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Agency

Office of
Emergency and
Remedial Response

EPA/ROD/R05-89/109
September 1989

EPA

Superfund Record of Decision:

Wausau Water Supply, WI

50272-101

REPORT DOCUMENTATION PAGE	1. REPORT NO. EPA/ROD/R05-89/109	2.	3. Recipient's Accession No.
4. Title and Subtitle SUPERFUND RECORD OF DECISION Wausau Water Supply, WI Second Remedial Action - Final			5. Report Date 09/29/89 6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Orgainization Name and Address			10. Project/Task/Work Unit No. 11. Contract(C) or Grant(G) No. (C) (G)
12. Sponsoring Organization Name and Address U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460			13. Type of Report & Period Covered 800/000 14.
15. Supplementary Notes			

16. Abstract (Limit: 200 words)

The Wausau Water Supply site, also known as the Wausau Ground Water Contamination site, is in Wausau, Marathon County, Wisconsin. The site includes six city ground water production wells along the east and west sides of the Wisconsin River. These wells supply drinking water to 33,000 people, and is used for industry in the area. Three primary source areas of ground water contamination have been identified; a municipal landfill, the Wausau Chemical Company, and the Wausau Energy Company. The landfill, which is on the west side of the site, operated from 1948 to 1955 and accepted almost all commercial, industrial, and residential waste generated within Wausau. The landfill appears to be the predominant source of TCE contamination in the underlying aquifer. On the east side of the river the Wausau Chemical and Wausau Energy companies are suspected sources of soil and ground water contamination due to spills from past operations. Wausau Chemical, a bulk solvent distributer, was responsible for spilling 1,000 gallons of PCE-contaminated waste in 1983 alone. Wausau Energy, a petroleum bulk storage and disposal center, has reportedly contaminated soil and ground water with petroleum by-products. To provide sufficient water of acceptable quality EPA temporarily installed a granular activated carbon treatment system on one well in 1984 and VOC stripping towers at the municipal water treatment plant to treat water from two contaminated wells. The city has been blending treated water with uncontaminated water to reduce VOC levels. As an interim remedy, (See Attached Sheet)

17. Document Analysis a. Descriptors

Record of Decision - Wausau Water Supply, WI
Second Remedial Action - Final
Contaminated Media: soil, gw
Key Contaminants: VOCs (TCE, PCE)

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report) None	21. No. of Pages 90
	20. Security Class (This Page) None	22. Price

(See ANSI-Z39.18) *See Instructions on Reverse* OPTIONAL FORM 272 (4-77) (Formerly NTIS-35) Department of Commerce

16. Abstract (continued)

EPA signed a 1989 Record of Decision (ROD) implementing ground water contamination controls, which included pumping and treatment at one of the landfill source areas followed by discharge into the Wisconsin River, to prevent the contaminant plume from migrating to the source of the river. The primary contaminants of concern affecting the soil and ground water are VOCs including PCE and TCE.

The selected remedial action for this site includes treating contaminated soil using an in situ soil vapor extraction (SVE) system and treating gases emitted from the SVE system using vapor phase carbon filters; and continued pumping and treatment of ground water using existing air strippers with modified pumpage rates. The estimated present worth cost for this remedial action is $738,000, which includes present worth O&M costs of $482,000.

RECORD OF DECISION

SELECTED REMEDIAL ALTERNATIVE

Site Name and Location

Wausau Groundwater Contamination Site
Wausau, Wisconsin

Statement of Basis and Purpose

This decision document presents the selected remedial action for the Wausau Groundwater Contamination Site in Wausau, Wisconsin, developed in accordance with CERCLA, as amended by SARA, and to the extent practicable, the National Contingency Plan. This decision is based on the administrative record for this site. The attached index identifies the items that comprise the administrative record upon which the selection of the remedial action is based.

The State of Wisconsin has concurred with the selected remedy.

Assessment of the Site

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record Of Decision, may present current or potential threat to human health, welfare, or the environment.

Description of the Selected Remedy

The selected alternative for the final remedy will address the principal threats posed by the site. The remaining concerns (following implementation of the first operable unit) include three source areas and the contaminant plume affecting the East Well Field in the City of Wausau's well field. The specific components of the selected remedy include:

- Installation of soil vapor extraction (SVE) systems to remove contaminants from soils at each of the identified source areas;

- Treatment of off-gases from the SVE system operation using vapor phase carbon units which will be regenerated off-site; and

- Groundwater remediation utilizing the municipal wells and existing air strippers for expedited removal of contaminant plumes.

Declaration

As required by Section 121(a) of CERCLA as amended by SARA, the selected remedy is protective of human health and the environment, attains Federal and State requirements that are applicable or relevant and appropriate for the remedial action, and is cost effective. This remedy satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable for this site. Because this remedy will not result in hazardous substances remaining on-site above health-based levels, the five-year review will not apply to this action.

September 29th, 1989
Date

Valdas V. Adamkus
Regional Administrator

ADMINISTRATIVE RECORD INDEX-UPDATE
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
	6	85/12/02	Request for Information.	USEPA	See service list	Correspondence	1
	2	88/12/19	Letter documenting the WDNR's position on the interim remedy.	C.D.Beadoy-WDNR	Valdas Adamkus-USEPA	Correspondence	2
	5	89/04/12	Follow-up letter to the Mayor's recent visit to the USEPA and discussion of several questions he had at that time.	Rose Freeman-USEPA	Mayor Robinson-Wausau,WI	Correspondence	3
	2	89/05/02	Request for review of the Alternatives Array Document.	Basil Constantelos-USEPA	Paul Didier-WDNR	Correspondence	4
	8	89/05/16	General Notice Letter.	Norm Niedergang-USEPA	See Attach.II-servicelist	Correspondence	5
	1	89/05/23	Authors intend to continue to cooperate with the USEPA and would be willing to discuss the implementation of the remedy of this site as well as other matters.	Mark Thimke-Foley & Lardner	Margaret Guerriero-USEPA	Correspondence	[illegible]
	3	89/05/25	Amoco declines any involvement in financing or performing the response activities at the site in response to the USEPA letter of 5/16/89..	Debra Mitchell-Amoco Corp.	Guerriero & Gomez-USEPA	Correspondence	[illegible]
	2	89/05/26	Response to General Notice Letter by the counsel for Wausau Energy Corp.	Ronald Ragatz-Huggett,Schumacher,...	Margaret Guerriero-USEPA	Correspondence	8
	8	89/05/30	Response to the "Request for Applicable or Relevant and Appropriate Requirements" for the FS as well as comments on the Alternatives Array Document and on the Alternatuves.	Paul Didier-WDNR	Basil Constantelos-USEPA	Correspondence	9
	1	89/05/30	Attorney for Wausau Chem.	Raymond	Margaret Guerriero-USEPA	Correspondence	10

ADMINISTRATIVE RECORD INDEX-UPDATE
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

FICHE/FRAME PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
		advises the USEPA that they it intends to negotiate a resolution of its "purported" responsibility in connection with the site.	Krueger-Charne, Glassner, ..			
1	89/06/07	Additional ARAR for the site's NPL Site alternatives.	Michelle DeBrock-Owens-WDNR	Margaret Guerriero-USEPA	Correspondence	11
1	89/06/26	Comments on the Agency Review Draft RI.	Michelle DeBrock-Owens-WDNR	Margaret Guerriero-USEPA	Correspondence	12
285	89/07/31	Evaluation of Bio-remediation of Ground Water at the Wausau site along with reports as mentioned in the evaluation.	Dick Scalf-USEPA Kerr Environ. Lab.	Margaret Guerriero-USEPA	Correspondence	13
8	89/08/01	Comments on the Agency Review Draft of the Feasibility Study.	Michelle DeBrock-Owens-WDNR	Margaret Guerriero-USEPA	Correspondence	14
4	89/08/00	"Wausau Well Feasibility Study."	USEPA		Fact Sheet	15
11	88/06/13	Review of the draft addendum Quality Assurance Project Plan for Phase II RI/FS activities.	James Adams-USEPA	Beverly Kush-USEPA	Memorandum	16
1	88/12/16	Air Regulations concerning the proposed Stripping Tower in the Wausau NPL Site Phased Feasibility Study.	Neal Baudhuin-WDNR	M. DeBrock-Owens-WDNR	Memorandum	[illegible]
1	89/05/18	Comment on the Alternatives Array for Final Remedy.	Wen Huang-USEPA	Margaret Guerriero-USEPA	Memorandum	[illegible]
3	89/05/24	Comments on the Alternatives Array Document.	Steve Rothblatt-USEPA	Margaret Guerriero-USEPA	Memorandum	[illegible]

ADMINISTRATIVE RECORD INDEX-UPDATE
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
	4	89/05/26	Water Division review of the Alternatives Array document.	Charles Suftin-USEPA	Basil Constantelos-USEPA	Memorandum	20
	2	89/07/03	Request for assistance in review of In-Situ Bio-reclamation for Remediation of groundwater contamination at the Wausau Groundwater Contamination Site.	Margaret Guerriero-USEPA	Scalf&Matthews-KerrEnvLab	Memorandum	21
	6	89/07/18	Risk Assessment on three Air Strippers.	Mardi Klevs-USEPA	Margaret Guerriero-USEPA	Memorandum	22
	1	89/08/08	Water Division review of the Draft FS and Proposed Plan.	Charles Suftin-USEPA	Basil Constantelos-USEPA	Memorandum	23
	1	89/08/11	Review of the Air Portion of the Draft Proposed Plan.	Mardi Klevs-USEPA	Margaret Guerriero-USEPA	Memorandum	24
	1	89/08/07	"EPA Seeks Comments On Wausau Well-Field Study; Public Meeting Aug. 22."	USEPA		News Release	25
	18	00/00/00	Proposed Plan for Remedial Action.	USEPA		Reports/Studies	26
	114	89/04/26	Alternatives Array Document Feasibility Study.	Warzyn Engineering	USEPA	Reports/Studies	27
	7	89/06/00	Preliminary Health Assessment.	Wisconsin Div. of Health	USEPA & ATSDR	Reports/Studies	28
	290	89/07/24	Remedial Investigation Report: Vol. I - Report, Tables And Figures.	Warzyn Engineering	USEPA	Reports/Studies	29
	615	89/07/24	Remedial Investigation Report: Vol. II - Appendix A.	Warzyn Engineering	USEPA	Reports/Studies	30
	566	89/07/24	Remedial Investigation Report: Vol III - Appendices B-Q.	Warzyn Engineering	USEPA	Reports/Studies	31

ADMINISTRATIVE RECORD INDEX-UPDATE
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

FICHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
	252	89/08/11	Feasibility Study.	Warzyn Engineering	USEPA	Reports/Studies	32

No.
5/89

UPDATE
ADMINISTRATIVE RECORD INDEX
WAUSAU,WISCONSIN GROUNDWATER CONTAMINATION
WAUSAU, WISCONSIN

F/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCNUMBER
	2	89/09/12	Wausau Chemical requests direction within the Record of Decision regarding operational requirements for groundwater system	D. Kiesling-Wausau Chemical	S.Pastor-USEPA	Correspondence	
	1	89/09/14	USEPA Water Division Comments on Record of Decision review	C.Sutfin-USEPA	B.Constantelos-WMD	Correspondence	
	1	89/09/14	RCRA/CERCLA Liason comments on Record of Decision	J.Kleiman-USEPA	M.Guerriero-USEPA	Correspondence	
	1	89/09/18	Comments on the review of the Air Portion within the Record of Decision by Air and Radiation Branch	K.Klevs-USEPA	M.Geurriero-USEPA	Correspondence	
	1	89/09/19	Comments concerning Draft of Record of Decision by WDNR	M.DeBrock-Owens/WDNR	M.Guerriero-USEPA	Correspondence	
	54	89/08/22	Typed notes on the Wausau Well Field Superfund Public Meeting held at Wausau City Hall, August 22, 1989	USEPA		Meeting Notes	
	80	89/09/00	Record of Decision (ROD);document explaining selection of final remedy	Valdus Adamkus-USEPA		Reports/Studies	

WAUSAU, WISCONSIN REMEDIAL ACTION:GROUNDWATER CONTAMINATION
GUIDANCE DOCUMENTS FOR THE ADMINISTRATIVE RECORD UPDATE.
DOCS. NOT COPIED - MAY BE REVIEWED AT THE
USEPA REGION V OFFICES, CHICAGO, ILLINOIS.

TITLE	AUTHOR	DATE
Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.	OSWER 9355.3-01	88/10/00

ADMINISTRATIVE RECORD SAMPLING/DATA INDEX UPDATE.
WAUSAU, WISCONSIN GROUNDWATER CONTAMINATION SITE
DOCUMENTS MAY BE REVIEWED AT THE USEPA
REGION V OFFICES, CHICAGO, IL.

DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE
89/02/09	Copies of the sample tags, chromatograms, and quantitation lists for samples in case no. 9659 SAS 3887E.	Patrick Churilla-CLP-DPO:USEPA	Craig Rawlinson-Warzyn	Sampling/Data

**WAUSAU, WISCONSIN REMEDIAL ACTION:GROUNDWATER CONTAMINATION
GUIDANCE DOCUMENTS FOR THE ADMINISTRATIVE RECORD.
DOCS. NOT COPIED - MAY BE REVIEWED AT THE
USEPA REGION V OFFICES, CHICAGO, ILLINOIS.**

TITLE	AUTHOR	DATE
Guideline on preparing Superfund Decision Documents; Interim Final	OSWER 9355.3-02	89/7/00
Guidance on Remedial Actions for Contaminated Groundwater at Superfund Sites	OSWER 9283.1-2	88/12/00

ADMINISTRATIVE RECORD INDEX-UPDATE #2
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

CHE/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
	5	89/08/27	Warzyn Engineering responds to WDNR comments concerning Feasibility Study; with focus on the groundwater flow and contaminant transport models.	K.Quinn-Warzyn Engineering	M.Guerriero-USEPA	Correspondence	
	2	89/09/12	Wausau Chemical requests direction within the Record of Decision regarding operational requirements for groundwater system	D. Kiesling-Wausau Chemical	S.Pastor-USEPA	Correspondence	
	1	89/09/14	USEPA Water Division Comments on Record of Decision review	C.Sutfin-USEPA	B.Constantelos-WMD	Correspondence	
	1	89/09/14	RCRA/CERCLA Liason comments on Record of Decision	J.Kleiman-USEPA	M.Guerriero-USEPA	Correspondence	
	1	89/09/18	Comments on the review of the Air Portion within the Record of Decision by Air and Radiation Branch	M.Klevs-USEPA	M.Geurriero-USEPA	Correspondence	
	1	89/09/19	Comments concerning Draft of Record of Decision by WDNR	M.DeBrock-Owens/WDNR	M.Guerriero-USEPA	Correspondence	
	2	89/09/28	State of Wisconsin concurrence regarding final remedy for Wausau Contamination Site	C.Besadny-WDNR	V.Adamkus-USEPA	Correspondence	
	1	89/08/14	Public Notice	USEPA	General Public	Fact Sheet	

ADMINISTRATIVE RECORD INDEX-UPDATE #2
WAUSAU, WISCONSIN
GROUNDWATER CONTAMINATION SITE

F/FRAME	PAGES	DATE	TITLE	AUTHOR	RECIPIENT	DOCUMENT TYPE	DOCUMENT NUMBER
			on the Wausau Well Field Superfund Study/Proposed Plan				
	54	89/08/22	Typed notes on the Wausau Well Field Superfund Public Meeting held at Wausau City Hall, August 22, 1989	USEPA		Meeting Notes	
	1	89/08/23	News Article in Wausau Daily Herald on proposed cleanup plan	T.Rutlin-Wausau Daily Herald		News Article	
	80	89/09/29	Record of Decision (ROD); document explaining selection of final remedy	Valdus Adamkus-USEPA		Reports/Studies	

SUMMARY OF REMEDIAL ALTERNATIVE SELECTION

WAUSAU GROUNDWATER CONTAMINATION SITE
WAUSAU, WISCONSIN

I. SITE LOCATION AND DESCRIPTION

The City of Wausau is located along the Wisconsin River in Marathon County, Wisconsin. The Wausau Groundwater Contamination site encompasses an area in the northern section of the city which includes the City Well Field and six of its production wells (See Figures 1 and 2).

The City of Wausau provides drinking water for approximately 33,000 people. The City presently operates seven groundwater production wells, six of which are located on the north side of the City. A seventh well, City Well 8 (CW8), is located adjacent to the Wausau Municipal Airport, on the south side of the City. The water from CW8 has a high concentration of iron and is used only during peak demand periods. Production wells CW6, CW7, CW9 and CW10 are located west of the Wisconsin River and are collectively referred to as the West Well Field. The West Well Field (Figure 2) is located in a predominantly residential area, although a few industrial facilities are located in this area. Production wells CW3 and CW4 are located on the east side of the Wisconsin River and are referred to as the East Well Field. The East Well Field is located in a predominantly industrial section of the City.

The seven production wells are screened in an aquifer of glacial outwash and alluvial sand and gravel deposits which underlie and are adjacent to the Wisconsin River. This unconfined aquifer supplies nearly all potable, irrigation, and industrial water to residents and industries located in Wausau and the surrounding areas. Within the study area the alluvial aquifer ranges from 0 to 160 feet thick, and has an irregular base and lateral boundaries.

II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

A. Site History

The City discovered in early 1982 that its production wells CW3, CW4, and CW6 were contaminated by volatile organic compounds (VOCs). The major contaminants include Tetrachloroethene (PCE), Trichloroethene (TCE), and 1,2-dichloroethene (DCE). Toluene, ethylbenzene, and xylene were also detected at CW4. TCE is the

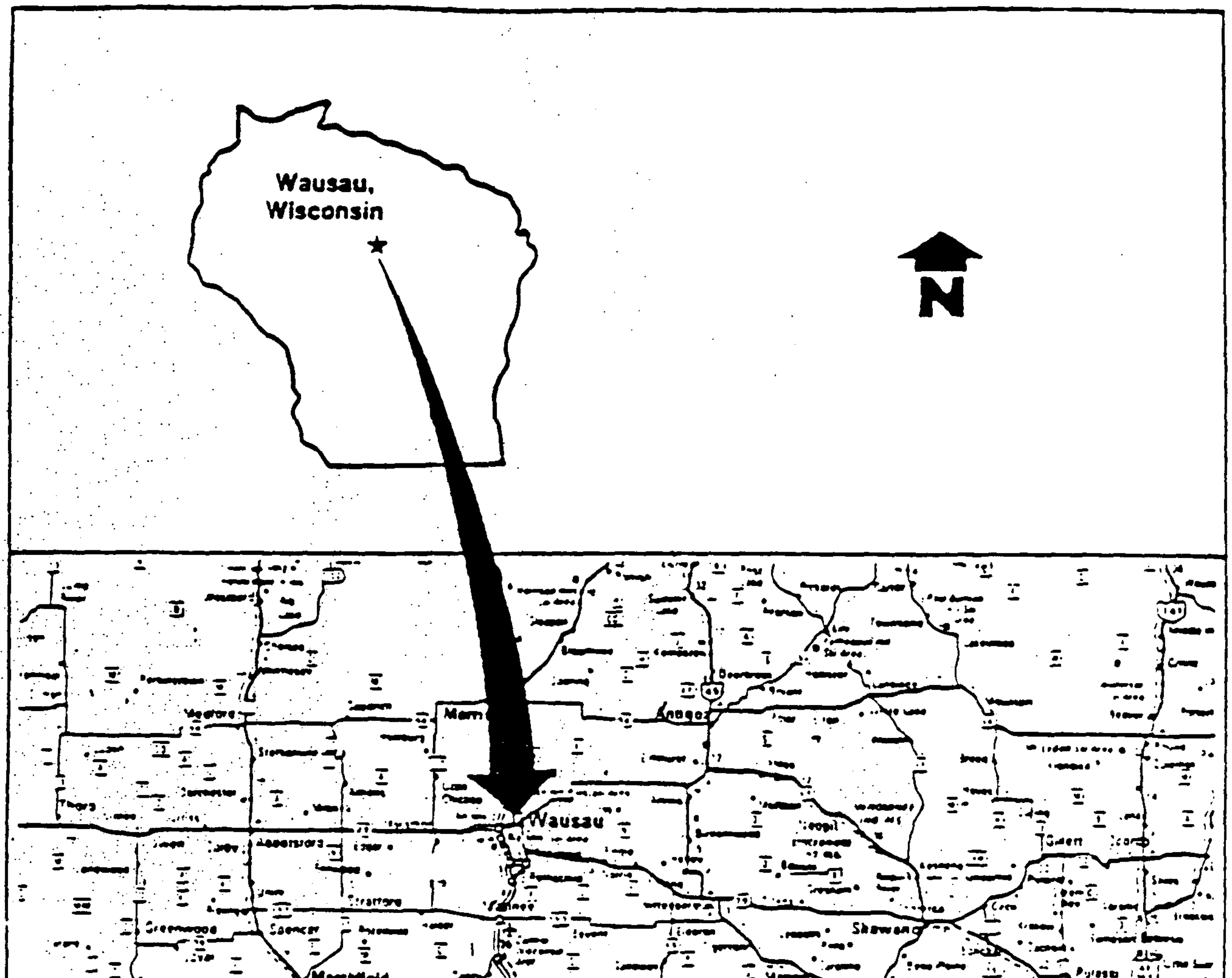
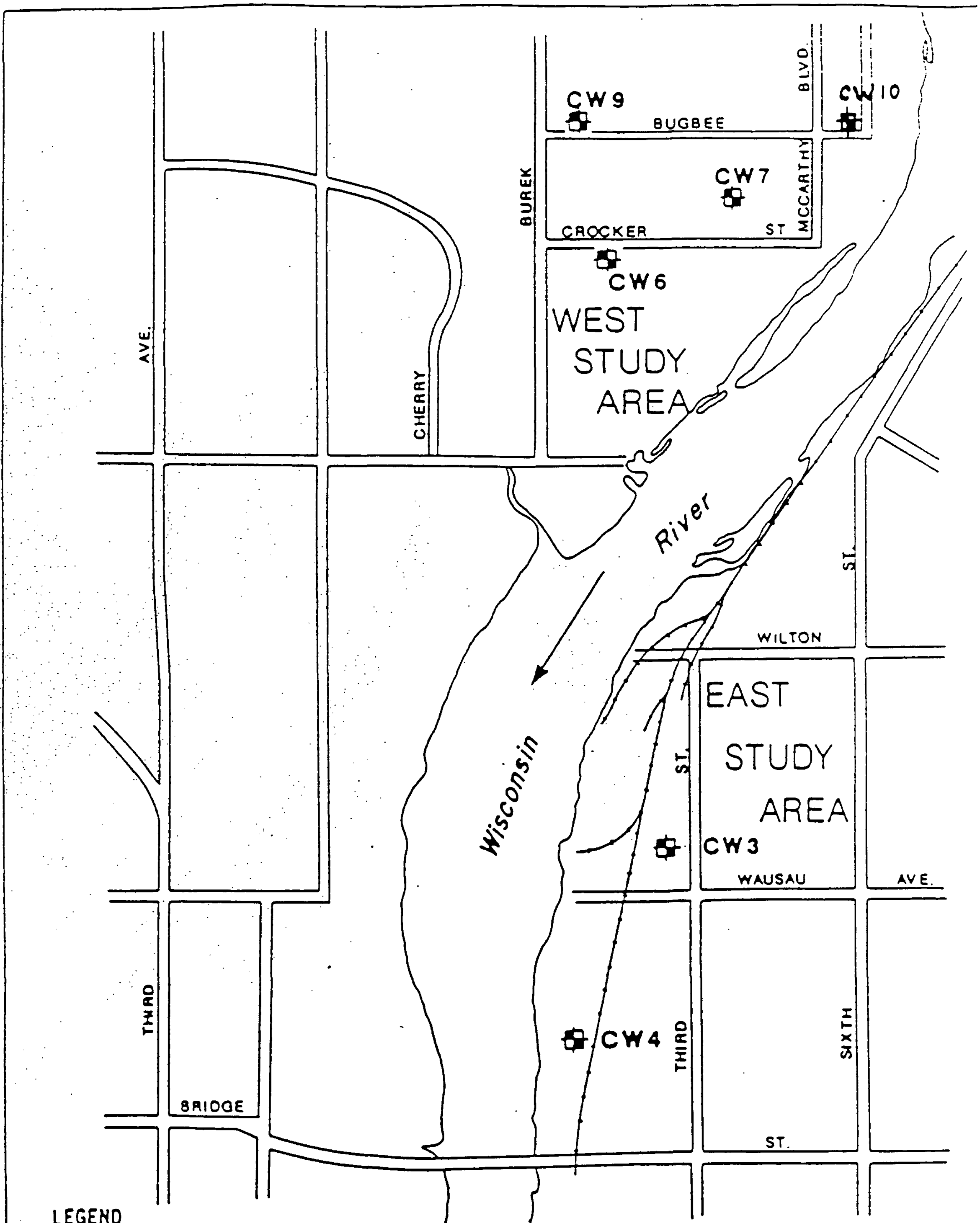


FIGURE 1 REGIONAL LOCATION MAP



LEGEND

CW6 CITY SUPPLY WELL

NOTE:

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

SCALE: 1" = 1000'

FIGURE 2

predominant volatile organic compound detected at CW6, although below method detection limit (BMDL) concentrations for PCE and (DCE) have also been previously reported (Weston, 1984). Since the contamination was first detected in early 1982, TCE concentrations from CW6 have ranged from 70 micrograms per liter (ug/L) to 260 ug/L. The most recent sampling (August 1988) indicates TCE concentrations of approximately 160 ug/L. Sample results from the East Well Field (CW3 and CW4) have indicated considerable PCE, TCE, and DCE impacts at both wells. CW4 has generally indicated steadily decreasing concentrations of the three constituents since February 1984. CW3 has indicated decreasing PCE and DCE concentrations since the VOCs were discovered in early 1982. However, TCE concentrations at CW3 have remained relatively constant at concentrations ranging between 80 ug/L and 210 ug/L.

