Five-Year Review Report

Fourth Five-Year Review Report
for
Vestal Water Supply Well 1-1 Superfund Site
Broome County, New York

September 2013

PREPARED BY:

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Region 2
New York, New York

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EXECUTIVE SUMMARY

This is the fourth five-year review for the Vestal Water Supply Well 1-1 Superfund Site (the Site) located in the Town of Vestal, New York. The remedies for the Site include treatment of contaminated groundwater via air stripping (operable unit 1 (OU1)), and the treatment of contaminated soil via *in-situ* vacuum extraction in two distinct areas, i.e., Area 2 and Area 4, both located in the Stage Road Industrial Park (operable unit 2 (OU2)). Because the remedial action for groundwater requires more than five years to complete, this five-year review is being conducted as a matter of Environmental Protection Agency (EPA) policy. The triggering action for this policy review was the completion of the third five-year review for the Site on September 4, 2008.

The OU1 remedy is protective of human health and the environment. The OU1 groundwater pump and treat facility is effectively capturing the groundwater plume and treating extracted water to protective levels prior to discharging the treated water to the Susquehanna River.

The OU2 remedy protects human health and the environment in the short term. However, in order for the remedy to be protective in the long term, an enhancement to the *in-situ* vacuum extraction system (such as the addition of *in-situ* heating) or other remedy modification may be needed in Area 4 to remediate the soils to cleanup levels identified in the Record of Decision (ROD).

Since OU1 is protective of human health and the environment and OU2 is protective in the short term, the Site is protective of human health and the environment in the short term. For the Site to be protective in the long term the Area 4 *in-situ* vacuum extraction system needs to be enhanced to remediate soils to cleanup levels identified in the ROD.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site Name: Vestal Water Supply Well 1-1		
EPA ID: NYD980763767		
Region: 2	**State:** NY	**City/County:** Vestal, Broome County
SITE STATUS		
NPL Status: Final		
Multiple OUs? Yes	**Has the site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA **If "Other Federal Agency" was selected above, enter Agency name:**		
Author name (Federal or State Project Manager): Sharon Trocher		
Author affiliation: EPA		
Review period: 9/1/2008 – 4/31/2013		
Date of site inspection: 11/13/2012		
Type of review: Policy		
Review number: 4		
Triggering action date: 9/4/2008		
Due date *(five years after triggering action date)*: 9/4/2013		

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): OU2	Issue Category: Remedy Performance			
	Issue: The *in-situ* vacuum extraction system is not capable of remediating the remaining volatile organic compounds from the soil in Area 4 to ROD soil cleanup levels because the remaining contaminants are located in fine-textured soils and/or in the saturated zone.			
	Recommendation: Complete a focused feasibility study and determine the required enhancements/modifications needed to achieve ROD soil cleanup levels and update the remedy decision document as appropriate.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Implementing Party**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	12/31/2014

Five-Year Review Summary Form (continued)

Protectiveness Statement(s)

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU1	Protective	

Protectiveness Statement:
The remedy for the first operable unit (OU1) is protective of human health and the environment.

Operable Unit:	*Protectiveness Determination:*	*Addendum Due Date (if applicable):*
OU2	Short term Protective	

Protectiveness Statement:
The remedy for the second operable unit (OU2) is protective of human health and the environment in the short term. In order to be protective in the long term, the Area 4 *in-situ* vacuum extraction system needs to be enhanced. The *in-situ* vacuum extraction system is not capable of remediating the remaining volatile organic compounds from the soil in Area 4 to ROD soil cleanup levels because the remaining contaminants are located in fine-textured soils and/or in the saturated zone.

Sitewide Protectiveness Statement (if applicable)

Protectiveness Determination:	*Addendum Due Date (if applicable):*
Short term Protective	

Protectiveness Statement:
The Site is protective of human health and the environment in the short term. For the Site to be protective in the long term the Area 4 *in-situ* vacuum extraction system needs to be enhanced.

Vestal Water Supply Well 1-1 Superfund Site
Town of Vestal, New York
Fourth Five-Year Review Report

I. Introduction

This is the fourth five-year review for the Vestal 1-1 Site in the Town of Vestal, New York. This review was conducted by the Remedial Project Manager for the Site. The review was conducted in accordance with the Comprehensive Five-Year Review Guidance, OSWER Directive 9355.7-03B-P (June 2001). The purpose of a five-year review is to ensure that implemented remedies are protective of human health and the environment and that they function as intended by the decision documents. This report will become part of the Site file.

The Site is being addressed in two phases, or OUs. OU1, which involves groundwater extraction and treatment via air stripping, has been constructed and is currently operating. OU2 addresses two discrete sources (Area 2 and Area 4) of groundwater contamination. Remediation of the contaminated soil via *in-situ* vapor extraction in Area 2 has been completed. An *in-situ* vacuum extraction system was also constructed to address the contaminated soil in Area 4 and was operated for approximately three years. This segment of the OU2 remedy for Area 4 is currently shut down pending further actions needed to enhance the remedy.

II. Site Chronology

See Table 1 for Site chronology.

III. Background

Physical Characteristics

The Site is located in the Town of Vestal, Broome County, New York, about five miles southwest of the City of Binghamton, on the South Bank of the Susquehanna River (see Figure 1). The Site is generally flat and lies within the flood plain of the Susquehanna River. The western portion of the Site is located between the Susquehanna River and New York State Route 17 and includes a well field, a fire department training center, state-owned forest lands, and a recreational field. The eastern portion of the Site contains the Stage Road Industrial Park which is located approximately 1000 feet southeast of Well 1-1 (see Figure 2). The Stage Road Industrial Park contains several active industrial facilities. Several marshy areas and drainage ditches encompass and interlace the industrial park. Two areas, Area 2 and Area 4 (see Figure 3), located in the industrial park are sources of groundwater contamination. Area 2 consists of approximately one acre of land, formerly used as a truck parking area between Stage Road and the abandoned Erie Lackawanna railroad tracks. Area 4 consists of a large one-story building with an area covering approximately 60,000 square feet and an adjacent parking lot. The building was used to manufacture transformers and later electronic circuit boards. The circuit board

manufacturing operations ceased in May 2002. Since 2007 to present day, the building is used to recycle electronic equipment. Approximately 27,000 people reside in the Town of Vestal, and approximately 23,000 rely on public water supplies for drinking water.

Land and Resource Use

Land use on the eastern portion of the area surrounding the Site evolved from agriculture to light and medium industrial. Land use on the western portion currently includes open spaces, a fire department training center and a public water supply well field. It is anticipated that the mix of land uses described above will continue into the future. The identified source areas were located in an industrial part of active light industrial properties. These properties are within the Stage Road Industrial Park and are zoned for commercial/light industry. These properties are likely to continue to be zoned and used for commercial/light industrial.

Well 1-1 was one of three production wells in Water District 1 that provide drinking water to several water districts in the Vestal area. In 1954, Well 1-1 was constructed with the capacity of 1.4 million gallons per day as a backup well to supplement the Vestal water supply which was provided at that time by the Town of Endicott, located across the Susquehanna River. A few years later, Water District 1 became an independent water supplier for the Town of Vestal, utilizing Wells 1-1, 1-2, and 1-3 with a combined capacity of 4.6 million gallons per day. In 1980, after significant concentrations of chlorinated solvents, primarily 1,1,1-trichloroethane (TCA), trichloroethene (TCE) and 1,2-dichloroethene (DCE) were detected in Well 1-1, the well pumpage was diverted and discharged into the Susquehanna River. Well 1-2 became physically impaired in 1988 and has since been replaced by a new Well 1-2A. Before the construction of Well 1-2A, Well 1-3 served for several years as the district's primary water supply. Additionally, reserve capacity is provided by an emergency interconnection to another water district and a holding tank in District 1.

The aquifer underlying the Site is extremely permeable, resulting in high production capacities; this characteristic also allows for the rapid migration of contaminants introduced to the aquifer. There also exist many variations in the subsurface geology in this area that give rise to highly complex groundwater hydrology. The direction of the shallow groundwater flow from the source area is generally from southeast to northwest.

History of Contamination

A chemical spill at the IBM plant in Endicott, New York in 1978 led to the development of a testing program of all drinking water wells in the vicinity of the plant for organic compounds. As a result of this testing program, chlorinated solvents were detected in Well 1-1, and the well was taken out of service in 1980 and pumped to the Susquehanna River. A subsequent investigation determined that the presence of chlorinated solvents in Well 1-1 was not related to the spill at the IBM plant. As previously mentioned, the source of the groundwater contamination was determined to be two areas located in the Stage Road Industrial Park.

Initial Response

After chlorinated organic solvents were discovered in Well 1-1, the well pumpage was diverted to the Susquehanna River in 1980 in order to hydraulically "capture" and discharge a plume of contaminated groundwater before the contaminants could reach the remainder of the well field. EPA proposed the Site for listing on the National Priorities List (NPL) on December 30, 1982 (47 *Federal Register* 58476) and formally added it to the NPL on September 8, 1983 (48 *Federal Register* 40658).

Basis for Taking Action

The New York State Department of Environmental Conservation (NYSDEC) commenced a remedial investigation/feasibility study (RI/FS) of the Site in April 1985 under a Cooperative Agreement with EPA. The RI, risk assessment and FS for the Site, completed in 1986, confirmed the presence of volatile organic compounds (VOCs) in the groundwater southeast and east of Well 1-1 and identified a future risk to residents consuming TCE contaminated drinking water at 2.1×10^{-5}. NYSDEC, concluded that this risk was unacceptable. The contaminants of concern identified in the risk assessment for the ingestion of groundwater were primarily the VOCs TCE, TCA, DCE and 1,1-dichlorethane (DCA). Based on the RI/FS and the risk assessment, EPA issued a ROD for OU1 which addressed the VOCs in the groundwater on June 27, 1986. The OU1 ROD also recommended that a second RI/FS be undertaken to evaluate suspected source areas of contamination upgradient of Well 1-1.

EPA assumed the lead role for the OU2 source investigation and initiated the RI/FS in November 1988. The results of the RI/FS revealed significant VOC contamination in subsurface soils located in two areas in the Stage Road Industrial Park, identified as Area 2 and Area 4. Most of the subsurface contamination was determined to reside between five and 25 feet below ground surface with the highest VOC concentrations at depths greater than 10 feet.

