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Freeman Chemical Corporation
Saukville, Wisconsin

Corrective Measure Activities

TASK 1
DESCRIPTION OF PAST AND CURRENT CONDITIONS

Site Construction Documentation Report

Prepared by:

Hatcher Incorporated
Richmond, Virginia
Job No. 0001-003

June 1, 1987

ADDENDUM
November 20, 1987

SITE CONSTRUCTION DOCUMENTATION REPORT
FREEMAN CHEMICAL CORPORATION
Saukville, Wisconsin

TABLE OF CONTENTS

Section and Title		Page
1.0	Facility Background	1-1
1.1	Facility Location	1-1
1.2	General Facility Description	1-1
1.3	Facility Manufacturing Processes	1-5
1.3A	History of Solid and Hazardous Waste Treatment, Storage and Disposal	1-10A
1.4	General Hydrogeology	1-11
1.4A	Groundwater Direction and Rate of Flow	1-11A
2.0	Nature and Extent of Contamination	2-1
2.1	Sources of Contamination	2-1
2.2	Groundwater Contaminants	2-1
2.2A1	Groundwater Quality Determinations During 1987	2-6A
2.2A2	Soil, Air and Surface Water Contamination	2-6A
2.3	Investigation and Remediation of the Church School Ballfield	2-7
2.3A1	Investigation and Remediation of the Laubenstein Property	2-7A
2.3A2	Saukville Public Water Supply	2-7A1
2.3A2.1	Quality	2-7A1
2.3A2.2	Quantity	2-7A3
3.0	Corrective Measures	3-1
3.1	HNU Testing and Calibration	3-1
3.1.1	Field PID Monitoring Procedures	3-2
3.1.2	Soil Borings for PID Calibration	3-3
3.1.3	Post-Construction Soil Handling, Storage, Testing, and Removal	3-3
3.1.3A	Recent Soil Handling Data	3-6A
3.2	Storage and Disposal of Pumped Groundwater	3-6A
3.3	Remediation Plan	3-7
3.4	Results of Pilot Tests	3-7
3.5	Ranney Well Collection System Construction	3-8
3.5.1	Ground Penetrating Radar Survey	3-8
3.5.2	Caisson Construction	3-12
3.5.3	Ranney Collector Ditch Construction	3-13
3.6	Construction of Glacial Overburden Wells	3-20
3.7	Construction of Shallow Dolomite Wells	3-22

TABLE OF CONTENTS (CONTINUED)

	Section and Title	Page
3.8	Construction of the Deep Dolomite Production/Dewatering Well	3-22
3.8.1	Location	3-22
3.8.2	Well Construction	3-23
3.8.3	Preliminary Pump Test	3-24
3.9	Old Dry Well Remediation	3-24
3.9.1	Location and Background	3-24
3.9.2	Remediation	3-25
3.10	Old Farmhouse Well Remediation	3-27
3.10.1	Location and Background	3-27
3.10.2	Remediation	3-29
3.11	Caustic Tank Remediation	3-30
3.11.1	Location	3-30
3.11.2	Remediation	3-30
3.12	Styrene Tanks Remediation	3-30
3.12.1	Location	3-30
3.12.2	Remediation	3-31
3.13	Remediation of Broken Linseed Oil Line	3-31
3.14	Remediation of Sumps	3-31
3.15	Remediation of Fuel Tanks	3-32
3.15.1	Diesel Tank	3-32
3.15.2	Old Gasoline Tank	3-32
3.16	Laubenstein Well	3-32
3.16.1	Location and Background	3-32
3.16.2	Remediation	3-33
3.17	Monitoring Well Construction and Decommissioning	3-33
3.17.1	Monitoring Well Construction	3-33
3.17.2	Decommissioned Wells	3-34
3.17A	Construction Documentation for Pumping Systems	3-34A
3.18	Surface Water Runoff	3-35
3.18A	Up-Date on Surface Water Runoff	3-35
3.19A	Evaluation of Corrective Measures	3-36A

APPENDICES

Appendix 1 - 1986 Chemical Analyses
Appendix 1A - 1987 Chemical Analyses
Appendix 2 - Individual Borehole Logs
Appendix 3 - Records of Soil VOA Tests, Storage, and Removal
Appendix 3A - Recent Soil Handling Data
Appendix 4 - Strip Chart Recording for Radar Survey Lines
Appendix 5 - Geologist Daily Construction Logs
Appendix 6 - Construction Diagrams
Appendix 6A - Groundwater Monitoring Well Information
Appendix 7 - Preliminary Pump Test Data
Appendix 7A - Pumping Systems Design Specifications
Appendix 8 - Photographs
Appendix 8A - Photographs (AT&E)

LIST OF FIGURES

Number	Title	Page
1-1	USGS Site Topography Map	1-2
1-2	Land Use & Topography	1-3
1-3	Property Owners Bordering Plant Site as of April 1987	1-4
1-4	1975 Physical Layout of Plant Site	1-6
1-5	1987 Physical Layout of Plant Site	1-7
1-6	Total Area Covered by Pavement Upon Project Completion	1-8
1-7A	Potentiometric Contour Diagram, Glacial Aquifer, 12/15/86	1-11A1
1-8A	Potentiometric Contour Diagram, Glacial Aquifer, 4/22/87	1-11A2
1-9A	Potentiometric Contour Diagram, Glacial Aquifer, 6/22/87	1-11A3
1-10A	Potentiometric Contour Diagram, Glacial Aquifer, 10/9/87	1-11A4
1-11A	Potentiometric Contour Diagram, Dolomite Aquifer, 12/15/86	1-11A6
1-12A	Potentiometric Contour Diagram, Dolomite Aquifer, 4/22/87	1-11A7
1-13A	Potentiometric Contour Diagram, Dolomite Aquifer, 6/22/87	1-11A8
1-14A	Potentiometric Contour Diagram, Dolomite Aquifer, 10/9/87	1-11A9
2-1	Location of Potential Sources of Groundwater Pollution Existing Prior to 1986	2-2
2-2	Approximate Extent of Glacial Aquifer Contamination - Winter 1986	2-4
2-3	Approximate Extent of Shallow Dolomite Aquifer Contamination - Winter 1986	2-6
2-4A	Existing Village Water Supply and Treatment	2-7A4

LIST OF FIGURES

Number	Title	Page
2-5A	Five-Year Projected Village Water Supply and Treatment	2-7A6
3-1	Borehole Location Map	3-4
3-2	Soil Handling Location Map	3-6
3-3	Typical Cross-Section of Ranney Collection System	3-9
3-4	Location of Radar Survey Lines	3-11
3-5	Ranney Collector #1 Ditch Profiles	3-14
3-6	Ranney Collector #2 Ditch Profiles	3-15
3-7	Ranney Collector #3 Ditch Profiles	3-16
3-8	Ranney Collector and Well Location Map	3-17
3-9	Location of Dolomite Repair Area	3-19
3-10	Location of "Old Dry Well"	3-26
3-11	Location of "Old Farmhouse Well"	3-28
3-12A	Site Plan (AT&E)	3-34A5
3-13A	Pump House Layout (AT&E)	3-34A6
3-14A	Process and Instrumentation Diagram (AT&E)	3-34A7
3-15A	Electrical E-1 (AT&E)	3-34A8
3-16A	Electrical E-2 (AT&E)	3-34A9
3-17A	Details (AT&E)	3-34A10
3-18A	Plant Drainage System	3-35A
3-19A	Storm Sewer/Surface Drainage	3-35A1

List of Figures NOT Included in this copy of Volume 1
(note: these figures are included in the copy of Vol 1 at SED)

Fig #	Title	Page
1-2	Land Use & Topography	1-3
1-3	Property Owners Bordering Plant Site As of April 1987	1-4
1-6	Total Area Covered by Pavement upon Project Completion	1-8
3-4	Location of Radar Survey Lines	3-11
3-5	Ranney Collector #1 Ditch Profiles	3-14
3-7	Ranney Collector #3 Ditch Profiles	3-16
3-12A	Site Plan (AT&E)	3-34A5
3-13A	Pump House Layout (AT&E)	3-34A6
3-14A	Process & Instrumentation Diagram (AT&E)	3-34A7
3-15A	Electrical E-1 (AT&E)	3-34A8
3-16A	Electrical E-2 (AT&E)	3-34A9
3-17A	Details (AT&E)	3-34A10
3-18A	Plant Drainage System	3-35A
3-19A	Storm Sewer/Surface Drainage	3-35A1

LIST OF TABLES

Number	Title	Page
2-1	Organic Chemicals At Freeman´s Saukville Site .	2-3
2-1A	Approximated Average Monthly Inventory of Raw Materials Stored at Freeman Chemical´s Saukville Plant	2-3A

1.0 FACILITY BACKGROUND

1.1 FACILITY LOCATION

Freeman Chemical Corporation's Saukville Plant is centrally located in the Village of Saukville, Wisconsin. A portion of the U.S. Geological Survey (USGS) 7.5-minute topographic map surrounding the Village of Saukville is shown in Figure 1-1.

The site is bounded by Main Street, Linden Street, a short section of Railroad Street, and Church Street on the east, south, west, and north, respectively (Figure 1-2). The Chicago, Milwaukee, St. Paul, and Pacific Railroad runs along the full length of the site's western boundary.

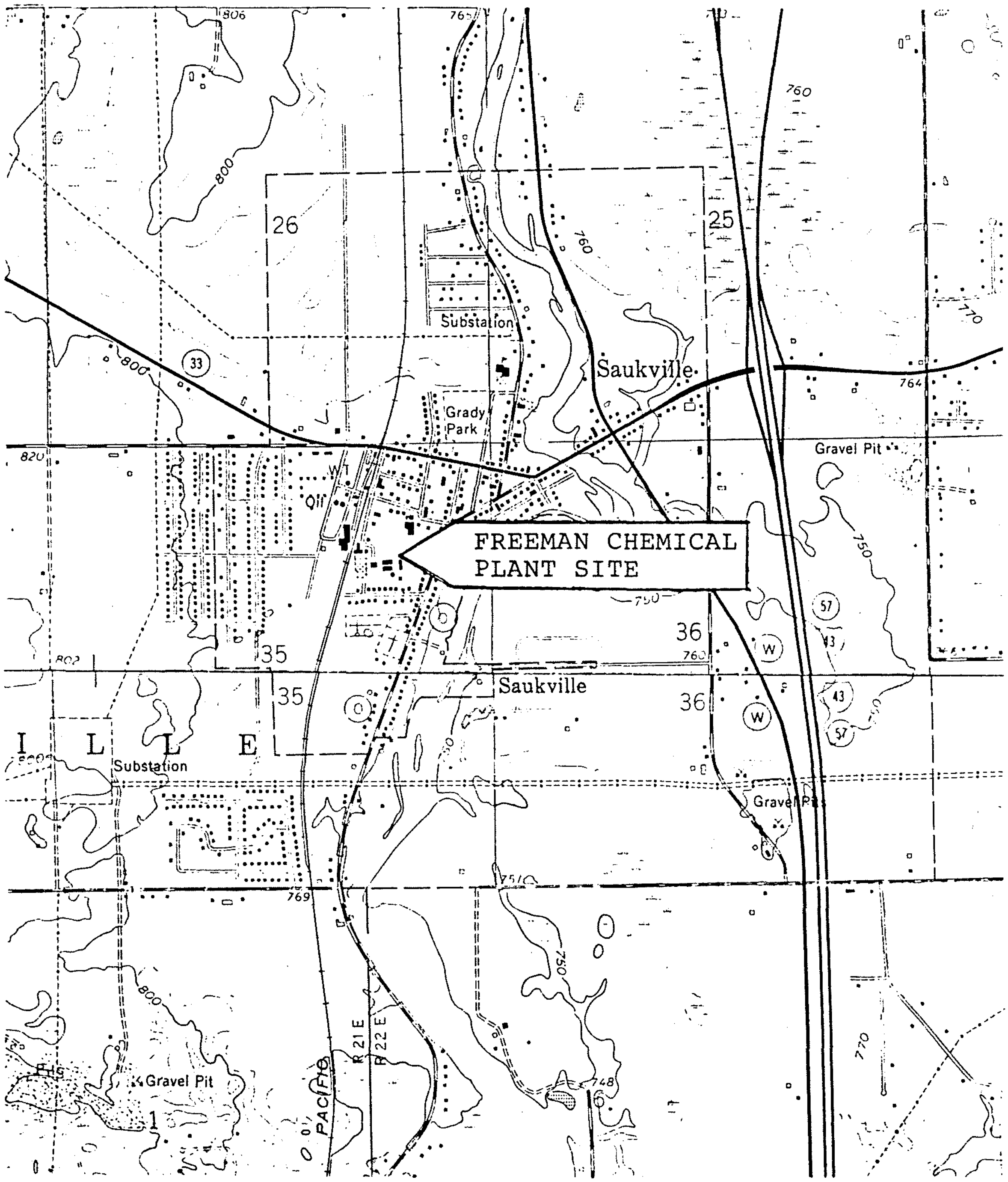
Land use immediately surrounding the site is depicted on Figure 1-2. Within 1,000 feet of the Freeman property, residential properties exist in essentially all directions; commercial properties are located north of the site; industrial zoning occurs to the west, northwest and southeast; and some agricultural land is found east of the plant. Freeman's property is bounded by residential properties on all sides except the western border which is zoned industrial. A land ownership plat for the adjacent properties is presented as Figure 1-3.

1.2 GENERAL FACILITY DESCRIPTION

Both the Village of Saukville and the plant site are located on relatively flat lying ground which gently slopes to the Milwaukee River (see Figures 1-1 and 1-2). The river flows through the village and to the east of the plant site, approximately 1,000 feet from the main plant area.

The Saukville Plant is an old plant that was originally operated as a cannery. Freeman Chemical installed its original plant equipment in 1949. Since that time, the plant site has grown geographically, by acquiring additional properties to the east and southeast of the original site, and the addition of

FIGURE 1-1.
USGS SITE TOPOGRAPHIC MAP



SCALE 1:24 000

1 ½ 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS 578 FEET

MN
GN
0°39'
11 MILS
0°

UTM GRID AND 1976 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

PORT WASHINGTON WEST, WIS.
NW/4 PORT WASHINGTON 15' QUADRANGLE
N4322.5—W8752.5/7.5

1959
PHOTOREVISED 1971 AND 1976
AMS 3470 IV NW-SERIES V861

equipment, by adding various kettles, tanks, and buildings for adjusting, blending, thinning, rinsing, and storage of its raw materials and finished products. No new equipment has been installed since 1969.

The Saukville Plant presently covers an area of approximately 10.5 acres. The original plant site in 1948 was much smaller, mainly the western portion of the property along the railroad tracks. The existing expanded plant site is roughly L-shaped. The physical layout of the Saukville Plant as it existed in about 1975 is shown by Figure 1-4. This figure shows the location and identity of the various buildings, storage facilities, present incinerator, perimeter fence, and gates.

The present (1987) physical layout of the plant, including the most recent (1986) construction, is shown in Figure 1-5. The main manufacturing and storage areas are in the southwestern, central, and south-central areas of the plant. The present incinerator and most of the on-site laboratory facilities are in the northern arm of the "L," adjacent to Church Street. Underground piping installed in 1986 to connect the effluent pumped from wells and Ranney collectors is shown in Figure 1-5. The portion of the plant site that will be paved is illustrated in Figure 1-6.

1.3 FACILITY MANUFACTURING PROCESSES

Since 1949 this plant has manufactured alkyd, polyester, and urethane synthetic resins. The alkyd and polyester resins are produced by a condensation reaction; the urethane resins are produced either by blending or by an isocyanate reaction. Alkyd resins are used in the coatings industry to make paints and varnishes. Polyester Resins are sold to the reinforced plastics industry for use in fiberglass boats and molded polyester parts. Urethane resins are widely used for insulation and seating applications.

Five hazardous wastes are presently generated at Freeman Chemical's Saukville Plant: waste rinse solvent, reaction water, waste resin, spill residues from "U"-listed chemicals, and ash from the present incinerator. By far, the greatest amount of wastes are the waste rinse solvent and reaction water.

At the Saukville Plant, the waste rinse solvent is generated by two different processes: 1) by cleaning process equipment with various non-halogenated solvents, and 2) as a process waste from the manufacture of resins. The rinse solvent is re-used several times before it is considered spent and is stored in the production area between uses. When it is no longer usable as rinse, the solvent is transferred to the hazardous waste treatment area for incineration.

In the manufacturing of resin, xylene and toluene are used in an azeotrophic distillation to remove reaction water from the finished product. Just prior to incineration, these solvents are physically separated from the reaction water and piped to a holding tank. The total spent solvents produced per year is estimated at 1,500 tons. These spent solvents are hazardous because of ignitability, listing, and content of significant but highly variable quantities of one Table VI constituent - toluene.

The reaction or esterification water is generated in the chemical reaction that forms polyesters and alkyd resins. It is codistilled with the solvents toluene and xylene. The total amount of reaction water generated per year is estimated to be about 500 tons. It is hazardous by virtue of its potential ignitability. Although this is truly an aqueous solution, it does flash below 140°F about 50 percent of the time. A particular sample flashes only once and does not sustain combustion; nevertheless, it still qualifies as ignitable. An Appendix IX analysis of the reaction water yielded the following results:

Organic Hydrocarbons -

- Ethyl benzene 31 mg/l
- Styrene 23 mg/l
- Toluene 710 mg/l
- Xylene (total) 120 mg/l
- Phenol 2,600 mg/l

Total Metals (≥ 1 mg/l) -

•	Iron	1.2 mg/l
•	Tin	1.6 mg/l
•	Zinc	53 mg/l
•	Sodium	503 mg/l

Freeman Chemical also produces a hazardous ignitable waste resin (D001). This material is produced from sampling, transfer line drawings, filter drainage, and reject finished products. It is hazardous solely because of its ignitability. It contains only insignificant amounts of some Table VI compounds, except perhaps larger amounts of toluene.

The fourth source of hazardous waste at the Saukville Plant is residues from the clean-up of spills of "U"-listed chemicals. Freeman Chemical uses large quantities of "U"-listed chemicals, and, inevitably, there are de minimis losses and spills of these chemicals. The hazardous constituents and Principal Organic Hazardous Constituents (POHC's) contained in these wastes, which are incinerated, are the following Table VI constituents:

- Maleic Anhydride
- Phthalic Anhydride
- Toluene Diisocyanate
- p-Benzoquinone
- Methyl Methacrylate
- Bis (2-ethylhexyl) Phthalate
- Isobutyl Alcohol
- Toluene

The laboratory waste generated at Freeman Chemical's Port Washington Research Laboratory consists of adsorbed solvents and resins (onto sawdust), a variety of empty tin cans and paper cups, paper towels, etc. Presently, this waste is generally combined and shipped to the Saukville Plant for incineration.

1.3A HISTORY OF SOLID AND HAZARDOUS WASTE TREATMENT, STORAGE AND DISPOSAL

Practically no documentation exists for Freeman Chemical Corporation's waste handling at the Saukville, Wisconsin plant prior to 1972, when the present incinerator was installed. What we report herein is the recollection of several longtime employees.

The primary wastes generated at the Freeman Saukville plant are:

1. Reaction water;
2. Spent solvents;
3. Solid debris, including filter press residues contaminated with resins and solvents.

Since 1972, reaction water has been destroyed in an on-site incinerator. Prior to 1972, reaction water was disposed of in various ways. Initially, that is from 1949 through the 1950's, the water was discharged directly to the Milwaukee River. Once that practice ceased, reaction water was put into a "dry well" west of Building 5 (Figure 1-5), a practice approved by the State of Wisconsin. The pit had a sand and gravel base. Sometime in the mid 1960's, the practice stopped and Freeman incinerated the reaction water in an air curtain incinerator located on what is now the Logeman property (A.G. Associates), adjacent to the Freeman property. Starting in 1972, the reaction water was incinerated in the present incinerator, a practice which continues today. Currently, the the company has a Part B Application, now in the public review process, addressing a state-of-the-art fume incinerator designed by the John Zink Company.

Spent solvents generated at Freeman are currently the fuel used to incinerate reaction water and debris in the existing incinerator. Prior to 1972, the solvents were sent off-site to various recycling facilities including Acme in Rockford, Illinois. Also, it is likely that some of the solvents were drummed and sent to two local landfills: Mr. Didier's dump in Port Washington and Mr. Didier's dump in the Town of Sherman. The Didier dump and the Sherman dump both burned in the late 1960's, substantially destroying all of the accumulated materials at both locations. Also, prior to incineration in the existing device, solvents were destroyed in the air curtain incinerator referenced in the previous paragraphs.

Solid waste, such as bags, pallets, and filter press residues, were disposed of off-site until the construction of the curtain incinerator in the 1960's. It is probable that some of the material simply went to local landfills. Other materials, in particular, the filter press residues, were drummed and disposed of in the landfills referenced in the paragraph concerning solvents above. Presently, all such wastes are incinerated in the on-site interim status unit.

1.4 GENERAL HYDROGEOLOGY

The plant site and surrounding area are underlain by a layer of glacial till of varying thickness over dolomite bedrock. Generally, the upper-level groundwater flows through the till toward the river. The Village municipal well field pumps water from the underlying dolomite. Presently, storm drainage from the plant site discharges to the river from on-site storm sewers. Normal runoff from the land surrounding the plant site generally flows toward the river.

The Dolomite Aquifer was found to be semiconfined by the glacial sediment cover. The water table in the tight glacial sediments is shallow and locally highest on the west side of the property. From that point, water flows in all directions but principally to the Milwaukee River to the East. Groundwater in the Dolomite Aquifer was found to flow directly to the Milwaukee River, except where under the drawdown influence of the Village well field.

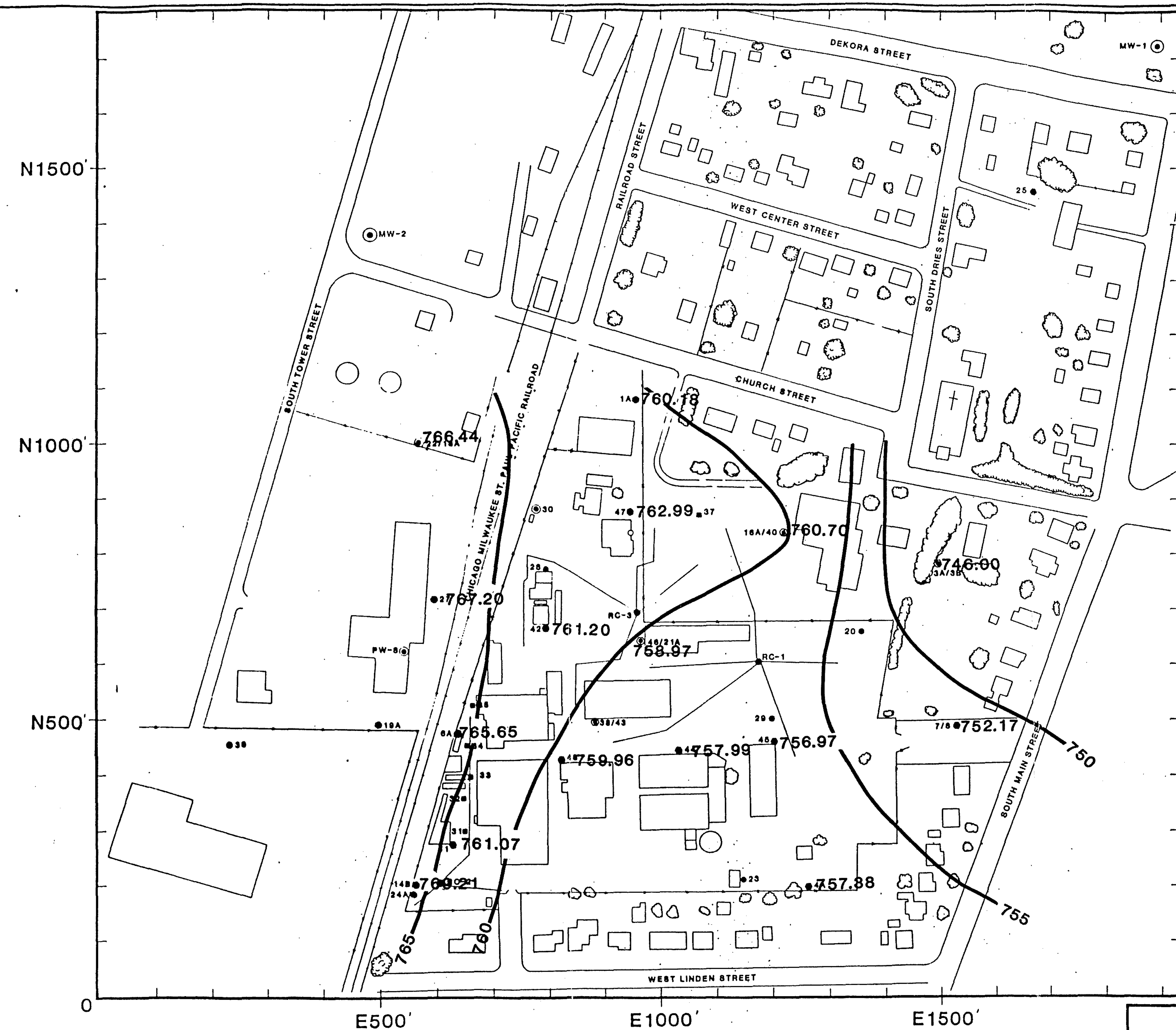
The upper surface of the dolomite was found to be weathered and solutioned down to approximately 100 feet. Below this level, the dolomite is quite competent, but solution channels do exist probably as enlargements of fracture systems. The glacial sediment cover over the underlying Dolomite Aquifer, which exhibited quite low permeability (1.2×10^{-8} to 5.5×10^{-8} cm/sec), recharges the pervious and karsted upper surface of the Dolomite. A more detailed discussion concerning the hydrogeology of the site can be found in Hatcher Incorporated's report entitled "Summary - 1985, Interim Remedial Investigations Report, Freeman Chemical Corporation, Saukville, Wisconsin" submitted previously.