To reduce VOC concentrations, the City originally instituted a program where uncontaminated water from CW9 and CW7 was blended with water from CW3, CW4, and CW6 to dilute the VOC concentrations. However, increasing VOC concentrations in groundwater caused this method to be ineffective, and resulted in then current regulatory limits being exceeded.

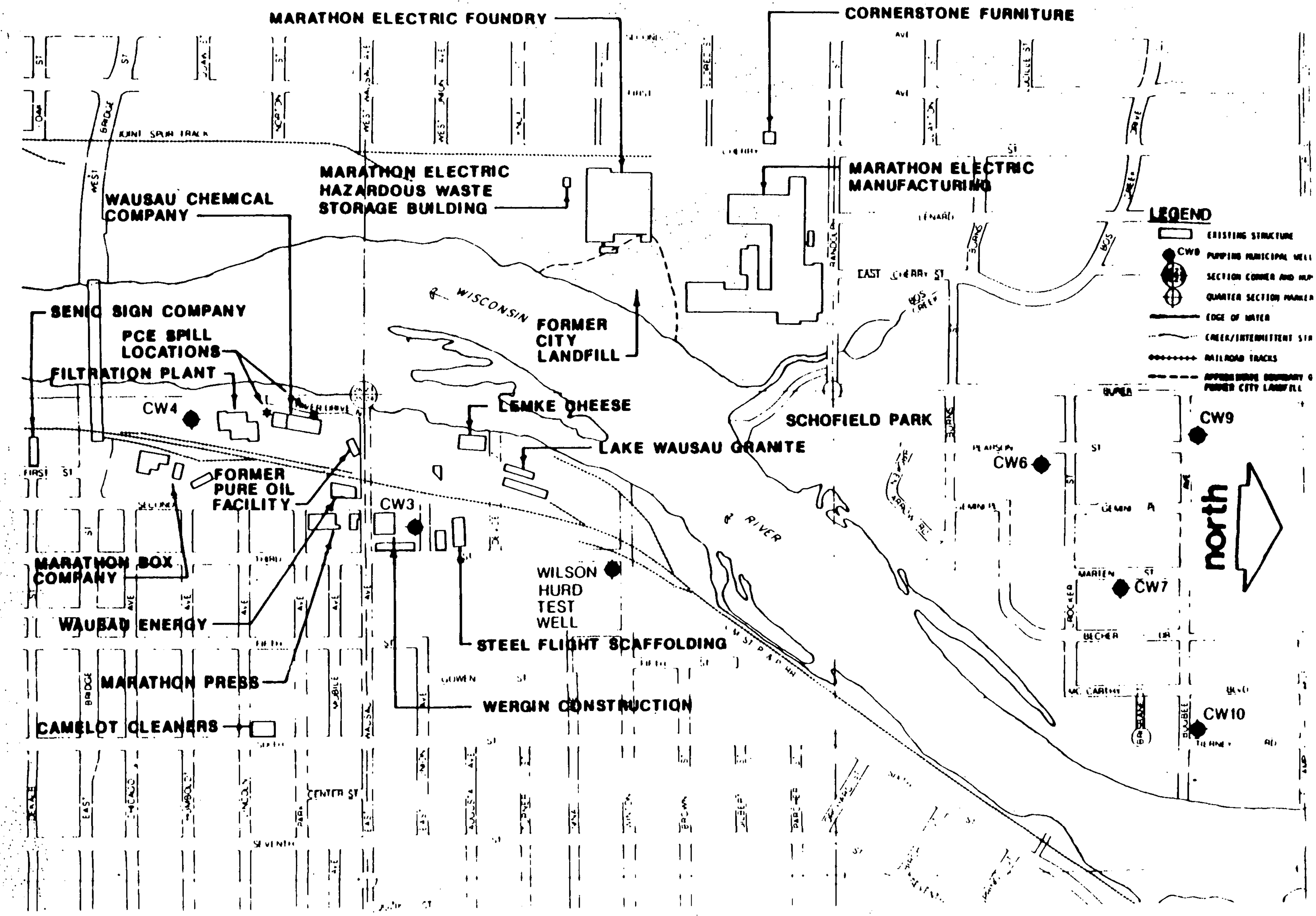
In 1983, the United States Environmental Protection Agency (U.S. EPA) awarded the City of Wausau a federal grant to help fund the design and installation of a packed tower VOC stripper in order to provide sufficient water of acceptable quality to City residents. However, because VOC levels in the distribution system continued to increase, U.S. EPA's emergency response team was asked for assistance. As an interim measure in June 1984, the U.S. EPA installed a granular activated carbon (GAC) treatment system on CW6. VOC stripping towers were installed in the Summer and Fall of 1984 at the City water treatment plant to treat water from CW3 and CW4. Subsequently, the GAC system was removed from service in October 1984. In December 1985 the Wausau Groundwater Contamination site was added to the National Priorities List (NPL) for remedial activities under Superfund.

The City has been blending water treated for VOC removal with water from uncontaminated supply sources (CW7, CW9 and CW10) to reduce VOC concentrations in the water supply distribution system. Data indicate that prior to installation of treatment units (pre-July 1984), drinking water samples taken from various taps in the City of Wausau consistently contained TCE with concentrations ranging from detectable levels (>1 ug/L) to 80 ug/L. Lower levels of PCE and DCE were identified shortly after discovery of the contamination, probably before blending had reduced the levels of VOCs. Following installation of the packed tower VOC strippers, the water supply distribution system has had relatively low levels of VOC's (generally below detection limits of 0.5 to 1.0 ug/L). These levels are dependent on continued effective operation of the treatment system for CW3 and CW4, the influent VOC concentration for each well, and continued use of the three uncontaminated wells (CW7, CW9 and CW10).

B. Previous Studies

Previous investigations have identified several potential point sources of VOC contamination in the vicinity of City production wells. Becher-Hoppe Engineers, Inc. was contracted by the City of Wausau to conduct an investigation of the East Well Field in the vicinity of CW3. The study concentrated on the Wergin Construction Co. property, the former site of a City maintenance garage. Foth & Van Dyke and Associates, Inc. performed a groundwater investigation at the Wausau Energy Company property located just south of the above property, in order to determine the effect of past bulk oil operations at the site. STS Consultants Ltd. performed groundwater investigations at the Wausau Chemical Company, also located in the East Well Field, and instituted a groundwater extraction and treatment system to remediate effects of past VOC releases from their facility operations. In addition, approximately 1000 cubic yards of contaminated soils were excavated from the site. Twin City Testing and Engineering Laboratory, Inc. conducted investigations in the East Well Field vicinity on behalf of the Wisconsin Department of Natural Resources (WDNR). Roy F. Weston Inc. conducted an investigation of both the East and West Well Fields as part of the U.S. EPA emergency response action. CH_2M Hill Inc. was contracted by the WDNR to perform a hydrogeologic investigation of the abandoned City of Wausau landfill, located on property presently owned by Marathon Electric Company in the southern part of the West Well Field. RMT Inc. and Geraghty & Miller Inc., representing Marathon Electric Corporation and the City of Wausau, respectively, performed a hydrogeologic investigation to determine the source of TCE in the groundwater in the vicinity of CW6. Geraghty & Miller, Inc. also installed several wells in the East Well Field in order to investigate VOC contamination of CW3. Locations of facilities discussed above are illustrated in Figure 3, and a listing of previous studies is presented in Table 1.

Investigations conducted previously have produced inconclusive results. Potential sources have been identified, but data gaps existed on source concentration, release rates, migration routes, aquifer characteristics, effect of river stage and groundwater pumping on flow direction, and velocity of groundwater and contaminants. The conclusions of most of these studies include a recommendation for further study. At least two studies also expressed the need for a comprehensive investigation to address the entire well field. The Remedial Investigation/Feasibility Study (RI/FS), was initiated by U.S. EPA to fill the data gaps and determine a cost-effective solution to the groundwater problem.



LOCATION OF MUNICIPAL WELLS & INDUSTRIAL SURVEY BUSINESSES

FIGURE 3

TABLE 1

EXISTING REPORTS ON WAUSAU GROUNDWATER CONTAMINATION SITE

1. Groudwater Investigation, (for City of Wausau), Becher Hoppe Engineers, Inc., 1983.

2. Subsurface Exploration and Testing Program to Evaluate Ground Water Quality at the Wausau Chemical Facilities in Wausau, Wisconsin, (for Wausau Chemical Company), STS Consultants, Ltd., July, 1984.

3. Hydrogeological Investigation of Volatile Organic Contamination in Wausau, Wisconsin Municipal Wells, (for U.S. EPA), Roy F. Weston, Inc., September, 1985.

4. Investigation of an Abandoned City of Wausau Landfill, (for WDNR), CH_2M Hill, February, 1986.

5. Existing Conditions Report and Exploration Program, East Municipal Well Field, Wausau, Wisconsin, (for WDNR), Twin City Testing Corporation, August, 1986.

6. VOC Groundwater Investigation at the Former Wausau Energy Facility in Wausau, Wisconsin, (for Wausau Energy Corporation), Foth & Van Dyke and Associates, Inc., July, 1986.

7. Hydrogeological Investigation of the Alluvial Aquifer Beneath City Well Six, Wausau, Wisconsin, (for City of Wausau and Marathon Electric), RMT, Inc., and Geraghty & Miller, Inc., July, 1987.

C. Previous Operable Unit

An operable unit ROD to address the west side contaminant plume, composed mainly of TCE, was signed in December 1988. Prior to the summer of 1988, CW6, which the City pumped directly into Bos Creek as waste (subsequently contaminating Bos Creek), served as a blocking well to the rest of the West Well Field. The discharge of CW6 to Bos Creek has resulted in a contaminated groundwater mound between the source area and CW6. The influence of the groundwater mound may not have fully penetrated the glacial outwash aquifer, but Phase I RI data suggest that the mound served effectively to divide the West Well Field contaminant plume into northern and southern portions, slowing contaminant migration from the source area.

In summer 1988 the City of Wausau placed CW6 back in service after completion of a transport pipe to carry contaminated water to the air stripper located on the east side of the River. Because of this, the pumping rate of CW6 has increased substantially, and the untreated discharge to Bos Creek has been discontinued. These two factors tend to increase the rate of migration from the source area toward CW6. Water from CW6 is now treated for VOC removal using the existing air strippers at the water utility. However, CW6 continues to serve as an interceptor well, providing the sole protection for the remaining wells in the West Well Field.

The scope of the operable unit was limited to the contaminant plume impacting the West Well Field and CW6, since additional protection of the West Well Field was possible by preventing or limiting the extent of future contaminant movement to the north. Previously, protection was provided due to the apparently slowed contaminant migration to the north caused by discharge of CW6 to Bos Creek. Implementation of plume migration controls is expected to effectively limit the time during which CW6 draws in contaminants, thereby also limiting the period during which water consumers are exposed to trace levels of contaminants.

The Phased Feasibility Study (PFS) for the interim remedy included four alternatives to address the contaminant plume affecting the West Well Field. The selected remedy calls for the installation of an extraction well located in the southern portion of the plume, implementation of a treatment system for removal of contaminants from extracted water, and discharge of the treated water to the Wisconsin River. The selected remedy also includes a provision for an additional extraction well if necessary to effectively address the contaminant plume.

The remedial design for the operable unit is currently under way. It is expected that the system will be installed by winter of

1989, and operational by spring of 1990.

D. CERCLA Enforcement

CERCLA enforcement activities began at the site in 1986. U.S. EPA identified five Potentially Responsible Parties (PRPs) as having potential responsibility as waste generators and/or transporters. Notice letters informing PRPs of their potential liabilities and offering them the opportunity to perform the RI/FS were sent via certified mail on January 17, 1986 to the five identified PRPs listed below:

* City of Wausau
* Marathon Electric Company
* Wausau Chemical Company
* Wausau Energy Company
* Amoco Oil Corporation

Several negotiation meetings were held to discuss technical and legal issues of a consent decree for the site. However, negotiations were unsuccessful, and the PRPs declined to participate in the RI/FS. The U.S. EPA then contracted with Warzyn Engineering, Inc. in July 1987 to conduct the RI/FS.

Although the PRPs failed to reach an agreement with U.S. EPA, they have maintained considerable involvement in U.S. EPA's study. Two of the five PRPs conducted an investigation of the West Well Field and all have requested split samples and/or results of data collected. In addition, two of the PRPs, the City of Wausau and Marathon Electric, have entered into a consent decree to perform the operable unit Remedial Design/Remedial Action (RD/RA).

In November, 1987, (as amended April 1988) U.S. EPA filed suit for recovery of past costs spent on U.S. EPA's emergency response actions. A settlement was reached between three of the four defendant PRPs (Marathon Electric, The City of Wausau, and Wausau Chemical) for approximately 85% of past costs. A consent decree was entered in federal district court July 18, 1989. A second consent decree with Wausau Energy is expected to be lodged with the court in the near future.

Negotiations with the PRPs for the final RD/RA have been postponed at the request of the PRP group. This is based on the fact that two of the PRPs are currently involved in the implementation of the operable unit RD/RA based on an agreement with U.S. EPA to perform the operable unit, and to allow the final remedy PRP group to organize. Special Notice letters will be sent following ROD signature to the five PRPs listed above. Negotiations will proceed according to U.S. EPA's general guidance and policies.

III. COMMUNITY RELATIONS

An RI/FS "kick-off" public meeting was held in September 1987, to inform the local residents of the Superfund process and the work to be conducted. Issues raised during the meeting, attended mostly by PRP agents and City officials, included the cost of the RI/FS, the estimated time to complete the study, and the number of previous studies performed for the site.

A second public meeting was held in October 1988 to discuss the findings of the Phase I RI and PFS, and to present the proposed plan for an operable unit at the site. Two formal public comments were received during the public meeting and written comments were also received during the public comment period. All comments received during the comment period and U.S. EPA's responses were included in the responsiveness summary for the Interim ROD.

Information repositories have been established at Wausau City Hall, 407 Grant Street, and the Marathon County Public Library, 400 First Street, Wausau, Wisconsin. In accordance with section 113(k)(1) of CERCLA, the administrative record for the site is available to the public at these locations. The draft FS and the proposed plan were available for public review and comment from August 14, 1989 to September 12, 1989.

A public meeting to discuss the findings of the RI/FS and to present U.S. EPA's preferred alternative for the final remedy was held August 22, 1989 in the Wausau City Hall. Four formal public comments were received during the public meeting. All of the comments were in support of U.S. EPA's preferred alternative. One additional comment was received during the remainder of the public comment period. All comments will be addressed in the responsiveness summary of this document. The provisions of sections 113(k)(2)(i-v) and 117 of CERCLA relating to community relations have been satisfied.

IV. SCOPE AND ROLE OF RESPONSE ACTION

The scope of this response action is to address the remaining concerns (principal threats) at the site. As discussed, a previous operable unit action at the site addresses the contaminant plume originating from the former landfill/Marathon Electric source area which affects CW6.

During development of the final FS, it was determined that the deep plume which originates from the former City landfill area and migrates under the River to CW3 would best be addressed by purging groundwater at the same location as the interim remedy extraction system. Therefore, it was determined that an increase in the minimum pumping rates called for in the extraction system and modifications to the monitoring plan would provide the most effective remediation for this contaminant plume. It was also assumed that the City would continue to use CW3 as a supply well and thus continue to remove contaminants from the most eastern portion of the plume.

The selected alternative for the final phase of the Wausau project, in conjunction with the operable unit, will address all concerns at the site. Remaining concerns include three source areas and the shallow east side groundwater contaminant plume originating from the Wausau Chemical source area. The identified source areas include; former City landfill/Marathon Electric property, Wausau Chemical property, and Wausau Energy property.

The final remedy for the site is intended to address the entire site with regards to the principal threats to human health and the environment posed by the site as indicated in the risk assessment for the site. The findings of the risk assessment are included in the RI Report and are summarized in a later section of this document.

V. CURRENT SITE STATUS AND SITE CHARACTERISTICS

A. Current Site Status

The RI/FS was completed in August 1989 for U.S. EPA by its contractor, Warzyn Engineering, Inc. The RI entailed two phases of field sampling events. Phase I of the RI field work was conducted from August through January 1987, results of which are summarized in the April 1988 technical memorandum. Phase II of the RI field work was conducted from June to September 1988. Results of both phases of work are included in the RI report for the site.

The FS details the development and evaluation of an array of remedial action alternatives to address the entire Wausau Groundwater Contamination site and sources impacting it.

B. Site Characteristics

1. Hydrogeology

The City production wells are located within glacial outwash and alluvial sediments underlying and adjacent to the Wisconsin River. The aquifer is located within a bedrock valley which is underlain and laterally bounded by relatively impermeable igneous bedrock. Groundwater flow within the unconfined glacial aquifer has been drastically changed by the installation of the production wells. Under non-pumping conditions, groundwater flows toward the Wisconsin River and its tributary (Bos Creek). Groundwater naturally discharges at the surface water bodies.

However, under pumpage conditions, groundwater flows toward the production wells. The natural groundwater flow directions are frequently reversed due to City well pumping which induces recharge of surface water into the aquifer. The horizontal flow in the vicinity of the well field is indicated by the potentiometric contours shown in Figure 4.

The potentiometric surface map also indicates that the cone of depression from the East Well Field appears to affect groundwater flow below and to the west of the Wisconsin River. Monitoring well nests located at Marathon Electric indicate very slight downward gradients adjacent to the Wisconsin River. Below the Wisconsin River, the East Well Field production well pumpage has induced surface water recharge of the aquifer, causing flow downward through the river bed and toward CW3.

Aquifer hydraulic conductivity tests performed during the Phase I RI investigation indicated hydraulic conductivity values ranging from 1.7×10^{-4} cm/sec to 8.1×10^{-2} cm/sec. The overall average hydraulic conductivity of the outwash aquifer is approximately 2.2×10^{-2} cm/sec, based on test data at monitoring wells.

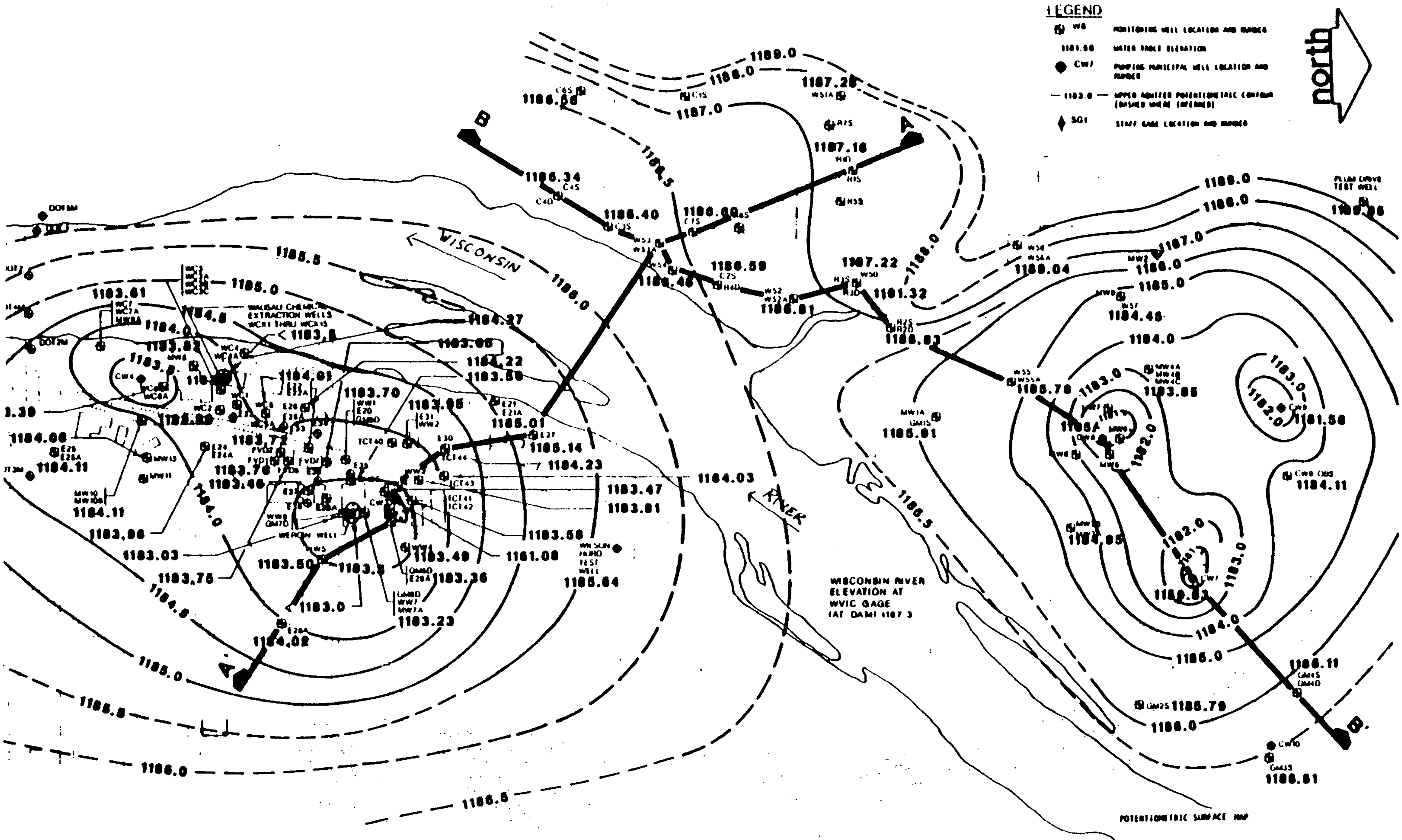
2. Chemical Characteristics

a. Groundwater Quality

Groundwater quality sampling conducted during both phases of the field investigation has identified a vertical and lateral distribution of total chlorinated ethenes which suggests that a minimum of three sources are affecting the City well field. The estimated areal distribution of total chlorinated ethenes is shown in Figure 5. The distribution is based on a combination of data obtained from laboratory VOC analyses of Rounds 1, 2, and 3 groundwater samples (October 1987 to September 1988), and field laboratory analyses of groundwater samples collected during drilling (October and November 1987).

