TECHNICAL MEMORANDUM
INTERIM REMEDIAL MEASURE
HYDROGEOLOGIC EVALUATION

DRAFT

FORMER HIDDEN VALLEY ELECTRONICS SITE
VESTAL, BROOME COUNTY, NEW YORK

WORK ASSIGNMENT NO. D003826-9

SITE NO. 7-04-029

Submitted to:

New York State Department of Environmental Conservation
Albany, New York

Submitted by:

MACTEC Engineering and Consulting
Portland, Maine
Project Number: 3612042017

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1.0 INTRODUCTION

MACTEC Engineering and Consulting, P.C., (MACTEC) has prepared this technical memorandum to present the results of the hydrogeological evaluation conducted to support the installation of three new groundwater monitoring wells near the Former Hidden Valley Electronics (HVE) site in Vestal, Broome County, New York, on behalf of the New York State Department of Environmental Conservation (NYSDEC) (see Figure 1.1). The new groundwater monitoring wells will be installed in accordance with the Scope of Work for Groundwater Monitoring Well Installation, Former Hidden Valley Electronics Site, Vestal, Broome County, New York dated August 2006 (MACTEC, 2006).

The objective of the evaluation presented in this technical memorandum is to determine the number of extraction wells required to adequately contain the chlorinated solvent groundwater plume originating on the HVE site and support an Interim Remedial Measure (IRM). This information will support the upgrade and subsequent operation, maintenance, and monitoring (OM&M) of the existing Miller's Sunoco/KOST Tire Groundwater Extraction and Treatment (GWET) system to address the HVE groundwater plume. A Scope of Work for the upgrade and OM&M has been prepared under a separate cover.

2.0 HYDROGEOLOGIC DATA EVALUATION

MACTEC has performed calculations of expected groundwater flows based upon data collected during the RI investigation (see Attachment 1 - Calculations). The following subsections provide a summary of this evaluation and present the rationale and design basis for determining the proposed extraction well configuration. In addition to the following evaluation, MACTEC conducting observations during a site visit to the existing GWET system. A summary of observations made during the site visit is presented in Section 3.0 of this technical memorandum.

Hydraulic conductivity data

Slug tests have been previously performed on MW-101, MW-102, MW-103 and MW-104. Review of the data plots of the Bouwer and Rice and Hvorslev methods suggested that the Horslev method produced the most representative values for hydraulic conductivity (K). The K values for the wells, based upon the Horslev method, were:

- MW-101, 1.7 feet per day (ft/d);
- MW-102, 0.35 ft/d;
- MW-103, 51 ft/d; and
- MW-104, 1.44 ft/d.

The K value at MW-103 is relatively high compared to the other wells and may reflect a local zone of higher K.

Hydraulic gradient

The hydraulic gradient (i), the difference in elevation between selected isocontours (12 feet) divided by the measured perpendicular distance between the contours (240 feet), is 0.05 ft/ft in the vicinity of the site.

Aquifer thickness

The aquifer thickness (water table to bedrock) was taken from the geologic cross-section presented on Figure 3.1 of the Remedial Investigation Report (MACTEC, 2005) as approximately 40 feet.

Estimates of Flow by Darcy's Law

Flow rates were computed by Darcy's Law as Q = KiA, where A is the cross sectional area (width of plume times aquifer thickness), using the following two selected K values:

- 1.7 ft/d, the highest K value excluding the value for MW-103; and
- 2.6 ft/d, calculated as the geometric mean of all the well K values.

For a K of 1.7 ft/d, the calculated flow is 6.1 gpm. For a K of 2.6 ft/d, the calculated flow is 9.3 gpm.

Estimates of Flow by Recharge Area

A topographic map of the area was inspected to provide an estimate of the available recharge area upgradient of Vestal Parkway. Although the area upgradient of the site is a complex of two hillsides and an intermittent stream, a distance to a groundwater divide of about 2100 feet was taken as representative. Assuming an effective recharge (precipitation that infiltrates the ground and actually becomes part of the aquifer) of from 10 to 15 inches per year, resulted in an estimate of from 8.6 to 12.9 gpm of groundwater flow through the plume width. This agrees well with the flow rates calculated from the K values.