1.4A GROUNDWATER DIRECTION AND RATE OF FLOW

Historically, shallow groundwater flowed to the lower southeastern part of the plant site (as did the surface water generally) except the shallow groundwater along the western edge of the site which flowed toward the railroad track area.

Within the dolomite aquifer, a groundwater high exists in the west central part of the Saukville site, from which the groundwater flows in almost every direction governed by the pumping of local dolomite wells. Prior to any remediation, the western 1/3 of the dolomite aquifer within the Freeman site was flowing toward the drawdown cone of MW-2, toward the cone of the unpumped Laubenstein well (PW-8), and from PW-8 to MW-2 through fractures/solution channels. From the 1985 potentiometric diagrams for the dolomite aquifer, it was also apparent that deep groundwater was being routed southward to the Milwaukee River, northward to the river, and to some extent to MW-1.

Recent potentiometric diagrams constructed from water level data collected from December, 1986 to October, 1987 (Figures 1-7A through 1-10A) generally indicate that the shallow groundwater continues to flow east to southeast toward the Milwaukee River. A cone of depression in the glacial aquifer is indicated from the potentiometric surface diagrams in Figures 1-8A and 1-9A. The head loss is centered around Piezometer 38, and is present in the April and June, 1986 aquifer conditions. This corresponds to the start-up of W-30 in early March and it is thought that this depression is caused by leakage of the glacial aquifer into the fractured dolomite. Many of the shallow piezometers on the site have exhibited head loss in response to pumpage of the dolomite aquifer. This effect has been noticed in the past when Well 30 has been pumped and local piezometers monitored, demonstrating a direct hydraulic connection between the two aquifers. The most recent potentiometric surface contour of the glacial aquifer shown in Figure 1-10A, also indicates a concentration of shallow groundwater flow in the area of Piezometer 38, the western part of the Freeman site. Generalized flow direction of the glacial



Potentiometric Contour : Glacial Aquifer.

December 15, 1986

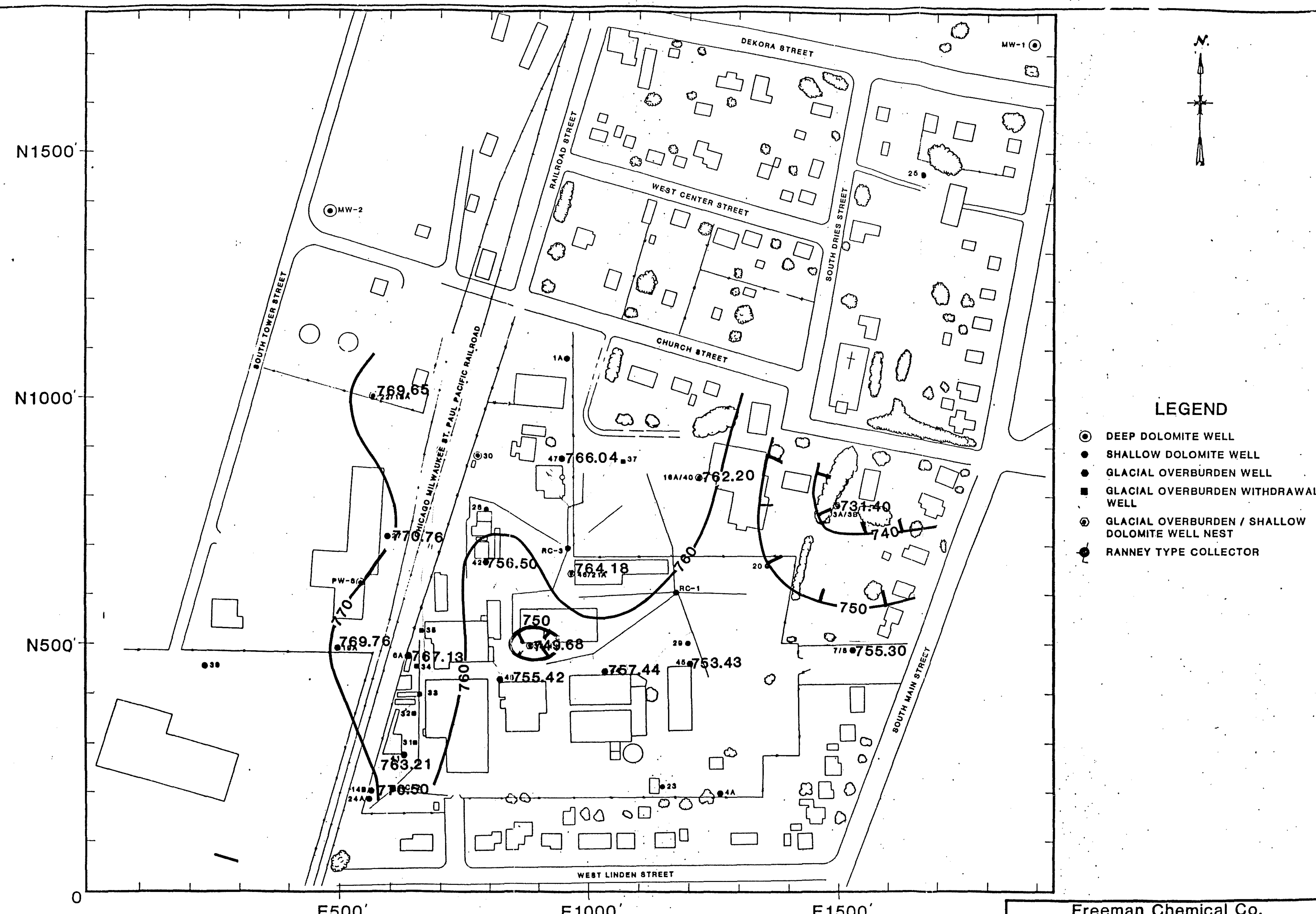
Contour Interval : 5 feet

100 0 100 200 scale feet

LEGEND

- DEEP DOLOMITE WELL
- SHALLOW DOLOMITE WELL
- GLACIAL OVERBURDEN WELL
- GLACIAL OVERBURDEN WITHDRAWAL WELL
- GLACIAL OVERBURDEN / SHALLOW DOLOMITE WELL NEST
- RANNEY TYPE COLLECTOR

Freeman Chemical Co. Saukville, Wisconsin MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-7A	Drawn By: C.E.W. Approved By: G.L.B.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A1	Drawing No.: H-018



Potentiometric Contour : Glacial Aquifer.

April 22, 1987

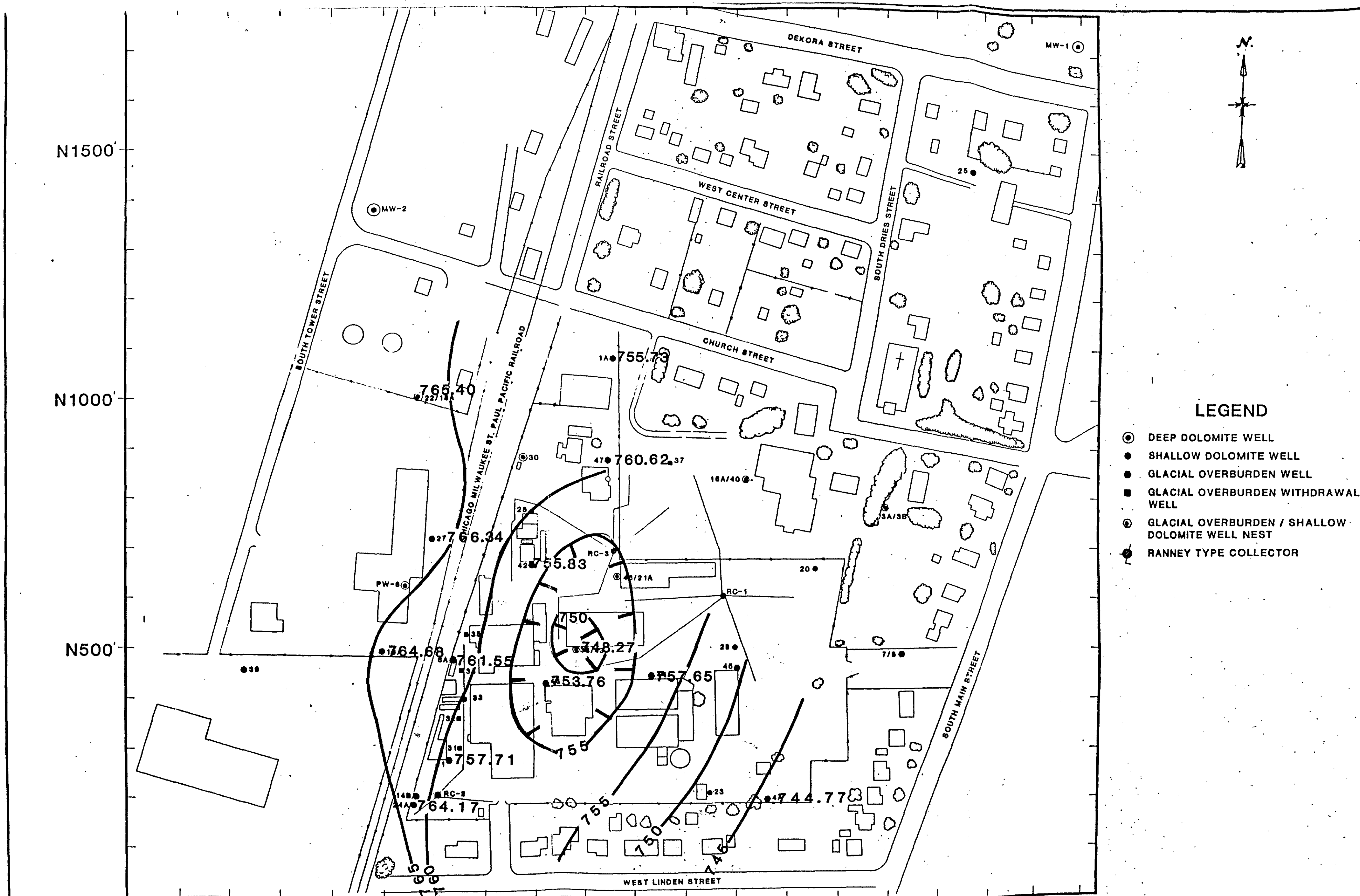
Contour Interval : 10 feet

100 0 100 200 scale feet

Freeman Chemical Co.
Saukville, Wisconsin

MONITORING WELL LOCATION MAP

Date: 12/4/86	Fig. 1-8A	Drawn By: C.E.W.
Scale: As Noted		Approved By: G.L.B.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A2	Drawing No.: H-018



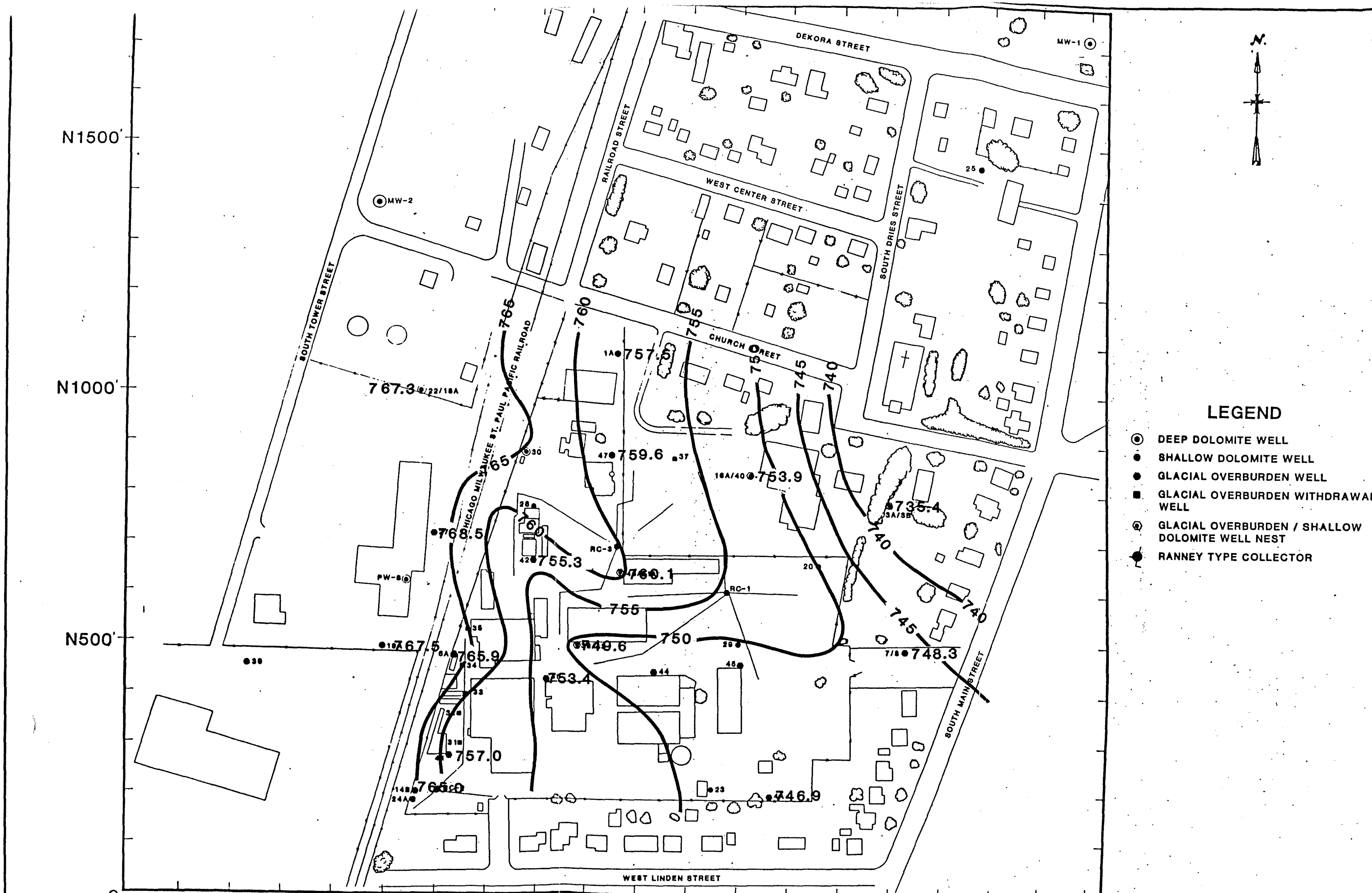
Potentiometric Contour : Glacial Aquifer.

June 22, 1987

Contour Interval : 5' Feet

100 0 100 200 scale feet

Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-9A	Drawn By: C.E.W. Approved By: G.L.B.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A3	Drawing No.: H-018



Potentiometric Contour : Glacial Aquifer.
October 9, 1987

Contour Interval : 5 feet

100 0 100 200
scale feet

Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-10A	Drawn By: C.E.W. Approved By: G.L.B.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A4	Drawing No.: H-018

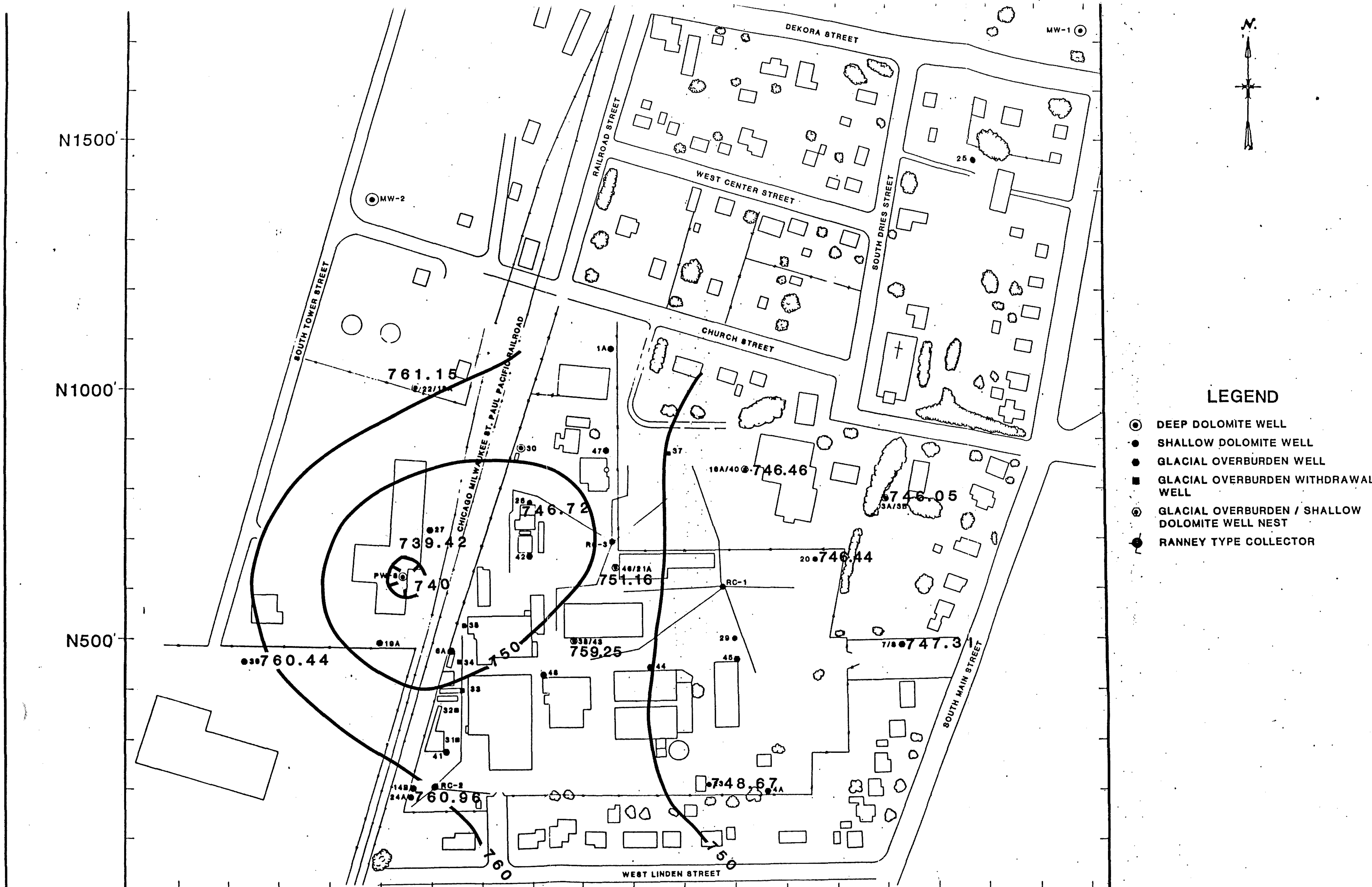
aquifer as indicated by the latest data from October 9, 1987, continues to be east to southeast, and to some degree, northeast.

The potentiometric diagram constructed from data obtained in October, 1987, documents the first shallow groundwater flow anomolies, thought to be in response to the Ranney collectors. A new flow pattern seems to have been established, particularly in the north central portion of the site, since the activation of the Ranney system on July 23, 1987. Groundwater flow has generally become more concentrated in the area of the Ranney collectors, with increased velocities, as indicated by in the increased potentiometric gradients in this area.

Groundwater in the deeper fractured dolomite aquifer regionally flows to the east but the flow direction is controlled by the extensive pumping in this formation. The potentiometric diagrams for the dolomite aquifer in April, June, and October of 1987 (Figures 1-12A - 1-14A), show a head depression throughout a trough trending approximately east-west through the Freeman site. This depression is the result of the pumping of Well 30 and the elongation of the drawdown cone is thought to be associated with an underlining fracture through which significant amounts of water are routed.

Historical rate of flow for the dolomite groundwater must be estimated using the best available data from pump tests conducted on wells constructed in the dolomite aquifer. Based on these data, if one assumes conservatively that T = 2,000 feet^2/day, porosity = 0.05, aquifer thickness = 500 feet, and the natural potentiometric gradient = 0.0125 (from the center of the Freeman site toward the Milwaukee River) then the average velocity of the groundwater in the dolomite is approximately 1 foot per day.

