FOURTH FIVE-YEAR REVIEW REPORT FOR
Commodore Semiconductor Group Superfund Site
Montgomery County, Pennsylvania

Prepared by

U.S. Environmental Protection Agency
Region III
Philadelphia, Pennsylvania

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Date

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Table of Contents

Tables

Figures

Appendices

LIST OF ABBREVIATIONS & ACRONYMS

AOC	Administrative Order by Consent
AGC	Advanced GeoServices Corporation
ARAR	Applicable or Relevant and Appropriate Requirement
AWC	Audubon Water Company
CBM	Commodore Business Machines
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	Contaminant of Concern
CSG	Commodore Semiconductor Group
EPA	United States Environmental Protection Agency
ERM	Environmental Resources Management
ESD	Explanation of Significant Differences
ET	Enhanced Treatment
FD	French Drain System and Sump
FS	Feasibility Study
GWRTS	Groundwater Recovery and Treatment System
FYR	Five-Year Review
ICs	Institutional Controls
ISCO	In-Situ Chemical Oxidation
MCHD	Montgomery County Health Department
MCLs	Maximum Contaminant Levels
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
PA	Preliminary Assessment
PADEP	Pennsylvania Department of Environmental Protection
PCE	Tetrachloroethene or Perchloroethene
PCOR	Preliminary Closeout Report
POTW	Publicly Owned Treatment Works
PPB	Part Per Billion
PRP	Potentially Responsible Party
PSV	Plume Stability Verification
RA	Remedial Action
RD	Remedial Design
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act of 1986
SDWA	Safe Drinking Water Act

SI	Site Inspection
SMCL	Secondary Maximum Contaminant Level
TCE	Trichloroethene
TCL	Target Compound List
USACE	U.S. Army Corps of Engineers
UU/UE	Unlimited Use and Unrestricted Exposure
VE	Vapor Extraction
VI	Vapor Intrusion
VISL	Vapor Intrusion Screening Level
VFCC	Valley Forge Corporate Center
VOC	Volatile Organic Contaminant
WTU	Wellhead Treatment Unit

I. INTRODUCTION

The purpose of a Five-Year Review (FYR) is to evaluate the implementation and performance of a remedy in order to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in five-year review reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the Fourth FYR for the Commodore Semiconductor Group (CSG) Superfund Site (Site). The triggering action for this policy review is the completion date of the previous FYR dated August 28, 2015. This Fourth FYR has been prepared because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of two Operable Units (OUs), both of which will be addressed in this FYR. Operable Unit 1 (OU1) consists of a water line extension which supplied a permanent source of clean drinking water to residences. Operable Unit 2 (OU2) consists of a Groundwater Recovery and Treatment System (GWRTS) to address groundwater contamination. The Potentially Responsible Party (PRP) has used voluntary Enhanced Treatment (ET) technologies to expedite groundwater treatment.

This FYR was led by Sharon Fang, EPA Region III Remedial Project Manager (RPM). When the review began on June 27, 2019, the relevant entities, such as the PRP and the Township, were notified of its initiation. The FYR team included the following personnel:

Sharon Fang, EPA RPM
Mark Leipert, EPA hydrogeologist;
Kimberly Plank, EPA ecologist;
Martin Gelhaus, EPA toxicologist;
Alex Mandell, EPA Community Involvement Coordinator (CIC)
Yvette Hamilton-Best, EPA counsel; and
Josh Crooks, Pennsylvania Department of Environmental Protection (PADEP).

Site Background

The Site is located at 950 Rittenhouse Road, Norristown, Lower Providence Township, Montgomery County, Pennsylvania. Commodore Business Machines (CBM) previously operated a semiconductor manufacturing business at the Site in a 147,000 square foot building located on a 14.1-acre parcel within the Park Pointe business park, formerly known as the Valley Forge Corporate Center (VFCC). The property is bordered on the northwest by Rittenhouse Road, on the northeast by Van Buren Avenue and on the southeast by Adams Avenue. The Transcontinental Gas Company (Transco) Pipeline, which includes three natural gas pipes,

transverses the property. The Site includes the 14.1-acre parcel as well as surrounding property beneath which contaminated groundwater has come to be located. See Figure 1- Site Location Map.

Aerial photographs indicate that development of the business park began in 1959 and has a mix of land uses including industrial and commercial office space. The CBM property was developed in 1970. In 1985, CBM completed construction of a building addition on the northeastern portion of the Site, adjacent to Van Buren Avenue. The two-story building addition included an approximately 28,000 square foot by 20 foot deep basement that extended into the shallow bedrock. The basement has a sub-slab, French drain system to capture and prevent shallow perched groundwater from entering the basement. CBM conducted operations at the Site, consisting of manufacturing semiconductor chips until 1993. In 1994, GMT Microelectronics, Inc. acquired the Site, and its process technology and equipment, to produce integrated microelectronic circuits. GMT Microelectronics, Inc. discontinued its operation in 2000 and abandoned all its assets, including the Site. Currently, the property is owned by a private party who anticipates redeveloping the property. The former CSG building is currently unoccupied. Land use in the immediate vicinity of the Site has not changed significantly since 1992. However, the business park has high occupancy and the area immediately outside the business park has become much more developed over the past ten years.

The Site is located in a gently rolling terrain in the Schuylkill River Drainage Basin. The Schuylkill River is approximately one mile south of the Site. Regional surface water drainage near the Site is directed to the south and southwest toward the Schuylkill River via tributary systems. Local surface drainage in the vicinity is to the south or west, while actual Site runoff is collected and discharged through the storm water system to Lamb Run, a small tributary of the Schuylkill River. There are no known endangered species or critical habitats within the immediate vicinity of the Site. The golf course at the Club at Shannondell, formerly known as the Washington Golf Course, occupies the property immediately west of the facility on Rittenhouse Road. This property has been permanently preserved as public open space. Residential land use exists within a ½ mile of the Site in all directions.

Groundwater is the only source of potable water in the area of the Site for both residents and businesses. EPA has classified this aquifer as a Class IIA aquifer, a current source of drinking water. This aquifer is located in a Groundwater Protected Area of Southeastern Pennsylvania as designated by the Delaware River Basin Commission. Groundwater movement and the migration of the Site-related contaminants are influenced by the pumping of the nearby bedrock public water supply wells. The regional groundwater flow is to the southeast: however, groundwater in the vicinity of the Site appears to move south-southwest as well.

The Audubon Water Company (AWC) has been the primary supplier of public water to homes and businesses in the vicinity of the Site. Several of the AWC production wells are located within ½ mile radius of the Site. AWC treats groundwater prior to distribution. Based on the population and development of the area, pumping of the bedrock aquifer will likely continue in the future.

There are residential wells in use within ½ mile of the Site. Most of the residences on Rittenhouse Road are connected to the public water supply; however, there were some homeowners who did not accept the connection to public water. The PRP provided carbon

treatment units to those homeowners who are now responsible for maintaining the carbon filter units. Further to the southwest of the Site on Apple Valley Lane there are private wells in use. According to AWC, a couple homes in the Apple Valley Lane area recently connected to public water due to bank financing requirements. Groundwater monitoring data indicates that these private wells are located beyond the Site plume. Also, according to AWC, there have been some changes in residential groundwater use near Egypt and Rittenhouse Roads, which is upgradient of the Site.

TABLE 1
FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site Name: Commodore Semiconductor Group Superfund Site		
EPA ID: PAD093730174		
Region: 3	**State:** PA	**City/County:** Lower Providence Township, Montgomery County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name (Federal Remedial Project Manager): Sharon Fang		
Author affiliation: EPA		
Review period: 6/27/2019 - Click here to enter a date		
Date of site inspection: September 11, 2019		
Type of review: Policy		
Review number: 4		
Triggering action date: August 28, 2015		
Due date *(five years after triggering action date)*: August 28, 2020		

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

In 1978, AWC detected trichloroethene (TCE) in two of its wells located near the Site. The Pennsylvania Department of Environmental Resources (PADER), now known as the PADEP, identified the CSG facility as a possible TCE source.

Groundwater sampling, documented in the 1993 Remedial Investigation/ Feasibility (RI/FS) report, identified Volatile Organic Compounds (VOCs), primarily TCE and its breakdown products, in the bedrock groundwater beneath the CSG property and portions of the Township above maximum contaminant levels (MCLs). VOC concentrations detected in onsite soil and in surface water were below risk-based screening levels and therefore did not represent a risk. The RI/FS Report explained that the ingestion of, and contact with, contaminated groundwater posed the primary risk to human health from the Site.

The site's Record of Decision (ROD) identifies the following Contaminants of Concern (COCs) in groundwater at the Site: Bromodichloromethane, Chloroform, 1,2 Dichlorobenzene, 1,4 Dichlorobenzene, 1,1 Dichloroethane, 1,2 Dichloroethane, 1,1 Dichloroethene, 1,2 Dichloroethene, Tetrachloroethene, 1,1,1 Trichloroethane, Trichloroethene, and Vinyl Chloride.

The Site was proposed for inclusion on the CERCLA National Priorities List (NPL) in January 1987. The EPA finalized the listing of the Site on the NPL on October 4, 1989.

Response Actions

In the fall of 1979, CSG underground tanks and surrounding contaminated soil were excavated. Sampling for TCE and tetrachloroethene (PCE) during the excavation revealed high levels of TCE and PCE in the soil directly below the underground storage tanks and in the surrounding groundwater. CBM replaced the tanks with a waste solvent collection system consisting of a tank within a lined vault. In 1981, CBM discontinued the use of TCE in its manufacturing process. At the same time, the company installed groundwater monitoring wells and began a sampling program.

Measures to reduce TCE contamination at the Site started in early January 1981. From 1981 to 1983, CBM pumped and spray irrigated water from AWC's public supply well, VFCC-4. Spray irrigation is a practice consisting of spraying contaminated water on a field and allowing VOCs to evaporate into the air. CBM obtained informal state approval for the spray irrigation system, but did not operate the system under a PADER permit.

In February 1984, CBM purchased and installed an air stripper on VFCC-4 to be used in the treatment of contaminated groundwater. Naturally occurring elevated concentrations of dissolved salts in groundwater produced from VFCC-4 limited its use by AWC as a back-up/reserve water source. In 1984, CBM began a residential sampling program and installed whole-house carbon filter systems on 23 residences where at least 1 part per billion (ppb) of TCE was detected in the well water.

EPA's Record of Decision (ROD) for the Site was issued on September 29, 1992 and was subsequently modified by four Explanations of Significant Differences (ESDs). The ROD for the Site established the remedial action objectives (RAOs) as follows:

- to prevent current or future exposure to contaminated groundwater,
- to protect uncontaminated groundwater for current and future use, and
- to restore contaminated groundwater to MCLs or to background concentrations, if background for Site-related contaminants is lower than the MCLs.

The ROD remedy was divided into two operable units:

- OU1 – Waterline Extension focused on providing safe drinking water to the residences to prevent current or future exposure to contaminated groundwater; and
- OU2 – Groundwater Pump and Treat System addresses capturing contaminated groundwater to protect uncontaminated groundwater and the cleanup of contaminated groundwater to site cleanup standards.

Since OU2 is a long-term remedial action which requires more than five years to achieve cleanup standards, OU2 is the primary focus of this FYR. The selected remedy for OU1 and OU2 included the following major components:

- Construction of public water supply lines and connections to the residences south of the CSG facility on Rittenhouse Road and on Audubon Road between Rittenhouse Road and Thrush Lane;

- Continued maintenance of the whole-house carbon filtration systems previously supplied to residences along Audubon Road near Trooper Road;

- Installation, operation, and maintenance of groundwater extraction wells to remove contaminated groundwater from beneath the Site and to prevent contaminants from migrating further;

- Installation, operation, and maintenance of air strippers at the groundwater extraction wells to treat groundwater to the required levels;

- Installation, operation, and maintenance of vapor phase carbon units on air strippers;

- Periodic sampling of groundwater and treated water to ensure that treatment components are effective and that groundwater remediation is progressing towards the required cleanup levels; and

- Creation of a groundwater management zone with restrictions on the installation of new wells in areas of contamination which exceed MCLs set forth under the Safe Drinking Water Act (SDWA).

On May 5, 1993, EPA issued its First ESD for the Site which withdrew Pennsylvania's secondary maximum contaminant levels (SMCLs) as an applicable or relevant and appropriate requirements (ARAR) for the discharge of treated water to the AWC.

