUM TCE CONCENTRATION
(11/2014 - 5/2016)

- NOT DETECTED
- ≤ 5 µg/L
- >5 and ≤50 µg/L
- >50 and ≤500 µg/L
- >500 and ≤5000 µg/L
- >5000 and ≤50000 µg/L
- >50000 and ≤100000 µg/L
- >100000 µg/L
- RESIDENTIAL WELL

NATIONAL PRIORITY LIST (NPL) SITE AREAS (AREAS SHOWN ARE APPROXIMATE)

- AREA 1
- AREA 2
- AREA 3

NOTE:
MAXIMUM CONCENTRATION FOR PROPERTY 1 REPRESENTS THE MAXIMUM FOR ALL PRODUCTION WELLS AND TREATMENT SYSTEM INFLUENT FROM NOVEMBER 2014 TO JUNE 2016.

CAYUGA COUNTY
GROUNDWATER CONTAMINATION
SUPERFUND SITE
CAYUGA COUNTY, NEW YORK

MAXIMUM TCE CONCENTRATIONS IN DESIGN PHASE D3 MONITORING WELLS

0 750 1,500 3,000
Feet

CEP.612.65685
FEBRUARY 2018

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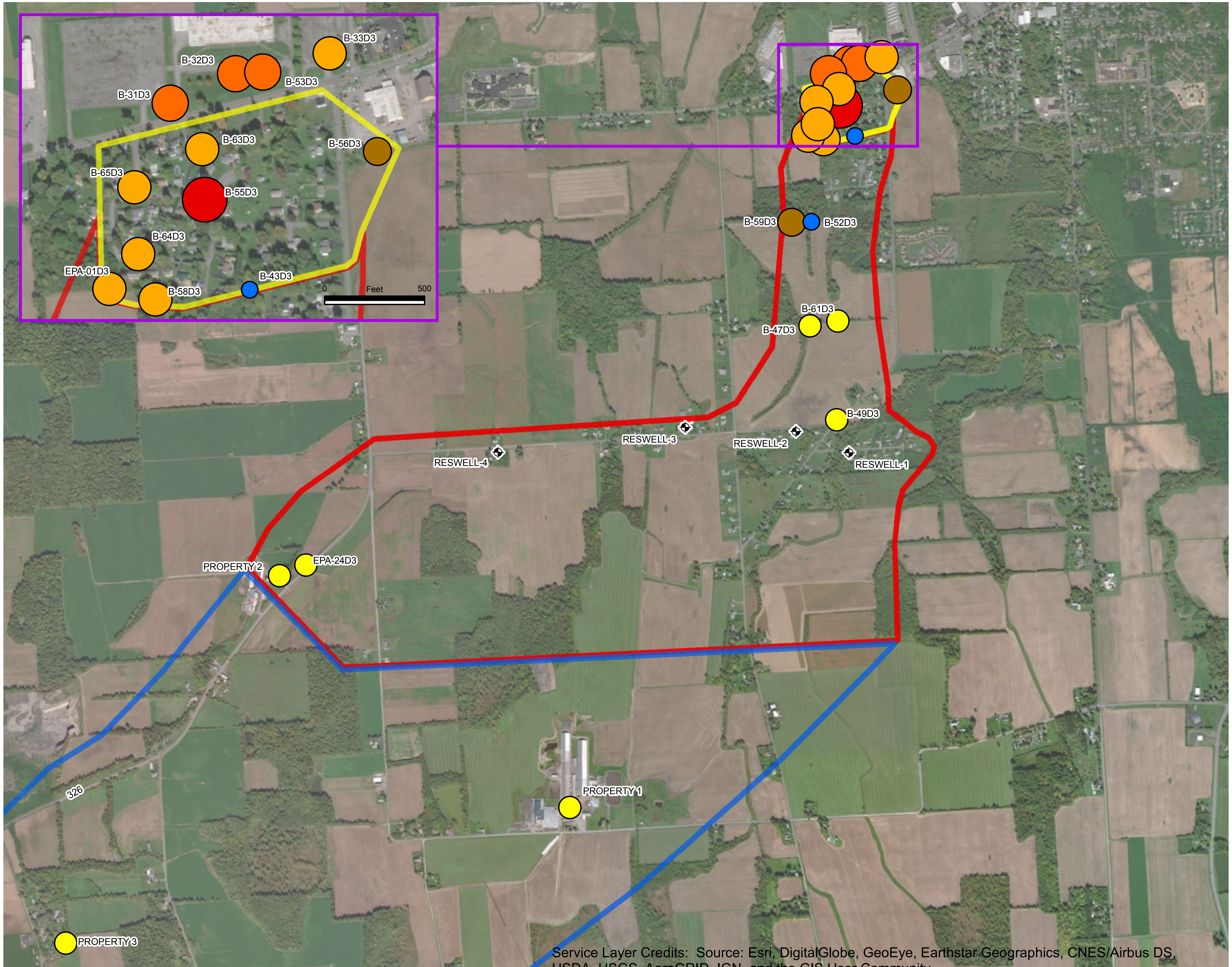
PLOTDATE: 02/15/18 11:59:25 AM Freyerpa

\\server01-01\Projects\Ge-Cep.612\65685.Cayuga-2017-2019\Docs\DWG\MXD\FIGURE-2a_TCE_MAX_2014-2016.mxd

FIGURE 4b



N

LEGEND

MAXIMUM cDCE CONCENTRATION
(11/2014 - 5/2016)

- NOT DETECTED
- ≤ 5 µg/L
- >5 and ≤50 µg/L
- >50 and ≤500 µg/L
- >500 and ≤5000 µg/L
- >5000 and ≤50000 µg/L
- >50000 and ≤100000 µg/L
- >100000 µg/L
- RESIDENTIAL WELL

NATIONAL PRIORITY LIST (NPL) SITE AREAS (AREAS SHOWN ARE APPROXIMATE)

- AREA 1
- AREA 2
- AREA 3

NOTE:
MAXIMUM CONCENTRATION FOR PROPERTY 1 REPRESENTS THE MAXIMUM FOR ALL PRODUCTION WELLS AND TREATMENT SYSTEM INFLUENT FROM NOVEMBER 2014 TO JUNE 2016.

CAYUGA COUNTY
GROUNDWATER CONTAMINATION
SUPERFUND SITE
CAYUGA COUNTY, NEW YORK

MAXIMUM cDCE CONCENTRATIONS IN DESIGN PHASE D3 MONITORING WELLS

0 750 1,500 3,000
Feet

CEP.612.62168
FEBRUARY 2018

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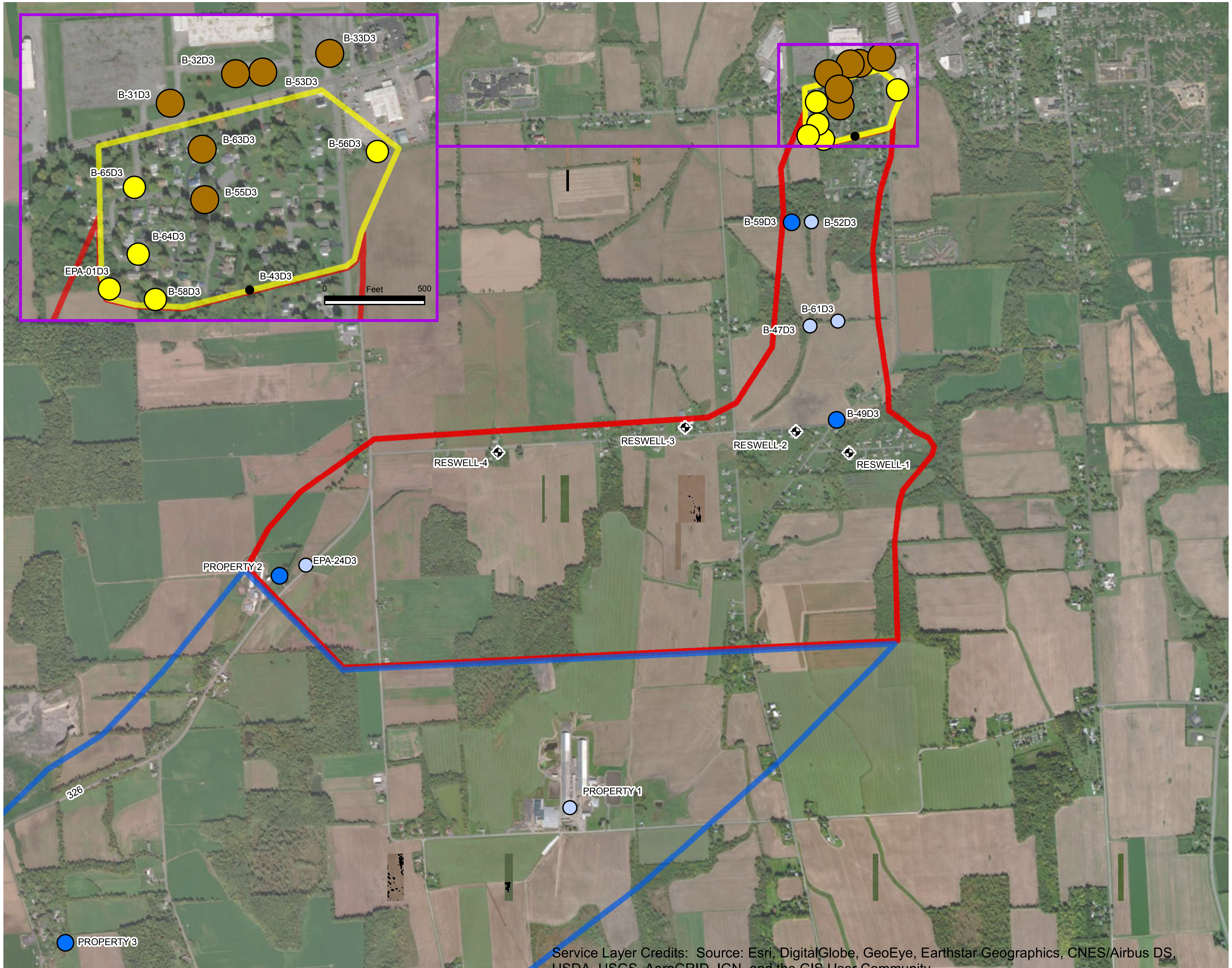
\\server01-01\Projects\Ge-Cep.612\65685.Cayuga-2017-201\Docs\DWG\MXD\FIGURE-2b_cDCE_MAX_2014-2016.mxd



LEGEND

MAXIMUM tDCE CONCENTRATION
(11/2014 - 5/2016)

- NOT DETECTED
- ≤ 5 µg/L
- >5 and ≤50 µg/L
- >50 and ≤500 µg/L
- >500 and ≤5000 µg/L
- RESIDENTIAL WELL

NATIONAL PRIORITY LIST (NPL) SITE AREAS (AREAS SHOWN ARE APPROXIMATE)

- AREA 1
- AREA 2
- AREA 3

NOTE:
MAXIMUM CONCENTRATION FOR PROPERTY 1 REPRESENTS THE MAXIMUM FOR ALL PRODUCTION WELLS AND TREATMENT SYSTEM INFLUENT FROM NOVEMBER 2014 TO JUNE 2016.