The OU2 risk assessment identified unacceptable risks to future construction workers exposed through ingestion and dermal contact with the contaminated soil and inhalation of VOCs. The risk assessment found the excess risk under the plausible maximum case was 4×10^{-4} in Area 2 and 5×10^{-4} in Area 4. In addition, the risk assessment identified unacceptable risk (i.e., greater than 10^{-6}) to residents from the ingestion of groundwater contaminants which were leached from the soil. Potential exposure pathways considered were ingestion of groundwater from directly below source Area 2 and Area 4 and from Well 1-1. Primarily VOCs such as TCE, TCA, DCE, DCA and tetrachloroethene (PCE) were identified as contributing to the health risks to construction workers and to residents. The ecological risk assessment determined that is unlikely that the soil and groundwater contamination has adversely affected any plant life in the study area, particularly wetlands, due to the considerable depths at which the higher concentrations of contaminants have been detected (below root levels). The study area was considered by EPA to have limited ecological significance (both flora and fauna). Based on the supplemental RI/FS and risk assessment, EPA signed a ROD for OU2 on September 27, 1990 which addressed the contaminated soil located in the two discrete source areas, Area 2 and Area 4.

IV. Remedial Actions

Remedy Selection

The OU1 ROD, which addressed the contaminated groundwater, was signed on June 27, 1986, and the OU2 ROD, which addressed the source areas, was signed on September 27, 1990.

OU1

The following are the remedial action objectives selected in the OU1 ROD to address groundwater contamination:

-Contain the plume of contamination to mitigate further contamination of public water supplies.
-Provide a safe, reliable drinking water supply to the Town of Vestal.
-Ensure that the quality and best use of the Susquehanna River are not impaired.

The following are the major components of the selected remedy for the OU1 ROD:

-Construction of a packed column air stripping system on Well 1-1 in order to return the well to full service as Vestal Water District 1's primary water supply.
-Initiation of a supplemental remedial investigation/feasibility study to investigate further the extent of soil contamination in suspected source areas and to evaluate possible source control measures.

OU2

The following are the remedial action objectives selected in the OU2 ROD to address soil contamination:

-Ensure protection of groundwater from the continued release of VOC contamination from soil.
-Ensure protection of Well 1-1 water quality from any inorganic groundwater contamination not addressed in the first operable unit, if necessary.
-Ensure protection of human health, to construction workers who may be potentially exposed to contaminated soils during future excavation.

The following are the major components of the selected remedy for the OU2 ROD:

-*In-situ* vapor extraction of VOCs from soil in source Area 2 and Area 4 within the Stage Road Industrial Park, followed by carbon adsorption, with subsequent treatment and disposal of contaminated carbon at a permitted off-site facility.
-A monitoring program to evaluate progress of the *in-situ* vacuum extraction remedy.
-A monitoring program to assess periodically inorganic contaminants in the aquifer upgradient of Well 1-1 (the decision to implement a monitoring program for organic contamination was contained in the EPA's June 27, 1986 ROD for OU1).

-A contingency remedy for Well 1-1 involving treatment of inorganic contaminants and groundwater to be implemented, if necessary in the future.

The remedial action objectives for the OU1 ROD had an ambiguity concerning the groundwater cleanup. One of the remedial action objectives was "containing" the groundwater contamination. However, the ROD text indicated that the OU1 remedy would restore the aquifer, stating "At the present time, it is estimated that continued pumping of Well 1-1 will clean the aquifer in 20+ years...." The OU2 ROD reviewed the OU1 groundwater remedy and confirmed that no additional wells were necessary since Well 1-1 would provide for "aquifer restoration." Subsequent actions taken by the State and EPA were consistent with aquifer restoration. This ambiguity may be that when the ROD was issued, the Region intended that the remedy would restore the aquifer as well as contain the contamination. However, the ROD did not explicitly refer to restoration of the aquifer because the provision of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Section 104(c)(6) and the National Contingency Plan (NCP), Section 300.465(f) had not been enacted yet; and therefore, the ROD did not explicitly refer to the restoration of the aquifer as it would have occurred had those sections of the NCP been enacted at the time of the ROD. Consequently, the containment of groundwater contamination was important to the remedy at the time, but not inconsistent with an aquifer restoration. Throughout the remainder of this report, the remedial action objective for OU1 will be considered aquifer restoration and the remedial action objectives for the Site soils and groundwater will be considered to provide for unlimited use of the source area properties and the groundwater aquifer without any restrictions on exposures.

Remedy Implementation

EPA performed the remedial design/remedial action (RD/RA) for OU1 and for Area 2 of OU2 because no viable potentially responsible parties were identified. In March 1991, EPA issued a unilateral administrative order to three potentially responsible parties for the performance of the RD/RA at Area 4. Although the Area 4 RD was completed in September 1994 pursuant to the Unilateral Administrative Order, the potentially responsible parties indicated that financial constraints would prevent their implementation of the RA; therefore, EPA assumed performance of the Area 4 RA. In May 1999, EPA negotiated an ability to pay settlement with the potentially responsible parties for past and future costs incurred by EPA.

OU1

The RD for the air stripper was approved by EPA in September 1987. The construction of the air stripping facility was started in May 1989 and completed by EPA in July 1990. However, due to operational problems at existing Well 1-1, EPA replaced Well 1-1 with a new well, Well 1-1A. The RD for Well 1-1A was completed in May 1992, and construction of Well 1-1A was completed in December 1993. Well 1-1A has a maximum pumping capacity of 1150 gallons per minute (gpm). The depth to the bottom of the well is approximately 125 feet below ground surface, and the well pump intake is located at approximately 90 feet below ground surface. The typical operating flow rate ranges from 300 to 500 gpm.

In March 1995, EPA issued a Remedial Action Report which determined that Well 1-1A and the associated air stripping facility were fully operational and functional as a potable water supply. However, NYSDEC, which had previously agreed through a cooperative agreement with EPA to provide long term response action for this facility, was unable to secure a contract with the Town of Vestal to perform long term response action on behalf of the State. In May 1995, NYSDEC withdrew its request for a cooperative agreement to perform the long term response action. The Town of Vestal also indicated that it no longer required water from Well 1-1A for its drinking water supply. Therefore, EPA performed the long term response action to treat the extracted groundwater and discharged the treated water to the Susquehanna River. Under CERCLA, EPA can perform long term response action activities for only ten years after which the operation and maintenance (O&M) of the groundwater treatment facility is transferred to the State. In 2006, NYSDEC assumed responsibility for the O&M of the facility.

The monitoring for OU1 consists of both treatment plant performance monitoring and groundwater monitoring. The performance monitoring criteria are designed to monitor the performance of the air stripper treatment system and determine whether the treated water meets the requirements for discharge to the Susquehanna River. The performance evaluation requires monthly sampling and analysis of the influent and effluent of the Well 1-1A treatment system. The groundwater monitoring criteria are designed to monitor the effectiveness of capture of the groundwater contamination plume and to determine the progress of groundwater restoration and compliance with the groundwater quality standards. The evaluation requires annual sampling and analysis of groundwater from monitoring wells in the contamination plume area and measurements of groundwater elevation during sampling to develop a potentiometric surface map reflecting the current aquifer conditions. Figure 4 provides the locations of the monitoring wells.

OU2

The remedial designs of the *in-situ* vacuum extraction systems for Area 2 and Area 4 were completed in September 1994. Construction of the *in-situ* vacuum extraction system for Area 2 started in October 1996. The *in-situ* vacuum extraction system was designed to remove VOCs from unsaturated soil. Initial concentrations of total contaminants of concern in untreated subsurface soil in Area 2 ranged from 40 to 150,000 parts per billion (ppb). The system was designed with horizontal wells (12) to treat the upper vadose zone and vertical wells (36) down to the groundwater. A semi-permeable Site cover consisting of six inches of clay was constructed over the treatment area to minimize vertical leakage of air. The extracted soil gas was treated using two vapor-phase granular activated carbon canisters connected in series prior to release into the atmosphere. The *in-situ* vacuum extraction system operations began in January 1997, after installation and system start-up activities were completed. In December 1997, four additional vertical *in-situ* vacuum extraction wells were installed to extend the treated area to the contaminated soil in the eastern portion of Area 2 for a total of 40 vertical wells. The *in-situ* vacuum extraction system operation was terminated in November 2000, after the results of the Interim Soil Sampling Program confirmed that the *in-situ* vacuum extraction system successfully achieved ROD cleanup levels. Actual operation of the *in-situ* vacuum extraction system was for

approximately 30 months since the system was shut down for four extended periods due to operating problems that occurred as a result of extremely high rainfall and subsequent high elevation of the groundwater table. The volume of treated soil was approximately 17,000 cubic yards or 47.6 million pounds of soil. The total targeted VOCs removed were approximately 1,046 pounds.

EPA and the U.S. Army Corps of Engineers (USACE) have determined that the remediation of contaminated soil in Area 2 has been completed and met the cleanup levels specified in the OU2 ROD. In addition, construction in Area 2 was performed consistent with the Remedial Design Final Performance Specifications and conforms to the remedy selected in the OU2 ROD.

In Area 4, soil sampling was performed in September and October 2001 to further delineate the area of contamination and to refine the RD completed in September 1994. The highest initial concentrations of contaminants of concern detected in the untreated subsurface soil in Area 4 were 2,840 parts per million (ppm) of TCE and 2,250 ppm of TCA. Construction of the *in-situ* vacuum extraction system was started on April 1, 2003 and was completed on June 27, 2003. *In-situ* vacuum extraction system construction activities included installation of 55 vertical wells and an air conduit network assembly, installation of condensate water discharge lines, construction of two distribution buildings, electrical hook-up, connection of distribution buildings to an existing equipment building located in Area 2, and upgrading the equipment in the equipment building (see Figure 5). The manifolds and individual well piping were constructed for rotational flexibility between injection and withdrawal of air to allow increased control of air flow within the treatment area. The *in-situ* vacuum extraction system was fully automated and designed to be operated 24 hours per day, seven days per week. The *in-situ* vacuum extraction system was similar to the *in-situ* vacuum extraction system used in Area 2. The extracted soil gas was treated using two vapor-phase granular activated carbon canisters connected in series prior to release into the atmosphere.

In February, September and October 2005, EPA conducted soil and groundwater sampling at the Site to evaluate the progress of the *in-situ* vacuum extraction system in cleaning-up Area 4 due to the low VOC contaminant removal rates. The results of the sampling showed that very high levels of VOCs still remained in the deep unsaturated and the shallow saturated zones. The *in-situ* vacuum extraction system was shut down in January 2006 for reevaluation to determine if the *in-situ* vacuum extraction system could achieve OU2 soil cleanup levels. Prior to its shutdown, approximately 2,300 pounds of VOCs were removed from the soils.