On September 28, 2004, EPA issued the Second ESD for the Site. EPA determined that a change to the 1992 ROD, as modified, regarding implementation of institutional controls (ICs), the purpose of which is to minimize the potential for human exposure to the contaminated groundwater, was warranted. As stated above, the 1992 ROD, as modified, required the creation of a groundwater management zone with restrictions on the installation of new wells in areas of contamination which exceed applicable MCLs. Since there was no statutory mechanism in the Commonwealth of Pennsylvania governing the establishment of groundwater management zones, EPA was unable to implement a groundwater management zone for this Site. However, on February 1, 1997, the Montgomery County Board of Health Department's Division of Water Quality Management adopted Chapter XVII, Individual Water Supply System Regulations (Regulations) and amended these regulations on August 1, 2003. The purpose of these Regulations is "to establish minimum standards for location, construction, modification or abandonment of individual water supply wells and system installation for protection of public health and welfare" based on groundwater quality results. The Second ESD modified the IC component of the 1992 ROD by removing the provision calling for the creation of a Groundwater Management Zone and selecting the Regulations as the institutional control mechanism that would aid in minimizing human exposure to contaminants in groundwater that exceed MCLs.

Additionally, the Second ESD incorporated, as a component of the ICs required by the 1992 ROD, two deeds of grants dated May 24, 2000 and June 28, 2000, which were executed in connection with the Site to protect the integrity of the constructed remedy.

EPA issued a Third ESD on September 8, 2006. The Third ESD provided for the elimination of the Commonwealth of Pennsylvania's groundwater background concentration cleanup standard set forth at 25 PA Code § 264.97(i) and (j) as set forth in the 1992 ROD, as modified. Since the Commonwealth repealed that standard and established a new groundwater cleanup standard in the Land Recycling and Environmental Remediation Standards Act of May 19, 1995, P.L. 4, No.2., 35 P.S. § 6026.101 *et seq*. (Act 2). EPA evaluated whether Act 2 should be an ARAR. Consequently, EPA determined that Act 2 is no more stringent than the Safe Drinking Water Act's MCL for contaminants of concern at the Site, therefore, Act 2 standards are not ARARs.

EPA issued a Fourth ESD on September 28, 2011 since concentrations of contaminants in the groundwater in the vicinity of the former manufacturing building on the Site are above the MCLs and redevelopment was believed to be imminent. This Fourth ESD modified the IC component of the 1992 ROD to address potential occupant exposure to VOCs underlying the former manufacturing building in indoor air in the event that the building is rehabilitated and reoccupied. This modification was also necessary to prevent potential occupant exposure to Site contaminants in the event that future development or construction takes place on top of the groundwater contamination at the Site.

Status of Implementation

On June 30, 1993, EPA issued a Unilateral Administrative Order, EPA Docket No. III 93-37-DC)(Order or UAO), to both CBM and Rockwell Automation, Inc. (Rockwell). The Order required both parties to perform all activities necessary to implement the Remedial Design and Remedial Action (RD/RA) for the Site. CBM went bankrupt shortly after the UAO was issued and has since been dissolved; thereby leaving Rockwell as the only PRP performing the response actions at the Site.

OU1 included the installation of a waterline extension to twelve residences along Audubon and Rittenhouse Roads and maintenance of the existing whole-house carbon filtration systems until the remedy was constructed. Filters were also maintained in homes southeast of the Site along Audubon Road near Trooper Road, until EPA's revaluation of this area confirmed the existence of a groundwater divide which would prevent site-related contaminants from migrating in this direction. Onsite construction of the waterline extension began during the week of September 16, 1996. On June 14, 1998, EPA accepted Rockwell's RA report for the AWC waterline extension.

For OU2, Rockwell installed the systems: (1) a newly constructed on-site groundwater extraction and treatment system (GWRTS); (2) an air stripping system at AWC's production well, VFCC-2; and the French Drain (FD) system in the former CSG building. The GWRTS contains seven pumping wells EW-1, EW-2, EW-3, AUD-MW-1M, VFCC-4, MOS-11R, and MOS-14 and the following treatment processes: air stripping to remove COCs from the water, vapor phase carbon adsorption to capture COCs from air, and liquid phase carbon adsorption to serve as a final polishing step. The VFCC-2 System consists of a groundwater extraction system, air stripping system, and disinfection and distribution system and is owned, maintained, and operated by the AWC. The FD system and sump collects shallow, infiltrating water from beneath the former CSG building to keep the basement from flooding. The FD discharges contaminated groundwater to the Publicly Owned Treatment Works (POTW) via the Lower Perkiomen Valley Regional Sewer Authority sanitary sewer system. On August 9, 2000, EPA determined that the Remedial Action activities at the Site were constructed and completed satisfactorily. On August 24, 2000, EPA issued the Preliminary Closeout Report for the Site.

Implementation of Institutional Controls

As indicated above, the Second ESD modified the IC mechanism as part of the remedy. The IC RAO at the Site is to prevent human exposure to site-related contaminants. This exposure could occur if new drinking water wells were installed within the area of the Site plume exceeding MCLs, if remedial systems are compromised or if workers occupy a building (either new or existing) on Site. ICs for the Site were implemented via a July 17, 2015 Environmental Covenant and are summarized in the table below:

TABLE 2: ICs for CSG

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date
Contaminated groundwater, constructed remedial systems, including the groundwater recovery treatment systems and appurtenances, Vapor Intrusion (VI)	Yes	Yes	Area drinking water, Remedial systems, building use	No drinking water well installation without testing, No disturbance or interference with remedy, no building occupation without VI assessment	Environmental Covenant July 17, 2015

Systems Operations/Operation & Maintenance

Rockwell has retained Environmental Resource Management (ERM) to conduct long-term operation and maintenance of the FD & GWRTS which began regular operation in August 2000. VFCC-4 was reclaimed by AWC and ceased operation as part of the GWRTS in 2007. ERM modified operation of a nearby extraction well, MOS-11R to replace VFCC-4. An Operations & Maintenance Plan (O&M Plan), dated December 6, 2001, describes standard procedures and routine maintenance required to keep the groundwater extraction system operating efficiently. Most of the GWRTS is automated so that it can be operated remotely. On-going maintenance, water level monitoring, and system performance sampling were all completed during the FYR reporting period.

During this FYR cycle, the operation of the GWRTS did not operate due to a Plume Stability Verification (PSV) study to evaluate the effects of upgradient contamination while the GWRTS is not pumping. Figures 3-4 show shallow and deep groundwater contours, during the March 22, 2019 sampling event. The PSV study began in December 2014, with the plan that the GWRTS would be restarted if monitoring yields results greater than a statistically calculated threshold for each contaminant.

Currently, only perched zone groundwater recovery is occurring via the FD system which operates to prevent the former CSG manufacturing facility basement from flooding. Extraction wells were also pumped to obtain groundwater samples. All the recovered groundwater (including sampling purge water) was discharged to the sanitary sewer under the facility self-monitoring permit. During this FYR period, the FD was the principal influence on plume recovery in the perched zone portions of the aquifer in the immediate vicinity of the Site and VFCC-2 was the principal CSG remedy well influencing plume mass recovery for the deeper portions of the aquifer.

Rockwell has conducted semi-annual groundwater sampling since 2004. Currently, monitoring wells are sampled semi-annually or annually. Pump and treat performance and plume recovery analysis is reported annually.

Voluntary Remedial Enhanced Treatment

Rockwell is committed to expediting the remediation of the Site by implementing enhanced treatment activities that are in addition to those required by the ROD. The enhanced treatment (ET) was developed to address COCs concentrations located in the vadose zone and shallow bedrock adjacent to and beneath the building. Under the ROD remedy, infiltrating water slowly transports the COCs through these localized areas downward to be captured by the GWRTS. ET is designed to reduce the time necessary to achieve the Site groundwater cleanup standards.

Phase I evaluated three technologies: vapor extraction (VE), in-situ chemical oxidation (ISCO), and anaerobic biodegradation in 2001. Based on the work performed, VE and ISCO were implemented and the first FYR, dated August 2005, summarized the VE and shallow soil ISCO work performed under Phase I.

Phase II ET consisted of an ISCO pilot to treat COCs in the transition zone bedrock under and immediately adjacent to the former CSG building. While ERM was preparing for Phase II in situ chemical oxidation, wellhead treatment units (WTU) were installed at drinking water wells VFCC-2 and VFCC-3 as a precaution. Part of this installation included flushing the WTUs with water and food grade citric acid. At the same time, AWC was flushing the water distribution lines. The timing of the two typically routine activities caused copper to chelate in the water lines and AWC distributed blue-green water to customers for less than one day in November 2006. This incident eventually led to AWC terminating their agreement with Rockwell Automation, causing the Phase II ET activities to cease. In July 2010, ERM submitted a draft workplan to EPA to continue ET. Comments from AWC stalled that effort.

In 2013, ERM performed an Off-Site Investigation at 960 Rittenhouse Road to delineate upgradient contamination. This investigation included a GORESorber survey and follow-up soil and perched water sampling. The results indicated a localized VOC source not associated with the Site. The current groundwater pumping of the Site French drain and recovery wells are pulling the offsite contamination onto the Site.

In 2017, Rockwell completed construction of an Air Injection/Sparge-Vapor Extraction (AI/S-VE) and treatment system for the perched zone source area located beneath the southeastern, slab-on grade portion of the former CSG factory building. Air is injected into the shallow bedrock via a newly installed, 265 feet long by 38 feet deep horizontal well and several existing vertical former oxidant injection points. Vapors are extracted via a shallow recovery gallery that is connected with the extensive sandy regolith that covers the underlying fractured bedrock. The air for the AI/S is obtained from an air compressor and VE is performed using the existing blower/aftercooler/activated carbon infrastructure located at the Site treatment plant. Several maintenance related upgrades have been made to the system in response to changing weather conditions that affected performance. These modifications included increased building ventilation, a variable frequency drive for the VE blower, updated level controls for the VE system moisture separator, and additional operational telemetry.

The AI/S-VE system has operated from April 2018 to the present, notwithstanding certain down periods of time to address system operations. Based on field measurements obtained on May 7, 2020 an estimated 162 pounds of VOC have been removed, with an overall estimated mass recovery rate of approximately 0.32 lbs/day while the system is operating.

Combining the 162 pounds with prior ET efforts, recovered mass estimates results in an estimated total of 1,314 pounds removed from ET. In contrast, the GWRTS has recovered an estimated 647 pounds. Rockwell remains committed to expediting the remediation with ET.

III. PROGRESS SINCE THE LAST REVIEW

This section includes the protectiveness determinations and statements from the last FYR as well as the recommendations from the last FYR review and the current status of those recommendations.

Table 3: Protectiveness Determinations/Statements from the 2015 FYR

OU #	Protectiveness Determination	Protectiveness Statement
OU1	Protective	The remedy for OU1 (water line) of the Site is protective in the short-term and long-term. This Third Five-Year review finds that the remedy has been constructed in accordance with the requirements of the ROD and is functioning as designed. The remedy for OU1 remains protective of human health since it supplied a permanent source of clean drinking water to residences.
OU2	Protective	The remedy for OU2 (groundwater) of the Site is protective in the short-term. Long-term protectiveness of the remedy will be achieved by continuing to pump and treat the groundwater and maintaining effective ICs until cleanup standards have been achieved. Further evaluation will be conducted on the impact of upgradient VOC contamination on achievement of site groundwater cleanup levels.
Sitewide	Protective	This Third Five-Year review finds that the remedy has been constructed in accordance with the requirements of the ROD and is functioning as designed. The remedy for OU2 has been effectively capturing the Site plume and is expected to achieve the groundwater cleanup standards, which are protective of human health and the environment. However, based upon upgradient groundwater data, additional sources of groundwater contamination that are believed to be unrelated to the CSG Site exist in the area and, if not addressed, will likely impact decisions about when site cleanup levels are achieved.

