WARZYN

Final
Work Plan
13076.11

Remedial Investigation/ Feasibility Study
Wausau NPL Site
Wausau, Wisconsin

Prepared for:

United States Environmental Protection Agency
Region V
Chicago, Illinois

Prepared by:

Warzyn Engineering Inc.
Madison, Wisconsin

September 1987

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Engineers & Scientists
Environmental Services
Waste Management
Water Resources
Site Development
Special Structures
Geotechnical Analysis

September 4, 1987
13076.12

Ms. Margaret M. Guerriero
Wausau Project Officer
Environmental Protection Agency
5 HR-11
Region V
230 S. Dearborn Street
Chicago, IL 60604

Re: Revised Work Plan
Wausau Wisconsin WPL Site RI/FS

Dear Ms. Guerriero:

Attached is the revised Work Plan for the Wausau NPL Site RI/FS. Revisions were incorporated based on your comments on the Draft Plan which were received August 25, 1987.

Please contact us if you have questions.

Sincerely,

WARZYN ENGINEERING INC.

Dennis L. Iverson, P.E.
Project Manager

DLI/jap/DWH
[jap-109-88]

cc: Mr. Vincent Gonzales, U.S. Environmental Protection Agency
Mr. Gary Kulibert, WDNR (2)
Mr. Mark Giesfeldt, WDNR (2)

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Remedial Investigation/ Feasibility Study Wausau NPL Site Wausau, Wisconsin

September 1987

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WORK PLAN
CITY OF WAUSAU MUNICIPAL WELL FIELD
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SECTION 1.0 - INTRODUCTION

This Work Plan describes the scope of activities required to complete a Remedial Investigation/Feasibility Study (RI/FS) for the City of Wausau Well Field Project at Wausau, Wisconsin. The Work Plan includes background information on the project site, a description of the problem, assessment of past investigations and information, a task-by-task description of the project activities and a project schedule.

The City's municipal well field (Figure 1) is contaminated with volatile organic compounds (VOCs) from several possible sources. As shown on Figure 1, the municipal well field under investigation is separated into two areas, one on the east side of the Wisconsin River and the other on the west side. Groundwater contamination studies have been conducted in the area of the well field sites; however, results to date are inconclusive as to the sources and extent of contamination. Potential sources have been identified, but data gaps exist on plume definition, aquifer characteristics and the effects of river stage and groundwater pumping on flow direction and velocity of groundwater.

The major goals and objectives of the RI and FS include:

- Identification of contaminant sources
- Determination of the nature and extent of impacts
- Determination of probable fate of contaminants through time
- Assessment of the dangers to public health associated with the contamination

- Development of remedial action alternatives to address varying levels of response
- Evaluation of response actions utilizing environmental, public health, economic, institutional, and technical reliability criteria

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SECTION 2.0 - BACKGROUND INFORMATION

PREVIOUS AND CURRENT REMEDIAL ACTIONS

Upon identification of VOC contamination, operation of the individual City of Wausau water supply wells was modified in order to limit the use of contaminated wells. However, in mid-1983, water in the Wausau supply system exceeded recommended drinking water standards for VOCs. In Spring 1984, the City of Wausau and the Wisconsin Department of Natural Resources (WDNR) requested U.S. EPA emergency assistance. The U.S. EPA Emergency Response Group installed temporary granular activated carbon (GAC) adsorption units on Production Well CW6, while a packed tower stripper study was being completed by Michigan Technical University (MTU). One VOC stripper was installed in August 1984, through funding by EPA to treat water from Production Well CW4. A second stripper was subsequently purchased by the City to treat water from either Production Wells CW3 or CW6. The GAC units were shut down on October 29, 1984. The City has been blending treated water with well water from uncontaminated supply sources to reduce VOC concentration in the water supply distribution system.

Data indicate that prior to treatment (pre-July 1984), the water supply consistently contained TCE with concentrations ranging from detectable levels to 80 ug/L. Lower levels of PCE and DCE were identified shortly after discovery of the contamination, probably before blending had reduced levels of VOCs. Following installation of the treatment systems, the water supply distribution system has had relatively low levels of VOCs (generally < 5 ug/L). These levels are dependent on continued effective operation of the treatment system, the influent VOC concentrations from each well, and continued use of the two clean wells (Production Wells CW7 and CW9).

Wausau Chemical Company, located between Production Wells CW3 and CW4, has had documented releases of PCE. The groundwater beneath their facility has relatively high levels of VOCs (e.g., PCE/ TCE/DCE of 20,000/8,800/8,880 ug/L respectively at well Monitoring Well WC6A in April 1985).

Wausau Chemical Company has retained a technical consultant and currently is operating a groundwater extraction system and a VOC air stripper. Reports on the performance of the stripper have been submitted to the WDNR.

ASSESSMENT OF EXISTING CONDITIONS

Topography and Hydrology

The topography in the Wausau area is controlled by the Pre-Cambrian bedrock topography, glacial deposition and post-glacial erosion. The glacial terrane consists of relatively low rolling hills marked with topographic highs formed by the bedrock. The Wisconsin River has created a major valley and flood plain by erosion into the glacial deposits. Valley slopes can be relatively steep adjacent to the river's edge, which occurs in the vicinity of the East study area.

The Wisconsin River stage in the study area is controlled by the Wausau Dam, which is located a short distance downstream (south) of the study area. The Rothschild Dam controls the Wisconsin River stages downstream of the Wausau Dam. Member companies of the Wisconsin Valley Improvement Company (WVIC) operate the Wausau and Rothschild Dams. Stage records for these two dams are available from WVIC, and will be used to establish historic river stages.

Hydrogeology

The aquifer within the Wausau area consists of glacial outwash deposits. Figure 2 is a cross-section of the East study area which appears representative of the study area soil types. The outwash deposits appear laterally extensive and consist of fine to coarse sand. Existing studies report only minor silty sand units within the aquifer. The aquifer thickness is controlled by the topography on the Pre-Cambrian igneous and metamorphic bedrock. Although the bedrock is used as an aquifer for domestic supplies in some areas, it has a very low hydraulic conductivity relative to the sand aquifer.

The bedrock topography has been characterized through seismic surveys on both sides of the Wisconsin River (Weston, 1985) and wells which have extended to bedrock. These sources of information indicate a major bedrock valley that roughly parallels the present Wisconsin River (see Weston, 1985 bedrock maps). The bedrock slopes to the east at a relatively uniform moderate slope (36 feet/mile) in the vicinity of Production Wells CW3 and CW4. The bedrock surface near Production Wells CW6, CW7 and CW9 slopes upward to the northwest away from the river. The slope is cut by two deep valleys which are approximately 100 feet deep.

Under natural conditions, the Wisconsin River is a regional discharge area for groundwater flow which occurs primarily in the sand aquifer (Lippelt and Hennings, 1981). Although river stage records are not presented with the groundwater levels in available reports, it appears the groundwater levels shown on Figures 3 and 4 are below the river stage due to the City wells inducing infiltration from the river. Fluctuations in river stage may have

an effect on the rate of recharge from the river, which in turn, affects groundwater flow directions and the amount of dilution of VOCs at certain production and monitoring well locations.

Figure 2 presents a vertical flow net based on potentiometric contours developed from water level monitoring conducted by Roy F. Weston, in April 1985. The flow net indicates the presence of a groundwater divide between Production Wells CW3 and CW4. This divide is shown on the Water Table Map (Figure 3), close to Production Well CW4. The small cone of depression shown at Production Well CW4 was probably due to infrequent pumpage at Well CW4. The 1985 Water Table Map indicates that the divide between Production Wells CW3 and CW4 extended below the Wausau Checmical site. Downward vertical gradients were observed at Monitoring Well Nest WC3 (located on the crest of the groundwater divide), whereas upward flow occurred in the shallow portion of the aquifer at Monitoring Well Nest WC5. The groundwater divide observed during the 1985 groundwater monitoring may no longer extend below Wausau Chemical Company due to the operation of extraction wells at the site.

Groundwater recharge from the vicinity of Monitoring Well Nest WC3 flows deep within the aquifer appears to and discharge to Production Well CW4 when pumping, and to Production Well CW3. Recharge that occurs west of Monitoring Well Nest WC3 remains relatively shallow, but appears to discharge to Production Well CW3 and/or the Wergin well. Recharge at the Wausau Chemical Company site may or may not discharge to the Wisconsin River, depending on river stages and pumping conditions.

Recent hydrogeologic investigations (RMT/Geraghty & Miller Inc., 1987) indicate Production Wells CW6, CW7 and CW9 exert considerable influence on groundwater flow conditions on the west side of the Wisconsin River (Figure 4). Water levels recorded during sustained production well pumpage indicate a large asymmetric cone(s) of depression exists which is several thousand feet in diameter. The orientation of the cone of depression appears to be strongly controlled by the relative pumping rates of the three production wells and the proximity of induced recharge areas (Wisconsin River and Bos Creek). Comparison of groundwater levels at Monitoring Well Nest R1D/R1S, R2D/R2S, and R-3S/R3D indicates strong vertically downward gradients (± 0.007 ft/ft to 0.025 ft/ft) (recharge conditions) relative to the horizontal gradient (± 0.01ft/ft NE). These vertically downward gradients may be the result of induced recharge caused by production well pumpage, by a small impoundment area on Bos Creek or by a combination of these factors.

GROUNDWATER QUALITY

East Study Area

The vertical distribution of contaminants between Production Wells CW3 and CW4 are shown on Figure 5. The inferred contaminant plumes shown on this cross-section are based on the inferred flow directions shown on Figure 2 and the VOC concentrations obtained from groundwater quality monitoring conducted by Roy F. Weston Inc. in November 1984. The contaminants present and the flow directions between Monitoring Well WC5A and the wells surrounding the Wergin well indicate a probable continuous plume below some installed wells.

The plume observed at the surface in Monitoring Well WC6A and at depth at Well B3A contains all three of the primary VOCs (PCE/TCE/DCE) identified on the east site. The flow directions between Well WC3A and Production Well CW3 indicate a probable continuous plume below the installed monitoring wells. Monitoring Wells FVD1, FVD2, FVD3, FVD5 and GM9S also indicate the presence of PCE and TCE at the water table between Monitoring Well WC3A and Production Well CW3. Recently installed (August-September 1986) deep Monitoring Wells GC6D, GM7D and GM8D indicate slightly elevated concentrations of PCE, TCE and DCE. However, these monitoring wells are screened at the bedrock surface approximately 30 to 40 feet below the screened portion of Production Well CW3 and therefore may be screened too deep to detect a large portion of the plume.

Monitoring Well MW7A is screened at a depth of 69.5 feet (approximately the same depth as the upper portion of the screen for Production Well CW3). Analyses of groundwater from Monitoring Well MW7A indicate PCE, TCE and DCE concentrations of 900, 58 and 260 ug/l, respectively, during the April 1986 monitoring period. Further hydrogeologic investigation is necessary to determine the contaminant plume at elevations adjacent to the pumping well screen(s). Figure 6 presents a comparison of the total VOCs observed at selected wells on each side of the Wisconsin River and well pumping history. Observations that can be made from these comparisons are:

- VOCs were observed at Production Well CW4 only after it was placed into continuous use for several months
- The VOCs at the Wergin well decreased substantially after Well CW3 pumpage was shifted to Production Well CW4 for several months in 1982
- The VOC concentrations at Monitoring Well Nest MW10 in the vicinity of Marathon Box appear to be strongly related to the pumping rate at Production Well CW4.

These observations indicate that Production Well CW4, even when pumped intermittently, has an effect on VOC concentration at Production Well CW3 and Wergin. Based on this information, it therefore appears the source(s) is (are) influenced by pumpage by both Production Wells CW3 and CW4, and are probably located between the two wells. The correlation of concentration at Monitoring Well Nest MW10 with pumpage at Production Well CW4 indicates that as the cone of depression from Well CW4 developed during 1984 and then again in 1986, the flow direction changed and Monitoring Well Nest MW10 intercepted contaminant flow, probably from the north. Prior to the continuous pumpage at Production Well CW4, this contaminant plume may have been migrating toward Production Well CW3 and the Wergin Well.

West Study Area

Prior to the RMT investigation of the Marathon Electric facility, several monitoring wells were installed in the west study area with little success in detecting the plume associated with VOC contamination of Production Well CW6. The four monitoring wells installed near Production Well CW6 (Monitoring Wells W5, W6, W7, W8) were all placed above the screened interval of Production Well CW6. Based on observations from the east study area (see cross-section in Figures 2 and 5), the flow to a production well which is pumping from the base of the aquifer creates a downward vertical gradient at some distance away from the pumping well. Therefore, unless the source is adjacent to the pumping well, contaminants are not expected to be present in substantial concentrations at the pumping well above the screened interval of the pumping well. Recently installed Monitoring Well Nests R1S/R1D, R2S/R2D, and R3S/R3D indicate downward vertical gradients which may be associated with the pumping of the municipal production wells or effects of Bos Creek. These

monitoring wells are located north of the Marathon Electric facility (refer to Figure 4). The results of groundwater quality monitoring conducted by RMT Inc., during September 1986 indicate a maximum TCE concentration of 3,190 ug/l at Monitoring Well R4D. Elevated TCE concentrations were also detected at Monitoring Wells R2S (29.2 ug/L), R2D (1,140 ug/l), R3S (49.7 ug/L), R3D (4.4 ug/L) and C2S (615 ug/L). A summary of water quality monitoring for VOCs at the west study area is presented in Table 1. These concentrations appear to indicate a contamination source within close proximity. Further investigation is necessary to determine the extent of groundwater impact, identify the source(s) of contamination and determine the effect of municipal well pumpage on groundwater flow in the vicinity of Marathon Electric.

Elevated concentrations of TCE were also detected in Monitoring Wells W4C (18.8 ug/L) and W7 (62.9 ug/L). These wells are located west of Production Well CW6 and are screened at the water table. These elevated TCE concentrations may indicate a potential VOC source west of Production Well CW6 and therefore, warrant further investigation.

The CH2M Hill study (February 1986) of the abandoned City of Wausau Landfill (see Figure 4) indicates that groundwater flow in the vicinity of the landfill is toward the southeast and the Wisconsin River. Groundwater flow in this area does not appear to indicate an influence from municipal wells to the north. Several rounds of groundwater quality monitoring for VOCs have been conducted at landfill monitoring wells (CH2M Hill, 1986; RMT, 1987). The groundwater quality data indicate TCE concentrations between 280 and 1,058 ug/L at Monitoring Well C2S. These elevated concentrations appear to be associated with a groundwater contamination source area to the north of the landfill. With

the exception of Monitoring Well C4D, TCE concentrations at the other landfill monitoring wells are generally low (ND to 12.7 ug/L). Monitoring Well C4D has exhibited increasing TCE concentrations over the past three sampling rounds. This trend warrants further investigation.