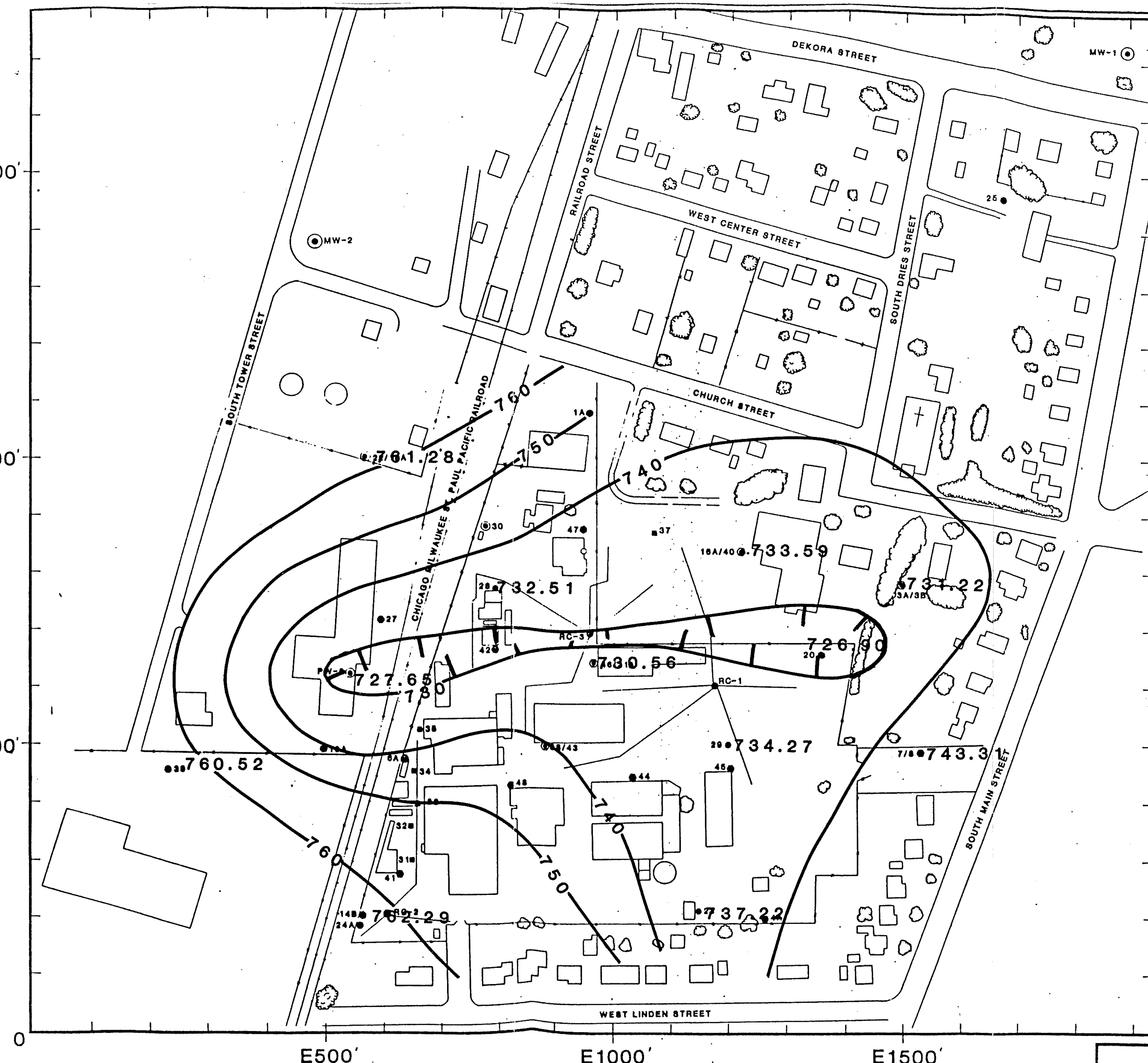
In the immediate area of the Freeman site, groundwater velocities have increased due to the effect of pumping on site. Referring to the potentiometric diagrams for the dolomite aquifer, average potentiometric gradients increase from December, 1986 to October 1987 from 0.05 to 0.11, respectively, corresponding to an increase in average groundwater velocity. The calculated velocity for the dolomite groundwater in December



Potentiometric Contour : Dolomite Aquifer.
December 15 1986

Contour Interval : 10 feet

Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-11A	Drawn By: C.E.W. Approved By: G.L.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A6	Drawing No.: H-018



LEGEND

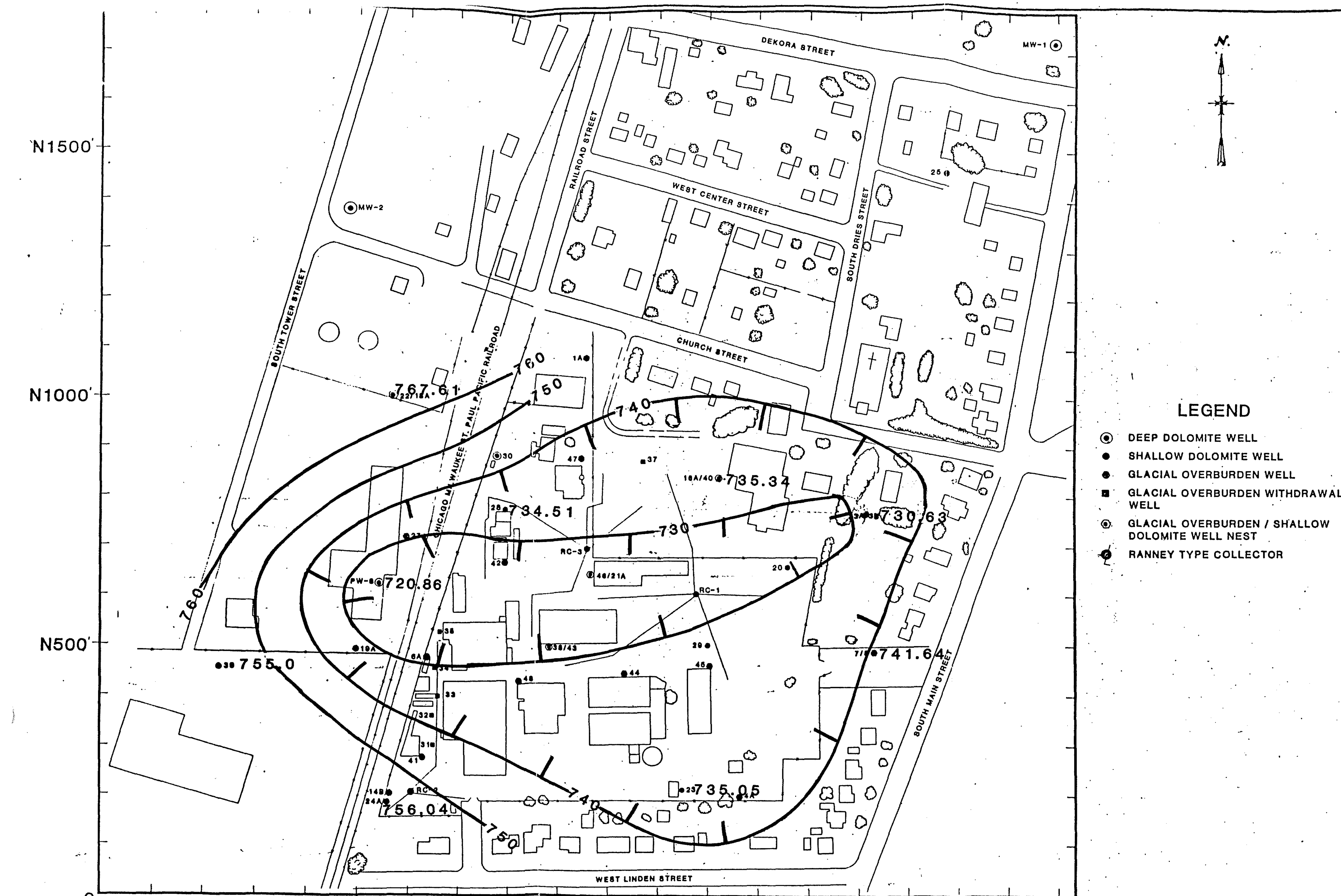
- DEEP DOLOMITE WELL
- SHALLOW DOLOMITE WELL
- GLACIAL OVERBURDEN WELL
- GLACIAL OVERBURDEN WITHDRAWAL WELL
- GLACIAL OVERBURDEN / SHALLOW DOLOMITE WELL NEST
- RANNEY TYPE COLLECTOR

Potentiometric Contour : Dolomite Aquifer.
April 22, 1987

Contour Interval : 10 feet

100 0 100 200
scale feet

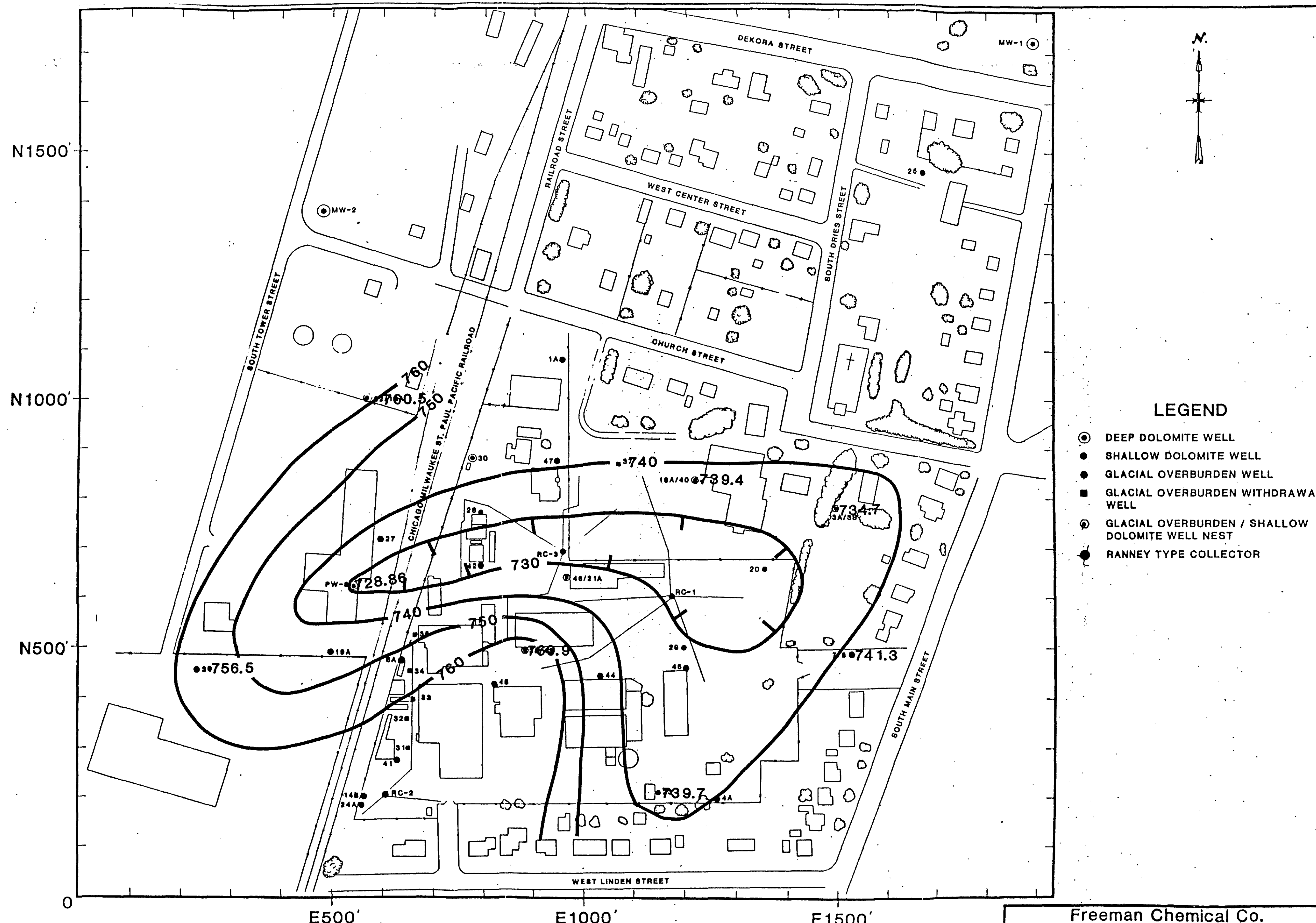
Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-12 A	Drawn By: C.E.W. Approved By: G.L.B
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A7	Drawing No.: H-018



Potentiometric Contour : Dolomite Aquifer.
June 22, 1987

Contour Interval : 10 feet
100 0 100 200
scale feet

Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-13A	Drawn By: C.E.W. Approved By: G.L.B.
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A8	Drawing No.: H-018



Potentiometric Contour : Dolomite Aquifer.
October 9, 1987

Contour Interval : 10 feet

Freeman Chemical Co. Saukville, Wisconsin		
MONITORING WELL LOCATION MAP		
Date: 12/4/86 Scale: As Noted	Fig. 1-14A	Drawn By: C.E.W. Approved By: G.L.B
HATCHER INCORPORATED		
Job No.: 0001-003	1-11A9	Drawing No.: H-018

1986, in the area of pumping well drawdown influence was 4 feet/day, increasing, as indicated by the April-October, 1987 data to 8.8 feet/day.

2.0 NATURE AND EXTENT OF CONTAMINATION

2.1 SOURCES OF CONTAMINATION

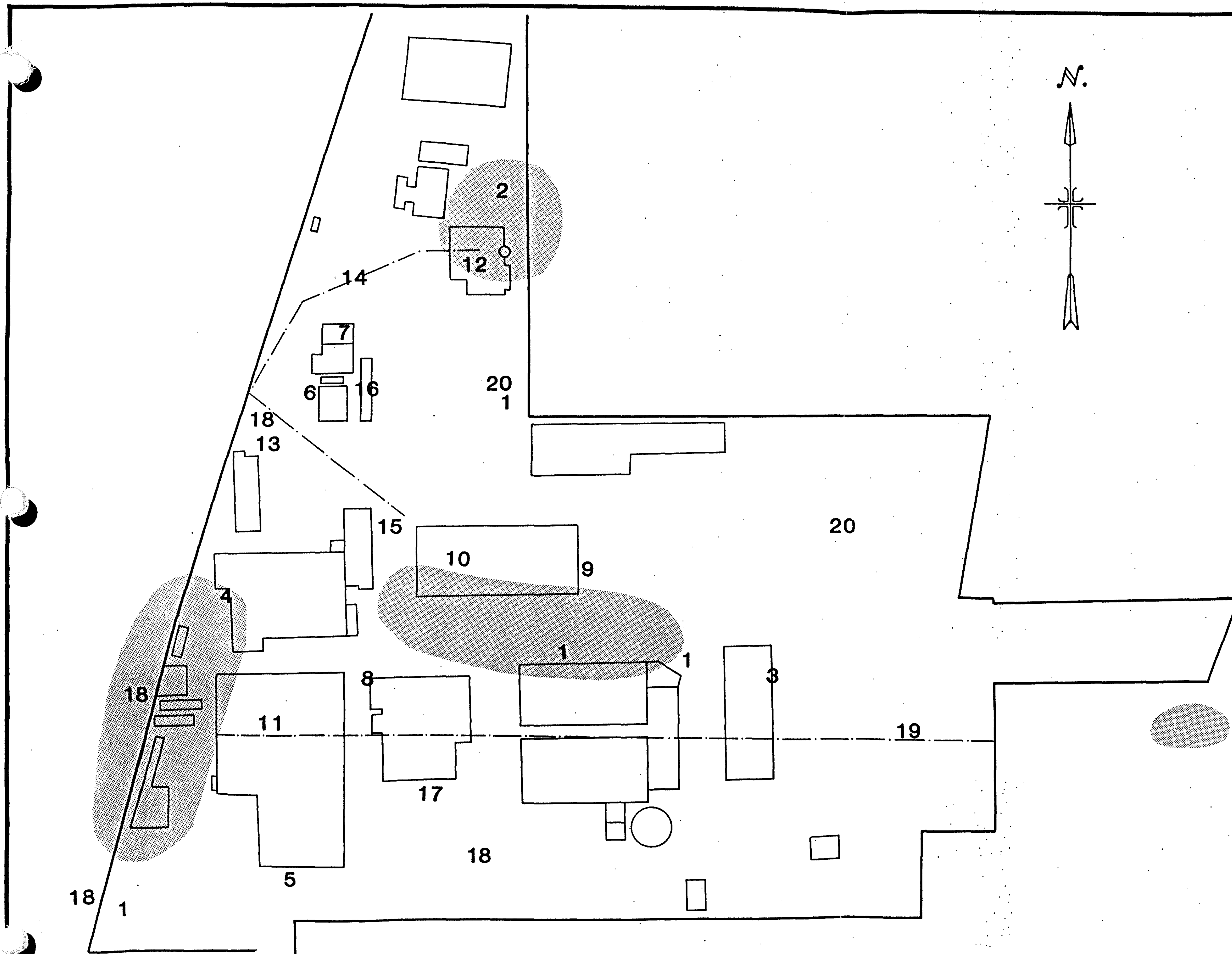
The location of potential sources of groundwater pollution existing prior to 1986 are shown in Figure 2-1. The figure also indicates areas in which the highest levels of groundwater contamination were found. These data indicate that contamination probably resulted from discharge of the acid reaction water to the "old dry well" in addition to leaks and spills of chemicals and wastes from handling and storage areas, including the former tank farm and incinerator areas.

2.2 GROUNDWATER CONTAMINANTS

The four quarters of groundwater monitoring data are presented in Appendix 1. The most universal groundwater contamination constituents representing the highest concentrations at the Freeman site are xylene, toluene, ethylbenzene, benzene, and trans-1,2-dichloroethylene. Other constituents found less frequently and in lower concentrations include acetone, styrene, 2-butanone, methylene chloride, trichloroethylene, 1,1,2-trichloroethane, 2-hexanone, 1,1-dichloroethylene, vinyl chloride, and chloroform. A few additional compounds had one or two analyses at low levels - near their detection limit.

The behavior of the above mentioned contaminants is represented on Table 2-1. Of the five major contaminants, all are only slightly soluble in water and with the exception of trans-1,2-dichloroethylene, they are less dense than water, volatilize and slowly biodegrade. The chlorinated compounds would tend to be the most persistent.

An overview of the approximate extent of the site contamination in the glacial aquifer was developed from the 1986 winter monitoring data (Figure 2-2). This was the first set of



1 Barrel Storage Areas
2 Buried Incinerator Location (?)
3 Old Farm Water Well (Decommissioned)
* 4 Old Dry Well (Decommissioned)
5 Buried Caustic Tank (Filled With Concrete)
6 Buried Diesel Tank (Filled With Sand)
7 Buried Tank (?)
8 Buried Tank (Removed)
9 Buried Styrene Tanks (Removed)
10 Tank Farm
11 Basement Sump
* 12 Present Incinerator
13 Location of Former Tanks
14 Underground Route of "Acid Water" Line
15 Broken Linseed (?) Oil Line (Removed)
16 Pit for Tank Scales
17 Truck Washing Area
18 Acid Water & Other Product Spill Areas
19 Storm Sewer
20 Tanker Parking Areas
* Former Hazardous WasteTreatment / Disposal Areas

Approximate Locations of Highest Groundwater Contamination Within the Glacial Sediments

1"=100' 100 0 100 200 scale feet

Job No.: 0001-003

Hatcher Incorporated
RICHMOND, VIRGINIA

Date: 5/1/87
Scale: As Noted

Location of Potential Sources of Groundwater Pollution Existing Prior to 1986

Drawing No.:
Figure No.: 2-1

TABLE 2-1

ORGANIC CHEMICALS AT FREEMAN'S SAUKVILLE SITE

Compound	Solubility(ppm)	Density	Transformation
Acetone	Miscible	0.790	Volatilization
Benzene	sl.s. 1280 @ 25°C	0.879	Volatilization Slow Biodegradation
2-Butanone	v.s. 100,000 @ 25°C	0.805	Volatilization Readily Biodegradable
Chlorobenzene	sl.s. 488 @ 25°C	1.105	Volatilization
Chloroform	h.s. 8200	1.485	Volatilization
1,1-Dichloroethylene	i.	1.213	Volatilization
Trans-1,2,-Dichloroethylene	sl.s. 600 @ 20°C	1.257	Volatilization
Ethylbenzene	sl.s. 206 @ 13°C	0.867	Volatilization Slow Biodegradation
2-Hexanone	sl.s.	0.830	Volatilization
Methylene Chloride	h.s. 20,000 @ 25°C	1.335	Volatilization
Styrene	i. 0.3	0.905	Volatilization Readily Biodegradable
Toluene	sl.s. 470-534.8 @ 25°C	0.866	Volatilization
1,1,2-Trichloroethane	sl.s. 4400 @ 20°C	1.325	Volatilization
Trichloroethylene	sl.s. 1100 @ 20°C	1.460	Volatilization
Vinyl Chloride	sl.s. 1.1 @ 25°C	0.912	Volatilization Slow Biodegradation
m-Xylene	sl.s. 130 @ 20°C	0.868	Volatilization Slow Biodegradation
o,p-Xylene	sl.s. 175-198	0.870	Volatilization Slow Biodegradation

TABLE 2-1A. Approximated Average Monthly Inventory of Raw Materials Stored at Freeman Chemical´s Saukville Plant

Solvents:	245	Tons
Oils:	90	Tons
Fatty acids:	60	Tons
Resins:	43.5	Tons
Glycols:	550	Tons
Driers:	5	Tons
Acids:	385	Tons
Monomers:	205	Tons
Miscellaneous Solids:	5.5	Tons
Miscellaneous Liquids:	130	Tons

data with all of the new monitoring wells installed. These data, which represent total volatile organic carbons (VOC´s), compare quite favorably to the map on odor concentrations presented in the 1985 Summary Report referred to earlier.

The approximate extent of contamination within the shallow dolomite aquifer is presented in Figure 2-3. Although it is not as distinct as the glacial aquifer, it does indicate that the more highly contaminated areas are smaller and located towards the center of the site, on the north and south sides of the tank farm.

Only three deep aquifer samples were collected during the winter sampling period. No VOC´s were detected in MW-4; a total of approximately 32 µg/l was found in MW-2; and a total VOC concentration of 688 µg/l was determined for PW-8 (Laubenstein Well). During earlier samples, no VOC´s were detected during the first two quarters of monitoring at MW-1. At MW-3, during the first three quarters of sampling, acetone and methylene chloride were detected only in the February sample at 4 and 12 µg/l, respectively. These two compounds were not detected in any of the other four deep wells (including the Laubenstein Well) during this time.

2.2A1 GROUNDWATER QUALITY DETERMINATIONS DURING 1987

The analytical data on the quarterly groundwater samples collected during the Spring, Summer and Fall from Freeman Chemical's Saukville plant site are included in Appendix 1A. The results of these analyses have indicated continued improvement in the conditions at the site throughout the year. No detects were found in the three municipal wells sampled; deep Well 30, which Freeman is now utilizing as its cooling water source, has markedly improved throughout the year; approximately half of the shallow dolomite wells indicate reduced contamination; and glacial water contamination appears to be shrinking along its southern boundary based upon the results from Wells 14B, 41, and 44 (dry).

Also included in Appendix 1A, are the results of the priority pollutant analyses which were conducted on Freeman's River Outfall 001, cooling water from deep Well 30. As can be seen, none of the 35 volatile, 65 semivolatile, 26 organochlorine pesticides/PCBs, or 13 heavy metal constituents were found above the reporting limits. A library search of the gas chromatogram peaks revealed only one unidentifiable semivolatile compound at an estimated concentration of 41 μg/l.

2.2A2 SOIL, AIR AND SURFACE WATER CONTAMINATION

Soil contamination has occurred around the former tank farm, the incinerator, former loading and unloading areas, near the "old dry well" discharge area, and to some degree below the surface in areas through which contaminated groundwater has flowed. These areas are shown in Figures 2-1, 2-2 and 2-3. Off-site contamination is addressed in Sections 2.3 and 2.3A.

The majority of the contamination is located below the surface and would contribute very little to any air contamination. A minor contribution has occurred from the handling of contaminated soils. This area, which was approximately 0.5-acre in size, is located in the northeast corner of the Freeman property. The contaminated soils are spread in thin layers to allow the VOC's to volatize. HNU meter readings taken adjacent to the soil handling area did not indicate the presence of any VOC's (detection level 0.2 ppm).

Another potential source of air contamination would result when the contaminated groundwater is discharged to the Village sewerage system. Although some of the VOC's would volatilize traveling to the POTW, most would remain in the water until it is treated. During treatability testing at the POTW, however, Gene Hueppchen (Personal Communication) indicated that they did not observe any odors from the contaminated groundwater even when testing was conducted at forty times the normally expected loading.

No major surface water contamination is known to be occurring at this time as a result of the Freeman Chemical operations. Freeman Chemical's deep Well 30 is currently being utilized as a cooling water source and is discharged to the Milwaukee River through their River Outfall - 001. As indicated previously, a recent priority pollutant analysis (Appendix 1A) of this discharge indicates only trace quantities of two organics; isophorone and another unknown semivolatile organic. The discharge meets all primary drinking water standards and, with the exception of odor, all measured secondary drinking water standards.

Water samples collected from the stormwater basin also indicate only trace quantities of organics; 0.029 mg/l methylene Chloride and 0.01 mg/l phenolics (Appendix 1A). These waters also meet the primary drinking water standards and, therefore, were discharged to the river.

2.3 INVESTIGATION AND REMEDIATION OF THE CHURCH SCHOOL BALLFIELD

De minimis leaks and spills from the old incinerator site, various loading and off-loading areas and suspected leaks from the tank farm area have apparently resulted in some soil and groundwater contamination at the church school ballfield.

Surface soil contamination was visually noted (by lack of vegetation growth) on the church school ballfield in the vicinity of the existing incinerator. Remediation consisted of removing the contaminated surface soil, treating as per the approved soil handling plan and resodding the area.

Figures 2-2 and 2-3 indicate the anticipated extent of groundwater contamination in the ballfield area. Glacial water remediation consists of extending three Ranney Collector laterals onto the site: RC-1 leg AG-H; RC-3 legs AB and LMN. In addition, Well W-37 was installed in the ballfield beyond the Ranney Collector lateral extensions. This combination of Ranney Collector legs and pumping well should retard the spread of contamination through the glacial soil laterally toward the church site and vertically into the dolomite.

Shallow dolomite pumping Well 21A and the deep dolomite pumping Well 30 have been installed to collect any existing contamination within the dolomite aquifer under the ballfield area. Wells 16A and 40 (in the ballfield) and wells 3A and 3B (behind the Boys Home) will be utilized to monitor the effectiveness of these remediation steps.