Table 4: Status of Recommendations from the 2015 FYR

OU #	Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
02	Upgradient Sources	Additional off-site investigations at upgradient property	Completed	On 7/9/15, PADEP agreed to negotiate AOC with owner of the upgradient source. See below for additional information.	2/24/2020 owner entered into voluntary cleanup program
02	Upgradient Sources	PRP will establish technical information regarding the effects of off-site contamination on the CSG Site	Ongoing	See below	N/A
02	VFCC-4	Work with AWC to reinstall packer or other technology in VFCC-4 at the proper interval to prevent vertical migration of contamination between the shallow and deep portions of the bedrock aquifer.	Ongoing	See below	N/A

Recommendation #1:
PADEP has attempted to enter into a Consent Order with the current property owner of the suspected source of the property immediately upgradient of the Site. The property owner is performing some investigations; however, the QA/QC of this data has not been reviewed or agreed upon by PADEP or EPA. Recently, the upgradient property owner has filed paperwork entering into the PADEP Act 2 voluntary clean-up program.

Recommendation #2:
Rockwell continues to evaluate sampling data to document contamination at and potentially flowing onto the Site from upgradient source(s). The investigation of upgradient source(s) will affect the ability for Rockwell to meet its cleanup standards of MCLs. This issue is ongoing.

Recommendation #3:
Rockwell proposed installing a FLUTe liner in VFCC-4 to prevent vertical migration of contamination between the shallow and deep portions of the bedrock aquifer. AWC owns VFCC-4 and an agreement has not been reached regarding the installation of a FLUTe liner. AWC has offered to install a packer; however, they are seeking funding from Rockwell to do so. Discussions are ongoing between AWC and Rockwell.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

An advertisement in the Times Herald newspaper on January 14, 2020 (Appendix A) notified area residents of the FYR, explained why EPA was conducting a FYR, invited the public to provide any comments to EPA, and provided contact information for the CIC. Neither the CIC nor the RPM received any questions or comments as a result of the ad. The ad also noted that the completed FYR will be made available online at https://www.epa.gov/superfund/commodore.

During the FYR process, interviews were conducted to document any information that may be relevant to the protectiveness determination(s) and generally includes the following:

- Successes/problems in the implementation of access and ICs
- Successes/problems with the construction of the remedy and/or O&M
- Unusual situations or problems at the Site

The first interview conducted for this FYR was with Lower Providence Township personnel on September 11, 2019. The EPA RPM, CIC, and technical staff; PADEP project officer, geologist and environmental group manager; and technical consultant representing Rockwell were present. The following topics were discussed:

- The Township would like to see the Site property in reuse. About two years ago, the township school district enacted a local tax incentive (LERTA) to provide an incentive for redevelopment. The business center where the Site is located has increased occupancy over the last five years. It is currently 85-90% occupied.
- The Township views the empty building as an eyesore. However, the current property owner's securing and maintaining the property seems to be more effective than in the past. The local police continue to perform periodic patrol for trespassers.
- The Township is pleased with the overall communication about the Site. They do not have any issues related to the operations at the Site and are not receiving any Site-related complaints.

The second interview conducted was with the Site owner and their counsel on September 17, 2019. The EPA RPM, EPA counsel, EPA hydrogeologist, PADEP project officer, and technical consultant representing Rockwell were present. The following topics were discussed:

- The owner has worked to keep the building secure and the property maintained.
- The owner has been trying to sell the property.
- EPA reminded the owner of his obligation to annually certify that ICs are being followed according to the 2015 Environmental Covenant. Also, EPA reminded the owner of his obligation to notify EPA upon any changes of use at the property.

The third interview conducted was with AWC on September 17, 2019. The EPA RPM, EPA CIC, EPA hydrogeologist, PADEP project officer and PADEP hydrogeologist were present. The following topics were discussed:

- Rockwell coordinates with AWC on an as needed basis.
- EPA discussed the status of Plume Stability Analysis and AI/S-VE.
- EPA asked AWC to consider addressing the previous FYR recommendation to protect the drinking water aquifer by preventing vertical migration in their well VFCC-4.

No issues affecting the current remedy protectiveness were identified from these interviews.

Data review

Monitoring data provides information to assess and demonstrate that the remedy is achieving the performance standards described in the ROD and provides information for the FYR. Table 5 presents all MCL exceedances for COCs present in each well collected during this FYR period. Figures 6-9 show these MCL exceedances graphically. These tables and figures show residual contamination remaining from the CSG source area. Off-site monitoring wells MW-30S, MW-31D, and MOS-18 and water supply well VFCC-3 continue to show elevated CVOC concentrations consistent with pre-PSV trends. This indicates a non-CSG source area in close proximity to these wells that reside upgradient and off-property.

As of the first quarter 2020, more than 1.27 billion gallons of water had been treated and 651 pounds of COCs had been removed via the recovery wells and the French drain. An overall decrease in contaminant concentrations has been observed since the start of GWRTS operation.

Rockwell proposed the PSV study because the GWRTS had reached asymptotic levels of contaminant recovery. Since the beginning of the PSV in December 2014, contaminant concentrations have been below statistically calculated Upper Predictive Levels (UPLs) with a few exceptions from high groundwater levels due to precipitation. While typically stable at low levels, contaminant concentrations have exhibited a seasonal variability based upon precipitation.

Groundwater monitoring confirms the stability of the plume and provides an opportunity to observe changes in the distribution of COCs over the area when the recovery wells are off. Such changes are indicative of off-site source areas that are no longer being pulled onto the CSG Site in response to cessation of pumping at EW-1, EW-2, and EW-3.

Historically, 1,1,1-TCA has been detected at the Site and 1,4-dioxane was a stabilizer commonly used with 1,1,1-TCA. Two 1,4-dioxane samples were taken in May 2015 in the CSG source area (MOS-11 and MOS-13) and were non-detect. However, 1,4-dioxane has been observed to migrate further in groundwater than other solvents.

Per-fluoro alkyl substances (PFAS) are an emerging contaminant class known to be associated with plating activities, which were historically performed at the Site. Two PFAS samples were taken in May 2015 in the CSG source area (MOS-11 and MOS-13). PFOA and PFOS are two chemicals within the group of PFAS. PFOA was detected at concentrations of 0.013 µg/L and 0.014 µg/L and PFOS was detected at 0.023 µg/L and 0.026 µg/L, respectively. The current screening level for PFOA and PFOS is 0.04 µg/L. In February 2020, PADEP took two additional PFAS samples from AWC entry point locations (i.e. post treatment adjacent to a drinking water supply well) and both PFOA and PFOS were detected at concentrations below the screening level. PFOA and PFOS have not been found to exceed screening levels in the vicinity of the CSG site. However, PFAS has been observed to migrate further in groundwater than other solvents.

Table 5
Summary of Groundwater Sampling Results-
Trichloroethene (TCE) concentrations (µg/l)

Well	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q3 2016	Q1 2017	Q3 2017	Q1 2018	Q3 2018	Q1 2019	Q3 2019
RW-1											1.1
RW-2											
RW-3											
RW-4											
AUD-5										9.3	
AUD-MW-1D	9.9	2.0			4.7		0.5J		6.4		0.2 J
AUD-MW-1M		6.0		4.7	2.7	2.3	12	12	10	8.3	9.3
AUD-MW-2		3.9		3.3	3.7	2.3/2.3	2.4	2.9	4.1	4.5	2.8
EW-1	15	14	11	13	9.5	8.8	13	NS	9.9	25	9.3
EW-2	22	17	22	31 J	16	13	19 J	41	17	17	25
EW-3	16	8.9	8	16	7.4	11	18	15	7.4	7.6	21
French Drain	160	41	33	11	14	31	11	120	48	89	12
GW-1	6.9	23			9.0		8.2		6.8		7.6
GW-2		6.2			0.3 J		5.3		0.5 J		
MOS-11R	17	10/9.9	18	14/14	7.6 J/14 J	3.5/3.6	13/13	5.9/5.2	8.0 J	3/3.1	14/13
MOS-13	4.1	4.3	2.0/2.0	1.9	7.2	4.9	6.8	4.8	4.4	2.6	3.4
MOS-14	6.7	23	9	5.5	14	6.2	3.3	4.4	3.6	3.2	3.2
MOS-15	7.1	6.1	4	4.5	3.6	2.6	2.4	2.0	2.9	2.9	2.5
MOS-18		0.5		0.2 J	1.2	0.1J/0.1J	0.3 J	0.6	0.5 J	0.7	1.4/1.4
MW-19D		2.7		2.7/2.8	2.1/2.1						
MW-19M		0.4 J		0.2 J	0.4 J						
MW-20D	9.2	2.3	2.9	1.2	2.6	1.2	1.9	3.3	6.5	2.7	2.0
MW-21D	12	5.4	8	7.5	6.5	4.4	2.9/3.0	2.3	4.4	9.1	6.0
MW-21M	8.5	6.7	8	8.5	5.7	5.6	5.2	8.2	6.6	6.1	5.0
MW-23		0.5 U			1.3						
MW-24	2.4	0.2 J	0.5 U	0.4J/0.4J	0.5U/0.5U		1.1	0.2 J	2.4		
MW-29		1.3			1.3						
MW-30D	0.5 J	4.4	5	0.6	15	2.6	4.8	1.4	11	8.1	
MW-30S	940/830	150	260	550	57	770	390	440/410	270/310	870	180
MW-31D		2.1		24	72		79		43		14
MW-31S		5.4/5.3		0.8	5.9		8.1		1.6		3.9
MW-32S		1.0			0.7						
MW-33S	5.9	0.8	0.7	0.5	0.5		2.2	0.3 J	2.2	0.6	2.2
MW-33D	1.4	3.2/3.1	3	2.8	2.4		2.3	3.2	2.2		
VFCC-2	6.3	5.5	6	NS	5.7	NS	4.4	4.6	4.6		4
VFCC-3	30	16/16	12	25/27	21	16	23	19	32	42	24
VFCC-4	18	16	16	20	19	12	14	45	13/13	7.5	12

NS: This well was not sampled due to dry conditions or inaccessibility; or not reported due to sampling irregularities.
Blanks indicate that the well was not scheduled for sampling during the quarter.
J: This result should be considered a quantitative estimate
U: Compound was not detected. The numerical value represents the sample quantitation/detection limit of the compound.
Shading indicates that the result exceeds the EPA MCL of **5 µg/l**

Table 5 Summary of Groundwater Sampling Results- Tetrachloroethene (PCE) concentrations (µg/l)

Well	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q3 2016	Q1 2017	Q3 2017	Q1 2018	Q3 2018	Q1 2019	Q3 2019
RW-1											0.1 J
RW-2											
RW-3											
RW-4											
AUD-5		NS			0.4 J		0.3 J		NS	0.7	
AUD-MW-1D	1.9	0.5			1.6		0.2 J		1.7		0.6
AUD-MW-1M		7.4		5.2	5.3	2.6	11	14	24	14	9.4
AUD-MW-2		6.7		3.7	7.0	5.8/6.0	5.9	4.6	5.4	3.5	7.8
EW-1	19	16	18	16	15	14	13	NS	15	18	17
EW-2	15	14	12	11	13	10	14	14	16	15	26
EW-3	11	9.9	8	9.5	9.5	8.3	11	9.8	14	11	22
French Drain	7.9	8.2	5	0.8	3.5	2.9	5.4	8.3	5.5	4.2	4.0
GW-1	0.4 J	0.2 J			1.3		1.3		1.7		2.3
GW-2		0.5 U			0.5 U		0.5 U		0.5 U		
MOS-11R	4.8	4.6/4.5	11	13/13	5.7J/13J	1.6/1.6	11/11	2.7/2.3	5.2	1.8/1.9	14/12
MOS-13	9.0	9.6	5.9/5.7	7.6	8.4	6.3	12	14	11	8.7	12
MOS-14	0.1 J	2.5	0.6	0.5 U	1.2	0.5 U	0.5 U	0.5 U	0.1 J	0.5	0.5 U
MOS-15	0.2 J	0.2 J	0.2 J	0.1 J	0.2 J	0.1 J	0.1 J	0.5 U	0.2 J	0.1 J	0.2 J
MOS-18		15		4.1	36	3.0/2.9	7.9	21	14	18	33/34
MW-19D		0.2 J		0.2J/0.2J	0.2J/0.2J						
MW-19M		0.1 U		0.5 U	0.5 U						
MW-20D	2.2	0.5 J	0.6	0.1 J	0.5	0.3 J	0.4 J	1.1	1.7	0.9	0.7
MW-21D	5.0	3.0	4.0	4.2	3.2	2.5	1.5/1.6	0.9	2.7	3.6	3.4
MW-21M	1.0	0.9	0.9	0.9	0.9	0.7	0.7	0.8	1.0	0.8	1.1
MW-23		0.5 U			0.5 U						
MW-24	0.8	0.1 U	0.2 J	0.2J/0.2J	0.5U/0.5U		0.4 J	0.6	0.8		
MW-29		0.5 U			0.5 U						
MW-30D	0.2 J	2.0	3	0.2 J	13	1.3	3.3	1.0	12	7.8	
MW-30S	1.1/1.0J	0.1 J	0.3 J	0.6 J	0.1 J	0.4 J	0.5 J	1.1/1.0	0.6J/0.6J	3.5/3.3	0.2 J
MW-31D		0.1 U		0.5 U	0.5 U		0.1 J		0.5 U		0.5 U
MW-31S		0.1U/0.1U		0.5 U	0.5 U		0.5 U		0.5 U		0.5 U
MW-32S		0.9			0.7						
MW-33S	23	1.7	0.9	0.7	0.8		12	0.4 J	15	0.9	19
MW-33D	0.3 J	0.8/0.8	0.6	0.5 J	0.3 J		0.4 J	0.7	0.4 J		
VFCC-2	0.5	0.5 J	0.6	NS	0.6	NS	0.4 J	0.5 J	0.5		0.5
VFCC-3	5.0	3.7/3.8	4	3.7/3.9	4.4	3.8	3.6	4.2	5.3	5	5.6
VFCC-4										19	7.6

