

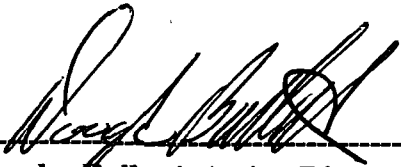


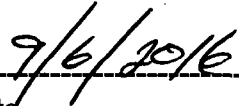
**FOURTH FIVE-YEAR REVIEW REPORT FOR  
CHARLEVOIX MUNICIPAL WELL SUPERFUND SITE  
CHARLEVOIX COUNTY, MICHIGAN**



**Prepared by**

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**Date**

## TABLE OF CONTENTS

LIST OF ABBREVIATIONS & ACRONYMS.....	3
EXECUTIVE SUMMARY.....	4
FIVE-YEAR REVIEW SUMMARY FORM.....	5
I. INTRODUCTION.....	8
II. PROGRESS SINCE THE LAST REVIEW .....	9
III. FIVE-YEAR REVIEW PROCESS.....	15
IV. TECHNICAL ASSESSMENT .....	21
V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS .....	24
VI. PROTECTIVENESS STATEMENT.....	25
VII. NEXT REVIEW .....	25
APPENDIX A – EXISTING SITE INFORMATION.....	26
A. SITE CHRONOLOGY .....	26
B. BACKGROUND.....	27
C. REMEDIAL ACTIONS.....	29
APPENDIX B - MAPS, DATA, FIGURES OR TABLES FOR REFERENCE.....	33

## LIST OF ABBREVIATIONS & ACRONYMS

bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
EPA	United States Environmental Protection Agency
FFS	Focused Feasibility Study
FYR	Five-Year Review
GSI	Groundwater Surface Water Interface
HDV	Human drinking water value
IAG	Interagency Agreement
ICs	Institutional Controls
MCLs	Maximum Contaminant Levels
MDEQ <sup>1</sup>	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDPH	Michigan Department of Public Health
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
ND	Non-Detect
NPL	National Priorities List
O&M	Operation and Maintenance
PCE	Tetrachloroethylene (also known as Perchloroethylene)
ppb	Parts per billion
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
ROD	Record of Decision
RPM	Remedial Project Manager
RI/FS	Remedial Investigation and Feasibility Study
SSC	Superfund State Contract
SSD	Sub-Slab Depressurization
SVE	Soil Vapor Extraction
TAT	Technical Assistance Team
TCE	Trichloroethylene
TAGA	Trace Atmosphere Gas Analyzer
USACE	U.S. Army Corps of Engineers
UST	Underground Storage Tank
UU/UE	Unlimited Use/Unrestricted Exposure
VI	Vapor Intrusion
VISLs	Vapor Intrusion Screening Levels
VOC	Volatile Organic Compound
µg/kg	Micrograms per kilogram
µg/L	Micrograms per Liter

<sup>1</sup> This report will use the term MDEQ to refer to the Michigan Department of Environmental Quality or the former Department of Natural Resources & Environment.

## **EXECUTIVE SUMMARY**

This is the fourth Five-Year Review (FYR) for the Charlevoix Municipal Well Superfund Site (Site) located in Charlevoix, Charlevoix County, Michigan. The purpose of this FYR is to determine if the remedy is and will continue to be protective of human health and the environment. The triggering action for this FYR was the signing of the previous FYR on September 23, 2011.

Two Records of Decision (ROD) were signed selecting interim and final remedies at the Site. The June 12, 1984 ROD called for a new water supply to replace a contaminated city well. The United States Environmental Protection Agency (EPA) provided a water intake in Lake Michigan and a water treatment plant for the city. The September 30, 1985 ROD selected a final remedy that included groundwater monitoring and institutional controls (ICs) to prevent drinking of the groundwater. The remedy allowed contaminated groundwater to naturally discharge and disperse into Lake Michigan.

EPA investigated additional sources and the vapor intrusion (VI) pathway in 2013 and 2014. EPA has removed additional sources and reduced potential exposures through the installation of underground vacuum systems called "sub-slab depressurization (SSD) systems." However, residual tetrachloroethylene (PCE) and trichloroethylene (TCE) contamination remains in the source areas that will affect soil vapor and groundwater for an unknown length of time.

The remedy at operable unit (OU) 1 is protective of human health and the environment. The new water supply drawing water from Lake Michigan provides safe drinking water to the City.