Selected Flow Rate

Since slug test data typically provides an underestimate of the aquifer effective K, a flow rate of 10 gpm was indicated as a reasonable value for further calculations. This may vary seasonally.

Transmissivity

Transmissivity indicates the aquifer's ability to yield water, and is simply the K times the aquifer thickness. Using the K data from above, the estimated transmissivity is from 68 square feet per day (or 509 gallons per day per foot) to 104 square feet per day (or 778 gpd/ft). These values, although they may be a slight underestimate, are used in a conservative sense to estimate what drawdowns might be expected at extraction wells to provide adequate space between the natural water table and the expected drawdown and thus avoid exposing the well screen to air. Calculations using the Theis Equation for a single well suggest that at a 2.5 gpm rate and a K of

1.7 ft/d, a drawdown of about 7 to 8 feet could be expected. At the higher K of 2.6 ft/d and a rate of 3.3 gpm a drawdown of from 6 to 7 feet could be expected.

Data Limitations

These estimates were prepared using limited data and several assumptions. In addition, the role of the small stream immediately east of the site is not known. Aerial photos of the stream suggest it is dry. It may be fed by surface run-off or discharging groundwater at higher elevations, but may recharge the aquifer at lower elevations. During wet seasons, this may add significant water to the aquifer and drive the plume more westerly. This may affect necessary pumping rates and require seasonal adjustments to flow. Also unknown are the possible effects of the existing extraction wells along the long axis of the BTEX plume, however, these have been determined to be too far from the proposed fence along Vestal Parkway to affect conditions at the proposed fence.

3.0 GWET SYSTEM SITE VISIT OBSERVATIONS

On August 30, 2006, MACTEC conducted a site visit at the existing Miller's Sunoco/KOST Tire GWET system. A representative of the current GWET system operations contractor, Nature's Way Environmental, was on-site to provide information on the existing treatment system. Upon arrival, GWET system operations included extraction of groundwater from extraction wells RW-1 and RW-3 at a combined flow of approximately 6.7 gpm. It should be noted that the flow control valves for RW-1 and RW-3 were configured such that the majority of this flow was from RW-1. RW-1 is located on the KOST Tire property and is proposed for future use with the upgrade GWET system. Historically, flow rates from RW-1 have been approximately 3 to 4 gpm, and as low as 2.5 gpm. Currently, the flow control valves have been throttled such that all extraction well pumps operate continuously without cycling due to excessive drawdown. It appears therefore that a yield of 2.5 to 4 gpm produced a drawdown of about 12 feet in RW-1. With RW-1 operating alone and throttled half-way, the flow rate is approximately 8 gpm (the submersible pump is rated at maximum of 15 gpm). At this flow rate, the water level in the extraction well was drawdown excessively, such that the pump cycled on and off as the water level would rise and fall triggering the float switch. A flowrate of approximately 5 gpm appeared to be sustainable during the short observation period.