NS: This well was not sampled due to dry conditions or inaccessibility; or not reported due to sampling irregularities.
Blanks indicate that the well was not scheduled for sampling during the quarter.
J: This result should be considered a quantitative estimate
U: Compound was not detected. The numerical value represents the sample quantitation/detection limit of the compound.
Shading indicates that the result exceeds the EPA MCL of **5 µg/l**

Table 5 Summary of Groundwater Sampling Results- Cis-1,2 Dichloroethene (cis-1,2 DCE) concentrations (µg/l)

Well	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q3 2016	Q1 2017	Q3 2017	Q1 2018	Q3 2018	Q1 2019	Q3 2019
RW-1											0.7
RW-2											
RW-3											
RW-4											
AUD-5		NS			13		7.3		NS	7.4	
AUD-MW-1D	19	14			9.1		5.5		5.4	14	3.7
AUD-MW-1M		110		110	52	85	58	47	27	22	17
AUD-MW-2		11		9.4	10	5.0/4.9	6.4	7.4	6.7	8	6.1
EW-1	18	16	13	9.4	9.9	13	9.7	NS	6.8	76	6.3
EW-2	27	29	21	30 J	28	20	22	26	17	19 J	18
EW-3	25	23	13	21	15	14	14	13	12	10	20
French Drain	69	60	36	17	25	32	14	71	47 J	54	17
GW-1	8.0	42			14		13		6.2		11
GW-2		0.5 U			0.5 U		0.5 U		0.5 U		
MOS-11R	6.8	6.9/6.7	12	15/15	6.3J/14J	1.4/1.4	12/12	2.1/1.8	4.7 J	1.2/1.2	15/13
MOS-13	5.6	5.7	2.4/2.5	2.5	9.7	4.9	6.5	3.9	5.0	3.4	3.8
MOS-14	1.5	59	27	2.8	69	2.5	1.7	1.5	2.8	0.8	1.0
MOS-15	5.5	5.1	3	4.8	3.2	2.0	2.1	1.7	2.6	3.1	2.1
MOS-18		1.2		0.2 J	2.3	0.1J/0.1J	0.8	0.9	0.7	1.1	3.1/3.1
MW-19D		0.4 J		0.3J/0.4J	0.3J/0.3J						
MW-19M		0.1 U		0.5 U	0.5 U						
MW-20D	4.1	1.9	0.8	0.3 J	0.7	2.0	0.5	0.9	2.9	1.2	1.8
MW-21D	28	18	22	20	16	8.6	6.3/7.1	5.1	7.9		11
MW-21M	7.1	5.9	5	6.9	5.7	4.8	6.0	5.2	5.2	4.6	5.4
MW-23		0.5 U			0.5 U						
MW-24	0.5 J	0.1 U	0.5U/0.5U	0.5U/0.5U	0.5U/0.5U		0.2 J	0.2 J	0.4 J		
MW-29		1.0			1.8						
MW-30D	0.3 J	4.1	3	0.5 U	23	0.6	4.0	0.2 J	9.5	9	
MW-30S	320J/260J	51	45	190	35	180	180	210/200	160/180	510/540	64
MW-31D		0.1 U		0.2 J	0.4 J		0.4 J		0.2 J		0.5 U
MW-31S		0.1U/0.1U		0.5 U	0.5 U		0.5 U		0.5 U		0.5 U
MW-32S		5.9			4.1						
MW-33S	2.1	0.6	0.2 J	0.1 J	0.2 J		1.3	0.5 U	1.5	0.4J	1.5
MW-33D	1.0	1.3/1.2	1	1.0	1.0		0.8	1	0.9		
VFCC-2	7.8	7.3	6	NS	6.5	NS	4.2	4.2	4.0		3.4
VFCC-3	7.1	4.5/4.6	3	4.6/4.8	4.9	4.2	4.5	4.2	6.7	10	6.1
VFCC-4	28	30	24	26	37	12	23	24	14/14	14	17

NS: This well was not sampled due to dry conditions or inaccessibility; or not reported due to sampling irregularities.
Blanks indicate that the well was not scheduled for sampling during the quarter.
J: This result should be considered a quantitative estimate.
U: Compound was not detected. The numerical value represents the sample quantitation/detection limit of the compound.
Shading indicates that the result exceeds the EPA MCL of **70 µg/l.**

Table 5 Summary of Groundwater Sampling Results-
1,1 Dichloroethene (1,1 DCE) concentrations (µg/l)

Well	Q2 2015	Q3 2015	Q4 2015	Q1 2016	Q3 2016	Q1 2017	Q3 2017	Q1 2018	Q3 2018	Q1 2019	Q3 2019
RW-1											0.5 U
RW-2											
RW-3											
RW-4											
AUD-5		NS			1.1		0.7		NS	0.9	
AUD-MW-1D	1.1	0.3 J			0.6		0.2 J		0.6		0.5 U
AUD-MW-1M		0.2 J		0.2 J	0.2 J	0.1 J	0.2 J	0.2 J	0.2 J	0.3 J	0.3 J
AUD-MW-2		0.2 J		0.5 U	0.3 J	0.5 U/0.5 U	0.2 J	0.2 J	0.2 J	0.3 J	0.2 J
EW-1	2.1	1.6	1.0	1.7	1.2	1.2	1.3	NS	1.1	0.9 J	1.1
EW-2	2.0	1.8	1	3.5	1.7	1.6	1.3	2.6	1.4	1.7	1.3
EW-3	1.7	0.7	0.8	1.5	0.5	1.1	0.7	1.2	0.7	0.9	0.9
French Drain	3.4	0.8	0.5	0.2 J	0.2 J	0.6	0.2 J	1.0	1.1	2.0	0.2
GW-1	1.3	3.8			1.1		1.1		1.0		0.99
GW-2		1.6			0.1 J		1.4		0.5 U		
MOS-11R	1.7	1.1/1.1	2	1.6/1.6	0.8 J/1.9 J	0.4J/0.4J	1.7/1.7	0.5J/0.5J	1.0	0.3J/0.3J	2.1/1.9
MOS-13	0.3 J	0.3 J	0.3 J/0.3 J	0.2 J	0.6	0.5	0.5 J	0.1 J	0.3 J	0.2 J	0.2 J
MOS-14	0.5	0.5 J	0.4 J	0.3 J	0.5 J	0.4 J	0.2 J	0.2 J	0.2 J	0.3 J	0.3 J
MOS-15	0.7	0.5 J	0.3 J	0.4 J	0.4 J	0.2 J	0.2 J	0.1 J	0.2 J	0.2 J	0.2 J
MOS-18		0.5 U		0.5 U	0.5 U	0.5U/0.5U	0.5 U	0.5 U	0.5 U	0.5 U	0.5U/ 0.5U
MW-19D		0.1 J		0.1J/0.1J	0.1J/0.1J						
MW-19M		0.1 J		0.1 J	0.2 J						
MW-20D	0.9	0.3	0.2 J	0.1 J	0.2 J	0.5 U	0.2 J	0.3 J	0.6	0.3 J	0.2 J
MW-21D	1.2	0.4 J	0.8	0.6	0.5	0.2 J	0.2J/0.2J	0.1 J	0.4 J	1.1	0.8
MW-21M	0.5 U	0.1 U	0.5 U	0.5 U	0.5 U	0.5 U	0.1 J	0.5 U	0.5 U	0.5 U	0.5 U
MW-23		0.5 U			0.3 J						
MW-24	0.2 J	0.1 U	0.5U/0.5U	0.5U/0.5U	0.5U/0.5U		0.5 U	0.5 U	0.2 J		
MW-29		0.1 J			0.2 J						
MW-30D	0.5 U	0.3 J	0.3 J	0.5 U	1.5	0.5 U	0.4 J	0.5 U	1.3	1.0 J	
MW-30S	91J/173J	12	42	44	4.7	68	41	39/36	18/21	73/76	16
MW-31D		0.2 J		2.1	4.3		5.7		2.4		1.0
MW-31S		0.6/0.6		0.3 J	1.0		0.8		0.4 J		0.4 J
MW-32S		0.1 J			0.5 U						
MW-33S	0.4 J	0.1 J	0.5 U	0.5 U	0.5 U		0.2 J	0.5 U	0.2 J	0.5U	0.2 J
MW-33D	0.1 J	0.2J/0.2J	0.5 U	0.2 J	0.1 J		0.1 J	0.2 J	0.1 J		
VFCC-2	0.5	0.5 J	0.5 J	NS	0.6	NS	0.4 J	0.4 J	0.5 J		0.4 J
VFCC-3	2.5	1.2/1.2	0.6	2.0/2.2	1.6	1.2	1.6	1.8	2.4	2.9	1.7
VFCC-4	1.7	1.3	1.4	1.8	2.1	1.0	1.5	1.3	1.0/1.0	0.6	1.4

NS: This well was not sampled due to dry conditions or inaccessibility; or not reported due to sampling irregularities.
Blanks indicate that the well was not scheduled for sampling during the quarter.
J: This result should be considered a quantitative estimate
U: Compound was not detected. The numerical value represents the sample quantitation/detection limit of the compound.
Shading indicates that the result exceeds the EPA MCL of **7 µg/l**

Site Inspection

The inspection of the Site was conducted on September 11, 2019 in order to assess the protectiveness of the remedy. The following personnel were in attendance during the Site inspection:

Sharon Fang, EPA Site RPM;
Alex Mandell, EPA CIC;
Mark Leipert, EPA hydrogeologist;
Martin Gehlhaus, EPA toxicologist;
Kimberly Plank, EPA ecologist; and
Richard Dulcey, ERM Principal
John Roberts, ERM Project Manager
Shari Walsh, ERM Site Project Manager
Michael Pettit, ERM ET engineering Coordinator

A key component of the FYR at the Site is the physical inspection of the GWRTS system and appurtenances such as wells and vaults, and the vacant building. Even though the AI/S-VE system is not part of the remedy, the group did inspect this system.

The inspection consisted of inspecting the GWRTS control room for necessary on-site documentation, observing the GWRTS which is currently not extracting groundwater except for the French Drain, walking the Site, inspecting the AI/S-VE system housed inside the vacant building, locating the monitoring wells around the Site, and viewing the basement of the building to the extent possible. All equipment (treatment building, treatment equipment, well vaults) appeared to be in satisfactory condition. Rockwell stated they would evaluate the efficacy of the pumping wells if the GWRTS needed to be restarted. The vacant building was secured, and no evidence was present of trespassers. The basement appeared to have random equipment scattered. The parking lot is being used by a local car dealership to stage their inventory.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Although the selected remedy was effective at controlling the groundwater plume and reducing contaminant concentrations while it operated, the GWRTS has not operated in this FYR period, and there is some indication that upgradient sources might impact the ability of the remedy to achieve cleanup goals. Review of analytical data indicates that contaminant concentrations decreased, hydraulic containment and capture of site related VOCs occurred, and currently residual levels of VOCs exist beneath the CSG property. The highest level of contamination associated with the Site exists in an upgradient shallow bedrock well, MW-30S. The GWRTS was shut down in 2014 for a plume stability analysis, but Rockwell has continued to perform AI/S-VE to recover contamination immediately beneath the building. Additional information is being collected to determine the contribution from upgradient sources. It may not be possible to attain the cleanup levels as required by the ROD and subsequent ESDs without addressing upgradient sources.