As part of the evaluation, EPA conducted further soil and groundwater sampling to fully delineate the horizontal and vertical extent of VOC contamination remaining at the Site and to evaluate the subsurface geology/hydrology. The results of the sampling revealed that the VOCs TCA and TCE were the most prevalent and exhibited the highest concentrations. The highest concentrations of VOCs in the soil were detected in the 10- to 20-foot depth range where fine-textured soil and the capillary fringe of the aquifer exist. The VOCs were detected in two areas of the parking lot, located on the south side of the building, underneath the building and in the northeast corner of the Site. The highest level of contamination detected in the parking lot was

nearly 24,000 ppm of TCA and 13,000 ppm of TCE at 16 feet below ground surface. The extremely high VOC contamination (in the thousands of ppm) appears to be limited to an area approximately 20 feet long by less than 10 feet wide in the eastern area of the parking lot and approximately 25 feet by 20 feet in the western area of the lot. Significant levels of VOCs were also detected beneath the building, at levels as high as 83 ppm of TCA and 108 ppm of TCE, and in the northeast corner of the Site, at levels as high as 15.9 ppm of TCA, 244 ppm of TCE and 107 ppm of 1,2,4-trimethylbenzene. Figure 6 shows the aerial extent of soil contamination that was detected above ROD soil cleanup levels in Area 4.

Based on the results of this evaluation, EPA determined that the *in-situ* vacuum extraction system is unable to address the remaining VOC contamination in the fine-textured soils at the Site without enhancing the *in-situ* vacuum extraction treatment system. *In-situ* vacuum extraction technology alone is unsuitable for fine-textured soils and/or saturated soils since these conditions limit the radius of influence of the *in-situ* vacuum extraction system. The *in-situ* vacuum extraction system will need to be enhanced, e.g., with *in-situ* heating, in order to assist in the removal of VOCs from the vadose and aquifer zones in the Area 4 source area, or other measures will need to be taken to achieve cleanup levels. All appropriate remedial options will be evaluated in the focused feasibility study. Based on the focused feasibility study, EPA will issue an appropriate decision document for the enhancement of the Area 4 remedy. Prior to issuing the decision document, EPA may conduct a pilot study on part of the Site to determine the effectiveness of the enhancement to the *in-situ* vacuum extraction/*in-situ* heating system.

Institutional Controls Review

Area 4 is located in an industrial park of active light industrial properties. This part of Vestal, New York is zoned for commercial/light industry; there are no residential uses of property in this area. The Site property is likely to continue to be zoned for commercial/light industrial use into the future, and there are no future residential uses of the Site property that can be reasonably contemplated. There is also a Consent Decree which restricts the use of the property including limiting the use of the groundwater and excavation activities. This Consent Decree is binding on the current and future property owners.

The remedial action objectives for the Site soils and groundwater provide for unlimited use of the source area properties and the groundwater aquifer without restrictions on exposures. There are no institutional controls included in the selected final remedies. The source area soil cleanup is complete in Area 2. The groundwater cleanup is ongoing. The groundwater remedy did not include any "interim" actions, including institutional controls. At the time of the ROD, the use of the public water supply appeared to be universal in the area. This was probably because of local requirements mandating the use of the public water supply. The New York Sanitary Code (Title 10 of the New York Code of Rules and Regulations Section 5-2.4) states that "No person shall construct or abandon any water well unless a permit has first been secured from the permit issuing official." Based on these statutory controls, it is likely that most potable uses of the site groundwater would not be permitted in the future. Consequently, no "interim" institutional controls were included in the remedy and none are anticipated at this time.

System Operations/Operation and Maintenance

OU1

NYSDEC's contractor is conducting the long term O&M activities for the air stripping facility according to the October 2006 Final Operation and Maintenance Manual approved by NYSDEC and EPA. EPA's contractor conducted the long term response action for the air stripping facility from October 1996 to October 2006. The primary activities associated with O&M include the following:

-Inspection and maintenance of Well 1-1A pump packing, pre-lube line and pump motor oil.
-Inspection, maintenance and lubrication of motors and pumps and inspection of blowers' air filters.
-Periodic manual removal of calcium carbonate deposits from several key locations where the deposition impedes flow.
-Inspection of tower packing, clearwell water levels and recording of flow rates.
-Verification that the high level and low level shut-off switches for the clearwell are working properly.
-Verification that the motor control center and the alarm/control panel are working properly, and inspection and testing of the auto dial-out system.
-Monthly sampling of plant influent and effluent, and annual sampling of ground water monitoring wells.
-Periodic well development of Well 1-1A.

Since the last five-year review report (Third Five-Year Review Report, September 2008), the groundwater treatment facility was shut down two times for an extended period for repairs. From October 6, 2008 to February 9, 2009, the State shut down the groundwater treatment facility to replace the Well 1-1A pump and motor, redevelop the well, install a variable frequency drive to reduce the torque on the well drop pipe, and upgrade the corrosion protection system. From June 7, 2010 to August 20, 2010, the groundwater treatment facility was shut down again to install a new pump motor and to redevelop the well. A flow sleeve was also installed to reduce the well casing diameter to allow for operating at lower flow rates without overheating the pump motor. These repairs increased the flow rate back to normal operating levels. Table 2 provides the annual O&M costs for OU1, which include the O&M of the air stripping facility, sampling and monitoring efforts, utilities and repairs.

OU2

The *in-situ* vacuum extraction system for Area 2 operated from January 1997 until November 2000 when the operation was terminated after the system successfully achieved ROD cleanup levels. Operation of the Area 2 *in-situ* vacuum extraction system was similar to the operation of the Area 4 *in-situ* vacuum extraction system which is discussed below. Costs for operation of the

Area 2 and Area 4 *in-situ* vacuum extraction systems are provided in Table 3a and 3b, respectively, and include operation of the *in-situ* vacuum extraction system, sampling and monitoring efforts, repairs and utilities.

USACE, who provides project oversight for EPA and its contractor, operated the *in-situ* vacuum extraction system in Area 4 from startup in June 2003 until the *in-situ* vacuum extraction system was shut down in January 2006. The primary activities with operation of the Area 4 system included the following:

-Inspect, maintain and lubricate motors, heat exchangers and discharge and purge pumps.
-Inspect the piping system and all control and relief valves.
-Remove any sediment from the water knock-out tank and verify that the low-level and high-level shut-off switches are working properly.
-Sample process air and monitor system parameters, including pressures, vacuums, flow rates and temperatures.
-Evaluate the analytical data to determine if the system needs to be reconfigured to obtain optimal performance of the system.
-Verify that the control system is working properly. Inspect the sensor switches, control relays, and programmable logic controller on a quarterly basis. Also, inspect and test the auto dial-out system monthly.

Mechanical and operational changes were made to the system based on parameter monitoring and off-gas sampling data. The startup well field configuration was modified when the contaminant removal yields dropped substantially for an extended period of time. The well field configuration was changed in February 2004, April 2005 and November 2005 to increase treatment effectiveness and efficiency. Since 2006, the system equipment is turned on once or twice a month to ensure the system remains functional.

V. Progress Since the Last Five-Year Review

The third five-year review was completed in September 2008. The document concluded that: (1) the OU1 and OU2 remedial actions will restore soil and groundwater to allow for unlimited use without restriction; (2) the implemented remedy for OU1 and OU2 protects human health and the environment because there are no exposure pathways that could result in unacceptable risks and none expected during remediation as long as the soils and groundwater continue to be remediated and monitored and (3) because both OUs are protective, the site is protective of human health and the environment.

The 2008 report recommended addressing the observed decrease in the groundwater pumping rate and the continued remedial actions for OU1. Repairs were made to Well 1-1A and the normal pumping rates were restored in February 2009.

The 2008 report also recommended monitoring for vapor intrusion into the Area 4 building using the health-based screening criteria provided in EPA's 2002 Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils. This evaluation was conducted in February 2009 and in February 2011; the results are discussed in the data review section and summarized under **Question B** of Section **VII. Technical Assessment**.

Finally, the 2008 report recommended reevaluating the *in-situ* vacuum extraction system in Area 4 to determine if the *in-situ* vacuum extraction system can achieve OU2 ROD soil cleanup levels and to restart the *in-situ* vacuum extraction system. EPA has determined that the ROD soil cleanup levels cannot be achieved without an enhancement to the *in-situ* vacuum extraction system. EPA conducted extensive groundwater and soil sampling and updated the Conceptual Site Model in 2012 based on the field assessment in order to determine the nature and extent of the contamination. Upon review of this data, EPA will determine if pilot studies are necessary. If enhancements to the *in-situ* vacuum extraction system or other revision of the OU2 remedy are appropriate, the changes will be documented in a decision document.

VI. Five-Year Review Process

Administrative Components

The five-year EPA review team consisted of: Sharon Trocher, remedial project manager; Marian Olsen, human health risk assessor; Mike Clemetson, ecological risk assessor; Robert Alvey, hydrogeologist and Salvatore Badalamenti, section chief. Payson Long, the NYSDEC project manager, also participated in the review effort. This is an EPA-lead Site. NYSDEC's contractor for the OU1 groundwater treatment system is ARCADIS. EPA's contractor for OU2 is USACE. USACE procured Sevenson Environmental Services Inc. (Sevenson) to implement the OU2, Area 2 and Area 4 RAs. Since October 2012, USACE procured Los Alamos Technical Associates, Inc. to maintain the Area 4 *in-situ* vacuum extraction system. EPA's Environmental Response Team procured Lockheed Martin Technology Services to reevaluate the *in-situ* vacuum extraction system in Area 4.

Community Involvement

The EPA Community Involvement Coordinator for the Site is Cecilia Echols. The Site property owners and a representative for the Town of Vestal were notified by the EPA Remedial Project Manager that EPA was initiating a five-year review of the remedies for the Site.

Document Review

This five-year review consisted of a review of relevant documents including O&M records and monitoring data (see Table 4).

Data Review

Groundwater Monitoring

The air stripper treatment system is monitored to evaluate its performance and whether the treated water meets the requirements for discharge to the Susquehanna River. Groundwater samples of the influent and the effluent of Well 1-1A's air stripper were collected and analyzed for VOCs on a monthly basis by EPA from November 1996 to October 2006. Since October 2006, NYSDEC's contractor has collected groundwater samples on a monthly basis. Since the last five-year review, performance monitoring data indicate that the influent exceeds the surface water discharge criteria for Site VOCs of concern while the treated effluent meets the surface water discharge criteria for all VOCs. These results indicate that the air stripper is effectively treating the water pumped from Well 1-1A to applicable criteria and are documented in quarterly monitoring reports. To date, approximately 3.52 billion gallons of contaminated groundwater have been treated at Well 1-1A.