In addition to the VOC analyses summarized in Table 1, analyses of several inorganic and hazardous substance list (HSL) parameters have also been recently performed (RMT/Geraghty & Miller Inc., 1987). Groundwater samples from Monitoring Wells W1D, R2D, C2S, R4D, GM4S and GM4D were analyzed for HSL semi-volatiles, pesticides and PCBs. The HSL analyses tentatively identified various phthalate compounds in several of the samples. However, the concentrations of these compounds were below specified detection limits and therefore, could not be quantified.

SECTION 3.0 - RI/FS WORK PLAN

TASK 1 - PROJECT PLANS AND MANAGEMENT

This task includes preparation of planning documents necessary for the performance of the RI/FS. Plans are considered working documents and may require modification in the field during the RI/FS. Documents developed in this task will be submitted to U.S. EPA for review and comment and/or approval prior to commencing associated work.

Subtask 1.1 - Work Plan Preparation

The Work Plan provides detailed descriptions of tasks to be performed during the RI/FS. This Work Plan was prepared based upon a review of existing site and regional data, discussions with representatives of the U.S. EPA and a site visit by Warzyn personnel. Additional tasks and changes contained in the U.S. EPA's revised Statement of Work (SOW) have been incorporated into the Plan. These Plan revisions and comments on the original Work Plan were discussed with U.S. EPA representatives in a meeting in February 1987. Review comments received on the Plan were considered and incorporated into this Final Work Plan.

Subtask 1.2 - Project Plans

1.2.1 Health and Safety Plan

A Site Health and Safety Plan will be prepared to protect the investigation team and nearby residents from potential hazards which may be present as a result of on-site investigation activities. The Plan will:

- Address applicable regulatory requirements and detail personnel responsibilities, protective equipment, procedures and protocols, decontamination, training and medical surveillance

- Identify problems or hazards that may be encountered and their solutions
- Indicate procedures for protecting third parties, if necessary, such as residents, visitors and transient motorists
- Take into consideration facility conditions and be consistent with:
  - Section 111(c) (6) of CERCLA
  - EPA Order 1440.1 - Respiratory Protection
  - EPA Order 1440.3 - Health and Safety Requirements for Employees Engaged in Field Activities
  - EPA Occupational Health and Safety Manual
  - EPA Interim Standard Operating Safety Procedures and other EPA guidance as developed by EPA

In conducting the health and safety assessement, available information on the site will be examined and reviewed to identify potential hazards. Such information will be used in selecting and implementing procedures that provide nearby residents and investigators with adequate warnings and safeguards. The Site Health and Safety Plan will specify the following:

- Protective clothing and respiratory equipment to be worn
- Air monitoring to be performed
- Action levels at which respiratory protection will be upgraded
- Decontamination procedures

The Site Health and Safety Plan will be developed in accordance with applicable U.S. EPA guidance documents and requirements. Applicable OSHA and NIOSH requirements will be followed. Review comments from U.S. EPA on the Draft Site Health and Safety Plan will be considered and incorporated into the Final Site Health and Safety Plan. The Site Health and Safety Plan will be updated for the Phase II investigation, based on results of Phase I and the scope of the Phase II investigation.

1.2.2 Sampling Plan

Individual Sampling Plans will be developed to cover the sampling and data gathering efforts described in Phase I and Phase II of this Work Plan. Preparation of the Phase II Sampling Plan will be completed after developing the scope of work for Phase II. Specifically, the Sampling Plans will address the following topics:

- Sample types and locations
- Sampling equipment and procedures
- Sampling QA/QC
- Sample handling and preservation
- Chain of custody procedures
- Sample documentation
- Sample shipping
- Analytical arrangements
- Sampling team organization, responsibilities and training
- Scheduling
- Investigation types and methods

The Sampling Plans will be developed in accordance with applicable U.S. EPA guidance documents. Review comments from the U.S. EPA on the Draft Sampling Plans will be considered and incorporated into the Final Sampling Plans.

1.2.3 Quality Assurance Project Plan (QAPP)

The Quality Assurance Project Plan will be developed to cover both on and off-site activities. The plan will cover data collection, reduction, and analyses, and address analytical testing, surveying, soil testing, drilling, and sampling activities. Development of the plan will be in accordance with applicable U.S. EPA guidance documents.

It is assumed that review by the U.S. EPA Quality Assurance Office will result in minimal changes to the draft document.

1.2.4 Data Management and Documentation Plan

A plan will be developed in cooperation with the U.S. EPA and initiated to document and track investigation data and results. The plan will identify and set up data documentation materials and procedures(including computer-based storage systems), project file requirements and project-related progress reporting procedures and documents.

Review comments from U.S. EPA on the Draft Data Management and Documentation Plan will be considered and incorporated into the Final Data Management and Documentation Plan.

Subtask 1.3 Project Management

Project Management efforts will play a key role in the success of the Wausau RI/FS project. The Project Manager will have overall responsibility for Warzyn's administrative and technical aspects of the project. He will direct staff in completing the following major project activities:

- Organizing a project team with the skills and experience to complete the project requirements
- Planning and implementation of field and laboratory investigation
- Maintaining quality control and quality assurance in field, laboratory and reporting activities
- Monitoring the schedule and budget
- Preparing and submitting project documents and graphics in accordance with the project schedule and U.S. EPA Standards
- Identifying, selecting and developing agreements with subcontrctors
- Communicating project-related information to staff

In addition, the Project Manager will participate in meetings with U.S. EPA personnel to discuss project goals, progress and financial status.

Project deliverables will be distributed as follows:

Number of Copies	Recipients
3	Project Officer (Margaret Guerriero)
1	Contracting Officer (Vincent Gonzales)
2	State Project Manager (Mark Giesfeldt)
2	WDNR North Central District (Gary Kulibert)

Additional copies will be submitted to the project officer upon request.

The Project Manager will also prepare and submit monthly progress reports to the U.S. EPA. Both a technical progress report and a financial management report will be provided on a monthly basis.

Technical progress reports will contain the following project information:

- Identificaton of activities completed;
- Status of work at the site and progress to date;
- Percent complete;
- Difficulities encountered during the reporting period;
- Actions being taken to rectify problems;
- Activities planned for next month; and
- Personnel changes.

The monthly financial management report will include the following information:

- Identification of activities;
- Actual expenditures by activity; and
- Projected expenditures to complete the project, including an explanation of significant variations from the forecasted budget.

Graphic representations will be provided to illustrate proposed versus actual expenditures and actual versus target direct labor hours.

Subtask 1.4 Review of Existing Data

Available field data collected at the site by the U.S. EPA, City of Wausau, consultants and the Wisconsin Department of Natural Resources (WDNR) have been reviewed including:

Author	Date	Title
Joseph L. Gehin	Jan. 1985	Wausau's Water Quality Update and Performance Evaluation of Well 3 and Well 4 Air Strippers
Roy F. Weston, Inc.	Sept. 1985	Hydrogeologic Investigation of Volatile Organic Contamination in Wausau, Wisconsin, Municipal Wells
U.S. EPA	June 1986	Aerial Photographic Analysis of the Wausau Water Supply, Wausau, Wisconsin
CH2M Hill	Feb. 1986	Investigaton of an Abandoned City of Wausau Landfill
Twin City Testing Corp.	Aug. 1986	Existing Conditions Report and Exploration Program, Wausau East Municipal Well Field, Wausau, Wisconsin
Eloise Kendy	1986	Hydrogeology of the Wisconsin River Valley in Marathon County, Wisconsin (Thesis)
RMT, Inc./Geraghty & Miller, Inc.	June 1987	Hydrogeological Investigaton of the Alluvial Aquifer Beneath City Well 6, Wausau, Wisconsin
Geraghty & Miller, Inc.	March 1987	Preliminary Data Sheets, East Side Groundwater Quality Investigations, City of Wausau, Wisconsin
Wisconsin DNR		Water Quality Records, Wisconsin River
Wisconsin Valley Improvement Company		Wisconsin River Stage Data
City of Wausau		Municipal Well Pumping Records

These existing data were used in preparing this Work Plan. Additional information on the project site that becomes available during the course of the RI/FS investigation will also be reviewed. Meetings will be held with the City, consulting firms and the WDNR, as necessary, to discuss field methodologies and data collected to date.

Data Requirements

Based on a review of the available data, the following data requirements are necessary to meet the objectives of the RI/FS:

- A summary of potential source areas on both the east and west sides should be compiled.
- A groundwater flow and transport model should be developed and calibrated to existing conditions and used for evaluation of potential source areas prior to field investigation and for remedial action (FS) alternative assessment, and potentially for design of final remedial actions.
- Preliminary screening of potential source areas identified by the industry survey and guided by the groundwater flow model should consist of geophysical or soil gas survey methods to locate monitoring wells in the most probable source areas.
- Groundwater monitoring wells should be installed to characterize the vertical distribution of VOCs and contaminant mass present in the aquifer. Screen locations for groundwater monitoring wells should be established by water quality sampling and analysis during drilling prior to well placement, to minimize the potential for missing the plume vertically.
- Aquifer properties (hydraulic conductivity, stream bed resistance, storage) and contaminant transport properties (distribution coefficient, dispersivities and degradation half-lives) should be determined which will affect contaminant migration and potential clean-up rates.
- Water levels and stream stages should be monitored on a regular interval to detect and record changes in groundwater flow directions.
- A location and elevation survey of all wells and stream gages may be required, to U.S.G.S. datum and a local coordinate system. The existing elevation and location surveys have been completed by several consultants and may require better Quality Control for U.S. EPA's decisions.

- Evaluation of the Wausau Chemical Company's remedial action should be conducted to determine the effectiveness and possible duration of that remedial action.
- Continued recording of City pumping wells discharge (as required by WDNR).
- Evaluation of the existing airstrippers on Production Wells CW3 and CW4 should be conducted to determine the effectiveness of the existing treatment system, possible system changes due to model predicted changes in VOC concentrations (i.e., effect of higher concentration observed at Monitoring Well MW10A which may affect Production Well CW4) and the risk imposed on the water supply users.
- Evaluation of the VOC stripper and air emissions to assist in the risk assessment.
- Continued monitoring of the water supply concentrations for the risk assessment.

Subtask 1.5 - Preliminary Remedial Alternatives Development

1.5.1 Assessment of Current Situation

A preliminary assessment of the site will be performed based on the review of the existing data. This assessment will include the following, for which brief observations are provided below:

- Preliminary assessment of health risks
- Evaluation of the current treatment technology
- Evaluation of the need for expedited response activities

The preliminary assessment of health risks will include consideration of both short-term and long-term risks. Activities undertaken in support of this preliminary assessment will be consistent with needs of the formal risk assessment process outlined in Task 5, to avoid duplicaton of effort. Exposure to contaminants in environmental media and potable water will be considered.

Current treatment technologies will be evaluated. Based on available information, this includes the stripping towers at the Wausau Water Utility

and at Wausau Chemical Company and their associated groundwater pumping practices. The adequacy, performance and applicability of the technologies in addressing site problems will be evaluated. This evaluation will include the intent of the technologies (e.g., design performance level, capacity and extent of use) and actual use (e.g., flow rates, contaminant loadings, and periods of use). Available performance data will be used to determine whether performance goals have been acheived (e.g., design criteria and regulatory criteria). New drinking water regulations will be considered in determining whether the Water Utility stripping towers appear to adequately address VOC contamination.

Existing data will also be used to identify contaminants and contaminated areas not addressed by remedial technologies currently in use. Based on the preliminary health risk assessment and technology evaluation, the need for expedited response activities will be assessed. The purpose of expedited response actions would be to reduce or eliminate unacceptable risks due to exposure to contaminants from source areas or potable water. Expedited response actions may include measures to provide potable water or to limit access to source areas.

It is understood that activities under this subtask will be directed toward a preliminary assessment of site conditions and risks, based on information available in advance of the field investigation. Limitations of this preliminary assessment will be identified, as will additional data needs.

1.5.2 Establishment of Response Objectives

Based on the data review and preliminary assessment, and considering RI/FS goals and guidance, site-specific objectives for remedial response will be

developed. The response objectives will address public health and environmental concerns identified in the assessment of the current situation. Response objectives will consider guidance on groundwater remedial actions and section 300.68 of the National Contingency Plan. A preliminary identificaton of Federal and State applicable or relevant and appropriate regulations (ARARs) will be made. Identified ARARs will be considered in developing response objectives. In addition, preliminary clean-up objectives (performance objectives for the remedial responses) will be developed in consultation with the U.S. EPA and the WDNR.

1.5.3 Preliminary Remedial Technologies

Based on findings of the assessment of the current situation and on response objectives, a list of potentially feasible technologies will be developed. First, site specific response actions will be developed to address response objectives. At a minimum, response actions will include the following:

- Aquifer management, including institutional constraints on aquifer use;
- Containment of contaminants, including containment by pumping City production wells, with continued treatment;
- Aquifer restoration, using purge and treatment and in-situ methods;
- Providing an alternate water supply, including groundwater and surface water sources; and
- Treating contaminated source area soils.

A master list of technologies having the potential to accomplish the response actions will then be developed. The following resources will be used to identify technologies:

- Guidance on Feasibility Studies under CERCLA, ORD/HWERL, U.S. EPA, Cincinatti, Ohio EPA/540/G-85/003.

- Handbook: Remedial Action at Waste Disposal Sites. Office of Emergency and Remedial Response, U.S. EPA, Washington, D.C. EPA 625/6-85-006.
- RCRA/CERCLA Alternative Treatment Technology Seminar, June 10-11, 1986 seminar manual.
- Guidelines for Preliminary Selection of Remedial Action for Hazardous Waste Sites. U.S. Army Corps of Engineers, EM-1110-2-505.
- Additional U.S. EPA Technology Transfer and Research Publications.
- Technical literataure - texts, handbooks, periodicals.
- University of Wisconsin libraries.
- Manufacturer's product literature.
- Staff expertise, experience and judgement.

To comply with the SARA statutory preference for permanent remedies, technologies that have the potential to significantly reduce toxicity, mobility or volume of waste will be included. The technologies will then be screened using criteria that will include:

- Site conditions;
- Contaminants, pollutants and hazardous substances identified;
- Technology availability and performance record;
- Potential for reduction in toxicity, mobility and/or volume (SARA s.121 (b)(1).

Technology screening will be done in consultation with the U.S. EPA and the WDNR.

1.5.4. Identification of Remedial Alternatives

A limited number of remedial alternatives will be developed. Alternatives will incorporate response actions and associated technologies into comprehensive, site-specific approaches designed to meet defined response objectives. A range of alternatives will be developed, to include the following:

- Alternatives that result in limited or no long-term management of residuals;

- Alternatives that involve treatment as a principal element, to significantly reduce toxicity, mobility or volume of waste or waste constituents;
- Alternatives relying primarily on containment, with little or no treatment; and
- No action.