The implementation of the Montgomery County Health Department (MCHD) regulations regarding Individual Water Supply Wells should prevent any potential exposure to contaminated groundwater via the use of a newly installed water supply well. The Deeds of Grant, creating the easements and the rights of way, should provide the appropriate access to and protect the integrity of the GWRTS. The 2015 Environmental Covenant requires either the installation of a vapor barrier, an engineered vapor mitigation system, or performance of regular indoor air monitoring prior to occupation of an existing building. It also requires the inclusion of foundation vapor barriers and subsurface piping for a sub-slab depressurization for all new buildings constructed on the Site. These requirements provide protection to future occupants of the existing building currently located on the property and/or a new building constructed above contaminated groundwater at the Site from potential exposure to VOCs through VI.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Yes, exposure assumptions, toxicity data, cleanup levels, and RAOs as described in the remedy (ROD and four ESDs) are still valid. Note, however, there have been changes in toxicity criteria that are not expected to impact the remedy selected for the Site, since the cleanup levels are based on the MCLs. Changes in toxicity criteria for 1,1-DCA could impact the remedy completion targets, since it could result in a lower risk-based cleanup level [note that this contaminant does not have an MCL and the current Regional Screening Level (RSL) is 2.7 ppb]. However, the 1,1-DCA groundwater data from 2010 to the present do not show levels of contamination near the current risk-based cleanup level of 810 ppb. Since first quarter of 2015, the 1,1-DCA concentrations were below 2ppb and the current RSL in all wells. Thus, this change in toxicity criteria does not impact remedy protectiveness.

In addition, since the ROD, the potential ecological significance of exposure to contaminants in the hyporheic zone (the ecosystem beneath the bed of a river or stream that is saturated with water and that supports invertebrate fauna) and the discharge of groundwater contaminants to surface water have become further recognized as potential issues and are addressed in the current ecological risk assessment process. The CSG remedial investigation did evaluate the potential impact of groundwater on surface water, but it did not evaluate exposure in the hyporheic zone. Even though this evaluation was not conducted, the established groundwater cleanup values are expected to be protective to receptors in the hyporheic zone. This FYR evaluated this potential pathway and determined the current levels of contaminants to be protective of the environment if potential discharges were to occur.

VI is a pathway that was not evaluated during the baseline risk assessment and was not evaluated at the time of remedy selection. During the previous FYRs, VI concerns for the residential area to the Southwest (or downgradient) of the Site were evaluated by installing and sampling well MW-32S and vapor intrusion was not found to be a concern for residents adjacent to the golf course. However, given that shallow groundwater contamination remains above MCLs, MW-32S should continue to be sampled every FYR cycle. For this fourth FYR period, groundwater concentrations in MW-32S continued to be below VISLs indicating that vapor intrusion from impacted groundwater is not likely a concern to these nearby residences. Additional investigations should be performed if the shallow groundwater contamination at this location is shown to be above VISLs. Concentrations in other areas of Site groundwater remains more than

one order of magnitude above VISLs. However, there is currently no VI exposure on the CSG property because the CSG building is unoccupied. In the event the building were to be reused, EPA incorporated ICs into the remedy by issuing the Fourth ESD and implemented them via the 2015 Environmental Covenant. This covenant protects potential exposure if the existing building is rehabilitated and reoccupied or in the event there is future development above the groundwater contamination on the CSG property. The VI assessment and evaluation for upgradient source(s) will be performed by upgradient PRPs as part of the PADEP Act 2 voluntary clean-up program.

The current remedy is not progressing as expected towards meeting RAOs. While regional contamination was acknowledged in the original ROD, the enactment of PADEP's Act 2 precipitated the ESD removing the calculation of a background standard for the Site. Since the remaining cleanup levels are MCLs, the upgradient contamination impacts the PRP's ability to remove contamination to these standards while upgradient contamination continues to flow onto the Site.

In addition, at AWC's direction, removal of the packer assembly in VFCC-4 in 2007 has left the well open and available for shallow contamination from the Site to migrate into the deep bedrock.

Current samples taken for 1,4 dioxane and PFAS do not call in to question the protectiveness of the remedy; however, protectiveness could be affected if these contaminants are found to impact nearby drinking water wells above risk-based levels or the HAL, respectively.

QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

No.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
OU1

Issues and Recommendations Identified in the Five-Year Review:				
OU(s): 02	**Issue Category:** Remedy Performance			
	Issue: Production well VFCC-4 is currently an open borehole and may provide a conduit for vertical contaminant migration.			
	Recommendation: Install packer or other technology in VFCC-4 at the proper interval to prevent vertical contaminant migration.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP & AWC	EPA	12/30/20
OU(s): 02	**Issue Category:** Remedy Performance			
	Issue: The current remedy may not be able to achieve current groundwater cleanup levels.			
	Recommendation: Determine if a modification to the current remedy is needed that will allow achievement of groundwater cleanup levels in light of contamination from other source(s).			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	12/30/21

OTHER FINDINGS

In addition to the issues discussed above, the nature and extent of emerging contaminants 1,4-dioxane and PFAS are unclear at the site. If 1,4-dioxane or PFAS are detected in surrounding drinking water supply or monitoring wells at concentrations exceeding risk-based levels or the HAL, respectively, additional evaluation will be performed to determine the relevance to CSG. This is not placed into the issues/recommendations table above because it does not affect current and/or future protectiveness.

VII. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: *OU1*	*Protectiveness Determination:* Protective	*Planned Addendum Completion Date:* Not applicable

Protectiveness Statement:

The remedy for OU1 (water line) of the Site is protective of human health and the environment. This Fourth Five-Year review finds that the remedy has been constructed in accordance with the requirements of the ROD, as modified, and is functioning as designed. The remedy for OU1 remains protective of human health since it supplies a permanent source of clean drinking water to residences.

Protectiveness Statement(s)		
Operable Unit: *OU2*	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* Not applicable

Protectiveness Statement:

The remedy for OU2 (groundwater) of the Site currently protects human health and the environment Because ICs are in place to prevent installation of groundwater wells in areas impacted by site contamination. Long-term protectiveness of the remedy will be achieved by addressing the following issues:

- Install a packer or other technology in VFCC-4 to prevent vertical contaminant migration; and
- Determine if a modification to the current remedy is needed that will allow achievement of groundwater cleanup levels in light of contamination from other source(s).

Sitewide Protectiveness Statement	
Protectiveness Determination: Short-term Protective	*Planned Addendum Completion Date:* Not applicable

Protectiveness Statement:

This Fourth FYR finds that the remedy currently protects human health and the environment . Both the OU1 and OU2 remedies have been constructed in accordance with Site decision documents. The waterline supplies a permanent source of clean drinking water to residences, and ICs are in place to prevent installation of groundwater wells in areas impacted by site contamination which prevents current exposure. For the remedy to be protective in the long term, the following issues need to be addressed:

- Install a packer or other technology in VFCC-4 to prevent vertical contaminant migration;
- Determine if a modification to the current remedy is needed that will allow achievement of groundwater cleanup levels in light of contamination from other source(s).

VIII. NEXT REVIEW

The next FYR for the Site is required five years from the completion date of this review.

REFERENCE LIST

U.S. Environmental Protection Agency, Record of Decision, Commodore Semiconductor Group Superfund Site, Audubon, Montgomery County, Pennsylvania, September 29, 1992.

U.S. Environmental Protection Agency, Explanation of Significant Difference, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, May 5, 1993.

Environmental Resources Management, Enhanced Treatment Technologies Screening Evaluation Report, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, October 3, 2019

U.S. Environmental Protection Agency, Second Explanation of Significant Difference, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, September 28, 2004.

Environmental Resources Management, Phase II Work Plan for Enhanced Treatment (ISCO), CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, July 2, 2004

U.S. Environmental Protection Agency, Third Explanation of Significant Difference, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, September 8, 2006.

Environmental Resources Management, Biogeochemical Reductive Dechlorination Pilot Test Workplan, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, July 13, 2010

U.S. Environmental Protection Agency, Fourth Explanation of Significant Difference, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, September 28, 2011.

Environmental Resources Management, Plume Stability Verification (PSV) Study Workplan, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, July 2014

Environmental Resources Management, Off-Site Perched Water and Soil Sampling, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, January 15, 2014

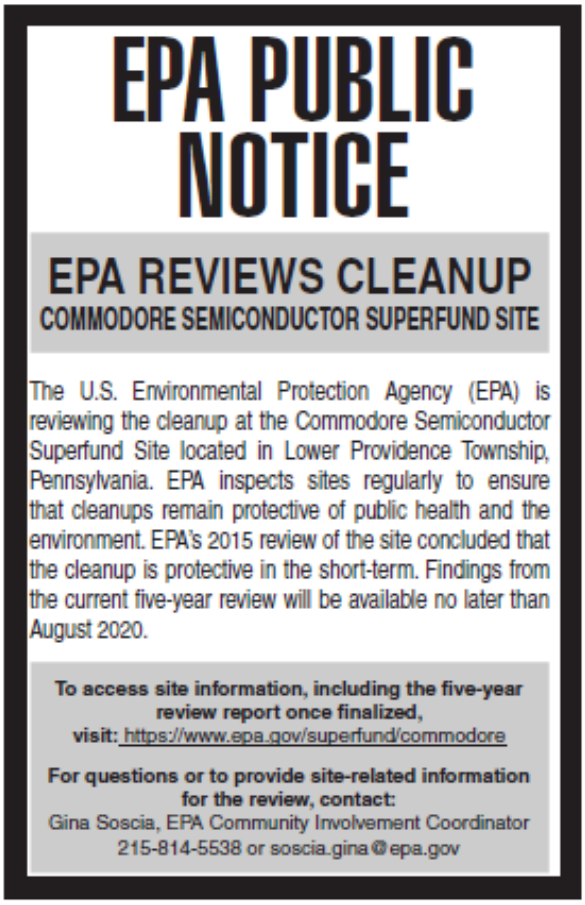
Environmental Resources Management, Conceptual Design Air Injection/Sparge/Vapor Extraction Pilot Test Results & Conclusions, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, December 27, 2016

Environmental Resources Management, Pump and Treat Performance and Plume Stability and Recovery Analysis (PRSA), Second Quarter 2018 through First Quarter 2019, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, October 3, 2019

Environmental Resources Management, Progress Report for 4th Quarter Activities, CSG Superfund Site, Audubon, Montgomery County, Pennsylvania, January 24, 2020

APPENDIX A

Newspaper: Norristown Times Herald
Issue Date: January 14, 2020



EPA PUBLIC NOTICE

EPA REVIEWS CLEANUP
COMMODORE SEMICONDUCTOR SUPERFUND SITE

The U.S. Environmental Protection Agency (EPA) is reviewing the cleanup at the Commodore Semiconductor Superfund Site located in Lower Providence Township, Pennsylvania. EPA inspects sites regularly to ensure that cleanups remain protective of public health and the environment. EPA's 2015 review of the site concluded that the cleanup is protective in the short-term. Findings from the current five-year review will be available no later than August 2020.