CAYUGA COUNTY
GROUNDWATER CONTAMINATION
SUPERFUND SITE
CAYUGA COUNTY, NEW YORK

MAXIMUM tDCE CONCENTRATIONS IN DESIGN PHASE D3 MONITORING WELLS

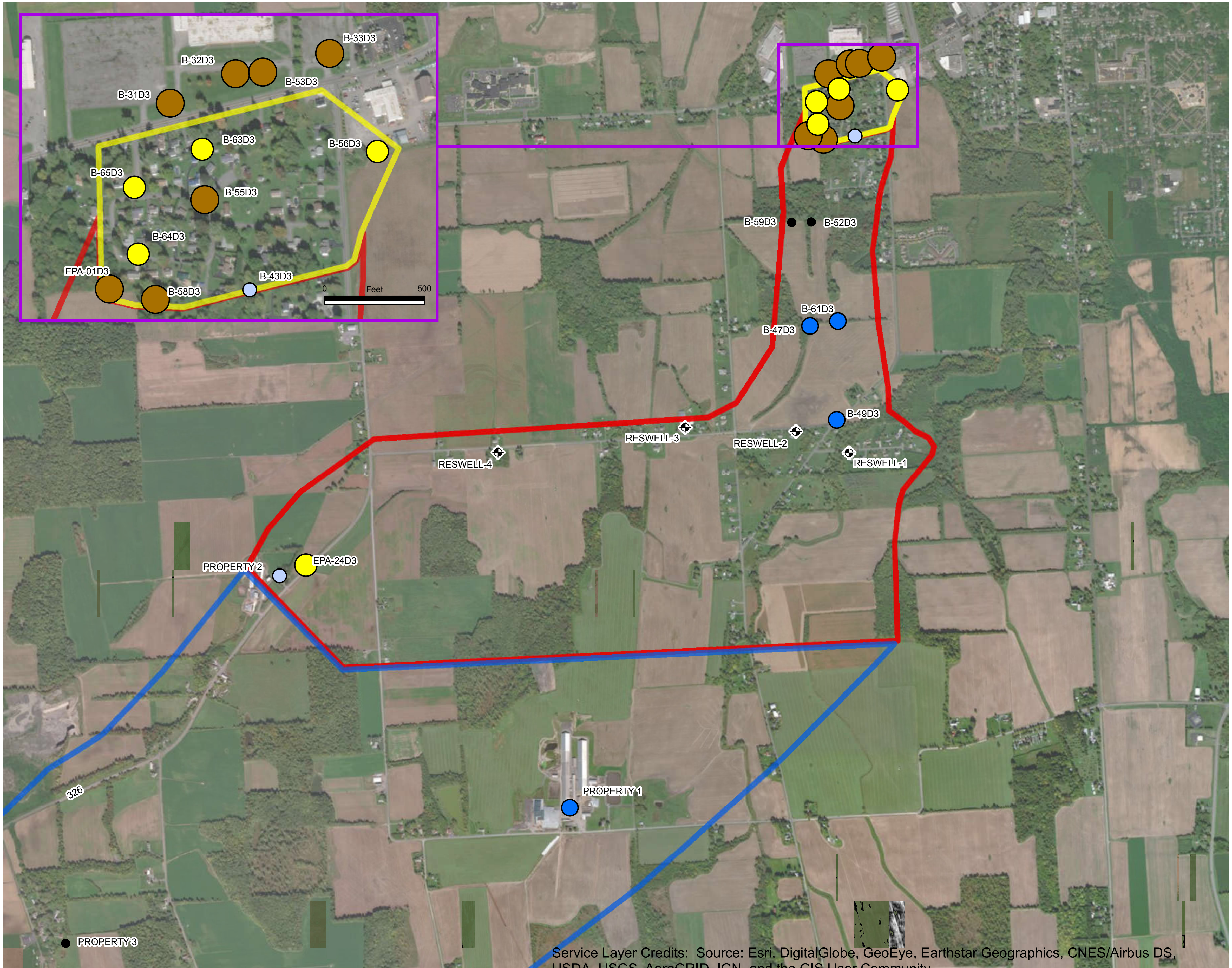
0 750 1,500 3,000
Feet

CEP.612.65685
FEBRUARY 2018

O'BRIEN & GERE ENGINEERS, INC.

PLOTDATE: 02/15/18 12:55:00 PM Freyerpa

\\server01-01\Projects\Ge-Cep.612\65685.Cayuga-2017-201\Docs\DWG\MXD\FIGURE-2c_tDCE_MAX_2014-2016.mxd



N

LEGEND

MAXIMUM VINYL CHLORIDE CONCENTRATION
(11/2014 - 5/2016)

- NOT DETECTED
- ≤ 5 µg/L
- >5 and ≤50 µg/L
- >50 and ≤500 µg/L
- >500 and ≤5000 µg/L
- RESIDENTIAL WELL

NATIONAL PRIORITY LIST (NPL) SITE AREAS (AREAS SHOWN ARE APPROXIMATE)

- AREA 1
- AREA 2
- AREA 3

NOTE:
MAXIMUM CONCENTRATION FOR PROPERTY 1 REPRESENTS THE MAXIMUM FOR ALL PRODUCTION WELLS AND TREATMENT SYSTEM INFLUENT FROM NOVEMBER 2014 TO JUNE 2016.

CAYUGA COUNTY
GROUNDWATER CONTAMINATION
SUPERFUND SITE
CAYUGA COUNTY, NEW YORK

MAXIMUM VINYL CHLORIDE CONCENTRATIONS IN DESIGN PHASE D3 MONITORING WELLS

0 750 1,500 3,000
Feet

CEP.612.65685
FEBRUARY 2018

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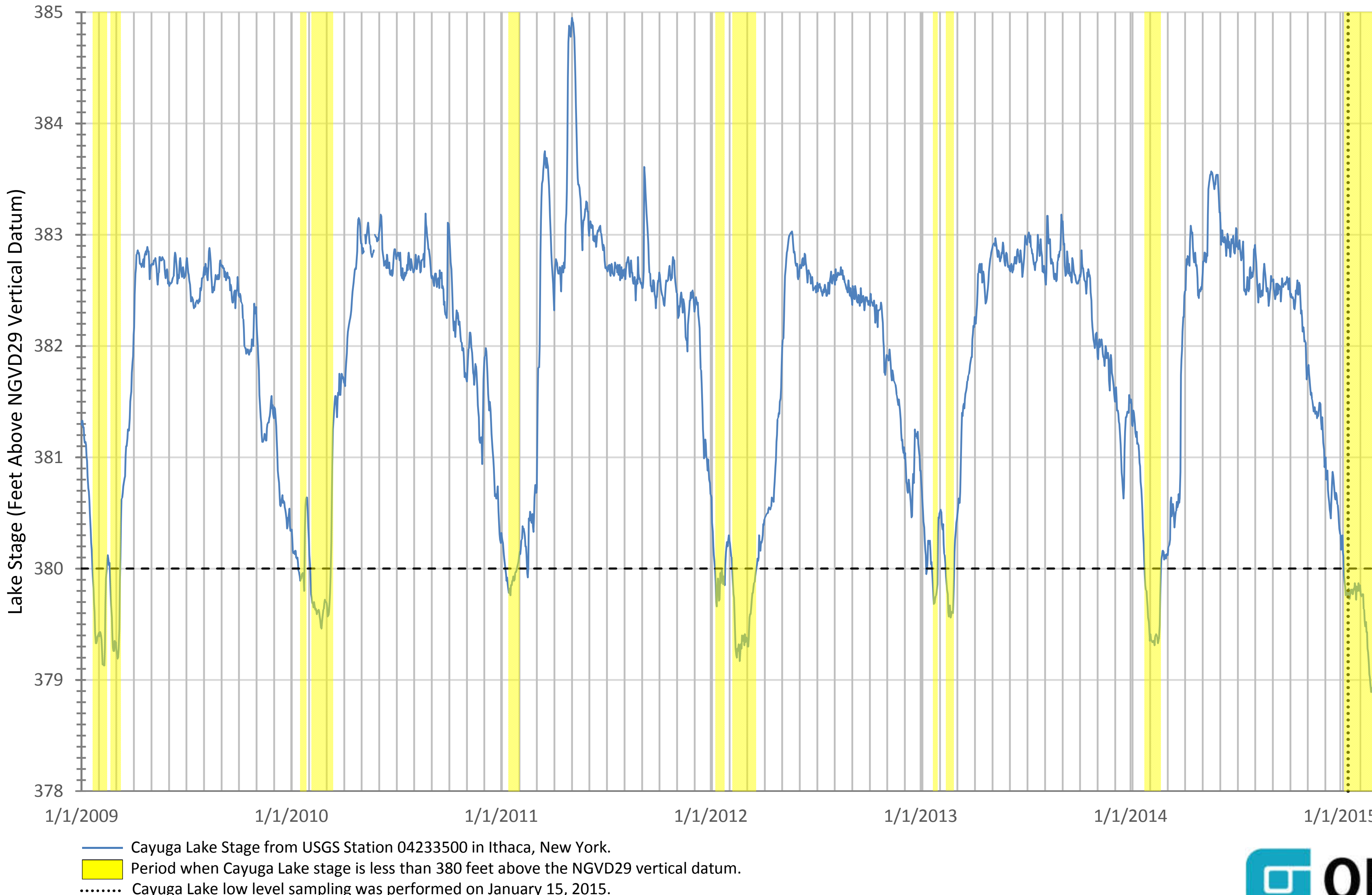
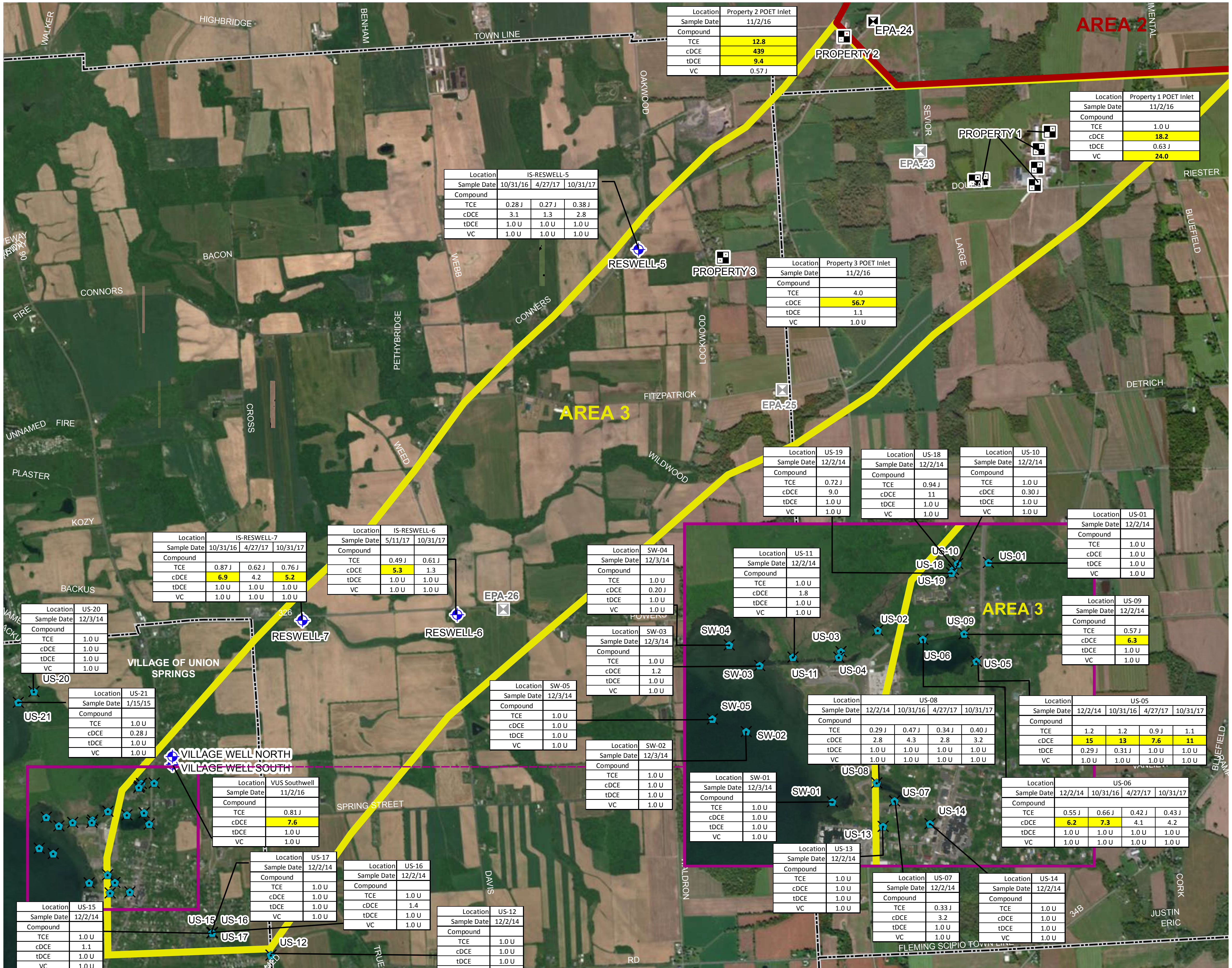
\\server01-01\Projects\Ge-Cep.612\65685.Cayuga-2017-201\Docs\DWG\MXD\FIGURE-2d_VC_MAX_2014-2016.mxd

Figure 5
Cayuga Lake Stage Hydrograph
Cayuga County Groundwater Contamination Superfund Site



OBG



Location	Property 2 POET Inlet
Sample Date	11/2/16
Compound	
TCE	12.8
cDCE	439
tDCE	9.4
VC	0.57 J

Location	Property 1 POET Inlet
Sample Date	11/2/16
Compound	
TCE	1.0 U
cDCE	18.2
tDCE	0.63 J
VC	24.0

Location	IS-RESWELL-5		
Sample Date	10/31/16	4/27/17	10/31/17
Compound			
TCE	0.28 J	0.27 J	0.38 J
cDCE	3.1	1.3	2.8
tDCE	1.0 U	1.0 U	1.0 U
VC	1.0 U	1.0 U	1.0 U

Location	Property 3 POET Inlet
Sample Date	11/2/16
Compound	
TCE	4.0
cDCE	56.7
tDCE	1.1
VC	1.0 U

Location	US-19
Sample Date	12/2/14
Compound	
TCE	0.72 J
cDCE	9.0
tDCE	1.0 U
VC	1.0 U

Location	US-18
Sample Date	12/2/14
Compound	
TCE	0.94 J
cDCE	11
tDCE	1.0 U
VC	1.0 U