Alternatives will be developed in consultation with the U.S. EPA and the WDNR. Rationale will be provided for excluding technologies retained after screening, but not included as part of an alternative. Prior to alternatives screening (Task 9), additional alternatives formulation may be conducted in response to RI findings and/or modifications of response objectives.

Subtask 1.6 - Work Plan Revisions

The Work Plan will be revised, as necessary, following the collection and analysis of additional field data at the two municipal well field sites. If additional field investigations or specific data needs are identified, recommendations will be made to the U.S. EPA for acquiring the data. The Work Plan will be revised to reflect the additional data collection activities only after approved by, and in consultation with, the U.S. EPA's Project Officer.

TASK 2 - FIELD INVESTIGATION

Subtask 2.1 - Phase I Site Investigation

The Phase I Site Investigation will consist primarily of well installation, water quality sampling, aquifer testing, and the support activities necessary to select the well locations. An industrial site survey and preliminary groundwater model development will also be performed as part of Phase I activities.

The horizontal and vertical placement of monitoring wells will be based on the following criteria:

- The vertical and horizontal location of the production wells
- The locations of potential contaminant sources identified through evaluation of present and past industrial practices in the area
- The results of the preliminary evaluation of potential sources
- The results of a soil gas survey with in-field sample analyses
- The results of water quality sampling during drilling with in-field analyses.

A total of thirty-nine (39) monitoring wells and one (1) soil boring are planned for the Phase I investigation of the Wausau Well Field. Fifteen (15) monitoring wells at 9 new locations and 8 monitoring wells nested adjacent to existing wells are planned, based primarily on the first two criteria. Locations for these wells are shown on Figures 7 and 8 for the west and east study areas, respectively. Sixteen other wells will be located, based specifically on the results of the soil gas survey and in-field groundwater quality sampling and analysis results determined while drilling. Therefore, locations and depths of all new wells have not been determined for this Work Plan.

The soil gas survey will be conducted concurrent with the drilling program to make the most efficient use of both the personnel and the field GC (gas chromatograph). The Team Leader will be the Project Hydrogeologist who will be making field decisions in concert with the U.S. EPA and the Warzyn Project Manager in selecting the additional well locations. Although the following

task descriptions do not identify sampling locations, the rationale for selecting soil gas sampling and well locations is given.

2.1.1 - Industrial Site Survey

There are numerous potential source areas of VOCs on both sides of the Wisconsin River. The Wausau Chemical Company site is the only documented site. An industrial site survey to evaluate potential sources will utilize the existing surveys and will include site visits and interviews with industry representatives.

Facilities currently planned for a site visit and personnel interviews are Wausau Chemical Company, Marathon Box Co., Marathon Press Co., Wausau Energy Corp. the CM ST P&P Railroad, Marathon Electric and City representatives for the former garage and landfill operations. Other industries identified during the survey, either operating or closed, will be included in a site visit, if possible.

The site surveys will be conducted by the Environmental Engineer and the Hydrogeologist assigned to the project. A Technical Memorandum will be prepared summarizing the observations made and information gained during each plant survey. During the plant survey, the field investigation will be explained to the plant manager to assist in U.S. EPA's effort to gain access to the facilities if necessary.

2.1.2 - Preliminary Model Development

A preliminary estimate of groundwater flow directions and potential source areas will be evaluated through groundwater flow and contaminant transport modeling. The preliminary groundwater flow model will be developed using

existing geologic and hydrogeologic data and several years of pumping rate records. The purposes for this preliminary model will be to:

- Identify possible groundwater flow directions under variable pumping rates and river stages;
- Outline plausible contaminant source areas within the zones of capture of each of the contaminated wells;
- Identify the aquifer parameters to which the simulated groundwater flow direction and velocity are most sensitive. Knowledge of these sensitivities will allow the investigation to focus on those areas or parameters that will control potential remedial actions and the potential changes in contamination distribution under various alternative pumping scenarios.

The USGS modular model (McDonald and Harbaugh, 1984) has been identified as the two-dimensional flow model to be used on the project. The ISWS Random Walk transport model (Illinois State Water Survey Random Walk (Prickett, Naymik and Lonnquist, 1981) will be used for the contaminant transport model. Several years of pumping records prior to discovery of the contamination (1982) will be used in the transient simulation. Simulated water table maps will be developed for several points in time to map the zone of influence of each well through time. The sensitivity of the boundary conditions, aquifer hydraulic conductivity and thickness and vertical hydraulic resistance of the stream bed will be evaluated on a preliminary basis.

2.1.3 - Preparation for Site Investigation

In preparation for the field GC analysis of soil gas and water quality samples using a laboratory GC, a short method development and calibration study will be conducted with the GC in the lab. This study will establish efficient and effective methods (i.e., detection limits, temperature program, column type and standards preparation) to detect the primary compounds of interest;

PCE, TCE and DCE. This effort will require approximately two days of the laboratory GC and operator time. The product from this study will be written standard operating procedures for the on-site GC analysis.

A site trailer (10 ft by 40 ft) will be set up as a base of operations for the project. This trailer will house the on-site laboratory in one room and a site operations quarters in a separate room. The trailer set-up location and a location for storage of well materials, sample bottles, and sample coolers will be determined in cooperation with the City.

A decontamination pad will be constructed at a location to be determined in cooperation with the City. The pad will be constructed so that water from steam cleaning operations is collected and discharged to the city sanitary sewer systems. The decontamination pad will be located in close proximity to the site trailer. Decontamination of well pipe, screen, tools and drilling rigs will occur at the decontamination pad. Drilling rigs, tools, casing and/or augers will be steam cleaned prior to setting up at a new location. Shallow wells located within a well nest will not require additional steam cleaning. However, sampling tools such as split spoons, bailers or sampling pumps will be cleaned at the drilling rig using a TSP solution wash and clean water rinse.

2.1.4 - Existing Well Sampling

Fifty-one (51) selected existing monitoring wells, and five (5) production wells will be sampled for water quality. The purpose for this sampling and analysis is to provide information on existing site conditions at the

beginning of the study. Although there is a substantial amount of existing data, the changes in pumping rates of the City wells may have affected the plume distribution since the last sampling.

Pending Central Regional Laboratory (CRL) approval, the VOC analyses will be conducted by Warzyn using a GC to provide fast turnaround (approximately 7 days). The fast turnaround will provide data on which to revise the soil gas investigation and the well installation program. Samples will also be submitted for analysis through the CLP (through SAS) for the following water quality parameters: pH, conductivity, calcium, magnesium, alkalinity, sulfate, chloride, iron, sodium, potassium, nitrate-nitrogen, ammonia-nitrogen, total Kjeldahl nitrogen, and total organic carbon. Prior to sampling, wells will be pumped or bailed until infield parameters (pH and conductivity) have stabilized and at least three well volumes of water have been removed. Purged water will be collected and discharged to the city sewer. The samples will be collected from the sample tap at production wells and from a stainless steel bottom loading bailer or a Johnson Keck submersible pump at the monitoring wells. The water level measurements will be taken prior to sampling.

A brief Technical Memorandum (TM) summarizing sampling methods and results will be prepared and submitted to U.S. EPA. This TM will contain recommendations regarding whether sampling for base/neutrals and acid extractables should be completed in Subtask 2.1.7.

Assumptions in developing costs for the existing well monitoring effort are:

- 56 monitoring and water supply wells will be sampled, collecting 6 duplicates, 3 field blanks, 3 trip blanks and 6 matrix spikes, for a total of 74 samples

- These 74 samples will be analyzed by Warzyn's GC lab using U.S. EPA methods 601 and 602, with a 7-day turnaround
- The 74 samples will also be submitted to the CLP for analysis
- Sampling and water level measurements will require two teams of two personnel to collect samples and one person for sample preparation, packaging and chain-of-custody
- Sampling and water level measurement will require nine-10 hour days
- Level D protection will be required 90% of the time and Level C 10% of the time
- HNu or OVA monitoring will be required during sampling
- The U.S. EPA will obtain access to the existing wells for sampling

2.1.5 - Soil Gas Survey

Soil gas sampling with on-site analysis will be conducted to help identify potential source areas and in an attempt to map the distribution of VOCs at the water table surface near a potential source. Results of on-site analyses will be used to guide the selection of well locations. These samples are not intended to be used to characterize the nature and extent of contamination in the soils or groundwater. However, samples collected from the wells under Subtask 2.1.8 will be analyzed by methods suitable for determining source areas, the nature and extent of contamination and evaluation of potential remedial actions.

The scope of the soil gas survey at each potential source area will be determined based on the size of the facility, the type of operation conducted (past or present) at the site, and the results of the on-site industrial survey, if conducted.

Soil gas sampling will be conducted at an estimated 10 facility studies. Figures 7 and 8 show the tentative locations for 7 of the soil gas investigation areas. The remaining 3 are reserved for additional sources which may be identified. Table 2 is a list of the sites planned to be surveyed and the tentative number of samples.

A total of 93 soil gas samples are planned to be collected for the purpose of evaluation of potential VOC sources. If additional potential sources are identified in the Subtask 2.1.1 Industrial Site Survey, collection of three additional samples per site is planned. Assuming the possibility of locating up to three source areas, a maximum of 102 soil gas samples is planned plus 10 sample blanks and 10 duplicates.

Soil gas sampling will consist of driving a probe to a depth of approximately 3 ft, purging the sampling probe and tubes and collecting a sample in a glass gas sampling vial. The sample will be returned to the on-site GC for analysis. Sample blanks will be collected between each facility being surveyed. Results of the soil gas analyses will be plotted and used to evaluate each facility as a potential VOC source area, to locate additional soil gas sampling sites if needed, on the property, and to identify areas where direct groundwater sampling through wells is required.

Assumptions for developing costs for the soil gas sampling program are as follows:

- Up to 122 samples will be collected and analyzed over a 10-day period;
- Two field personnel will be required for soil gas sampling over the 10-day period; and
- An on-site GC operator will be shared with the water quality sampling and analyses on a half-time basis;

TABLE 2

SOIL GAS SAMPLING LOCATIONS

LOCATION	NUMBER OF SAMPLES	COMMENTS
East Side		
1-Railroad Line	15	200-foot spacing along rail line with double line of samples on southern half of area
2-Marathon Pilot Press	8	locations based on plant survey
3-Marathon Box	8	locations based on plant survey
4-Wausau Chemical	12	locations based on review of the most recent reports
5-Wausau Energy	7	locations based on plant survey
West Side		
6-Marathon Electric	15	locations based on plant survey and observed TCE concentrations at Monitoring Wells C2S and R4D.
7-Outer Arc-Well CW6	15	200-foot sample spacing around 3000 feet of arc West and South of Well CW6.
8-Well CW6	13	200-foot sample spacing around Well CW6 to evaluate potential sources within outer arc extending from Pearson Street north of Well CW6 to Burns Street Southwest of Well CW6 (see Figure 7).

Total 93 Samples

Notes:

Additional soil gas samples may be collected from potential source areas identified from the industrial survey.

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2.1.6 - Monitoring Well Installation

Groundwater monitoring wells will be installed to collect groundwater quality samples, groundwater levels and for hydraulic conductivity testing during the Phase I investigation. Thirty-nine new wells and one soil boring are planned (17 wells and 1 soil boring on the west study area and 22 wells on the east study area). A total of 2,245 feet of drilling and 2,125 feet of well installation are planned for the Phase I investigation. The rationale for these locations is presented in Figure 7 for the west study area and Figure 8 for the east study area.

The wells will be drilled using two different methods. The deepest well at each well nest will be drilled first by rotary drilling methods using clear water and advancing casing to allow water quality sampling during drilling. The water table wells at each nest will be drilled using a screened hollow stem auger. Split-spoon soil sampling will be completed at the deepest well in each nest on a 5-ft interval to a depth of 25 ft and a 10-ft interval to the bottom of the hole or at changes in soil type. Thirty (30) soil samples will be analyzed for grain size distribution and 15 for natural organic content. Natural organic content will be analyzed by wet combustion after pretreatment to remove inorganic carbon. Thirty (30) soil samples are planned to be submitted to the CLP for analysis of VOCs, base/neutral and acid extractables by GC/MS, to characterize contamination in the unsaturated zone at potential source areas.

Water quality samples will be collected during drilling from selected locations through the aquifer to help in identifying the plume distribution prior to setting the well screen. These samples will be analyzed using the on-site GC. Results

will be used to help identify the vertical and horizontal plume distribution so that the well screen can be placed within the plume and the location of additional wells can be placed based on an improved knowledge of the plume distribution. The results of the on-site analyses are not intended to be used to determine the nature and extent of contamination or formally identify contaminant source areas. Rather, the data will be used to locate well screens based on preliminary information. Samples collected from the wells and analyzed under Subtask 2.1.8 will be collected in a manner suitable to support U.S. EPA's decisions on remedial actions and enforcement.

Groundwater quality samples will be collected while drilling at approximately 10-ft intervals within the aquifer at the west study area and at 15-ft intervals at the east study area. An average of eight samples per deep well and one sample from each of the individual shallow wells are anticipated to be collected. A total of 106 samples, 11 duplicates and 11 blanks will be analyzed. The analysis method, pending approval of the QAPP, is intended to be on a head-space sample using a dual detector (PID/HECD) on a laboratory model GC (Refer to QAPP, Appendix F). Detection limits are anticipated to be on the order of 1 ug/L. Two water quality samples will be collected from each sampling depth, a VOA vial with a 1/2 in. head space sample for on-site analysis and a full VOA vial for lab analysis. Twenty (20) samples are planned to be submitted to the CLP for low detection GC/MS analysis for confirmation purposes. Samples to be sent for lab analysis will be selected as a representative range of results based on the on-site analysis.

Water sampling during drilling will consist of driving a 2-inch diameter Schedule 80 galvanized steel drive point ahead of the casing. If necessary,

a solid rod will be driven first to loosen the soils. The water within the drive point would then be purged using one of the following: Brainard Kilman 1.7" O.D. PVC pump, a Johnson Keck submersible pump with packer or a stainless steel bailer. Approxmately ten well volumes will be removed before sample collection.

Each of the deep wells will be logged using a natural gamma ray logging tool. A Mount Sopris 1000C Unit with the stratigraphic gamma ray tool will be used. The gamma ray log will provide information on the clay content of the formations penetrated and will be used in selecting the vertical position of the well screen. The geologist on the drill rig will run the log when the borehole has been drilled to its terminus.