A protectiveness determination for the remedy at OU 2 cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.

The Sitewide protectiveness determination cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.

## Five-Year Review Summary Form

SITE IDENTIFICATION		
<b>Site Name:</b> Charlevoix Municipal Well		
<b>EPA ID:</b> MID980794390		
<b>Region:</b> 5	<b>State:</b> MI	<b>City/County:</b> Charlevoix, Charlevoix County
SITE STATUS		
<b>NPL Status:</b> Deleted		
<b>Multiple OUs?</b> Yes	<b>Has the site achieved construction completion?</b> Yes	
REVIEW STATUS		
<b>Lead agency:</b> EPA		
<b>Author name (Federal or State Project Manager):</b> Matthew Ohl		
<b>Author affiliation:</b> EPA		
<b>Review period:</b> 2/18/2015 - 8/3/2016		
<b>Date of site inspection:</b> 1/5/2016		
<b>Type of review:</b> Discretionary		
<b>Review number:</b> 4		
<b>Triggering action date:</b> 9/23/2011		
<b>Due date (five years after triggering action date):</b> 9/23/2016		

### Five-Year Review Summary Form (continued)

<b>Issues/Recommendations</b>
-------------------------------

<b>OU(s) without Issues/Recommendations Identified in the Five-Year Review:</b>
<i>OU 1</i>

<b>Issues and Recommendations Identified in the Five-Year Review:</b>
---

<b>OU(s): 2</b>	<b>Issue Category: Remedy Performance</b>			
	<b>Issue:</b> Volatile Organic Compound (VOC) contamination remains underground as a source for VI and groundwater contamination.			
	<b>Recommendation:</b> Complete the VI and source investigations.			
<b>Affect Current Protectiveness</b>	<b>Affect Future Protectiveness</b>	<b>Party Responsible</b>	<b>Oversight Party</b>	<b>Milestone Date</b>
No	Yes	EPA	EPA/State	1/31/2019

<b>Protectiveness Statement(s)</b>
------------------------------------

<i>Operable Unit:</i> 01	<i>Protectiveness Determination:</i> Protective	
<i>Protectiveness Statement:</i> The remedy at OU 1 is protective of human health and the environment. The new water supply drawing water from Lake Michigan provides safe drinking water to the City.		
<i>Operable Unit:</i> 02	<i>Protectiveness Determination:</i> Protectiveness Deferred	<i>Addendum Due Date:</i> 1/31/2020
<i>Protectiveness Statement:</i> A protectiveness determination for the remedy at OU 2 cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.		

## Sitewide Protectiveness Statement

***Protectiveness Determination:***  
Protectiveness Deferred

***Addendum Due Date:***  
1/31/2020

***Protectiveness Statement:***

The Sitewide protectiveness determination cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.

## I. INTRODUCTION

The purpose of a FYR is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. FYR reports document the methods, findings and conclusions of reviews. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

EPA prepares FYRs pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121 and the National Contingency Plan (NCP). CERCLA 121 states:

*“If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.”*

EPA interpreted this requirement further in the NCP; 40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii), which states:

*“If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such actions no less often than every five years after the initiation of the selected remedial action.”*

EPA conducted a FYR on the remedy implemented at the Charlevoix Municipal Well Superfund Site in Charlevoix, Charlevoix County, Michigan. EPA is the lead agency for developing and implementing the remedy for the Site. The Michigan Department of Environmental Quality (MDEQ), as the support agency representing the State of Michigan, has reviewed all supporting documentation and provided input to EPA during the FYR process.

This is the fourth FYR for the Charlevoix Municipal Well Superfund Site. The triggering action for this discretionary review is the completion date of the previous FYR. The FYR is required because hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The Site consists of two OUs addressed in this FYR.



## II. PROGRESS SINCE THE LAST REVIEW

Table 1: Protectiveness Determinations/Statements from the 2011 FYR

OU #	Protectiveness Determination	Protectiveness Statement
1	Protective	The interim remedy at OU 1 is protective of human health and the environment because the alternate water supply provided by construction of a lake water intake line to the water treatment plant prevents human health exposure to contaminated ground water.
2	Protectiveness Deferred	A protectiveness determination for the remedy at OU 2 cannot be made at this time. While exposures to the groundwater pathway are not taking place due to implementation of the alternate water supply required under the OU 1 ROD and ICs required under the OU 2 ROD that prevent the use of contaminated ground water, the remedy at OU 2 includes the expectation that groundwater would be allowed to vent to Lake Michigan and should be returned to a "useable state after 50 years" or by 2035. However, PCE contamination that remains in the soil and groundwater could potentially pose vapor intrusion risks via the indoor air pathway and may result in a longer period of time for groundwater to return to a useable state. Additional evaluation of the source area will be necessary to confirm the determination of the protectiveness of this pathway and whether groundwater will return to useable state within a reasonable period of time.
Sitewide	Protectiveness Deferred	A site-wide protectiveness determination is also deferred until vapor intrusion risks via the indoor pathway are assessed.