Location	US-10
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	0.30 J
tDCE	1.0 U
VC	1.0 U

Location	US-01
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	IS-RESWELL-7		
Sample Date	10/31/16	4/27/17	10/31/17
Compound			
TCE	0.87 J	0.62 J	0.76 J
cDCE	6.9	4.2	5.2
tDCE	1.0 U	1.0 U	1.0 U
VC	1.0 U	1.0 U	1.0 U

Location	IS-RESWELL-6	
Sample Date	5/11/17	10/31/17
Compound		
TCE	0.49 J	0.61 J
cDCE	5.3	1.3
tDCE	1.0 U	1.0 U
VC	1.0 U	1.0 U

Location	SW-04
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	0.20 J
tDCE	1.0 U
VC	1.0 U

Location	US-11
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.8
tDCE	1.0 U
VC	1.0 U

Location	US-09
Sample Date	12/2/14
Compound	
TCE	0.57 J
cDCE	6.3
tDCE	1.0 U
VC	1.0 U

Location	US-20
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	SW-03
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	1.2
tDCE	1.0 U
VC	1.0 U

Location	US-21
Sample Date	1/15/15
Compound	
TCE	1.0 U
cDCE	0.28 J
tDCE	1.0 U
VC	1.0 U

Location	SW-05
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	US-08			
Sample Date	12/2/14	10/31/16	4/27/17	10/31/17
Compound				
TCE	0.29 J	0.47 J	0.34 J	0.40 J
cDCE	2.8	4.3	2.8	3.2
tDCE	1.0 U	1.0 U	1.0 U	1.0 U
VC	1.0 U	1.0 U	1.0 U	1.0 U

Location	US-05			
Sample Date	12/2/14	10/31/16	4/27/17	10/31/17
Compound				
TCE	1.2	1.2	0.9 J	1.1
cDCE	15	13	7.6	11
tDCE	0.29 J	0.31 J	1.0 U	1.0 U
VC	1.0 U	1.0 U	1.0 U	1.0 U

Location	SW-02
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	VUS Southwell
Sample Date	11/2/16
Compound	
TCE	0.81 J
cDCE	7.6
tDCE	1.0 U
VC	1.0 U

Location	SW-01
Sample Date	12/3/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	US-06			
Sample Date	12/2/14	10/31/16	4/27/17	10/31/17
Compound				
TCE	0.55 J	0.66 J	0.42 J	0.43 J
cDCE	6.2	7.3	4.1	4.2
tDCE	1.0 U	1.0 U	1.0 U	1.0 U
VC	1.0 U	1.0 U	1.0 U	1.0 U

Location	US-17
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	US-16
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.4
tDCE	1.0 U
VC	1.0 U

Location	US-13
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	US-07
Sample Date	12/2/14
Compound	
TCE	0.33 J
cDCE	3.2
tDCE	1.0 U
VC	1.0 U

Location	US-14
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

Location	US-15
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.1
tDCE	1.0 U
VC	1.0 U

Location	US-12
Sample Date	12/2/14
Compound	
TCE	1.0 U
cDCE	1.0 U
tDCE	1.0 U
VC	1.0 U

N

LEGEND

- USEPA MONITORING WELL LOCATION
- AGRICULTURAL WELL WITH POET SYSTEM
- MONITORING WELL
- SURFACE WATER SAMPLE LOCATION

NATIONAL PRIORITY LIST (NPL) SITE AREAS (Areas Shown are Approximate)

- AREA 2
- AREA 3

NOTE:
POET - Point-of-Entry Treatment

Location	US-09
Sample Date	12/2/14
Compound	
TCE	0.57 J
cDCE	6.3
tDCE	1.0 U
VC	1.0 U

RESULTS IN PPB

HIGHLIGHTED CELLS EXCEED APPLICABLE STATE AND/OR FEDERAL WATER QUALITY STANDARDS.
FOR ADDITIONAL DETAILS SEE TABLES 3, 4, AND 5.

CAYUGA COUNTY GROUNDWATER CONTAMINATION SUPERFUND SITE AUBURN, NEW YORK

SITE-RELATED CONSTITUENTS OF CONCERN

0 1,200 2,400 4,800
Feet

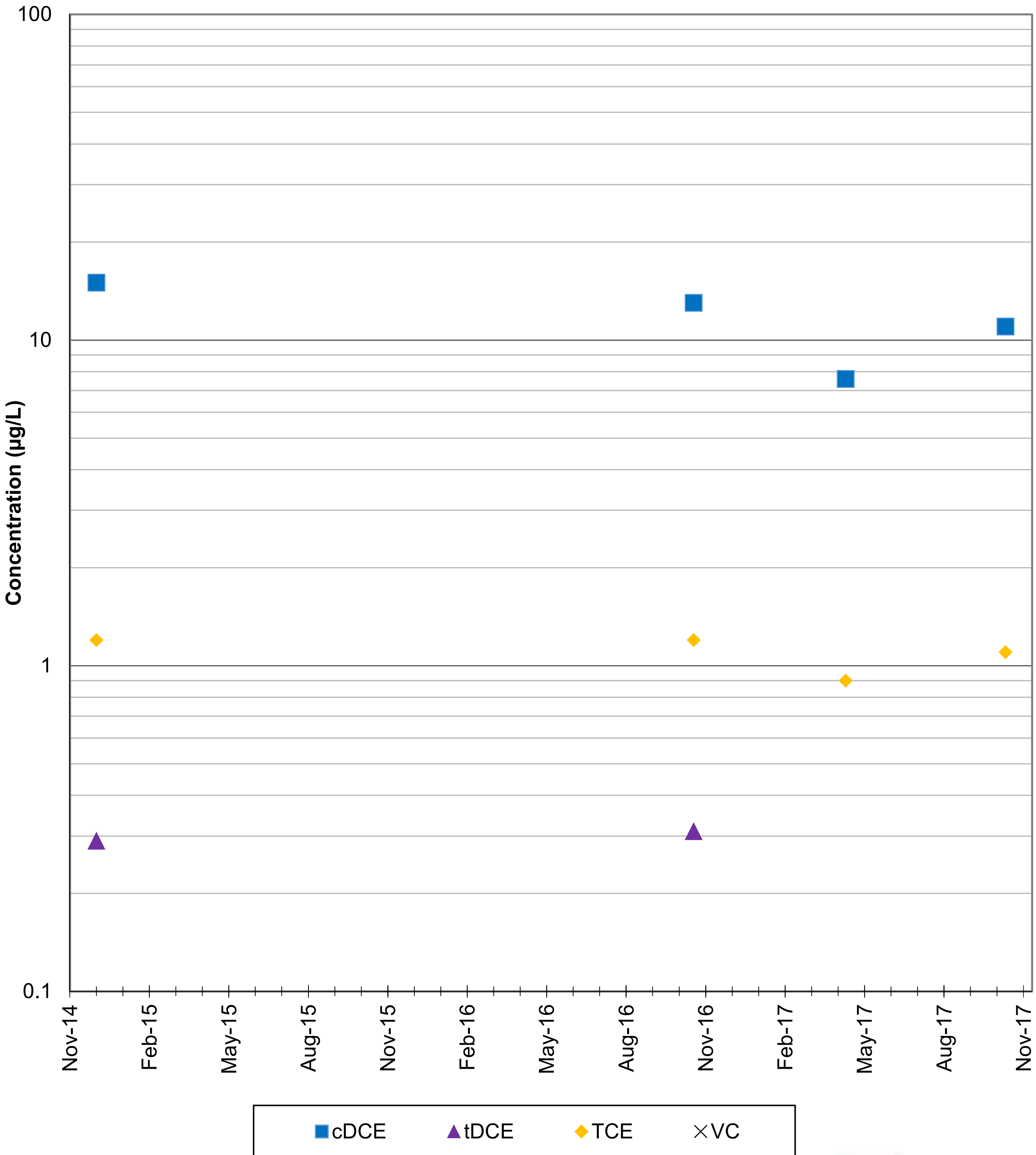
CEP.612/65685
FEBRUARY 2018

O'BRIEN & GERE ENGINEERS, INC.

PLOTDATE: 02/15/18 2:59:04 PM Freyerpa

\\syracusesvr\projects\Ge-Cep.612\STDS\GIS\Cayuga-Site\MXD\GW_SW_Summary_Rpt\NPL_AREA_3_SAMPLE_LOCATIONS_DB.mxd

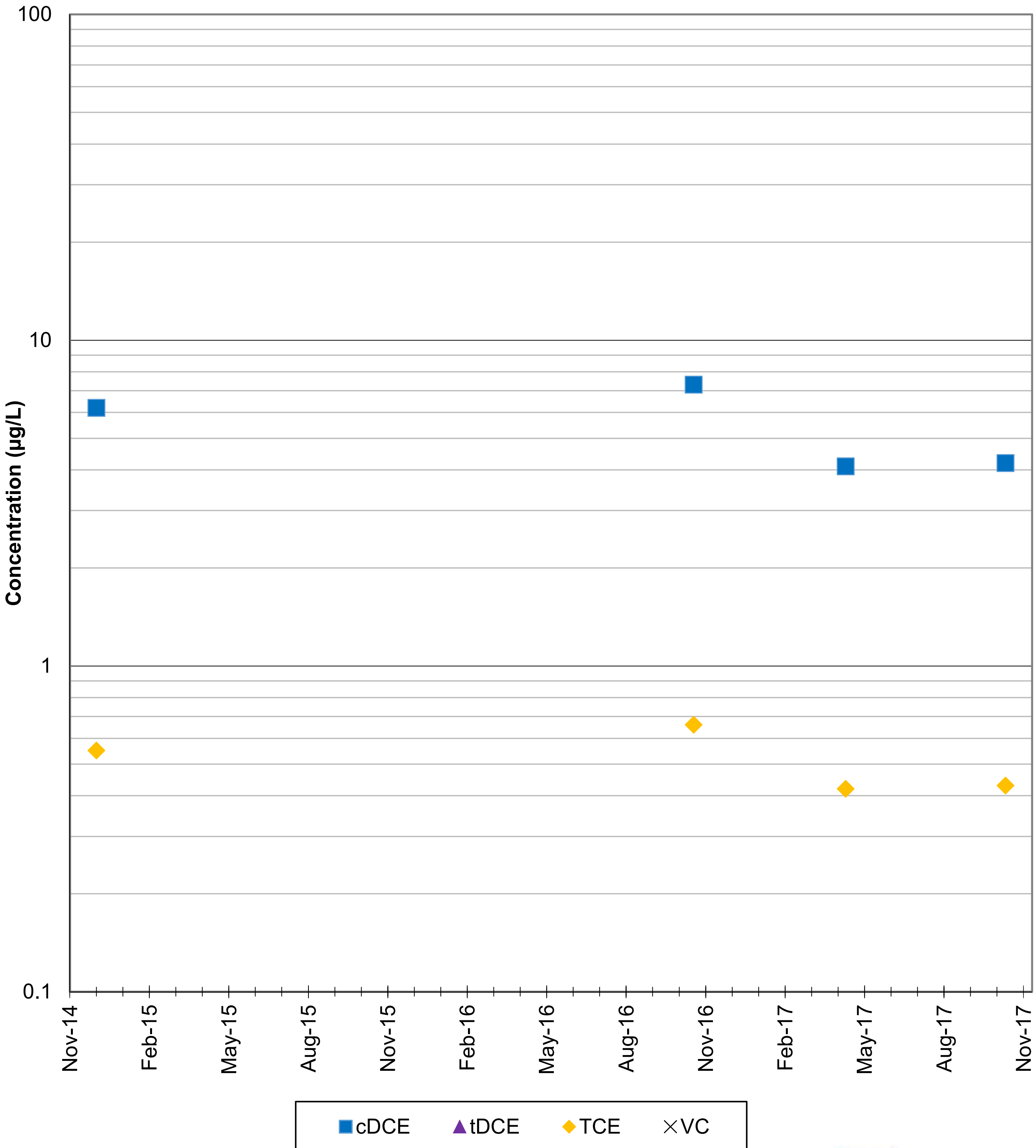
Figure 7a
Trend Graph for Surface Water Location US-05
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