4.0 CONCLUSION

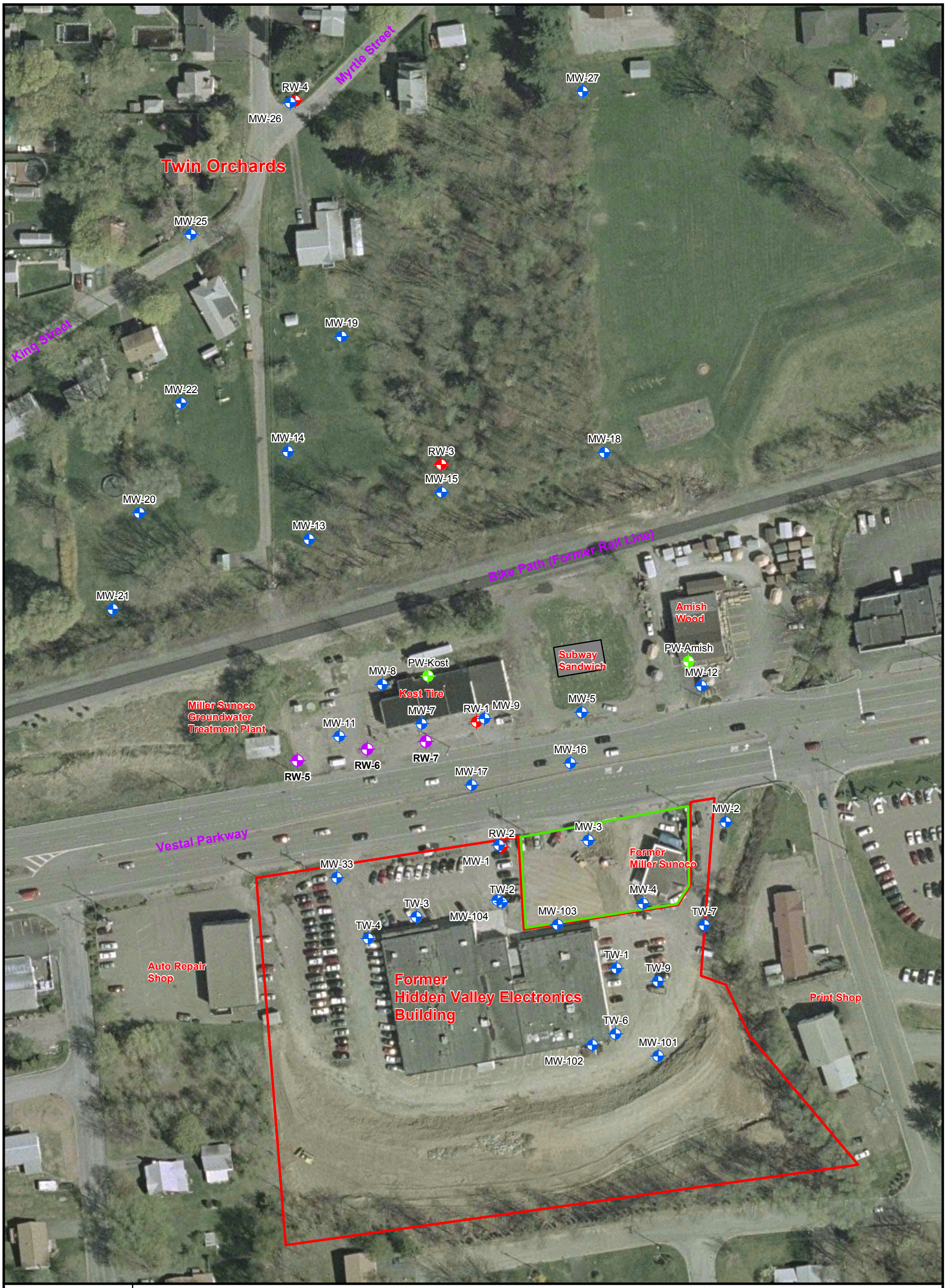
The combined plume width at the northern edge of Vestal Parkway (Route 434) is about 345 feet. Limited hydraulic conductivity (K) data exist for this area. MACTEC used this data together with observed hydraulic gradients, and also made some estimates of flow based on approximate recharge areas for groundwater. These results suggest that the plume groundwater flow rate is approximately 10 gallons per minute (gpm). The current GWET operates at approximately 6.7 gpm, utilizing two extraction wells oriented longitudinally to the BTEX for which it was designed to capture. According to the representative from Nature's Way Environmental, the extraction scheme has included up to three extraction wells, situated longitudinally to the BTEX plume, with the majority of extracted groundwater draw from RW-1 with extraction wells RW-3 and RW-4 used to capture any BTEX contamination which is not intercepted at RW-1. Historically, flow rates from RW-1 have been approximately 3 to 4 gpm, and as low as 2.5 gpm. Historical and current operational information for RW-1 support the determination that three or four extraction wells operating in the range of 2.5 to 3.3 gpm would be adequate to intercept the entire chlorinated solvent groundwater plume. MACTEC proposes the installation of three additional extraction wells, for a total of four (including RW-1), to support the upgrade of the existing GWET system for use in intercepting the chlorinated solvent groundwater plume originating on the HVE site. An extraction well configuration consisting of a total of four extraction wells evenly spaced across the approximately 345-foot wide plume allows for the most flexibility with regard to optimization of the groundwater extraction.