The groundwater monitoring program is designed to monitor the effectiveness of capture of the groundwater contamination plume and to determine the progress of groundwater treatment and compliance with the groundwater quality criteria. The groundwater monitoring program includes annual sampling of groundwater monitoring wells located upgradient and side-gradient of Well 1-1A which are analyzed for VOCs (see Figure 4). The program also includes yearly sampling at three groundwater monitoring wells located in close proximity to Well l-1A and monitoring of the influent and effluent of the air stripper at Well 1-1A. These samples are also analyzed for inorganic compounds to measure any inorganic groundwater contamination and to determine if inorganic treatment is needed at Well 1-1A.

Table 5 summarizes the total VOC concentrations detected in monitoring wells during the annual groundwater monitoring sampling performed between 1996 and 2012. The maximum concentration of total VOCs during the latest sampling event was 2,428 ppb in the sample collected from the shallow monitoring well 4009-8 located in the industrial park. This well is immediately downgradient of Area 4. From the data in Table 5, total VOC concentrations remain elevated between Area 4 and the 1-1A extraction well. This is consistent with EPA site investigations which concluded that residual source material was present in Area 4. As a result, the groundwater is not expected to attain the groundwater maximum contaminant levels between Area 4 and Well 1-1A until the source of VOC contamination in Area 4 is remediated. Since the source remains in this area, there are no discernible VOC specific trends. The contaminants found in these monitoring wells continue to be Site-related contaminants, TCE, 1-1 TCA and their daughter products.

The Area 2 source remedy was completed in 2000. The groundwater wells downgradient of Area 2 are currently being impacted by residual source material in Area 4; therefore, groundwater data cannot confirm Area 2 does not impact groundwater. However, the confirmatory soil sampling conducted in 2000 shows that the soil cleanup levels, which are protective of groundwater have been achieved. In addition, the recent groundwater modeling

(Lockheed Martin Technology Services, January 2013) done to update the conceptual site model continues to affirm that Area 4 is the primary source of impact to downgradient wells. Therefore, it is believed that the Area 2 source area has been effectively remediated and is not contributing to the groundwater contamination.

The January 2013 groundwater modeling demonstrates that Well 1-1A is effectively capturing the plume from Area 4 and prevents the plume from impacting the river. Based on the groundwater modeling and the elevated levels of VOCs detected downgradient of Area 4, it was concluded that continued pumping and treating the groundwater is required for containing and remediating the groundwater plume.

Based on the presence of TCA in groundwater, groundwater samples were collected and analyzed for 1,4-dioxane. In December 2012, a groundwater sample was collected from the influent and effluent of the groundwater pump and treat facility, and two groundwater samples were collected from a monitoring well with high levels of TCA. 1,4-Dioxane was not detected in any of the samples.

Consistent with previous five-year reviews, the groundwater monitoring data indicate that the inorganic levels for site-related contaminants detected in the groundwater collected from three monitoring wells located in close proximity to Well 1-1A and the influent and effluent of the air stripper for site-related contaminants are below the groundwater quality criteria. Over the past five years, data collected from the extraction well and monitoring wells have not shown inorganic concentrations above groundwater drinking water standards. Based on this information inorganic treatment at Well 1-1A is not needed.

Although OU1 is functioning as intended, NYSDEC is planning to conduct a remedial system evaluation of the groundwater pump and treat facility to optimize the groundwater pump and treat system for cost and performance efficiencies. This evaluation of the groundwater pump and treat system is expected to last approximately a year. It is expected that any temporary shutdown of the groundwater pump and treat system will not affect the water quality of the Vestal water supply. The Vestal water supply wells are routinely tested for groundwater quality. NYSDEC will also monitor the groundwater for potential plume migration in the vicinity of the facility, and the system will be turned back on if a problem is detected. In addition, if the plume were to migrate to the Vestal supply wells, they are all equipped with treatment systems designed to remove the Site contaminants of concern.

Vapor Intrusion

Starting in 2007, vapor intrusion sampling was conducted in the Area 4 building every two years. Subslab and indoor samples were collected over a 24-hour period during three vapor intrusion sampling events, April 2007, February 2009 and April 2011. The results of the subslab samples indicate that VOC vapors are collecting beneath the building foundation. EPA's review of the 18 indoor air samples collected in April 2007 shows that in two of the samples TCE concentrations exceed the New York State Department of Health air criterion of 5 micrograms per cubic meter

(ug/m^3). The two samples were detected at 5.2 ug/m^3 and 16 ug/m^3. In February 2009, all 16 indoor air samples collected were below screening levels. The evaluation of data from the April 2011 sampling event concluded that the subslab concentrations exceeded levels of concern for vinyl chloride, 1,1-DCE, trans-1,2-DCE, 1,1-DCA, TCE and PCE and the concentrations of the indoor air samples were within the risk range based on toxicity values available at the time of the evaluation and industrial exposure assumptions.

Although some of the results were above EPA's current residential screening levels, these levels of 2 ug/m^3 are based on consistent occupancy of 24 hours per day. Due to the industrial use of the building where exposures are assumed to be eight hours per day, five days per week and a review of all of the indoor air data, EPA does not believe that the indoor air concentrations pose chronic health concerns. However, EPA will continue to monitor indoor air concentrations to ensure that conditions do not change. In the future, EPA will also be implementing additional remedial measures to remove VOCs from soils in Area 4. These actions are expected to reduce the VOC vapors that collect below the building foundation.

Source Control Monitoring

Initial concentrations of total contaminants of concern in untreated subsurface soil in Area 2 ranged from 40 to 150,000 ppb. Upon completion of operation of the *in-situ* vacuum extraction system, the concentration of total contaminants of concern in subsurface soil was reduced to below 76 ppb. Based on analytical results of the soil samples, EPA concluded that the *in-situ* vacuum extraction system successfully treated soil in Area 2 to below OU2 ROD soil cleanup levels of 170 ppb for TCA, 140 ppb for TCE and 188 ppb for 1,2 DCE.

From June 2003 to January 2006, approximately 2,300 pounds of TCA and TCE were removed from the subsurface soil. The *in-situ* vacuum extraction system operated for approximately 80 percent of the time or for approximately 25 months during this period. Reasons for the system shutdowns included routine maintenance, excessive moisture in the well lines, replacement of equipment damaged due to power surges and polarity reconfigurations. The system has been off since 2006. No data has been collected during this five-year review period as efforts have focused on further evaluating the extent of contamination and appropriate measures to more effectively treat the contaminants of concern.

Site Inspection

A Site inspection was performed on November 13, 2012. Payson Long, NYSDEC, Susan Edwards, NYSDEC and Sharon Trocher, EPA were in attendance. There were no new or outstanding issues identified.

Interviews

No interviews were conducted for this review. However, the Site property owners and a representative of the Town of Vestal were informed that a review of the Site was underway. No comments or concerns were received.

VII. Technical Assessment

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

The remedy is functioning as intended based on the OU1 ROD and the OU2 ROD for Area 2. The remedy in the OU2 ROD for Area 4 is being reevaluated since the current *in-situ* vacuum extraction system was unable to remove the remaining VOCs from the fine-textured soils and the saturated soils at the Site. The *in-situ* vacuum extraction system in Area 4 needs to be enhanced in order to achieve ROD soil cleanup levels (see Table 6) and ensure the groundwater remedy meets the restoration objectives.

The remedy for OU1 involved containing the groundwater plume of contamination to mitigate further contamination of public water supplies; providing a safe reliable drinking water supply to the Town of Vestal from Well 1-1, and ensuring the water quality of the Susquehanna River is not impaired. The review of documents, applicable or relevant and appropriate requirements, risk assumptions, and the results of the Site inspection indicate that the air stripper is functioning as intended by the ROD. The packed column air stripper was designed to reduce VOC contaminants of concern from levels above the maximum detected concentrations to less than one ppb for each VOC, which is below the groundwater quality criterion of five ppb. The air stripper is performing as designed and this was verified by reviewing the monthly sampling data collected since November 1996 from the plant influent and effluent. Additionally, the groundwater plume of contamination is effectively being captured as demonstrated in the 2013 groundwater modeling report. However, the overall progress of meeting the cleanup levels of the OU1 ROD remains slow and may be impacted by continued releases of VOC contamination from soil in Area 4. As previously discussed, NYSDEC is planning to conduct a remedial system evaluation of the groundwater pump and treat facility to optimize the groundwater pump and treat system for cost and performance efficiencies.

The objective of the OU2 ROD included ensuring protection of groundwater from the continued release of VOC contamination from soil; ensuring protection of Well 1-1A water quality from any inorganic groundwater contamination not addressed in OU1, if necessary; and ensuring protection of human health of on-site workers and construction workers who may be exposed to contaminated soils during excavation by interrupting potential exposures. The soil sampling confirmed that the *in-situ* vacuum extraction system in Area 2 successfully treated the contaminated soil to ROD cleanup levels. However, the *in-situ* vacuum extraction system was highly vulnerable to water infiltration, resulting in frequent system shutdowns. The *in-situ* vacuum extraction wells in Area 4 were modified to minimize system shut-down due to high water table levels. The *in-situ* vacuum extraction system in Area 4, which was based on the

design of the Area 2 *in-situ* vacuum extraction system, will not achieve the ROD cleanup levels due to the remaining VOC contaminants being located in the fine-textured soils and in the shallow saturated soil at the Site. The enhancement of the *in-situ* vacuum extraction system, i.e., with *in-situ* heating, or other remedy modification will be needed to achieve the ROD cleanup levels.

Overall, the remedies are functioning as intended in the original decision documents with the exception of Area 4 which was discussed above. However, there are no current exposures occurring, or complete exposures pathways that are likely to occur in the future, to Area 4 contamination.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy still valid?

Are the (1) exposure assumptions and toxicity data (2) used at the time of the remedy selection still valid?

a. Groundwater. The original risk assessment identified unacceptable risks from the potential future ingestion of contaminated drinking water from Well 1-1 by community residents. Currently, nearby residents are on public water supplies, which have interrupted this exposure pathway. The remedy is protective for the direct ingestion route of exposure under current and future conditions. The primary contaminants of concern identified in the original ROD for groundwater were the VOCs, TCE and TCA.