The vertical position of the well installed at each well nest will be selected based on the results of the on-site water quality analyses and the geophysical results. At locations where no contaminants were identified by the on-site analyses, the intent is to install a deep well at the approximate elevation of the closest pumping well's screen. At those wells where on-site analyses identify contaminants, the well screen would be placed within the zone where the highest concentration was identified. Nested wells are intended to be installed at several locations, in addition to those shown on Figures 7 and 8. Locations for these well nests, and the number and vertical positions of the wells within each nest, will be determined based on the soil gas survey results, the geophysical logging and the results of the on-site water quality analysis.

The well construction is intended to be consistent with U.S. EPA guidance documents. Flush joint threaded #304 stainless steel with 0.010 inch slots will be used for each well screen. The riser immediately above the screen will also be composed of #304 stainless steel. The remaining riser will be composed of galvanized steel. Ten foot well screens are planned to be used, because of the thickness of the aquifer being monitored and the past problems with the inability to detect the vertical position of the plume. Several five foot well screens will be maintained on site in the event contaminated sand seams are identified which are thinner than 10 ft. Well development will be completed using air development in the deep wells and a bailer in the shallow wells. Water will be produced from the well until it is visually clear, or on-site pH and conductivity measurements stabilize.

Assumptions for developing costs for this task are as follows:

- 41 wells at 34 locations will be installed
- 2525 ft of drilling will be conducted, 1850 ft using clear water rotary and casing, 675 ft using hollow stem augers
- Drilling will require approximately 22 field days for three drilling rigs
- The field crew will consist of three geologists, one site safety officer (SSO) (between three drilling rigs), an on-site GC operator and a Team Leader
- 80% of the drilling will be done in Level D protection, 10% in Level C protection and 10% in Level B protection
- HNu or OVA monitoring will be done by the site geologist or the SSO for site safety and screening soil samples
- 106 water quality samples will be collected and analyzed during drilling, plus 11 blanks and 11 duplicates (128 total). The GC and operator will be on-site for 22 days
- Twenty of the water quality samples analyzed on-site will be submitted for low detection GC/MS analysis for VOCs, with 3 duplicates and 2 blanks (25 total)

- Thirty soil samples will be submitted to the CLP for analysis of VOCs and base/neutral-acid extractables

2.1.7 - Surface Water and Sediment Investigation

Four surface water and four sediment samples will be collected from the Wisconsin River to supplement the results of WDNR's survey conducted during the fall of 1984. The locations will be in the river adjacent to the Wausau Chemical Company site treatment system discharge and the City of Wausau landfill, one up stream and one downstream from each facility. Surface water and sediment samples also will be collected in Bos Creek at two locations, one upstream of the Randolph Street crossing and the other downstream of Marathon Electric.

Surface water samples will be collected using stainless steel sampling equipment. Sediment samples will be collected using a hand corer and will be composites of 5 subsamples representative of the sediment at that location.

Surface water samples will be analyzed for pH and conductivity in the field. The surface water samples will be submitted to the CLP for VOC and inorganic parameter analyses by SAS methods. Sediment samples will also be analyzed for volatiles by GC/MS.

Details of the sample collection methods and protocols will be stated in the Phase 1 Sampling Plan (Subtask 1.2). Sampling of the specified surface water and sediment locations will occur concurrently with the collection of Phase 1 groundwater samples (Subtask 2.1.8).

2.1.8 - Groundwater Sampling and Aquifer Testing

One hundred seventeen wells, 5 production wells and one private well will be sampled (123 total) and analyzed. Twenty of these samples will also be analyzed for HSL parameters by the CLP using RAS. The CLP analyses for the HSL are intended to identify other compounds that may be of concern, which previously have not been analyzed. The analytical results will form the basis for the RI evaluation, including source identification, extent of contamination, determination of the mass of contaminants present, and the evaluation of remedial action alternatives. Therefore, these sample results will be analyzed and presented so that the results are suitable for U.S. EPA decision-making.

Groundwater sampling will be performed by Warzyn and will occur approximately 20 days after completion of well installation and development.

Prior to sampling, each well will be purged using either a Johnson Keck Submersible pump or a stainless steel bailer until field conductivity stabilizes and a minimum of three well volumes have been removed. A stainless steel bailer is anticipated for shallow well sampling and a Johnson Keck submersible pump with inflatable packer is anticipated to be used for piezometer sampling. Production well samples will be obtained from the well head sampling tap. Purging and sampling equipment will be decontaminated before reuse. Water purged from the wells will be collected and discharged to the City sanitary sewer. Conductivity, temperature and pH of samples will be measured in the field by the sampling team. Samples will be preserved (as specified in the QAPP) and shipped on ice to the laboratory daily. Selected samples will be analyzed for base/neutral and acid extractables depending on results of the sampling from Subtask 2.1.4.

Groundwater samples will be analyzed for VOCs and general water quality parameters listed below:

pH (field)	Iron	Nitrate-Nitrogen
Conductivity (field)	Alkalinity	Total Kjeldahl Nitrogen
Calcium	Sulfate	Ammonia Nitrogen
Sodium	Potassium	Total Organic Carbon
Magnesium	Chloride	

The VOC analyses will be conducted by a CLP laboratory using low detection ($\pm$ 1 ug/L) GC/MS methods (see QAPP Appendix D for SAS request). These methods will provide reliable compound identification at low detection limits.

Hydraulic conductivity tests will be conducted on 20 selected piezometers and water table wells. The tests will be conducted in piezometers using air pressure to provide additional head change within the well. The recovery will be measured with a pressure transducer and data logger. The air method cannot be used on water table wells because air pressure would be lost through the screen. Therefore the tests will be performed on water table wells by removing or displacing a volume of water from the well and measuring the recovery through the use of a pressure transducer and data logger. The data that are collected will be used to calculate the hydraulic conductivity of the aquifer. These tests will be conducted concurrently with the groundwater sampling program, and wells will be tested after sampling has occurred. Recovery in the wells is not anticipated to be a problem, although water levels at the time of the test will be compared to those prior to sampling to confirm recovery has occurred. Data obtained from the tests will be used to determine if hydraulic conductivities vary areally or vertically accross the aquifer. The tests can be conducted more economically than full

scale pumping tests and do not require containing large amounts of potentially contaminated water or the disruption of municipal well service.

These hydraulic conductivity test results will be used in conjunction with the aquifer properties determined through previous testing (original City pumping tests) and through groundwater flow model calibration.

The following assumptions were used in developing the costs for this subtask:

- Sampling will require a six person team. Two teams of two people will collect the samples and one person will be responsible for sample preparation and preservation, a person will also be required to complete chain of custody and traffic reports.
- Sampling will require fifteen-10 hour days
- 90% of the sampling will be conducted at Level D and 10% at Level C
- 123 groundwater, 12 duplicate, 12 blank samples, and 12 matrix spikes (159 total) will be collected and submitted to the CLP for analysis by low detection GC/MS methods (See QAPP Appendix D for SAS request) and standard methods for the general water quality parameters
- 6 surface water and sediment, 1 duplicate, 1 blank sample and 1 matrix spike (9 total) will be collected and submitted to the CLP for analysis by low detection GC/MS methods (see QAPP Appendix D for SAS requests) and standard methods for the general water quality parameters.
- 90% of the groundwater samples will be of low concentration and 10% medium concentration
- Continuous HNu monitoring will be performed during drilling, purging and sampling
- A hydrogeologist will conduct the hydraulic conductivity tests, and testing will take two-10 hour days.

2.1.9 - Groundwater Level Monitoring

Groundwater level and river stage monitoring will be conducted on a regular interval to determine changes in groundwater flow directions due to variations in pumping rates, river stages and groundwater recharge. These levels will be used in groundwater flow model calibration and to determine horizontal and vertical groundwater gradients.

At the completion of the well installation program, water levels will be measured at project wells. Water levels will also be measured concurrent with each groundwater sampling effort. Six additional rounds of water levels will be collected during the course of the RI to record fluctuations in water levels. Water levels will be measured using a fiberglass tape and sounding device or an electronic water level indicator. The water level measuring devices will be calibrated prior to use, so that readings from the various devices are accurate to within $\pm$ 0.01 feet (accuracy of elevation survey).

2.1.10 - Location and Elevation Survey

A location and elevation survey of project monitoring and production wells will be performed by Warzyn's surveyors following Phase I and Phase II investigations. The location and elevation surveys will locate new sampling points to $\pm$ 1.0 foot horizontally, the top of well pipe to $\pm$ 0.01 foot and ground surface to $\pm$ 0.1 foot. The survey will be performed with respect to the same USGS datum used by most recent comprehensive survey completed.

Existing wells located at new well locations will be surveyed for elevation so that vertical gradients can be accurately calculated. This will also allow for comparison of this survey to previous surveys.

2.2 - Phase II Investigation

The need for a Phase II investigation will be determined based on data gaps identified in the Phase I Technical Memorandum (Subtask 4.9). It is not anticipated a Phase II investigation will be needed except to obtain a second round of water quality samples. If additional wells are needed, an update of the Work Plan to detail the Phase II activities will be necessary. The Sampling Plan and the Health and Safety Plan will be updated as described in Subtask 1.2. For the purposes of estimating the cost of the Phase II investigation, it is assumed:

- No new wells will be required
- Phase II sampling will include groundwater sampling of the same 123 wells as in Phase I with 12 duplicates, 12 blanks, and 12 matrix spikes and (159 total). Groundwater levels will also be measured at all monitoring wells on one occasion
- Water quality samples will be submitted to the CLP for VOC analysis by low detection GC/MS methods and general water quality parameters listed in Subtask 2.1.8.
- A Technical Memorandum for the Phase II investigation will be prepared to describe sampling methods only

TASK 3 - SAMPLE ANALYSIS/VALIDATION

Written procedures for sample analysis and data validation will be followed throughout the RI/FS investigation. Specific activities to be performed under this task will be addressed in the Sampling Plan and QAPP. These plans include descriptions of the following sample analysis/validation procedures:

- Sample management;
- Procedures for handling and analyses of samples for non-CLP and mobile laboratories;
- Procedures for data validation; and
- Physical parameters to be tested.

In addition, analytical methods and quality control of laboratory analyses are described in the QAPP.

As part of the RI report, a review of QA/QC procedures for the sampling, analysis and data handling aspects of the RI will be conducted as specified in the QAPP. Any limitations on data usage based on deviations from the QAPP or from available analytical QA/QC information, will be identified.

TASK 4 - DATA EVALUATION

Validated data from the site investigations will be evaluated as part of this task. The objectives of the data evaluation effort are to provide field data that are sufficient in quality and quantity to support the FS, and to provide data for the risk assessment. Data evaluation will be conducted after the Phase I Investigation (Subtask 2.1) and will include an assessment of the data to be used in the RI report.

Results from the source identification/characterization, groundwater quality and surface water/sediment investigations will be included in the evaluation. After completion of the Phase I data evaluation, a Technical Memorandum will be prepared. This memorandum will summarize the RI activities performed in the Phase I Subtask 2.1 including:

- A summary of the source indentification/characterization study
- A summary of methods and procedures used in soil gas and surface water/sediment sampling
- A summary of the monitoring well installation, aquifer testing and water level monitoring programs, and details of the hydraulic conductivity results. Boring logs and well construction details will be included

- Procedures used for groundwater sampling
- Results of the field analysis of soil gas and water samples collected during Subtasks 2.1.5 and 2.1.6
- Laboratory analysis results for the Phase I investigation
- Presentation of the groundwater flow and quality data through water table maps, flow sections and contaminant plume maps and sections
- Results of preliminary groundwater flow and transport modeling
- An interim site assessment based on the evaluation of Phase I data
- Recommendations for additional data needed at the site

This document will be prepared so that most of the summary data can be transferred to the RI report.

Four copies of the draft Technical Memorandum will be distributed to U.S. EPA. After review of the Technical Memorandum, a meeting will be held to discuss the results of the Phase I investigation, whether additional investigation is warranted, and the scope of the Phase II investigation. If the additional investigation is deemed unnecessary, the Phase II groundwater sampling will be conducted, but no other subsurface investigation is anticipated.

It is assumed that U.S. EPA's review time for this report will be 30 days, and that the Phase I completion meeting will be held 30 days after submission of the Technical Memorandum.

TASK 5 - RISK ASSESSMENT

The Risk Assessment, which will be incorporated into the RI Report, will combine site evaluation, chemical fate and transport evaluation, basic

toxicology and risk and exposure assessment into a description and quantification of actual and potential hazard associated with the site. The assessment will aid in the determination of remedial action(s) required to mitigate actual or potential threats to human health, welfare or the environment, and the level to which site clean-up may be required. U.S. EPA guidance on Risk Assessment and Management and the Superfund Public Health Evaluation Manual will be used to prepare the assessment, which will be presented in sufficient detail to support an action for relief through the Federal enforcement process.

TASK 6 - TREATABILITY STUDY/PILOT TESTING

Pilot scale, bench scale and/or treatability studies may be conducted under this task. Based on site data and technologies selected, the potential need for testing will be identified. Activities undertaken in support of test program development may include a review of process/system analysis methods and testing methods, to determine parameters requiring evaluation. The types of tests required and data quality objectives would be established. The need for equipment, facilities and/or testing services would be identified. The testing program would then be developed to select waste sources and quantities, design or select equipment, detail test procedures, establish procedures, for sample analysis, set guidelines for data analysis and interpretation, and develop a schedule and budget.

The pilot test program would be implemented after U.S. EPA and WDNR plan approval. Testing results would be analyzed and a report would be prepared summarizing the program and findings.

TASK 7 - COMMUNITY RELATIONS SUPPORT

The purpose of the community relations program is to give the public prompt, accurate information on the nature of the project. Further, it is the intent of the program to keep appropriate public and private interests informed of the progress being made on the project and solicit their comments and concerns, as appropriate.

Warzyn's Project Manager and lead technical people will provide technical support to the U.S. EPA Project Officer (PO) in public meetings and other briefings. Warzyn's presence will be under the direction of the PO will have primary responsibility for calling and organizing these meetings and briefings. Warzyn will be responsible for providing information in the form of hand-out material, audio-visual aids and graphic material for use in supporting presentations by the PO and designated technical staff.

TASK 8 - REMEDIAL INVESTIGATION REPORT

A Remedial Investigation (RI) Report will be prepared to summarize and evaluate the data collected during the site investigation (Task 2). The primary emphasis of the RI Report will be to delineate sources and extent of released hazardous constituents. The report will address site conditions based upon the operable units investigated. It is anticipated the identifiable operable units will be unsaturated zone soils, groundwater in source areas and groundwater out of the source areas.

The nature and extent of the releases in each operable unit will be determined and discussed in the report. The character of the releases with respect to

known or potential threats to public health, welfare or the environment, will be identified. An assessment of the significance of any observed or potential releases will be made.