2.3A1 INVESTIGATION AND REMEDIATION OF THE LAUBENSTEIN PROPERTY

Investigation of the Laubenstein property was conducted by utilizing five borings and monitoring well installations on or adjacent to the property. Of the five wells, three were placed in the glacial overburden (18A, 19A, and 27) and the other two were installed as shallow dolomite wells (22 and 39). The existing on-site deep well (PW-8) has also been included in the monitoring program.

Although PW-8 had not been in use for some time, monitoring revealed that it appeared to have a direct hydraulic connection to MW-2 so that when MW-2 was pumping, a cone of depression was noted around PW-8. This resulted in the drawing of contaminated groundwater from the "old dry well" discharge and loading/ unloading area from the Freeman property towards this well. To eliminate the spread of contamination by this means, a new casing was installed in PW-8 (see discussion in Section 3.16).

To eliminate the contamination which resulted in the above manner, the following remedial actions have been implemented: Glacial overburden contamination is being collected by Ranney Collector (RC)2 and a series of five glacial withdrawal wells (31 through 35). Two shallow dolomite wells (24A and 28) have been installed to collect any contaminated waters from this area. A deep well (30) has been installed to collect any contaminants which have reached the deep dolomite aquifer.

The Laubenstein property adjoins the Freeman plant site to the west. From 1951 through 1971, Northern Signal Company, an electrical parts manufacturer, owned and conducted operations on this property. It used trichloroethylene ("TCE") for degreasing metal parts and disposed of waste TCE sludge on the property. The TCE apparently contaminated shallow groundwater beneath the property, and a 450′ deep well on the property apparently allowed TCE to reach the deep aquifer. Freeman voluntarily repaired the well in the Fall of 1986 to prevent further contamination of the deep aquifer from leakage through the well. Waters Instruments, Inc. ("Waters") purchased the stock of Northern Signal Company in the early 1970's, but has taken no actions to remedy TCE problems at the site.

DNR and Freeman have had discussions with Waters about Waters' assuming responsibility to investigate and remedy problems from the TCE contamination on the Laubenstein property. Waters has been unwilling to-date, however, to assume that responsibility. Some of the pertinent documentation regarding efforts by Freeman to reach an agreement with Waters Instruments have been attached at the end of Section 2.0.

2.3A2 SAUKVILLE PUBLIC WATER SUPPLY

2.3A2.1 Quality

Since 1979, when odors were first detected in the Saukville drinking water, Freeman Chemical Corporation has been actively involved with the Village of Saukville and the State of Wisconsin to assure that the Village water supply is protected. Because of the odors and because of the presence of trichloroethylene in Municipal Well (MW) 2, Freeman has been the dedicated user of that well since 1979. The well is close to the Freeman site and has been operating continuously, except for periods of maintenance.

Beginning in 1983, Freeman actively began conducting a groundwater quality evaluation of all of the Village wells, several private wells, and many piezometers and observations wells for study purposes. Two private wells, PW-3 and PW-6, were found to be contaminated and, therefore, were decommissioned.

Most recently, Freeman has constructed a detailed groundwater remediation project including an excess of 2,000 feet of shallow drainage ditches, four medium depth wells, and one deep well. The design and construction of this system has been thoroughly documented elsewhere in this report. Since the installation of that system, meetings have been held with the Village, including tours of the site, and discussions on the relationship between the Freeman groundwater system and the Village water supply. A detailed fee arrangement with the Village and Freeman Chemical Corporation has been arranged assuring the Village of adequate operating capital and avoiding the loss of revenue from Freeman Chemical as its chief water user.

Other efforts to assure adequate water supply in the Village include restoration of Municipal Well 3, even though the problem was not one of chemical contamination or in any way related to the Freeman Chemical Corporation. Freeman Chemical provided the necessary funds to have the well redeveloped to greatly minimize the sedimentation problem that had caused its non-use for a period of years. Also, related to Well 3, there was a "taste problem" probably caused by a high iron and manganese discharge which was released during the development process. Freeman reacted promptly in attempting to identify the source of the taste and provided pilot testing of carbon filtration to determine if this was an effective remedy.

The great majority of the odor in Municipal Well 2 and the Freeman deep well is caused by the presence of reaction water. Reaction water was directly discharged to the ground with the permission of the State of Wisconsin for a long period of time in the 1950's and 1960's. Due to a direct hydraulic connection between a deep abandoned well (PW-8 immediately west of the Freeman site) and Municipal Well 2, the reaction water was drawn deep into the dolomite aquifer and traveled horizontally to the Municipal Well field.

The exact chemical compound responsible for the odor and reaction water is unknown. Numerous GC/MS analyses of reaction water have been conducted, including Appendix IX analyses. These analyses are appended to this report for your review (Appendix 1A). In addition, Freeman has recently conducted the priority pollutant analyses of the Well 30 discharge, including a library search of non-priority pollutant peaks. The result of this most recent analyses gives no indication as to the cause of the odor in the water.

Because of the source of the reaction water (i.e., esterification water created in the kettle during the organic acid-alcohol reaction), it is quite likely that there are a number of intermediate compounds formed. We suspect that the source of the odor is from trace quantities of such compounds.

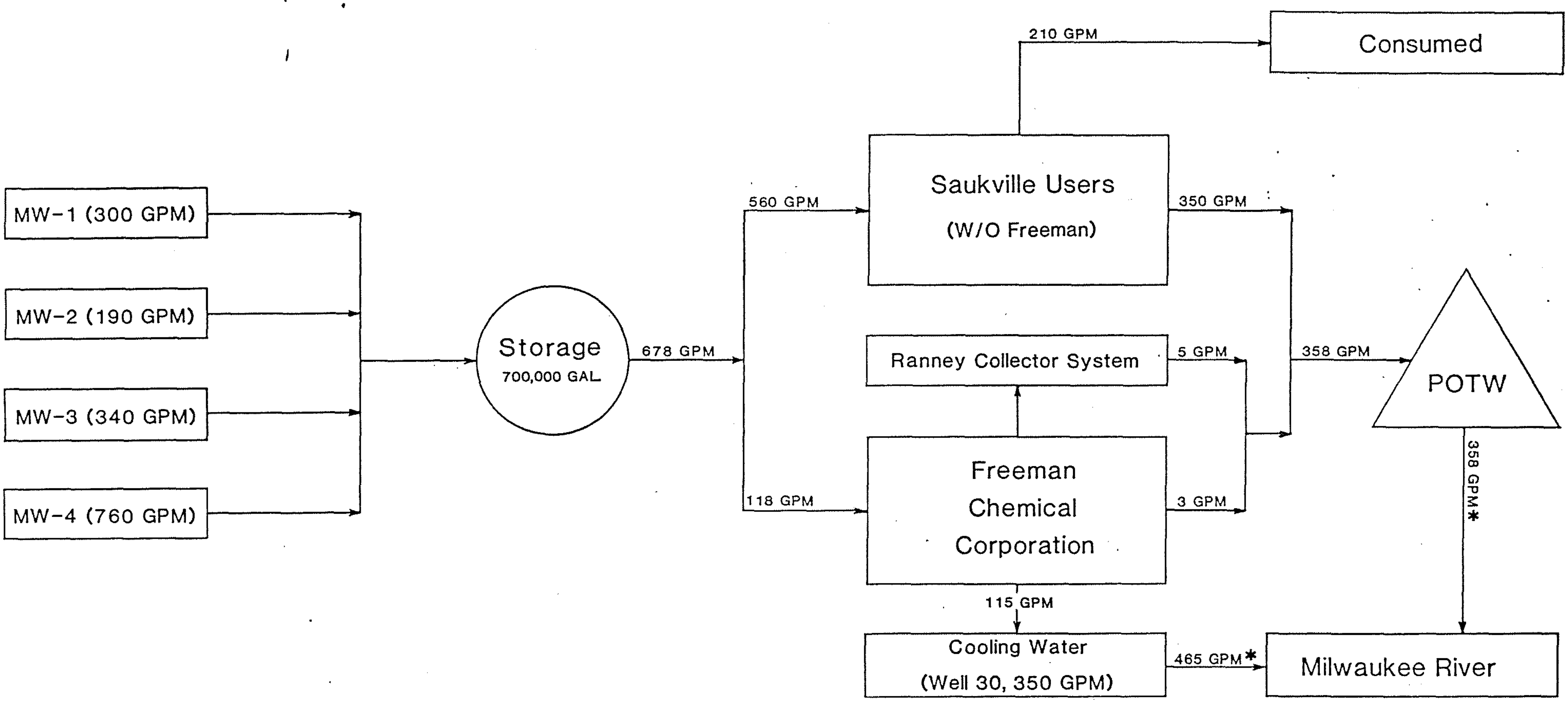
2.3A2.2 Quantity

The Village of Saukville presently has four municipal wells with a total pumping capacity of 1590 gpm. Current usage for the Village including the Freeman Plant averages 675 gpm, as depicted on Figure 2.4A, and represents approximately 42% of their total capacity or 48% of total capacity with MW-2 shut down. They have a total storage capacity of 700,000 gallons; a 400,000 gallon stand pipe and a 300,000 gallon underground tank. Their peak demand occurred during 1986 at 1.2 million gpd or about 833 gpm. This total rate has remained relatively constant over the past 3 years (1985-1987). Future known demands consist of an alum plant with a projected usage rate of 20 gpm and a couple of smaller plants with presently unknown demands. [Gerald Dickmann, Personal Communication]

Freeman Chemical is presently using about 468 gpm; 118 gpm from the Village supply (115 gpm to supplement their cooling water needs and 3 gpm for potable needs) and 350 gpm from their on-site Well 30 for cooling water. Their projected demand is expected to increase about 25% to around 580 gpm. The anticipated increase will probably be split from their on-site Well 30 and the Village supply.

To estimate future water demands during the next five years, the following assumptions were utilized:

1. The 115 gpm of additional water anticipated to be required by Freeman has been allocated as follows: 50 gpm from W-30 and 65 gpm from the Village.
2. In addition to the alum plant with a estimated demand of 20 gpm, one additional plant with a similar demand



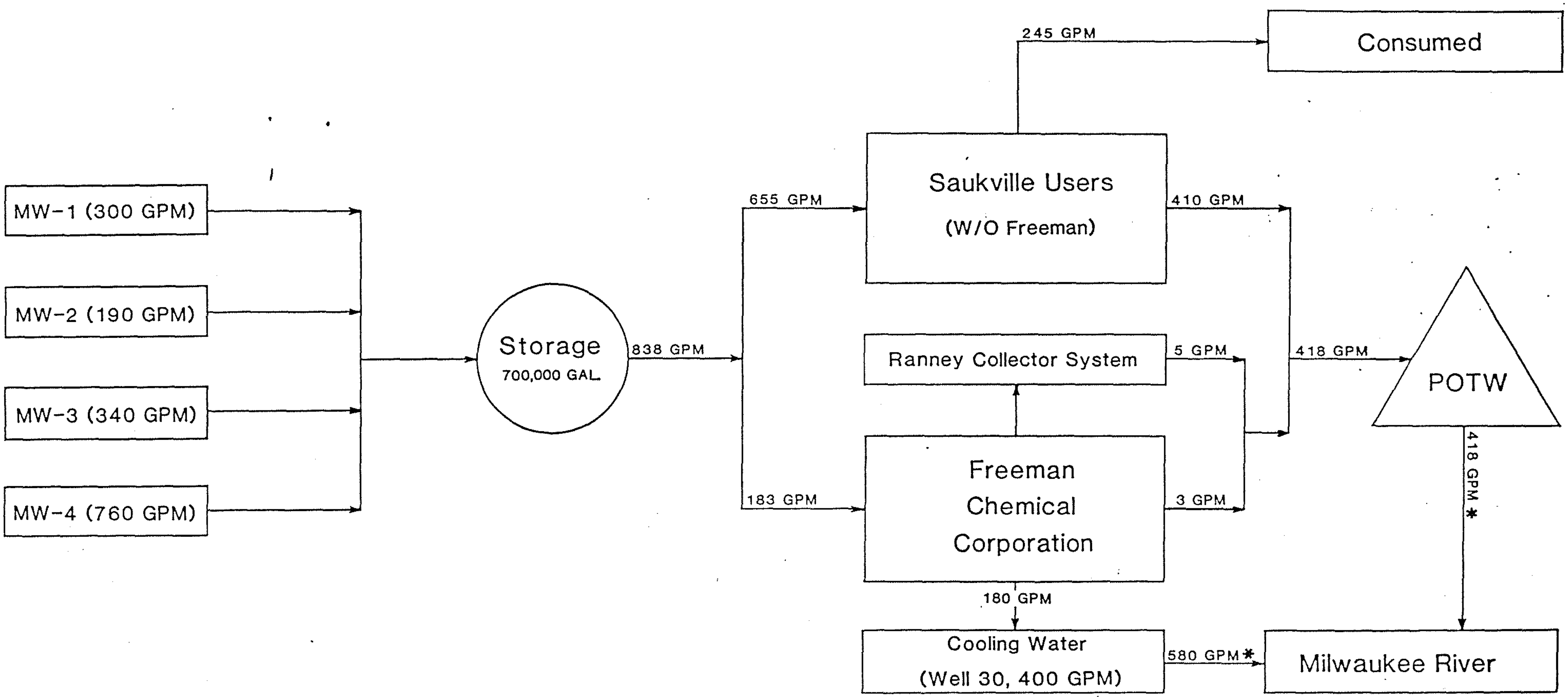
* Assumes No Additional Evaporative or Consumptive Losses

Figure 2.4A Existing Village Water Supply and Treatment.

of 20 gpm and four smaller plants with demands of 10 gpm have been included in the future demand estimate.

3. The population of Saukville has been estimated to grow from its current level estimated at about 3,700 people to approximately 4,000 people over the next 5 years (Kevin Brunner, Personal Communication). Since the average per person use is estimated at 0.05 gpm, the total demand from the increased population amounts to 15 gpm.

This future water demand scenario has been depicted in Figure 2.5A. The estimated future demand of 838 gpm represents approximately 53% of the current total capacity of the Village and nearly 60% of the capacity with MW-2 shut down. The projections indicate that if MW-4 is out of service for more than 2 days, MW-2, if possible, would have to be brought on-line. Extensive pump tests are scheduled for this next year that are to provide input for a mathematical model which will indicate interactions between the groundwater remediation pumping and the Village wells. The projected 418 gpm to be treated by the Saukville POTW 5 years from now represents about 60% of the current plant treatment capacity.



* Assumes No Additional Evaporative or Consumptive Losses

Figure 2.5A Five - Year Projected Village Water Supply and Treatment.

ATTACHMENT TO SECTION 2.3A1

Documentation of Laubenstein Property Negotiations

Hatcher Incorporated
9025 Forest Hill Avenue • P.O. Box 3527 • Richmond, VA 23235 • Phone: 804/320-0193

November 9, 1984

Mr. Russell L. Cerk
Vice President - Manufacturing
Freeman Chemical Corporation
P.O. Box 247
Port Washington, Wisc. 53074

Mr. Richard Thompson
Vice President
Waters Instruments Incorporated
P.O. Box 6117
Rochester, Minn. 55903

Re: Proposal for Continued
Ground Water Investigation
Saukville, Wisconsin

Gentlemen:

This letter constitutes a proposal by Hatcher Incorporated to conduct a hydrogeological study of the industrial portion of the Village of Saukville which has been impacted by the manufacturing activities of your two companies. This study is necessitated by findings of the study by Olver Incorporated of Blacksburg, Virginia and by the renewed interest of Wisconsin DNR and US EPA to include this site on the Superfund National Priority List. In particular, the high concentration of trichloroethylene and benzene in the deep aquifer connected to the Laubenstein well, the high solvent levels under Freeman Chemical Corporations tank farm, the direct connection of the contaminated aquifers to the Village's deep wells, and the continued presence of trichloroethylene and benzene in Municipal Well No. 2, make this site an emminent danger to the Village water supply.

This proposal is organized into four sections following this introduction.

- The program to date.
- Missing data.
- Scope of work.
- Estimated cost.

0001-003
CORRES

Freeman
SUBSIDIARY OF H. H. ROBERTSON COMPANY
Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporation
222 E. Main Street
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 — Telex 2-6737

December 5, 1984

Mr. Richard E. Thompson, V.P.
Waters Instruments, Inc.
P. O. Box 6117
Rochester, Minnesota 55903-6117

Dear Mr. Thompson:

Per your request to Russ Cerk I have enclosed a copy of the October 18, 1984, Olver, Inc. study concerning the hydrogeological study at Saukville.

The most recent information I have from Hatcher's geologist, George Bain, is that he has found a lack of some critical data in Olver's test program. It is not known if the conclusions drawn by Olver can be supported by the data. Mr. Bain is trying to determine which data is salvageable. Hence, the specific details of the test program for 1985 is yet to be determined.

Should you have any technical questions kindly contact either Roger Hatcher, George Bain or myself.

Sincerely,

FREEMAN CHEMICAL CORPORATION

Ronald H. Horn

Ronald H. Horn
Chief Engineer

RHH/ss

cc: R. H. Hatcher
R. L. Cerk

01301-003
c- les

Freeman

TERNAL CORRESPONDENCE

R. C. Ross

FROM R. L. Cerk

DATE 1-22-85

BJECT Waters Instruments

COPIES TO G. H. MacDonald
✓R. Hatcher
Ronald H. Horn

Mr. Burton, the president, called me today and stated that they want to investigate their liability in the ground water problem. To accomplish this, they have hired their own consultant to evaluate the data we have submitted. He told me in all likelihood, they will probably wind up paying half, but being a public company, he can't spend $100,000 without looking into the problem from their end.

When their consultant calls me, I'll turn it over to Roger.

R. L. Cerk

RLC:fy

RECEIVED
JAN 24 1985

Form 703-7/72

0001-0023
CORRES

Freeman
OF H. H. ROBERTSON COMPANY
...ly Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporation
222 E. Main Street
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 — Telex: 2-6737

May 24, 1985

Mr. Richard Burton, President
Waters Instruments Inc.
P.O. 6117
Rochester, MN 55903-6117

Dear Dick:

Re: Saukville Ground Water Study and Remedial Action Program

Richard Thompson's letter of March 27, 1985 and recent discussions with Hatcher Inc., prompts me to write you concerning progress on Water Instruments' decision to support the ground water studies at Saukville, Wisconsin. While Freeman Chemical Corporation recognizes your need to conduct an independent evaluation of the situation, we are concerned about the amount of time that has already lapsed. Also, we are somewhat concerned that the questions raised by your consultants are more related to procedural aspects associated with Remedial Investigation and Feasibility Studies (RIFS) at Superfund sites, than with the investigations conducted to date at Saukville.

Freeman Chemical Corporation sees three reasons why Waters Instruments should support 50% of the cost of the study program:

(1) All of the available GC/MS data on the ground water quality and hydrogeological data support the facts that the trichlorethylene (TCE) problem in Saukville municipal well no. 2 is related to activities at your former site, rather than any activity at Freeman Chemical Corporation.

(2) There is a very high likelihood that the Saukville ground water problem will result in the site being listed on the National Priorities List of the Superfund program. This has been indicated to us by the staff members at the Wisconsin DNR Bureau of Hazardous Waste Management.

(3) Administratively Freeman Chemical Corporation has the option to solve our portion of the ground water problem via the RCRA ammendments that became effective November 8, 1984 (see attached description), since we are pursuing a RCRA permit to incinerate hazardous waste on our site. In effect, this means we can separate our ground water problems from your admitted TCE spill and resultant ground water contamination, and we can propose a clean-up without addressing the TCE problem. In the event the EPA pursues Water Instruments' problems, i.e. the TCE problem, with the Superfund action, you will be <u>greatly</u> in need of cooperation for Freeman Chemical Corporation to

provide, at a shared cost, a ground water treatment system to assist in the TCE clean-up.

Freeman Chemical Corporation is aware of some of the shortcomings of field studies peformed in 1983 and 1984. These shortcomings were identified by Hatcher Inc., who was hired in late 1984 to significantly upgrade the program. Currently these problems are being addressed. Nevertheless, we are concerned you are not giving adequate consideration to the financial benefits, to both companies, from the combined study and clean-up. In lieu of such consideration, Freeman Chemical Corporation will most certainly elect to utilize the options under RCRA to conduct remedial actions at our own site, leaving Water Instruments to its own resources, to deal with the TCE/Superfund problem in the Saukville drinking water.

In summary, Freeman Chemical Corporation is trying to establish a working relationship with Waters Instruments that will reduce the financial obligations by both companies resulting from past operational mistakes. Without cooperation there will certainly be duplicate efforts in all phases of the problem resolution, and Waters Instruments will be left with no convenient property on which to construct the treatment system that will <u>duplicate</u> those Freeman Chemical Corporation intends to install.

Freeman Chemical Corporation requires a reply to this letter within 30 days. At that time we will approach Wisconsin DNR and the USEPA to inform them of the direction of our studies and clean-up.

Thank you for your attention to this matter.

Very truly yours,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice-President, Manufacturing

RLC/mba

Attachment

CC: G. H. MacDonald
R. C. Ross

REF: 111:201/1:055/4

examination, 17 sites are ranked "bizarrely" low, despite threats to nearby groundwater and surface waters as serious as threats from sites with higher scores on the agency's hazard ranking system.

EPA itself has told regional offices not to heed state requests to keep sites off the priority list, and the agency is already reviewing the sites noted by Public Citizen. The official designation of a site on the list prevents the state from handling cleanup its own way, and requires the state to pay for ten percent of the cost of cleanup carried out under the Superfund program. As for the other sites with data gaps, EPA expects that many of them will soon be proposed for listing, once quick early estimates have been firmed up.

Two Currently Operating Sites in Michigan, that were kept off the Superfund list because they are still in operation under RCRA regulation, were also criticized by Public Citizen, which is seeking a change in EPA's policy not to list such sites. People should have a chance to learn of the threats at a site, argues the public interest group, and companies sending wastes to the site might well seek to avoid doing so for fear of liability for part of future cleanup costs.

Other sites still operating with interim status under RCRA may be headed for the Superfund list as well, once the time comes to qualify for a final permit or close down under the deadlines set in last year's RCRA amendments. EPA's Superfund program boss, William Hedeman, said that the agency is considering changing its policy on cleanup of closed areas of facilities that are still in operation, to require cleanup to be paid for by operators under the authority of RCRA, rather than using the Superfund mechanism. Hedeman said that using RCRA authority allows the agency to require cleanup without having to wait for federal money to become available through the Superfund. EPA wants to use Superfund only in cases where the site permittee is bankrupt.

In Brief . . .

Minority Representation Will Increase on two important environmental subcommittees of the House Committee on Energy and Commerce, under an agreement that ends a standoff between Democrats and Republicans over committee seats. The dispute had led to a boycott of committee meetings by Republicans who were upset at not getting a fair share of the seats. The Republicans now have been promised about 40 percent representation on each subcommittee, not quite the 42 percent share of House seats held by the G.O.P. For the Subcommittee on Commerce, Transportation and Tourism which handles Superfund and RCRA legislation, it means a makeup of 11 Democrats and seven Republicans, a major shift from the previous 7-to-3 split, and for the Subcommittee on Health and Environment, there will be 15 Democrats and 10 Republicans, compared with 12-to-5 split last year. Both subcommittees have seen important issues decided by close votes in past years.

A New Representative Targets Toxic Waste as her top legislative priority. Cathy Long, widow of the late Rep. Gillis Long, won her husband's seat in an election held last Saturday in the 8the Congressional District of Louisiana. Although she had not won assignment to a committee seat, the newly elected representative said she wants to check reports of slow action by U.S. EPA on Superfund, including the complaint by Public Citizen of sites being left off the National Priorities List (see above).

Freeman
SUBSIDIARY OF H. H. ROBERTSON COMPANY
Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporation
217 Freeman Drive
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 – Telex: 2-6737

April 4, 1986

Mr. Tom Burton
President
Waters Instruments, Inc.
2411 Seventh Street N.W.
Rochester, Minnesota 55901

Dear Tom:

We have pulled all of Hatcher's bills for 1985 and the bills through March for 1986. Each bill was studied and an allocation of what we believe to be a fair share was determined.

In all fairness, we should discuss the costs Freeman Chemical Corporation has generated in support of Hatcher. We have over $9,000 in travel, phone and time expended by plant personnel who assisted Hatcher. We should also look at $4,000 in interest on the $82,420 we had to pay out in 1985.

I have enclosed the summary for 1985, 1986 for your review before the meeting next Wednesday.