The remedy for the Site has prevented pollutants from entering the Susquehanna River by capturing and treating the contaminated plume prior to discharging the groundwater to the River, and provided a backup public drinking water supply to the Town of Vestal, if needed. Further, the results of the January 2013 groundwater modeling indicate that the pumping rate of Well 1-1A is effectively capturing the contaminated groundwater plume. A review of the current data confirms the efficacy of this pumping rate as a continued remedial action.

Since the last five-year review, the toxicity values for TCE were updated. The ROD identified the Maximum Contaminant Level (MCL) of 5 ppb as the basis for the remedial action. Based on the new toxicity values, the risks associated with consumption of water are within the risk range and slightly exceed a noncancer HI = 1; therefore the basis for remedial action is still appropriate.

b. Soil. The original risk assessment identified unacceptable risks to the future construction worker exposed through ingestion and dermal contact with the contaminated soil and inhalation of volatile organic compounds. Many of the exposure assumptions used in the original risk assessment would be comparable to those used in an assessment today. As described above, the Area 2 *in-situ* vacuum extraction system was operated from December 1997 to November 2000 when the system was terminated. The results of the Interim Soil Sampling Program confirmed that the *in-situ* vacuum extraction system successfully achieved ROD

cleanup levels. EPA determined that the *in-situ* vacuum extraction system is unable to address the remaining VOC contamination in fine-grained soils in Area 4 unless the *in-situ* vacuum extraction treatment system is enhanced.

The toxicity values for TCE and trans-1,2-DCE were updated since the last five-year review. The remedial levels identified in the ROD were designed to protect groundwater and were identified as 140 ppb for TCE; 170 ppb for TCA; and 188 ppb for DCE (Area 2). The residential direct contact concentrations for contaminants in soil associated with the current toxicity values for TCE at a risk level of 10^{-6} is 900 ppb and the concentration associated with an HI = 1 is 4,400 ppb; the concentration of TCA associated with a noncancer HI = 1 is 8,700 ppm; and the concentration of trans-DCE associated with a noncancer HI = 1 is 150 ppm. Comparison of the remedial levels for impacts of soils on groundwater with those for direct contact with soils indicates that the residential soil concentrations direct contact numbers are less stringent than the impact to groundwater concentrations and therefore the cleanup levels for soil identified in the ROD are protective.

c. Vapor Intrusion. As a result of the previous five-year review, soil vapor intrusion studies were conducted at the facility. In February 2009 and 2011, EPA conducted an investigation at 200 Stage Road (the Area 4 industrial building) to determine if indoor air might be impacted by the intrusion of VOC vapors resulting from groundwater and soil contamination existing beneath the Site building. The process of assessing the indoor air quality included testing the soil gas levels beneath the concrete slab of the Area 4 building to see if any vapors have been created by the contamination in the underlying groundwater and soil and testing the actual indoor air quality. EPA collected and tested approximately 32 subslab and 16 indoor air locations within the Area 4 building. The subslab and indoor air samples were collected over a 24-hour period. The results of the subslab samples indicated that VOC vapors are collecting beneath the building foundation. EPA's review of the indoor air samples shows that some of the samples had TCE concentrations that exceed levels of concern of 2 ug/m^3 for TCE for residences as a screening level assessment for noncancer endpoints, but did not exceed concentrations associated with industrial exposures. Based on the zoning of the property as commercial/light industrial, the transient nature of the building occupancy, the high ventilation and air exchange rates in the warehouse building, and a review of all of the indoor air data, EPA does not believe that the indoor air concentrations pose chronic health concerns. The results of this investigation were shared with the current building owner. EPA plans to continue monitoring the subslab and indoor air concentrations to ensure that conditions do not change (see Table 7).

Are the Cleanup Values Selected in the ROD Still Valid?

a. Groundwater. The original ROD for OU1 selected the federal MCLs in groundwater for TCE and TCA. In the original ROD, the state MCL for TCE was 10 ppb; it was subsequently changed to 5 ppb (NYS Part 703 Surface and Groundwater Quality Standards and Groundwater Effluent Limitations) which is comparable to EPA's MCL. The federal MCLs for these chemicals, 200 ppb for TCA and 5 ppb for TCE, have not changed since the ROD was signed and the MCLs remain protective. Since the last five-year review, the toxicity value for TCE was

updated. The ROD identified the MCL of 5 ppb as the basis for the remedial action. Based on the new toxicity values, the risks associated with consumption of water are within the risk range and slightly exceed a noncancer HI = 1. The MCLs remain protective.

b. Soil. The original ROD for OU2 selected soil remediation levels that were designed to reduce the impacts to groundwater and also reduce the potential future risk from human exposure to excavated soils. The remedial levels were 140 ppb for TCE; 170 ppb for TCA; and 188 ppb for DCE (Area 2). The removal of VOCs from the Area 2 soil has removed this potential route of exposure. The original remediation levels are lower than risk based residential concentrations for these same contaminants calculated using current exposure and toxicity values.

The soil remedial levels for TCE, TCA and DCE (in Area 2 only) are still valid and protective of the groundwater. The remedial levels are below NYSDEC soil cleanup objectives for unrestricted use and for the protection of groundwater. The NYSDEC cleanup levels for both objectives are 470 ppb for TCE, 680 ppb for TCA, and 190 ppb for DCE. The remediation levels remain protective as discussed above for direct contact with soil.

Are the Remedial Action Objectives Still Valid?

There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedy. The land use for the Site is expected to remain commercial/light industrial over the next five years, the period of time within which the next five-year review will be performed. The land use considerations and potential exposure pathways considered in the baseline human health risk assessment are still valid. In addition, residents and industries in the area continue to obtain drinking water from public supply wells.

There were no completed pathways identified for ecological receptors in previous documents. Based upon review of the past and current data, the previous conclusion that there are no completed exposure pathways for ecological receptors is still valid. The remedial actions objectives used at the time of the remedy selection are still valid and protective of the environment.

Question C: has any other information come to light that could call into question the protectiveness of the remedy?

At the current time, EPA is evaluating the implementation of new toxicity values for vapor intrusion for TCE. The recommendation will need to be evaluated in the next five-year review. There is no other information that calls into question the protectiveness of the remedies.

Technical Assessment Summary

Based on the data reviewed and the Site inspection, the remedies are functioning as intended by the RODs with the exception of the Area 4 *in-situ* vacuum extraction system, which will need to be enhanced. The Area 4 *in-situ* vacuum extraction system is not currently operating and is not removing VOCs from subsurface soils to protect the groundwater from the leaching of VOC contaminants from the soil. There have been no changes in the physical conditions of the Site that would affect the protectiveness of the remedies. The cleanup levels cited in the RODs have not yet been met for OU1 or for OU2, Area 4. The remedial action objectives are still valid and are currently being met for OU1. The remedial action objectives were met for OU2, Area 2. The groundwater contamination plume is being contained and treated prior to discharge to the Susquehanna River to prevent degradation of surface water quality. The groundwater monitoring wells are functional, and the annual groundwater sampling data from these wells and the OU1 plant influent indicate that treatment for inorganics at Well 1-1A is not necessary.

Currently, there is no human exposure to, or ingestion of, contaminated groundwater and soil, and exposures that exceed levels of concern are not expected during the next five years. In addition, no ecological targets were identified in the RODs and none were identified during the five-year review, and therefore, monitoring of ecological targets is not necessary. The groundwater contamination is being addressed under OU1 through pumping and treating to reduce the levels of contamination to appropriate federal and state standards. Since the community is serviced by public water that meets appropriate federal and state standards, the pathway of potential exposure if no public water supply were available has been interrupted. Potential impacts of contaminated soil on groundwater were addressed under OU2, Area 2 through removal of VOCs via an *in-situ* vacuum extraction system. Site remedial action at OU2, Area 4 is ongoing and is expected to fully protect human health and the environment when it is completed. Currently, there is no exposure to VOC vapors resulting from contaminated groundwater and soil above levels at which adverse health effects are anticipated. Vapor intrusion of VOC vapors into the indoor air of the Area 4 building will continue to be monitored and evaluated.

VIII. Issues, Recommendations and Follow-Up Actions

Table 6 contains the issue, recommendation and follow-up action resulting from this review.

IX. Protectiveness Statements

The remedy at first operable unit (OU1) is protective of human health and the environment.

The remedies at second operable unit (OU2) are protective of human health and the environment in the short term. In order to be protective in the long term, the Area 4 *in-situ* vacuum extraction system needs to be enhanced, or other measures need to be taken to remediate the soils to ROD cleanup levels.

The Site is protective of human health and the environment in the short term. For the Site to be protective in the long term the Area 4 *in-situ* vacuum extraction system needs to be enhanced.

X. Next Review

The next five-year review for the Vestal Water Supply Well 1-1 Site should be completed within five years from the date of this review.

Table 1

Chronology of Site Events

Event	Date
Volatile organic contamination detected at Well 1-1 and well taken off- line	1980
NPL listing	9/8/1983
Remedial Investigation/Feasibility Study completed - OU1	5/1986
ROD selecting OU1 remedy signed	6/27/1986
Remedial design approved for air stripper - OU1	9/29/1987
Superfund State Contract signed	11/2/1988
Start of construction of air stripper – OU1	5/31/1989
Remedial Investigation/Feasibility Study completed - OU2	5/1990
Completion of construction of air stripper - OU1	6/10/1990
ROD selecting OU2 remedy signed	9/27/1990
Unilateral Administrative Order issued - OU2, Area 4	3/29/1991
Remedial design completed for Well 1-1A - OU1	5/1992
Start of construction of Well 1-1A – OU1	9/10/1992
Completion of construction of Well 1-1A - OU1	12/31/1993
Remedial design completed - OU2, Area 2 & Area 4	9/30/1994
Remedial Action Report for groundwater remedy approved - OU1	3/30/1995
Start of construction of soil vapor extraction system - OU2, Area 2	10/11/1996
Start of long term response action for OU1	10/15/1996
Completion of construction of *in-situ* vacuum extraction – OU2, Area 2	1/18/1997
First Five-Year Review Report signed	9/30/1998
Cost Recovery Consent Decree entered - OU2, Area 4	5/26/1999
Completion of *in-situ* vacuum extraction remediation - OU2, Area 2	11/20/2000
Remedial Action Report for *in-situ* vacuum extraction approved - OU2, Area 2	5/15/2001
Start of construction of *in-situ* vacuum extraction - OU2, Area 4	4/1/2003
Completion of construction of *in-situ* vacuum extraction - OU2, Area 4 signifying completion of all Site construction activities	6/27/2003

Table 1 (cont.)