OBG

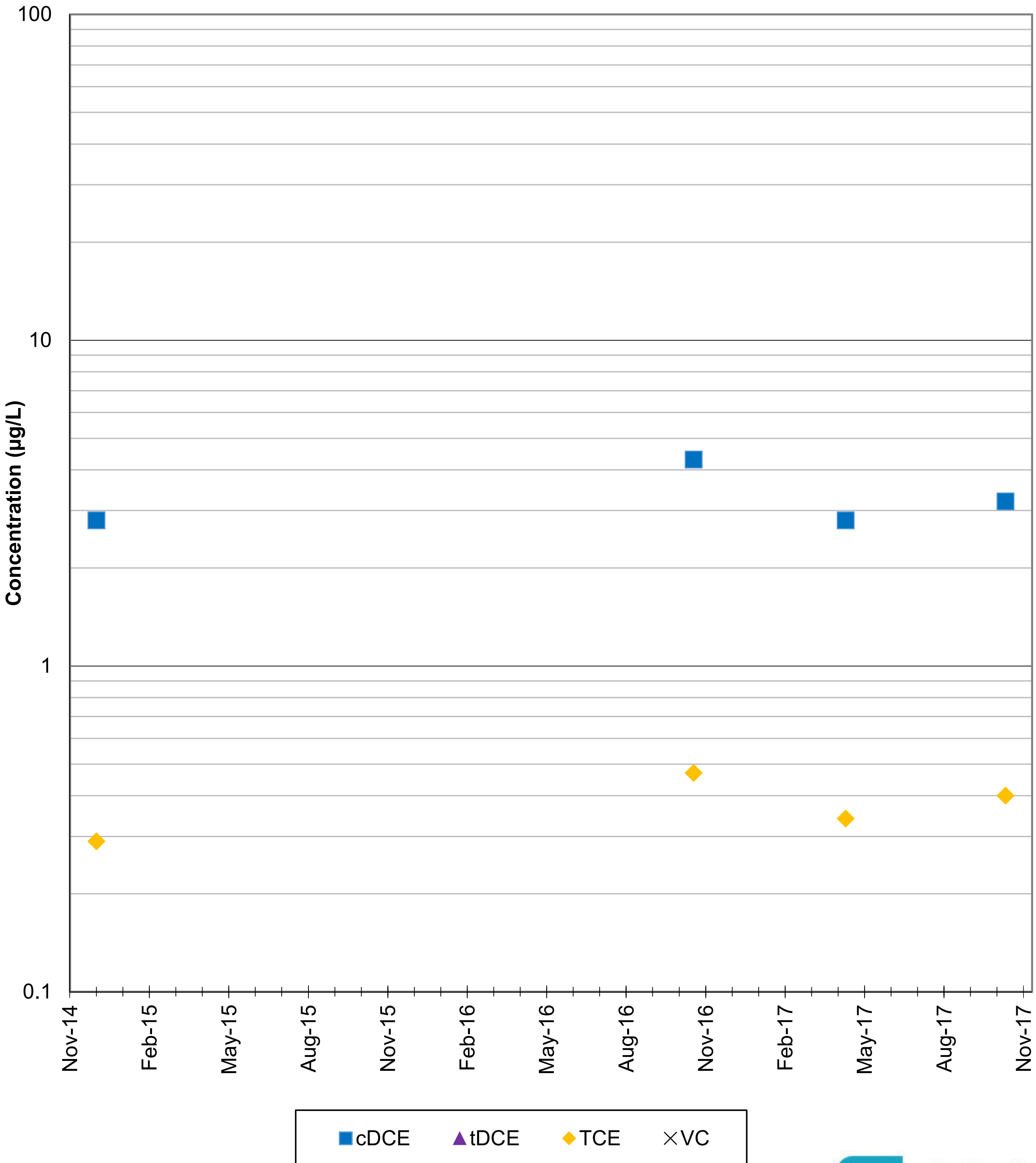
Figure 7b
Trend Graph for Surface Water Location US-06
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

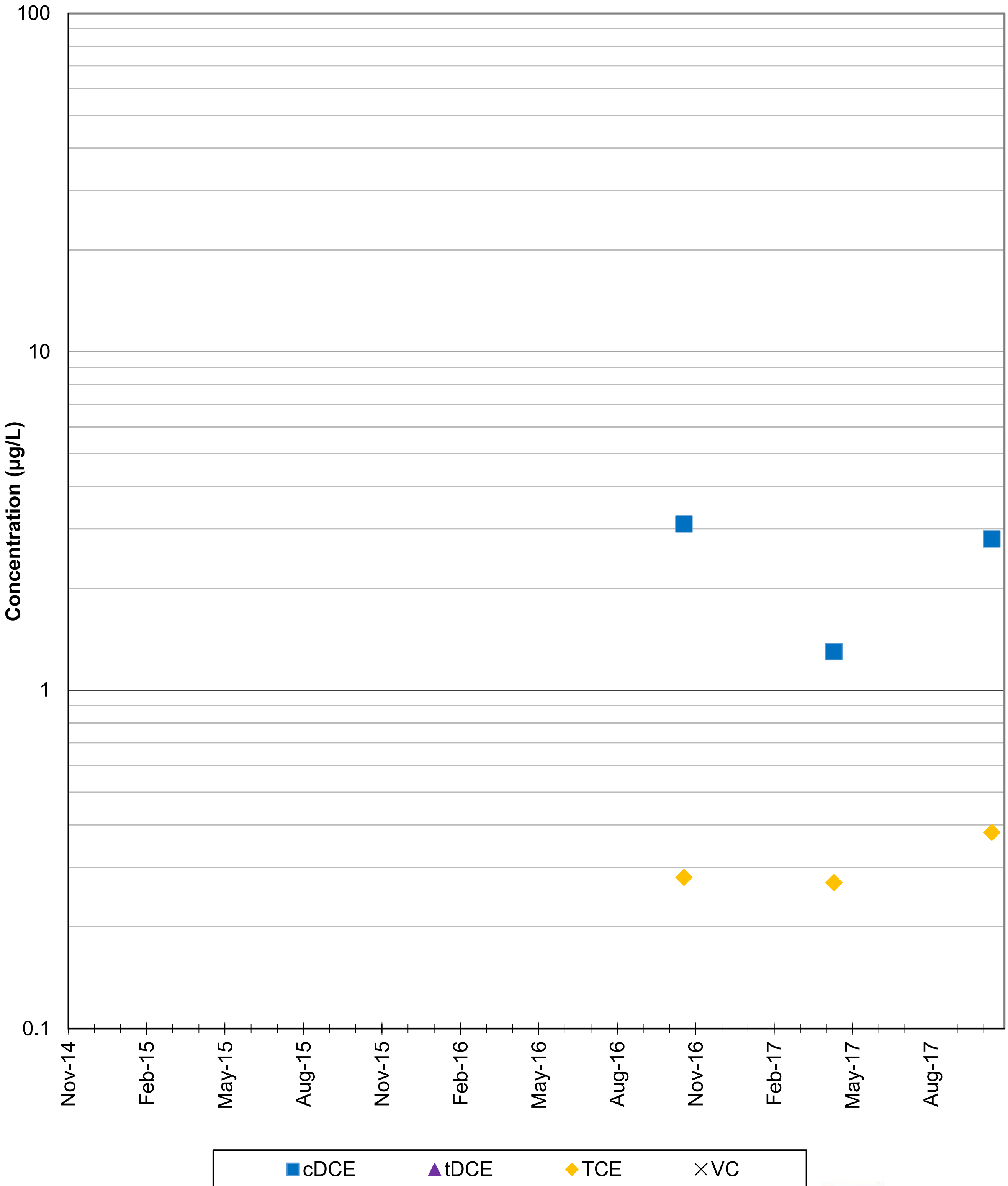
OBG

Figure 7c
Trend Graph for Surface Water Location US-08
Cayuga County Groundwater Contamination Superfund Site



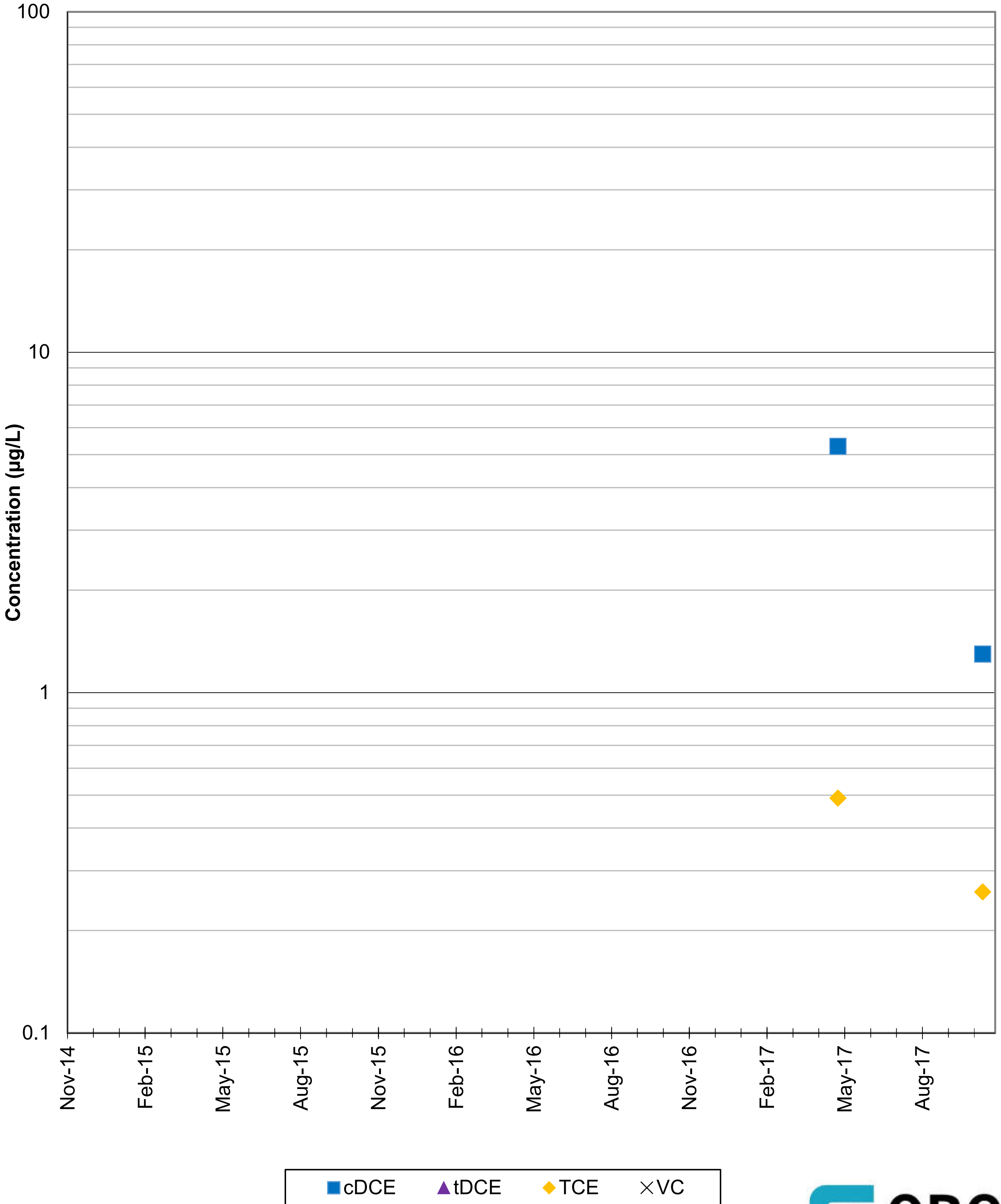
For clarity, non-detects are not shown

Figure 8a
Trend Graph for Monitoring Well RESWELL-5
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