Table 2: Status of Recommendations from the 2011 FYR

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Party	Original Milestone Date	Current Status	Completion Date (if applicable)
2	1. There are concerns about potential vapor intrusion and whether groundwater will return to useable	Evaluate the potential for vapor intrusion and the remedial timeframe. This will necessitate the collection of additional data and an evaluation of the need for	EPA	State	11/1/2012	Completed	9/15/2014

	state within a reasonable period of time given that residual PCE remains in the source area.	additional remediation in the PCE source area.					
2	2. The Record of Decision (ROD) calls for 50 years of groundwater monitoring, i.e., through 2035, while the groundwater is being returned to a useable state; however, groundwater monitoring was not conducted after 2006 until September 2010.	Continue long-term monitoring of groundwater in accordance with ROD considering the recommendations of the report titled, "Contaminant Distribution and Groundwater Sampling Analysis for the Charlevoix, Michigan, Site," S.S. Papadopoulos & Associates, Inc..(see appendix)	State	EPA	11/1/2012	Completed	09/30/2012
2	3. Long-term stewardship must be assured which includes maintaining, monitoring and enforcing effective ICs.	Develop a plan to oversee, monitor and enforce ICs to ensure long term stewardship.	State	EPA	11/1/2012	Considered But Not Implemented	10/1/2012

### **Recommendation 1**

To determine the potential for VI from contaminated soil and groundwater EPA undertook additional investigation activities under separate mobilizations in 2012 to 2014. These investigations confirmed the potential for VI at buildings near sources of contamination and indicated the need for a removal action.

On September 15, 2014, EPA approved a time critical removal action to mitigate the threat of VI from hazardous substances into residential and commercial structures. The removal action included additional sampling to characterize the nature and extent of waste and contaminated soil for removal and off-site disposal, the delineation of soil gas impacts, and VI assessment activities in buildings. EPA removed the contents of three underground storage tanks (USTs) and SSD systems were installed at most non-commercial buildings where contaminant levels exceeded screening levels. Additional response actions are necessary to prevent potential VI risks in the long term. See the Remedy Implementation Activities section of this FYR below for additional information.

### **Recommendation 2**

MDEQ conducted annual monitoring of groundwater over the period 2011 – 2015.

### **Recommendation 3**

EPA, MDEQ, the Northwest Michigan Health Department and the City of Charlevoix actively monitor ICs to ensure they are in place and effective so that the remedy continues to function as intended. As a result, EPA determined that a plan to oversee, monitor and enforce ICs is not necessary at this time.

See Institutional Controls section of this FYR for further discussion of the ICs.

## **Remedy Implementation Activities**

Since the 2011 FYR, EPA undertook additional investigations and response actions, discussed below. See the Data Review section of this FYR for a discussion of the data resulting from these investigations.

### **August 2012 Investigation**

EPA collected soil, soil gas and groundwater samples at the Site and sent them to laboratories for analysis. The investigation results indicated the potential for VI from contaminated soil and groundwater.

The sampling team collected two soil samples at 19 locations and three samples at soil boring SB-2. The depth to the soil/groundwater interface ranged from approximately 20 feet at the northern sample locations to 55 feet at the southern locations. The sampling team also collected a deep soil gas sample from each location just above the water table. The team collected two soil gas samples from the soil boring called SB-2 based on elevated detector readings.

The team collected 58 groundwater samples across three depth intervals from 19 of the 20 temporary wells for vertical profiling. Once the groundwater depth, also called interface, was determined, the driller advanced a boring about 30 feet below the interface and installed a temporary well with a five-foot screen. Following the collection of a groundwater sample from the deep interval, the sampling team lifted the temporary well to the intermediate interval and subsequently to the shallow interval to

collect representative groundwater samples. The team collected shallow, intermediate and deep groundwater samples at 19 of 20 locations. At SB-20, there was only a deep sample because the temporary well broke while extracting the well to the intermediate location.