Chronology of Site Events

Event	Date
Preliminary Close-Out Report signed	9/11/2003
Second Five-Year Review Report signed	9/30/2003
Shut down of *in-situ* vacuum extraction system – OU2, Area 4	1/20/2006
Operation of the groundwater treatment facility transferred to NYSDEC-OU1	10/16/2006
Groundwater and soil sampling conducted in Area 4	8/2/2006 – 9/8/2006
Vapor intrusion sampling at Area 4	4/2007
Soil sampling conducted in Area 4	11/26/2007 – 12/7/2007
Groundwater and soil sampling conducted in Area 4	7/22/2008 and 3/3/2009
Third Five-Year Review Report signed	9/4/2008
Vapor intrusion sampling at Area 4	2/2009
Vapor intrusion sampling at Area 4	2/2011
Groundwater and soil sampling conducted in Area 4	12/3/2012 – 12/10/2012

Table 2

Annual System Operation Costs for OU1

Dates		Total Cost rounded to nearest $1,000
From	To	
1/1997	12/1997	$227,000
1/1998	12/1998	$295,000
1/1999	12/1999	$261,000
1/2000	12/2000	$231,000
1/2001	12/2001	$188,000
1/2002	12/2002	$307,000
1/2003	12/2003	$238,000
1/2004	12/2004	$274,000
1/2005	12/2005	$261,000
1/2006	12/2006 [a]	$432,000[a]

[a]Cost includes upgrading the air stripper, such as replacement of the packing. The operation of the groundwater treatment facility was transferred to NYSDEC on October 16, 2006. Costs after 12/2006 are not available.

Table 3a

Annual System Operation Costs for OU2, Area 2

Dates		Total Cost rounded to nearest $1,000
From	To	
1/1997	12/1997	$274,000
1/1998	12/1998	$85,000 [a]
1/1999	12/1999	$352,000
1/2000	12/2000	$237,000 [a]

[a] The 1998 and 2000 actual costs are much lower than expected since the *in-situ* vacuum extraction system was shut down for approximately six and four months, respectively, as a result of extremely high rainfall and subsequent elevation of the groundwater table. During shut down, system operation costs including maintenance, field personnel, monthly soil vapor sampling, utilities, carbon changes and the disposal of water were not incurred.

Table 3b

Annual System Operation Costs for OU2, Area 4

Dates		Total Cost Rounded to Nearest $1,000
From	To	
7/2003[a]	12/2003	$93,000
1/2004	12/2004	$254,000
1/2005	12/2005	$262,000[b]
1/2006	12/2006[c]	$100,000
1/2007	12/2007[c]	$52,000
1/2008	12/2008[c]	$48,000
1/2009	12/2009[c]	$57,000
1/2010	12/2010[c]	$54,000
1/2011	12/2011[c]	$52,000
1/2012	12/2012[c]	$77,000

[a]Construction of the *in-situ* vacuum extraction system was completed on June 27, 2003.

[b]Cost includes a Management and Supervision Fee of $21,000 and dditional cost to award a new contract to Sevenson for operations in a shutdown mode.

[c]Facility was shut down on January 20, 2006. From January 2006 to September 2012, the *in-situ* vacuum extract system was operated twice a month for a short period of time to exercise the equipment. After September 2012, the *in-situ* vacuum extract system was operated once a month. Also, general site maintenance and upkeep as well as annual groundwater sampling of the site monitoring wells has been continued.

Table 4

Documents Reviewed

Reference No.	Author	Date	Title/Description
1	U.S. Environmental Protection Agency	June 1986	Record of Decision Vestal Water Supply Well 1-1
2	Ebasco Services Inc.	May 1990	Final Supplemental Remedial Investigation, OU2
3	U.S. Environmental Protection Agency	June 1990	Record of Decision Vestal Water Supply Well 1-1
4	ARCADIS Malcolm Pirnie, Inc.	Quarterly reports (from 1st Qtr 2008 to 2nd Qtr 2012)	Vestal Water Supply Site Quarterly Report
5	U.S. Environmental Protection Agency	September 2008	Third Five-Year Review Report
6	Lockheed Martin Technology Services	October 2008 and June 2009	Trip Report – Groundwater and Soil Sampling Vestal Chlorinated Hydrocarbon Source Assessment/Remedy Site, OU2, Area 4
7	ARCADIS Malcolm Pirnie, Inc.	Annual reports (2008 to 2012)	Vestal Water Supply Site Quarterly Report and Annual Groundwater Monitoring Summary
8	Lockheed Martin Technology Services	June 2009 and May 2011	Trip Report – Soil Vapor Intrusion Study, OU2, Area 4
9	Lockheed Martin Technology Services	April 2012	Preliminary Conceptual Site Model Vestal Chlorinated Hydrocarbon Source Assessment/Remedy Site, OU2, Area 4
10	Malcolm Pirnie, Inc.	May 2012	Remedial Site Optimization Work Plan Vestal Water Supply Site
11	Lockheed Martin Technology Services	January 2013	Groundwater Flow & Contaminant Transport Models Vestal Chlorinated Solvent Site
12	Lockheed Martin Technology Services	April 2013	Additional Site Characterization to Support a Human Health Risk Assessment Vestal Chlorinated Solvent Site

Table 5

Total VOC Concentration (ppb) in Groundwater Monitoring Wells

Monitoring Well Identification[a]	Depth of Monitoring Well (feet)	July 2012	June 2011	March 2010	June 2009	October 2008	August 2007	June 2006	June 2005	June/July 2004
Well S-1 / 4009-6	25	ND	1.08	1*	1	3	3	ND	3.72	3.19
Well S-2 / 4009-7	32	278.89	673.56	288	488	390	157	188.34	185.59	409.98
Well S-6 / 4009-4	41	32.3	46.56	48	48	25	41*	66	69.3	62.36
Well S-7 / 4009-3	32	204.88	141.35	134	207	962	224	131.45	210.9	164.26
Well S-8 / 4009-1	25	6.2	5.84	8	8	15	6	5.48	19.7	2.57
Well S-11 / 4009-8	40	2,427.9*	1692	1,173	1122*	466	1,037	833.78	1,172.35*	2,049.25
Well EB-31 / 4009-5	53	305.7	98.34	113	76	101	56	54.5	90.31	119.9
Well EB-33 / 4009-2	35	44.31	33.05	61	50	42	61	46.65	75.34	70.55
Well EB-41 / 4009-9	30	13.46	4.70	6	9	12	10	3.74	14.56	9.69*
Well EB-42 / 4009-10	44	ND	1.59[b]	ND	1	ND	ND	0.46	1.52	0.67
Well 1-22 / 4009-	132	NS	NS	NS	NS	NS	NS	NS	NS	NS
Well 1-23 / 4009-14	136	ND	0.3	2	4	2	ND	NS	NS	NS
Well 1-24 / 4009-15	129	2.3	2.19	6	5	ND	ND	4.12	5.02	5.84
Well 1-25 / 4009-	155	NS	NS	NS	NS	NS	NS	0.81	ND	0.38
Well 1-25A / 4009-	49	NS	NS	NS	NS	NS	NS	0.41	0.97	0.49
Well 1-28 / 4009-	118	NS	NS	NS	NS	NS	NS	NS	NS	NS
Well 1-28A / 4009-	54	NS	NS	NS	NS	NS	NS	NS	NS	NS
Well 1-29 / 4009-12	119	237.4	500.93	214	401	322*	27	120.7*	170.5	125.5
Well 1-29A / 4009-12A	64	40.3	42.01	50	54	40	39	42.44	50.3	45.85
Well 1-30 / 4009-13	114	ND	NS	2.4	3.5	4	ND	ND	1.6	ND
Well 1-30A / 4009-13A	30	ND	0.15	2	1	1	ND	ND	ND	ND
Well 1-32 / 4009-11	152	ND	2.35[b]	ND	7	8	ND	0.58	ND	ND
Well 1-32A / 4009-11A	35	ND	0.27[b]	ND	1	2	ND	ND	1.7	ND

*Average of duplicate data ND – Not Detected NS – Not Sampled

[a]The monitoring well names were changed when the site was transferred from EPA to NYSDEC. This column contains the EPA name / NYSDEC name.

[b]The total VOC concentration does not include acetone, which is not site-related and is often a laboratory contaminant.

Table 5 (cont.)

Total VOC Concentration (ppb) in Groundwater Monitoring Wells

Monitoring Well Identification[a]	Depth of Monitoring Well (feet)	May 2003	October 2002	June 2001	June 2000	June 1999	November 1997	November 1996
Well S-1 / 4009-6	25	2.9	22.26	NS	NS	NS	NS	NS
Well S-2 / 4009-7	32	741	533.68	807	1472	994	504.9*	1572.5
Well S-6 / 4009-4	41	78	55.35*	NS	NS	NS	NS	NS
Well S-7 / 4009-3	32	286	1445.3	NS	NS	NS	561.22	380
Well S-8 / 4009-1	25	0.1	35.5	NS	NS	NS	NS	ND
Well S-11 / 4009-8	40	394	467.9	417	4154	383	441.7	5131
Well EB-31 / 4009-5	53	62	97.62	81	79	67	106	128.5
Well EB-33 / 4009-2	35	176	355.35	552	833	1321	1,285.23	2,384.4
Well EB-41 / 4009-9	30	8.4	31.2	8	6	6	4.6	ND
Well EB-42 / 4009-10	44	1.5	ND	ND	1	ND	1	2
Well 1-22 / 4009-	132	1.8	ND	NS	NS	NS	NS	NS
Well 1-23 / 4009-14	136	NS	NS	ND	ND	ND	1	NS
Well 1-24 / 4009-15	129	6.6	ND	5	9	4	8.33	3.6
Well 1-25 / 4009-	155	NS	NS	NS	NS	NS	NS	NS
Well 1-25A / 4009-	49	NS	NS	NS	NS	NS	NS	NS
Well 1-28 / 4009-	118	NS	NS	ND	NS	NS	NS	NS
Well 1-28A / 4009-	54	NS	NS	ND	NS	NS	NS	NS
Well 1-29 / 4009-12	119	200	175.7	NS	58.5*	217*	249.3	963
Well 1-29A / 4009-12A	64	49	43.86	51	NS	69	97.4	30
Well 1-30 / 4009-13	114	NS	NS	ND	ND	ND	1	ND
Well 1-30A / 4009-13A	30	NS	NS	ND	NS	NS	NS	NS
Well 1-32 / 4009-11	152	0.6	ND	NS	NS	NS	NS	NS
Well 1-32A / 4009-11A	35	0.1	ND	NS	NS	NS	NS	NS

Table 6

Issues, Recommendations and Follow-up Actions

Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Follow-up Actions: Affects Protectiveness (Y/N)	
					Current	Future
The *in-situ* vacuum extraction system is not capable of remediating the remaining volatile organic compounds from the soil in Area 4 to ROD soil cleanup levels since the remaining contaminants are located in fine-textured soils and/or in the saturated zone.	Complete a focused feasibility study and determine the required remedy enhancements/modifications needed to achieve ROD soil cleanup levels and update the remedy decision document as appropriate.	EPA/USACE	EPA	12/31/2014	No	Yes

Table 7

Comments and Suggestions

Comment	Suggestion
The results of previous subslab sampling indicate that VOC vapors are collecting beneath the Area 4 building foundation. VOCs are present inside the buildings, but not at levels that present an unacceptable risk based upon the existing use building use and associated exposures.	Continue to conduct indoor air and subslab sampling at 200 Stage Road to monitor for intrusion of VOC vapors resulting from groundwater and soil contamination existing beneath the building.