Very truly yours,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice President - Manufacturing

RLC·fy
Enclosures
cc: G. H. MacDonald
R. C. Ross

Mtg - Waters - Those present - Mac, Russ, Tom B. George Waters

SAUKVILLE GROUNDWATER STUDY

1985

	Freeman	Waters Instruments	Total
Labor			
Consulting	14,400.00	9,600.00	24,000.00
Geohydrologist	39,600.00	26,400.00	66,000.00
Draftsman	4,666.20	3,110.80	7,777.00
Word Processor	3,785.40	2,523.60	6,309.00
Subtotal Labor	62,451.60	41,634.40	104,086.00
Expenses			
Travel	12,016.80	8,011.20	20,028.00
Communication	525.00	350.00	875.00
Reproduction	328.20	218.80	547.00
Groundwater Monitoring	19,018.65	11,291.15	30,309.80
EM Survey	1,625.00	--	1,625.00
Deep Piezometers	11,908.06	11,908.06	23,816.12
Seismic Survey	6,970.00	--	6,970.00
Downhole Geophysics	1,971.90	1,971.90	3,943.80
Laubenstein Pump Test	7,034.62	7,034.62	14,069.24
Subtotal Expenses	61,398.23	40,785.73	102,183.76
TOTAL	123,849.83	82,420.13	206,269.96

SAUKVILLE GROUNDWATER STUDY

1986 TO DATE

	Freeman	Waters Instruments	Total
Labor			
Consulting	7,440.00	4,960.00	12,400.00
Geohydrologist	9,672.00	6,448.00	16,120.00
Senior Research Associate	990.00	660.00	1,650.00
Draftsman	2,392.50	1,595.00	3,987.50
Word Processor	1,109.55	739.70	1,849.25
Subtotal Labor	21,604.05	14,402.70	36,006.75
Expenses			
Travel	2,589.60	1,726.40	4,316.00
Communication	137.40	91.60	229.00
Reproduction	807.00	538.00	1,345.00
Groundwater Monitoring	6,742.50	4,625.00	11,367.50
Test Shallow Well	2,000.00	2,000.00	4,000.00
Ground Penetrating Radar	3,613.00	--	3,613.00
Soil Permeability	3,140.50	3,140.50	6,281.00
Subtotal Expenses	19,030.00	12,121.50	31,151.50
TOTAL	40,634.05	26,524.20	67,158.25

Freeman
A SUBSIDIARY OF H. H. ROBERTSON COMPANY
Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporation
217 Freeman Drive
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 – Telex: 2-6737

April 21, 1986

Mr. Tom Burton
President
Waters Instruments, Inc.
2411 Seventh Street N.W.
Rochester, Minnesota 55901

Dear Tom:

Since our last meeting we have contacted the State of Wisconsin, and they are open to several arrangements. I have enclosed a letter from R. Hatcher to Freeman Chemical which covers our conversation with the State.

I suggest that you contact Richard O'Hara at the DNR for the specifics on a "no dollar contract." You should ask about indemnification, and if it is necessary for Waters to sign a consent agreement.

If this concept of a "no dollar contract" is functional, then you should realize that in our view, Waters Instruments should fund a portion of cleanup from January, 1985 to March, 1986, which is $108,944.00.

I would appreciate a call from you after you talk to the DNR.

Very truly yours,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice President - Manufacturing

RLC:fy
Enclosure
cc: R. C. Ross
G. H. MacDonald

File

HATCHER INCORPORATED

April 16, 1986

Mr. Russell L. Cerk
Vice President - Manufacturing
Freeman Chemical Corporation
P.O. Box 247
Port Washington, Wisconsin 53074

Re: Freeman Chemical Corporation/
Waters Instruments, Inc.
Shared Groundwater Remedial
Program
Job No. 0001-003

Dear Russ:

Per your request, I have evaluated the possibility of including Waters Instruments, Inc. into the Groundwater Remedial Actions Program, which is due to be implemented in Saukville in the very near future. Specifically, I have investigated three aspects of the problem:

- The probable technical resolution of the trichloroethylene spill on the property previously owned by Waters Instruments, Inc.

- Legal arrangements with the State of Wisconsin to recognize Waters Instruments' involvement with the Remedial Actions Program

- Financial arrangements between Hatcher Incorporated, Freeman Chemical Corporation, and Waters Instruments, Inc.

Each of these items is briefly discussed below.

Based upon internal discussions, which have not been reviewed with the State of Wisconsin, we speculate that the trichloroethylene problem on the property adjacent to the west side of your plant can be resolved by measures similar to those proposed for your site. In particular:

- Construction of a Ranney type collector around the west, south, and east end of existing warehouse and treating the water in Freeman's proposed low volume treatment system and discharging treated water to the Saukville POTW.

- Regrouting the deep well and casing to a depth of approximately 100 feet.

2025 Forest Hill Avenue P.O. Box 3527 Richmond Virginia 23235 (804)320-0193

- Installation of a permanent submersible pump deep in the well to deliver approximately 50 to 75 gpm on a continuous basis. The water would be treated in Freeman's high volume treatment system and used as cooling water.

This arrangement will necessitate the purchase of right-of-way from the railroad. However, in the long run it should be cost effective since it minimizes the number of treatment system approvals and discharge permits to be acquired. As stated above, however, the system will have to be studied further to specify the details of the design, and the final design will have to be submitted to the State of Wisconsin for approval.

Concerning arrangements with the State of Wisconsin to protect the interests of Waters Instruments, Inc., we have determined that the most feasible instrument is what Richard O'Hara termed a "no dollar contract". In essence, this device would recognize the involvement of Waters Instruments, Inc. with Freeman's Groundwater Remedial Actions Program. It would be specific in terms of the nature of the problem associated with their site and Waters Instruments, Inc.'s contribution to the Remedial Investigation and the Remedial Actions Program. As I understand it, it would have language that would promise no action against Waters Instruments as long as the problem with trichloroethylene is not greater than we presently anticipate. Obviously, the State is not going to give them an indemnification against any future problems with trichloroethylene. For example, if the trichloroethylene were to show up in municipal well no. 4, I am quite confident that the investigation would be reopened and additional remedial measures investigated. However, given that the proposed program should reverse the distribution of the trichloroethylene, Waters Instruments will benefit by implementing remedial measures in the immediate future rather than sometime later when they may be forced to do so anyway. I strongly suggest that you have Waters Instruments, Inc. directly contact Richard O'Hara for the specifics on the proposed "no dollar contract". Also, it will be to Freeman's advantage to have Bill Rosbe draft or review this contract.

It is my understanding that the Remedial Investigation and Remedial Actions Program at the trichloroethylene site may be handled by Hatcher Incorporated in conjunction with the program at Freeman's site. If this were to be the case, then we would still continue to bill Freeman under Job. No. 0001-003 at the end of each month for services rendered during that month. However, we would carefully detail activities that occurred during the month and would proportion costs between Freeman Chemical Corporation and Waters Instruments, Inc. We will be happy to supply any documentation required by Waters Instruments, Inc..

If you have any further questions of Hatcher Incorporated concerning a cooperation between Freeman Chemical Corporation and Waters Instruments, Inc. in the Groundwater Remedial Actions Program, please call.

Sincerely,

HATCHER INCORPORATED

Roger F. Hatcher

Roger F. Hatcher, Ph.D.
President

RFH/pac

cc: George H. MacDonald
R. Charles Ross
William L. Rosbe, Esq.

Freeman
SUBSIDIARY OF H. H. ROBERTSON COMPANY
Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporatio
217 Freeman Drive
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 – Telex: 2.67

May 7, 1986

Mr. Tom Burton, President
Waters Instruments, Inc.
P. O. Box 6117
Rochester, Minnesota 55903

Dear Tom:

I have enclosed a letter from the Secretary of the DNR to the head of the EPA Region V in Chicago. As you can see, we are in all likelihood going to avoid the Superfund cleanup at this site.

The DNR wants something done at the Laubenstein property and our response was that it is not our problem.

Next Monday the DNR will mail out their recommendations to us, and at that time our lawyer will start to draft a consent agreement. We will have specific language on the Laubenstein property and at this time, you will have to deal with EPA and DNR, not Freeman Chemical.

The State feels that they are obligated to address the Laubenstein property, and Superfund is the only recourse they have when potential responsible parties are out of the state.

Had you decided to join us, we could have resolved the Laubenstein problem with several trenches and a small pump on the old Laubenstein well (30 GPM). The water could be treated on our stripping tower and discharged to the river.

In all likelihood, two of eight sites mentioned by Mr. Besadny are Freeman Chemical Corporation, and the Laubenstein property.

We will document our technical study on T.C.E. as to source, concentration, etc., in our consent agreement. Inasmuch as we have not received any correspondence from you, we are assuming that you are going to wait and see what happens.

Very truly yours,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice President - Manufacturing

RLC:fy
Enclosure

cc: G. H. MacDonald
R. C. Ross

Freeman
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Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corpora
217 Freeman Drive
P. O. Box 247
Port Washington, WI 5307
(414) 284-5541 – Telex: 2

May 23, 1986

Mr. Tom Burton
President
Waters Instruments, Inc.
2411 Seventh Street N.W.
Rochester, Minnesota 55901

Dear Tom:

I asked Hatcher to talk to the DNR in regard to what they would accept as a cleanup of the Laubenstein site. They would buy a proposal of 300 feet of Ranney collectors, and that the water collected be treated in our small stripper. They also want the Laubenstein well sealed to bedrock, and pumped to our large stripper at 50 GPM.

The cost of this project is as follows:

A. 300 ft. collectors - $45,000

B. Soil removal - worst case, $60,000; could be $5,000. Negotiate with State. An onsite sniffer for V.O.C. has been purchased so we could analyze soil as we dig.

C. Seal Laubenstein well with pump 50 GPM to FCC stripper - $16,000

D. Project management, analysis, lines to strippers, railroad right-of-way - $50,000

Total - $165,000. With soil disposed of at Omega Mills, $110,000 (good possibility).

We intend to force the DNR to list this site as a Superfund site, and if necessary, litigate who is responsible for the contamination.

If you are going to work with us on this project, we would contact the State with a written proposal, and proceed with the construction. If Waters is going to share in the cleanup, we would need the following monies:

A. $109,000 up front.

B. $165,000 or $110,000 (soil) to be funded as bills arrive for this part of the project.

C. Fund well analysis for all wells, except the shallow wells on Freeman Chemical Corporation property (city wells included) on a 50/50 basis with Freeman Chemical. These analyses are done quarterly, but we are working to extend the time period to every six months or a year.

Please let me know your decision within two weeks.

Sincerely yours,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice President - Manufacturing

RLC:fy
cc: G. H. MacDonald
R. C. Ross
R. Hatcher
J. M. Nickel

Freeman
A SUBSIDIARY OF H. H. ROBERTSON COMPANY
Specialty Products and Services Today For Tomorrow's Needs

Freeman Chemical Corporat
217 Freeman Drive
P. O. Box 247
Port Washington, WI 53074
(414) 284-5541 – Telex: 2-6

September 15, 1986

Mr. Thomas A. Burton
President and Chief Executive Officer
Waters Instruments, Inc.
P. O. Box 6117
Rochester, Minnesota 55903-6117

Dear Tom:

We have reviewed your letter of August 11 and the terms of your proposal regarding the former Laubenstein site.

We are willing to make the following arrangement with Waters Instruments, Inc.:

First, we will accept your offered payments and the schedule for making those payments.

Second, we cannot control, and, therefore, leave to your efforts, whatever assurances Wisconsin DNR might provide Waters as a result of your payment to Freeman of funds for use in the corrective action program on the former Laubenstein site.

Third, we can agree not to take legal action against Waters with regard to the former Laubenstein site if Wisconsin DNR, U.S. Environmental Protection Agency or another agency or authority requires only well repair, groundwater pumping and treating or both as corrective actions on or with regard to the former Laubenstein site. As you can understand, we cannot agree to take no legal action against Waters in the event that further corrective or remedial actions are required regarding that site. In particular, we could expect far greater costs and efforts would be required regarding that site if "contaminated" soil at the site must be treated or removed if the site were listed on the Superfund National Priorities List or otherwise subject to a Superfund or similar action.

As you undoubtedly know, cleanup of the site under Superfund would probably cost several hundred thousand dollars for the Remedial Investigation/Feasibility Study and several million dollars for the remedial action. Waters would, in all likelihood, be the primary responsible party under Superfund. For that reason, we agree that it is in the best interests of Waters and, probably, Freeman to take appropriate corrective actions regarding the former Laubenstein site under the RCRA "corrective action" program rather than the Superfund. We will use our best efforts to limit actions regarding that site to the corrective action program. As you can certainly understand, however, we cannot agree to forego any legal action against Waters if further actions are required beyond a limited corrective action program. In light of the substantial potential sums involved, we would be irresponsible to our shareholders if we were to agree to do so.

We look forward to your prompt response. I will call you on September 19 to discuss your initial thoughts on this letter.

Sincerely,

FREEMAN CHEMICAL CORPORATION

Russell L. Cerk
Vice President - Manufacturing

RLC:fy

cc: William L. Rosbe, Esquire
Hunton & Williams
Jean M. Nickel

3.0 CORRECTIVE MEASURES

3.1 HNU TESTING AND CALIBRATION

Soil volatile organic content was monitored with an HNU Photoionization Detector (PID Meter) during excavation and subsequent aeration of spoil. The HNU meter used was a Model No. ISPI 101 fitted with a 9.5 ev probe. This instrument is normally calibrated before and during use with a gas of known concentration in ppm by feeding gas into the probe and adjusting the meter's scalar response to the corresponding gas concentration. Because the PID meter readings of volatiles coming off a soil sample are not a true measure of the organic content of soil, a calibration relationship between the field meter reading and the actual organic content was established by comparing laboratory analysis of volatile organic content to field readings of the same samples.

PID field meter readings for comparison with the actual soil organic content were accomplished by:

1. Taking continuous cores of the glacial sediments at known contaminant location,
2. Placing recovered samples in a clean 1-liter polyethylene bottle which had been previously fitted with a lid containing two holes to accommodate the probe snorkel and a pressure relief,
3. Recording meter response.

Subsequently, a number of the bottled samples representing a range of concentrations was selected for analysis and shipped in ice chests to the laboratory. Based upon the results of these analyses, a correlation was developed for determining degree of soil contamination.

3.1.1 Field PID Monitoring Procedures

The procedures used in monitoring soil volatiles on the site, from which soil handling and disposal decisions were made, consisted of the following:

1. Calibration of the instrument with the calibration gas was done at least once daily and, when used continuously, twice daily.
2. A clean 1-liter polyethylene bottle having two 1/4-inch holes in the lid was always used to determine organic vapor concentration. The meter reading was taken by inserting the probe snorkel into the bottle, waiting for the meter to stabilize, recording the reading as necessary, emptying the sample, and cleaning the bottle. Cleaning of the bottle depended upon contamination and ranged from merely emptying and making a confirmation PID reading, to washing and drying it, to replacement with a new bottle.
3. For measurements of concentrations at stored piles, a map was sketched of the relationship of individual piles to surrounding landmarks, and the locations of the actual points at which measurements were made were noted on the sketch.
4. During excavation of the lateral collection ditches, grab samples were taken directly from the backhoe bucket and placed in the 1-liter bottle for measurement. Unless excavated fill was needed immediately as backfill, an on-the-spot decision was made as to whether a particular bucket of spoil would be loaded on a truck to be taken off-site or loaded on a truck to be taken to the on-site storage area. Contaminated soil was discovered to be almost always confined to specific horizons or strata within the glacial sediment column, thus allowing separation of

contaminated from uncontaminated soil on the basis of fewer meter readings taken on specific soil horizons.

3.1.2 Soil Borings for PID Calibration

Several shallow boreholes were constructed to obtain samples for the PID reading correlation with actual soil values. The locations of these boreholes are shown on Figure 3-1. Individual logs for these holes were contained in the Appendices of the 1985 Summary Report submitted earlier. These samples were taken by Layne Northwest using a CME continuous sampling device equipped with a 5-foot core barrel inside a hollow stem auger. Once the core was extracted from the hole, the core was split. Samples to be measured by the PID meter were taken from one half, and samples to be sent to the laboratory were taken from the other half. Each of these holes was grouted with neat cement when finished.

3.1.3 Post-Construction Soil Handling, Storage, Testing, and Removal

Contaminated soils were encountered during excavations of the Ranney Collectors, removal of buried tanks, and remediation of the broken linseed oil line. Additional contaminated soil was removed from the surface of the church ballfield. These contaminated soils were treated in accordance with the approved Soils Handling Plan which is included in Appendix 3. Essentially, the plan indicates that the excavation operations will be monitored by a HNU Model ISPI 101 photoionization detection meter (PID). The contaminated soils (≥10 ppm VOC´s) would be segregrated on the Freeman property based upon the degree of contamination and either treated on-site (10-10,000 ppm) or transported off-site as a hazardous waste (≥ 10,000 ppm).

None of the excavated soils contained VOC concentrations near the 10,000 ppm hazardous waste level. The soils to be treated were consolidated on Freeman´s property and covered with a tarpaulin to prevent precipitation run-off and/or run-on. A portion of the soil was taken from the pile and spread out over an adjacent area to a depth of between 10 and 20 inches (see Figure 3-2). The soil was allowed to dry and meter readings retaken. If corrected readings were still greater than 10 ppm, the soil would be turned with a disk. This procedure would be followed until meter readings were consistently below 10 ppm. A laboratory sample would be analyzed to verify meter readings and the clean soils would be then removed off-site or used as fill on-site.

Field and laboratory documentation of soil handling is contained in Appendix 3. Of the certified clean soil removed off-site, approximately 300-350 cu.yds. was initially trucked to the Hoffmann Landfill. Subsequent loads were trucked to the Tillman Landfill. Through April 1987, approximately 2,500-3,000 cu.yds. were hauled to this site.

Tested and lab-certified soil has also been used in the berms on the south and east sides of the Freeman property. These berms, which have trees planted on them, are being built to reduce noise and improve the plant's aesthetic appearance. Most of the soil currently being treated will be utilized to complete this project. The remainder of the soil, after being certified clean, will be hauled to the Tillman Landfill. Approximately 5,000 cu.yds. of soil remains to be treated.

3.1.3A Recent Soil Handling Data

This section presents an up-date on the remedial action soils handling which has taken place essentially since May, 1987. This recent treated soil and concrete testing and off-site disposal logs are presented in Appendix 3A.

A majority of the treated soil was moved to on-site berms around the plant. Since May, approximately an additional 620 cu.yds. of soil and 780 cu.yds. of concrete were removed off-site to the Tillmann Landfill. No additional soil reclamation is planned for the remainder of 1987. The existing stockpiled soil has been contoured into a manageable mound and has been completely covered with both the original and additional tarpaulins.

3.2 STORAGE AND DISPOSAL OF PUMPED GROUNDWATER

Groundwater pumped from any excavation during Remedial Construction was in most instances pumped to a Freeman tankwagon, tested for ignitability, styrene, and solvents and then drained to the Sanitary sewer at 10 gpm or less. Very little water was encountered in the shallow glacial sediments during construction of the Ranney collectors. However, the completed, gravel-filled collector legs slowly filled with groundwater when there was any break in the construction sequence. It was then necessary to dewater the entire collector before construction of additional legs could commence. Also, there were several instances of heavy rain during construction that caused immediate filling of the collectors with surface water. In the latter situation, pumped water was sometimes spread on the site and the water sampled periodically to determine its chemical quality.

3.3 REMEDIATION PLAN

The hydrogeologic situation existing at the Freeman Chemical facility resulted in the formulation of a remediation scheme consisting primarily of: 1) dewatering of the glacial overburden to remove contaminated groundwater; 2) removal or repair of existing site sources of contamination; 3) repair of the casing of the nearby Laubenstein well; 4) reconditioning of one of the Village Wells; 5) reversing the direction of groundwater flow in the Dolomite Aquifer back to the site by installing and pumping a system of one deep and several shallow dolomite wells located on site; and 6) directing surface runoff drainage to a collecting basin for treatment.

All of the above proposed remediation schemes were proven concepts with the exception of the drainage of the clayey glacial sediments. Subsequently, a pilot test program was begun on two likely solutions: 1) French drain or Ranney-type collector systems; and 2) large diameter shallow screened wells.

3.4 RESULTS OF PILOT TESTS

A 30-foot section of a Ranney-type collector was constructed to determine unit cost, whether caving would occur, which construction techniques would work in the glacial sediments, and the rate of filling of the completed collector section. Construction details and test results are described in Section 4.1 of the 1985 Summary Report. The Ranney collector construction was successful and the ditch was calculated to yield about 0.006 gpm per foot of ditch.

A 19-foot deep, 16-inch diameter gravel-packed well was constructed in a 24-inch hole on site to test the feasibility and cost of draining the glacial sediments with many such wells. Although the well installation and performance were successful, the high cost of large diameter well screen, the need to keep the surface of the site clear of obstruction to traffic flow, and the space needed for storage of raw materials and tank wagons clearly pointed to the greater efficacy of the Ranney-type collector system.