## **2013 – 2014 Investigations**

### **Geophysical Survey**

EPA conducted a geophysical survey at the site between November 12 and 15, 2013 with additional field activities performed between March 17 and 19, 2014. The purpose of the geophysical survey was to look for possible sources of contamination including buried tanks, drums or other large metal objects underground. EPA reported the findings of the geophysical survey in a report dated September 2014.

### **Tank Identification**

A subcontractor for EPA's START contractor, utilized an air knife and vacuum truck to soft excavate and exposed the top of the USTs. At the former Art's Dry Cleaners, START identified a small hole in the top of the UST. They used a rod to determine that the UST was 4-foot in diameter and contained approximately 2 feet of an unknown liquid. START found the tank at the former Impact Tool to be in good condition.

### **VI Assessment**

In response to the identification of a potential VI threat, EPA's START contractor (START) performed a VI assessment at the Site for EPA through separate mobilizations from June 10, 2013, through April 29, 2014. START summarized the field activities and findings in a report dated July 31, 2014.

EPA divided the VI investigation area into sub-areas (A, B, C and D) for this investigation based on known and potential source areas based on historical documents.

- Former Impact Tool - Area A
- Former Hoskins Manufacturing - Area A
- Former dry cleaners - Area A
- Former Hooker's Dry Cleaners - Area B
- Former commercial laundry facility - Area B
- Former Art's Dry Cleaners - Area C
- Former Charlevoix Middle School - Area C
- Elevated soil gas concentrations detected during 2012 - Area D

The VI investigation included the following components:

- soil gas probe installation and sampling
- sub-slab probe installation and sampling
- indoor air screening with the Trace Atmospheric Gas Analyzer (TAGA)
- indoor air sample collection
- soil sample collection
- UST locating and sampling
- the location and sampling of a degreasing pit

## **Time-critical Removal Action**

On September 15, 2014, the EPA issued an Action Memorandum requesting approval and funding for removal actions and investigations at the Site. Between November 12, 2014 and January 30, 2015, EPA, and EPA's START and Emergency and Rapid Response Services (ERRS) contractors performed a sub-slab investigation and removal activities near 230 Antrim Street. The work included the collection of eleven sets of air samples from beneath buildings and indoor air at and near the 230 Antrim Street property between November 2014 and January 2015.

Between December 8 and 10, 2014, EPA, START, and ERRS coordinated with a subcontractor to perform removal activities of three USTs located adjacent to the former Art's Dry Cleaners. Prior to the removal, START suspected only one UST at the former Art's Dry Cleaners. However, during field activities the subcontractor identified three USTs. Removal activities included the uncovering of the three USTs; sampling and analysis of their contents; removal of their contents using a vacuum truck; cleaning of the USTs; and the filling of the USTs with clean sand. During the removal activities, the subcontractor cut and capped piping associated with the three USTs. The subcontractor removed approximately 1,300 gallons of liquids from the USTs and disposed of the contents at a licensed and permitted facility. In addition, the subcontractor removed 18 cubic yards of contaminated soil and disposed of the soil at a licensed and permitted facility.

The subcontractor advanced five soil borings near the USTs to approximately 8 feet bgs and collected soil samples. Soil sample results did not show significant leakage from the USTs, however, the presence of PCE was found in soils surrounding the tank at concentrations that ranged from Non-Detect (ND) to 2,000 parts per billion (ppb).

See Appendix A for a discussion of previous activities.

## **Institutional Controls**

The 1985 ROD requires ICs to prevent the installation of private drinking water wells in the contaminated aquifer. The ROD stated that the necessary IC, the well permitting program in Charlevoix County, was already in place. Charlevoix County's Sanitary Code allows the designated health official to deny an application for a drinking water well when certain criteria are met including cases where an approved community water system is available. See Table 3 for a summary of the implemented and planned ICs for the Site. A map showing the area in which the ICs apply is included in Appendix B.