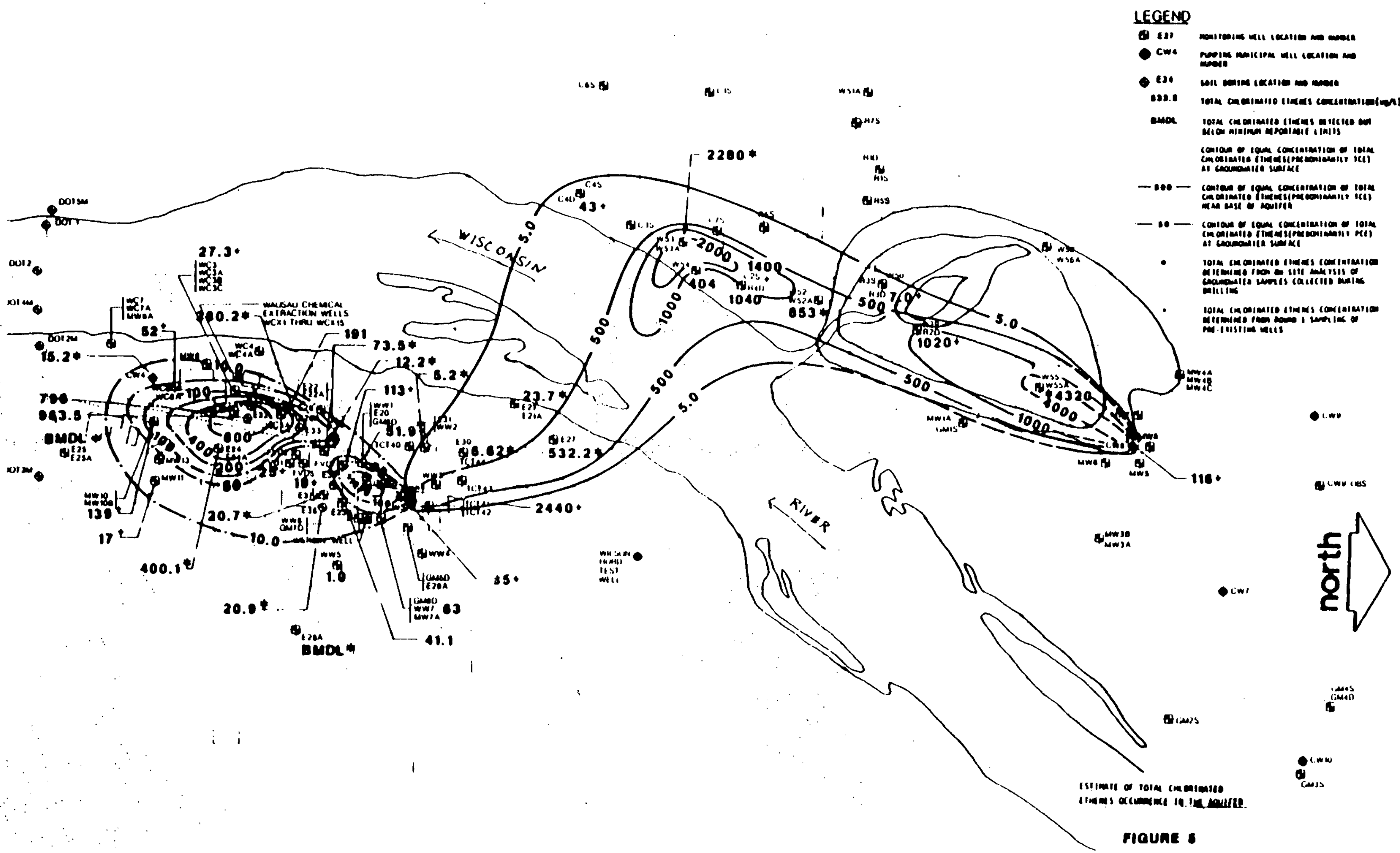
West side monitoring wells delineate a deep (greater than 100 foot) north-south trending TCE plume. Based on the vertical distribution of TCE throughout the aquifer in the vicinity of the old City landfill and the presence of TCE in the unsaturated zone in this area, a source appears to be located within the northern portion of the former City landfill/Marathon Electric property. The plume appears to have migrated northward, under influence of pumpage from CW6. The highest TCE concentration (4200 ug/L) in the plume was detected approximately 550 feet south of CW6.

TCE was also observed in the shallow aquifer between Bos Creek and CW6. This plume is shown on Figure 5 by the lightly shaded contours between Bos Creek and CW6. The shallow aquifer TCE contamination appears to result from the induced infiltration of



POTENTIOMETRIC SURFACE MAP

FIGURE 4



ESTIMATE OF TOTAL CHLORINATED ETHENES OCCURRENCE IN THE AQUIFER

FIGURE 5

surface water from Bos Creek, which has been contaminated by the discharge from CW6. The induced surface water recharge of the aquifer is evident from the downward vertical gradients at monitoring well nests in that area. Based on laboratory analyses of samples collected during the RI field work, TCE concentrations adjacent to the CW6 discharge were above 100 ug/L. TCE concentrations in the ponded area downstream were approximately 70 ug/L. TCE was not detected in surface water samples collected upstream of the CW6 discharge, nor was it detected at the point of discharge of Bos Creek to the Wisconsin River.

The distribution of TCE in monitoring wells located between the Wisconsin River and CW3 suggest eastward migration of a deep TCE plume below the Wisconsin River also from the vicinity of the former City Landfill (refer to Figure 5). TCE appears to be vertically distributed throughout the aquifer in the vicinity of the old City landfill. Slight vertical downward gradients were observed in monitoring wells in the area. The highest concentrations of TCE were detected at a depth of approximately 115 feet. After moving into the deeper portion of the aquifer, a portion of the plume appears to migrate eastward under the influence of pumpage from CW3 (refer to Figure 4).

East side monitoring wells indicate three plumes within the East Well Field area, one from the west side originating from the former City landfill/Marathon Electric property (discussed above) and two originating southwest of CW3. These two plumes are restricted to the shallow portion of the aquifer (upper 40 feet), and consist of primarily PCE, TCE, and DCE. Both of these plumes have resulted from releases of PCE from the Wausau Chemical facility.

A large widely dispersed VOC plume extending eastward from the Wausau Chemical property was identified during the three sampling rounds. The highest concentrations of VOCs in this plume were detected in the vicinity of the Wausau Chemical storage area behind the southern part of the building.

A second plume was detected north of the Wausau Chemical facility in the vicinity of the northern loading dock. This plume was differentiated from the other plume by the relative absence of PCE degradation products (TCE, 1,2-DCE, etc.). Analyses conducted for Round 3 samples (May 1988) indicate a PCE concentration of approximately 2000 ug/l. Based on the differences in plume composition and areal distribution, the two shallow aquifer impacts appear to be the result of separate release events from one or more sources at the Wausau Chemical facility.

Comparison of VOC concentrations and pumpage rates at CW3 and CW4 suggests that both wells have experienced multiple impacts from the same source area; the extent of impact being dependant on pumping schemes of the City's supply wells, river stage, and the strength of the source. Total VOCs at both CW3 and CW4 have been decreasing over time indicating a possible reduction in source intensity. However, TCE concentrations at CW3 have remained relatively consistent which is attributed to the TCE plume migrating under the River from the west side.

b. Sources of Contamination

Contamination source areas were identified and characterized based on results of field sampling of soils, landfill contents (using test pits and soil borings), groundwater, surface water, sediment and soil gas media. Based on sampling activities conducted during the RI, four source areas of VOCs were identified. Two of these sources are located on the west side of the Wisconsin River (the former City landfill and Bos Creek) and two sources are located on the east side (Wausau Chemical and Wausau Energy).

The former City landfill/Marathon Electric property occupies a former sand and gravel pit located on the west bank of the Wisconsin River. The landfill, which consists of approximately 4.5 acres, operated between 1948 and 1955 and accepted almost all commercial, industrial, and residential waste generated within the City of Wausau. The majority of the landfill is currently covered by a bituminous pavement parking lot, however the southern portion is vegetated.

The predominant source of TCE contamination to CW6 and CW3 appears to be the former City landfill/Marathon Electric property. Elevated concentrations of TCE were detected in groundwater, soil, and soil gas samples obtained from the northern portion of the landfill. Soil gas concentrations within the landfill range from below minimum detection limits (1.0 ug/L) to approximately 107 ug/L. Soil samples obtained from borings in the vicinity of the landfill contain concentrations of approximately 200 ug/kg. Groundwater samples obtained from the water table in the vicinity of the landfill indicate TCE concentrations ranging from 16 ug/L to approximately 1900 ug/L. Also detected in the vicinity of the landfill were 1,1,1-trichloroethane (TCA), 1,2-dichloroethene, chloroform, and carbon tetrachloride at concentrations generally below 100 ug/L.

In addition to VOCs, contaminants identified in landfill soil/waste samples include polycyclic aromatic hydrocarbons (PAHs) and metals. PAHs were found throughout the fill, with the highest concentrations observed in the center of the fill area. Heavy metals were distributed throughout the fill. Chromium, zinc, and nickel were also detected in groundwater samples from beneath the fill. These metals appear to be restricted to the immediate vicinity of the landfill and have not been detected in groundwater samples outside of the fill area.

Based on calculations performed for the RI, the total amount of VOCs remaining in the unsaturated soils in the northern portion of the landfill is estimated to be approximately 300 pounds. This is considered an estimate and could vary considerably if contamination exists beneath the fill and/or if areas of undetected high concentrations or non-aqueous phase of contaminants exist.

As discussed previously, low levels of TCE were also detected in samples from shallow monitoring wells on the west side in the vicinity of Bos Creek (see Figure 5). The shallow contamination appears to be a result of infiltration of TCE contaminated water to the aquifer from CW6 discharging to the Creek.

The Wausau Chemical Company is located between CW3 and CW4 on the east bank of the Wisconsin River. The facility, established in 1964, is a bulk solvent distributor and a transfer station for shipment of waste chemicals and solvents from area businesses. The facility experienced two documented PCE spills in 1983 totaling more than 1000 gallons, and has been cited for general poor 'housekeeping' practices. As early as 1975, workers at the adjacent water filtration plant reported "noxious odors" in excavated soils during expansion of the plant.

Solvents released from the Wausau Chemical source areas are responsible for a large percentage of the shallow groundwater contamination in the East Well Field. Soil gas and soil boring data reflecting the distribution of VOCs in unsaturated soils were collected as part of the soil gas survey and during soil boring for source characterization. Results of this data indicate higher concentrations of contaminants are located in the southern portion of the site with decreasing concentrations within an elongated contaminant zone trending toward the east-northeast. However, elevated concentrations of PCE were also found in unsaturated soils near the north loading dock. The highest levels of PCE in soil gas was reported from the southern end of the facility at a concentration of 4080 ug/l. Analyses of soil samples indicate 3500 ug/kg of PCE in the vicinity of the north loading dock, and 1000 ug/kg at the south end of the property.

Based on calculations performed for the RI, the total amount of VOCs remaining in the soils at Wausau Chemical is approximately 300 pounds. This is considered an estimate and could vary considerably if contamination exists beneath either the filtration plant or the Wausau Chemical building.

The Wausau Energy property located directly south of CW3 was also identified as a source for groundwater contamination. The facility operated as a petroleum bulk storage and distribution center from the late 1940's until 1983. Previous property owners include Amoco Oil and Rush Distributing. Historical data indicate that at least seven above ground storage tanks were located on the southern half of the property and contained various petroleum products.

Soil gas and unsaturated soil samples have been conducted at the property. Results indicate various petroleum by-products, commonly referred to as BETX (benzene, ethylbenzene, toluene, and xylenes) in unsaturated soils and groundwater beneath the site. PCE was detected at low levels in isolated soil samples and soil gas samples at depth. The maximum BETX concentration reported in on site soils was 25,100 ug/kg. The maximum concentration of PCE found in soils was 8,600 ug/kg (from a previous study-Foth & Van Dyke) and 17.4 ug/kg found in soil gas samples from the property.

VI. SUMMARY OF SITE RISKS

CERCLA requires that U.S. EPA protect human health and the environment from current and potential exposure to hazardous substances found at the site. An Endangerment Assessment was conducted as part of the RI in order to assess the current and potential risks from the site. This section summarizes the Agency's findings concerning the risks from exposure to groundwater and air emissions at this site.

Assessment of site related risks involved the identification of contaminants of most concern, routes of contaminant migration and populations potentially exposed to the contaminants. This information was then used to estimate exposure from contaminants for the population, which was then compared to chemical toxicity to arrive at an estimate of health risks for the site.

A. Identification of Contaminants of Concern

More than 50 compounds were identified from the RI data as being present at the site (Table 2). A subset of the total number identified was selected based on which compounds pose the greatest health risks, the concentrations and frequency of detection, and the physical properties relating to mobility and persistence.

Based on the above criteria, the following indicator chemicals were considered to be representative of site contamination and to pose the greatest potential health risk.

-Tetrachloroethene (PCE)
-Trichloroethene (TCE)
-1,2-Dichloroethene (DCE)

TABLE 2

TARGET COMPOUND LIST CHEMICALS DETECTED
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Medium	Chemical	Chemical Concentration: Minimum	Chemical Concentration: Maximum	Chemical Concentration: Geometric Mean	Number Locations Sampled for Analysis: Total	Number Locations Sampled for Analysis: Positive Detection
GROUNDWATER						
All Locations	Volatile	ug/L	ug/L	ug/L	134	
	Chloromethane	4	7	5		2
	Vinyl chloride	3	6	4		4
	Methylene chloride	1	190	8		8
	Acetone	2	3070	11		11
	1,1-Dichloroethene	--	2	--		1
	1,1-Dichloroethane	--	3	--		1
	1,2-Dichloroethene (total)	1	1300	20		43
	Chloroform	2	44	11		6
	2-Butanone	--	5	--		1
	1,1,1-Trichloroethane	1	53	3		16
	Carbon tetrachloride	2	69	19		3
	Trichlorethene	1	4200	29		63
	1,1,2-Trichloroethane	2	4	2		5
	Benzene	18	310	125		5
	4-Methyl-2-pentanone	--	2	--		1
	Tetrachloroethene	1	2440	45		53
	Toluene	2	890	46		5
	Chlorobenzene	2	54	7		6
	Ethyl benzene	3	440	53		4
	Xylenes (total)	16	2000	428		6
	Semivolatile	ug/L	ug/L	ug/L	31	
	Phenol	--	2	--		1
	Naphthalene	--	22	--		1
	2-Methylnaphthalene	--	23	--		1
	Fluorene	--	4	--		1
	Pentachlorophenol	--	6	--		1
	Phenanthrene	--	4	--		1
	Bis(2-ethylhexyl)phthalate	3	19	8		5
	Pesticide/PCB				31	
	None Detected					
	Metal/CN[b]	ug/L	ug/L	ug/L	32	
	Barium	206	325	259		3
	Chromium	28	594	77		3
	Iron	169	18100	1800		17
	Manganese	69	6100	937		25
	Zinc	2750	2860	2800		2
Production Wells CW3, CW4, CW6	Volatile	ug/L	ug/L	ug/L	3	
	Acetone	--	16	--		1
	1,2-Dichloroethene (total)	1	20	9		2
	Trichloroethene	53	150	100		3
	Tetrachloroethene	7	14	13		2
	Chlorobenzene	--	15	--		1
	Semivolatile				3	
	None Detected					
	Pesticide/PCB				3	
	None Detected					

Table 2
(Continued)

Medium	Chemical	Chemical Concentration: Minimum	Maximum	Geometric Mean	Number Locations Sampled for Analysis: Total	Positive Detection
	Metal/CN	ug/L	ug/L	ug/L	3	
	Iron	957	5300	2110		3
	Manganese	1610	2920	2110		3
SURFACE SOILS	Volatile	ug/kg	ug/kg	ug/kg	8	
	Methylene chloride	64	190	110		2
	1,1,1-Trichloroethane	--	3	--		1
	Tetrachloroethene	--	3	--		1
	Xylenes (total)	--	4	--		1
	Semivolatile	ug/kg	ug/kg	ug/kg	8	
	Phenol	89	93	90		2
	4-Methylphenol	--	200	--		1
	Benzoic acid	--	160	--		1
	Naphthalene	37	720	192		3
	2-Methylnaphthalene	32	770	264		4
	Acenaphthylene	2	110	22		4
	Acenaphthene	51	69	59		2
	Dibenzofuran	38	180	82		2
	Fluorene	100	120	109		2
	Phenanthrene	200	2500	651		5
	Anthracene	32	480	155		3
	Flouranthene	200	6600	1300		5
	Pyrene	150	2900	910		5
	Butylbenzylphthalate	59	390	150		3
	Benzo(a)anthracene	110	2400	749		3
	Bis(2-ethylhexyl)phthalate	150	1600	489		2
	Chrysene	390	3200	861		4
	Di-n-octylphthalate	--	380	--		1
	Benzo(b)fluoranthene	250	5400	1380		3
	Benzo(k)fluoranthene	--	1600	--		1
	Benzo(a)pyrene	100	2700	604		4
	Indeno(1,2,3-cd)pyrene	210	1200	614		3
	Dibenz(a,h)anthracene	--	390	--		1
	Benzo(g,h,i)perylene	230	1400	655		3
	Pesticide/PCB					
	Not Analyzed					
	Metal/CN					
	Not Analyzed					
SURFACE WATER						
Bos Creek	Volatile	ug/L	ug/L	ug/L	12	
	1,2 Dichloroethene (total)	1	1	1		2
	Trichloroethene	1	110	41		10
	Tetrachloroethene	1	3	2		2
	Semivolatile					
	Not analyzed					
	Pesticide/PCB					
	Not Analyzed					
	Metal/CN					
	Not Analyzed					

Table 2
(Continued)

Medium	Chemical	Chemical Concentration: Minimum	Chemical Concentration: Maximum	Chemical Concentration: Geometric Mean	Number Locations Sampled for Analysis: Total	Number Locations Sampled for Analysis: Positive Detection
Wisconsin River	**Volatile**	ug/L	ug/L	ug/L	4	
	1,2-Dichloroethene (total)	--	1	--		1
	Chloroform	1	4	2		3
	Tetrachloroethene	--	6	--		1
	Semivolatile					
	Not Analyzed					
	Pesticide/PCB					
	Not Analyzed					
	Metal/CN					
	Not Analyzed					
SEDIMENT						
Bos Creek	**Volatile**	ug/kg	ug/kg	ug/kg	11	
	Acetone	18	190	58		3
	1,2-Dichloroethene (total)	6	200	51		3
	Trichloroethene	6	17	59		5
	Toluene	--	7	--		1
	Semivolatile	ug/kg	ug/kg	ug/kg	3	
	None Detected					
	Pesticide/PCB				3	
	None Detected					
	Metals					
	Not Analyzed					
SUBSURFACE SOILS						
	Volatile	ug/kg	ug/kg	ug/kg	29	
	Methylene chloride	1	2000	43		5
	Trichloroethene	4	10	6		3
	Tetrachloroethene	1	3500	77		3
	Toluene	1	46	5		12
	Ethylbenzene	4	2900	37		9
	Xylenes (total)	2	21000	22		3
						7
	Semivolatile	ug/kg	ug/kg	ug/kg	29	
	Phenol	--	320	--		1
	Naphthalene	--	4900	--		1
	2-Methylnaphtalene	--	16000	--		1
	Dimethylphthalate	110	140	120		2
	Fluorene	63	1600	320		2
	Phenanthrene	63	2600	260		11
	Anthracene	48	120	85		6
	Di-n-butylphthalate	58	76	66		2
	Flouranthene	30	1400	220		15
	Pyrene	31	1300	210		12
	Benzo(a)anthracene	98	660	250		6
	Chrysene	130	750	290		6
	Bis(2-ethylhexyl)phthalate	45	84	60		5

Table 2
(Continued)

Medium	Chemical	Chemical Concentration: Minimum	Maximum	Geometric Mean	Number Locations Sampled for Analysis: Total	Positive Detection
	Benzo(b)fluoranthene	110	680	220		10
	Benzo(k)fluoranthene	100	760	210		9
	Benzo(a)pyrene	120	750	250		8
	Indeno(1,2,3-cd)pyrene	130	680	220		6
	Dibenz(a,h)anthracene	--	74	--		1
	Benzo(g,h,i)perylene	130	800	270		5
	Pesticide/PCB					
	Not Analyzed					
	Metal/CN	mg/kg	mg/kg	mg/kg	16	
	Copper	--	107	--		1
LANDFILL REFUSE						
	Volatile	ug/kg	ug/kg	ug/kg	15	
	Methylene chloride	9	1900	70		3
	Acetone	71	160	100		3
	1,2-Dichloroethene (total)	21	220	67		4
	Trichloroethene	36	160000	680		9
	Toluene	3	750	60		9
	Ethyl benzene	2	4	3		3
	Xylenes (total)	4	24	13		5
	Semivolatile	ug/kg	ug/kg	ug/kg	15	
	Phenol	--	2200			1
	2-Chlorophenol	--	2200	--		1
	1,2-Dichlorobenzene	--	210	--		1
	2-Methylphenol	--	75	--		1
	4-Methylphenol	--	830	--		1
	Isophorone	--	130	--		1
	1,2,4-Trichlorobenzene	--	1200	--		1
	Naphthalene	49	1300	150		7
	4-Chloro-3-methylphenol	--	2300	--		1
	2-Methylnaphthalene	65	890	150		7
	2-Chloronaphthalene	--	170	--		1
	Acenaphthylene	--	130	--		1
	Acenaphthene	45	730	180		3
	Dibenzofuran	19	330	63		7
	Fluorene	82	500	186		5
	Pentachlorophenol	820	32000	2900		5
	Phenanthrene	170	15000	1100		11
	Anthracene	19	2200	250		10
	Fluoranthene	60	45000	1600		12
	Pyrene	63	49000	1700		12
	Butylbenzylphthalate	130	2300	500		3
	Benzo(a)anthracene	420	24000	1400		10
	Bis(2-ethylhexyl)phthalate	110	54000	860		[illegible]
	Chrysene	54	25000	970		[illegible]
	Benzo(b)fluoranthene	410	25000	1700		[illegible]
	Benzo(k)fluoranthene	430	25000	1400		[illegible]
	Benzo(a)pyrene	480	25000	1200		9
	Indeno(1,2,3-cd)pyrene	640	31000	940		[illegible]
	Dibenz(a,h)anthracene	280	1200	490		4
	Benzo(g,h,i)perylene	560	14000	1600		[illegible]
	Pesticide/PCB	ug/kg	ug/kg	ug/kg	6	
	Arochlor 1260	850	2300	1400		2

Table 2
(Continued)

Medium	Chemical	Chemical Concentration Minimum	Maximum	Geometric Mean	Number Locations Sampled for Analysis Total	Positive Detection
	Metal/CNC	mg/kg	mg/kg	mg/kg	14	
	Arsenic	--	76	--		1
	Chromium	--	1130	--		1
	Copper	107	1410	383		8
	Mercury	0.5	1.9	1.2		9
	Zinc	323	3260	2160		8

These compounds have been used to evaluate toxicity, exposure pathways, and potential health risks for the site.

B. Exposure Assessment

Groundwater in the area is the current source of drinking water for the City of Wausau which provides potable water to approximately 33,000 people. The aquifer of concern is a class I aquifer (sole-source aquifer without a viable alternate source of supply) and is highly vulnerable to contamination. The City of Wausau treats water prior to distribution through the use of two air strippers. The air strippers effectively reduce VOC concentrations to below the detectable levels. Historical data indicate that during the period of 1982 through mid-1984, levels of VOCs in the City supply ranged from 10 ug/l to 100 ug/l. However, it is not known how long, prior to 1982, the City's water supply contained elevated levels of VOCs. Therefore, the exposure scenario for drinking water did not address possible exposures prior to 1982.

Currently there are no known private wells used for drinking water within the study area. In addition, there is a City of Wausau ordinance requiring residents to utilize the municipal supply for domestic purposes. However, in developing hypothetical exposure scenarios for groundwater, institutional controls were not considered adequate for protection from potential future use of private wells.