The RI will include development of the preliminary groundwater flow and contaminant transport model (Subtask 2.1.2) into a calibrated flow and transport model. The transport model may not be extensively calibrated due to the practicality of observing contaminant concentrations over a long enough time period. The flow and transport models will be 2-dimensional transient simulations. The model will be used to help draw conclusions regarding the source(s) and the extent of contamination within the aquifer. The effect of the no action alternative will also be evaluated. The primary use of the model (after Task 2) will be in the FS for evaluation of potential remedial actions on the contaminant distribution within the aquifer.

The RI Report will consider applicable U.S. EPA guidance documents. The report will be issued as a draft within 3 months of receipt of the groundwater monitoring data from the Phase II groundwater investigations. U.S. EPA review comments will be available in 30 days from receipt of the draft report. The final report will be issued within one month of receipt of agency comments on the draft report.

The probable cost for this task was developed based upon the following assumptions:

- Four copies of the draft report will be issued to the U.S. EPA and two to the WDNR. The report is assumed to be 100 pages long with ten drawings.

- One review meeting between representatives of Warzyn and U.S EPA will be held at U.S. EPA's office in Chicago to discuss review
- Four copies of the final report will be submitted to the U.S. EPA and two to the WDNR. The report is assumed to be of similar size and composition to the draft report.

TASK 9 - REMEDIAL ALTERNATIVES SCREENING

The alternatives developed during project planning activities will be screened to reduce the number of alternatives for detailed evaluation, while retaining a range of treatment and non-treatement alternatives. The criteria used in screening are the same as those used in the detailed analysis: effectiveness, implementability and cost. These factors are discussed in more detail under Task 10. At this stage, because alternatives are not fully developed, effectiveness and implementability assessments will be general in nature. For example, protection of public health (an effectiveness factor) may be assessed by identifying contaminant pathways and the consequent potential for exposure to contaminants, without quantification of risks. The cost analysis will include both capital and long-term operation and maintenance costs, and a present net worth analysis. The screening cost estimates are intended to be of order-of-magnitude level accuracy. Costs will be used only to discriminate among alternatives that provide similar results. Where cost comparison is appropriate, alternatives having costs an order of magnitude (or greater) higher than similar alternatives will be excluded from further consideration.

Following the alternatives screening, an alternatives array document will be prepared which outlines the remaining alternatives. The purpose of this document is to summarize the remedial alternatives under consideration to

facilitate identification of federal and state ARARs to be used in the detailed alternatives analysis.

TASK 10 - REMEDIAL ALTERNATIVES EVALUATION

A meeting will take place between Warzyn, U.S. EPA and WDNR in advance of the detailed analysis of alternativess. The alternatives which pass the initial screening will then be analyzed in detail using effectiveness, implementability and cost factors. Both short-term and long-term effects will be considered.

Public health and environmental factors will be evaluated as part of the effectiveness analysis. Protection of human health and the environment is a component measure of effectiveness. Anticipated effects of the alternatives will be determined and compared to identified ARARs to determine protection. Where health-based or environmental standards do not exist, risk assessment will be used to help establish appropriate contaminant concentration levels. The reliability of the alternatives will be assessed in terms of demonstrated (in similar applications) or anticipated performance, operation and maintenance requirements, the need for replacement, and the relative probability and consequences of failure. Additional factors may include the technical limitations of alternatives and/or component technologies. The degree to which toxicity, mobility or volume of a given hazardous substance, pollutant or contaminant is reduced will be assessed.

The implementability analysis will consist of evaluating the technical feasibility, availability of technologies and facilities, and the administrative feasibility of each alternative. The assessment of technical feasibility of each alternative will include an evaluation of: constructability (based on

site conditions), the time to implement remedial measures, the time required to achieve beneficial results, and worker and community safety. The availability of technologies, off-site facilities and capacity will be assessed, as will resource availability (e.g., alternate water supply source). The assessment of administrative feasibility will include consideration of such factors as the reliability and effectiveness of institutional controls, the ability to obtain permits, and the institutional requirements and ability to monitor and maintain remedial measures and equipment.

The cost analysis will include an evaluation of both capital and long-term operation and maintenance costs. Costs will be obtained from the literature (including standard costing guides) and engineering experience. A present net worth analysis will be conducted.

The alternatives will be compared using the factors discussed above. Key component measures of effectiveness, implementability and cost will be summarized.

TASK 11 - FEASIBILITY STUDY REPORT

A preliminary FS report will be prepared presenting pertinent results of Tasks 1 through 10, including supplemental information in appendices. Four copies will be submitted to the U.S. EPA Project Officer and two to WDNR. It is assumed that the preliminary report will be approximately 100 pages in length with appendices and ten drawings. One review meeting will be scheduled to discuss the report with U.S. EPA personnel. Sixty days are assumed for U.S. EPA review. (Note: U.S. EPA will review and select a remedial alternative.)

A public comment FS report will be prepared for submission to U.S. EPA. The report will incorporate comments, additions, etc., as received on the preliminary FS report. This report will be submitted for public response and comment. The public comment FS report is assumed to be similar in length and composition to the preliminary report. Four copies will be submitted to the U.S. EPA Project Officer.

TASK 12 - POST RI/FS SUPPORT

Activities that occur after release of the FS for public comment will be addressed as part of this task. These activities may include:

- Preparation and/or review of the responsiveness summary summarizing and responding to public comments;
- Preparation of a preliminary design report;
- Attendance at public meetings;
- Technical support in preparation of the Record of Decision (ROD);
- Preparation of FS addenda;
- Review and quality control of work efforts; and
- Close-out of the contract.

Technical support provided under this task will be considered complete upon close-out of the contract.

TASK 13 - ENFORCEMENT SUPPORT

Technical support will be provided to the U.S. EPA to assist in enforcement aspects of the project. Activities under this task may include:

- Review of technical documents submitted by potentially responsible parties (PRPs);
- Attendance at technical negotiations for site remedy;

- Preparation of briefing materials;
- Dissemination of collected data;
- Assistance in depositions and hearings; and
- Providing expert witness testimony.

Any activities performed under this task will be initiated only with prior consent of the U.S. EPA Project Officer.

[MAR-724-3]

TABLE 1

SUMMARY OF WATER QUALITY RESULTS FOR VOLATILE ORGANIC COMPOUNDS (ug/L)
(SEPTEMBER 15-17, 1986)

	Standards	Detection Limit*	C-1S	C-2S	C-3S	C-4S	C-4D	C-6S	C-7S	R-1S	R-1D	R-2S	R-2D	R-3S	R-3D	R-4D	EPA-1A	EPA-3A	EPA-3B	EPA-4A	EPA-4C	EPA-5	EPA-7	EPA-9	CW-1S	CW-2S	CW-6	CW-10	LAB BLANK	FIELD BLANK	TRIP BLANK
Tetrachloroethylene	Zero[1]	0.1	ND	ND	0.3	5.8	ND	0.2	ND	ND	0.2	ND	ND	ND	ND	15.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethylene	5.0[2]	0.1	ND	605.	8.3	2.5	41.9	ND	10.5	0.1	ND	29.2	1140.	49.7	4.4	3190.	0.1	ND	ND	1.4	18.8	0.1	62.9	ND	ND	ND	226.	ND	ND	ND	ND
1,2-Dichloroethylene	70.0[1]	0.3	ND	10.0	ND	5.7	8.1	ND	ND	ND	ND	14.4	30.0	4.7	0.4	725.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.0	ND	ND	ND	ND
Carbon Tetrachloride	5.0[2]	0.1	ND	ND	108.	ND	ND	ND	ND	ND	ND	ND	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	NA	0.1	ND	ND	47.5	0.2	1.1	0.7	ND	ND	2.1	ND	ND	ND	0.9	ND	ND	ND	ND	ND	ND	0.2	0.2	0.1	ND	0.3	ND	ND	ND	ND	ND
1,2-Dichloroethane	5.0[2]	0.3	ND	ND	ND	0.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dichloromethane	NA	0.2	ND	5.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	2000.[1]	0.1	ND	5.0	0.1	ND	0.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	0.1	ND
1,1,1-Trichloroethane	200.[2]	0.1	ND	ND	ND	ND	0.1	ND	28.0	ND	ND	ND	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	0.2	ND
Vinyl Chloride	1.0[2]	2.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1] Proposed Recommended Maximum Contaminant Level (federal)

[2] Proposed Maximum Contaminant Level (federal)

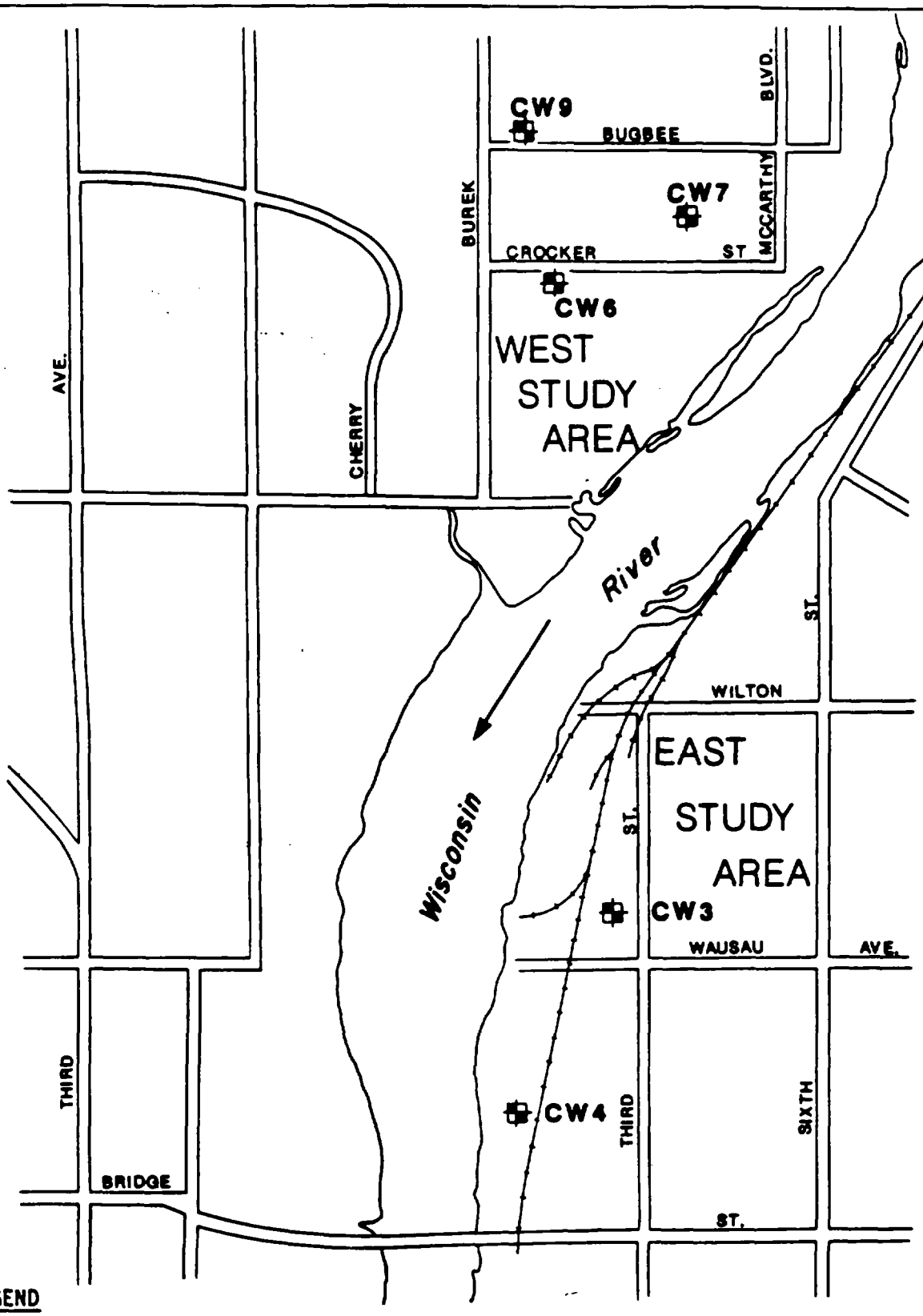
* - Detection limits were higher for CW-6, C-2S, R-2D and R-4D

ND - Analyzed but not detected

NA - Not Applicable

Source: RMT/Geraghty & Miller Inc. (1987)

FIGURES



LEGEND

CW6 CITY SUPPLY WELL

north

SCALE: 1" = 1000'

NOTE:

BASE MAP DEVELOPED FROM U.S.G.S. 15 MIN. QUADRANGLE MAPS WAUSAU EAST & WAUSAU WEST DATED 1963, PHOTOREVISED 1978.