To access site information, including the five-year review report once finalized, visit: https://www.epa.gov/superfund/commodore

For questions or to provide site-related information for the review, contact:
Gina Soscia, EPA Community Involvement Coordinator
215-814-5538 or soscia.gina@epa.gov

Figure 1
Site Location Map
Commodore Semiconductor Group
Norristown, PA

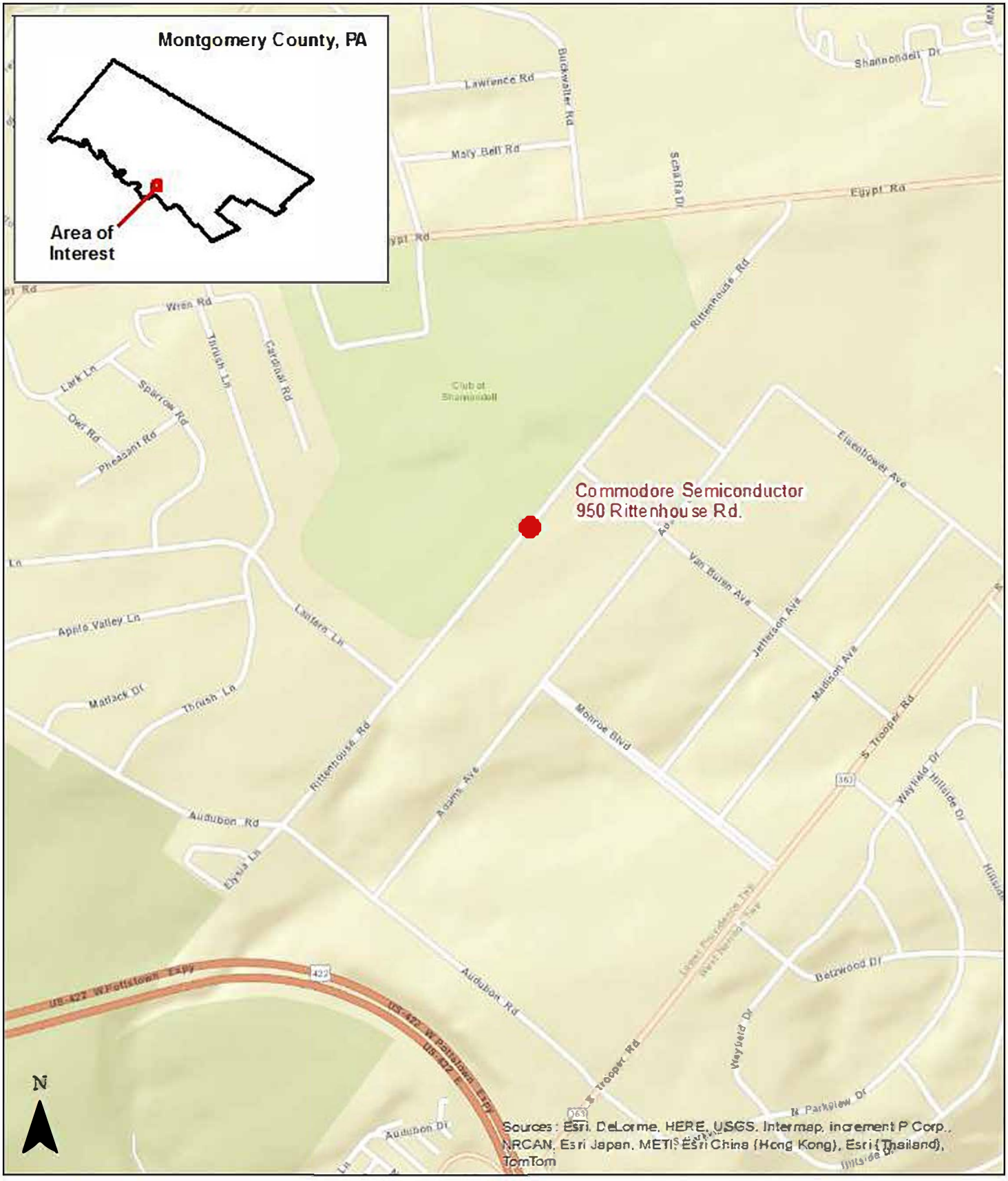
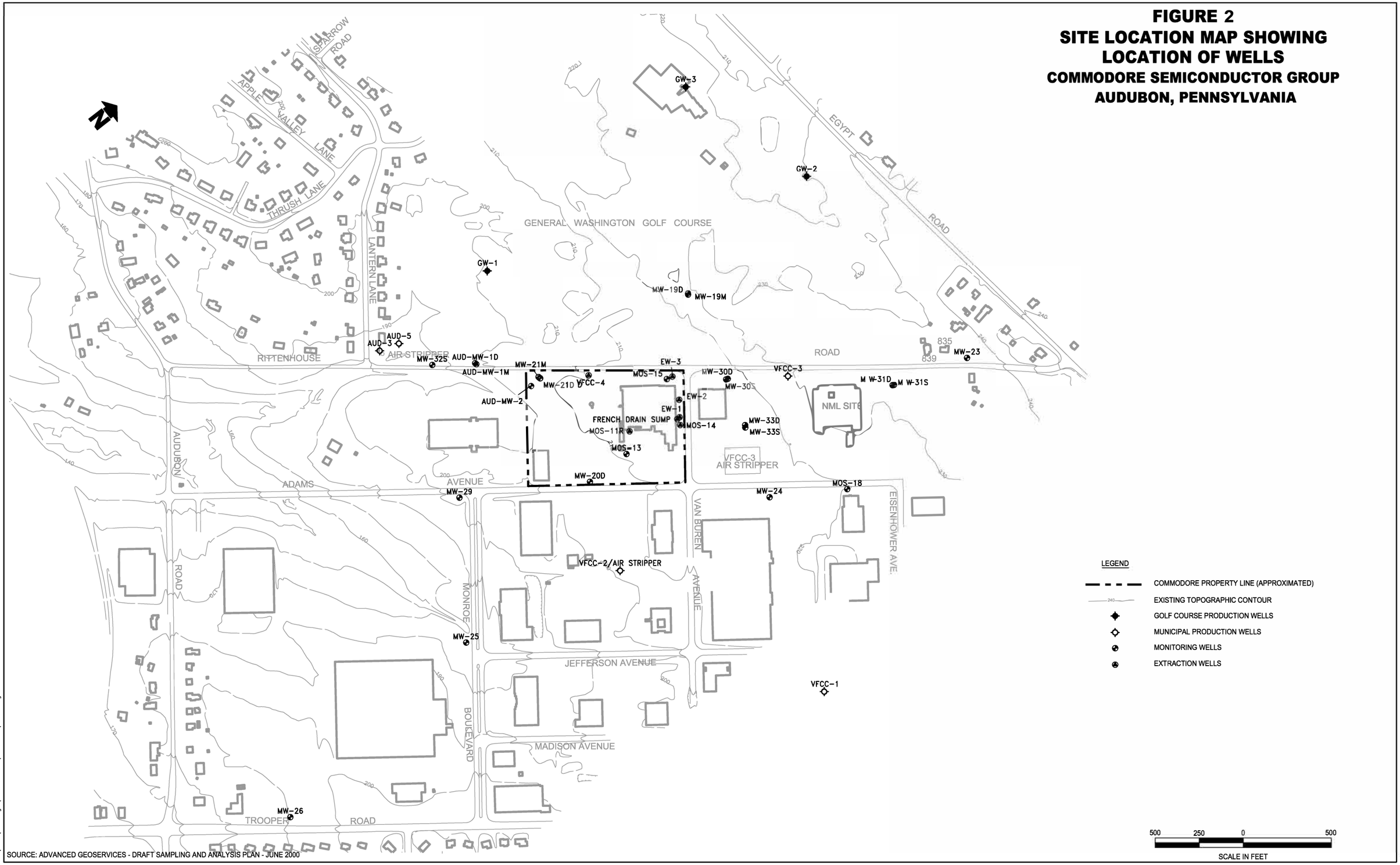


FIGURE 2
SITE LOCATION MAP SHOWING LOCATION OF WELLS
COMMODORE SEMICONDUCTOR GROUP
AUDUBON, PENNSYLVANIA



SOURCE: ADVANCED GEOSERVICES - DRAFT SAMPLING AND ANALYSIS PLAN - JUNE 2000

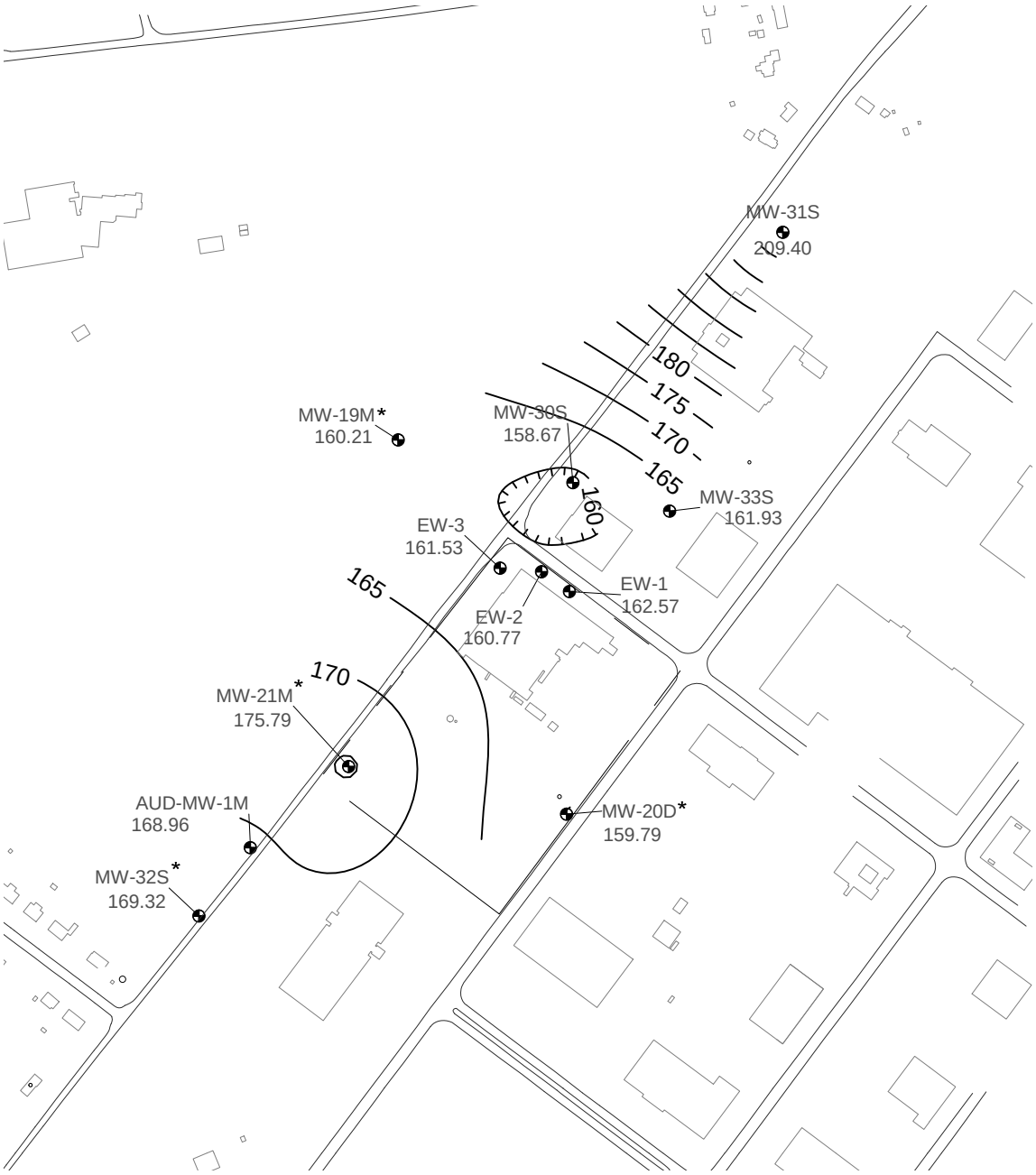
G:\CAD\Drawings\Commodore\0107032\A233.dwg

MLB/05-29-12

ERM, INC.

FIGURE 3

SHALLOW GROUND WATER CONTOUR MAP
MARCH 22, 2019
COMMODORE SEMICONDUCTOR GROUP SITE
AUDUBON, PENNSYLVANIA



* MW-21M and MW-32S are perched zone wells (not used).
MW-19M and MW-20D have hydraulic heads similar to shallow wells and therefore deemed appropriate for use in these plots.