Stripping tower treatment of contaminated groundwater is currently occurring at the City water treatment plant and at Wausau Chemical. In addition, the effluent from the extraction well proposed for the interim remedy will also involve dispersion of VOC emissions to the air. Indicator contaminants dispersed into the air from groundwater treatment pose a potential exposure pathway to employees of companies and residents near the sources of air emissions.

The potential exposure pathways for the site are listed below and summarized in Table 3. Potential health risks were evaluated for the following exposure pathways and potentially exposed population.

- Residents using municipal water assuming they are exposed to contaminant concentrations equal to the laboratory detection limits of 0.5ug/l for PCE and TCE, and 1.0 ug/l for DCE.

- Hypothetical users of private well water assuming a private well is installed within the contaminated aquifer in the future. It was assumed that a user would be exposed to the highest concentrations found in groundwater, approximately 4300 ug/l, to obtain the worst case scenario for this

TABLE 3
POTENTIAL EXPOSURE PATHWAYS
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Environmental Medium	Exposure Point	Exposed Receptors	Routes Exposure	Pathway Complete?	Exposure Potential	Risk Quantified?
Groundwater	Municipal water supply	Wausau residents	Ingestion, inhalation, dermal absorption	Yes	Very low; air stripping has reduced contaminant concentrations to below detection limits	Yes
	Private well water	Wausau residents with private wells	Ingestion, inhalation, dermal absorption	No; currently no private wells in contaminated aquifer. However potential for future private wells exists	None; currently. Moderate; future private well users could be exposed to untreated water	Yes
Surface soils	Direct contact	Wausau residents	Dermal absorption, incidental ingestion	Not determined	Very low; not considered to be above background	No
Surface water and sediments, Bos Creek and Wisconsin River	Direct contact	Children playing in creek or river	Dermal absorption, incidental ingestion	No, contaminated water no longer discharged to Bos Creek	None	No
		Aquatic organisms, terrestrial wildlife	Bioconcentration, bioaccumulation	No, contaminated water no longer discharged to Bos Creek	None	No
Subsurface soils and landfill refuse	None; subsurface location minimizes contact potential	Wausau residents	Dermal absorption, incidental ingestion	No	None	No
	Direct contact	Remediation workers	Dermal absorption, incidental ingestion	Not determined	Very low, workers assumed to be utilizing protective gear	No
Air	Direct contact, volatilization from soils or landfill refuse	Wausau residents, company employees	Inhalation	No, significant volatilization not occurring	None	No
	Direct contact, emissions from air strippers	Wausau residents, company employees	Inhalation	Yes	Moderate dispersion of VOC emissions may expose Wausau residents and employees of companies near the sources	Yes

exposure pathway.

- Residents and company employees exposed via air emissions in the vicinity of the emission sources. Estimated contaminant emissions from the source areas were calculated assuming continuous operation of the air strippers and a constant rate of loading of VOCs.

The contaminant intake, and thus risk that an individual would likely incur from exposure to an indicator chemical was estimated for the exposure pathway of concern by incorporating standard exposure assumptions of 70-kg man,ingestion of two liters of water per day, inhalation rate of 1.3 m^3/hr and a skin surface area of 18,200 cm^2 for water, and an inhalation rate of 20m^3/day for air emissions.

C. Toxicity Assessment

Based on toxicological studies performed on laboratory animals, both PCE and TCE are classified as probable human carcinogens. Scientific data collected to date are not sufficient to classify DCE as to its carcinogenic potential. Therefore, no cancer potency factor could be derived for DCE and thus, DCE was not included in the calculation of site risks. PCE is also assigned a reference dose value. This value represents the levels to which humans can be exposed on a daily basis without adverse effects. The critical toxicity values (i.e., cancer potency factor and reference dose) for PCE and TCE are listed in Table 4.

The U.S. EPA considers individual excess cancer risks in a range of 10^{-4} to 10^{-7} as protective; however, the 10^{-6} risk level is used as a point of departure for setting cleanup levels at Superfund sites. A 10^{-6} is considered appropriate as a point of departure for setting cleanup levels at this site considering that groundwater is currently used for drinking water and is the sole-source of drinking water for the residents of Wausau.

D. Summary of Risk Characterization

Under current water use conditions, a potential carcinogenic risk of approximately one in one million (1×10^{-6}) was calculated for users of municipal water for the combined effects of PCE and TCE. These risk levels are based on undetectable levels of VOCs present in the treated water within the City water distribution system. The short-term carcinogenic risks to health associated with PCE and TCE contamination would appear to be minimal under current water usage practices. The long-term cancer risk associated with City water use was calculated to be 1.5×10^{-6} based on a life time of 70 years (see Table 5).

TABLE 4

CRITICAL TOXICITY VALUES FOR INDICATOR CONTAMINANTS[a]
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

	Reference Dose (mg/kg/day)					Carcinogenic Potency Factor (mg/kg/day)-1	
	Oral		Inhalation				
Indicator Contaminant	Subchronic	Chronic	Subchronic	Chronic	EPA Weight of Evidence Classification[b]	Oral	Inhalation
Tetrachloroethene (PCE)	--	1.0E-02	--	--	B2	5.10E-02	3.30E-03
Trichloroethene (TCE)	--	--	--	--	B2	1.10E-02	1.3E-02
1,2-Dichloroethene (Total) (DCE)	--	--	--	--	D		

[a] Values obtained from Integrated Risk Information System (IRIS) (4/89).

[b]
Group A	(Human Carcinogen)	Sufficient evidence from epidemiologic studies to support a causal association between exposure cancer.
Group B1	(Probable Human Carcinogen)	Limited evidence of carcinogenicity in humans from epidemiological studies.
Group B2	(Probable Human Carcinogen)	Sufficient evidence of carcinogenicity in animals, inadequate evidence of carcinogenicity in humans.
Group C	(Probable Human Carcinogen)	Limited evidence of carcinogenicity in animals.
Group D	(Not Classified)	Inadequate evidence of carcinogenicity in animals.
Group E	(No Evidence of Carcinogenicity in Humans)	No evidence for carcinogenicity in at least two adequate animal tests or in both epidemiologic and animal studies.

The U.S. EPA has set a Maximum Contaminant Level (MCL) of 5 ug/l TCE for drinking water. An MCL of 5 ug/l for PCE is under consideration for proposal in the near future. MCLs are enforceable standards promulgated under the Safe Drinking Water Act. Because PCE and TCE are carcinogenic and are not considered to be without hazard below a given threshold, the U.S. EPA has set a non-enforceable Maximum Contaminant Level Goal (MCLG) of zero for TCE in drinking water and is considering the same MCLG for PCE. Because it is not possible to accurately measure levels of these compounds below the minimum detection limit, a future health risk may exist to individuals consuming water over a prolonged period of time during which PCE and TCE are present, but below detectable limits.

In addition, protection of residents from exposure to the contaminants of concern is dependent on adequate treatment of the water. The potential for exposure exists in that failure of the treatment system could result in an exposure pathway through the City's drinking water. Based on the possibility of failure of the air strippers, a potential future risk of exposure to PCE and TCE via drinking water ingestion exists at the site.

The calculated potential carcinogenic risks for future use of private well water were approximately 1000 times higher than those calculated for users of municipal water, assuming users would be exposed to maximum contaminant concentrations identified in groundwater at the site (see Table 5). Because institutional controls were not considered adequate for protection from private well usage, it was determined that a potential future risk of exposure via groundwater exists at the site.

The potential cancer risk to individuals inhaling contaminated air emanating from the stripping towers was estimated based on modeling of the combined contaminant plumes from the City's air strippers and the Wausau Chemical air stripper. Model results for a worst case scenario for exposure of receptors to air borne contaminants estimated a cancer risk of 1.7×10^{-6}. The estimated current risk level is not considered to present an appreciable health risk to residents. However, all alternatives evaluated in the FS include treatment of off-gases to eliminant any additional VOC emissions. In addition, the selected alternative calls for elimination of the Wausau Chemical air stripper, which will reduce the level of contaminants in the contaminant plume.

VII. DESCRIPTION OF ALTERNATIVES

A. Response Objectives

The feasibility study was initiated to evaluate alternatives for remediation of the groundwater contamination and source areas at the site. Based on the risk assessment, three primary site-

TABLE 5

MAXIMUM CONCENTRATIONS AND RESULTING POTENTIAL CANCER RISKS FOR CONTAMINANTS AND PATHWAYS OF CONCERN AT THE WAUSAU GROUNDWATER CONTAMINATION SITE

EXPOSURE PATHWAY/ CONTAMINANT OF CONCERN	MAXIMUM CONCENTRATION	POTENTIAL CANCER RISK
1) MUNICIPAL WATER SUPPLY[a]		
PCE	.5 ug/l	8.9×10^{-7}
TCE	.5 ug/l	6.3×10^{-7}
Exposure Pathway/Risk Total:		1.5×10^{-6}
2) GROUNDWATER (PRIVATE WELLS)[b]		
PCE	2440 ug/l	4.5×10^{-3}
TCE	4200 ug/l	5.2×10^{-3}
Exposure Pathway/Risk Total:		9.6×10^{-3}
3) AIR EMISSIONS FROM STRIPPERS		
PCE	1.3 ug/m^3	4.8×10^{-7}
TCE	.37 ug/m^3	1.2×10^{-6}
Exposure Pathway/Risk Total:		1.7×10^{-6}

a: Concentrations of indicator contaminants in the municipal system were assumed to be equal to laboratory analytical method detection limits.

b: Concentrations of indicator contaminants used in the private well scenario were the maximum concentrations detected in groundwater at the site.

specific response objectives were identified; 1) reduction of long-term exposure to low levels of VOCs from ingestion of drinking water; 2) protection from potential future use of private wells in contaminated groundwater; and, 3) protection from emissions of contaminants from proposed water treatment systems that release VOCs to the atmosphere.

B. Development of Alternatives

In developing alternatives for this site several initial assumptions were made regarding base line conditions at the site. It was assumed that the west side extraction system would be installed and operated as described in the Interim ROD. It was also determined, based on computer modeling of the site, that the deep TCE plume moving under the Wisconsin River to CW3 would best be addressed at the same location as the proposed extraction well at the former landfill source. Therefore, it was determined that an increase in the proposed minimum pumping rates called for in the west side extraction system and modifications to the monitoring plan would provide the most effective remediation of this contaminant plume.

As discussed, the remaining areas of concern for the site include the source areas and the shallow east side contaminant plume originating from the Wausau Chemical source area. The three identified source areas include the former City landfill, the Wausau Chemical property, and the Wausau Energy property.

At the Wausau Energy site, petroleum derived compounds have been found in groundwater samples directly below the site. Although toluene, ethylene, and Xylene were previously detected in CW4, no off-site migration of contaminants was been detected during the RI/FS, although toluene, ethylene and xylene were previously detected in CW4. Because off-site monitoring does not indicate groundwater impacts from the Wausau Energy source at present, groundwater remediation at Wausau Energy is not addressed as part of the final remedy. However, contaminated soils found at Wausau Energy will be addressed under the discussion of source control.

A variety of technologies to address response objectives were identified for further consideration including several for remediation of source areas. However, considering the nature of the source areas, and the contaminants present, only one source control technology (soil vapor extraction) was retained from the screening of technologies.

Following screening of technologies, alternatives were developed and screened for appropriateness based on response objectives. Five alternatives remained after screening and were subjected to detailed analysis using the nine evaluation criteria developed under the National Contingency Plan (NCP). Table 6 lists the five alternatives.

TABLE 6

REMEDIAL ACTION ALTERNATIVES

Alternative 1	No Action
Alternative 2	Groundwater Extraction and Treatment with Air Stripping and Discharge to the Wisconsin River
Alternative 3	In-Situ Bioreclamation with Partial Above Ground Treatment and Discharge to the Wisconsin River
Alternative 4	In-Situ Bioreclamation
Alternative 5	Active Source Control-Soil Vapor Extraction

C. Alternatives

Alternative 1 - No Action

The No Action Alternative is evaluated as required by the NCP. Under this alternative, no response action would be taken beyond the Interim remedy.

The interim remedy extraction well will provide a barrier to contaminant migration from the landfill source to CW6, ultimately resulting in the elimination of contaminant impact at this well. The time to achieve protection of CW6 under this alternative depends on the rate of aquifer purging provided by Well CW6 pumping. Computer simulation of the No Action alternative for the landfill source shows that a groundwater divide would be present in the vicinity of the ponded area in Bos Creek between CW6 and the landfill extraction well. Contaminants on either side of this divide would migrate north to CW6 or south to the extraction well. Given the pumping rates assumed for these simulations and the initial mass distribution, a time period of approximately 10 years is estimated to be necessary to achieve contaminant concentrations below the MCL for TCE (5 ug/L) at CW6. The period during which CW6 draws in contaminants from the landfill source is estimated to be approximately 20 years under projected pumping conditions.

The No Action simulation for the landfill source shows that the extraction well at the landfill would also stop additional migration of contamination beneath the Wisconsin River to CW3. A period of approximately 6 years is estimated to obtain contaminant concentrations at CW3 less than 5 ug/L.

The simulated groundwater piezometric surface contours for the East Well Field are shown on Figure 6. The map indicates an area of hydraulic influence which extends south of the Wausau Chemical property due primarily to pumping of CW3. With no CW4 pumping, the shallow east side contaminant plumes lie within this area of influence. The simulation shows the contaminant mass reaching CW3 from the Wausau Chemical sources would result in concentrations consistently less than 5 ug/L after approximately 6.3 years.

The time during which CW3 would draw in contaminants from either east side or west side sources is estimated to be approximately 15 years. It was assumed that the Phase I remedy extraction well north of the landfill would be in operation, and that contaminants in unsaturated zone soils at Wausau Chemical would represent a groundwater contaminant source that declines in strength over an approximately 8-year period.

Probable ARARs for the No Action alternative are summarized in Table 7. Chemical-specific ARARS identified include those related to drinking water, groundwater, surface water and air quality. Drinking water MCLs for VOCs can be met by stripping tower treatment, as evidenced by actual performance data. The No Action alternative would not comply with Chapter NR 140 requirements for responses where enforcement standards are exceeded. Air emission limits are not anticipated to be exceeded by any of the identified sources.

The only location-specific ARAR identified involves potential future requirements that may be implemented under a wellhead protection area program. No area has been designated to date and no requirements have been identified. Action-specific ARARs identified relate to property use at the landfill and uncontrolled emission of toxic organics from source areas.

There is no cost or operation and maintenance (O&M) associated with the No Action Alternative. Annual costs to operate the present air stripper were not considered as O&M under this alternative.

Alternative 2 - Groundwater Extraction/Above Ground Treatment

Alternative 2 involves installation of a groundwater extraction system to address the shallow groundwater contamination in the East Well Field originating from the Wausau Chemical facility. A groundwater extraction and treatment system would be installed on the Wausau Chemical property to extract contaminated water in

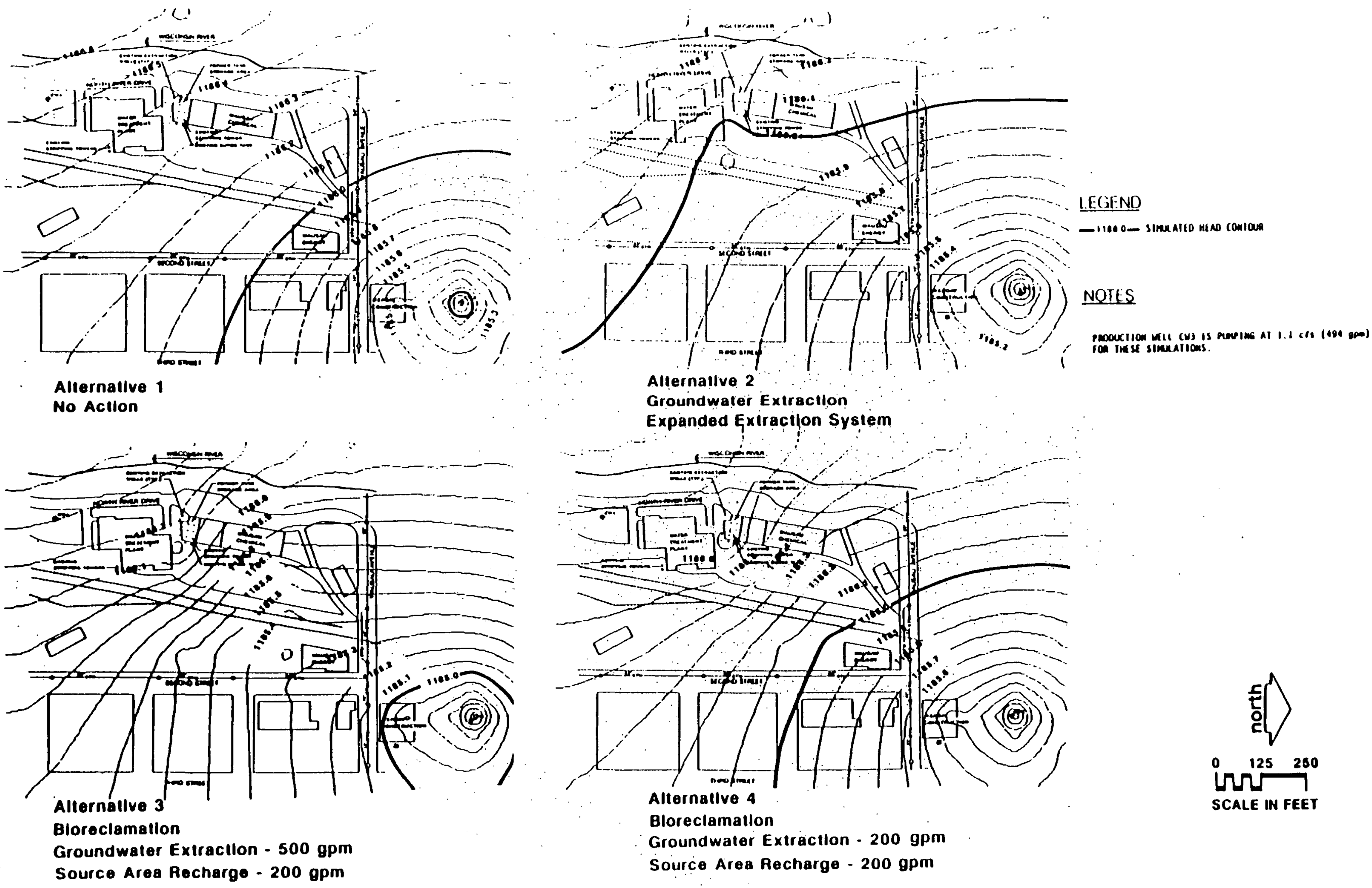

Alternative 1
No Action
Alternative 2
Groundwater Extraction
Expanded Extraction System
Alternative 3
Bioreclamation
Groundwater Extraction - 500 gpm
Source Area Recharge - 200 gpm
Alternative 4
Bioreclamation
Groundwater Extraction - 200 gpm
Source Area Recharge - 200 gpm
LEGEND
1180.0 SIMULATED HEAD CONTOUR
NOTES
PRODUCTION WELL CW3 IS PUMPING AT 1.1 cfs (494 gpm) FOR THESE SIMULATIONS.
north
0 125 250
SCALE IN FEET

FIGURE 6

TABLE 7

PROBABLE ARARs: ALTERNATIVE 1
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
		CHEMICAL-SPECIFIC
Federal		
40 CFR 141	National Primary Drinking Water Standards	Enforceable numerical standards for public water supplies. Standards for VOCs can be met using packed tower stripping treatment.
40 CFR 264.94	Groundwater Concentration Limits	Enforceable limits for substances in groundwater released from a solid waste management unit permitted under RCRA. May be considered relevant and appropriate for the former City Landfill. Anticipate meeting limits in the long term as a result of aquifer purging by existing production and remediation wells.
State		
NR 109 WAC	Safe Drinking Water	Establishes drinking water standards for public water supply. Applies to Wausau Water Utility. State standards are not more stringent than Federal MCLs. Standards for VOCs can be met by the water utility.
NR 140 WAC	Groundwater Quality	Establishes numerical standards for concentration of substances in groundwater. Different levels of response are appropriate when Preventive Action Limits (PAL) or Enforcement Standards (ES) are exceeded. Anticipate continually lower contaminant concentrations in the aquifer as a result of existing production and remediation (including Phase I remedy) wells. Lack of additional active groundwater remediation may not be acceptable to the State.
NR 104 WAC	Uses and Designated Standards for Interstate Waters	Mandates that the Wisconsin River shall meet criteria for fish and aquatic life and recreational use. Criteria should be met under Phase I remedy actions.
NR 105 WAC	Surface Water Quality Criteria for Toxic Substances	Establishes numerical water quality criteria for toxic substances. Criteria should be met under Phase I remedy actions.
NR 445 WAC	Control of Hazardous Pollutants	Establishes hourly or annual emission rate limits for specific substances. Limits do not appear to be exceeded by identified sources.
		LOCATION-SPECIFIC
Federal		
SDWA Sec. 1428	Wellhead Protection Areas	Requirement for states to develop program for establishing wellhead protection areas. No specific requirements are known at this time. No Action alternative should not conflict with possible future requirements.

TABLE 7 (Continued)

PROBABLE ARARs: ALTERNATIVE 1
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
		ACTION-SPECIFIC
Federal		
40 CFR 264.117	Post-Closure Property Use	May be relevant and appropriate for former City landfill. No restricted uses are proposed.
State		
NR 400-499	Air Quality Management	Source area emissions may be subject to requirements but emissions under No Action are not anticipated to exceed established limits.
NR 500-520	Solid and Hazardous Waste Management	Final property use requirements may apply for the former City Landfill performance and operational criteria regulate emissions of toxic substances to air. Air emissions under No Action do not appear to exceed limits.

close proximity to the area of greatest soil contamination (see Figure 7). The system would include a cluster of wells designed to extend the zone of influence beneath the City filtration plant and the Wausau Chemical building, as well as to the east of the facility where contaminants have migrated due to the effects of aquifer recharge from the Wisconsin River.