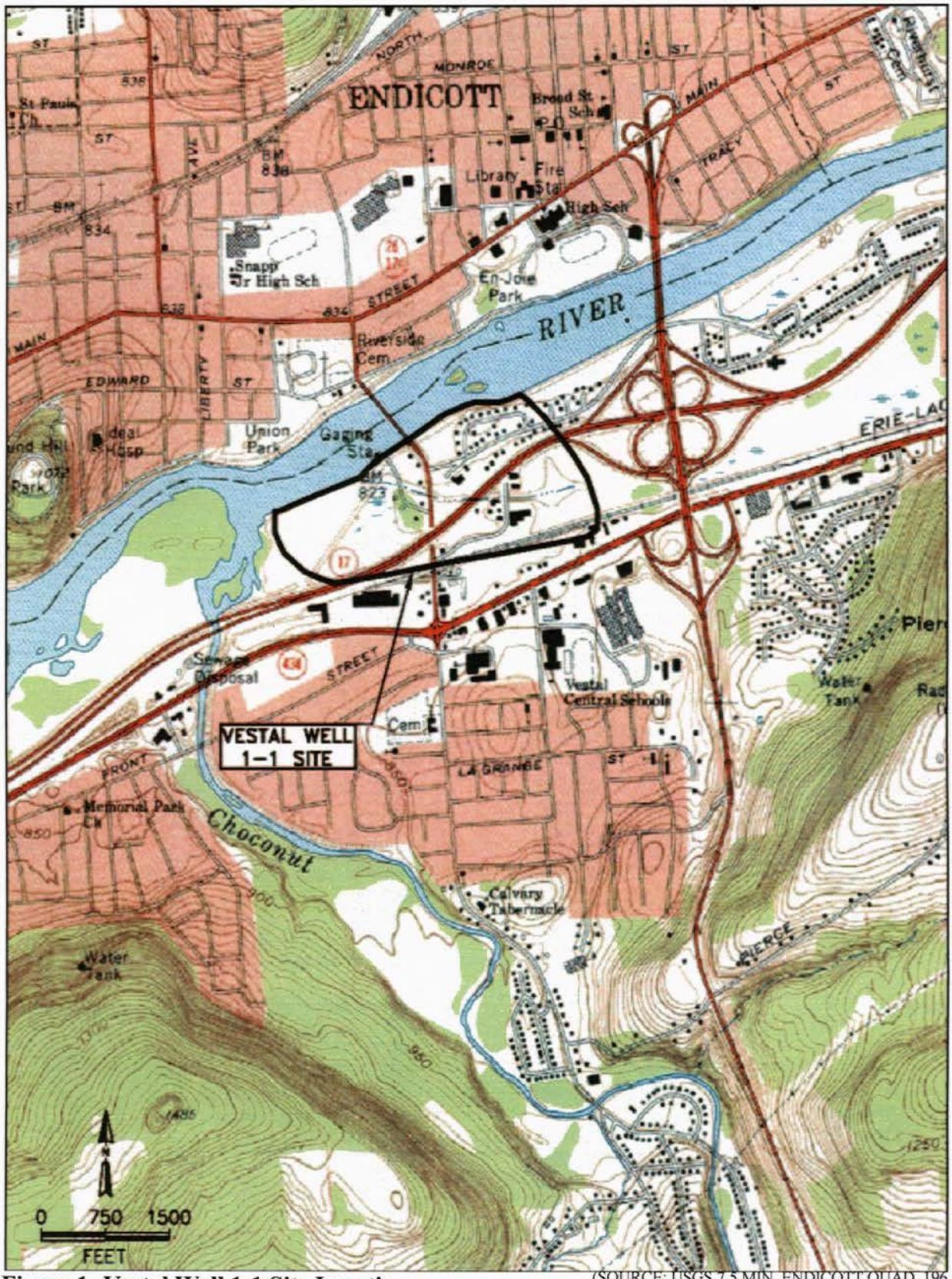

Figure 1- Vestal Well 1-1 Site Location (SOURCE: USGS 7.5 MIN. ENDICOTT QUAD, 196

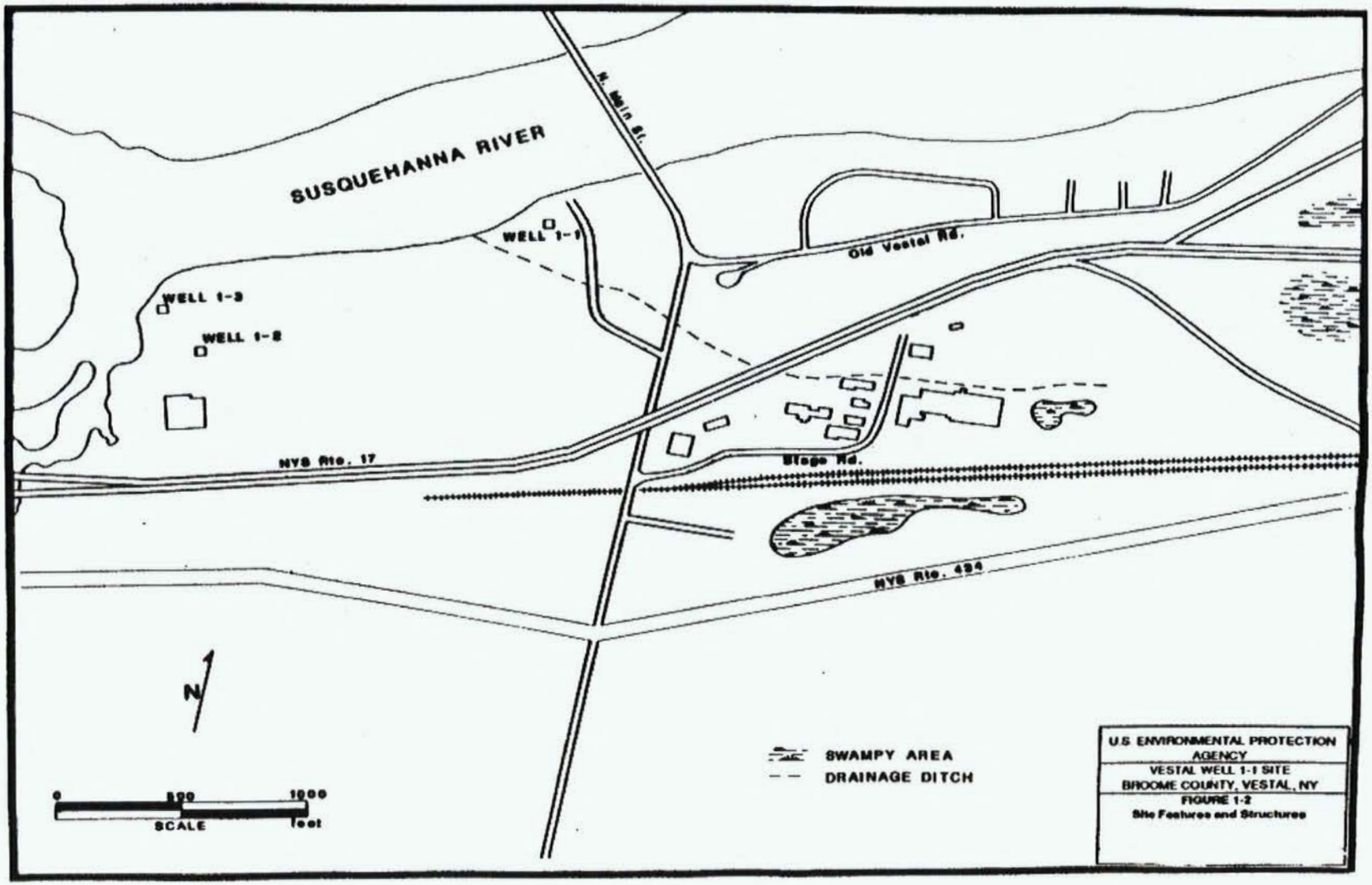

Figure 2 – Site Features and Structures

(SOURCE: REF. #2)