N
W E
S

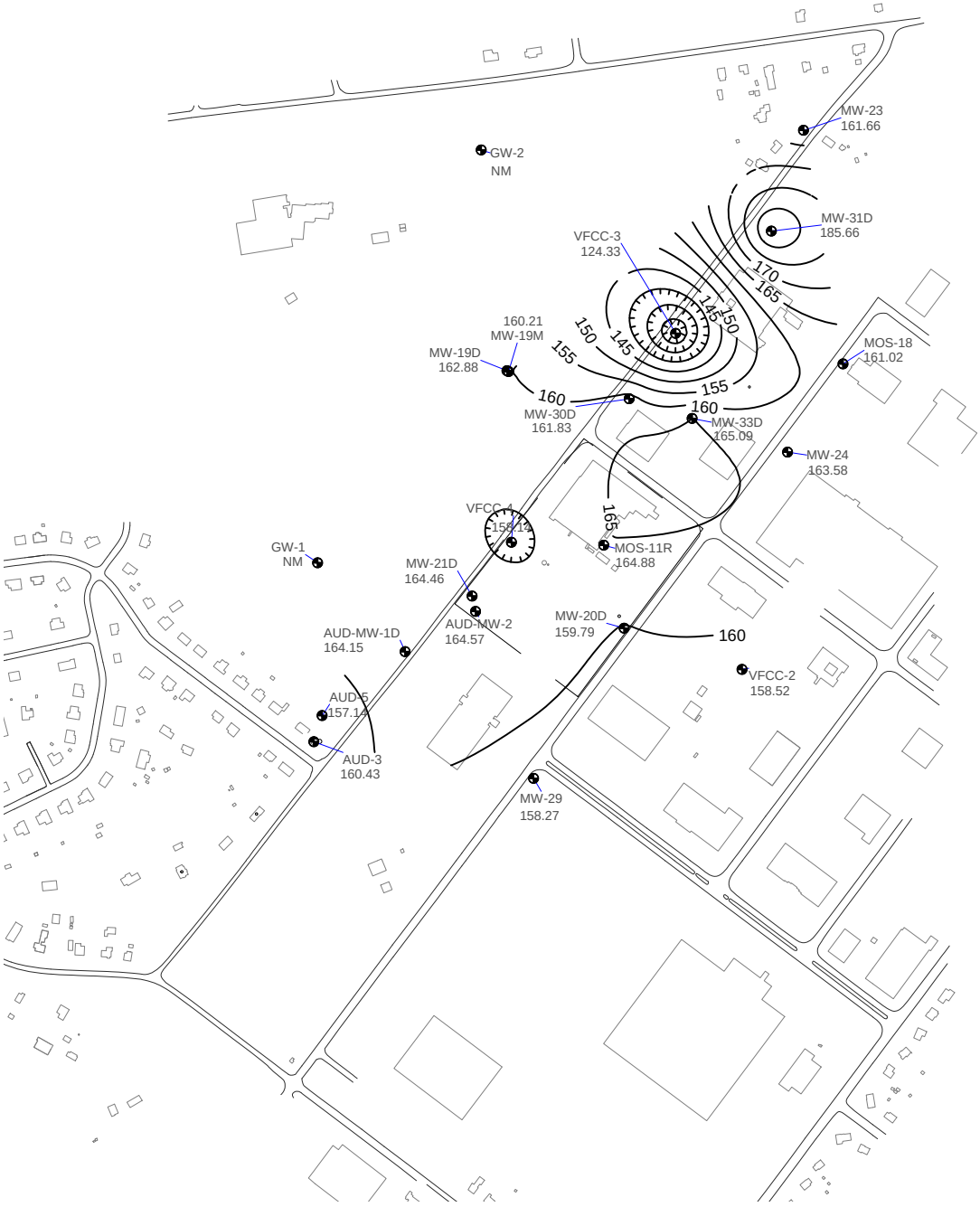
Scale in Feet

0 500 1000

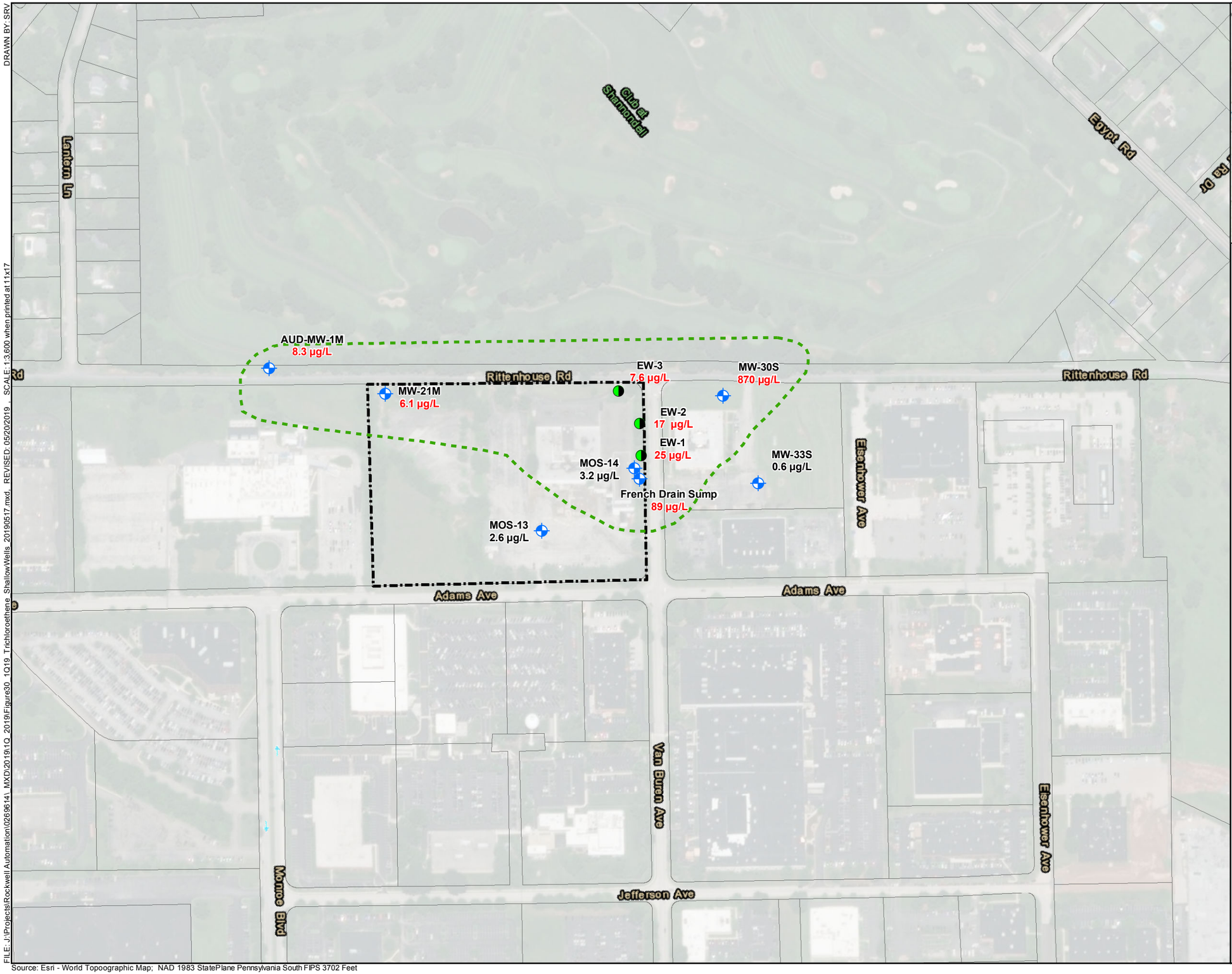
ERM

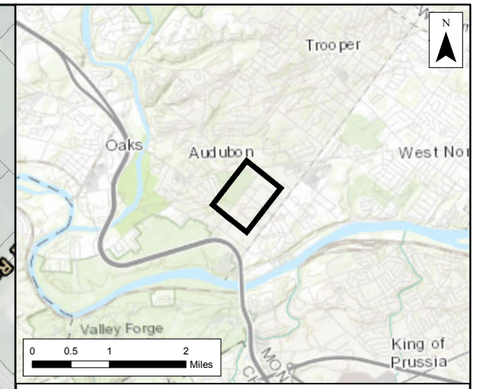
FIGURE 4

DEEP GROUNDWATER CONTOUR MAP
MARCH 22, 2019
COMMODORE SEMICONDUCTOR GROUP SITE
AUDUBON, PENNSYLVANIA



ERM





Legend

- Extraction Well
- Monitor Well
- TCE Isocontour (MCL = 5.0 µg/L)
- Property Boundary
- Parcel Boundary

Notes:
1.MCL = 5.0 µg/L
2.Aerial: ESRI ArcGIS 10.5

0 300 600
Feet

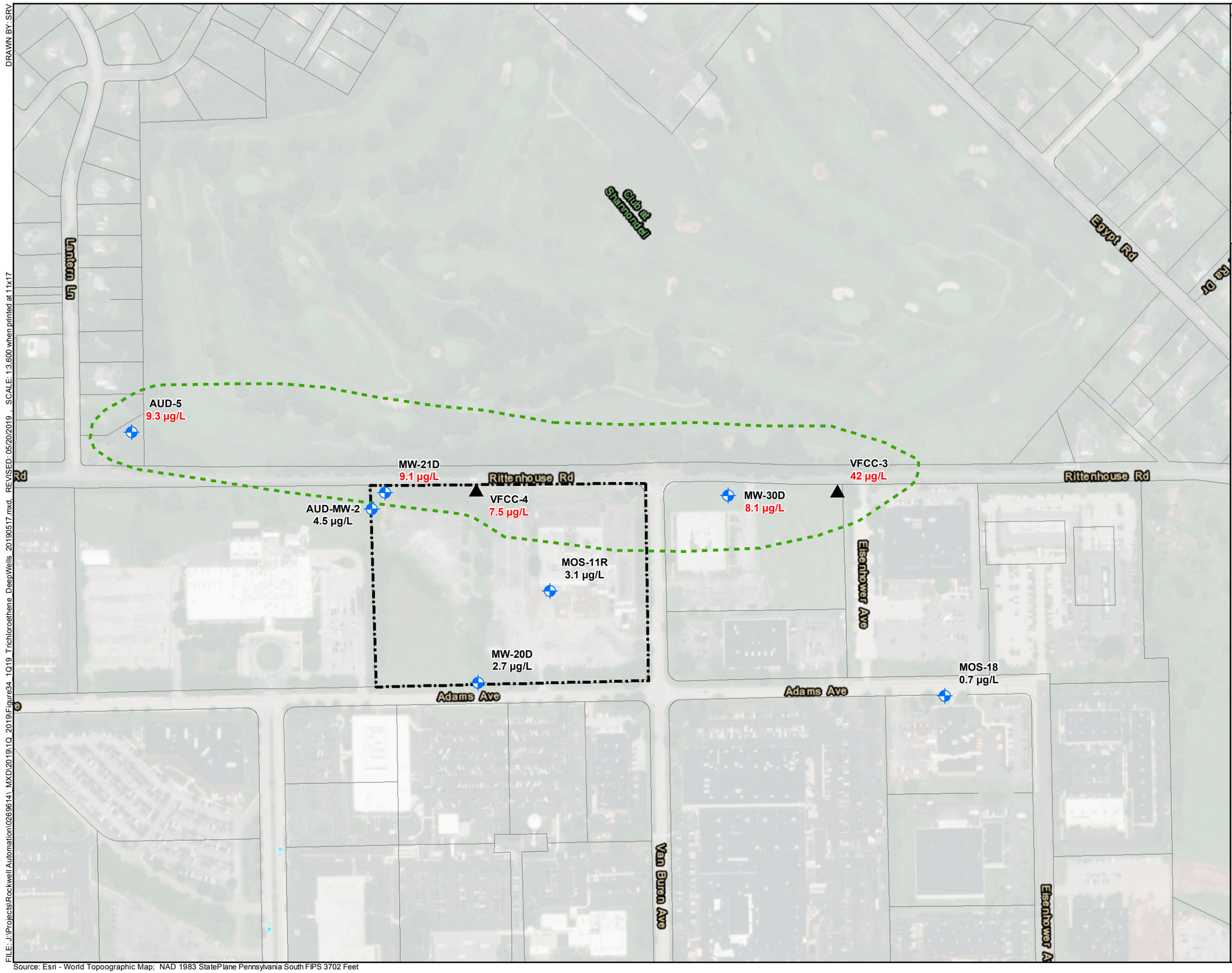
Figure 5
Shallow Groundwater
Trichloroethene Results
1st Quarter 2019
Commodore Semiconductor Group
Audubon, Pennyslvania