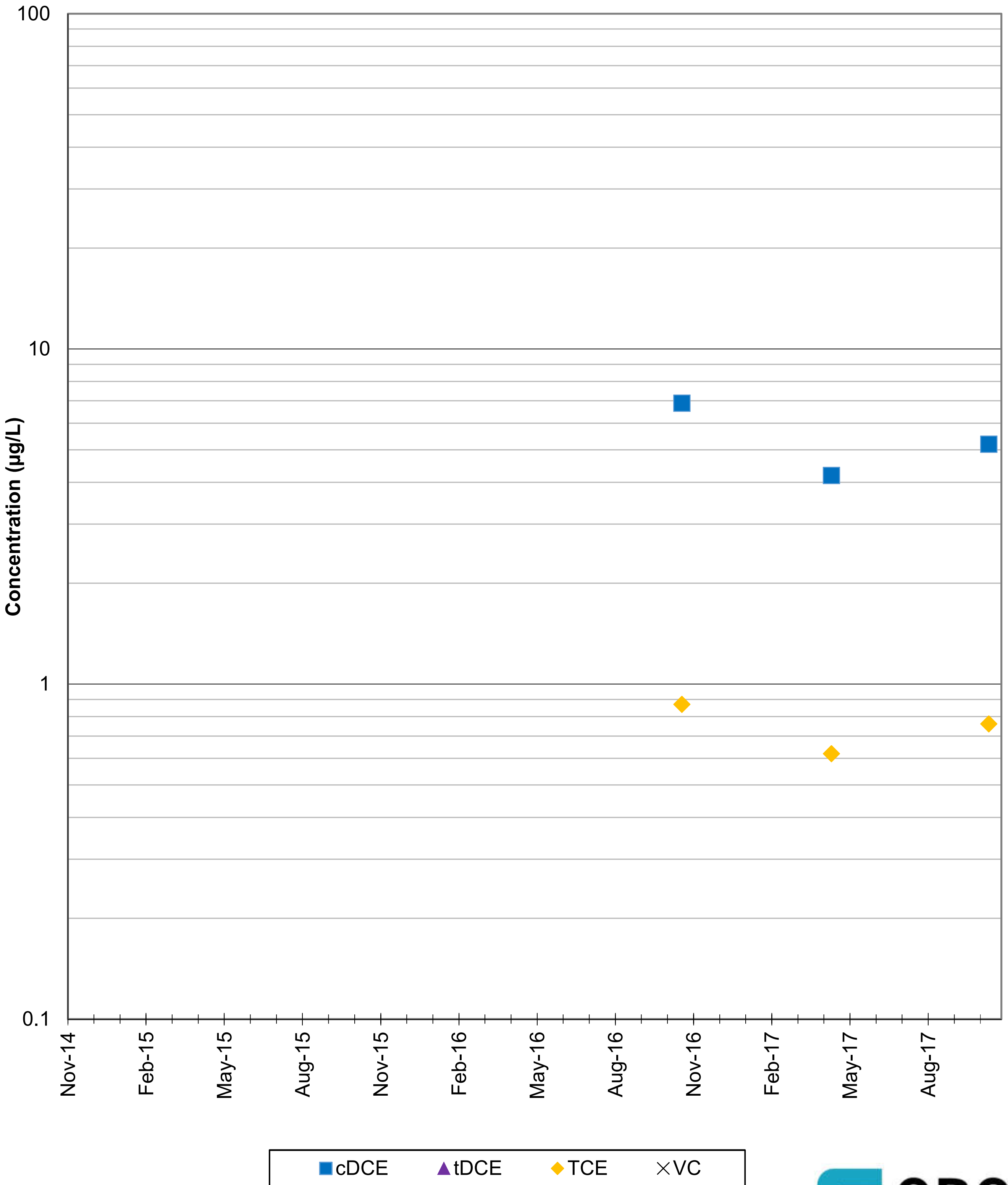
Figure 8b
Trend Graph for Monitoring Well RESWELL-6
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

OBG

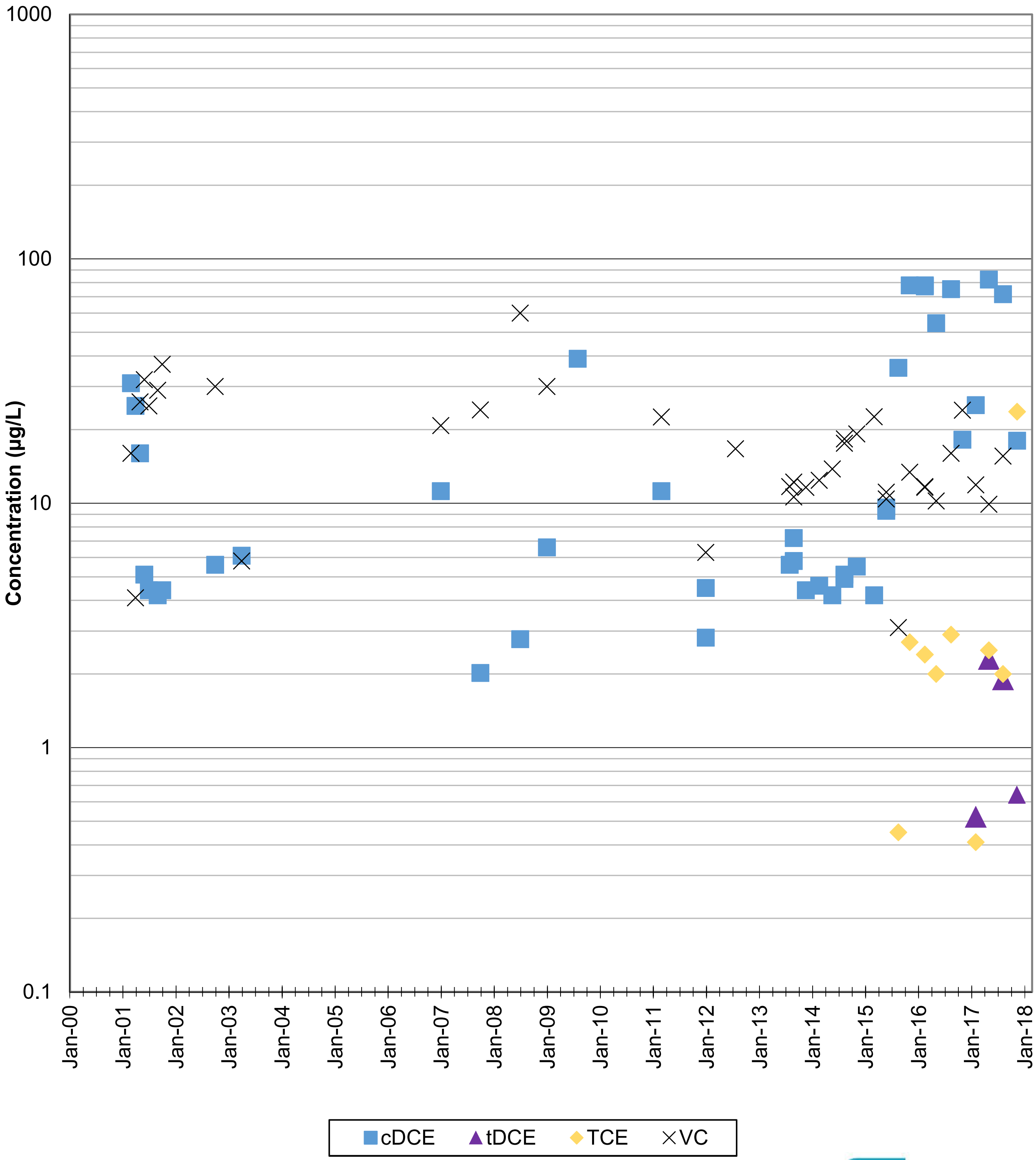
Figure 8c
Trend Graph for Monitoring Well RESWELL-7
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

OBG

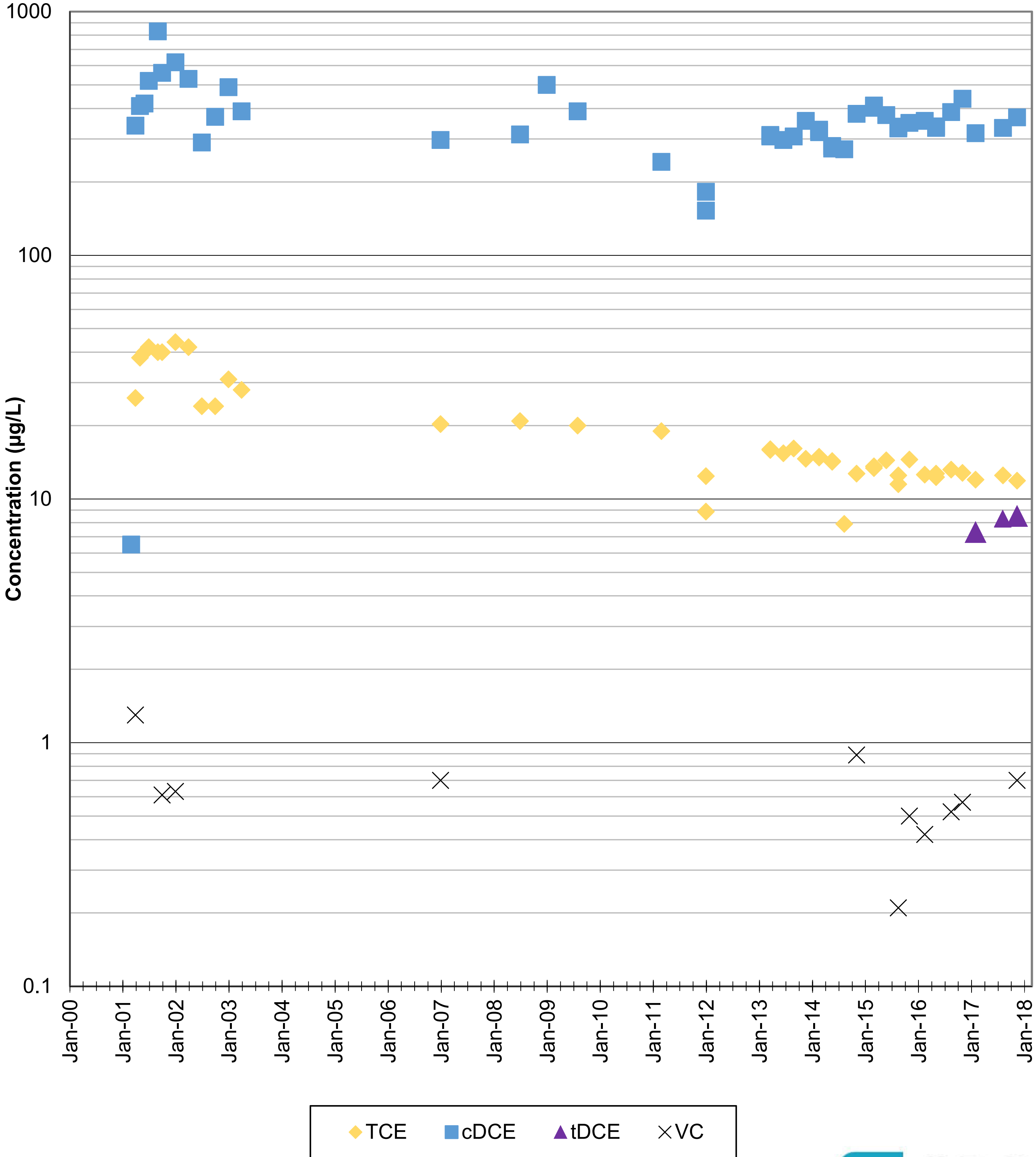
Figure 9a
Trend Graph for POET System Influent at Property 1
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

OBG

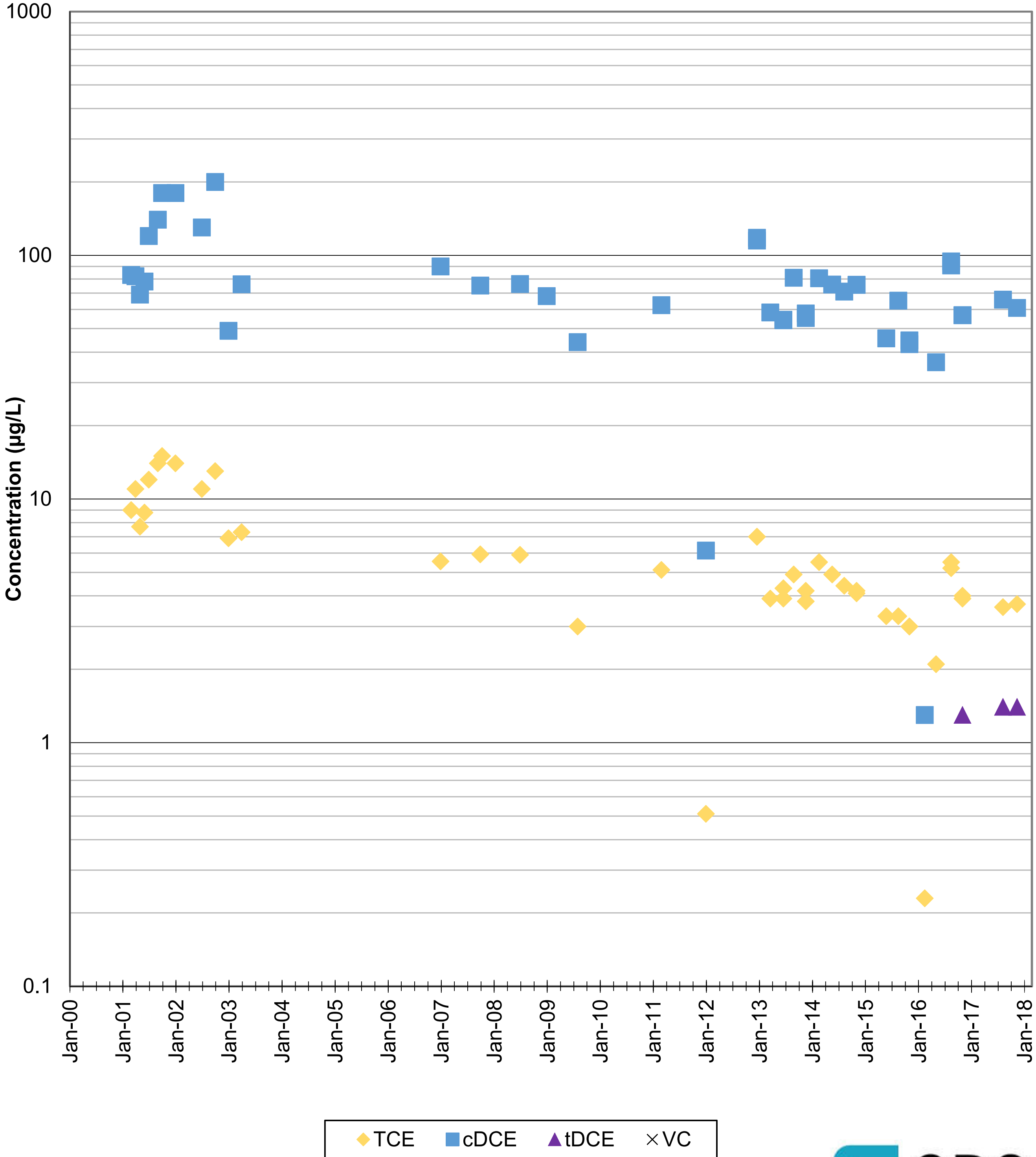
Figure 9b
Trend Graph for POET System Influent at Property 2
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