FIGURE 1

DWN SJP	APP'D CSR	DATE 9-2-87	13076-A1

WARZYN ENGINEERING INC

SITE LOCATION MAP
REMEDIAL PLANNING ACTIVITIES
WAUSUA NPL SITE
WAUSAU, WISCONSIN

TELEDYNE POST N&V1R

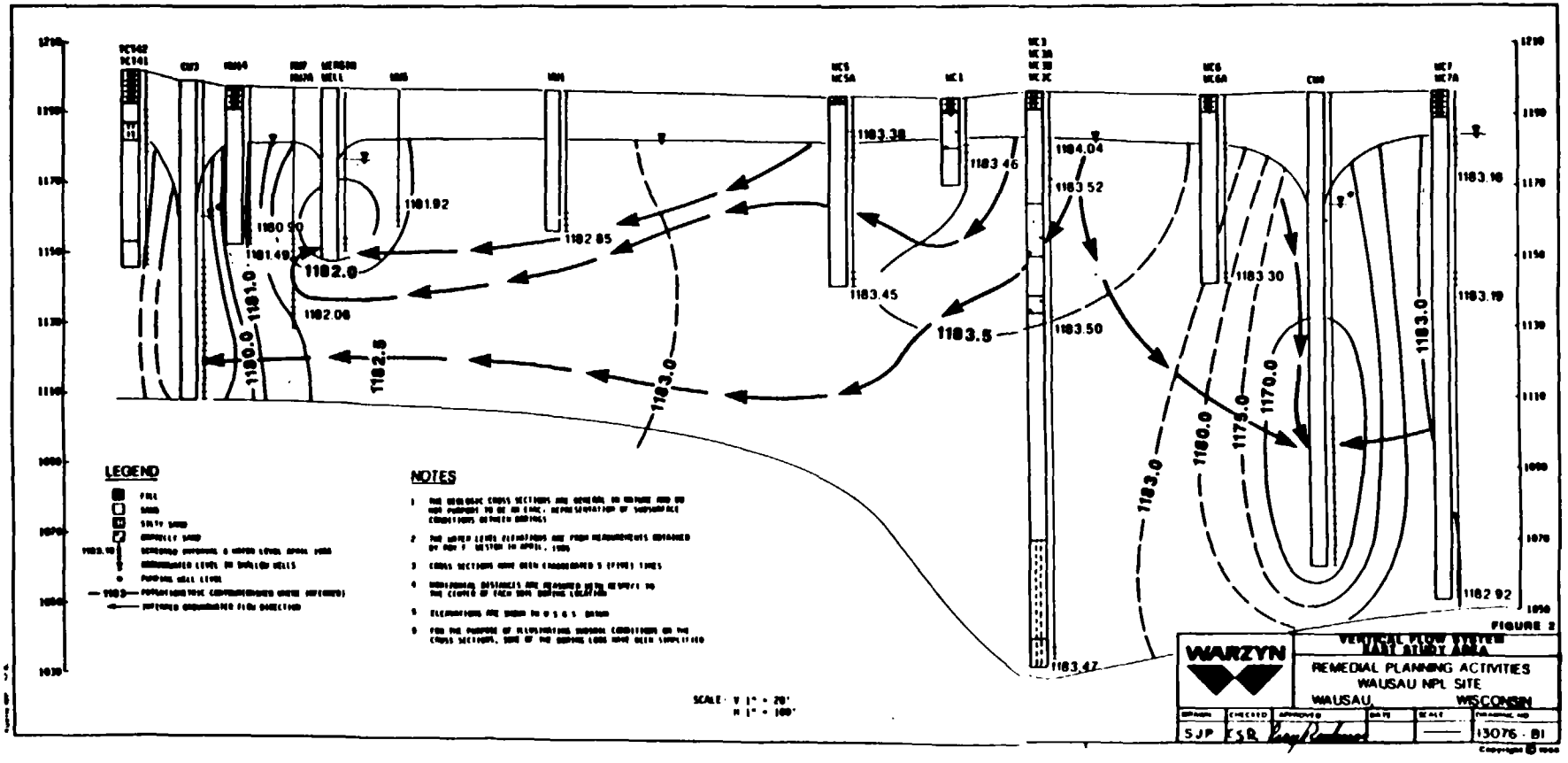
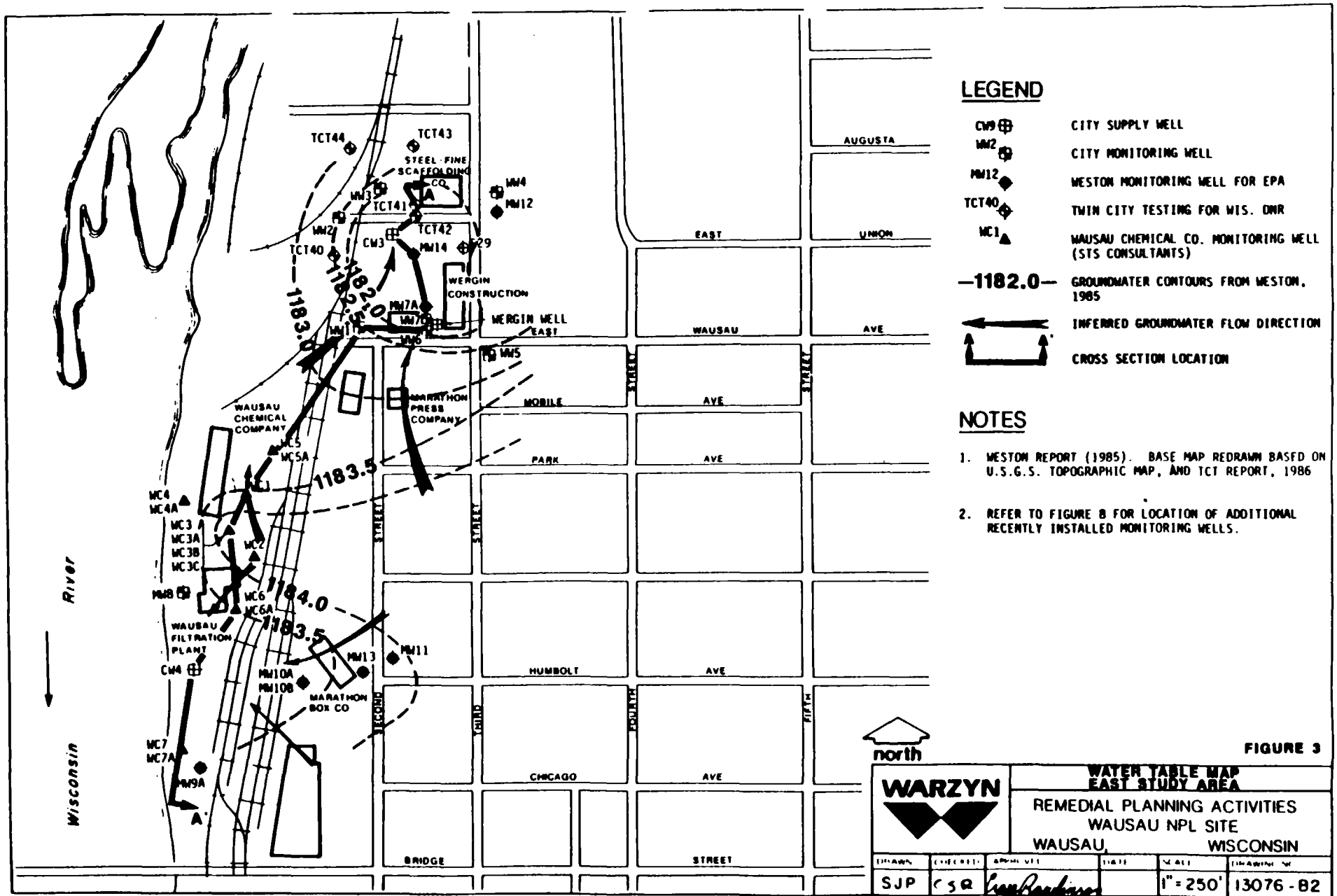

1183.38
1183.46
1184.04
1183.52
1183.45
1183.5
1183.50
1183.30
1183.47
1183.10
1183.19
1182.92
1181.92
1180.90
1181.49
1182.0
1182.85
1182.08
1180.0
1181.0
1182.5
1183.0
1180.0
1175.0
1170.0
1183.0
LEGEND
NOTES
SCALE: V 1" = 20'
H 1" = 100'
WARZYN
REMEDIAL PLANNING ACTIVITIES
WAUSAU NPL SITE
WAUSAU, WISCONSIN
SJP
13076 - B1

FIGURE 2



LEGEND

- CW9 — CITY SUPPLY WELL
- MW2 — CITY MONITORING WELL
- MW12 — WESTON MONITORING WELL FOR EPA
- TCT40 — TWIN CITY TESTING FOR WIS. DNR
- WC1 — WAUSAU CHEMICAL CO. MONITORING WELL (STS CONSULTANTS)
- —1182.0— GROUNDWATER CONTOURS FROM WESTON, 1985
- INFERRED GROUNDWATER FLOW DIRECTION
- CROSS SECTION LOCATION

NOTES

1. WESTON REPORT (1985). BASE MAP REDRAWN BASED ON U.S.G.S. TOPOGRAPHIC MAP, AND TCT REPORT, 1986
2. REFER TO FIGURE 8 FOR LOCATION OF ADDITIONAL RECENTLY INSTALLED MONITORING WELLS.

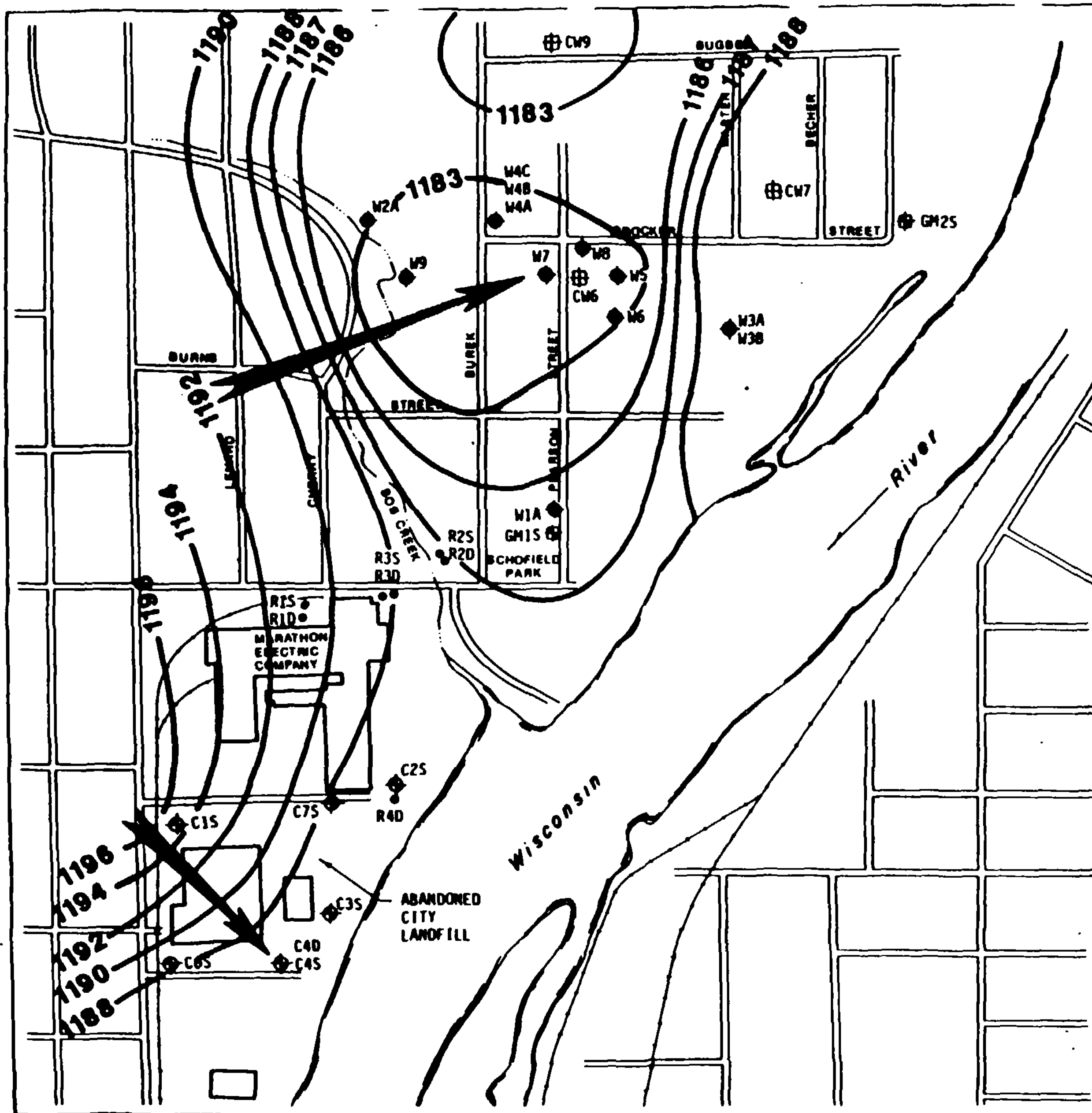
FIGURE 3

WARZYN

WATER TABLE MAP
EAST STUDY AREA

REMEDIAL PLANNING ACTIVITIES
WAUSAU NPL SITE
WAUSAU, WISCONSIN

DRAWN	CHECKED	APPROVED	DATE	SCALE	DRAWING NO.
SJP	CSQ			1" = 250'	13076-B2



LEGEND

- CITY SUPPLY WELL
- EPA WELL
- DNR WELL
- CITY MONITORING WELL
- MARATHON ELECTRIC WELL
- PROPOSED MONITORING WELL LOCATION "A" DENOTES NESTED WELL
- PROPOSED SOIL BORING LOCATION
- SOIL GAS SAMPLING LOCATION & NUMBER
- —1190— GROUNDWATER CONTOURS
- INFERRED GROUNDWATER FLOW DIRECTION