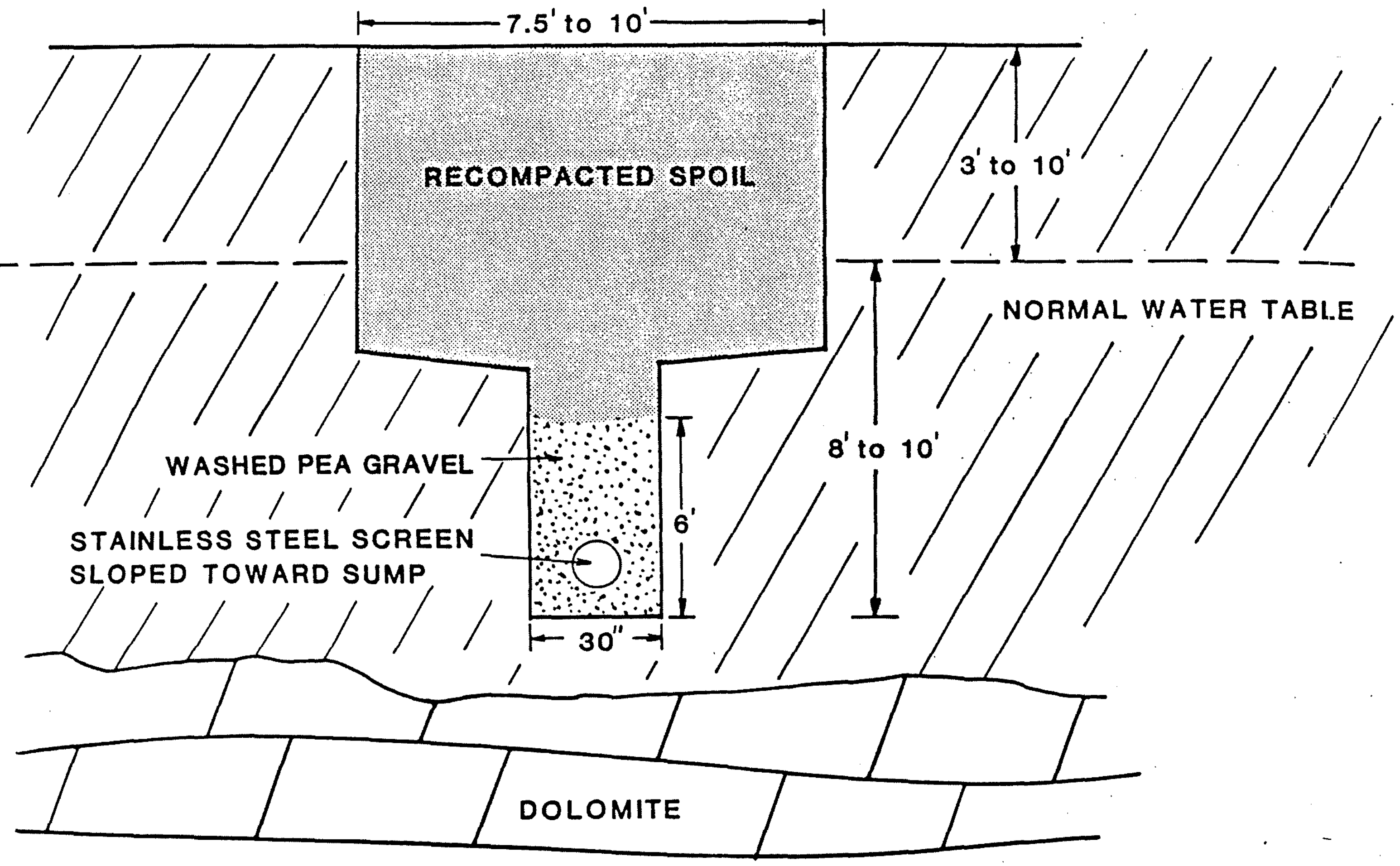
3.5 RANNEY WELL COLLECTION SYSTEM CONSTRUCTION

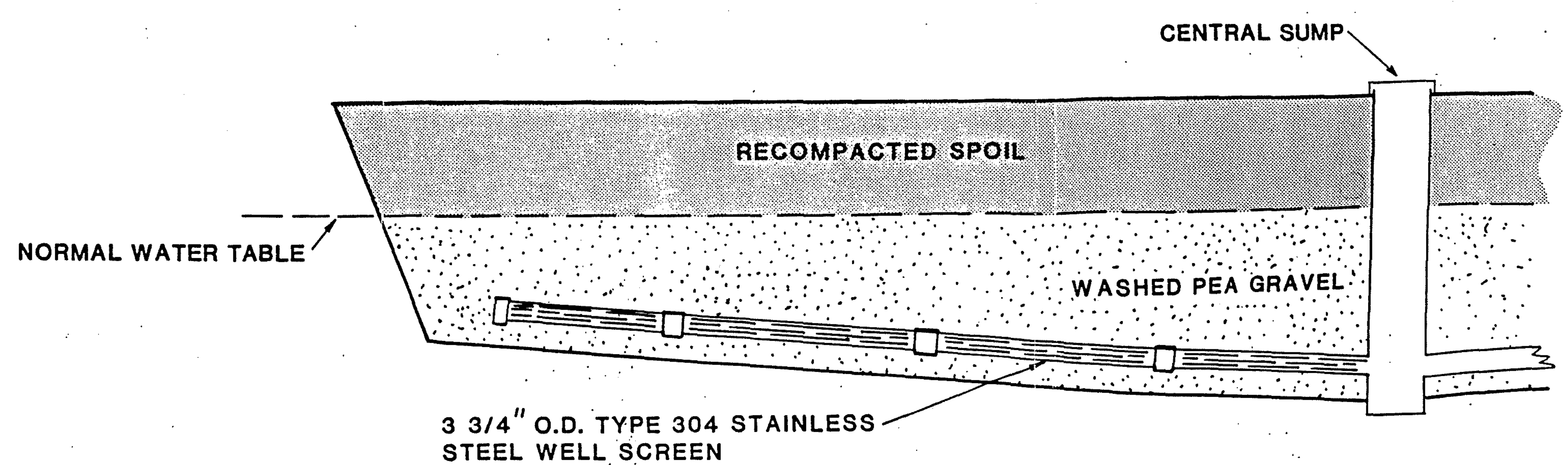
The Ranney-type collection system designed for this site consists of a central large-diameter well or caisson to which lateral ditches drain groundwater. Laterals, consisting of a gravel filled ditch and 4-inch well screen, radiate away from the bottom of each caisson at a designed gradient just above the upper surface of the underlying dolomite. The caissons were made of 42-inch-diameter steel pipe. A typical cross-section of a Ranney collection system, as used for this site, is illustrated in Figure 3-3.

The location of the caissons and the number and alignment of the laterals was determined primarily by the location of contaminant-saturated soil and the topography of the upper surface of the underlying dolomite. The ditch gradient had to be controlled so that the upper dolomite surface was not intersected. Secondly, consideration was given to established traffic patterns, utility piping, building foundations, surface drainage piping, and manufacturing processes.

3.5.1 Ground Penetrating Radar Survey

The conceptual layout of the pumping centers and drainage ditch alignment of the Ranney system was investigated using ground penetrating radar. The intent of the investigation was to





Job No.:0001-003	Hatcher Incorporated RICHMOND, VIRGINIA	Date: June 9, 1986 Scale: None	Typical Cross-Section of Ranney Collection System Drawing No.: Figure No.: 3-3

delineate depth to bedrock and any obstacles (i.e., buried utilities, tanks, and boulders) so that a final design could be determined.

The radar survey was conducted by Geoscan of Weare, New Hampshire. The survey was made on March 13, 1986, using an SIR System 7 instrument equipped with a 120-hz antenna. This equipment is towed over the line of interest. Radar energy transmitted into the ground and received by the antenna is converted to digital data and displayed in a strip chart format representative of the ground over which the antenna has just passed. The location of the beginning and end of each line and 10-foot increments along each line were marked with paint on the ground prior to the survey. Registration marks were made on the strip chart corresponding to these paint marks by the operator as the antenna passed over the marks. Following completion of the radar survey, the end points of each line were located in reference to existing site plats by at least two tape measurements to existing building corners, fences, or other mapped locations.

The strip chart recordings produced by this survey and the map showing their location are presented herein as Appendix 4. Figure 3-4 shows the location of each line represented by this survey. Most targets picked up by the radar survey were subsequently identified as buried pipes or round glacial erratics (boulders). Concrete, especially that containing rebar, shows up at the top of the radar record as an easily recognized ball and socket pattern such as on line 3 of RC-1, between 70 and 120 ft. Badly disturbed ground, such as occurs when a ditch is constructed, is identified by the interruption of the normal continuity of horizontal return lines typical of undisturbed ground. Thus, the area of chaotic signal between 260 and 280 of line 2N on RC-2 represents the location of the "old dry well" and is typical of signals from other utility ditches in that area, as was subsequently shown by excavations.

3.5.2 Caisson Construction

Two different installation strategies were used to install the central caissons. Initially, the three caissons, one shallow large-diameter well located in the ballfield, and the pit casing for the deep dolomite production well were installed in holes excavated with a large boring machine. However, because of the difficulties of safely welding lateral connectors in the hole bored for Ranney Collecter 3 (RC-3) and the decision to move RC-2 slightly, the caissons were reinstalled in a backhoe-constructed conical hole.

The bored holes were constructed by the Gillen Company of Milwaukee, Wisconsin, a subcontractor to Sam's Rotary Well Drilling of Randolph, Wisconsin. Holes RC-1, 2, and 3 were bored with a 48-inch diameter bit. Spoil was "spun off" next to the machine in a single pile and was monitored with an HNU meter for excessive VOC's as the boring operation progressed. Once the design depth had been reached, the 42-inch steel casing was placed in the hole, and the annulus was filled with washed pea gravel. In some instances it was necessary to go to 24-inch diameter bits to penetrate through zones of large, round boulders. Pictures showing construction and installation of these caissons can be found in Appendix 8.

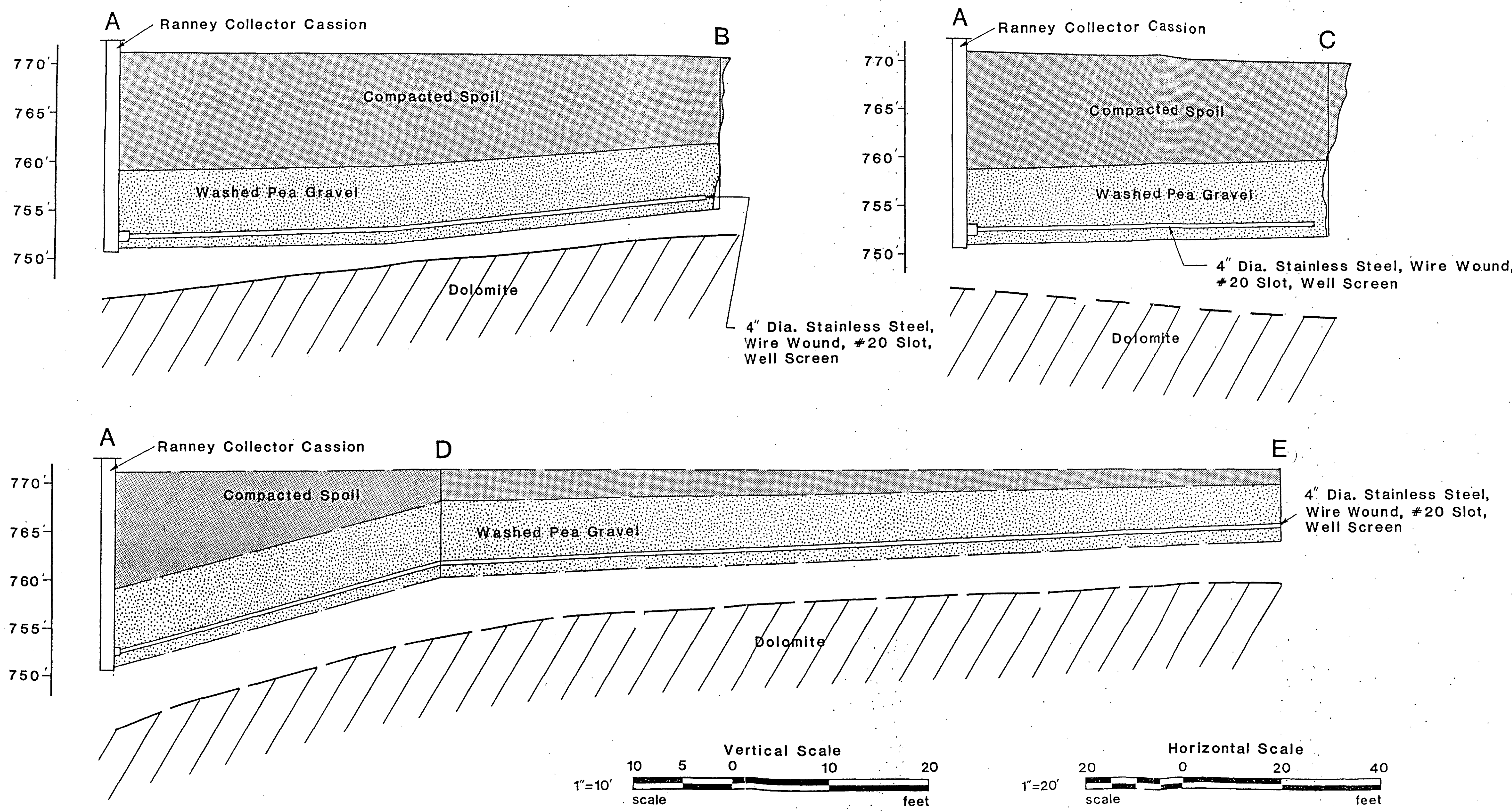
Borings constructed by the Gillen Company were done in the period of June 10 through June 12. On July 10, the RC-3 caisson was pulled by the lateral ditch installation contractor, the lateral connectors were welded onto the base of the caisson at the correct lateral angular direction, and the caisson was reinstalled the same day. The RC-2 caisson was pulled by the same contractor on August 22. To avoid any possible movement of contaminants into lower strata, a mix of four bags of portland cement to four bags of bentonite were placed inside this caisson before it was moved. Lateral connectors were then welded to the base of the caisson, and the caisson was reinstalled 30 feet to the southwest.

3.5.3 Ranney Collector Ditch Construction

Lateral ditches, designed to dewater the poorly permeable glacial materials by gravity, were constructed in a radial pattern from each of the three caisson locations. The ditches were constructed by Robert Tillman of Ozaukee Excavating, Inc., subcontracting to Miller Construction Company. Ditch construction was by conventional large backhoe methods. Figures 3-5, 3-6, and 3-7 present the actual ditch profiles. Figure 3-8 shows the locations of the Ranney Collector caissons and laterals. All ditches were begun at the caisson and worked outward. Soil was first stripped to a depth of about 5 feet along a path about 10 feet wide. Then the ditch was deepened by successively narrower lifts until the design depth was reached. Design depth and gradient were controlled by use of a Laser leveling gun and grade stakes.

Spoil was placed on either side of the ditch and monitored with the HNU meter as excavation proceeded. Decisions as to whether spoil would be retained in the on-site spoil pile or hauled off-site to a designated landfill were made immediately upon excavation on the basis of HNU readings of the excavated soil.

Once sufficient length and depth of the ditch had been excavated to accommodate the laying of screen, the 20-foot lengths of No. 20 slot, wire wound, 4-inch diameter well screen were installed. This process was begun by spreading approximately one foot of washed pea gravel in the ditch and adjusting the grade of the pea gravel surface as necessary. The well screen was then inserted into the exposed connector at the base of the caisson and laid down on the pea gravel. The connector or sleeve in the caisson was constructed larger in diameter to permit any future flexing or settling of fill that might occur and, thus, prevent breaking of the joint. The annular space between the well screen and the caisson connector was plugged with oakum to



	Hatcher Incorporated	Date: 5/8/87	Ranney Collector #2 Ditch Profiles	
Job No.: 0001-003	RICHMOND, VIRGINIA	Scale: As Noted	Drawing No.:	Figure No.: 3-6

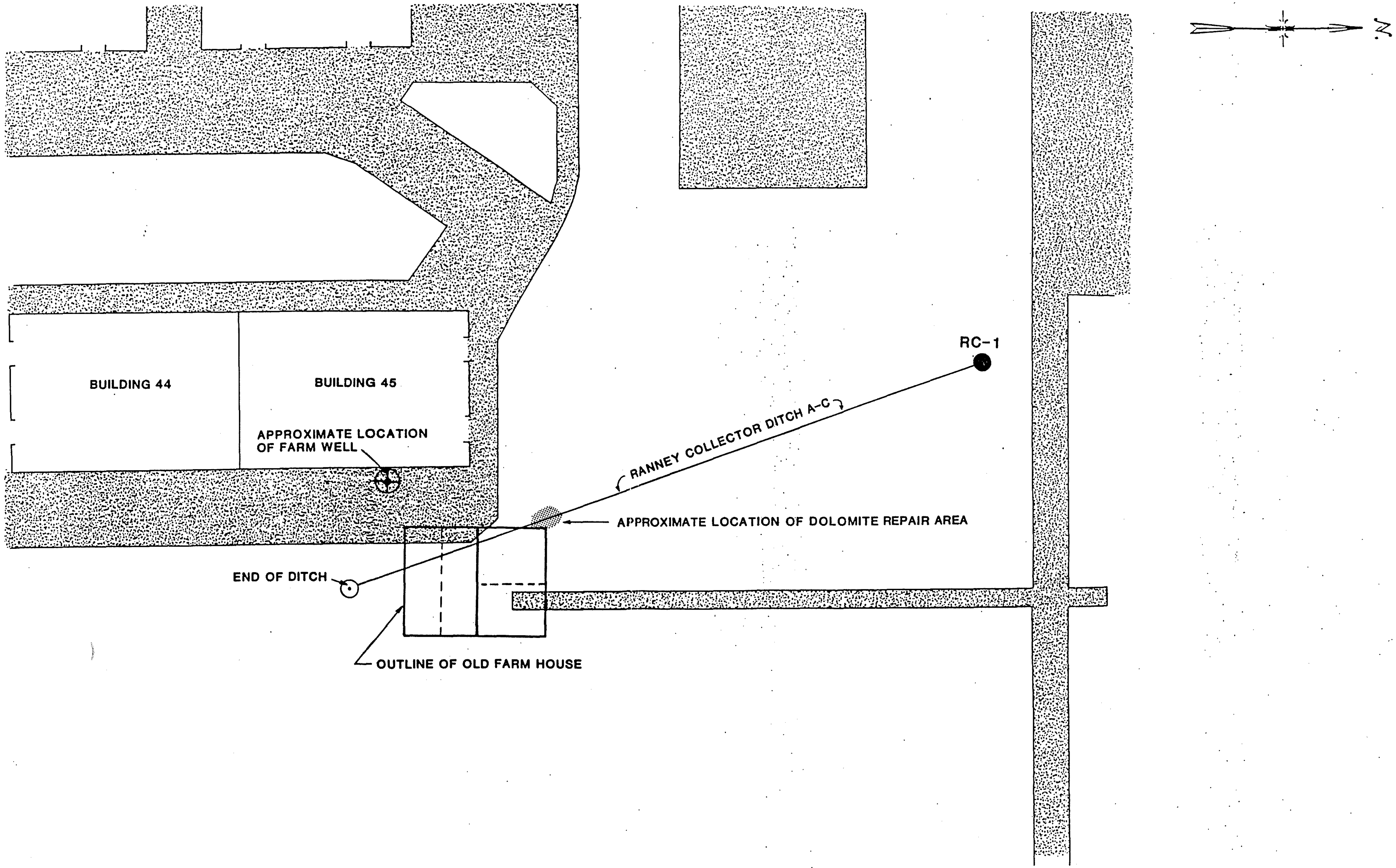
prevent gravel and sediment from entering the caisson. The next screen was then screwed into the one preceding it and tightened with pipe wrenches.

Next, pea gravel was placed over the installed screen to a depth of 4 to 6 feet, depending on ditch depth. Finally, spoil from the adjacent spoil piles was backfilled in lifts of about 2 feet thickness and compacted. Compaction was done with a large hydraulic vibrator plate fitted to an American (Model 254) excavating machine.

Exceptions to the above approach occurred when it was necessary to restore traffic immediately. In these instances, filter fabric was installed over the compacted spoil within 2 feet of the surface. Then a 1 to 1.5-foot layer of 3 to 4-inch stone followed by a layer of "traffic bond" was spread and compacted.

Because of the low permeability of the glacial overburden, water seepage into the ditches did not prove to be a problem, however, heavy rainfall did. Wet spoil proved difficult to compact, and the completed, gravel-filled laterals proved to be efficient storage basins for large volumes of rainwater. Following a rain, in order to complete a lateral ditch or start another, it was necessary to drain the partially completed collector system by pumping the caisson. As indicated earlier, water was either pumped to a tankwagon for disposal to the sewer or, in rare cases, to the ground if a water analysis proved this to be a viable alternative.

The depth, alignment, and gradient of the lateral ditches were designed to avoid breaching the underlying more permeable dolomite. Data for the topography of the dolomite upper surface was obtained during the previous year (see the 1985 Summary Report). Nevertheless, the dolomite surface was inadvertently exposed in lateral ditch AC of RC-1 near Building 45. Here a pinnacle of dolomite rises to within 11 feet of the surface. Figure 3-7 is a sketch map showing the location of this point relative to Building 45. The exposed dolomite was repaired by



1"=30' scale 30 0 30 60 feet	Job No.: 0001-003	Hatcher Incorporated	Date: October 28, 1986	Location of Dolomite Repair Area
	Freeman Chemical	RICHMOND, VIRGINIA	Scale: As Noted	Drawing No.: / Figure No.: 3-9

placing 1 foot of compacted native clay over the exposed rock surface. The clay used was carefully selected for low permeability and compactability from strata exposed in ditch AC. Following compaction of the repaired patch, the grade of the ditch was changed to place the bottom of the remainder of the lateral above the dolomite surface. The dolomite surface was not uncovered in any of the other laterals. Figures 3-5, 3-6, and 3-7 illustrate the relationship of Ranney Collector ditch bottoms to the dolomite upper surface.

The construction of the collector ditches was done during the period from July through December, 1986. The locations of these caissons and laterals are shown on Figure 3-8. The order and other daily details can be gleaned from the Geologist Log in Appendix 5 but is essentially as follows:

RC-1, AGH
RC-3, AB, AF, AL, FG, ACD
RC-1, AF, ADE
RC-3, DE
RC-1, AB, AC
RC-3, GH
RC-2, AC, AB, ADE

In addition to the above laterals, the contaminant-saturated soil and gravel lying immediately below the tank farm concrete slab was connected directly to the groundwater collection system by constructing short laterals from the tank farm foundation to adjacent laterals. The south side of the tank farm foundation now drains to leg DE of RC-1 and the north side drains to leg CD of RC-3.

3.6 CONSTRUCTION OF GLACIAL OVERBURDEN WELLS

Groundwater dewatering wells were constructed in the shallow glacial deposits at two different places and for two different reasons. Well W-37 was placed in the north end of the ballfield to access deeper sediments that could not otherwise be drained by the lateral collectors. Wells W-31 through W-36 were constructed along leg EF of RC-2 to facilitate drainage of shallow groundwater in that area before construction of the lateral EF, as well as to permit a shallower ditch design next to the existing building foundations.

Well W-37 was constructed at the time the Ranney collector system caissons were being installed. The 24-inch hole for this well was bored with the large Gillen machine to a depth of 19 feet at the top of the large boulder zone. A 15-foot section of 16-inch diameter, No. 20 slot screen, having 3.5 feet of 16-inch riser was installed in this hole flush with the surface. In order not to interfere with playground activities, clean pea gravel was placed by shovel (rather than by larger machinery) in the annulus to ground surface.

In July of 1985, Leg EF (now Leg DE) of RC-2 was redesigned at the request of Freeman Chemical. This redesign included a shallower ditch to accommodate concerns about the safety of building foundations and the integrity of buried utilities in an already narrow working area. In addition, six shallow dewatering wells were to be added to drain perched groundwater prior to construction activities and ultimately to serve as a means of draining any contaminated groundwater existing below the 8-foot depth of the ditch. This design was conditionally approved by the Wisconsin DNR on July 25.

Five wells were subsequently installed by Sam's Rotary Well Drilling. A sixth well (W-36), drilled the previous year as a pilot demonstration well, was incorporated into this scheme. Wells W-31 through W-35 were all similar in construction, being approximately 20 feet deep; having a 1-foot plug of clay at the bottom; having a 10-foot section of No.20 slot, 10-inch diameter screen at the base followed by 10 feet of riser pipe; and being installed in a 17-inch drilled hole. The annulus of each well was filled with pea gravel from bottom to top. Prior to installation, the riser of each was equipped with a pitless adapter and a flange welded to the top to accommodate a bolted-on cover. Construction diagrams for these and other wells are contained in Appendix 6. The location of the above wells can be found on Figure 3-8.

3.7 CONSTRUCTION OF SHALLOW DOLOMITE WELLS

Shallow, 6-inch diameter drilled wells were installed by Sam's Rotary Well Drilling into the upper surface of the Dolomite Aquifer to facilitate removal of contaminated groundwater. The upper surface of the dolomite is severely solutioned and is quite permeable. Rather than remove contaminated groundwater by pumping it through a thick section of the dolomite to the deep recovery well, the system of shallow dolomite wells is designed to scavange such water off the top of the aquifer near its source. Each has been located in the shallow part of the Dolomite Aquifer either near the center of known locations of contaminated groundwater or to prevent its flow off-site.

This dewatering or shallow dolomite scavanging system consists of four wells: W-28, W-29, W-21a, and W-24a. All are 6-inch wells cased into the top of the dolomite with steel casing and grouted with cement from the bottom to the surface. Wells W-21a and W-24a are redrills of wells W-21 and W-24 which were only 4 inches in diameter. Short-term pump tests of these wells have been made and those data are presented as Appendix 7. There is a significant range in yield among the four wells that is apparently directly related to the differences in solutioning. Construction diagrams of these wells are presented in Appendix 6. Their locations are shown on Figure 3-8.

3.8 CONSTRUCTION OF THE DEEP DOLOMITE PRODUCTION/DEWATERING WELL

3.8.1 Location

The location of this well (W-30) was carefully selected to function as both a source of cooling water for the Freeman

Chemical facility and, at the same time, as a means to reverse the groundwater gradient presently established toward the Village of Saukville back toward the plant site. Thus, the location finally selected is next to the point where the Village water main enters the plant and is centrally located with reference to the Laubenstein well and Municipal Wells 2 and 3. The location of W-30, relative to plant facilities, is shown on Figure 3-8.

3.8.2 Well Construction

The deep dolomite well was drilled by Sam's Rotary Well Drilling. It is permitted by the Wisconsin DNR as Well No. 56810 and is called well W-30 for purposes of this report. The 24-inch pit casing hole for this well was excavated with the Gillen Boring machine to a depth of 17 feet on June 24th and a 16-inch diameter casing installed. The drilling contractor began this well on July 8th and completed it on July 17th. The well at this point was drilled with a rotary air hammer, sometimes lubricated with a foaming agent, to a depth of 556 feet. The hole was drilled to 101 feet with a 15 5/8-inch bit at which point a 101-foot length of 13-inch well casing was installed and grouted from the bottom to the surface. Grouting was done by pumping cement grout with a large pump through a small diameter pipe placed in the annulus. See Pictures 207 through 209 in Appendix 8. It was then deepened by the same drilling method to 556 feet using a 12 5/8-inch bit.

