November 13, 1995

Ms. Pam Mylotta
Project Manager
Wisconsin Department of Natural Resources
4041 North Richards Street
Milwaukee, WI 53212

RE: Tecumseh Products Company
Grafton, Wisconsin

Dear Pam:

As we discussed with you during our meeting on October 10, Tecumseh Products and RMT do not believe that the Grafton facility is the source of the solvents detected in Village Well #1. Our conclusion is based on the findings of previous activities performed by the WDNR and the Village of Grafton, as well as on those of a capture zone analysis that RMT recently performed. In preparation for our upcoming meeting, we thought that it would be helpful for you, Mike Barden, and Sharon Schaver to be able to review the technical basis for this conclusion in advance. We are therefore enclosing a project memorandum that provides a summary of the technical justification for Tecumseh's position. We can discuss questions or comments about this evaluation when we meet.

As I am sure you can appreciate, the issue of potential responsibility for contamination in Well #1 is a significant concern for Tecumseh. Because this will be an active subject of discussion during the meeting on November 17, Daryl McDonald has asked either Hank Handzel or Timm Speerschneider of DeWitt Ross and Stevens to attend the meeting as well.

Please call either Kerry DeKeyser, at 414-898-5711, or me if you have questions that should be addressed before we meet.

Sincerely,

Linda Hicken

Linda E. Hicken, P.E.
Senior Project Manager

vld

Enclosure

cc: Kerry DeKeyser
Daryl McDonald
Timm Speerschneider

RMT, INC. — MADISON, WI
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RMT, Inc. **PROJECT MEMORANDUM**

DATE: **October 3, 1995**

TO: **Project File 3084.16**

FROM: **Bernd Rehm and Lisa Drzewiecki**

SUBJECT: **Evaluation of Solvent Source Locations for Grafton Village Well No. 1**

The Village of Grafton's Well No. 1 was found to be contaminated with chlorinated solvents in 1982. The compounds, and the range of concentrations detected, as reported by the WDNR in 1985 and 1989, included the following:

- Tetrachloroethene (PCE) at 0.7 to 16 μg/L
- Trichloroethene (TCE) at 9.3 to 260 μg/L
- 1,1- and 1,2-Dichloroethenes (DCEs) at 5.0 to 26 μg/L
- 1,1,1-Trichloroethane (TCA) at 1.3 to 24 μg/L

Tom Krueger, the Grafton Water and Wastewater Utility Manager, noted during conversations with Tecumseh Products and RMT representatives on December 5, 1994, that a consistent pattern of concentration change with time is observed when Well No. 1 is pumped. Initial solvent concentrations are on the order of 200 to 500 μg/L. Within 24 hours, however, the concentrations decrease to levels on the order of 20 to 50 μg/L.

The Tecumseh Products Company facility in Grafton is located about 700 feet north of Well No. 1. TCE, DCEs, and TCA have been observed in groundwater below the facility. The WDNR has recently questioned whether the Tecumseh facility is the source of compounds in Well No. 1. The mere proximity of the facility to Well No. 1, however, does not necessarily make the Tecumseh facility the source of the solvents found in the well. In fact, data generated to date indicate that the Tecumseh facility is <u>not</u> the source of the chlorinated solvents observed in Well No. 1. The following discussion addresses the potential for solvent migration from the facility to Well No. 1:

- The first issue is the mixture of solvents observed. PCE has been consistently observed in Well No. 1, but has not been observed beneath the Tecumseh facility. Because PCE cannot be chemically formed from the other solvents observed, its presence suggests an origin from some source other than the Tecumseh facility.

- The second issue is the likelihood that pumping Well No. 1 could draw contaminants from the Tecumseh facility to the well. This was recently evaluated by RMT using a two-dimensional numerical model of groundwater flow (QuickFlow, J.O. Rumbaugh, 1991) to develop steady-state (long-term) capture zones for Well No.1. The model requires information on the aquifer's thickness, porosity, and hydraulic conductivity; the direction and magnitude of the regional hydraulic gradient; and the pumping rate of the well.