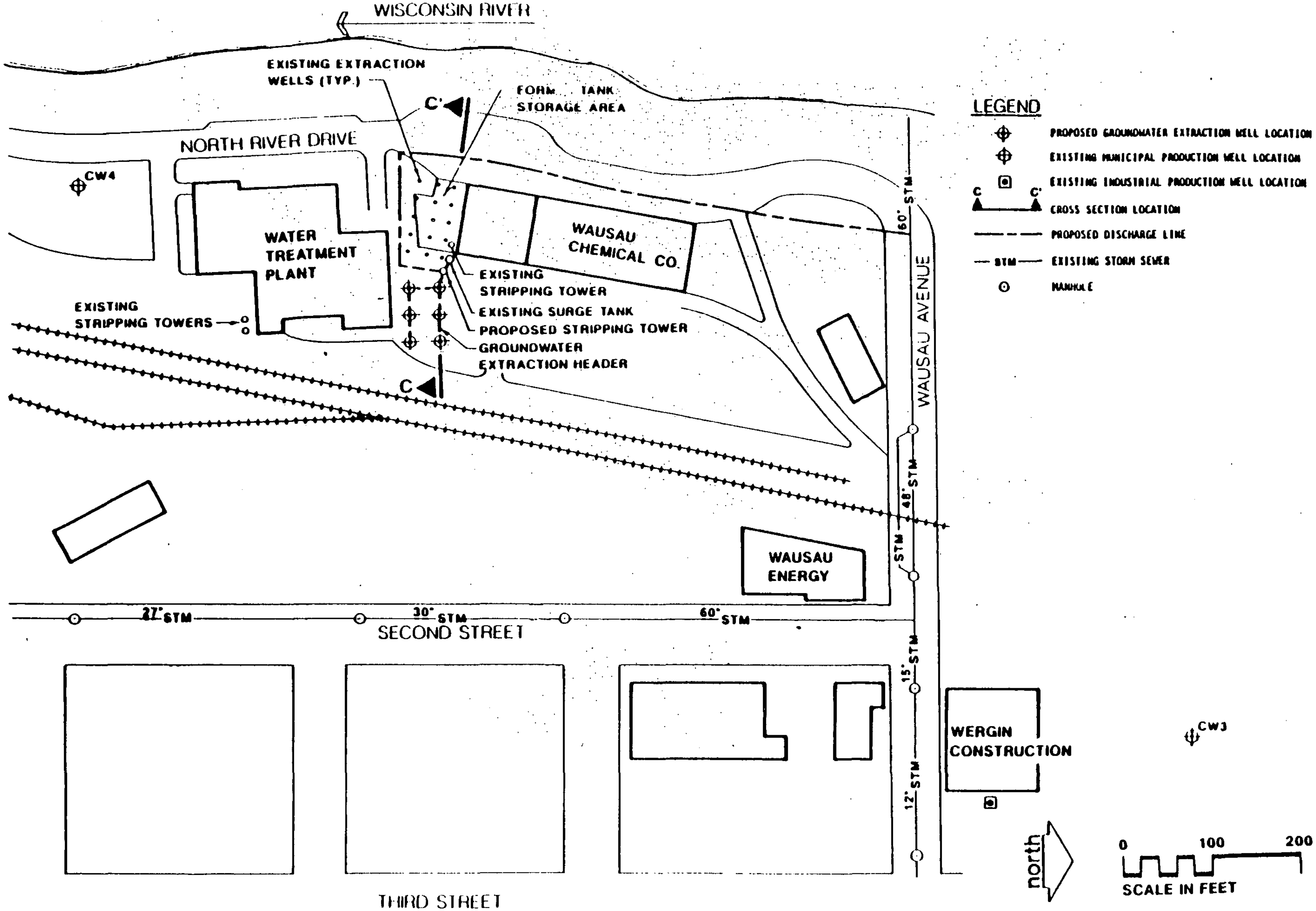
Extracted water would be pumped to an air stripper for treatment of VOCs prior to discharge to the Wisconsin River. Off-gas treatment would be included in the treatment process and would involve vapor phase activated carbon units to treat gases and off site regeneration of carbon and destruction of contaminants. It is estimated that the system flow rate would be approximately 300-500 gpm.

Implementation of this alternative is expected to limit migration of contaminants from Wausau Chemical to CW3. Contaminant transport simulations of this alternative shows that at total system pumping rates of 200 and 500 gpm, contaminant concentrations at CW3 resulting for migration form the Wausau Chemical source would be less than 5 ug/L in approximately 5.2 years. However, complete restoration of the aquifer on the east side of the river would require 12 years.

Contamination in the deep groundwater plume originating at the former City landfill/Marathon Electric source area is not anticipated to be influenced by pumping of the east side extraction well system. Thus, the time to achieve protection of CW3 under this alternative is not anticipated to be substantially different from that estimated under the No Action alternative, because the time to achieve aquifer purging under both alternatives is determined by the time required to remediate the deep TCE plume. However, the magnitude of contaminant concentrations affecting Production Well CW3 is expected to decrease, because the contribution of contaminants from the east side source will be reduced.

Costs for Alternative 2 are summarized in Table 12. Major capital cost items include groundwater extraction wells and header system, pumps, controls, stripping tower and discharge line. Major operation and maintenance items include energy costs, sampling and monitoring, analytical laboratory, routine systems inspection and maintenance, and reporting. Capital costs are estimated to be $480,000. Annual operation and maintenance costs are estimated to be approximately $120,000. The 10-year present worth (10% discount rate) associated with the above costs is $1,330,000.

Probable ARARs for Alternative 2 are summarized in Table 8. Chemical-specific ARARs include drinking water, groundwater, surface water and air quality standards, criteria or limits. These include drinking water MCLs and NR 140 standards. Drinking



WISCONSIN RIVER
EXISTING EXTRACTION WELLS (TYP.)
FORM... TANK STORAGE AREA
C'
NORTH RIVER DRIVE
CW4
WATER TREATMENT PLANT
WAUSAU CHEMICAL CO.
EXISTING STRIPPING TOWER
EXISTING STRIPPING TOWERS
EXISTING SURGE TANK
PROPOSED STRIPPING TOWER
GROUNDWATER EXTRACTION HEADER
C
WAUSAU AVENUE
60" STM
48" STM
STM
WAUSAU ENERGY
27" STM
30" STM
60" STM
SECOND STREET
15" STM
12" STM
WERGIN CONSTRUCTION
CW3
THIRD STREET
north
0
100
200
SCALE IN FEET
LEGEND
PROPOSED GROUNDWATER EXTRACTION WELL LOCATION
EXISTING MUNICIPAL PRODUCTION WELL LOCATION
EXISTING INDUSTRIAL PRODUCTION WELL LOCATION
CROSS SECTION LOCATION
PROPOSED DISCHARGE LINE
STM — EXISTING STORM SEWER
MANHOLE

FIGURE 7

TABLE 12

SUMMARY OF PROBABLE COSTS: ALTERNATIVE 2
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

CAPITAL COSTS

Item	Cost
Groundwater Extraction System	$ 70,000
Stripping Tower and Appurtenances	$110,000
Vapor Phase Carbon Unit and Appurtenances	$ 50,000
Discharge System	$ 40,000
Utilities, Excavation Spoils Management	$ 15,000
Capital Facilities Subtotal	$285,000
Engineering Design (15%)	$ 45,000
Contract and Project Administration (25%)	$ 70,000
Capital Subtotal	$400,000
Contingencies (20%)	$ 80,000
Capital Total	$480,000

ANNUAL OPERATION AND MAINTENANCE COSTS

	First Year	Subsequent Years
Water Levels	$ 5,000	$ 5,000
Water Quality	$ 26,000	$ 8,000
Flow Monitoring	$ 3,000	$ 3,000
Energy	$ 6,000	$ 6,000
General O&M Labor	$ 20,000	$ 20,000
Reporting and Administration	$ 30,000	$ 30,000
Carbon Purchase and Regeneration	$ 30,000	$ 30,000
O&M Subtotal	$120,000	$102,000
Contingencies (20%)	$24,000	$20,000
O&M Total	$144,000	$122,000

12-YEAR PRESENT WORTH

Present Worth of Capital (not discounted)	$480,000
Present Worth of O & M (10% discount rate)	$850,000
Present Worth Total	$1,330,000

water MCLs for VOCs can be met by the water utility. The proposed groundwater response actions would satisfy response requirements of NR 140. Meeting water quality-based effluent limits established to meet water quality criteria should be feasible using packed tower stripping. Meeting compound-specific limits for VOC emissions to air would be feasible based on anticipated concentrations and pumping rates, regardless of whether or not off-gas controls are used.

Location-specific ARARs include possible wellhead protection requirements, and floodplain activity requirements. Action-specific ARARs include requirements for well construction and plumbing system standards, treatment system plan review, obtaining a surface water discharge permit, VOC emissions limits and construction and industrial safety. No difficulties in achieving compliance with any of these have been identified.

Implementation of this alternative is not expected to be a problem. The technology is readily available, conventional, and well demonstrated. Construction is straight forward and no unusual features are anticipated to be required for the system. Coordination between U.S. EPA and the City of Wausau will be required to accomplish implementation of the system.

Alternative 3 - In-Situ Bioreclamation With Partial Treatment and Discharge

Alternative 3 is an in-situ method for remediation of the shallow east side groundwater contaminant plume. Groundwater would be extracted, a portion would be treated and discharged to the Wisconsin River and the remainder would be supplemented with nutrients and recharged to the aquifer to enhance microbially-mediated degradation of contaminants in-situ.

A line of groundwater extraction wells would be installed around the north and east portions of the Wausau Chemical property. A conceptual system layout is shown on Figure 8. The placement of barrier wells is intended to surround the section (downgradient of the Wausau Chemical sources) of the plume where volatile chlorinated hydrocarbon concentrations greater than approximately 200 ug/L were observed. Extracted groundwater would be pumped to a common header. The header would convey water back toward the treatment system. The flow would be split between the treatment system and recharge to groundwater.

For a groundwater extraction rate of 500 gpm, approximately 300 gpm would be treated using VOC stripping and discharged to the Wisconsin River. A VOC stripping tower with off-gas controls would be used for treatment. Carbon adsorption would be provided for off-gas treatment.

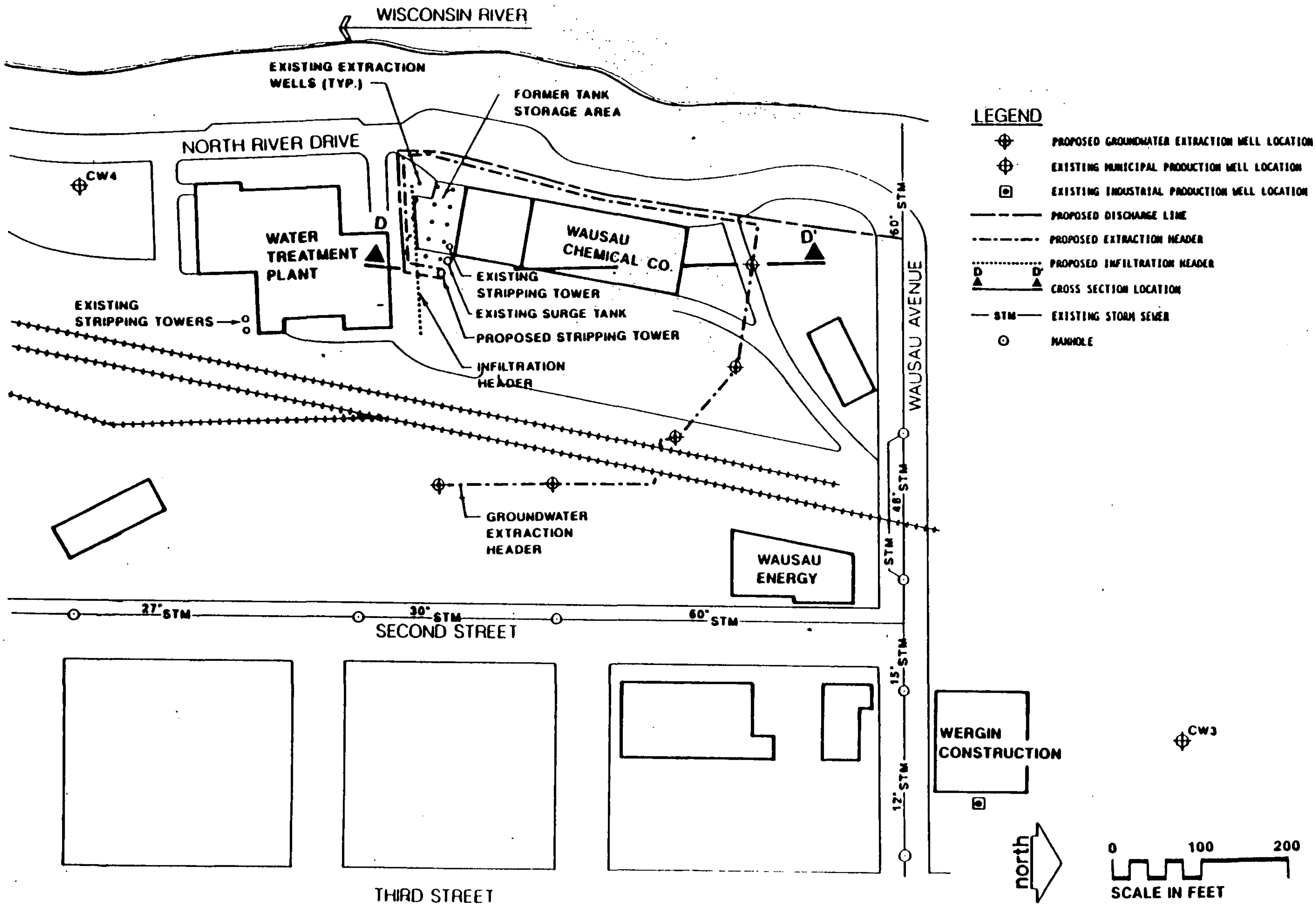

WISCONSIN RIVER
EXISTING EXTRACTION WELLS (TYP.)
FORMER TANK STORAGE AREA
NORTH RIVER DRIVE
CW4
WATER TREATMENT PLANT
D
D'
WAUSAU CHEMICAL CO.
EXISTING STRIPPING TOWER
EXISTING SURGE TANK
PROPOSED STRIPPING TOWER
INFILTRATION HEADER
EXISTING STRIPPING TOWERS
GROUNDWATER EXTRACTION HEADER
WAUSAU ENERGY
WAUSAU AVENUE
60" STM
48" STM
STM
27" STM
30" STM
60" STM
SECOND STREET
15" STM
12" STM
THIRD STREET
WERGIN CONSTRUCTION
CW3
LEGEND
PROPOSED GROUNDWATER EXTRACTION WELL LOCATION
EXISTING MUNICIPAL PRODUCTION WELL LOCATION
EXISTING INDUSTRIAL PRODUCTION WELL LOCATION
PROPOSED DISCHARGE LINE
PROPOSED EXTRACTION HEADER
PROPOSED INFILTRATION HEADER
CROSS SECTION LOCATION
STM EXISTING STORM SEWER
MANHOLE
north
0 100 200
SCALE IN FEET

FIGURE 8

TABLE 8

PROBABLE ARARs: ALTERNATIVE 2
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
		CHEMICAL-SPECIFIC
Federal		
40 CFR 141	National Primary Drinking Water Standards	Enforceable numerical standards for public water supplies. Standards for VOCs can be met using packed tower stripping treatment.
40 CFR 264.94	Groundwater Concentration Limits	Enforceable limits for substances in groundwater released from a solid waste management unit permitted under RCRA. Anticipate meeting limits in the long term as a result of aquifer purging by production and remediation wells.
CWA Sec. 304(a)(1)	Ambient Water Quality Criteria	Concentration values considered to be protective of aquatic species, based on reported bioassay results. Available limits can be met with treatment.
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards	Particulate standards may apply to dust-generating construction activities. Standard control practices should be effective.
State		
NR 109 WAC	Safe Drinking Water	Establishes drinking water standards for public water supply. Standards for VOCs can be met by the water utility. State standards are not more stringent than Federal MCLs.
NR 140 WAC	Groundwater Quality	Establishes numerical standards for concentration of substances in groundwater. Different levels of response are appropriate when Preventive Action Limits (PAL) or Enforcement Standards (ES) are exceeded. Anticipate continually lower contaminant concentrations in the aquifer due to purging wells. Proposed system accelerates overall contaminant removal rate.
NR 102 WAC	Surface Water Quality Standards	Establishes water quality standards for streams. Applies to the Wisconsin River. Stream standards can be maintained.
NR 104 WAC	Uses and Designated Standards for Interstate Waters	Mandates that the Wisconsin River shall meet criteria for fish and aquatic life and recreational use. Criteria can be met with a treated discharge.
NR 105 WAC NR 106 WAC	Surface Water Quality Criteria for Toxic Substances	Establishes numerical water quality criteria for toxic substances. NR 106 specifies methods for calculating water quality-based effluent limits. Limits can be met with a treated discharge.
NR 445 WAC	Control of Hazardous Pollutants	Establishes hourly or annual emission rate limits for specific substances. Estimated stripping tower emissions are lower than identified limits.
		LOCATION-SPECIFIC
Federal		
Executive Order 11988	Floodplain Management	Requires that federal agencies identify and evaluate potential effects of actions on floodplains. No appreciable adverse effects have been identified.
SDWA Sec. 1428	Wellhead Protection Areas	Requirement for states to develop program for establishing wellhead protection areas. No specific requirements are known at this time. Construction and operation of groundwater extraction and treatment system should not conflict with possible future requirements.

TABLE 8 (continued)

PROBABLE ARARs: ALTERNATIVE 2
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
State		
Chapter 30, Statutes	Protection of Floodplains	Regulates construction in floodplains. Some construction may take place within floodplain boundary. Outfall construction is specifically allowed. Obtaining approval for extraction wells or pipelines is considered feasible.
	ACTION-SPECIFIC	
Federal		
CWA Section 301; 40 CFR 122	Protection of Surface Water Quality	Technology-based effluent limits may apply to surface water discharge.
40 CFR 264.117	Post-Closure Property Use	In general, use must not be allowed to disturb the integrity of the final landfill cover. Deed restrictions may be appropriate to limit use of landfill property.
29 CFR 1910	Protection of Hazardous Waste Site Workers	Establishes requirements for training, protective equipment, waste handling, personnel monitoring, and emergency procedures for hazardous waste site workers.
State		
NR 108 WAC	Requirements for Plans and Specifications for Wastewater Facilities	Establishes procedures for submittal and review of plans and specifications for treatment facilities. No problems are anticipated.
NR 112 WAC	Well Construction and Pump Installation	Establishes requirements for design and construction of wells and appurtenances. Compliance with requirements is not anticipated to present difficulties.
NR 200 WAC	Application for Discharge Permits	Establishes procedures for WPDES permit application. No problems are anticipated.
NR 219 WAC	Analytical Test Methods and Procedures	Establishes acceptable methods for analyzing samples from point sources discharging to surface water. Standard procedures are appropriate for the remedy.
NR 220 WAC	Categories and Classes of Point Sources	Establishes categories of point sources. Surface water discharge from treatment system would likely be subject to BATEA requirements. VOC stripping tower treatment should satisfy this requirement.
NR 400-499	Air Quality Management	NR 400 series regulations covers the range of Wisconsin air quality requirements. Estimated VOC emission rates from stripping tower are estimated to be lower than limits where controls would be required.
ILHR 81-84 WAC	State Plumbing Code	Design, construction and materials for piping, plumbing and sewer connection associated with extraction system and discharge must comply with requirements. State review and approval is required.
ILHR 50-53 WAC	State Building Code	Design and construction of structures must comply with requirements.
IND 1 WAC	General Industrial Safety	Construction and operation must comply with safety requirements.
IND 6 WAC	Industrial Safety for Trenches and Excavation	Construction must comply with safety requirements.

The 200 gpm not treated above ground and discharged would be supplemented with nutrients and recharged over the southern end of the Wausau Chemical property. Infiltration trenches filled with gravel would effectively distribute water over the area. Nutrients such as nitrogen or phosphorus would be added. Where aerobic conditions are desired, hydrogen peroxide would be fed. A carbon and energy source such as a methanol may be required to support heterotrophic growth.

Laboratory and field study would be required to confirm feasibility at the site and determine the required operating environment and conditions. It is anticipated that planning, execution and analysis of laboratory studies could be accomplished within a 6-month period, and that planning, execution and analysis of field pilot testing program could be accomplished within a 1.5-year period, depending on the scope and complexity of studies and on the outcome of early test phase activities. Overall, a two-year period could be required for testing and demonstration.

Technologies described in this alternative are expected to provide protection of CW3 by creating a barrier to the migration of most of the contaminants in the shallow east side plume, in addition to aquifer restoration. This alternative is not expected to affect the deep contaminant plume originating on the west side.

Computer simulation of the alternative shows that the proposed line of extraction wells can create an effective hydraulic barrier to contaminant migration to CW3 if pumping rates are high enough. The simulated head contour map shown on Figure 6 shows this occurs at a total system pumping rate of 500 gpm and an infiltration rate of 200 gpm at the source. Contaminant transport simulation shows that PCE concentrations at CW3 would decrease below 5 ug/L after approximately 2.5 years. Complete aquifer purge time for the east side groundwater under this alternative could not be estimated using the contaminant transport model. The simulation shows that the groundwater mound resulting from the recharge may force a small amount (<1%) of contamination to migrate around the east side of the extraction system. However, the mass not captured is not likely to result in detectable concentrations at CW3. Pumping at lower rates or with widely spaced wells may not provide the desired hydraulic control.

Costs for Alternative 3 are summarized in Table 13. Major capital cost items include laboratory and field testing programs, system review and approval, extraction well and header system, stripping tower, carbon adsorber, foundations, nutrient feeding system, recharge trench and piping, controls and utilities and discharge piping. Major operation and maintenance cost items include energy costs, sampling and monitoring, analytical

TABLE 13

SUMMARY OF PROBABLE COSTS: ALTERNATIVE 3
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

CAPITAL COSTS

Item	Cost
Groundwater Extraction System	$ 95,000
Stripping Tower and Appurtenances	$110,000
Vapor Phase Carbon Unit and Appurtenances	$ 50,000
Discharge System	$ 40,000
Infiltration/Nutrient System	$ 90,000
Utilities and Excavation Spoils Management	$ 10,000
Lab and Pilot Testing	$200,000
Capital Facilities Subtotal	$595,000
Engineering Design (15%)	$ 90,000
Contract and Project Administration (25%)	$150,000
Capital Subtotal	$825,000
Contingencies (20%)	$165,000
Capital Total	$990,000

ANNUAL OPERATION AND MAINTENANCE COSTS

	First Year	Subsequent Years
Water Levels	$ 5,000	$ 5,000
Water Quality	$ 26,000	$ 8,000
Flow Monitoring	$ 5,000	$ 5,000
Energy	$ 6,000	$ 6,000
General O&M Labor	$ 40,000	$ 40,000
Reporting and Administration	$ 30,000	$ 30,000
Chemicals, Carbon and Regeneration	$ 40,000	$ 40,000
O&M Subtotal	$152,000	$134,000
Contingencies (20%)	$ 30,000	$ 27,000
O&M Total	$182,000	$161,000

6-YEAR PRESENT WORTH

Present Worth of Capital (not discounted)	$990,000
Present Worth of O & M (10% discount rate)	$720,000
Present Worth Total	$1,710,000

laboratory, routine systems inspection and maintenance, and reporting. For costing purposes, it is assumed a time period of six years would be required. Capital costs are estimated to be $990,000. The annual operation and maintenance costs are estimated to be approximately $160,000. The 6-year present worth (10% discount rate) associated with the above costs is $1,710,000.

Probable ARARs for Alternative 3 are summarized in Table 9. Chemical-specific ARARs for drinking water, groundwater, surface water and air were identified for this alternative. These include drinking water MCLs and NR 140 groundwater standards. Drinking water MCLs can be met by stripping tower treatment at the water utility. The aquifer restoration effort would be consistent with NR 140 requirements for remedial responses to groundwater contamination. Surface water criteria compliance would be feasible using stripping tower treatment to meet water quality-based effluent limits for water discharged to the Wisconsin River. VOC emission rate limits for specific compounds would be attainable for the stripping tower emissions.

Location-specific ARARs include floodplain and possible wellhead protection area requirements. Action-specific ARARs for the groundwater extraction, treatment and discharge systems are the same as for Alternative 2. No particular compliance difficulties are anticipated. To achieve compliance with State requirements regarding introduction of materials into groundwater or on land (including injection well and infiltration system restrictions), a demonstration that significant adverse effects will not result would be required.

Implementation of the extraction wells and above ground treatment portion of this alternative is not expected to be a problem. The major uncertainty with this technology is related to the ability to stimulate bacteria to degrade the compounds of concern. The technology is not well demonstrated for the contaminants found at the site.

Alternative 4 - In-Situ Bioreclamation

Alternative 4 is an in-situ method for remediation of the shallow east side groundwater utilizing biodegradation of contaminants in the groundwater. Alternative 4 is similar to Alternative 3, except all extracted groundwater would be recharged back to the aquifer. This alternative provides for rapid restoration of the aquifer and eliminates the costs associated with above ground treatment as with Alternative 3.