The well was completed entirely within the Silurian Niagarian Dolomite, except possibly the lower 45 feet where the typical tan to dark gray dolomite lithology changed to dark reddish brown, sandy to shaley materials interbedded with dolomite. This well was deepened below its designed 500-foot depth because of the poor yield potential exhibited by the upper 400 feet of the aquifer during drilling. A geologist sample description of the 5-foot interval cuttings is presented in Appendix 2. The well's construction details are diagrammed in Appendix 6.

The well was drilled with the aid of the State-approved foam method without difficulty or incident except for disposal of the large volumes of foam and water generated near the end of the job. Although normally not a problem in more remote drilling sites, it proved to be a visual nuisance in the highly populated area and near a regulated stream.

3.8.3 Preliminary Pump Test

Well W-30 was subsequently fitted with a submersible pump set at a depth of 284 feet and an air line at 276 feet. A 21-hour pump test was run at a yield of approximately 690 gpm on July 25 and 26. Yield was monitored with an orifice and totalizing flow meter. Drawdown was monitored with a nitrogen pressurized air line. Drawdown in the Village Wells (MW-1 and MW-2) was also monitored by air line. The Laubenstein Well (PW-8) water level during this test was taped. A short recovery test was run at the conclusion of the pump test.

Both PW-8 and MW-2 showed drawdown in response to this test. No drawdown was detected in MW-1. The test indicated that the deep dolomite well has a 1-day specific capacity of about 8.4 gpm/ft and that the 700-day drawdown at 690 gpm will be about 165 feet. The results of this aquifer test are given in Appendix 7.

3.9 OLD DRY WELL REMEDIATION

3.9.1 Location and Background

The "Old Dry Well" is a term used to refer to a pit which Freeman Chemical used to waste "acid reaction water." This pit is indicated by existing correspondence to have been constructed about 1952 and used until at least 1958 as an absorption pit. This structure was reported to have been located on the west side of Building 5 and to have had a sand and gravel base.

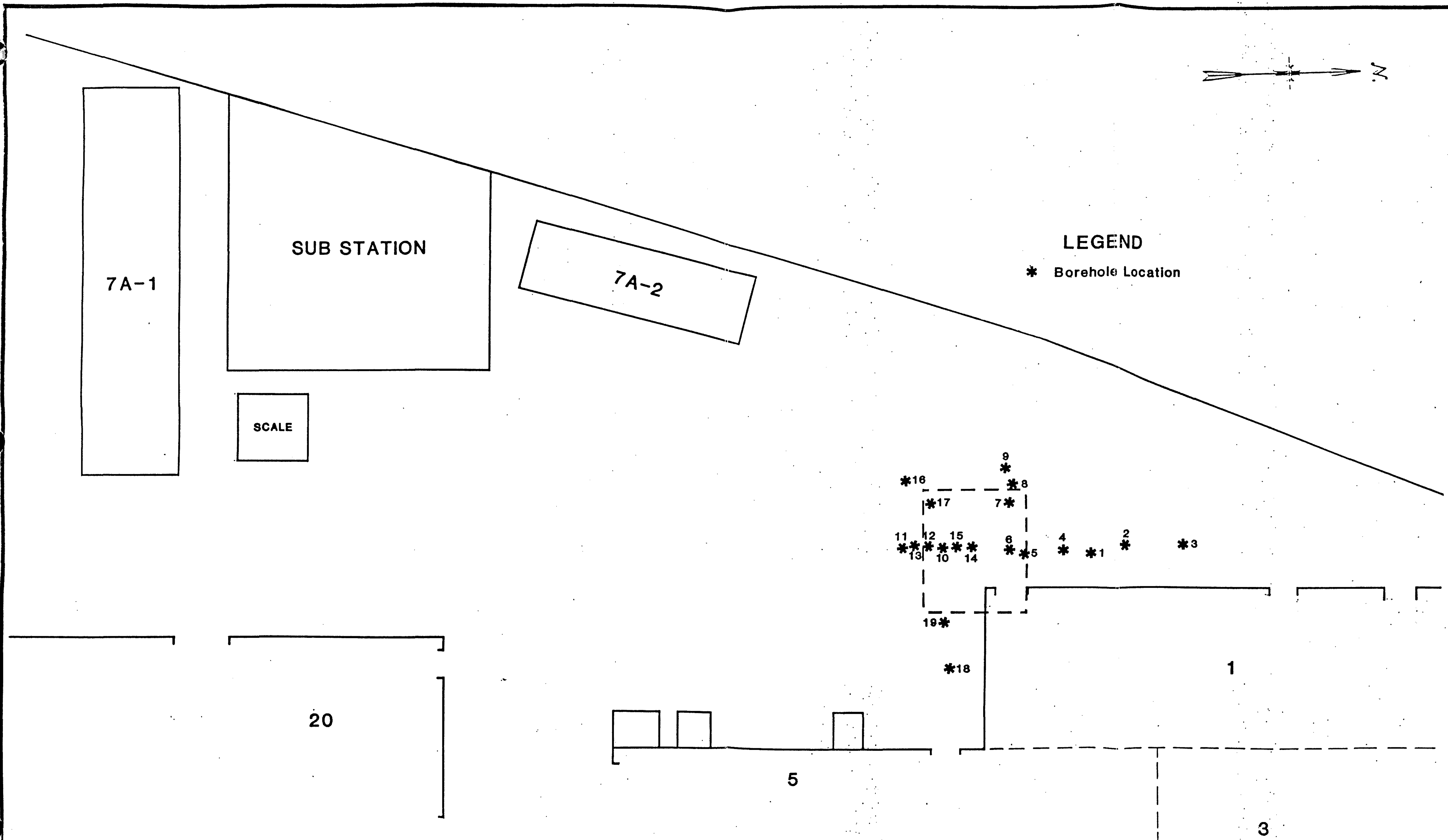
Exploration for this structure was dictated by the need to know hydrologic and soil stability conditions along the west wall of Building 5 prior to construction of Leg EF of RC-2, as well as DNR instructions for its remediation. Exploration was begun by probing the most likely area with an auger drilling machine from Wisconsin Testing Laboratories. This procedure consisted of first augering and then taking split spoon samples to determine whether the horizon penetrated was a disturbed or undisturbed soil profile. Once a normal soil profile was determined, the hole was terminated and the next hole location was started. If concrete or other obstruction was found, the location was marked with paint and the next hole was started. In all, 19 holes were drilled adjacent to Building 5 on November 3rd. Pictures 261 through 281 in Appendix 8 record details of the exhumation of the "Old Dry Well" structure.

Figure 3-10 shows the location of these holes relative to Building 5 and the general outline of a concrete, 11 by 11-foot, rebar-reinforced lid of about 10 inches in thickness found immediately below the concrete pavement. No holes were drilled deeper than 8.5 feet, except for hole 6 which was drilled to 12.5 feet to determine if the structure had a concrete bottom. No such bottom was found. Hole 15 drilled into the metal edge of a manhole cover frame. Samples of water standing on top of the sediment in the well bottom indicated that traces of solvent were present but that it was not ignitable.

3.9.2 Remediation

The "Old Dry Well" problem was remediated over the period from November 7th to November 15th by:

1. First removing the existing pavement by breaking the pavement up into pieces small enough to be loaded into a truck and hauled to the on-site spoil storage area.



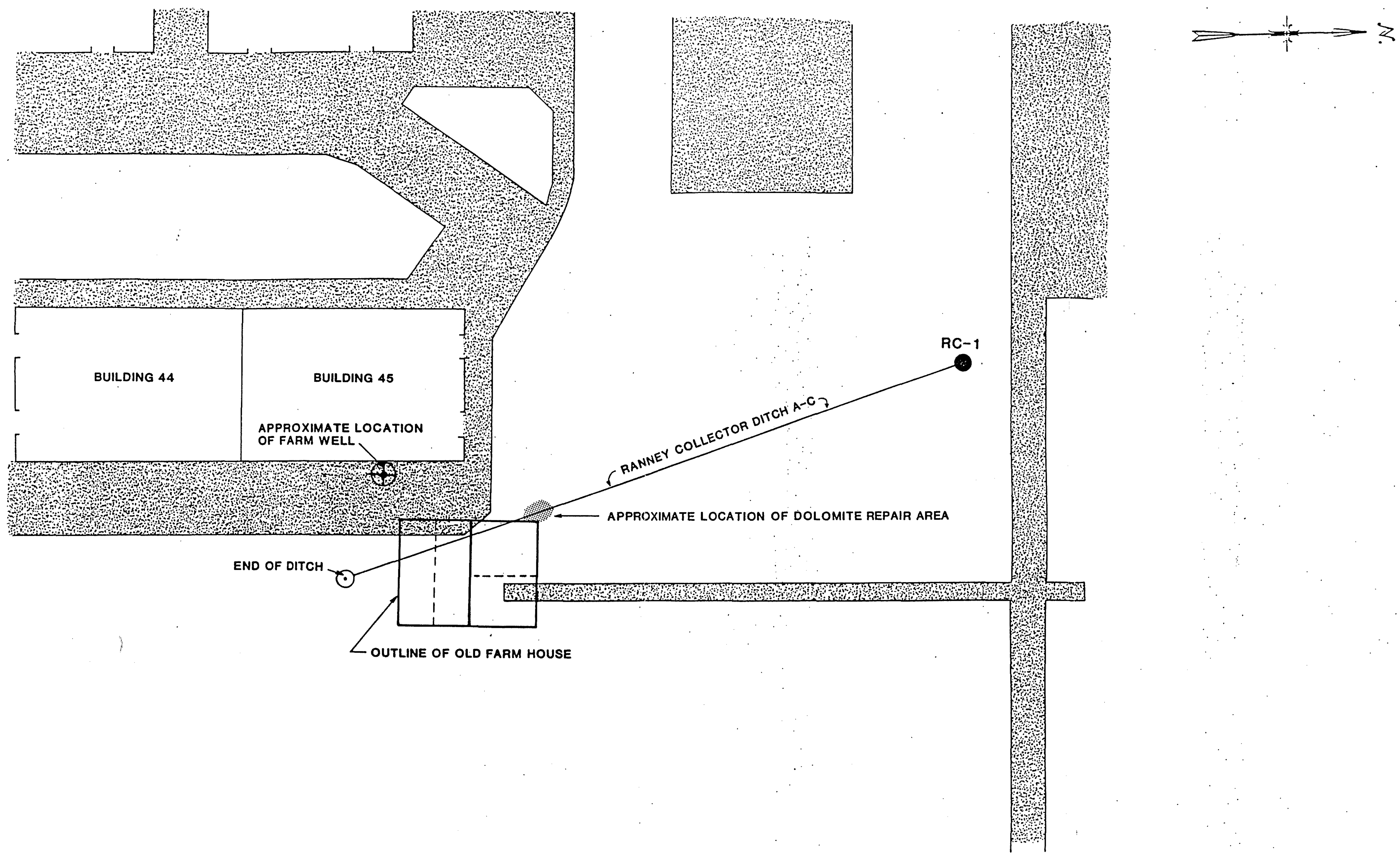
1"=10' scale 10 5 0 10 20 feet	Job No.: 0001-003	Hatcher Incorporated	Date: October 28, 1986	Location of "Old Dry Well"
	Freeman Chemical	RICHMOND, VIRGINIA	Scale: As Noted	Drawing No.: Figure No.: 3-10

2. The dry well lid was handled similarly, although the heavy rebar caused some difficulty. Removal of the tank lid on November 7th revealed that it had but one compartment, that the walls were constructed of concrete block turned on edge, and that an attempt had been made to fill the well with sand which was coned up beneath the manhole location.
3. As much as possible of the fluid in the well was pumped by mud pump into a tank wagon. The remaining sludge was excavated by backhoe, piled up adjacent to the well, and allowed to freeze before being transported to the on-site spoil storage area.
4. The block walls, consisting of 15 rows of 8-inch blocks turned on edge backed by filter material consisting of 2 to 3 inches of round stone, shoring material, and a few tile remnants, were removed by backhoe and also transported to the spoil storage area. However, a pillar of the old wall was left under the existing corner of Building 1 to provide continued foundation support.
5. The "Old Dry Well" excavation occupied a hole of about 15 feet by 12 feet by 10 feet in depth. This hole was backfilled with clean road bond size gravel and compacted.

3.10 OLD FARMHOUSE WELL REMEDIATION

3.10.1 Location and Background

The term "Old Farmhouse Well" refers to a domestic water well shown on existing photographs of a former farmhouse. The well was located on the southwest corner of that house. The house itself is shown on existing aerial photos as located just off the corner of Building 45 (see Figure 3-11). The probable location of the house was reestablished by measuring its location



1"=30' scale 30 0 30 60 feet	Job No.: 0001-003 Freeman Chemical	Hatcher Incorporated RICHMOND, VIRGINIA	Date: October 28, 1986 Scale: As Noted	Location of "Old Farm House Well" Drawing No.: Figure No.: 3-11

on old aerial photographs relative to landmarks still existing near and on-site, then plotting those locations on present-day plant maps. Confirmation of the general location of the old house was also established during construction of Leg AC of RC-1 when part of the foundation of the house was excavated. Figure 3-10 is a sketch of the relationship of the Ranney Collector ditch, Building 45, and the presumed location of the farmhouse.

A more precise location of the house and well was attempted in November by using a backhoe to excavate as much of the foundation as possible. Excavations carried out in November were successful in locating only part of the foundation and the outside cellar steps. Careful examination of existing photos showed that the cellar entrance was near the southeast corner and that the house was about 25 feet in length. From this information, a 20-foot diameter probable search area was estimated just outside the east wall of Building 45 and beneath the building´s concrete apron.

A metal detector (Shonstedt Instrument Co., Model MAC-51B) was used to search within the circular target area. To overcome interference from the concrete rebar, the metal detector was held head high during the survey. Only one significant magnetic anomaly was found in that area. Its location was then marked with paint and measured relative to the distance from surrounding objects. Following sawing and breaking out of the concrete over this spot on November 10th, the top of the old well was found at about 30 inches below grade.

3.10.2 Remediation

Remediation of this well consisted of cleaning out debris and grouting with concrete. This 6-inch well was cased with black iron pipe and was open to a depth of 17 feet when uncovered. Sam´s Rotary Well Drilling air rotary machine was moved onto the well on November 15 and the well was cleaned to 34 feet. Grout, consisting of 18 bags of cement in 100 gallons of water, was then pumped into the well from the bottom up. The following day a grout mix consisting of four bags of cement was added to the top to complete the job.

3.11 CAUSTIC TANK REMEDIATION

3.11.1 Location

The caustic tank was located on the south end of Building 55 [see Figure 2-1 (Location 5)] opposite the contractors entrance off Linden Street. A tile drain connected it to a floor drain inside the building. This tank had a standard cast iron cover accessible from the outside of the building. This tank was apparently used to store waste caustic from a process no longer used at Freeman Chemical.

3.11.2 Remediation

The tank was cleaned out by slowly diluting the contained liquid to reduce the pH and then pumping the diluted liquid to a tankwagon. Sediment in the bottom was shoveled to the surface and removed to the on-site storage pile. The tank proved to be a round concrete caisson 5.5 feet in diameter and 5.5 feet in depth with a poured concrete floor. Following inspection of the tank on November 5th, it was filled with 4 yards of concrete.

3.12 STYRENE TANKS REMEDIATION

3.12.1 Location

Two steel styrene tanks were located east of the existing tank farm (see Figure 2-1). The tanks were positioned horizontally on the ground and covered with dirt.

3.12.2 Remediation

On September 8, 1986, soil was carefully removed from around the buried tanks so that they would not be dented (see picture 249). When a tank was exposed, it was lifted by a crane supplied by Jacque's Welding & Crane Service of Port Washington, Wisconsin. The tanks were checked carefully, rinsed thoroughly and then placed on a trailer provided by Lannon Corporation of Lannon, Wisconsin. The company had been notified in a letter dated September 3, 1986, and on file at Triad Engineering's office, as to the previous use of the tanks and that they may still contain a crisp of resin.

The contaminated soil was moved to the soil handling area for treatment, testing, analysis, and disposition by the prescribed means.

3.13 REMEDIATION OF BROKEN LINSEED OIL LINE

The broken linseed oil line was located west of the tank farm and south of Building 11 [see Figure 2-1 (Location 15)]. Remediation consisted of replacing all previously underground or overhead process lines during August, 1986.

Contaminated water collected from the area was incinerated. The contaminated soil was moved to the soil handling area for treatment and approved disposal.

3.14 REMEDIATION OF SUMPS

A sump running to the gasoline tank south of Building 9 was remediated during August 1986. The sump was excavated, lifted out of the ground and discarded. No contaminated soil or water was detected.

3.15 REMEDIATION OF FUEL TANKS

3.15.1 Diesel Tank

The underground diesel tank, a 1000-gallon capacity steel tank used to store fuel for diesel yard equipment, was located on the north side of Building 31 near the northwest corner of the Shop door [see Figure 2-1 (Location 6)]. The tank was excavated intact by Miller Mason & Concrete during August, 1986. No contaminated soil or water was present. The tank was disposed of as scrap metal and the hole was filled with concrete.

3.15.2 Old Gasoline Tank

An old gasoline tank is located near the southwest corner of Building 9. This underground tank is reported to have been filled with sand several years ago.

3.16 LAUBENSTEIN WELL

3.16.1 Location and Background

The old Laubenstein Well (PW-8) is located in an old warehouse on the opposite side of and west of the railroad tracks from the Freeman Chemical property (see Figure 3-8). The warehouse, formerly owned by Northern Signal Corporation, is now occupied by J. T. Roofing, Inc. and owned by Mr. Jerry Thull and Mr. Jerry Dreis. This is an unused well, 8 inches in diameter, about 455 feet deep, and cased to about 30 feet. Geophysical surveys of the well reveal a large "washout" at the end of the casing. Past packer tests show that the casing is not sealed. From the response of this well during past pump tests, there is reason to believe that it is hydraulically connected directly to MW-2. The well contains VOC concentrations in excess of 2,000 ppm, and is next to an area reported to have been used for disposal of TCE.

Since the well is in the drawdown cone of influence of MW-2, will be in the drawdown cone of the new Freeman Chemical withdrawal well (W-30), and provides in its present condition an opportunity for a continuous source of shallow contamination to the Dolomite Aquifer, repair of the casing was chosen as the most logical remedial choice.

3.16.2 Remediation

Remediation of the Laubenstein Well consisted of the installation and grouting of a new 6-inch casing inside of the old casing. First a casing shoe, then a grout basket was installed on the end of the bottom section. Then each section of 6-inch well pipe was welded to the previous section as it was lowered into the well. The bottom of the pipe string was placed at 104 feet. Portland cement grout was pumped into the annulus with a large motor driven portable grout pump through a small diameter tremie pipe placed near the bottom of the pipe string. Grout was pumped until good return was observed at the surface. A total of 24 bags of cement was used to mix the grout subsequently pumped into this well.

3.17 MONITORING WELL CONSTRUCTION AND DECOMMISSIONING

3.17.1 Monitoring Well Construction

Monitoring wells have been installed at the Freeman Chemical Saukville Plant site in three different phases. The first set was installed by Olver Corporation in 1983. This was followed by a second set installed during the 1985 field season by Hatcher Incorporated. Finally, additional monitoring wells designed to monitor the effectiveness and progress of groundwater remediation were completed in the Fall of 1986. Figure 3-8 is a map showing the location of all of these wells.

Different construction techniques have been used depending on the purpose of the well and the specific geologic situation at each well site. The original set were all small-diameter, plastic, 2-inch, screened wells set in an auger hole of the required depth with filter sand and Bentonite plug added as needed. All had 4-inch steel lockable procovers. Monitor wells installed in 1985 were of two types: 1) small-diameter, 2-inch, screened wells similar to that described above for monitoring water levels and/or sampling in the shallow glacial sediments; and 2) 4-inch open holes into the upper surface of the dolomite. The latter were cased with schedule 80 plastic casing and grouted to the surface. One additional small-diameter screened well was installed in the deeper silts and sands of an old river channel or karst sink during this period. These too were fitted with lockable procovers.

Monitoring wells installed in 1986 were similar in construction to previous ones, except that in most instances the installation holes were 6 inches rather than 4 inches. Many of these are on site in traffic areas and have had a standard manhole placed over the top of the well. Physical details on each well can be obtained from the construction diagrams in Appendix 6. The sample description logs of these 1986 wells are contained in Appendix 2.

3.17.2 Decommissioned Wells

Monitoring wells have been decommissioned for three reasons: 1) some of the original set were improperly installed across the interface between the glacial overburden and the underlying dolomite; 2) they were no longer needed; and 3) they were in the way of construction and needed to be removed and replaced. Small diameter wells were decommissioned by punching out the bottom plug on the screen, pumping the hole full of grout from the bottom up, and pulling the screen and casing. Larger diameter wells, which were open holes in the dolomite, were decommissioned by also pumping grout from the bottom up and then pulling the casing. Their location can be found on Figure 3-8.

3.17A

Construction Documentation for Pumping Systems as Designed by Applied Technology and Engineering for Freeman Chemical Company Groundwater Recovery System

Introduction

This section provides documentation of groundwater pumping systems as designed by Applied Technology and Engineering(AT&E). AT&E was retained by Hatcher, Inc. to perform specific design functions for the Freeman Chemical Company groundwater recovery system. These functions included the mechanical and electrical aspects of the pumping system only as described on the Drawings and within the Specifications. AT&E's work did not include the location and installation of wells nor Ranney Collectors. In addition, AT&E was not responsible nor consulted in matters regarding environmental factors such as the nature, extent, behavior and characteristics of contamination or regarding other site conditions outside of those directly involving those items designed by AT&E. Design criteria, such as pumping capacities and discharge points for the well systems, were provided by Hatcher, Inc. Site visits were made by AT&E to verify installation of systems designed by AT&E as specified.

This section contains the following:

1. A narrative description of the groundwater pumping system.
2. Design Plans. (Figures 3-12A through 3-17A)
3. Design Specifications. (Appendix 7A)
4. Photographs of groundwater pumping system during various stages of construction. (Appendix 8A)

Description of Groundwater Pumping System

General

The groundwater pumping system design provides three basic systems of pumping configurations to move groundwaters from different geological formations to the area of the new pump house, located at the northwest corner of the Freeman site. Two pumping systems (W-31 thru W-37, & RC-1,-2,-3) extract groundwater from the layer of soil residing above a dolomite formation (shallow wells). The third pumping system (W-21,-24,-28,-29) extracts groundwater from the dolomite formation, at approximately one hundred feet below grade (deep wells). The two shallow well systems differ in their respective methods of collecting groundwater; the "W" series extract groundwater at a single point, whereas the "RC" series collect groundwater from a system of gravity pipes enfering 36 inch caissons, and then pump the collected flow. The layout of piping, sizes, and arrangements may be viewed on the ATE site plans.

The "W" series pumps (deep and shallow) are housed in small diameter steel casings (<= 16 inch), with manhole encasements from grade to 7 feet down surrounding the casing pipe. The manholes provide access to the pumps and mounting space for the electrical appurtenances, while permitting truck traffic unobstructed movement above grade. The same criteria exist for the 36 inch caissons, except that electrical and mechanical appurtenances are housed in adjacent manholes.

Mechanical

Deep Wells (W-21,-24,-28,-29):
The deep well pumps are 4 inch diameter submersible units, manufactured by Grundfos. Their discharges are tied into a common header system of 2 inch and 2-1/2 inch schedule 80, galvanized, carbon steel pipe. The system discharges into the pump control house, located at the northwest corner of Freeman's property. All pumps are suspended from the steel casing by a pitless adapter. Discharge piping connected to the pump housing runs up through the well casing, and terminates in the adapter fitting which mates with an appurtenance welded to the well casing wall. From this point, discharge piping threads to the outside wall of the casing, runs through the manhole interior, and enters the underground 6 feet below grade.

Pumps may be extracted by removing the manhole cover at grade, and attaching to the discharge pipe in the well casing. The manhole covers are positioned over the well casings to permit withdrawal of the pipe/pump arrangement above grade. For details of the electrical appurtenances, the reader should refer to the electrical section of this document and the electrical plans.