OBG

Figure 9c
Trend Graph for POET System Influent at Property 3
Cayuga County Groundwater Contamination Superfund Site



For clarity, non-detects are not shown

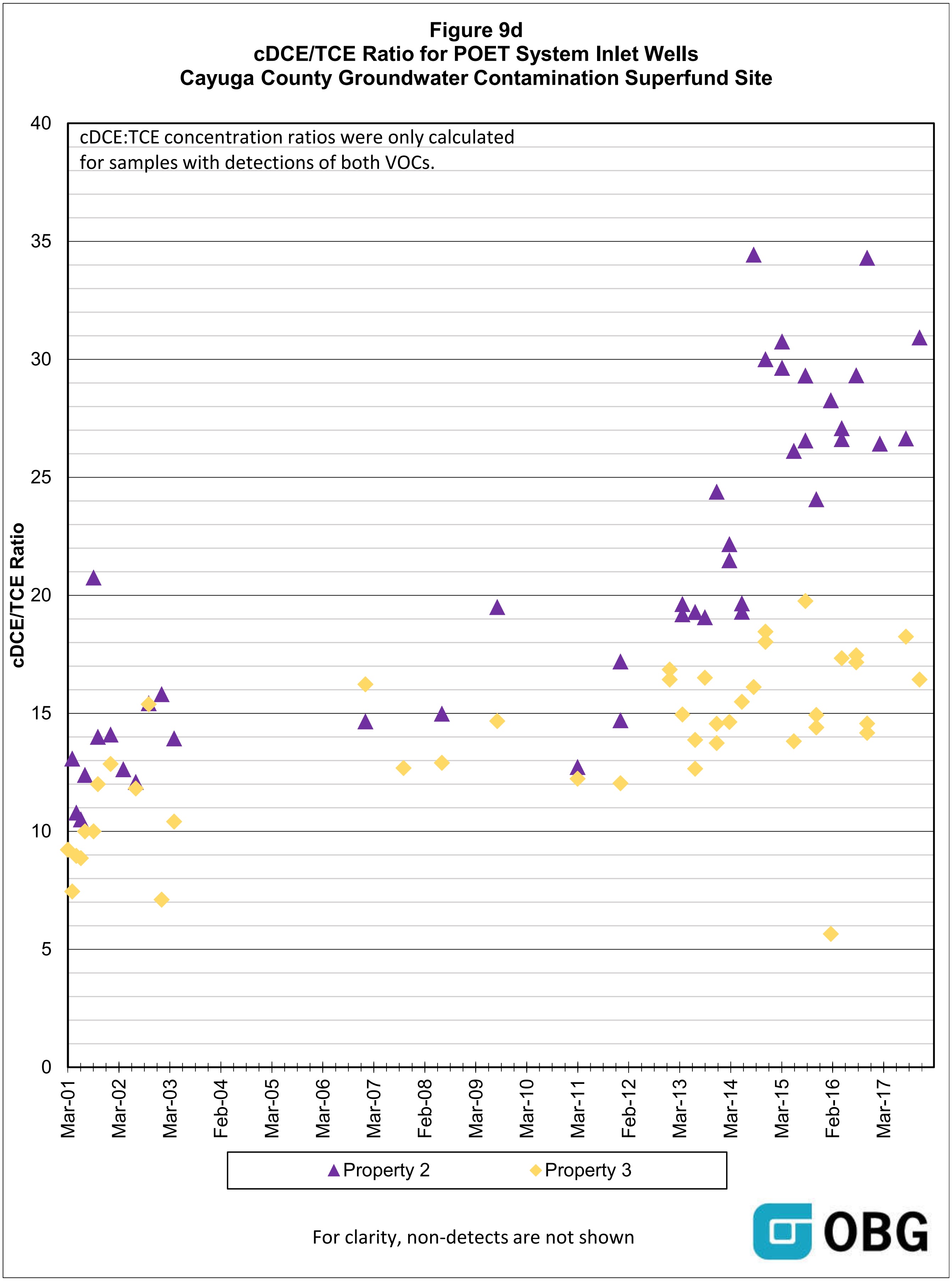


Figure 9d
cDCE/TCE Ratio for POET System Inlet Wells
Cayuga County Groundwater Contamination Superfund Site
cDCE:TCE concentration ratios were only calculated
for samples with detections of both VOCs.
cDCE/TCE Ratio
0
5
10
15
20
25
30
35
40
Mar-01
Mar-02
Mar-03
Feb-04
Mar-05
Mar-06
Mar-07
Feb-08
Mar-09
Mar-10
Mar-11
Feb-12
Mar-13
Mar-14
Mar-15
Feb-16
Mar-17
Property 2
Property 3
For clarity, non-detects are not shown
OBG

Figure 10a
Trend Graph for Village of Union Springs Supply Wells
Cayuga County Groundwater Contamination Superfund Site

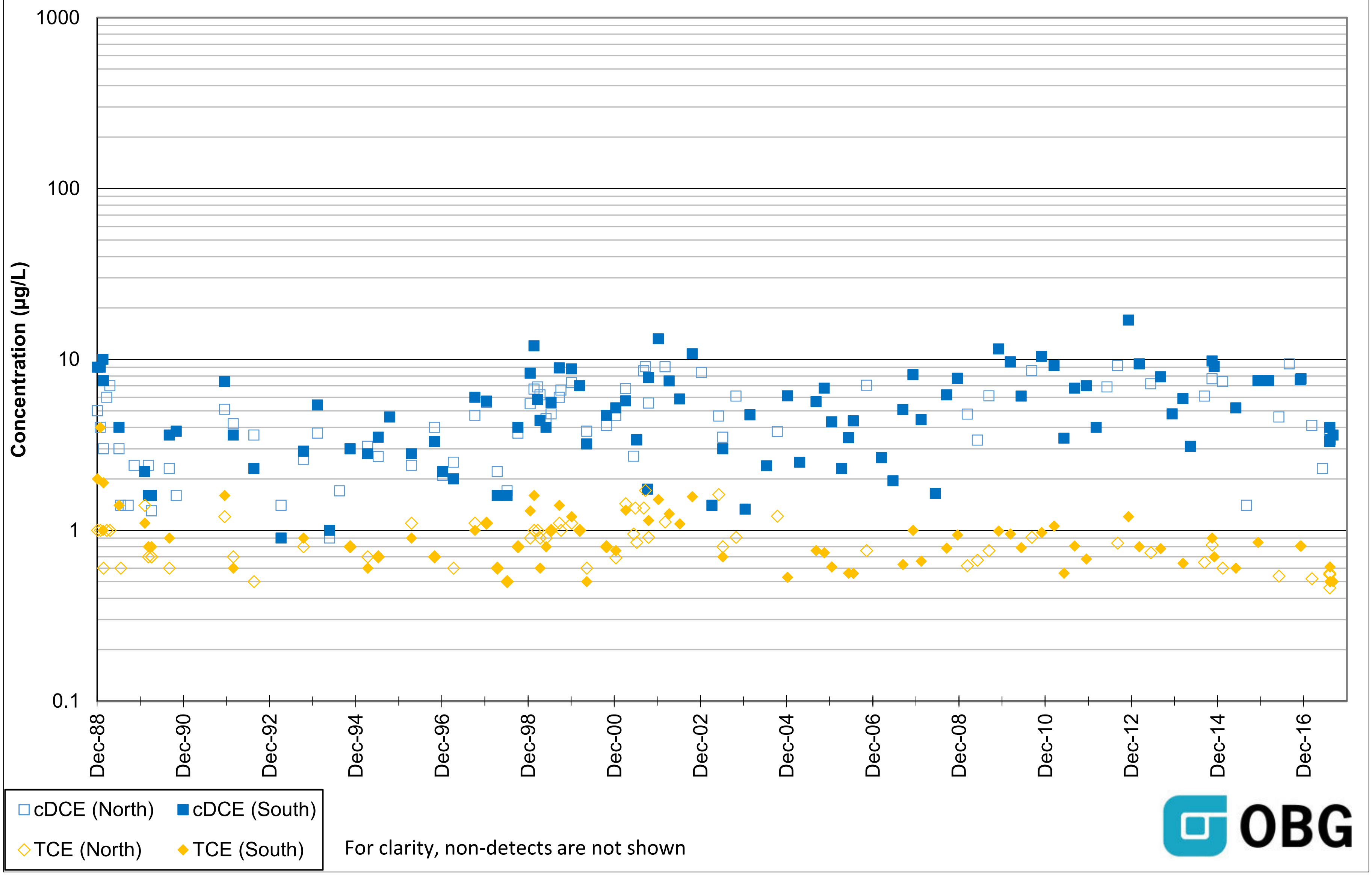
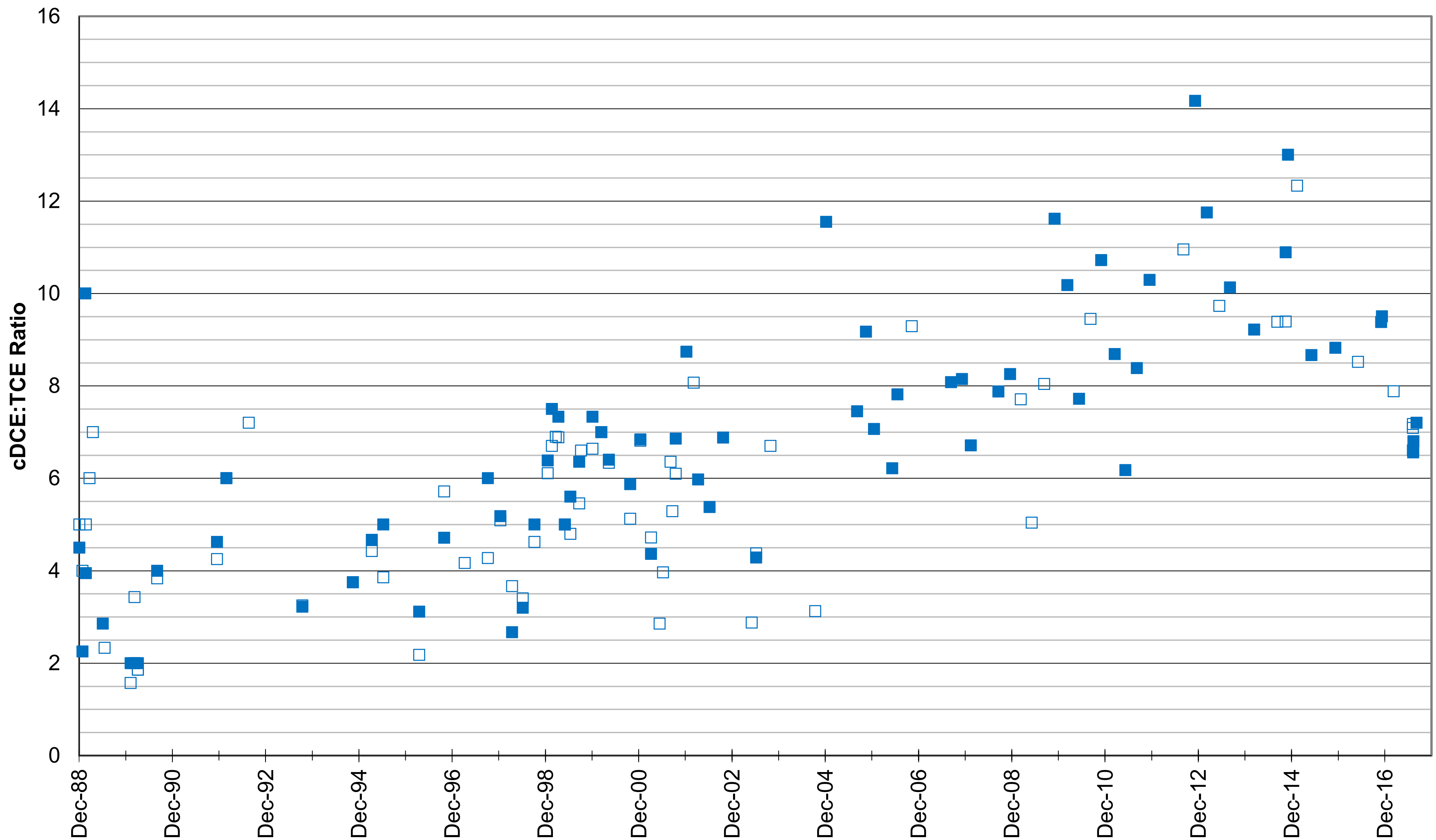