Under Alternative 4, groundwater would be extracted, supplemented with nutrients and recharged to the aquifer to enhance microbially-mediated contaminant degradation in-situ. A line of

TABLE 9

PROBABLE ARARs: ALTERNATIVE 3
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
		CHEMICAL-SPECIFIC
Federal		
40 CFR 141	National Primary Drinking Water Standards	Enforceable numerical standards for public water supplies. Standards can be met using stripping tower treatment.
40 CFR 264.94	Groundwater Concentration Limits	Enforceable limits for substances in groundwater released from a solid waste management unit permitted under RCRA. Anticipate continually decreasing contaminant concentrations in the aquifer as a result of pumping wells and in-situ contaminant degradation.
CWA Sec. 304(a)(1)	Ambient Water Quality Criteria	Concentration values considered to be protective of aquatic species, based on reported bioassay results. Identified criteria can be met with treated discharge.
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards	Particulate standards may apply to dust-generating construction activities. Standard control measures should be effective.
State		
NR 109 WAC	Safe Drinking Water	Establishes drinking water standards for public water supply. VOC standards can be met using stripping tower treatment.
NR 140 WAC	Groundwater Quality	Establishes numerical standards for concentration of substances in groundwater. Different levels of response are appropriate when Preventive Action Limits (PAL) or Enforcement Standards (ES) are exceeded. Anticipate continually decreasing contaminant concentrations in the aquifer as a result of pumping wells and in-situ contaminant degradation.
NR 102 WAC	Surface Water Quality Standards	Establishes water quality standards for streams. Standards can be maintained with a treated discharge.
NR 104 WAC	Uses and Designated Standards for Interstate Waters	Mandates that the Wisconsin River shall meet criteria for fish and aquatic life and recreational use. Criteria can be met with a treated discharge.
NR 105 WAC NR 106 WAC	Surface Water Quality Criteria for Toxic Substances	Establishes numerical water quality criteria for toxic substances. NR 106 specifies methods for calculating water quality-based effluent limits. Criteria can be met with a treated discharge.
NR 445 WAC	Control of Hazardous Pollutants	Establishes hourly or annual emission rate limits for specific substances. Estimated VOC emission rates for stripping tower are lower than limits where controls would be required.
		LOCATION-SPECIFIC
Federal		
Executive Order 11988	Floodplain Management	Requires that federal agencies identify and evaluate potential effects of actions on floodplains. No appreciable adverse effects have been identified.

TABLE 9 (Continued)

PROBABLE ARARs: ALTERNATIVE 3
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
SDWA Sec. 1428	Wellhead Protection Areas	Requirement for states to develop program for establishing wellhead protection areas. No specific requirements have been identified at this time.
State		
Chapter 30 Statutes NR 115-117 WAC	Protection of Floodplains	Regulates construction in floodplains. Some construction may take place within floodplain boundary. Outfall construction is allowed. Obtaining approval for wells, pipelines and recharge systems is considered feasible.
	ACTION-SPECIFIC	
Federal		
CWA Section 301; 40 CFR 122	Protection of Surface Water Quality	Technology-based effluent limits may apply to surface water discharge. The proposed stripping tower treatment should satisfy requirements.
40 CFR 264.117	Post-Closure Property Use	In general, use must not be allowed to disturb the integrity of the final landfill cover. Deed restrictions may be appropriate to limit use of the landfill property.
40 CFR 147	Underground Injection	Wisconsin underground injection control program prohibits the use of injection wells except for heat pump return flow. Federal code reflects the State's general prohibition.
29 CFR 1910	Protection of Hazardous Waste Site Workers	Establishes requirements for training, protective equipment, waste handling, personnel monitoring, and emergency procedures for hazardous waste site workers.
State		
NR 108 WAC	Requirements for Plans and Specifications for Wastewater Facilities	Establishes procedures for submittal and review of plans and specifications for treatment facilities. No difficulties in meeting requirements are anticipated.
NR 112 WAC	Well Construction and Pump Installation	Establishes requirements for design and construction of wells and appurtenances. Establishes specific prohibitions on well use, including well disposal of solid waste, sewage or surface water drainage. Various sections apply to groundwater extraction wells and extraction/ injection systems. Approval for the proposed activities is considered feasible under existing code provisions.
NR 200 WAC	Application for Discharge Permits	Establishes procedures for WPDES permit application. No difficulties are anticipated for surface water discharge. Approval for groundwater discharge may be time-consuming.
NR 214 WAC	Land Application and Disposal of Liquid Industrial Wastes and By-Products	Establishes design and construction criteria for land disposal systems. Prohibits discharge of toxic pollutants or hazardous waste to land (without demonstration that no pollution will result). Prohibits underground injection of pollutants, surface drainage or clear water waste through a well. Prohibits location of land disposal system in a floodway. Approval for the proposed activities is considered feasible under existing code provisions.
NR 219 WAC	Analytical Test Methods and Procedures	Establishes acceptable methods for analyzing samples from point sources discharging to surface water. Standard procedures would be appropriate for routine system monitoring.
NR 220 WAC	Categories and Classes of Point Sources	Establishes categories of point sources. Surface water discharge from treatment system would likely be subject to BATEA requirements. Stripping tower treatment would likely meet this requirement.

TABLE 9 (Continued)

PROBABLE ARARs: ALTERNATIVE 3
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
NR 400-499 WAC	Air Quality Management	NR 400 series regulations covers the range of Wisconsin air quality requirements. Estimated VOC emission rates from stripping tower are below limits where controls would be required.
NR 500-520 WAC	Solid and Hazardous Waste Management	NR 500 to 520 regulations cover the range of Wisconsin solid waste management requirements. Landfill performance and operational criteria regulate emissions of toxic substances to air. VOC emissions from the landfill were not identified as a health risk.
ILHR 81-84 WAC	State Plumbing Code	Design, construction and materials for piping, plumbing and sewer connection associated with extraction system and discharge must comply with requirements. State review and approval is required. No difficulties in meeting requirements are anticipated.
ILHR 50-53 WAC	State Building Code	Design and construction of structures must comply with requirements.
IND 1 WAC	General Industrial Safety	Construction and operation must comply with safety requirements.
IND 6 WAC	Industrial Safety for Trenches and Excavation	Construction must comply with safety requirements.

groundwater extraction wells would be installed around the northern and eastern portions of he Wausau Chemical property. The conceptual extraction and recharge system layout is the same as that developed for Alternative 3 (Figure 8). The groundwater extraction and recharge rates and considerations regarding the addition of nutrients and other enhancements to recharge water are the same as those discussed for Alternative 3.

Computer simulation of the alternative shows that the proposed line of extraction wells can not provide complete hydraulic control of the extraction/recharge system at any pumping rate. Contaminant transport simulation shows that PCE concentrations at CW3 would decrease below 5 ug/L after approximately 2.5 years. As with Alternative 3, complete aquifer purge time for the east side groundwater under this alternative could not be estimated using the contaminant transport model.

The simulation also shows that the groundwater mound resulting from the recharge causes approximately 5% of the contaminant mass to migrate around the east side of the extraction system to CW3 (see Figure 6). The actual recapture efficiency will depend on such factors as the specific system configuration, localized variations in aquifer properties, extraction/recharge rates and operating conditions, and local hydrologic factors, such as precipitation, runoff and infiltration rates. Achieving a 100 percent recapture efficiency is not considered feasible.

Costs for Alternative 4 are summarized in Table 14. Major capital cost items include laboratory and field testing programs, system review and approval, extraction well and header system, nutrient feeing system, recharge trench and piping, controls and utilities. Major operation and maintenance cost items include energy costs, sampling and monitoring, analytical laboratory, routine systems inspection and maintenance, and reporting. As with Alternative 3, remediation period estimates were not obtained using the contaminant transport model. It was assumed that Alternative 4 would require more time than Alternative 3, and less time than Alternative 2 (due to in-place contaminant degradation) to achieve remedial objectives. A period of 9 years was assumed for costing purposes. Capital costs are estimated to be $710,000. The annual operation and maintenance costs are estimated to be approximately $112,000. The 9-year present worth (10% discount rate) associated with the above costs is $1,380,000.

Probable ARARs for Alternative 4 are summarized in Table 10. Chemical-specific ARARs for drinking water, groundwater, surface water and air were identified for this alternative. These include drinking water MCLs and NR 140 groundwater standards. The aquifer restoration effort would be consistent with requirements for responses to groundwater contamination under NR 140.

TABLE 10

PROBABLE ARARs: ALTERNATIVE 4
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
		CHEMICAL-SPECIFIC
Federal		
40 CFR 141	National Primary Drinking Water Standards	Enforceable numerical standards for public water supplies. Standards can be met using stripping tower treatment.
40 CFR 264.94	Groundwater Concentration Limits	Enforceable limits for substances in groundwater released from a solid waste management unit permitted under RCRA. Anticipated continually decreasing contaminant concentrations in the aquifer as a result of pumping wells and in-situ contaminant degradation.
CWA Sec. 304(a)(I)	Ambient Water Quality Criteria	Concentration values considered to be protective of aquatic species, based on reported bioassay results.
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards	Particulate standards may apply to dust-generating construction activities. Standard control measures should be effective.
State		
NR 109 WAC	Safe Drinking Water	Establishes drinking water standards for public water supply. VOC standards can be met using stripping tower treatment.
NR 140 WAC	Groundwater Quality	Establishes numerical standards for concentration of substances in groundwater. Different levels of response are appropriate when Preventive Action Limits (PAL) or Enforcement Standards (ES) are exceeded. Anticipate continually decreasing contaminant concentrations in the aquifer as a result of pumping wells and in-situ contaminant degradation.
NR 102 WAC	Surface Water Quality Standards	Establishes water quality standards for streams. Standards can be maintained with a treated discharge.
NR 104 WAC	Uses and Designated Standards for Interstate Waters	Mandates that the Wisconsin River shall meet criteria for fish and aquatic life and recreational use. Criteria can be met with a treated discharge.
NR 105 WAC NR 106 WAC	Surface Water Quality Criteria for Toxic Substances	Establishes numerical water quality criteria for toxic substances. NR 106 specifies methods for calculating water quality-based effluent limits. Criteria can be met with a treated discharge.
NR 445 WAC	Control of Hazardous Pollutants	Establishes hourly or annual emission rate limits for specific substances. Estimated VOC emission rates for stripping tower or soil gas extraction systems are lower than limits where controls would be required.
		LOCATION-SPECIFIC
Federal		
Executive Order 11988	Floodplain Management	Requires that federal agencies identify and evaluate potential effects of actions on floodplains. No appreciable adverse effects have been identified.

TABLE 10 (Continued)

PROBABLE ARARs: ALTERNATIVE 4
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
SDWA Sec. 1428	Wellhead Protection Areas	Requirement for states to develop program for establishing wellhead protection areas. No specific requirements have been identified at this time.
State		
Chapter 30 Statutes NR 115-117	Protection of Floodplains	Regulates construction in floodplains. May apply to remedial construction activities. Some construction may take place within floodplain boundary. Outfall construction is allowed. Obtaining approval for wells, pipelines and recharge systems is considered feasible.
	ACTION-SPECIFIC	
Federal		
CWA Section 301; 40 CFR 122	Protection of Surface Water Quality	Technology-based effluent limits may apply to surface water discharge. The proposed stripping tower treatment should satisfy requirements.
40 CFR 264.117	Post-Closure Property Use	In general, use must not be allowed to disturb the integrity of the final landfill cover. Soil gas extraction system should not be a prohibited use. Deed restriction may be appropriate to limit use of the landfill area.
40 CFR 147	Underground Injection	Wisconsin underground injection control program prohibits the use of injection wells except for heat pump return flow. Federal code reflects the State's general prohibition.
29 CFR 1910	Protection & Hazardous Waste Site Workers	Establishes requirements for training, protective equipment, waste handling, and emergency procedures for hazardous waste site workers.
State		
NR 108 WAC	Requirements for Plans and Specifications for Wastewater Facilities	Establishes procedures for submittal and review of plans and specifications for treatment facilities. No difficulties in meeting requirements are anticipated.
NR 112 WAC	Well Construction and Pump Installation	Establishes requirements for design and construction of wells and appurtenances. Establishes specific prohibitions on well use, including well disposal of solid waste, sewage or surface water drainage. Various sections apply to groundwater extraction wells and extraction/ injection systems. Approval for the proposed activities is considered feasible under existing code provisions.
NR 200 WAC	Application for Discharge Permits	Establishes procedures for WPDES permit application. No difficulties are anticipated for surface water discharge. Approval for groundwater discharge may be time-consuming.
NR 214 WAC	Land Application and Disposal of Liquid Industrial Wastes and By-Products	Establishes design and construction criteria for land disposal systems. Prohibits discharge of toxic pollutants or hazardous waste to land (without demonstration that no pollution will result). Prohibits underground injection of pollutants, surface drainage or clear water waste through a well. Prohibits location of land disposal system in a floodway. Approval for the proposed activities is considered feasible under existing code provisions.
NR 219 WAC	Analytical Test Methods and Procedures	Establishes acceptable methods for analyzing samples from point sources discharging to surface water. Standard procedure would be appropriate for routine system monitoring.

TABLE 10 (Continued)

PROBABLE ARARs: ALTERNATIVE 4
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
NR 220 WAC	Categories and Classes of Point Sources	Establishes categories of point sources. Surface water discharge from treatment system would likely be subject to BATEA requirements. Stripping tower treatment would likely meet this requirement.
NR 400-499	Air Quality Management	NR 400 series regulations covers the range of Wisconsin air quality requirements. Estimated VOC emission rates for stripping tower or soil gas extraction systems are below limits where controls would be required.
NR 500-520	Solid and Hazardous Waste Management	NR 500 to 520 regulations cover the range of Wisconsin solid waste management requirements. Landfill performance and operational criteria regulate emissions of toxic substances to air. VOC emission from the landfill would be controlled, but actual emission rates would likely be higher than would be the case under the No Action alternative.
ILHR 81-84 WAC	State Plumbing Code	Design, construction and materials for piping, plumbing and sewer connection associated with pump house and discharge must comply with requirements. State review and approval is required. No difficulties in meeting requirements are anticipated.
ILHR 50-53 WAC	State Building Code	Design and construction of structures must comply with requirements.
IND 1 WAC	General Industrial Safety	Construction and operation must comply with safety requirements.
IND 6 WAC	Industrial Safety for Trenches and Excavation	Construction must comply with safety requirements.

TABLE 14

SUMMARY OF PROBABLE COSTS: ALTERNATIVE 4
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

CAPITAL COSTS

Item	Cost
Groundwater Extraction System	$120,000
Utilities and Excavation Spoils Management	$ 10,000
Infiltration/Nutrient System	$ 90,000
Lab and Pilot Study	$200,000
Capital Facilities Subtotal	$420,000
Engineering Design (15%)	$ 65,000
Contract and Project Administration (25%)	$105,000
Capital Subtotal	$590,000
Contingencies (20%)	$120,000
Capital Total	$710,000

ANNUAL OPERATION AND MAINTENANCE COSTS

	First Year	Subsequent Years
Water Levels	$ 5,000	$ 5,000
Water Quality	$ 26,000	$ 8,000
Flow Monitoring	$ 5,000	$ 5,000
Energy	$ 5,000	$ 5,000
General O&M Labor	$ 30,000	$ 30,000
Reporting and Administration	$ 30,000	$ 30,000
Chemicals	$ 10,000	$ 10,000
O&M Subtotal	$111,000	$ 93,000
Contingencies (20%)	$ 22,000	$ 19,000
O&M Total	$133,000	$112,000

9-YEAR PRESENT WORTH

Present Worth of Capital (not discount)	$ 710,000
Present Worth of O & M (10% discount rate)	$ 670,000
Present Worth Total	$1,380,000

Costs for Alternative 5 are summarized in Table 15. Major capital cost items include soil gas extraction and air recharge wells, header pipe line, blower, motor, controls and a shelter to protect equipment. Major operation and maintenance cost items include carbon, electricity, monitoring and analytical laboratory costs, routine systems inspection and maintenance, and reporting. Capital costs are estimated to be $252,000. Operation costs are estimated to be $222,000. Present worth costs are estimated to be $474,000. An 18-month operating period was assumed and costs were not discounted.

Use of the City production wells as part of the remedy requires that the cost of operating and maintaining the wells and stripping towers be considered part of the cost of the remedy. Costs were developed based on operating the 8-ft diameter tower at the Wausau Water Utility. Major items include energy costs for pumping wells and stripping towers, and operation and maintenance of stripping towers. It was assumed that for each City production well, the time until no more contaminants are drawn in to a well represents the time of operation. The estimated present worth of the City operating the two City wells and treating the water is $260,000. Operating CW6 and treating its water for VOC removal for 14 years accounts for $180,000. The corresponding cost for CW3 for a 6-year operating period is $80,000. The estimated total present worth cost of Alternative 5 is $734,000.

Probable ARARs for Alternative 5 are summarized in Table 11. Chemical-specific ARARs addressing drinking water, groundwater and air quality standards were identified for Alternative 5. These include drinking water MCLs and NR 140 groundwater standards. Drinking water standards for VOCs can be met at the water utility using VOC stripping tower treatment. This alternative would meet the requirements for response under Chapter NR 140. Meeting State emission limits can be achieved without controls for specific organic compounds.

Location-specific ARARs include requirements related to activities within floodplains and wellhead protection areas. Action-specific ARARs include landfill property use restrictions. Compliance with possible future requirements should not be a problem.

Implementation of this alternative is not expected to be a problem. The technology is readily available and well demonstrated. No unusual features are anticipated with implementation and operation of the system.

VIII. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

TABLE 11

PROBABLE ARARs: ALTERNATIVE 5
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
	CHEMICAL-SPECIFIC	
Federal		
40 CFR 141	National Primary Drinking Water Standards	Enforceable numerical standards for public water supplies. Standards for VOCs can be met at the water utility using packed tower stripping treatment.
40 CFR 264.94	Groundwater Concentration Limits	Enforceable limits for substances in groundwater released from a solid waste management unit permitted under RCRA. Anticipate meeting limits in the long term as a result of aquifer purging by existing production and remediation (including Phase 1 remedy) wells.
40 CFR 50.6	National Primary and Secondary Ambient Air Quality Standards	Particulate standards may apply to dust-generating construction activities. Standard control measures should be effective. Extensive excavation is not planned.
State		
NR 109 WAC	Safe Drinking Water	Establishes drinking water standards for public water supply. State standards are not more stringent than Federal MCLs. Standards for VOCs can be met by the wa utility.
NR 140 WAC	Groundwater Quality	Establishes numerical standards for concentration of substances in groundwater. Different levels of response are appropriate when Preventive Action Limits (PAL) or Enforcement Standards (ES) are exceeded. Values may be used as remedial objectives. Anticipate continually lower contaminant concentrations in the aquifer as a result of aquifer purging by existing production and remediation (including Phase 1 remedy) wells.
NR 445 WAC	Control of Hazardous Pollutants	Establishes hourly or annual emission rate limits for specific substances. Emission rates on the order of 1 lb/day for individual systems would meet limits.
	LOCATION-SPECIFIC	
Federal		
Executive Order 11988	Floodplain Management	Requires that federal agencies identify and evaluate potential effects of actions on floodplains. No appreciable adverse effects have been identified.
SDWA Sec. 1428	Wellhead Protection Areas	Requirement for states to develop program for establishing wellhead protection areas. No specific requirements are known at this time. Implementation of soil gas extraction systems should not conflict with possible future requirements.
State		
Chapter 30 Statues	Protection of Floodplains	Regulates construction in floodplains. Proposed systems do not appear to lie within floodplain.

TABLE 11 (Continued)

PROBABLE ARARs: ALTERNATIVE 5
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Probable ARAR	Subject	Requirement/Compliance
	ACTION-SPECIFIC	
Federal		
40 CFR 264.117.	Post-Closure Property Use	In general, use must not be allowed to disturb the integrity of the final landfill cover. Proposed soil gas extraction system does not appear to be a prohibited activity.
29 CFR 1920	Protection of Hazardous Waste Site Workers	Requirements for training, protective equipment, waste handling, personnel monitoring, and emergency procedures for hazardous waste site workers.
State		
NR 181 WAC	Hazardous Waste Management	Off-gas treatment process residuals may require management as hazardous waste.
NR 400-499 WAC	Air Quality Management	NR 400 series regulations covers the range of Wisconsin air quality requirements. VOC emission rates are anticipated to be below levels where controls would be required.
NR 500-520 WAC	Solid and Hazardous Waste Management	NR 500 to 520 regulations cover the range of Wisconsin solid waste management requirements. Landfill performance and operational criteria regulate emissions of explosive gases and toxic substances to air. Explosive gases are not anticipated due to the nature of the landfilled material. Extraction of VOCs will provide control of emissions, but likely would increase the rate over that expected to occur under No Action.
ILHR 50-53 WAC	State Building Code	Design and construction of structures must comply with requirements.
IND 1 WAC	General Industrial Safety	Construction and operation must comply with safety requirements.
IND 6 WAC	Industrial Safety for Trenches and Excavation	Construction must comply with safety requirements.

Location-specific ARARs include floodplain and possible wellhead protection area requirements. Action-specific ARARs for the groundwater extraction, treatment and discharge systems are the same as for Alternative 3.

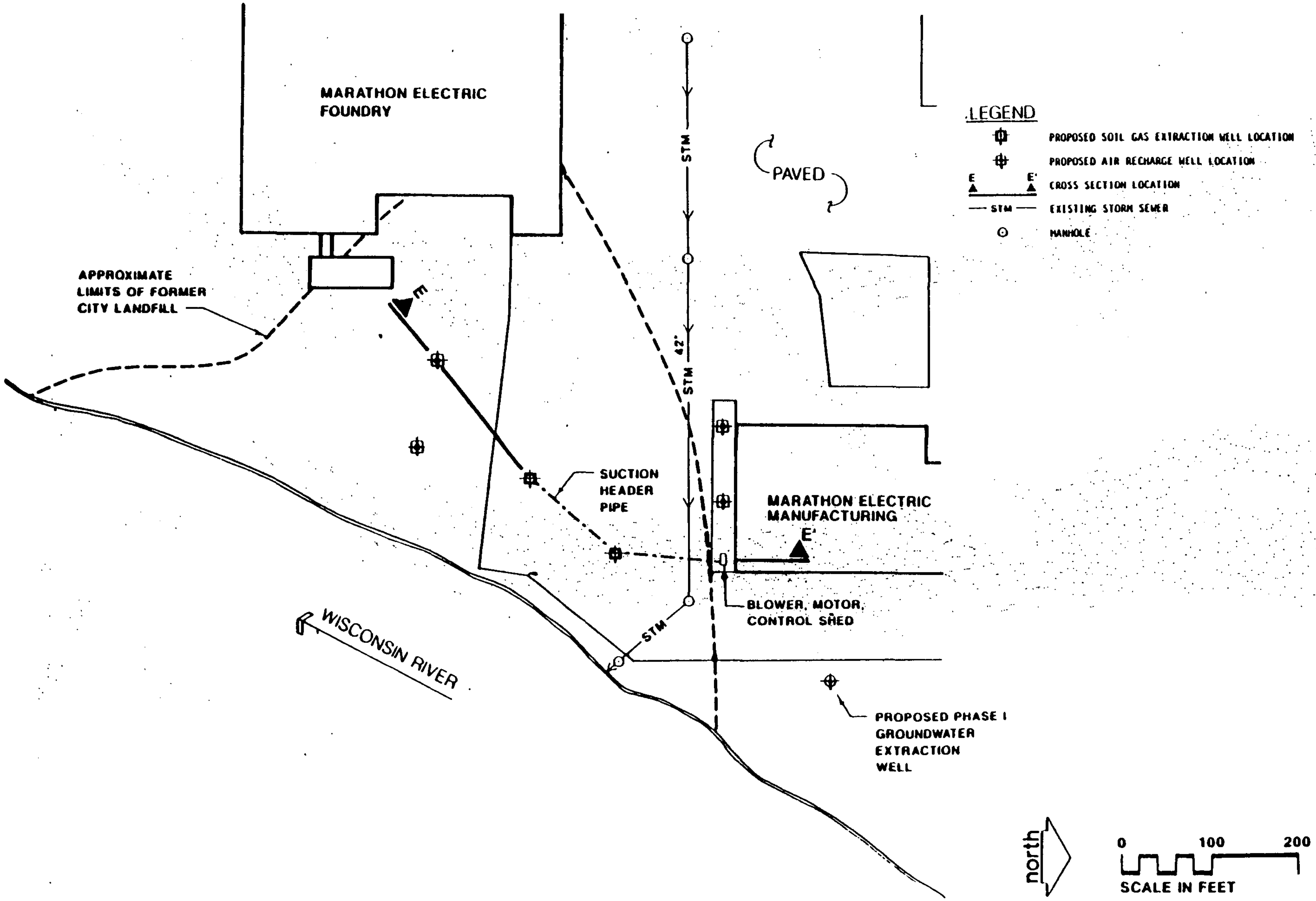
Implementation of the extraction wells, trenching, and discharge portion of this alternative is not expected to be a problem. The major uncertainty with this technology is related to the ability to stimulate existing bacteria to degrade the compounds of concern in the groundwater. This technology is not well demonstrated for the contaminants found at the site.