The well casings are vented into the manhole space, and the manholes are vented through a 1-1/2 inch galvanized, schedule 80, carbon steel pipe system, terminated 10 feet above grade throughout the plant site. Standard OPW fittings with birdscreens are used to cap vents. The vent piping is installed at the same elevation as the electrical underground raceways serving the wells.

Shallow Well Pumps (W-31 thru W-37, & RC-1,-2,-3):
The "W" series pumps are manufactured by Grundfos and are similar to the deep well units. Their installation is identical to that described above for the deep well units. The "RC" series pumps are self supporting submersible 10 inch pumps manufactured by Myers. All shallow well pumps discharge into a common piping system of 1-1/2 inch and 2 inch schedule 80, galvanized, carbon steel threaded pipe. The system parallels the discharge piping for the deep wells, but terminates in the sanitary sewer, west of the pump control house in the northwest corner of the plant site. All the details of construction noted above for the deep well system, also apply to these installations. The shallow well pump discharges differ from the deep system in that their flows are metered at three manholes contiguous to RC-3, RC-1, and building 11.

Electrical

Power and Control Voltages:
The entire pumping system operates on 480V, 3- phase, 3-wire service. However, since the various pumps are located in different areas of the plant (See Drawings), three sources of power are employed to run all the pump systems: W-24,-31,-32,-33,-34,-35, and RC-2 are controlled and powered from in the Inert Gas Generator Room at Building 5; W-21,-29,-37 and RC-1,-3 are controlled and powered from Building 42; and W-28 is controlled and powered from Building 33.
NOTE: The groundwater pumping system was installed prior to the completion of the plant wide 480V system; consequently, dry transformers (480V/230V) were installed to boost the voltage to 480V. Until such time as the conversion is complete, and the transformers removed, service personnel must be aware that these devices and their disconnects/fuses exist.

All circuits are positively grounded via dedicated conductors. The disconnect and controls for each pump are mounted in a separate control panel; this panel houses the circuit breaker, control transformer, starter, control relays, and alarm indicators for a particular pump. All control circuits derive their power from a 480V/120V control transformer tapped off the load side of the circuit breaker disconnect. It should be noted that in these areas panels controlling pumps in deep and shallow wells are mounted side by side, but the control logic of the deep system and shallow system differ. Hence, close attention should be maintained when working with individual pump panels, as adjacent enclosures will not necessarily house identical equipment, and circuits.

Layout of the Electrical System for the Southwest area:
480 volt power enters the south wall of the inert gas generator room in building 5, and is distributed by Panel 1. Control panels for the well pumps are located on the west wall of the room. High level alarm circuit power is derived from the alarm panel and then brought into the 8 control panels. Separate power and control circuits emanate from the 8 panels for each pump; they exit the west wall of the generator room, and become explosion proof at the exterior boundary. The raceways enter pullboxes mounted on the outside face of the west wall of the inert gas generator room of building 5. The raceways for W-32,-33,-34,-35 exit the pullboxes and proceed directly to the underground well installations. The raceways for W-24,-31, and RC-2 move underground to a set of junction boxes mounted on the outside west wall of building 20A; the raceways continue back underground to the well installations. The circuits terminate in manholes which house the hardware and provide access to the pump. The power circuits to all wells are 480 volt- 3 phase service, powering matching motors. The control circuits to all wells except W-24, are low voltage (< 12 v), and intrinsically safe. W-24 requires no level controls as it will be operating continuously from the deep aquifers. Specific information on wire sizes, circuit layout, hardware specifications, or other components of the system may be determined from the plans and specifications for construction published by ATE.

Control Panel Logic:
In the southwest area, three different sets of logic are used to control pumping operations. The deep well (W-24) is controlled to produce a continuous flow to the point of discharge. The controls are manual and provide the operator on/off capability. To monitor the power circuit for loss of suction to the pump a "real power" monitor is included in the circuitry, which will drop the incoming service to the motor if power use in the motor load circuit is abnormally low. The sensor will interrupt the power to the motor and hold the circuit open for the length of time set by the operator (range = 1-4 hours). After the prescribed time for the circuit to be open has elapsed, the sensor will automatically reset and permit the load circuit to energize for 10 seconds. If the loss of suction condition is corrected, the sensor will permit the load to remain on line. If the loss of suction condition has not been corrected and abnormally low power is utilized for the initial 10 seconds power is brought back on line, the sensor will interrupt the power a second time. This procedure will be repeated as required.

The southwest shallow well pumps (W-31 thru W-35) are controlled by the instantaneous water level sensed in the well casing. The control is accomplished by 5 separate conductors, suspended in the well casing from the manhole space at grade elevation. All sensing is accomplished with immersion electrodes. One conductor is dedicated to providing ground return for the system which provides a complete circuit for the remaining 4 conductors as they are immersed by the groundwater within the casing. The ground return electrode is set at the lowest depth in the well, measured from the top of the casing, in the manhole space. The next electrode set above the ground electrode monitors low water level in the casing. If the electrode is immersed, a complete circuit is made through the ground return conductor and no alarm is indicated. Should the water level fall below the low water level set point in the casing, the electrode will be "dry," and close the alarm circuit to indicate the low water condition at the control panel. The primary circuit component that accomplishes the logic described is an intrinsically safe relay. The relay is designed to use energy below the amount that would develop an explosive condition (i.e., intrinsically safe). The remaining control relays sensing level of water in the casing are of the same design, with one difference; one intrinsically safe relay works in tandem with the next two electrodes to turn power ON and OFF to the pump. A rising water surface in the well casing will submerge the pump off electrode and accomplish nothing. The continuation of the rising water surface will then reach/immerse the electrode for pump ON. This action powers the pump, which results in lowering the water surface in the well casing. The completed pump ON circuit simultaneously activates the pump OFF circuit within the same relay, so that a falling water level in the well, upon dropping below the pump OFF electrode, causes the power circuit to the pump to open and shut the pump down. If the water surface in the well casing should continue to rise after the pump ON level is reached, with the pump working, a fifth electrode is positioned in the casing to sense high water alarm. The circuit components are identical to those of the low water alarm circuit. This condition would be present if the pump were not on line, although called for, or if the pump could not keep up with the inflow to the well casing. In either situation an inspection is required by the operator. Coincidental, with the respective conditions cited above, indicator lights with reset/test stations are provided in parallel circuits. A master control selector is also provided for hand/off/auto operation. Auto position activates all of the control logic described hereinbefore; off position deactivates the pump ON/OFF control and maintains an open circuit for power to the pump; the hand position also deactivates the pump ON/OFF control, but maintains power to the pump. The specifics of the control circuitry should be viewed on the appropriate ATE drawings to ascertain normal position of contacts, and location of protective devices for the circuitry described.

The controls for the shallow ranney collector (RC-2) are identical to those described for the shallow wells (W-31 thru W-35), except that additional sensors are provided specific to the pumps being operated. The ranney collector pump is by a different manufacturer (Myers Co.) than the well casing pumps (Grundfos). The ranney pump is provided with a motor heat sensor and seal leak test probe, as built by the manufacturer. These sensors are picked up by conductors that run integrally with the power conductors. Their circuits are also provided with indicator/test lights and stations for monitoring by the operator. In all other respects, the operation of the ranney pump is identical to the shallow well pumps, W-31 thru W-35, for the southwest area.

<u>Deep Well System(W-30)</u>

The deep well pump (W-30) is installed at a depth of 275 feet below ground level. The 75-hp submersible pump is driven by a variable frequency controller capable of operating in either a constant speed or constant discharge pressure mode with capacity up to 750 gpm. The discharge piping from W-30 enters the Pump/Control Building which houses the backpressure regulator, pressure relief valve, filters, flow measuring equipment and associated controls. Details of this installation is shown on AT&E's Drawings.

Flow from W-30 is used for non-potable cooling water inside the plant. The well is intended to run continuously at a minimum flow of 350 gpm. In the event that plant requirements drop below 350 gpm, the excess flow is discharge to the storm water collection and discharge system.

3.18 SURFACE WATER RUNOFF

Current and future surface water runoff and proposed controls have been described in detail in the previously submitted Triad Engineering Incorporated report entitled "Final Report: Surface Runoff Control Facilities, Freeman Chemical Corporation, Saukville, Wisconsin" dated February 1986. Construction activities, under Triad Engineering supervision, are currently underway.

3.18A UP-DATE ON SURFACE WATER RUNOFF

TEI Corporation has completed construction of the surface runoff control facilities at the Saukville plant. As-constructed drawings are presented in Figure 3-12A, Plant Drainage System, and Figure 3-13A, Storm Sewer/Surface Drainage. As indicated, this first drawing depicts the paved areas on-site and plant drainage. The latter drawing differentiates the river storm sewer system from the storm basin sewer system.

3.19A EVALUATION OF CORRECTIVE MEASURES

The groundwater contamination remediation which is being implemented at Freeman Chemical, consisting of the combined use of groundwater drainage and pumping systems, has been accomplished successfully at a number of different locations. The remediation principle is quite simple in that the contaminated groundwater is intercepted by underground trenches and wells and is then pumped up and out of the aquifer. The withdrawal of the groundwater creates a cone of depression around the underground trench or well which induces the flow of groundwater and the contaminants towards the drainage system. The extracted groundwater can then be treated and pumped back into the aquifer or pumped to a treatment system. Examples of the use of these combined systems, along with the construction details, etc. can be found in EPA's "State-of-the-Art of Aquifer Restoration", Volume 1, November 1984 (EPA/600/2-84/1823) and the Proceedings of the National Conference on Hazardous Materials, March 16-18, 1987, Washington, D.C., among others.

Overall the system is quite reliable with very little risk should any of the components fail. The useful life of the Ranney Collectors and piping utilized in their construction is expected to be 25 to 30 years or longer. The system components with the lowest useful life are the submersible pumps. The projected mean time to failure for these pumps is about 5 to 8 years.

Although regular inspections are being conducted to ensure the systems are operating, periodic pump failure for the shallow water Ranney Collectors or wells would not be considered critical since the majority of the other shallow water collectors would still be operating. In addition, since the shallow groundwaters move slowly, the pumps could be replaced in time to draw back the water before it has an opportunity to travel any distance.

A more critical system failure would result if malfunction would occur to the on-site deep well, W-30. This well was constructed to collect any contaminants that have reached the dolomite aquifer, the principal source of drinking water in

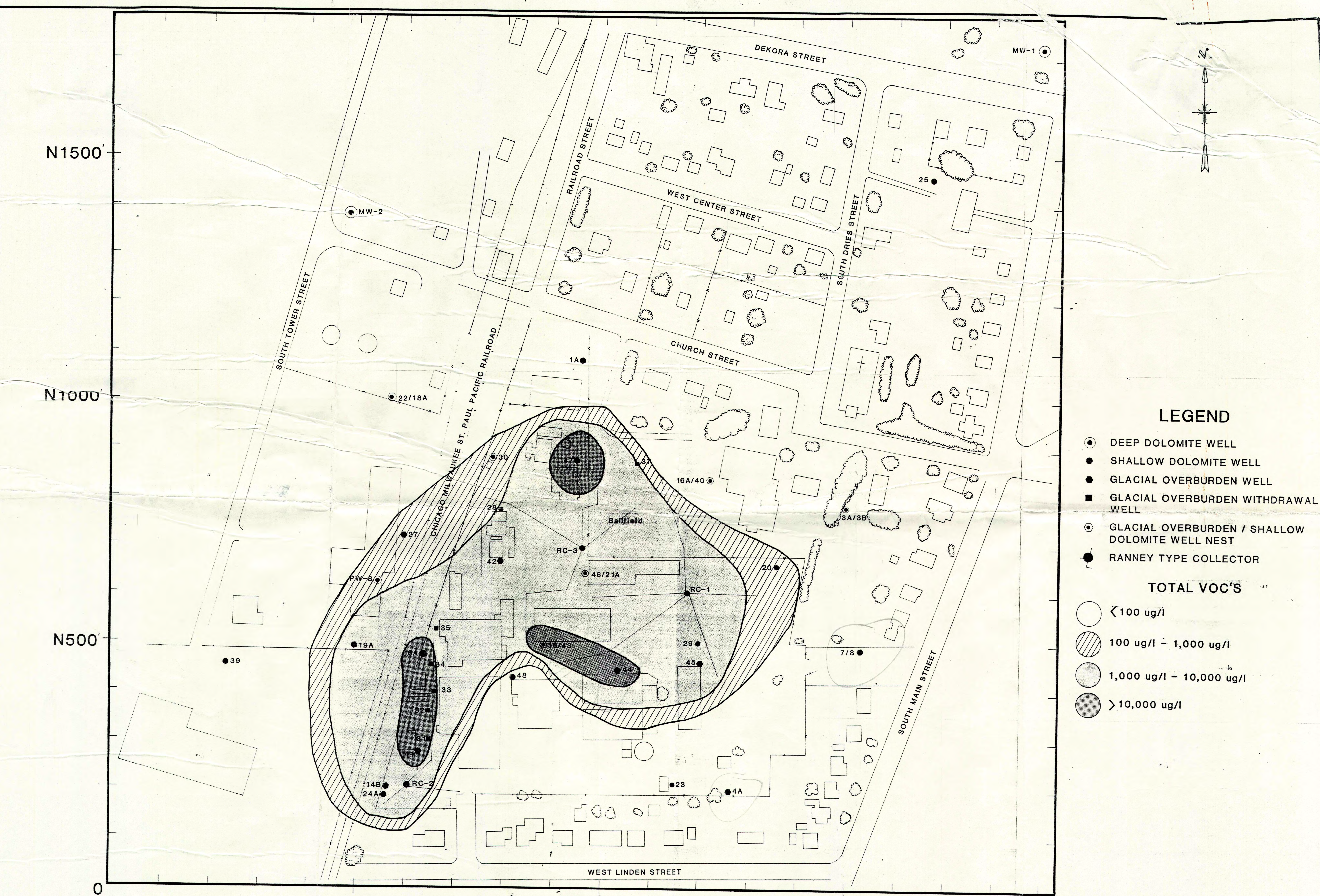
Saukville. Therefore, to minimize the downtime of this system, a second back-up pump has been purchased and remains on-site as an immediate replacement pump. Additionally, the pump is driven by a variable frequency controller (mean time to failure of 10 years). A pumptrol has been installed as a back-up to this component which would allow the pump to continue to operate at a set rate even if the variable frequency controller would malfunction.

With regard to safety, substances of concern at the Freeman Chemical Saukville facility consist primarily of volatile organics. The safety factors to be stressed when these compounds are present are fire, explosion and human exposure.

Freeman Chemical's entire manufacturing involves the handling of chemicals in much more concentrated forms than found in the contaminated groundwater and, therefore, the necessary health and safety precautions on-site are constantly and rigorously enforced. Safety and fire protection programs have been implemented to ensure that all activities are performed in a manner that prevents personal injury and unauthorized discharges to the environment. Safety and fire protection training are presently conducted at regular intervals for all plant personnel. Specific remedial action safety plans are to be submitted as a part of the Consent Order Task 3 plan submittals.

Extent of contamination within various media was discussed under Sections 2.2 through 2.2A2. As indicated in the latter section, VOC concentrations from the soil handling activities were not detected at the 0.2 ppm level. OSHA's 8-hour time weighted averages for employee exposure to most of the air contaminants of concern is from 100 to 200 ppm, with benzene having the lowest limit of 10 ppm. Since the area produces low air contaminant concentrations and is generally in a non-working area of the property, health concerns are not considered a problem.

With regard to fire and explosions, OSHA indicates that benzene with "a concentration exceeding 3,250 ppm is considered a potential fire explosion hazard." The highest concentrations of total VOC's occurring in the contaminated groundwater is at RC-1 which contains about 150 ppm. The concentration of total VOC's being pumped to the Village POTW averages only about 15 ppm. These values are considerably lower than the 3,250 ppm of benzene alone which is considered a fire or explosion hazard concentration.



Freeman Chemical Co.
Saukville, Wisconsin
Approximate Extent of Glacial Aquifer Contamination - Winter 1986

Date: 5/27/87	Pg. 2-4	Drawn By: C.E.W.
Scale: As Noted		Approved By: J.D.K.

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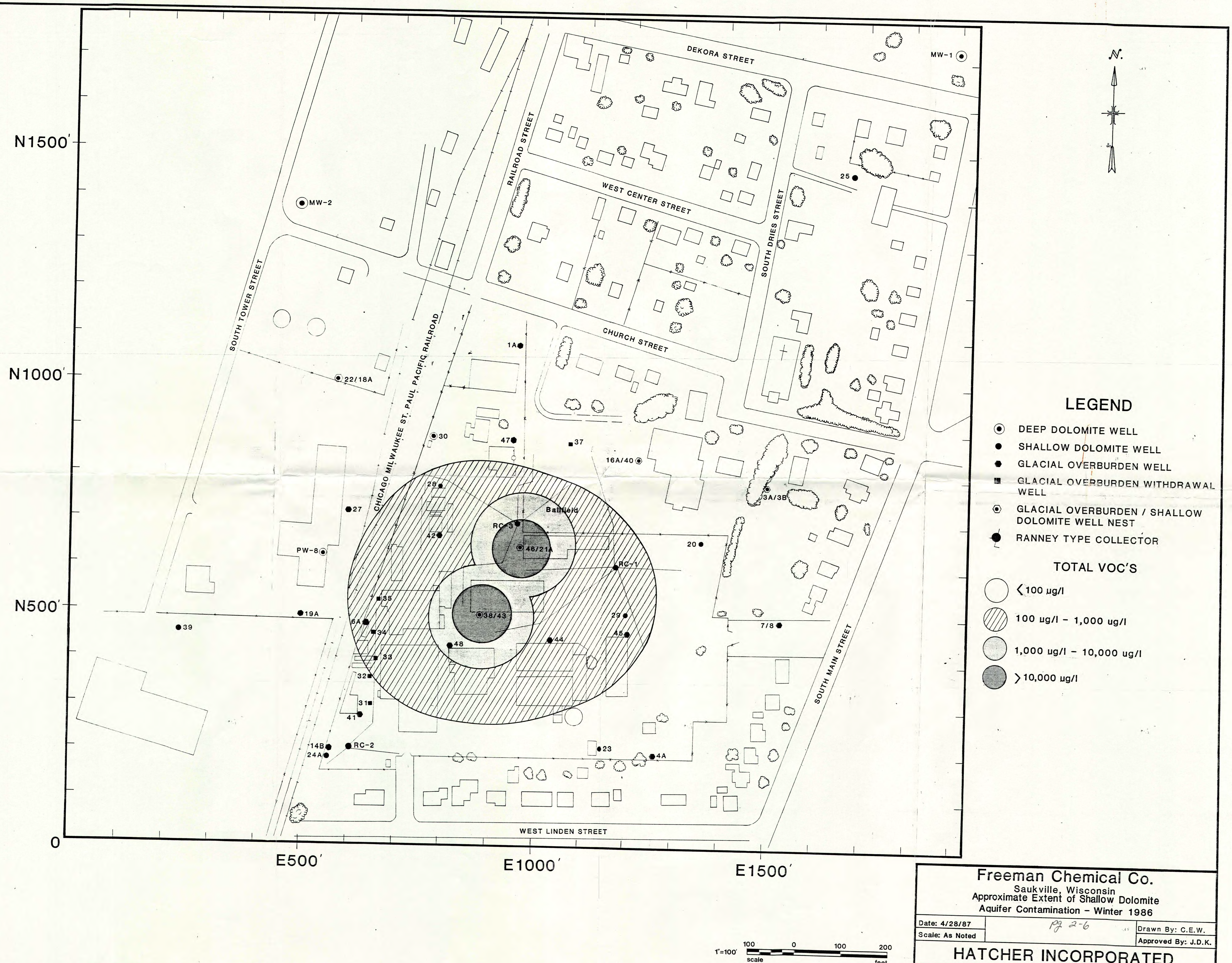
Figure No.: 2-2	BRRTS # 02-46-000767A 19870601 _ 43 Site Construction-	Drawing No.:



Freeman Chemical Co.
Saukville, Wisconsin
Approximate Extent of Shallow Dolomite
Aquifer Contamination - Winter 1986

Date: 4/28/87	pg 2-6	Drawn By: C.E.W.
Scale: As Noted		Approved By: J.D.K.

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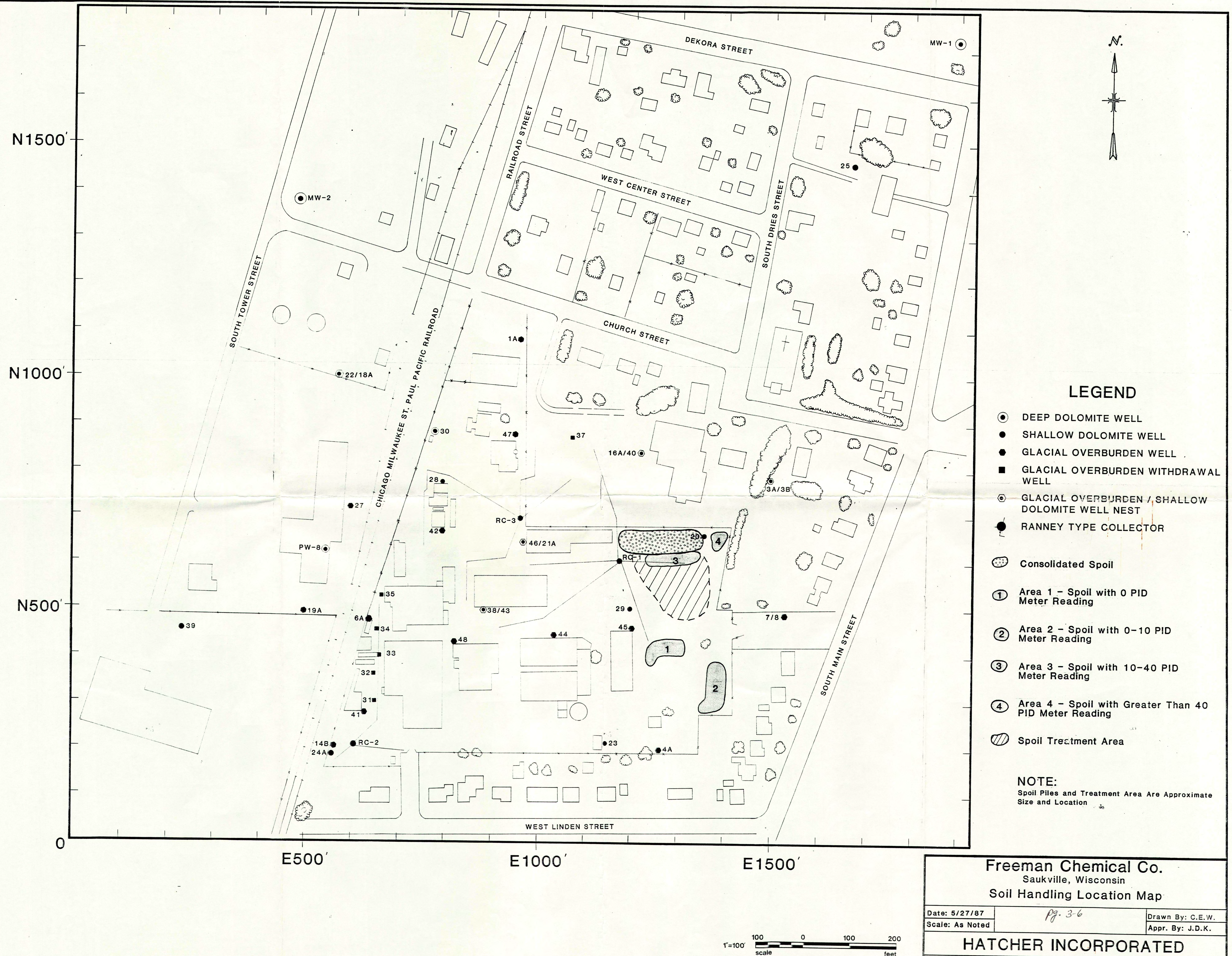
Figure No.: 2-3	BRRTS# 02-46-000767B	Drawing No.:



Freeman Chemical Co.
Saukville, Wisconsin
Soil Handling Location Map

Date: 5/27/87	Pg. 3-6	Drawn By: C.E.W.
Scale: As Noted		Appr. By: J.D.K.

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Figure No.:		Drawing No.:
3-2	BRRTS # 02-46-000767C 19870601_43_Site_Construction_Rpt_A1	0103-C10-011