The intake zone of the well is about 400 feet long (at depths of 147 to 545 feet below grade) in a 1,000-foot–thick aquifer. It was assumed that the well would draw water from between depths of 45 to 645 feet to account for the effects of partial aquifer penetration by the well. The hydraulic conductivity of the aquifer was assumed to be on the order of 0.01 centimeter per second (cm/s) based on the upper end of the range of values derived from borehole packer tests conducted by RMT during the Phase I and II groundwater investigations at, and downgradient of, the facility. The hydraulic conductivity of this aquifer is a result of the fractures in the bedrock aquifer. Fracture trace analyses, performed by RMT in mid-September 1995, identified photo lineaments that may reflect bedrock fracture patterns. Two dominant lineament orientations were defined, at about 50 degrees and at about 140 degrees. Both of these directions are consistent with regional fracture orientations. The fracture orientations cannot be quantitatively incorporated into the model, but the data can be used to qualitatively assess contaminant migration patterns. The porosity of the aquifer was assumed to be 0.05.

Data obtained from the monitoring wells installed during July and August 1995 were used to derive the magnitude of the regional gradient as being 0.005. The direction of the regional gradient was assumed to be parallel to the apparent fracture orientation of 140 degrees.

The pump in Well No. 1 has the capacity to pump approximately 215 gallons per minute (gpm). However, it is not the Village's typical operating practice to pump a well 24 hours per day. The current Village practice is to pump its primary production wells, of which Well No. 1 is not currently one, from 8 to 12 hours per day. On an assumed pumping schedule for Well No. 1 of 12 hours per day, the average daily pumping rate would be 108 gpm.

The results of the numerical simulation are illustrated on Figure 1 (attached). The capture zone is about 275 feet wide and extends northwestward from Well No. 1. The capture zone crosses Tecumseh property but does not intersect areas of known contamination on the facility. Decreasing the hydraulic conductivity of the aquifer would tend to increase the width of the capture zone (e.g., a hydraulic conductivity of 0.001 creates a capture zone that is about 2,000 feet wide). Incorporation of the apparent fracture patterns, however, would tend to decrease the width of the capture zone because the gradient is almost coincident with one of the two fracture orientations.

- The third and final issue is the time-concentration response observed when Well No. 1 is pumped. Figure 2 (attached) illustrates the reported concentration trend for Well No. 1, with high initial concentrations that decrease with continued pumping. This response indicates a solvent source that is immediately adjacent to, or upgradient of, the well that is releasing a variety of solvents to the groundwater. As Well No. 1 is pumped, it draws uncontaminated groundwater from the area defined by its capture zone. This dilutes the contamination found near the well, resulting in an order-of-magnitude decrease in solvent concentrations. The nearest solvent sources at the Tecumseh facility are about 700 feet to the north of Well No. 1, with contaminant migration to the southeast (see Figure 1). These sources are neither immediately adjacent to, nor upgradient of, Well No. 1. If the capture zone for Well No. 1 could become wide enough to encompass the Tecumseh facility and there were no sources near Well No. 1, this well would first pump clean groundwater. Concentrations of