Alternative 5 - Active Source Control-Soil Vapor Extraction

Alternative 5 is a source control alternative utilizing In-situ soil vapor extraction (SVE) to remove contaminants from unsaturated soils thereby reducing the potential for future contaminant releases to groundwater. Contaminants vacuumed from the soil, in the vapor phase, would be treated using vapor phase carbon units, prior to release to the atmosphere. The scope of Alternative 5 includes remediation of unsaturated soils at the former City landfill/Marathon Electric property, Wausau Chemical and Wausau Energy.

For the former landfill area, soil gas extraction wells would be installed within the limits of the fill in the northern portion of the landfill where the highest VOC concentrations have been observed. A conceptual system layout is shown on Figure 9. A header pipe would be installed to connect the wells to an induction fan blower. The blower and control panel would be housed in a small shed. It is anticipated that air recharge wells would be required and are included in the design & cost of the alternative.

A similar type of soil gas extraction system would be installed on the Wausau Chemical property. Soil gas would be extracted near the former tank storage area. This area is near the center of high soil gas VOC concentrations observed at the site. A second extraction area would be located near the north end of the building. A header would connect the extraction wells to a common blower. Air recharge wells would also be anticipated for this system. Conceptual layout is shown on Figure 10. Pilot study results indicate a radius of influence of approximately 85 ft. was obtained at a gas extraction rate of 72 scfm. A soil gas extraction system would also be installed at the Wausau Energy property on the south side of the building. Soil types encountered in on-site borings were similar to those encountered at several Wausau Chemical site borings and it is therefore, assumed that the radius of influence would be sufficient to cover the entire facility.



MARATHON ELECTRIC
FOUNDRY
PAVED
LEGEND
PROPOSED SOIL GAS EXTRACTION WELL LOCATION
PROPOSED AIR RECHARGE WELL LOCATION
E
E'
CROSS SECTION LOCATION
STM
EXISTING STORM SEWER
MANHOLE
APPROXIMATE
LIMITS OF FORMER
CITY LANDFILL
E
STM
42"
STM
SUCTION
HEADER
PIPE
MARATHON ELECTRIC
MANUFACTURING
E'
BLOWER, MOTOR,
CONTROL SHED
STM
WISCONSIN RIVER
PROPOSED PHASE I
GROUNDWATER
EXTRACTION
WELL
north
0
100
200
SCALE IN FEET

FIGURE 9

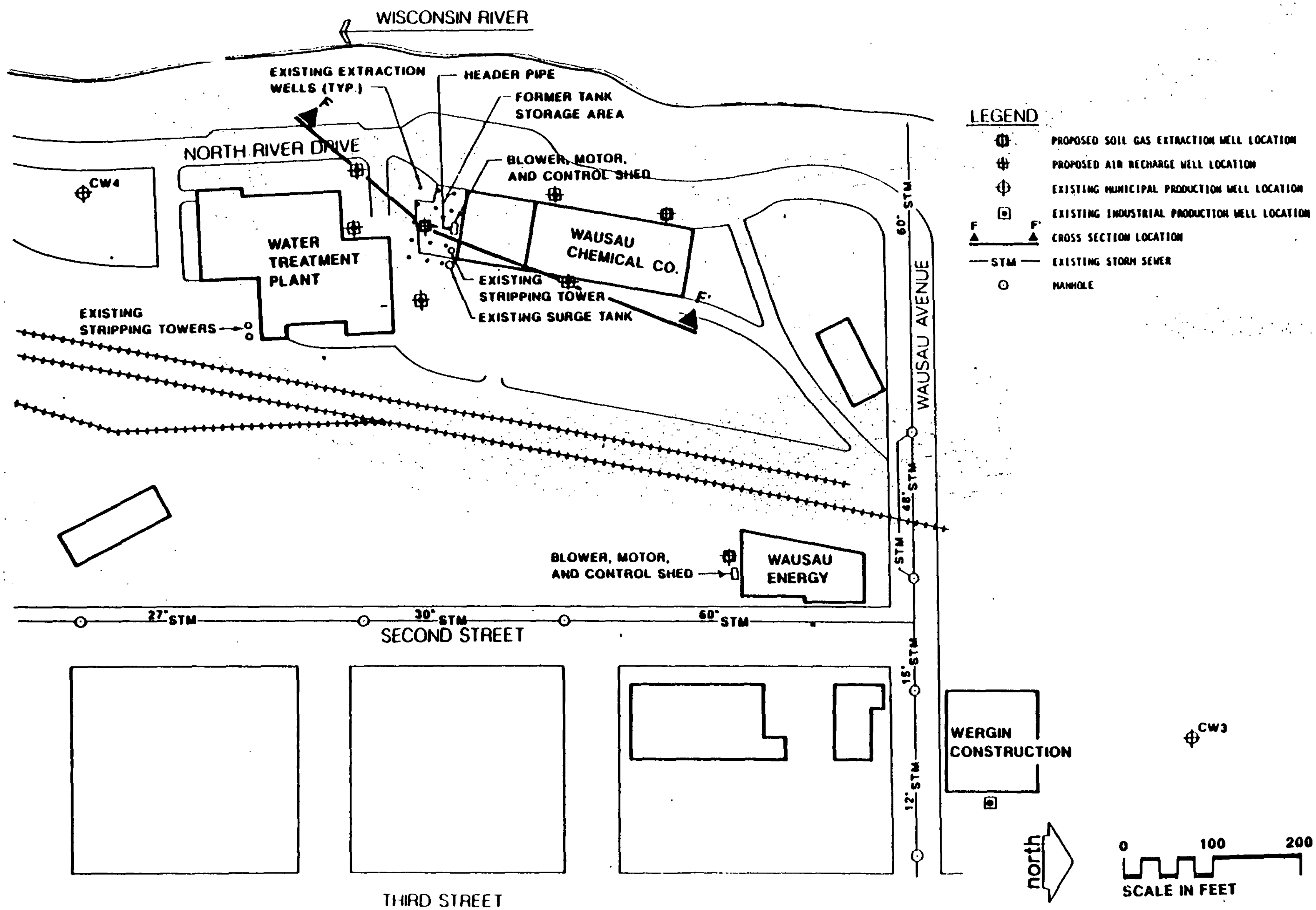

WISCONSIN RIVER
EXISTING EXTRACTION WELLS (TYP.)
HEADER PIPE
FORMER TANK STORAGE AREA
NORTH RIVER DRIVE
BLOWER, MOTOR, AND CONTROL SHED
CW4
WATER TREATMENT PLANT
WAUSAU CHEMICAL CO.
EXISTING STRIPPING TOWER
EXISTING SURGE TANK
EXISTING STRIPPING TOWERS
F
F'
WAUSAU AVENUE
60" STM
48" STM
STM
BLOWER, MOTOR, AND CONTROL SHED
WAUSAU ENERGY
27" STM
30" STM
60" STM
SECOND STREET
15" STM
12" STM
WERGIN CONSTRUCTION
CW3
THIRD STREET
LEGEND
PROPOSED SOIL GAS EXTRACTION WELL LOCATION
PROPOSED AIR RECHARGE WELL LOCATION
EXISTING MUNICIPAL PRODUCTION WELL LOCATION
EXISTING INDUSTRIAL PRODUCTION WELL LOCATION
CROSS SECTION LOCATION
EXISTING STORM SEWER
MANHOLE
north
0
100
200
SCALE IN FEET

FIGURE 10

Technologies described in this alternative would reduce the time required to meet response objectives for groundwater clean-up, because there will be a reduction in contaminant loading to the aquifer, by reducing contaminant levels in the unsaturated zone soils. However, substantial reductions in existing contaminant concentrations in groundwater would not be expected to occur as a result of vapor extraction at the source.

Based on computer simulations during development of the FS, it was shown that extraction of groundwater on the east side in the vicinity of the Wausau Chemical source area would create a groundwater divide where contaminants would get "hung up" due to competition for water between CW3 and the extraction system (see discussion under Alternative 2). Because of this phenomenon, extracting groundwater at the source results in a longer period to purge the aquifer than allowing contaminants to flow to the currently operating City supply wells. It was, therefore, determined that City supply wells CW6 and CW3 would be incorporated into the source control alternative as the means for addressing groundwater contamination remediation.

Computer modeling of this alternative was performed by decreasing the contaminant loading rates from soils to zero after 1.5 years to simulate removal of the sources. Two different computer simulations were performed to determine the optimum pumpage rates for the City's supply wells CW3 and CW6. It was determined that increased pumpage of the supply wells result in a reduced time period for remediation under this alternative.

Based on the simulation, a TCE concentration of less than 5 ug/L could be achieved at CW6 after approximately 4.5 years. TCE concentrations at CW3 resulting from migration from the landfill would be less than 5 ug/L after approximately 4 years. Wells CW3 and CW6 would continue to draw in contaminants from the landfill for 6 and 14 years, respectively. PCE concentrations at Production Well CW3 would be reduced to less than 5 ug/L after approximately 3.3 years and Well CW3 would no longer draw in contaminants from the Wausau Chemical sources after approximately 5 years.

It is not anticipated that VOC emissions from the water utility stripping towers would be higher than those assumed for modeling of air emissions. No off-gas controls are proposed for the water utility stripping towers considering that their operation would produce emissions within the acceptable risk level of 10^{-6} and therefore are considered representative of baseline conditions. The soil vapor extraction systems would represent new sources. Based on preliminary risk calculations, risks associated with new VOC emissions in the area would need to be addressed. Vapor phase carbon is therefore included for off-gas treatment for these systems.

TABLE 15

SUMMARY OF PROBABLE COSTS: ALTERNATIVE 5
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

CAPITAL COSTS

Item	Cost
Wells, Header and Appurtenances	$ 90,000
Blower House, Controls, Utilities	$ 60,000
Off-Gas Treatment (Carbon)	$ 25,000
Capital Facilities Subtotal	$175,000
Engineering Design (20%)	$ 29,000
Contract and Project Administration (25%)	$ 36,000
Capital Subtotal	$210,000
Contingencies (20%)	$ 42,000
Capital Total	$252,000

OPERATION AND MAINTENANCE COSTS

Monitoring	$ 15,000
Energy	$ 5,000
General O&M Labor	$ 30,000
Reporting and Administration	$ 45,000
Carbon Purchase and Treatment	$ 90,000
Vapor System 18 Month O&M Subtotal	$185,000
Contingencies (20%)	$ 37,000
Vapor System 18 Month O&M Total	$222,000
Well CW3 and Stripper - Energy	$ 15,000
- O&M	$ 3,000
Well CW6 and Stripper - Energy	$ 21,000
- O&M	$ 3,500
City Well and Stripper Annual O&M Total	$42,500

PRESENT WORTH

Present Worth of Vapor System Capital (not discounted)	$252,000
Present Worth of Vapor System O&M (not discounted)	$222,000
Vapor System Present Worth Total	$474,000
Present Worth of CW3 Cost (6 years)	$ 80,000
Present Worth of CW6 Cost (14 years)	$180,000
City Well and Stripper Present Worth Total	$260,000
Alternative 5 Present Worth Total	$734,000

In order to determine the most appropriate alternative that is protective of human health and the environment, attains ARARs, is cost-effective, and utilizes permanent solutions and treatment technologies to the maximum extent practicable, alternatives were evaluated against each other. Comparisons were based on the nine evaluation criteria outlined in SARA. A summary of the comparison is provided in Table 16. Following is a discussion of each of the criteria and a summary of the alternatives' performance against each of these.

1. <u>Overall Protection of Human Health and the Environment:</u> Each of the alternatives (except No Action) will achieve reduction of risks from contaminants and pathways of concern identified for the site. However, the alternatives differ in the time needed to purge the aquifer of contaminants, and thus time to reduce risks from drinking water, groundwater, and air emissions. Alternative 1 requires the longest time to achieve clean-up. Alternative 2 requires the next longest period. Alternatives 3 and 4 require similar periods for remediation of the east side contaminant plume which is expected to be shorter than pump and treat under Alternative 2. However, as with Alternative 2, Alternatives 3 and 4 do not provide any reduction in time for purging of the deep plume migrating under the River to CW3. This results in a significantly long time period for contaminants to remain in the aquifer. In addition, there is some uncertainty as to whether in-situ bioreclamation would perform as predicted for the contaminants present at the site. Alternative 5 achieves source reduction which results in a substantial reduction in time for remediation of contamination in the aquifer. Increased pumpage of City supply wells as called for under this alternative, further reduces the time for remediation of the site.

2. <u>Compliance with ARARs:</u> All applicable or relevant and appropriate requirements under Federal and State environmental regulations are met by Alternatives 2, 3, 4 and 5. Alternative 1 (No Action) would not comply with Wisconsin NR 140 requirements for response when groundwater quality standards are exceeded. Therefore, the No Action alternative will not be included in the discussions that follow pertaining to evaluation of alternatives against the remaining criteria.

Superfund monies may not be able to be used at the Wausau Energy source area if it is determined that contaminants from this source are strictly derived from a petroleum source. However, the Wisconsin Hazardous Substances Spill Law does include a provision to address such spills and would be pursued.

3. <u>Long-term Effectiveness:</u> The alternatives differ in the time required to achieve various objectives, but in the long-term, each of the action alternatives is expected to achieve compliance

TABLE 16

SUMMARY OF ALTERNATIVES EVALUATION
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Evaluation Factor	Alternative 1 No Action	Alternative 2 Groundwater Extraction and Treatment	Alternative 3 Groundwater Extraction and Treatment with In-Situ Bioreclamation	Alternative 4 In-Situ Bioreclamation	Alternative 5 Active Source Control(1)
Short-Term Effectiveness	No additional protection of community and workers is required.	Risks to workers during implementation addressed by standard controls and personal protection equipment. Community risks considered to be minimal.	Risks to workers during implementation addressed by standard controls and personal protection equipment. Community risks considered to be minimal.	Risks to workers during implementation addressed by standard controls and personal protection equipment. Community risks considered to be minimal.	Risks to workers during implementation addressed by standard controls and personal protection equipment. Community risks considered to be minimal.
	No additional risks beyond baseline conditions.	Stripping tower off gas controls are provided to control potential additional exposure risks.	Stripping tower off-gas controls are provided to control potential additional exposure risks. Possible migration of contaminants from recharge area is controlled by extraction rate greater than recharge rate.	Possible migration of contaminants from recharge area is anticipated. Quantity can be limited by controlling the bioreclamation system recirculation rate.	Vapor extraction system off-gas controls are provided to control potential additional exposure risks.
	Approximately 20 years of purging northern portion of west side plume by Well CW6.	Approximately 20 years of purging northern portion of west side plume by well CW6.	Approximately 20 years of purging northern portion of west side plume by well CW6.	Approximately 20 years of purging northern portion of west side plume by well CW6.	Approximately 20 years of purging northern portion of west side plume by well CW6.
		Achieves protection through contaminant removal and above-ground treatment.	Achieves protection through combination of contaminant removal, above ground treatment, and in-situ groundwater treatment.	Achieves protection through in-situ groundwater treatment.	Achieves protection primarilby preventing additional contaminant loading to the aquifer as a result of soil vapor extraction.
Long-Term Effectiveness	Can achieve MCLs and contaminant levels approaching state groundwater standards in aquifer.	Can achieve MCLs and contaminant levels approaching state groundwater standards in aquifer.	Can achieve MCLs and contaminant levels approaching state groundwater standards in aquifer.	Can achieve MCLs and contaminant levels approaching state groundwater standards in aquifer.	Can achieve MCLs and contaminant levels approaching state groundwatestandards in aquifer.
		Groundwater extraction and treatment technologies are reliable. Repair or replacement in relatively short time is feasible, in the event of failure.	Groundwater extraction, and treatment technologies are reliable. Infiltration technology is reliable but potentially subject to fooling. Limitations can be managed with sound operation and maintenance strategies. bioreclamation aspect is reliable if desired bacterial populations can be maintained. In worst case failure mode, system can operate as conventional pump and treat system.	Groundwater extraction technology is reliable. Infiltration technology is reliable but potentially subject to fooling. Limitations can be managed with sound operation and maintenance strategies. Bioreclamation is reliable if desired bacterial populations can be maintained.	Vapor extraction technology is reliable. Repair or replacement in relatively short time is feasible in the event of failure.

TABLE 16
(Continued)

SUMMARY OF ALTERNATIVES EVALUATION
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Evaluation Factor	Alternative 1 No Action	Alternative 2 Groundwater Extraction and Treatment	Alternative 3 Groundwater Extraction and Treatment with In-Situ Bioreclamation	Alternative 4 In-Situ Bioreclamation	Alternative 5 Active Source Control(1)
	Long-term management consists of monitoring water quality and aquifer purging effectiveness by existing wells.	Long-term management consists of monitoring water levels, water quality, discharge quality and routine system maintenance.	Long-term management consists of monitoring water levels, water quality, discharge quality and routine system maintenance.	Long-term management consists of monitoring water levels, water quality, recharge water quality and routine system maintenance.	Vapor extraction has a short operation period. Long-term management consists of monitoring as in Alternative 1.
Reduction of Toxicity, Mobility, Volume	None	Volume and toxicity reduction through carbon adsorption and thermal regeneration.	Toxicity reduction through contaminant degradation. Volume and toxicity reduction through carbon adsorption and thermal regeneration.	Toxicity reduction through contaminant degradation.	Volume and toxicity reduction through carbon adsorption and thermal regeneration.
Implementability	Technical feasibility considerations are not applicable.	Groundwater extraction, treatment and discharge technologies are conventional. System effectiveness and performance are readily monitored.	Groundwater extraction treatment discharge and infiltration technologies are all conventional Hydraulic control of the area appears feasible. Bioreclamation appears feasible. Full site-specific assessment will require testing. System effectiveness and performance are readily monitored.	Groundwater extraction and technologies are conventional. Complete recapture and recharged water is not feasible. Bioreclamation appears feasible. Full site-specific assessment will require testing. System effectiveness and performance are readily monitored.	Vapor extraction technology is conventional. System effectiveness and performance are readily monitored.
	May not be administratively feasible due to lack of additional responses.	Coordination between U.S. EPA and WDNR for plan review and approval. Coordination with local agencies may be required. Coordination with PRP representatives will be required. No apparent administrative difficulties.	Coordination between U.S. EPA and WDNR for plan review and approval. Coordination with local agencies will be required. Coordination with PRP representatives will be required. No apparent administrative difficulties.	Coordination between U.S. EPA and WDNR for plan review and approval. Coordination with local agencies will be required. coordination with PRP representatives will be required. No apparent administrative difficulties.	Coordination between U.S. EPA and WDNR for plan review and approval. Coordination with local agencies may be required. Coordination with PRP representatives will be required. No apparent administrative difficulties.
	No additional services required.	Required technologies and services are available. Off-site services including POTW and sanitary landfill may be required, and are considered to be available.	Required technologies and services are available. Off-site services including POTW and sanitary landfill may be required, and are considered to be available.	Required technologies and services are available. Off-site services including POTW and sanitary landfill may be required, and are considered to be available.	Required technologies and services are available. Off-site services including POTW and sanitary landfill may be required, and are considered to be available.
Cost	No direct monetary cost	Capital: $480,000 Annual O&M: $122,000 Present Worth: $1,330,000 Discount Period: 12 years Discount Rate: 10%	Capital: $990,000 Annual O&M: $161,000 Present Worth: $1,710,000 Discount Period: 6 years Discount Rate: 10%	Capital: $710,000 Annual O&M: $112,000 Present Worth: $1,380,000 Discount Period: 9 years Discount Rate: 10%	Capital: $256,000 O&M: $482,000 Present Worth: $738,000 Discount Period: 14 years Discount Rate: 10%

TABLE 16
(Continued)

SUMMARY OF ALTERNATIVES EVALUATION
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Evaluation Factor	Alternative 1 No Action	Alternative 2 Groundwater Extraction and Treatment	Alternative 3 Groundwater Extraction and Treatment with In-Situ Bioreclamation	Alternative 4 In-Situ Bioreclamation	Alternative 5 Active Source Control(1)
Compliance with ARARs	MCLs achieved for municipal water study.	MCLs achieved for municipal water study.	MCLs achieved for municipal water study.	MCLs achieved for municipal water study.	MCLs achieved for municipal water study.
	Likely would not comply with NR 140 requirement for response due to lack of source area control and no additional groundwater remediation.	Would likely comply with NR 140 requirement for response as a groundwater control measure.	Would likely comply with NR 140 requirement for response as a groundwater control measure.	Would likely comply with NR 140 requirement for response as a groundwater control measure.	Would likely comply with NR 140 requirement for response as a source control measure.
	MCLs and State groundwater standards could be achieved in the aquifer in the long term.	MCLs and State groundwater standards could be achieved in the aquifer in the long term.	MCLs and State groundwater standards could be achieved in the aquifer in the long term.	MCLs and State groundwater standards could be achieved in the aquifer in the long term.	MCLs and State groundwater standards could be achieved in the aquifer in the long term.
	Compliance with VOC emissions limits can be achieved.	Compliance with VOC emissions limits can be achieved.	Compliance with VOC emissions limits can be achieved.	Compliance with VOC emissions limits can be achieved.	Compliance with VOC emissions limits can be achieved.
		Effluent standards can be met for surface water discharge.	Effluent standards can be met for surface water discharge.		
		Compliance with action-specific ARARs related to design, approval, construction and monitoring can be met.	Compliance with action-specific ARARs related to design, approval, construction and monitoring can be met.	Compliance with action-specific ARARs related to design, approval, construction and monitoring can be met.	Compliance with action-specific ARARs related to design, approval, construction and monitoring can be met.
Overall Protection of Human Health and the Environment	MCLs are met by VOC removal at City water treatment plant.	MCLs are met by VOC removal at City water treatment plant.	MCLs are met by VOC removal at City water treatment plant.	MCLs are met by VOC removal at City water treatment plant.	MCLs are met by VOC removal at City water treatment plant.
	No additional source or groundwater controls.	Groundwater controls only.	Groundwater controls only.	Groundwater controls only.	Source controls only.
	Approximately ten years to meet TCE MCL at well CW6.	Approximately ten years to meet TCE MCL at well CW6.	Approximately ten years to meet TCE MCL at well CW6.	Approximately ten years to meet TCE MCL at well CW6.	Approximately ten years to meet TCE MCL at well CW6.