Figure 10b
cDCE:TCE Ratio for Village of Union Springs Supply Wells
Cayuga County Groundwater Contamination Superfund Site



North Well ■ South Well

For clarity, non-detects are not shown

OBG

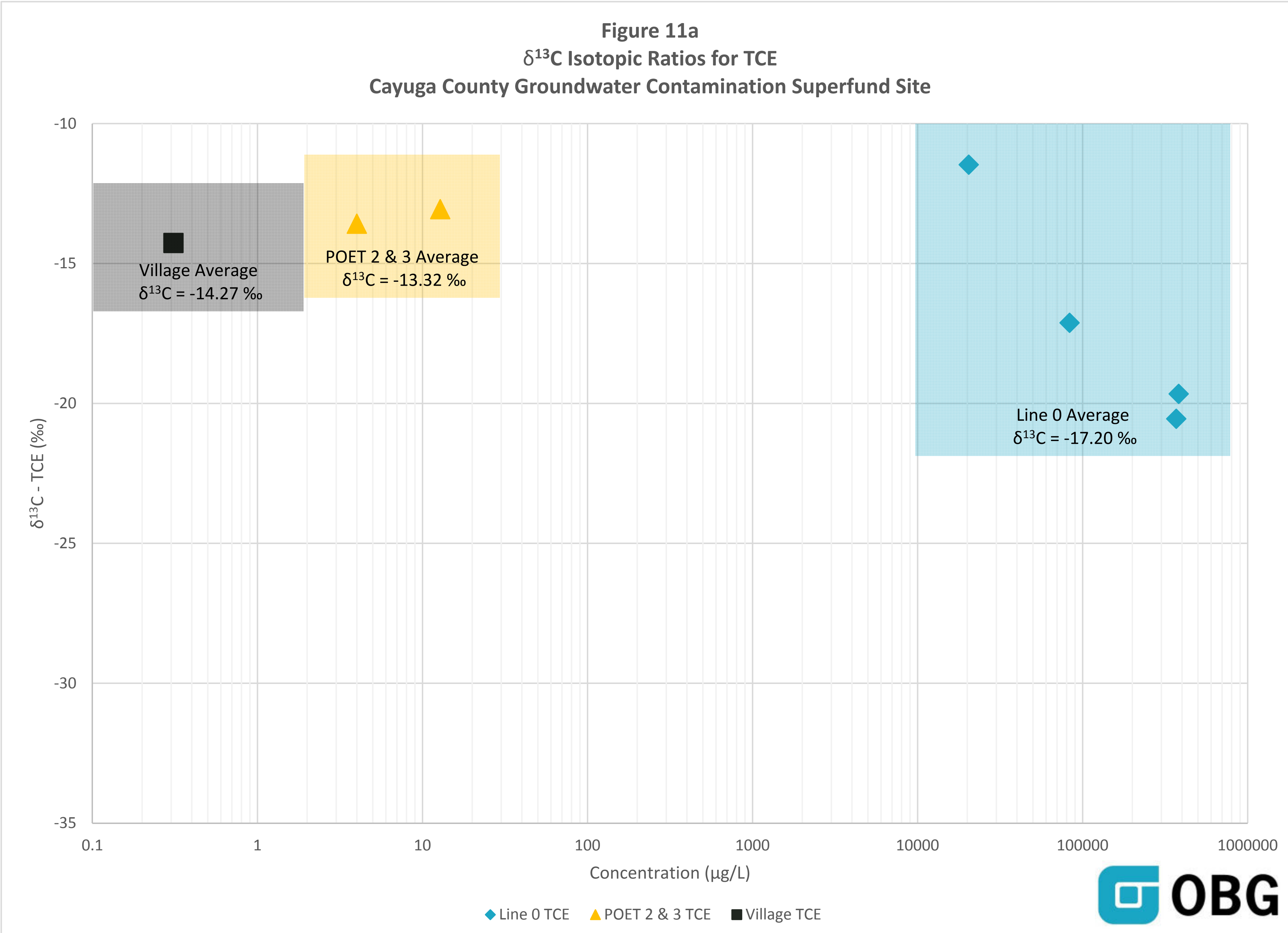


Figure 11a
δ13C Isotopic Ratios for TCE
Cayuga County Groundwater Contamination Superfund Site
-10
-15
-20
-25
-30
-35
δ13C - TCE (‰)
Village Average
δ13C = -14.27 ‰
POET 2 & 3 Average
δ13C = -13.32 ‰
Line 0 Average
δ13C = -17.20 ‰
0.1
1
10
100
1000
10000
100000
1000000
Concentration (μg/L)
Line 0 TCE
POET 2 & 3 TCE
Village TCE
OBG

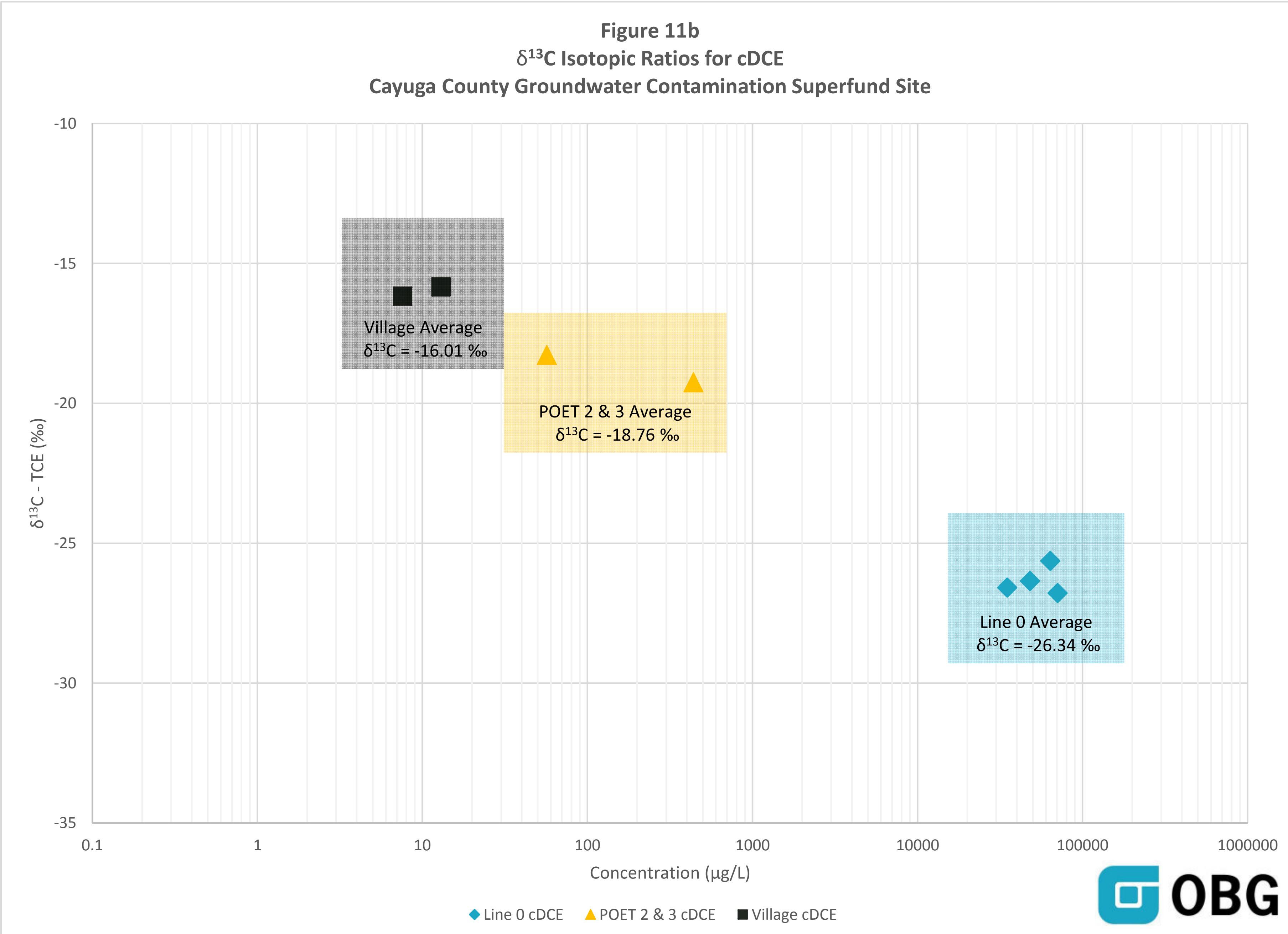


Figure 11b
δ13C Isotopic Ratios for cDCE
Cayuga County Groundwater Contamination Superfund Site
-10
-15
-20
-25
-30
-35
δ13C - TCE (‰)
Village Average
δ13C = -16.01 ‰
POET 2 & 3 Average
δ13C = -18.76 ‰
Line 0 Average
δ13C = -26.34 ‰
0.1
1
10
100
1000
10000
100000
1000000
Concentration (µg/L)
Line 0 cDCE
POET 2 & 3 cDCE
Village cDCE
OBG