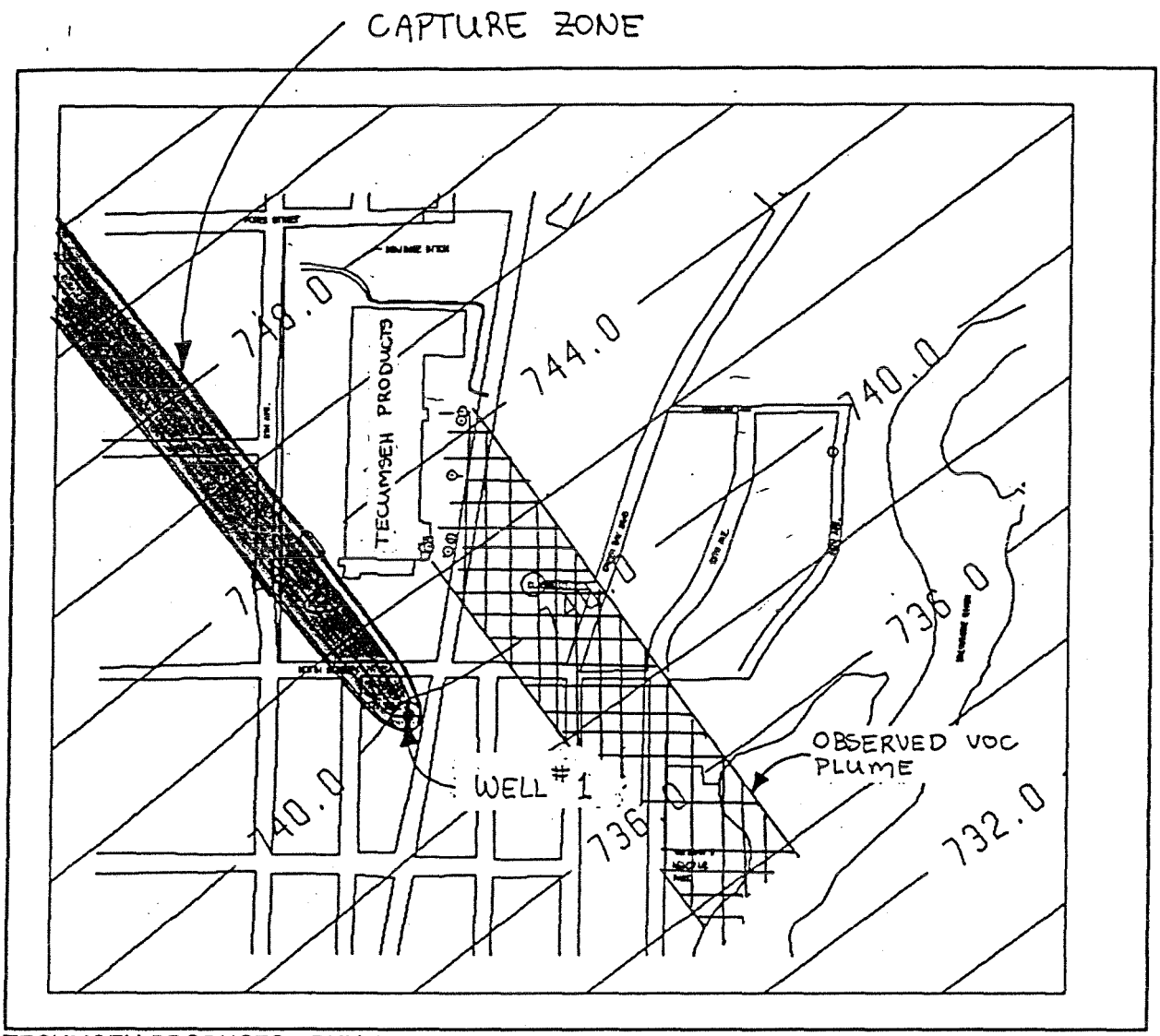
solvents would increase with time because pumping eventually draws solvents from beneath the facility. This alternative concentration response is not consistent with the Well No. 1 observations (Figure 2).

In summary, three lines of evidence indicate that the Tecumseh facility is not the source of the solvents observed in Village Well No. 1:

1. The mixture of solvents observed at Well No. 1 is not consistent with what has been observed beneath the Tecumseh facility.

2. The capture zone for Well No. 1 is not likely to extend over a wide enough area to encompass the Tecumseh facility.

3. The time-concentration response observed at Well No. 1 is consistent with a nearby source, not a source located some distance to the north of the well.



TECUMSEH PRODUCTS - RUN 1

Well No. 1 is pumping at 107.5 gpm

$K = 1 \times 10^{-2}$ cm/s
b = 600 feet
i = 0.005

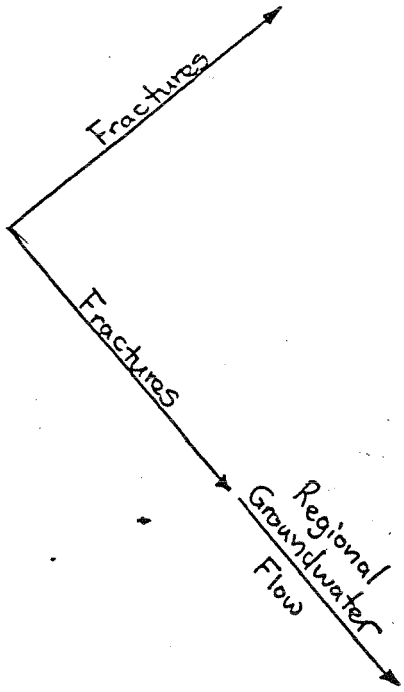


Figure 1. Grafton village well no 1. capture zone analysis

RMT INC.

COMPUTATION SHEET

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SHEET 1 OF 1

PROJECT / PROPOSAL NAME	PREPARED By:	Date:	CHECKED By:	Date:	PROJECT / PROPOSAL NO.
Tecumseh Products Co - Grafton	BWP	8/11/95			3084.20