NOTES

1. WATER TABLE MAP REDRAWN FROM GERAGHTY & MILLER/RMT 1987, FIGURE 7.

FIGURE 4

WATER TABLE MAP (5-22-86)
WEST STUDY AREA

WARZYN

REMEDIAL PLANNING ACTIVITIES
WAUSAU NPL SITE
WAUSAU, WISCONSIN

DRAWN	CHECKED	APPROVED	DATE	SCALE	DRAWING NO
SJP	CSR	[signature]		1" = 400'	13076-B3

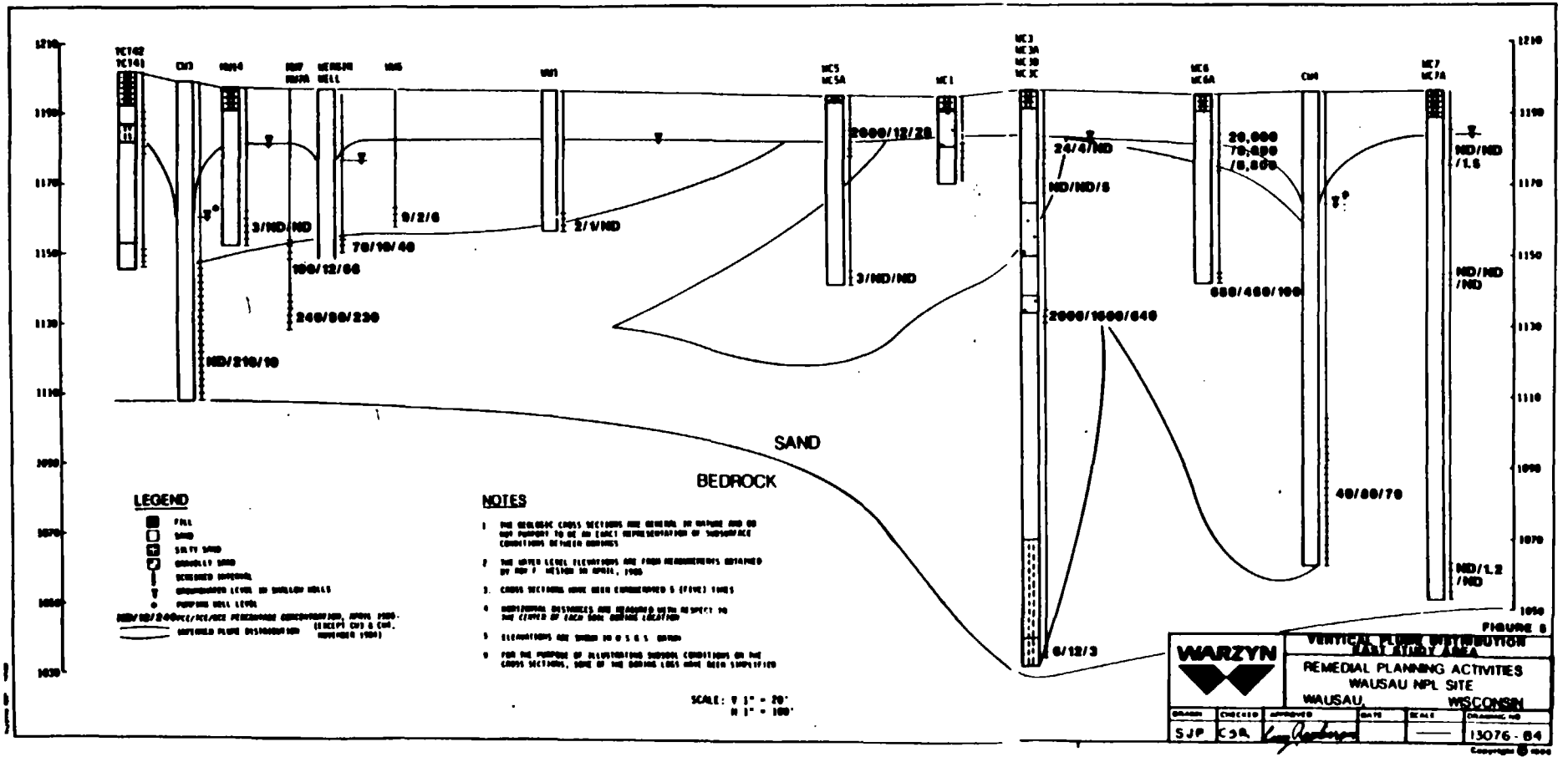
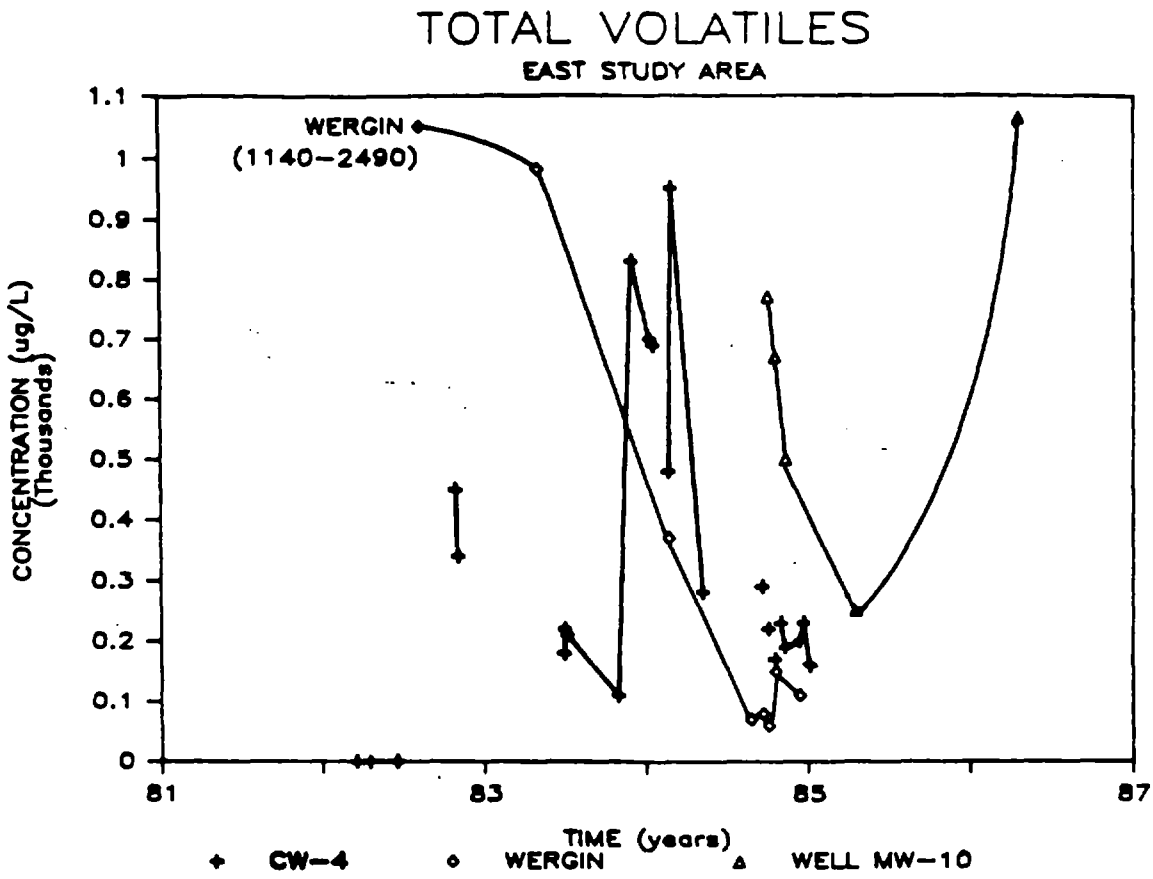

SAND
BEDROCK
3/ND/ND
9/2/6
2/VND
2000/12/20
24/4/ND
ND/ND/6
20,000
70,000
8,800
ND/ND
/1.8
ND/ND
/ND
ND/1.2
/ND
2000/1000/640
880/480/100
40/80/70
6/12/3
LEGEND
NOTES
SCALE: V 1" = 20'
H 1" = 100'
WARZYN
VERTICAL PLUME DISTRIBUTION
EAST STUDY AREA
REMEDIAL PLANNING ACTIVITIES
WAUSAU NPL SITE
WAUSAU, WISCONSIN
SJP
13076-84