5.0 REFERENCES

MACTEC Engineering and Consulting, P.C. (MACTEC), 2005. Remedial Investigation/Feasibility Study, Hidden Valley Electronics. Prepared for the New York State Department of Environmental Conservation, Albany, New York. Draft - August 30, 2005.

MACTEC Engineering and Consulting, P.C. (MACTEC), 2006. Scope of Work, Groundwater Monitoring Well Installation, Former Hidden Valley Electronics Site, Vestal, Broome County, New York, Prepared for the New York State Department of Environmental Conservation, Albany, New York. August 2006.

Figure 1.1 – Proposed Monitoring Wells



Prepared by CRS | Checked by JWP

Legend

- Monitoring Well
- Private Well
- Recovery Well

Approximate Property Lines

- HVE Site Property
- Milller Sunoco Site Property
- Proposed Well

Note: 2002 Aerial photo from NYS GIS Clearinghouse.

FIGURE 1.1
INTERIM REMEDIAL MEASURE
PROPOSED MONITORING WELLS
HIDDEN VALLEY ELECTRONICS SITE
VESTAL, NEW YORK

MACTEC

Attachment 1 – Calculations

Attachment 1 - Calculations
Technical Memorandum
Hydrogeologic Investigation
Former Hidden Valley Electronics Site
Vestal, Broome County, New York

Objective:
Determine the approximate flow rate of the chlorinated solvent groundwater plume originating on the HVE site and the number of extraction wells required to contain the plume based upon site-specific hydrogeologic data collected during the Remedial Investigation.

Procedure:

Step 1 - Recharge
The width of the plume is approximately 345 ft
Refer to Figure 4.2 of the Remedial Investigation

The upgradient distance to the groundwater divide is approximately 0.4 miles
Refer to USGS Endicott Quad or 2100 feet

Assume recharge of 10 to 15 inches per year 10 in/yr
15 in/yr

$Q_{recharge}$ = RA = 603750 ft^3/yr low
= 8.6 gpm

$Q_{recharge}$ = RA = 905625 ft^3/yr high
= 12.9 gpm

Note: Groundwater contours and the apparent dry creek bed suggest surface runoff coming down this stream may infiltrate and push groundwater more northerly and or north-northwesterly. This component of recharge is unknown and not included in the above calculations.

Step 2 - Groundwater Flow Rate from Darcy's Law

Where Q = KiA

Based upon highest Hvorslev result excluding MW-103

K =	1.7	ft/d	
i=	0.05	ft/ft	approximate from Figure 3.4 of the HVE Remedial Investigation Report
A = b*w			
b =	40	ft	aquifer thickness (refer to Geologic Cross-Section Figure 3.1)
w =	345	ft	plume width
Therefore:			
Q =	1173	ft^3/d	
	6.1	gpm	

Based upon geometric mean of Hvorslev results including MW-103

K =	2.6	ft/d	
i=	0.05	ft/ft	approximate from Figure 3.4 of the HVE Remedial Investigation Report
A = b*w			
b =	40	ft	aquifer thickness
w =	345	ft	plume width
Therefore:			
Q =	1794	ft^3/d	
	9.3	gpm	

Step 3 - Determination of required capture rate

Estimated flow and recharge rates are as follows

	8.6
	12.9
	6.1
	9.3
Average:	9.2 gpm

Use 10 gpm

Calculations conducted by: RAL
Calculations prepared by: RTB
Calculations checked by: ES
Date: 9/7/2006

UTM 18 415164E 4660867N (WGS84/NAD83)
USGS **Endicott** Quad
View *TopoZone Pro* aerial photos, shaded relief, street maps, interactive coordinate display, and elevation data