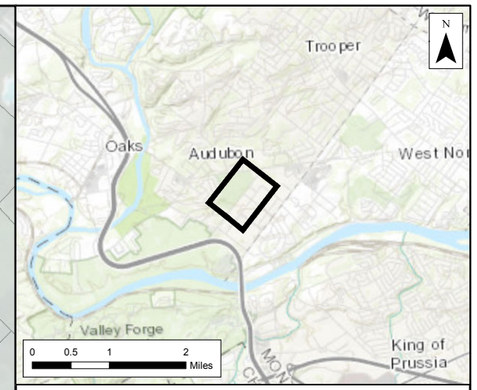
Environmental Resources Management
www.erm.com

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

DRAWN BY: SRV

FILE: J:\Projects\Rockwell Automation\0269614\ MXD\2019\1Q_2019\Figure30_1Q19_Trichloroethene_ShallowWells_20190517.mxd, REVISED: 05/20/2019 , SCALE: 1:3,600 when printed at 11x17





Legend

- Monitor Well
- Municipal Well
- TCE Isocontour (MCL = 5.0 µg/L)
- Property Boundary
- Parcel Boundary

Notes:
1.MCL = 5.0 µg/L
2.Aerial: ESRI ArcGIS 10.5

0 300 600
Feet

Figure 6
Deep Groundwater
Trichloroethene Results
1st Quarter 2019
Commodore Semiconductor Group
Audubon, Pennyslvania

Environmental Resources Management
www.erm.com

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

FILE: J:\Projects\Rockwell Automation\0269614\ MXD\2019\1Q_2019\Figure34_1Q19_Trichloroethene_DeepWells_20190517.mxd, REVISED: 05/20/2019 , SCALE: 1:3,600 when printed at 11x17

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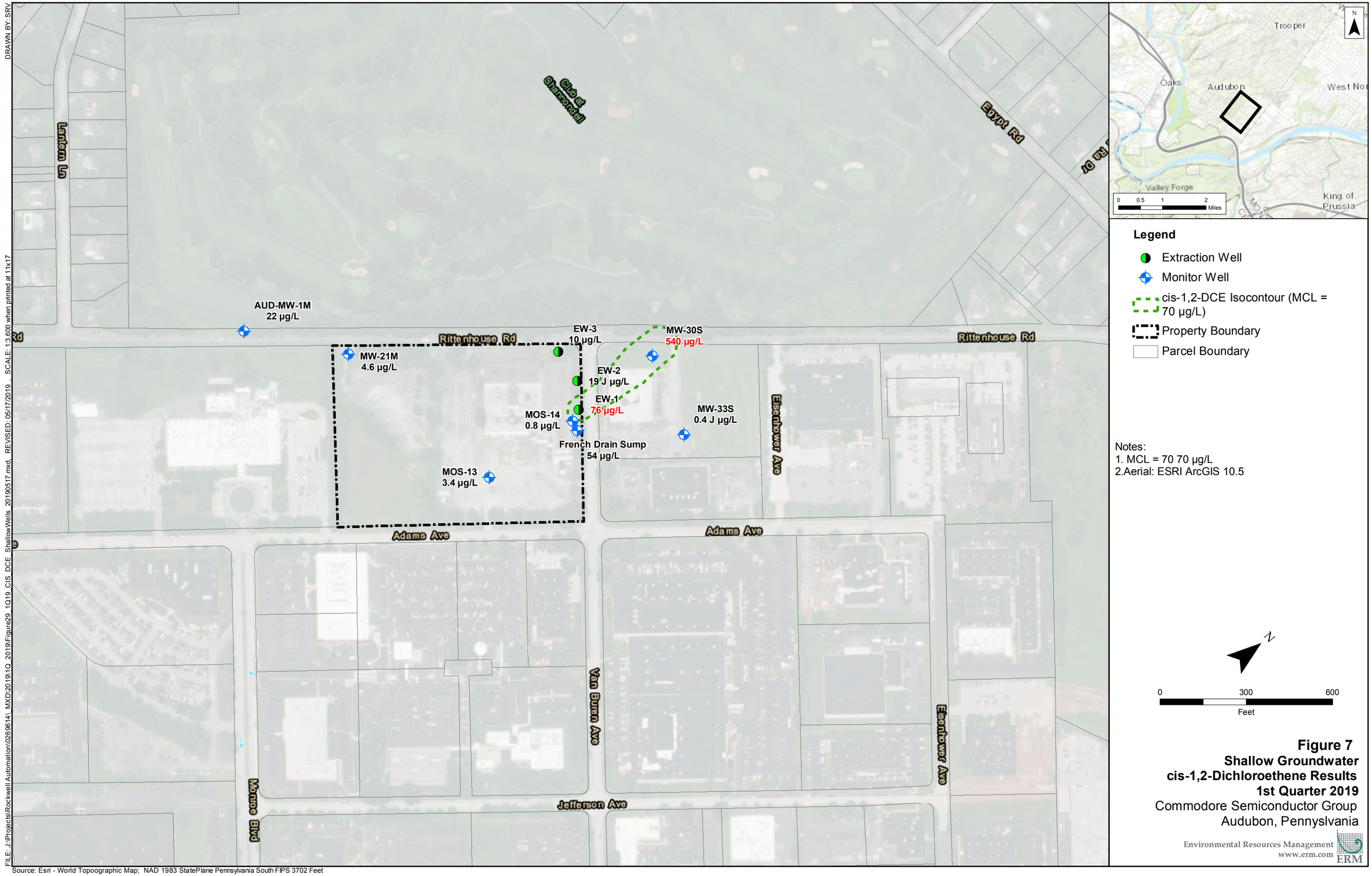

Figure 7
Shallow Groundwater
cis-1,2-Dichloroethene Results
1st Quarter 2019
Commodore Semiconductor Group
Audubon, Pennyslvania

Environmental Resources Management
www.erm.com

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

DRAWN BY: SRV

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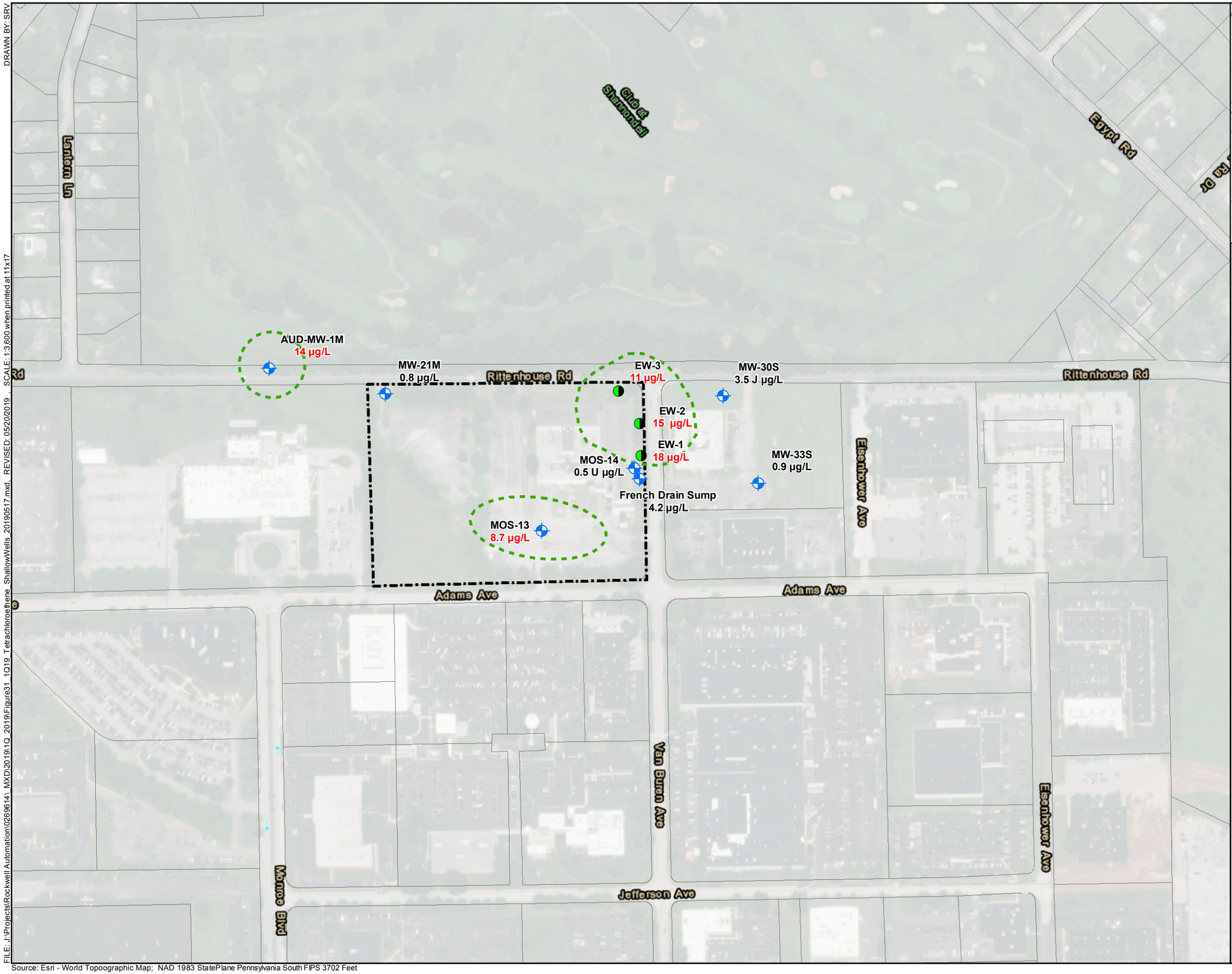

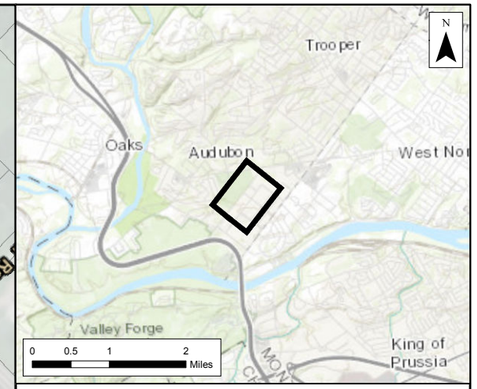

Legend

- Extraction Well
- Monitor Well
- PCE Isocontour (MCL = 5.0 µg/L)
- Property Boundary
- Parcel Boundary

Notes:
1.MCL = 5.0 µg/L
2.Aerial: ESRI ArcGIS 10.5

0 300 600
Feet

Figure 8
Shallow Groundwater
Tetrachloroethene Results
1st Quarter 2019
Commodore Semiconductor Group
Audubon, Pennyslvania

Environmental Resources Management
www.erm.com

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

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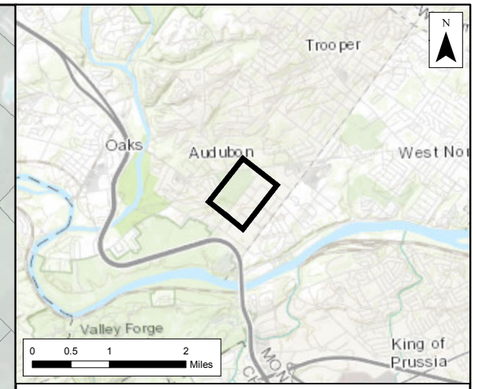
SCALE: 1:3,600 when printed at 11x17

FILE: J:\Projects\Rockwell Automation\0269614_MXD\2019\1Q_2019\Figure31_1Q19_Tetrachloroethene_ShallowWells_20190517.mxd REVISED: 05/20/2019



Legend

- Monitor Well
- Municipal Well
- PCE Isocontour (MCL = 5.0 µg/L)
- Property Boundary
- Parcel Boundary

Notes:
1.MCL = 5.0 µg/L
2.Aerial: ESRI ArcGIS 10.5

N

0 300 600
Feet

Figure 9
Deep Groundwater
Tetrachloroethene Results
1st Quarter 2019
Commodore Semiconductor Group
Audubon, Pennyslvania

Environmental Resources Management
www.erm.com

Source: Esri - World Topoographic Map; NAD 1983 StatePlane Pennsylvania South FIPS 3702 Feet

FILE: J:\Projects\Rockwell Automation\0269614\ MXD\2019\1Q 2019\Figure35 1Q19 Tetrachloroethene DeepWells 20190517.mxd REVISED: 05/20/2019 , SCALE: 1:3,600 when printed at 11x17

DRAWN BY: SRV