FIGURE 8



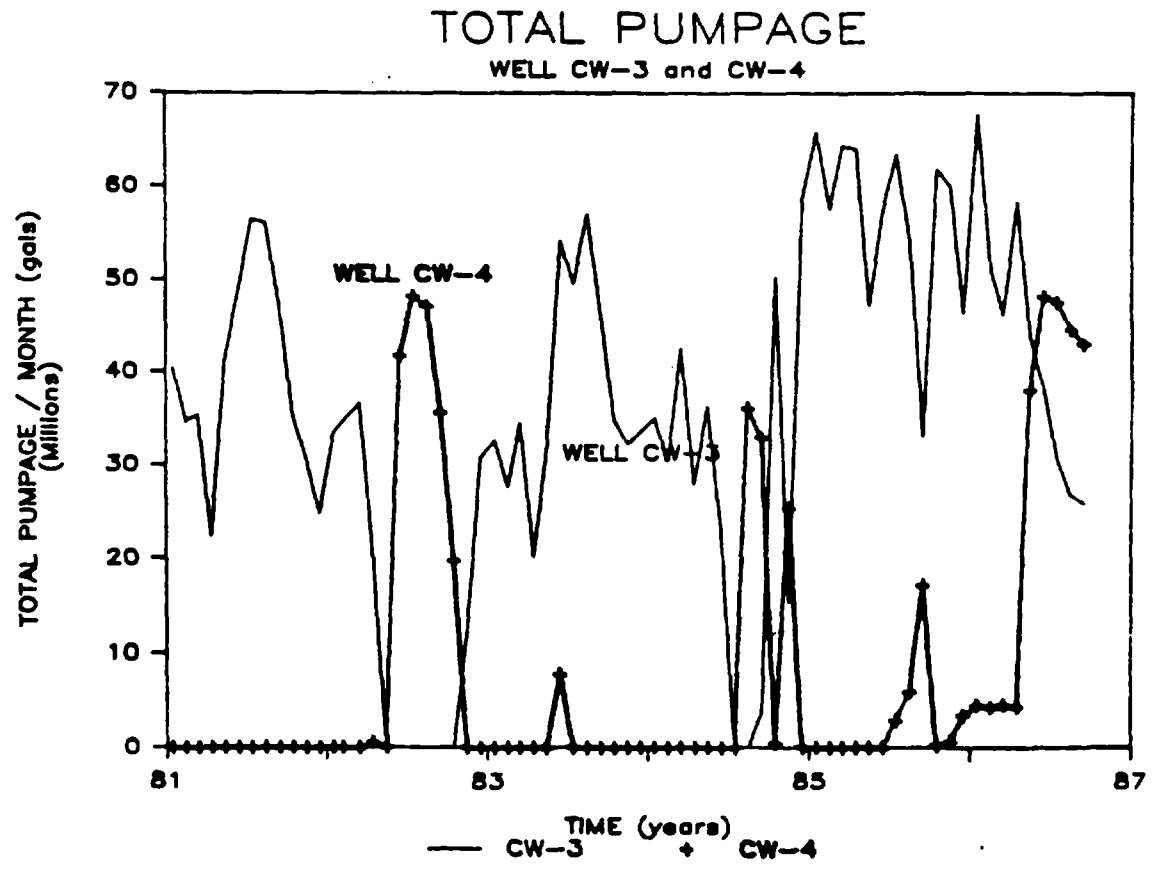


FIGURE 6
PUMPING HISTORY & VOC CONCENTRATIONS

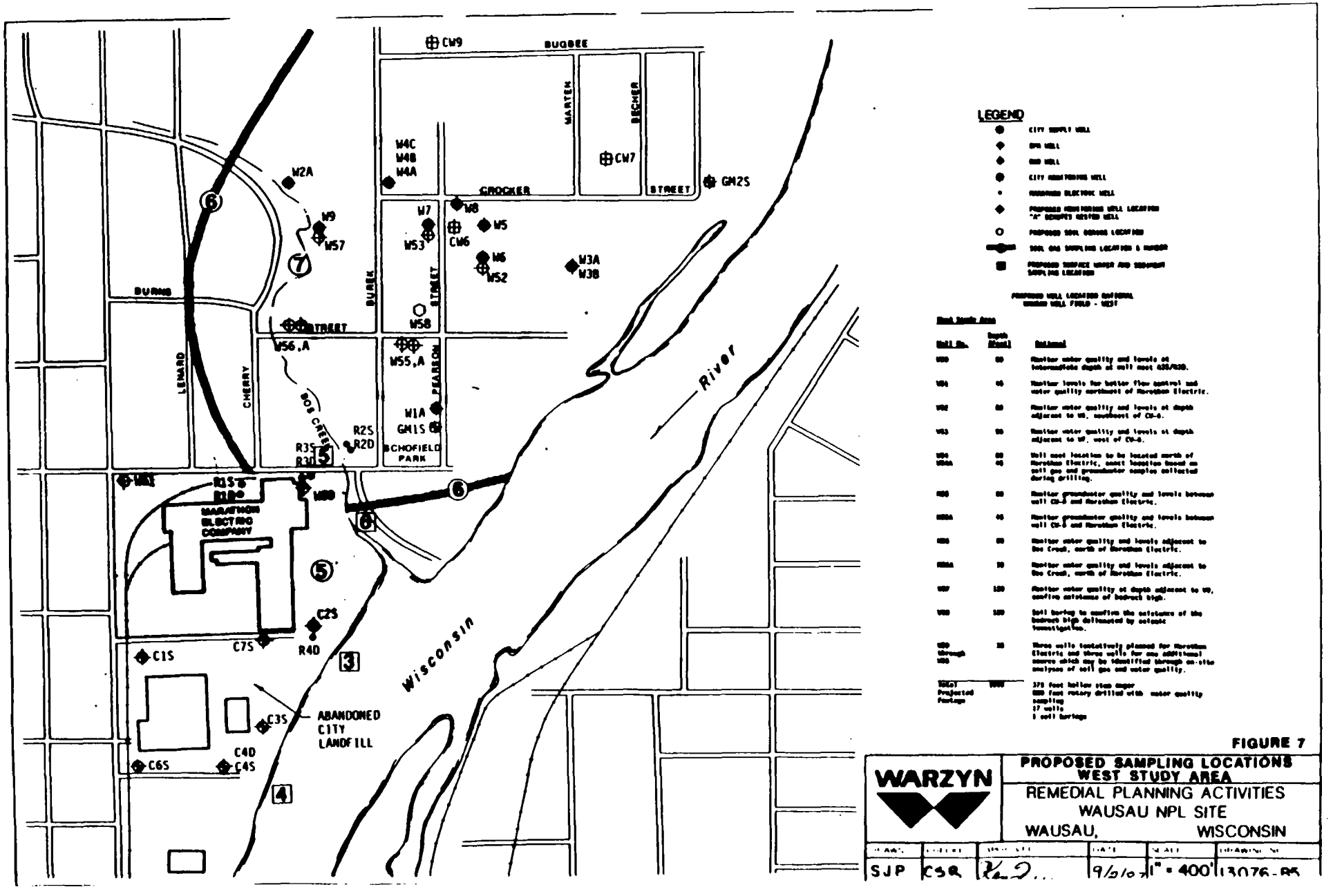


FIGURE 7

WARZYN

PROPOSED SAMPLING LOCATIONS
WEST STUDY AREA
REMEDIAL PLANNING ACTIVITIES
WAUSAU NPL SITE
WAUSAU, WISCONSIN

SJP	CSR	[illegible]	9/9/10	1" = 400'	13076-R5

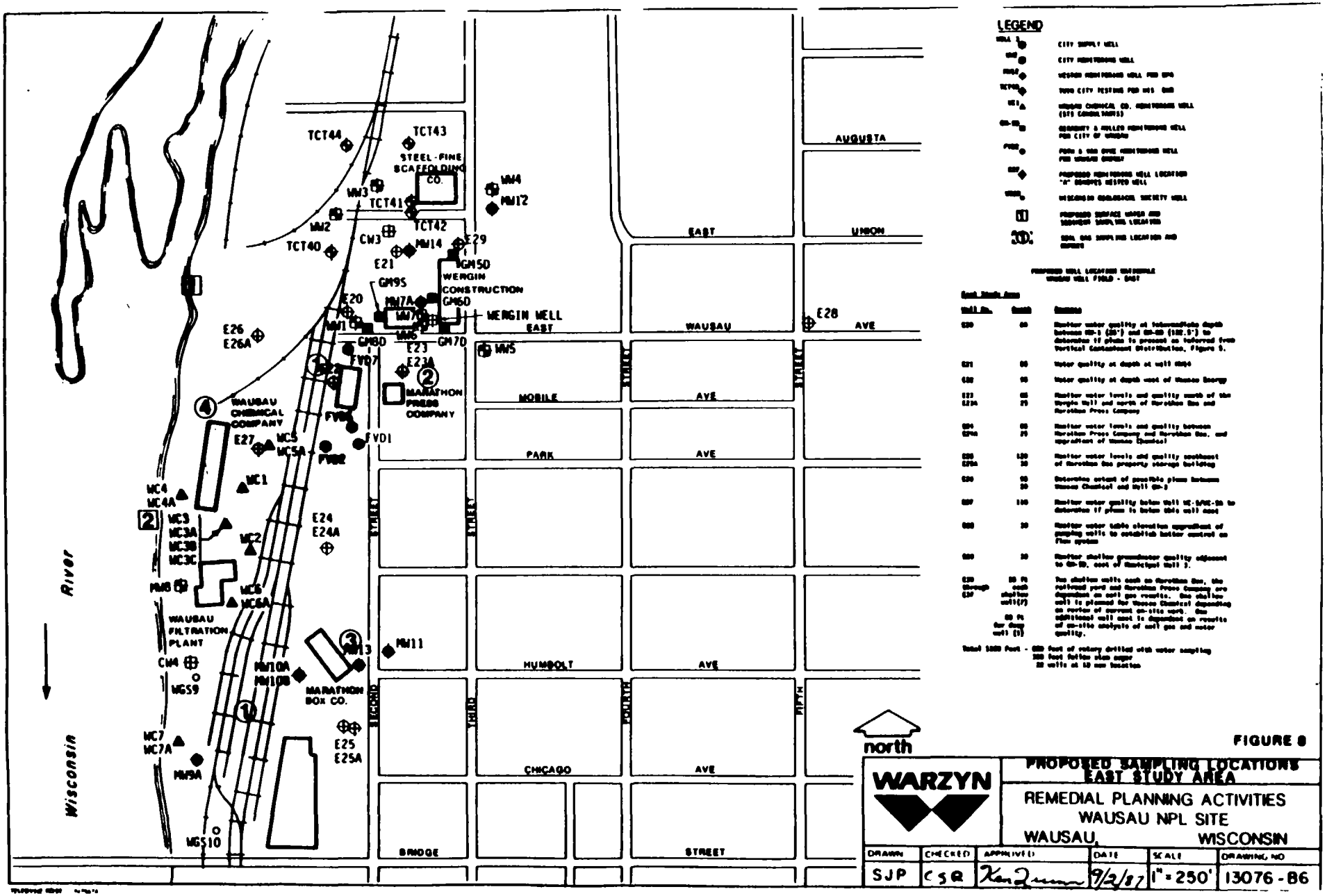


FIGURE 8

WARZYN	PROPOSED SAMPLING LOCATIONS EAST STUDY AREA REMEDIAL PLANNING ACTIVITIES WAUSAU NPL SITE WAUSAU, WISCONSIN				
DRAWN	CHECKED	APPROVED	DATE	SCALE	DRAWING NO
SJP	CSR		9/2/87	1" = 250'	13076-86

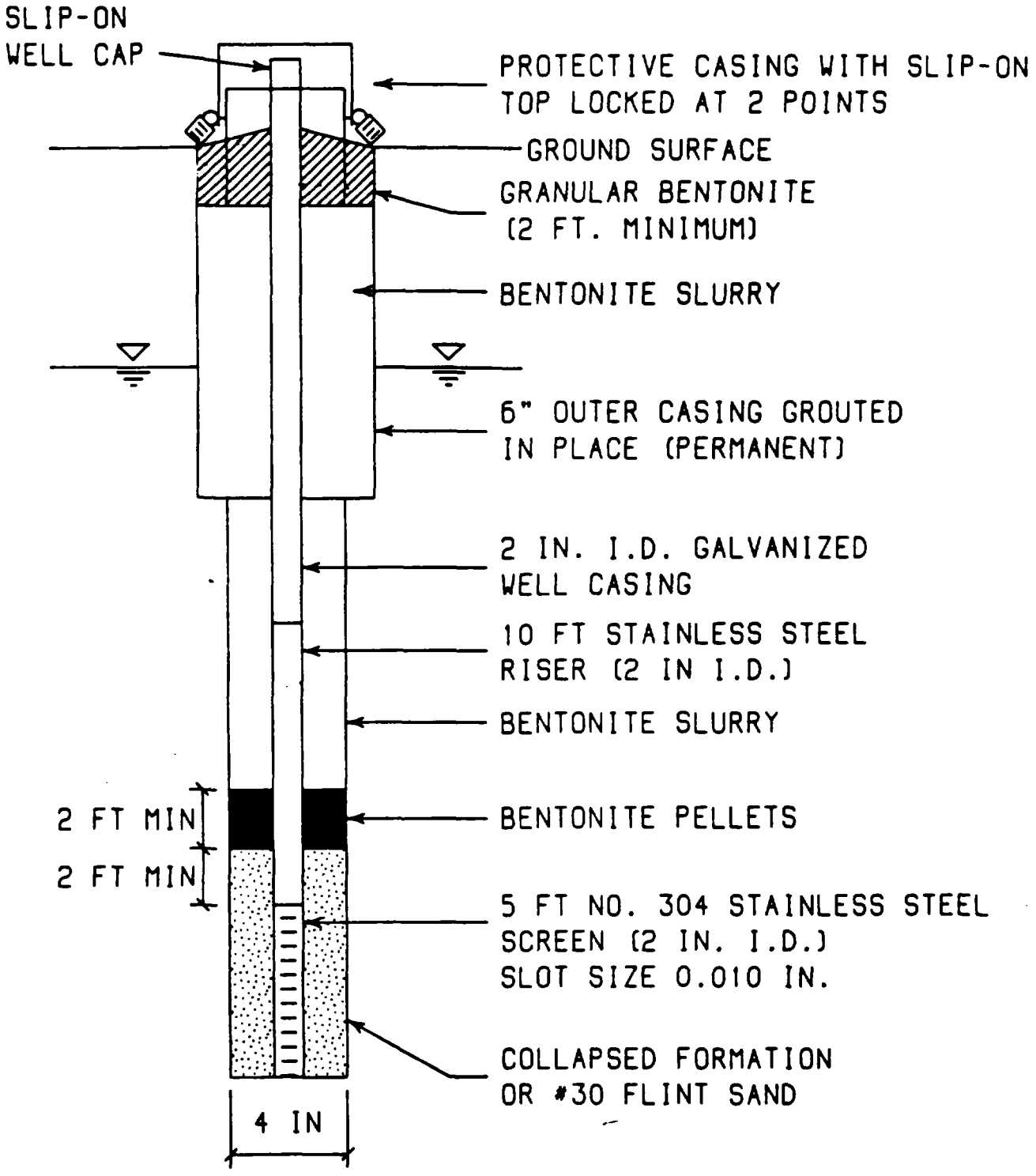


FIGURE 9

DWN ALH	APP'D	DATE 9/2/91	13076-A3	WARZYN ENGINEERING INC	DEEP (PIEZOMETER) WELL REMEDIAL PLANNING ACTIVITIES WAUSAU NPL SITE WAUSAU, WISCONSIN

TELEDYNE ROST N6718

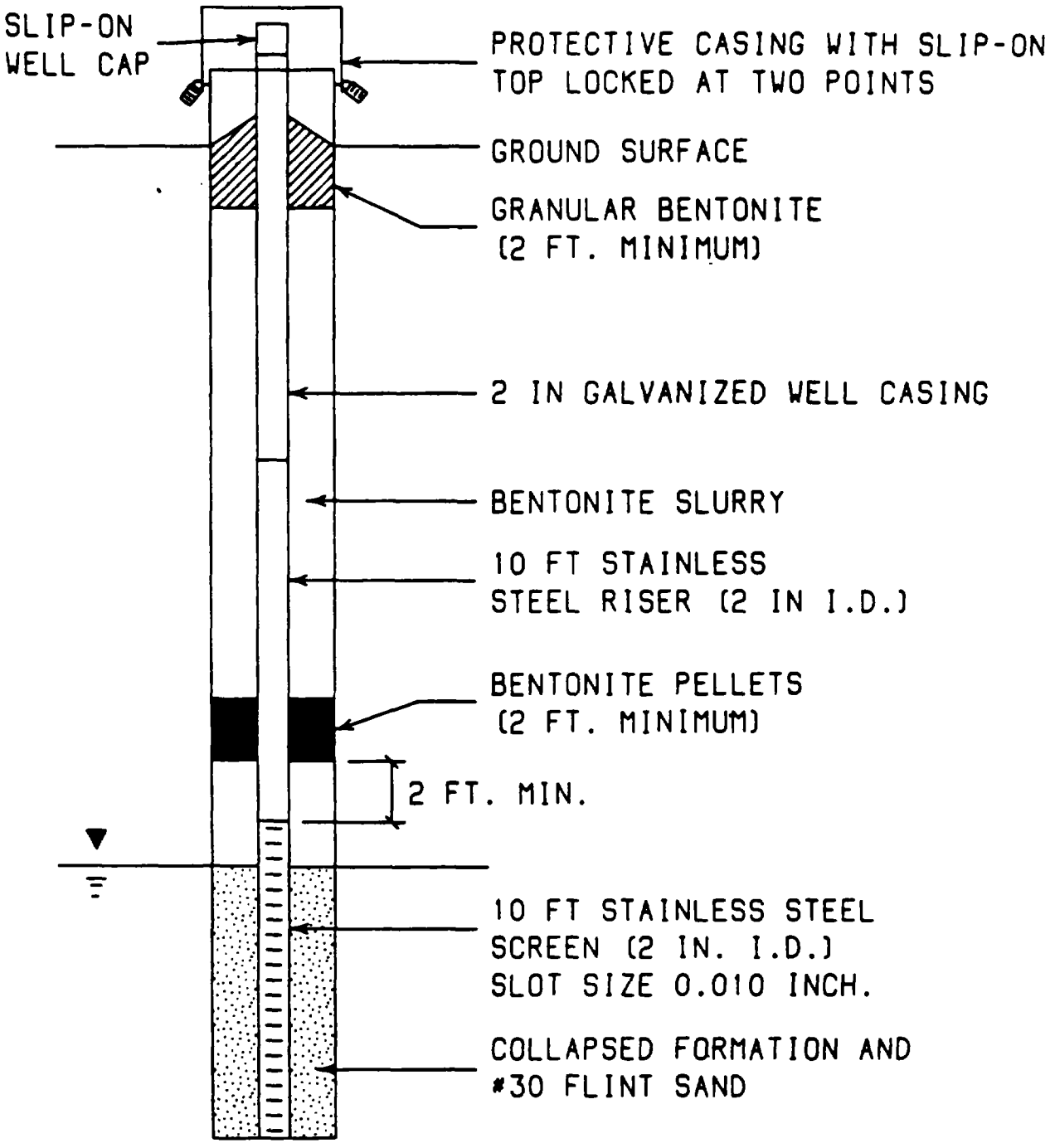


FIGURE 10

DWN ALH	APP'D	DATE 9/2/81	13076-A4	WARZYN ENGINEERING INC	WATER TABLE (SHALLOW) WELL REMEDIAL PLANNING ACITIVIES WAUSAU NPL SITE WAUSAU, WISCONSIN

TELEDYNE POST N3718

PROJECT ORGANIZATION CHART
FIGURE 11

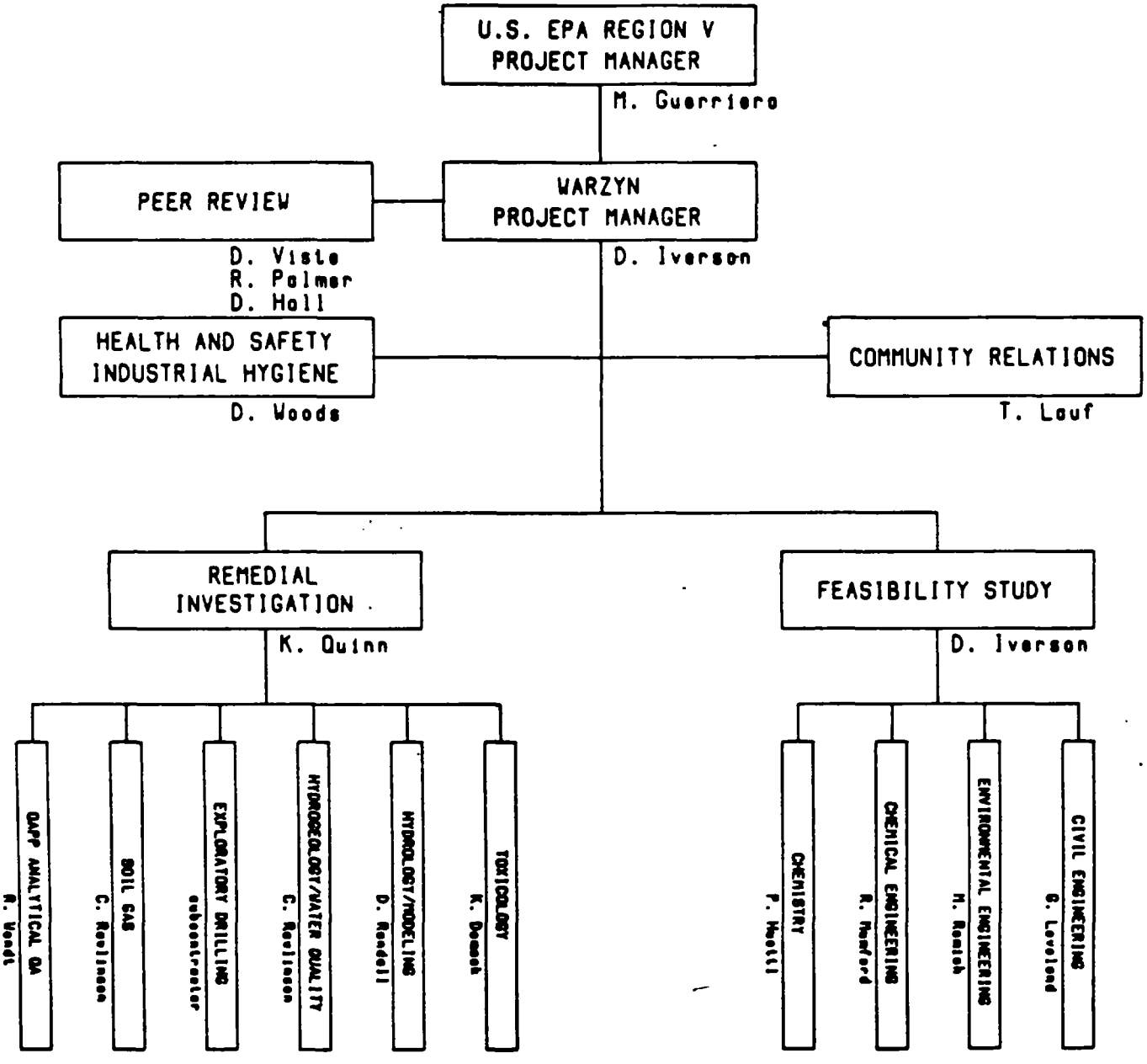


FIGURE 12
PROJECT SCHEDULE
WAUSAU WELL FIELD RI/FS