TABLE 16
(Continued)

SUMMARY OF ALTERNATIVES EVALUATION
FEASIBILITY STUDY
WAUSAU WATER SUPPLY NPL SITE
WAUSAU, WISCONSIN

Evaluation Factor	Alternative 1 No Action	Alternative 2 Groundwater Extraction and Treatment	Alternative 3 Groundwater Extraction and Treatment with In-Situ Bioreclamation	Alternative 4 In-Situ Bioreclamation	Alternative 5 Active Source Control(1)
	Approximately 20 years until contaminants are no longer drawn in by well CW6.	Approximately 20 years until contaminants are no longer drawn in by well CW6.	Approximately 20 years until contaminants are no longer drawn in by well CW6.	Approximately 20 years until contaminants are no longer drawn in by well CW6.	Approximately 14 years untilcontaminants are no longer drawn in by well CW6.
	Approximately 9.7 years to meet TCE MCL at Production Well CW6.	Approximately 9.7 years to meet TCE MCL at Production Well C6.	Approximately 9.7 years to meet TCE MCL at Production Well CW6.	Approximately 9.7 years to meet TCE MCL at Production Well CW6.	Approximately 4.5 years to meet TCE MCL at Production Well CW6.
	Approximately 6 years to meet TCE MCL at well CW3 (landfill source).	Approximately 6 years to meet TCE MCL at well CW3 (landfill source).	Approximately 6 years to meet TCE MCL at well CW3 (landfill source).	Approximately 6 years to meet TCE MCL at well CW3 (landfill source).	Approximately 4 years to meetTCE MCL at well CW3 (landfilsource).
	Approximately 6.3 years to meet PCE MCL at well CW3 (Wausau Chemical Source).	Approximately 5 years to meet PCE MCL at well CW3 (Wausau Chemical Source).	Approximately 2.5 years to meet PCE MCL at well CW3 (Wausau Chemical Source).	Approximately 2.5 years to meet PCE MCL at well CW3 (Wausau Chemical Source).	Approximately 3.3 years to meet PCE MCL at well CW3 (Wausau Chemical Source).
	Approximately 13 years until contaminants from landfill source are no longer drawn in by well CW3.	Approximately 13 years until contaminants from landfill source are no longer drawn in by well CW3.	Approximately 13 years until contaminants from landfill source are no longer drawn in by well CW3.	Approximately 13 years until contaminants from landfill source are no longer drawn in by well CW3.	Approximately 6 years until contaminants from landfill source are no longer drawn in by well CW3.
	Approximately 15 years until contaminants from Wausau Chemical are no longer drawn in by well CW3.	Approximately 12 until contaminants from Wausau Chemical are no longer drawn in by well CW3.	Aquifer purging time could not be estimated for this alternative with the existing contaminant transport model.	Aquifer purging time could not be estimated for the alternative with the existing contaminant transport model.	Approximately 5 years until contaminants from Wausau Chemical are no longer drawn in by well CW3.
	Would not comply with all identified ARARs.	Would comply with all identified ARARs.	Would comply with all identified ARARs.	Would comply with all identified ARARs.	Would comply with all identified ARARs.
State and Community Acceptance	Specific comments to be addressed in the Record of Decision.	Specific comments to be addressed in the Record of Decision.	Specific comments to be addressed in the Record of Decision.	Specific comments to be addressed in the Record of Decision.	Specific comments to be addressed in the Record of Decision.

(1) Remediation times shown for Alternative 5 are based on computer simulations of source control used in conjunction with increased pumping rates at Production Wells CW3 and CW6, and at the Phase 1 remedy extraction well.

with MCLs and State groundwater standards (NR 140) in the aquifer. Table 16 lists the time period requirement for each of the alternatives.

4. Reduction of Toxicity, Mobility or Volume: Alternatives 3 and 4 provide toxicity reduction as a result of contaminant degradation. Volume and toxicity reductions are provided by Alternatives 2, 3 and 5 as a result of contaminant adsorption on vapor phase carbon and subsequent destruction during thermal regeneration of the carbon.

5. Short-Term Effectiveness: The short-term risks associated with implementation are not expected to be a problem for any of the alternatives. All of the alternatives (including the Phase I Remedy) will result in contaminated material being brought to the surface, however no appreciable risks to residents are expected, and workers can use conventional personnel protective gear.

Short-term risks associated with operation of the alternatives vary. Carbon treatment of off-gases generated by stripping of VOCs is planned for Alternatives 2,5, and the pump and treat portion of Alternative 3. Alternative 4 and the bioreclamation portion of alternative 3 do have potential risks associated with the additives necessary for contaminant breakdown and the transformation products from the process. Risks from these alternatives would result if the contaminants were not broken down completely before reaching CW3, or if additives from the process were to reach CW3.

The alternatives differ in the time needed to purge the aquifer of contaminants. Alternative 2 requires the longest time to achieve aquifer purging. This is because pumping of extraction wells at Wausau Chemical in conjunction with CW3 would create a groundwater divide that would actually cause contaminants to be held up longer in the aquifer. In addition, this alternative would not reduce the time frame during which contaminants would continue to impact CW6 on the west side of the River. Alternatives 3 and 4 require similar periods for remediation of the east side contaminant plume which is expected to be shorter than pump and treat under Alternative 2. However, as with Alternative 2, these alternatives do not provide any reduction in time for purging of the deep TCE plume migrating under the River to CW3. Alternative 5 results in a substantial reduction in time for remediation of contamination in the aquifer because it addresses the source areas on both sides of the River. Added controls on pumping rates of City supply wells further reduces the time for remediation under this alternative.

6. Implementability: Technologies used for Alternatives 2 and 5, and part of 3, are conventional and well demonstrated. Bioreclamation as proposed for Alternative 4 and part of

Alternative 3 is not conventional or well demonstrated for the types of chemicals found at the site. In addition, U.S. EPA's Office of Research and Development (ORD) has reviewed the potential for In-situ Bioreclamation and has expressed concern over the uncertainties regarding whether this technology would work for the contaminants found at the site. Implementation would require fairly extensive laboratory and field testing prior to start-up. It is estimated that approximately two years would be required prior to full scale operation of a bioreclamation system at the site.

Administratively, Alternative 5 would require the least amount of coordination. Alternatives 2, and the above ground portion of 3 require additional coordination because of treatment and discharge system. Alternative 4 and the in-situ portion of 3 would be administratively difficult because the technology is relatively unknown, and requires reinjection of water back into the ground.

There are no difficulties anticipated in obtaining materials for any of the alternatives. Materials are available and considered conventional and readily available.

7. Cost: Comparison of present worth costs for the alternatives indicates that Alternative 5 is the least costly at $738,000. This is due to the shorter operation time of the source control action and the reduced O&M costs associated with the City air strippers due to the reduced time required for their use. Alternative 2 has the next lowest present worth cost at $1,330,000. Alternative 4 is somewhat higher at $1,380,000 and the present worth cost for Alternative 3 is highest at $1,710,000 due to the combination of systems used. Alternative 1 has no associated costs.

8. State Acceptance: The State had expressed interest in a bioreclamation alternative if one showed promise for the site. However, because of the need for extensive laboratory and field pilot studies, the State has agreed that a bioreclamation alternative should not be pursued for the site. The State supports Alternative 5 due to its ability to reduce aquifer purge times at a low cost.

9. Community Acceptance: The City of Wausau, Marathon Electric, and Wausau Chemical, all of which are PRPs, have expressed a preference for Alternative five. The community in Wausau has not expressed a preference for any alternative. Specific comments received during the public comment period and at the public meeting for the proposed plan are addressed in the responsiveness summary included with this document.

SUMMARY OF COMPARISON

Under Alternative 1 (no action), contaminants would be purged only through pumping of the supply wells and the west side extraction well. Nothing would be done to reduce contaminant loading to the aquifer from source areas nor to expedite removal of contaminants in the East Well Field. Given the nature and location of the site, this alternative is not consistent with the objectives for remedial action at the site and is therefore not considered a viable option for the site. In addition, Wisconsin groundwater standards under NR 140 would not be met under this alternative. NR 140 has been determined to be an ARAR for the site.

Although all of the other alternatives will achieve aquifer purging in the long-term, there are significant differences in the time to purge the groundwater. Alternatives 2, 3, and 4 are groundwater remediation alternatives that do not address remediation of source areas. In addition, they do not provide any reduction in the time to remediate the deep plume originating from the landfill. This results in a significant time period to achieve the response objectives. In addition, the actual time frame for aquifer purging under the bioremediation alternatives cannot be determined, so an estimate is based on groundwater flow. Alternative 5, source control, requires the shortest time period for remediation of the site because it eliminates the continued addition of contaminants to the groundwater and provides for the removal of remaining contaminants in groundwater through pumping of CW3 and CW6. Alternative 5 also provides for a reduction in time to purge the deep west side plume by removing the source and specifying pumping rates for the City's supply wells CW3 and CW6.

All of the alternatives (other than No Action) provide a reduction in toxicity of contaminants. Alternatives 2, 5 and the pump and treat portion of 3 provide a reduction in volume as well. Alternatives 2 and 5 use proven technologies that can easily be implemented and have a low potential for failure, and the proposed actions will have no problem complying with Federal and State ARARs. Alternatives 3 and 4 use a technology that may not be completely effective on the contaminants present at the site. In addition, some of the required additives needed to enhance biodegradation, could exceed the State's NR 140 groundwater standards for those substances.

Costs and implementation times for alternatives vary as well. Alternative 5, source control, is the least costly and requires the shortest time period to implement and complete the remedial action. Alternative 2 has the next lowest cost and requires a similar implementation period. Alternatives 3 and 4 have the highest costs associated with them due to the bioreclamation technology proposed. These alternatives also require the longest implementation time. A period of 2 years to begin the process will be required due to the need for extensive testing prior to start up.

IX. SELECTED REMEDY AND STATUTORY DETERMINATIONS

Section 121 of SARA required that all remedies for Superfund sites be protective of human health and the environment, comply with ARARs, be cost-effective, and utilize permanent solutions and alternate treatment technologies to the maximum extent practicable. Alternative 5 is believed to provide the best balance of trade-offs among alternatives with respect to the criteria used to evaluate remedies. Based on the evaluation of the alternatives, U.S. EPA and the State of Wisconsin believe that Alternative 5 would be protective, attain ARARs, be cost-effective, and will utilize permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable.

The selected remedy entails:

- Installation of soil vapor extraction (SVE) systems to remove VOCs in soils at each of the three identified source areas;

- Treatment of off-gases from the SVE operation using vapor phase carbon units which will be regenerated at an off-site RCRA approved facility; and

- Groundwater remediation utilizing specified pumpage rates of the municipal supply wells in order to expedite removal of the groundwater contaminant plumes affecting these wells.

- Treatment of groundwater utilizing existing City air strippers

The response objectives for the final remedy are to eliminate risks to groundwater by reducing the source of contaminants in source areas' soils, and to minimize VOC emissions to air from the existing and proposed treatment processes. The performance standards for the SVE in source soils will be determined using a mass-flux groundwater model to determine what cleanup levels are needed in soils to achieve cleanup of the aquifer. These cleanup levels will be based on the requirement to attain Wisconsin NR 140 groundwater standards for PCE, 1.0 ug/l, and TCE, 1.8 ug/l at the source boundary. Attainment of cleanup levels will be confirmed through sample analysis of groundwater at the boundary of the source areas.

The final remedy incorporates the interim remedy such that the west side extraction system is considered part of the overall site remediation. It is expected to address the TCE contamination originating from the former City landfill/Marathon Electric source area which migrates to both CW6 and CW3. It also includes a provision for an additional extraction well if required to obtain the desired performance objectives. The interim ROD did not specify a time period for operation of the west side extraction system because contaminant transport modeling had not been completed at the time. It is now anticipated that this system will be required to operate for approximately 14 years; until levels of TCE are not detected above the Wisconsin NR 140 Standard of 1.8 ug/l at specified points of compliance.

The costs estimated for Alternative 5 do not include costs for operating the interim remedy extraction well. Five years of operation and maintenance costs for the interim remedy were estimated in the Interim ROD. It is now estimated that the system will be required to operate for approximately 14 years. This will require an additional 9 years of O & M and will result in additional costs for that system. Estimated costs for O & M of the interim system were estimated to be $140,000 per year. However it is expected that actual O & M costs for the system will be somewhat less due to overlap of monitoring requirements for the remaining portions of the site.

The final remedy also will require that existing groundwater extraction systems currently operating in the East Well Field, other than City supply well CW3, cease operation once the SVE system is installed. This is necessary in order to obtain the desired result of purging contaminants from the aquifer utilizing CW3. Groundwater modeling performed during the FS indicated that competing extraction systems could cause contaminants to get trapped at the groundwater divide created by multiple pumping systems, and require longer purge time to remediate the aquifer.

As stated above, the remedy is considered the most cost-effective remedial action. It complies with Federal and State ARARs. It is protective of human health and the environment by reducing the time period during which water consumers are exposed to trace levels of contaminants in drinking water, by eliminating future potential risk to private well users, and by preventing increased VOC emissions to be released to the atmosphere. Requirements of Section 121(b)(1)(A-G) which have been determined to be applicable to this operation are discussed below.

1. Protection of Human Health and the Environment

Based on the risk assessment developed for the site, long-term exposure to low levels of VOCs in drinking water, potential exposure through the use of private wells, and exposure to air emissions from existing VOC treatment systems are the identified risks associated with the site. Implementation of SVE systems at the source areas and treatment of off-gases, as called for under Alternative 5, provides protection to human health and the environment through volatilization of VOCs from contaminated soils, and expedited removal of contaminants from groundwater by increased pumpage of municipal wells.

Volatilization of VOC-contaminated soils will eliminate the source of continued loading of VOCs to the aquifer; thus reducing the time during which residents are exposed to trace levels of VOCs. Implementation of Alternative 5 will not pose any unacceptable short-term risks or cross-media impacts to the site, the workers, or the community. No environmental impacts have been identified for the site. This is largely due to the fact that impacts from the site have been to groundwater, and soils in industrial areas.

2. Attainment of Applicable or Relevant and Appropriate Requirements of Environmental Laws

Alternative 5 will be designed to meet all applicable or relevant and appropriate requirements (ARARs) of Federal and more stringent State environmental laws. Tables 7-11 list the ARARs that apply to each of the action alternatives and the following discussion provides the details of the ARARs that will be met by Alternative 5. The Land Ban requirements of RCRA do not apply to this remedial action.

a. Federal: Safe Drinking Water Act (SDWA) / State: Chapter NR 109 Wisconsin Administrative Code (WAC)

The SDWA and corresponding State standards specifies maximum contaminant levels (MCLs) for drinking water at public water supplies. Since TCE is regulated under the SDWA MCLs, requirements for achieving MCLs are relevant and appropriate for this remedial action. PCE is under consideration for a proposed MCL of 5 ug/l in the near future. Therefore, the likely proposed MCL for PCE is a TBC (to be considered) for this remedial action.

b. State: Chapter NR 140 WAC

Wisconsin groundwater protection Administrative Rule, Chapter NR 140 WAC, regulates public health groundwater quality standards for the State of Wisconsin. The enforceable groundwater quality standard for TCE is 1.8 ug/L. Groundwater quality standards as found in NR 140 WAC are ARARs for this remedial action.

c. Federal: Clean air act (CAA)

The CAA identifies and regulates the release of pollutants to air. Section 109 of the CAA identifies those pollutants for which Ambient Air Quality Standards (AAQS) have been established. Section 112 outlines criteria for pollutants for which there are no applicable AAQS. Emissions from existing and proposed treatment systems are not expected to exceed the AAQSs for any of the compounds present in groundwater.

d. State: Chapter NR 445 WAC

Wisconsin Chapter NR 445 establishes hourly or annual emission rate limits for specific contaminants. Emissions rates on the order of 1 lb/day for individual systems are estimated and would be expected to meet the limits.

3. Cost-effectiveness

Alternative 5 affords a high degree of effectiveness by providing protection from chronic low level exposure of TCE for production wells CW3 and CW6, providing protection from potential exposure to future private well users, and preventing further discharge of VOC emissions. Alternative 5 is the least costly alternative that is protective of human health and the environment. Therefore, Alternative 5 is considered to be the most cost-effective alternative that is protective.

4. Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

U.S. EPA and the State of Wisconsin believe the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final remedy at the Wausau site. Of the alternatives that are protective of human health and the environment and comply with ARARs, U.S. EPA and the State have determined that the selected remedy provides the best balance of tradeoffs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility or volume achieved through treatment, short-term effectiveness, implementability, cost, also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

Although all of the alternatives that are protective and comply with ARARs will achieve reduction of risks, there are significant differences in the time required to achieve this goal. Alternatives 2, 3, and 4 are groundwater remediation alternatives that do not address source areas. This results in contamination from source area soils loading to the aquifer for several additional years. In addition, none of these alternatives provide any reduction in time to remediate the deep TCE plumes originating from the former landfill source area. This also results in a significant time period to achieve reduction of risks. Alternative 5 requires the shortest time period for remediation of the site because it eliminates the continued loading of contaminants to the groundwater, and it provides for reduction in time to purge the deep TCE plumes by removing the source and increasing removal rates of contaminants at the Municipal supply wells.

The selection of a treatment technology for remediation of contaminated soils is consistent with the Superfund program policy that the highly toxic and mobile wastes are a priority for treatment and to ensure permanence and long-term effectiveness of the remedy. Under the selected remedy, treatment of groundwater will not provide a reduction of toxicity, mobility, or volume (TMV). However, it will reduce contaminant levels in groundwater and thus reduce the risks associated with ingestion of groundwater, which has been determined to be a greater risk than inhalation of air emissions. While other alternatives evaluated provided treatment to achieve TMV reductions in groundwater, these alternatives had other difficulties. Alternative 2 required almost twice as long to purge contaminants. Alternatives 3 and 4 propose a technology that has not been shown to work on contaminants present in groundwater at the site and thus would require extensive testing that would delay full scale operation of the system for an estimated two years. Based on these factors, it was determined that Alternative 5 would provide the shortest time period during which receptors would be exposed to contaminants in drinking water. In addition, based on air modeling, release of emissions from the municipal air strippers do not contribute a greater than 1×10^{-6} risk level to receptors.

Since treatment of groundwater will not achieve a reduction in toxicity, mobility or volume, the major trade-offs that provide the basis for this selection decision are long-term effectiveness, short-term effectiveness, implementability, and cost. The selected remedy can be implemented and completed more quickly with less difficulty and at less cost than groundwater treatment alternatives, thus reducing the exposure time for pathways of concern. Alternative 5 is therefore considered to be the most appropriate solution to contamination at the site because it provides the best trade-offs with respect to the nine criteria and represents the maximum extent to which permanent solutions and treatment are practicable.

5. <u>Preference for Treatment as a Principal Element</u>

By treating the VOC-contaminated soils using SVE with carbon absorption of off-gases with regeneration of the carbon, the selected remedy satisfies the statutory preference for remedies that employ treatment of the principal threat which permanently and significantly reduces toxicity, mobility, or volume of hazardous substances as a principal element. Treatment of groundwater to reduce toxicity, mobility, or volume would also seem to be desirable to satisfy the statutory preference. However, treatment of groundwater to permanently and significantly reduce toxicity, mobility, or volume of contaminants was not found to be practicable or cost-effective for remediation of the site.

RESPONSIVENESS SUMMARY: WAUSAU GROUNDWATER CONTAMINATION SITE
WAUSAU, WISCONSIN

PURPOSE

This responsiveness summary is developed to document community involvement and concerns during the development of the feasibility study (FS) for the Wausau Groundwater Contamination site, Wausau, Wisconsin. Comments received during the public comment period were considered in the selection of the remedial action for the site. The responsiveness summary serves two purposes: It provides U.S. EPA with information about community preferences and concerns regarding the remedial alternatives, and it shows members of the community how their comments were incorporated into the decision-making process.

This document summaries the oral comments received at the public meeting held August 22, 1989, and one written comment received during the public comment period of August 14 to September 12, 1989.

OVERVIEW

The preferred alternative for the Wausau Groundwater Contamination (Wausau) site was announced to the public just prior to the beginning of the public comment period. The preferred alternative includes:

- Installation of soil vapor extraction (SVE) systems to remove VOCs in soils at each of the three identified source areas;
- Treatment of off-gases from the SVE operation using vapor phase carbon units which will be regenerated at an off-site RCRA approved facility; and
- Groundwater remediation utilizing specified pumpage rates of the municipal supply wells in order to expedite removal of the groundwater contaminant plumes affecting these wells.
- Treatment of groundwater utilizing existing City air strippers

Judging from the comments received during the public comment period, all parties support the selected remedy. However, concern has been expressed over the amount of money spent to date at the site by all parties involved.

SUMMARY OF PUBLIC COMMENTS AND AGENCY RESPONSES

The public comment period was held from August 14 to September 12, 1989 to receive comments concerning the draft feasibility study (FS). Because of the similarities, individual comments have been summarized and grouped where appropriate.

A. Comment: The Mayor of Wausau, the Wausau City Council President, Wausau Chemical Corporation, and Marathon Electric Corporation all expressed support for the Agency's selected alternative. However, all parties also expressed concern over the amount of money that has been spent on the site to date. Specifically, for the Remedial Investigation/Feasibility Study (RI/FS) conducted by U.S. EPA's contractor, and the expenses incurred by each of the involved parties for actions relating to the contamination problem.

A. Response: U.S. EPA wishes to extend thanks to all parties for their support of its selected remedial alternative for the site. It is hoped that an expedited agreement can be reached and the remedial action implemented in a timely manner. While U.S. EPA understands the concern over costs that have been spent to date, it also recognizes that the incurred costs could not have been avoided. Studies of the nature required to fully identify the extent of contamination at the site tend to be quite expensive. The cost of the RI/FS for this site is within the average range for an RI/FS. The costs incurred by individual parties related to the contamination have, for the most part, been necessary to address the more immediate problems posed by the contamination of the City's well field.

B. Comment: Wausau Chemical Corporation has requested specific direction from U.S. EPA and WDNR be included in the ROD as to the future operation of its groundwater extraction system in light of the fact that the selected alternative does not include the continued pumpage of groundwater in the vicinity of the Wausau Chemical property.

B. Response: The selected remedy calls for the removal of all groundwater extraction systems, other than City Well 3, from the East Well Field. This will include the Wausau Chemical extraction system. This subject is also addressed in Section IX-The Selected Remedy, of the ROD and is quoted below:

> The final remedy also will require that existing groundwater extraction systems currently operating in the East Well Field, other than City supply well CW3, cease operation once the SVE system is installed. This is necessary in order to obtain the desired result of purging contaminants from the aquifer utilizing CW3. Groundwater modeling performed during the FS indicated that competing extraction systems could cause contaminants to get trapped at the groundwater divide created by multiple pumping systems, and require longer purge time to remediate the aquifer.

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Carroll D. Besadny, Secretary
Box 7921
Madison, Wisconsin 53707
TELEFAX NO. 608-267-3579
TDD NO. 608-267-6897

September 28, 1989

IN REPLY REFER TO: 4440

Mr. Valdus Adamkus, Regional Administrator
U.S. Environmental Protection Agency, Region V
230 South Dearborn Street
Chicago, IL 60604

SUBJECT: Selected Superfund Remedy
Wausau Groundwater Contamination Site
Wausau, Wisconsin

Dear Mr. Adamkus:

Your staff has requested this letter to document our position on the final remedy for the Wausau Groundwater Contamination Site. The proposed final remedy, identified as Alternative No. 5, is discussed fully in the Record of Decision and includes:

- Installation of Soil Vapor Extraction (SVE) systems to remove volatile organic compounds (VOCs) in soils at each of the three identified source areas
- Treatment of off-gases from the SVE operation using vapor phase carbon units which will be regenerated at a off-site RCRA-approved facility; and
- Groundwater remediation utilizing specified pumpage rates of the municipal supply wells in order to expedite removal of the groundwater contaminant plumes affecting these wells.

The costs of the selected remedy are estimated to be

- Capital costs - $252,000
- Operation costs - $222,000

An eighteen month operating period was assumed and the costs were not discounted.

Based upon our review of the public comment Feasibility Study received on August 14, 1989, and the draft Record of Decision received on September 8, 1989, our agency concurs with the selection of this remedy.

We understand that your staff and contractors, or the potentially responsible parties will develop the major design elements of the soil vapor extraction systems, the off-gas treatment system and the groundwater remediation system in close consultation with my staff during the predesign and design phases of the project. We also understand that if the potentially responsible parties do not agree to fund the remedy, the State of Wisconsin will contribute 10% of the remedial action costs. In addition to cost sharing on the remedy we acknowledge our responsibility for operation and maintenance of this system once the remedy is constructed.

As always, thank you for your support and cooperation in addressing the contamination problem at this site. If you have any questions regarding this matter, please contact Mr. Paul Didier, Director of the Bureau of Solid & Hazardous Waste Management at (608) 266-1327.

Sincerely,

C. D. Besadny
Secretary

CDB:SB:sb33
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cc: Lyman Wible - AD/5
Paul Didier - SW/3
Mark Giesfeldt - SW/3
Gary Kulibert - NCD
Rene Sanford - FN/1
Norm Niedergang - EPA Region V
Margaret Guerriero - EPA Region V