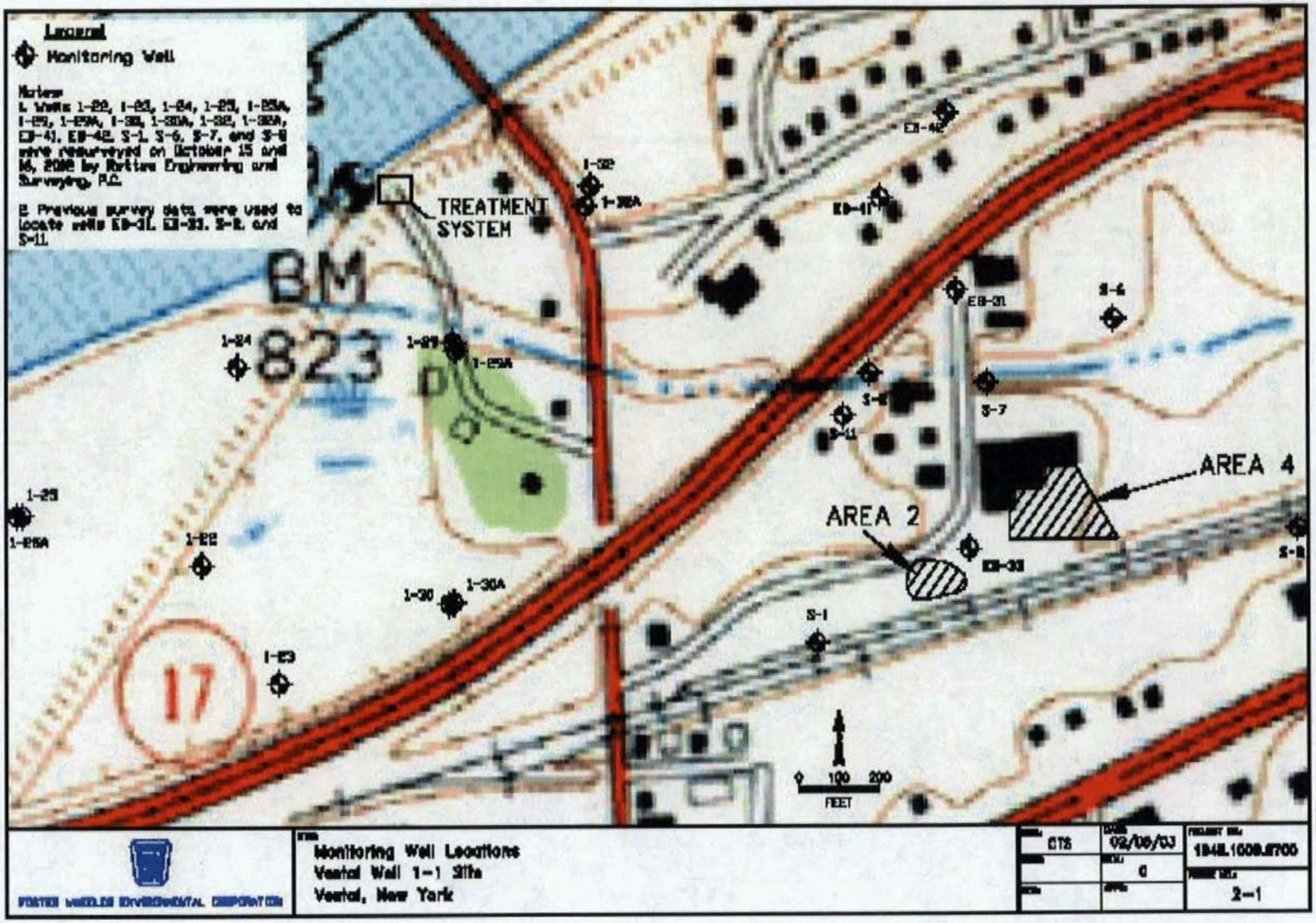

Figure 3 – Area 2 and Area 4 Locations

(SOURCE: Annual Effectiveness Monitoring Report No. 9, Tetra Tech EC, Inc., October 2006)

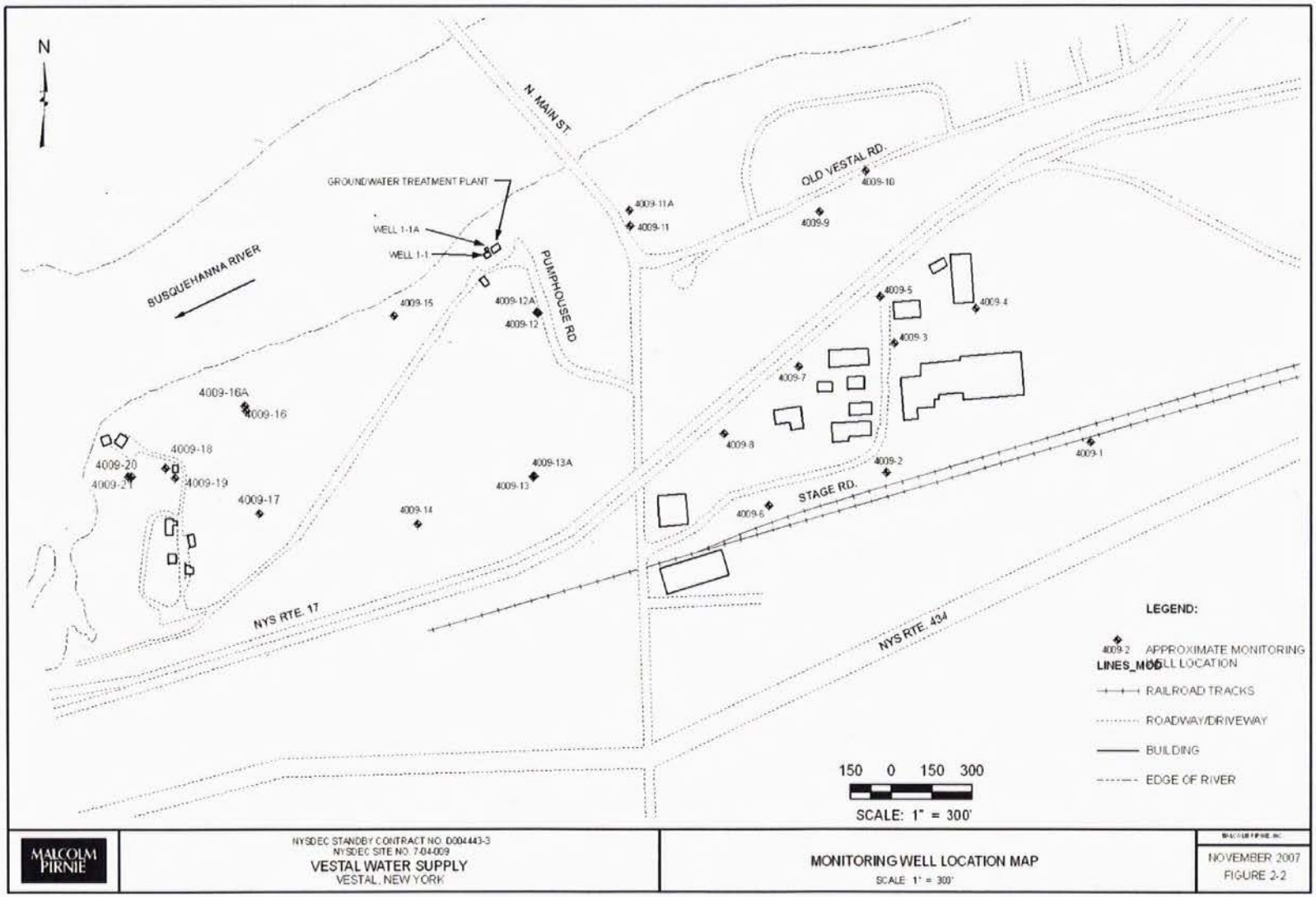

Figure 4 – Monitoring Wells Locations (SOURCE: Vestal Water Supply Site Qrtly Report & Annual Groundwater Sampling Summary, Malcolm Pirnie, Inc., 3rd Qtr 2007)

Figure 5 – Area 4 *In-situ* Vacuum Extraction System

SOURCE: Interim Soil Sampling Event #2 Report, Sevenson Env. Services, Inc, 11/2005)

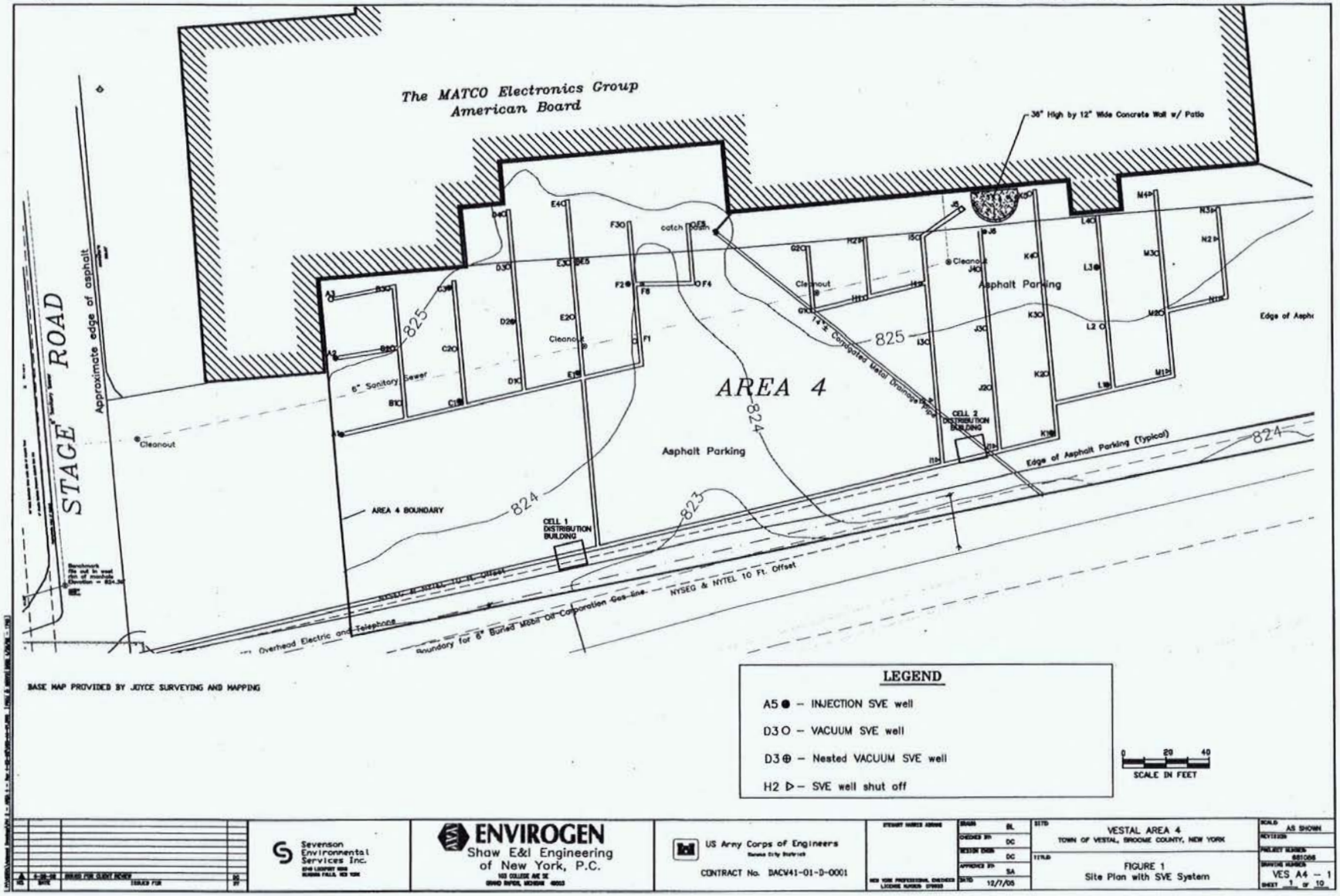

Figure 6 - Maximum Areal Extent of Contamination in Area 4 (March 2012)

(SOURCE: REF. #9)