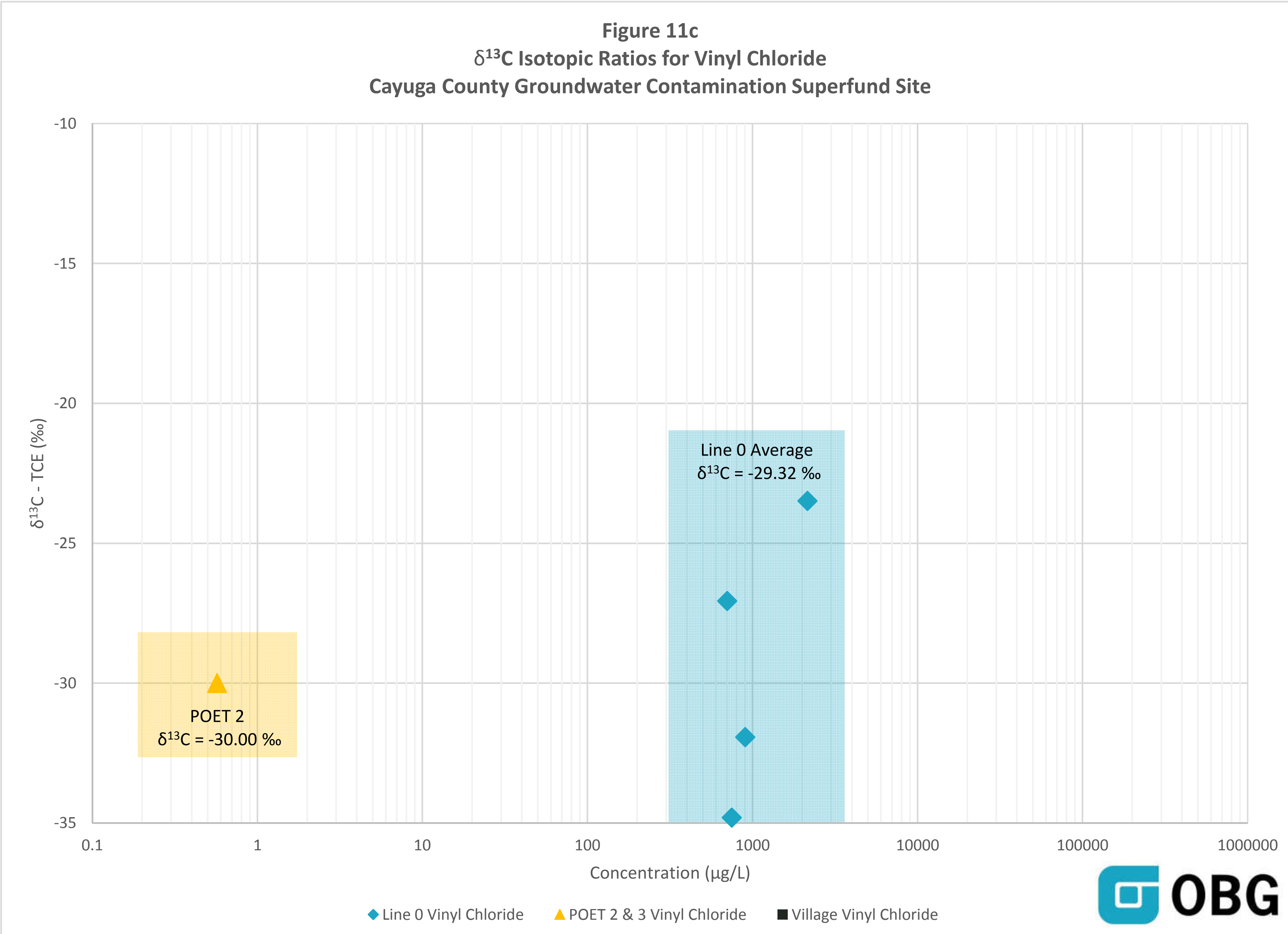
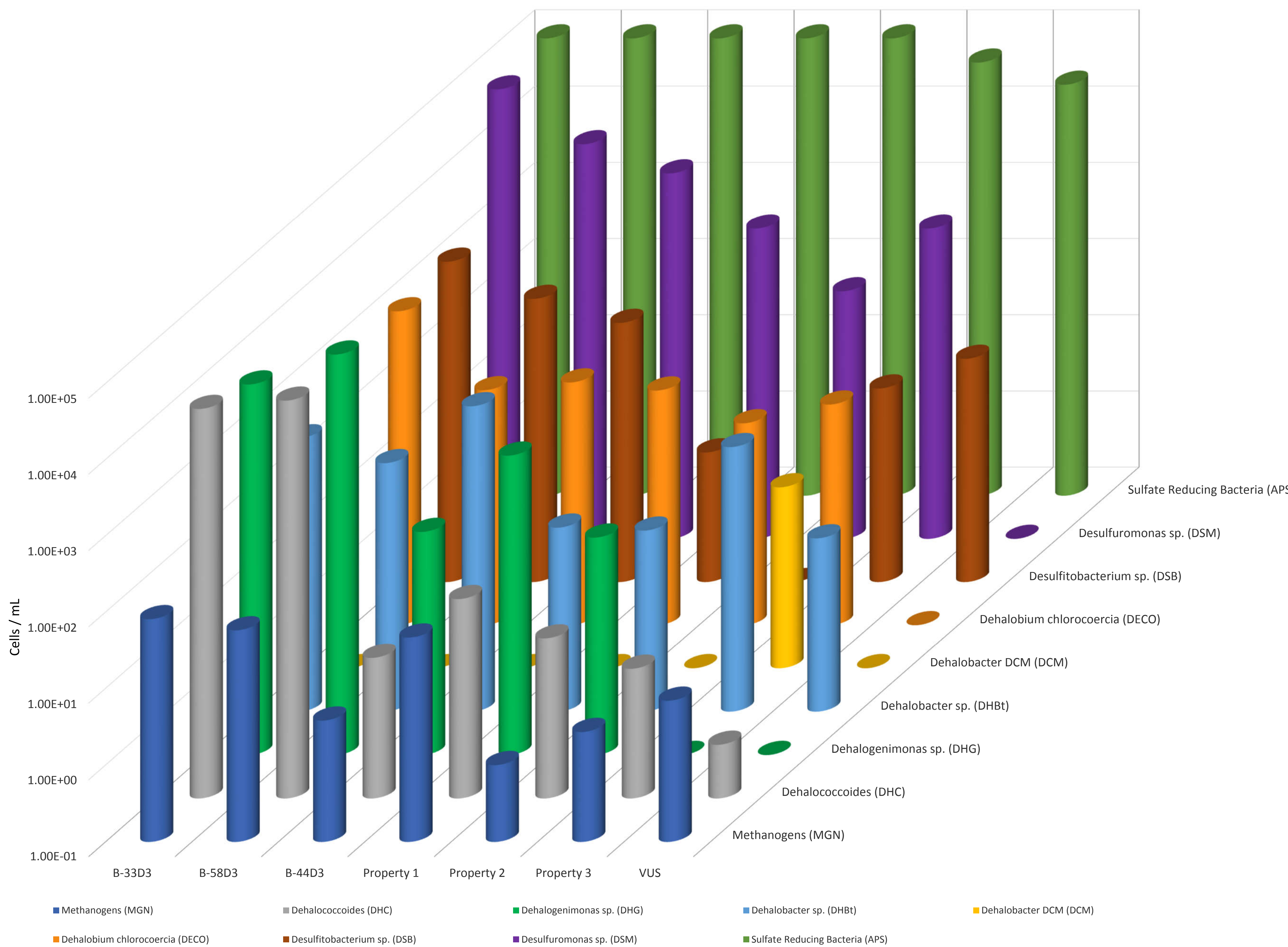


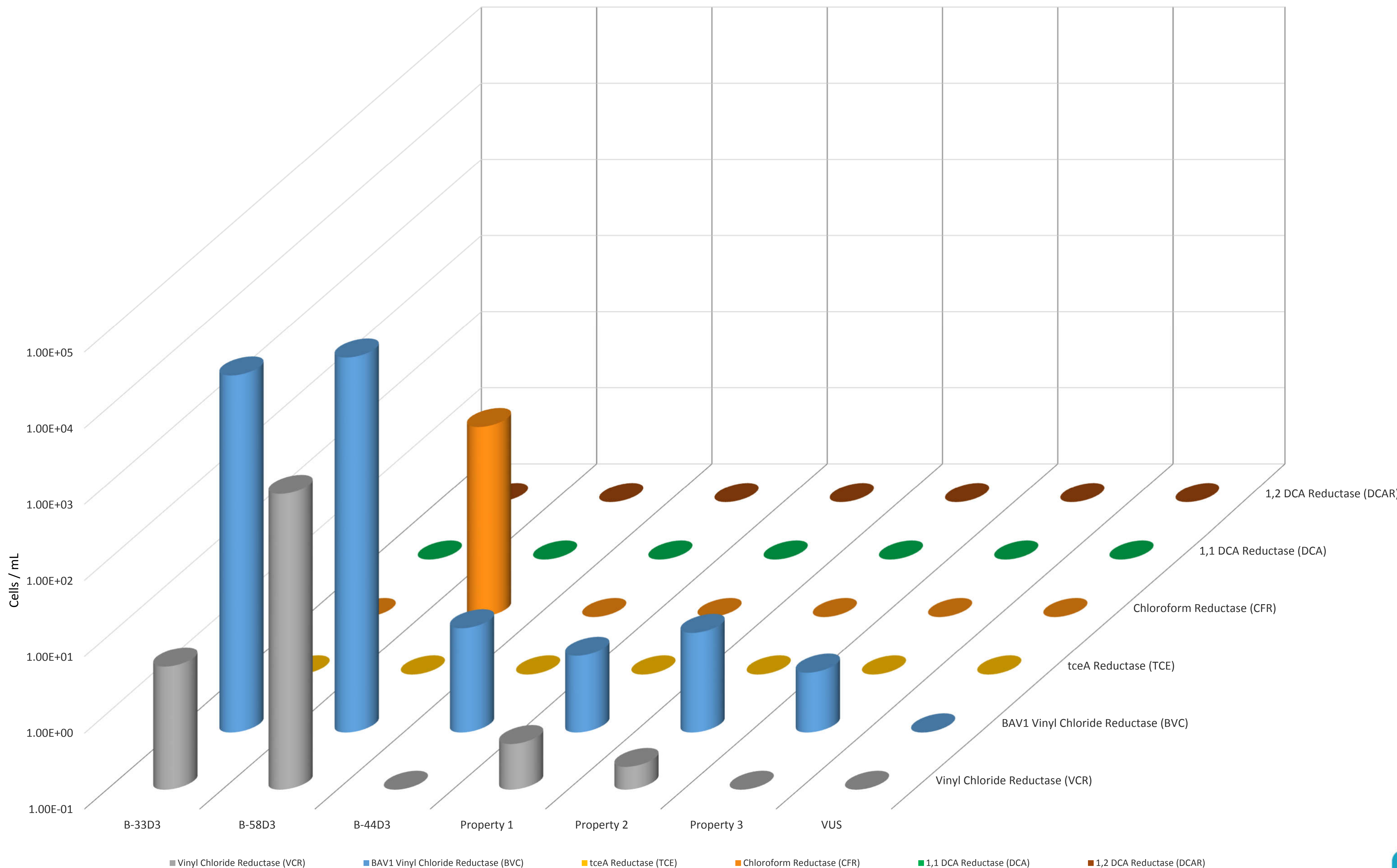
Figure 11c
δ13C Isotopic Ratios for Vinyl Chloride
Cayuga County Groundwater Contamination Superfund Site
-10
-15
-20
-25
-30
-35
δ13C - TCE (‰)
0.1
1
10
100
1000
10000
100000
1000000
Concentration (µg/L)
Line 0 Average
δ13C = -29.32 ‰
POET 2
δ13C = -30.00 ‰
Line 0 Vinyl Chloride
POET 2 & 3 Vinyl Chloride
Village Vinyl Chloride
OBG

Figure 12a
Microbiological Analysis Results
Bacteria Groups
Cayuga County Groundwater Contamination Superfund Site



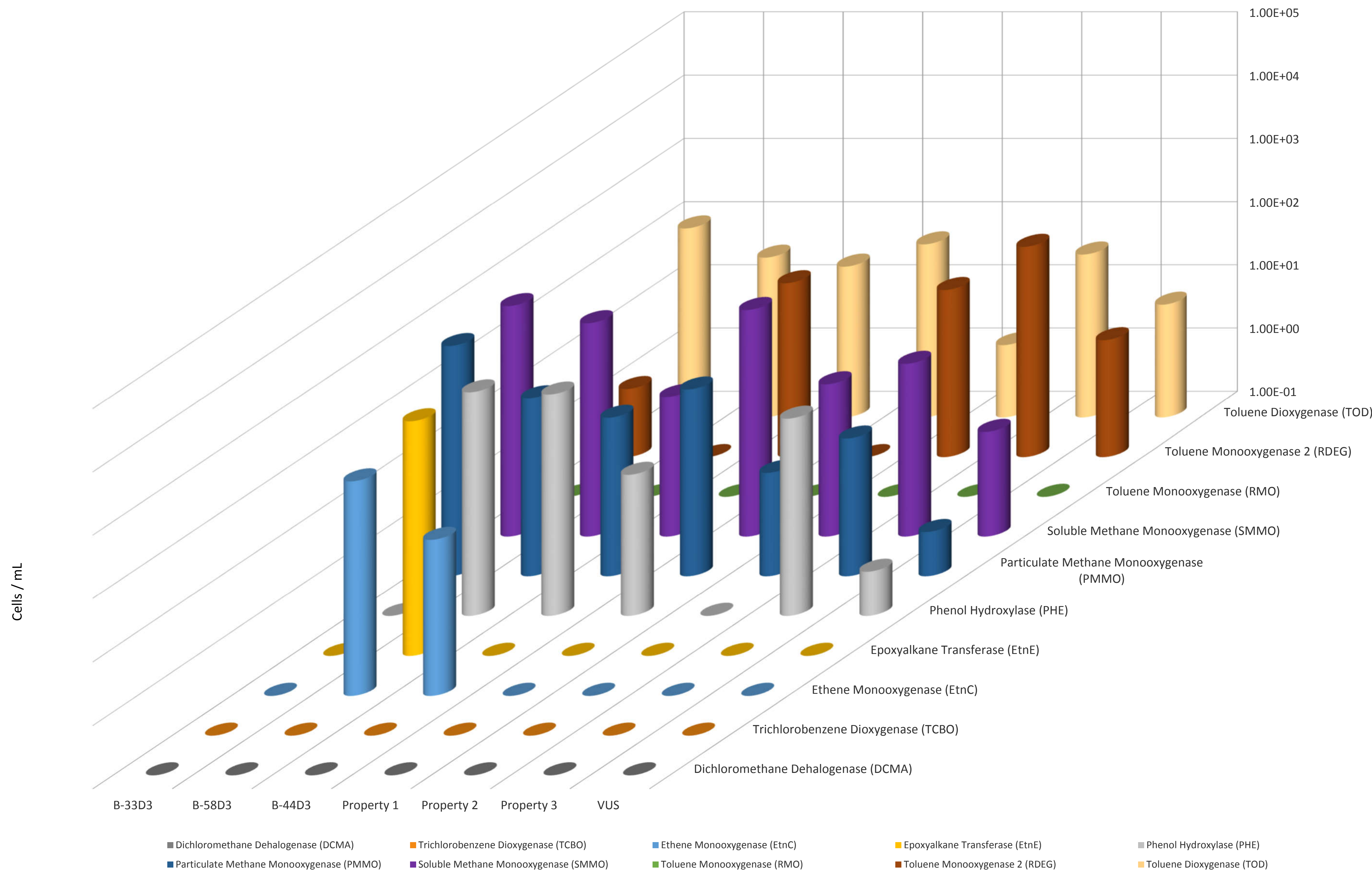
OBG

Figure 12b
Microbiological Analysis Results
Reductive Dechlorination Enzymes
Cayuga County Groundwater Contamination Superfund Site



OBG

Figure 12c
Microbiological Analysis Results
Metabolic / Cometabolic Enzymes
Cayuga County Groundwater Contamination Superfund Site



OBG

OBG

THERE'S A WAY