Table 3: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater underlying a portion of the city that exceeds maximum contaminant levels (MCLs)	Yes	Yes	Portion of the city that exceeds maximum contaminant levels (MCLs) and a buffer zone	Prohibit groundwater use until MCLs are no longer exceeded	City Ordinance No. 732 of 2008 amending Section 2.71(3) of Chapter 22A (see Appendix B)

**Status of Access Restrictions and ICs:** In 2008, EPA worked with the City of Charlevoix on incorporating areas of contaminated groundwater into a newer city ordinance for restricting groundwater use. On July 21, 2008, the City of Charlevoix passed Ordinance No. 732 of 2008 to amend Section 2.71(3) of Chapter 22A: City Water Service - Exclusive Water Source of Title II of the Code of the City of Charlevoix by revising the legal description of the impact area contained in Section 2.71(3). This ordinance is a more specific restriction compared to the local well permitting program. Based upon 2014 groundwater monitoring data, the revised impact area continues to cover the area of groundwater contamination associated with the known source areas.

**Current Compliance:** Based on inspections and discussions with local officials, EPA is not aware of Site or media uses inconsistent with the stated objectives of the ICs including the groundwater restriction ordinance. Access to the contaminated groundwater is limited. The IC portion of the remedy appears to be functioning as intended and is protective.

**IC Follow up Actions Needed:** Further IC evaluation and/or additional ICs are not necessary at this time.

**Long Term Stewardship:** Long-term protectiveness at the Site requires compliance with the prohibitions to assure the remedy continues to function as intended. This involves assuring effective procedures are in place to properly maintain, monitor and enforce the ICs along with monitoring of the groundwater. EPA, MDEQ, the Northwest Michigan Health Department and the City of Charlevoix actively monitor ICs to ensure they are in place and effective.

### **System Operation/Operation and Maintenance Activities**

For operation and maintenance (O&M), the 1985 ROD required semi-annual groundwater monitoring and sampling of surface water in Lake Michigan and Round Lake with an estimated annual cost of \$17,000. Since the 2011 FYR, MDEQ has conducted annual groundwater monitoring with an actual annual cost of about \$20,000.

### **III. FIVE-YEAR REVIEW PROCESS**

#### **Administrative Components**

Matthew Ohl, the EPA Remedial Project Manager (RPM) for the Site and Charles Rodriguez, the EPA Community Involvement Coordinator (CIC) led the Charlevoix Municipal Well Superfund Site FYR. EPA notified the state of the FYR initiation on 2/18/2015. Nic Dawson, of the MDEQ, assisted in the review as the representative for the support agency.

The review, which began on 2/18/2015, consisted of the following components:

- Community notification and involvement
- Document review
- Data review
- Site inspection
- FYR report development and review

#### **Community Notification and Involvement**

A meeting in October 2015 between the RPM and CIC for the Site initiated activities to involve the community in the FYR process. Notices published in the local newspapers, the "Charlevoix County News," on 11/12/2015 and the "Charlevoix Courier," on 11/13/2015, stated that there was a FYR and invited the public to submit their comments to EPA. The results of the review and the report will be available at the Site information repository located at Charlevoix Public Library, 220 West Clinton St., Charlevoix, Michigan.

#### **Document Review**

This FYR consisted of a review of relevant documents including O&M records and monitoring data. EPA also reviewed applicable or relevant and appropriate groundwater cleanup standards and current VI screening levels.

#### **Data Review**

The following is a summary of the data from the reports reviewed for this FYR. Each mobilization built upon information gathered under the previous investigation. Due to privacy concerns, the report refers to sampling results from properties outside of source areas by building number instead of street address.

#### **Soil, Soil Gas and Groundwater Sampling Trip Report - August 2012**

Eleven of fifty-eight groundwater samples collected from four of the twenty temporary wells contained TCE. The middle sample interval at the GW-11 location had the highest concentration of TCE at 2.6 micrograms per liter (µg/L). GW-11 was located on Park Avenue midway between Grant Street and State Street and down-gradient of the former Charlevoix Middle School/current Charlevoix Public Library.

Twenty-nine of fifty-eight groundwater samples collected from fifteen of the twenty temporary wells



had PCE. The highest concentration of PCE was 29 µg/L from the shallow sample interval at the GW-03 location. GW-03 was located on the corner of Lincoln and McLeod immediately down-gradient of the former Impact Tool, former Hoskins Manufacturing and the former dry cleaners. The middle sample interval at the GW-12 location had the next highest concentrations of PCE. GW-12 is located on Clinton Street near the intersection with State Street, side-gradient of the former Charlevoix Middle School.

#### **Geophysical Survey Report, Charlevoix Groundwater Contamination Site, Charlevoix, Michigan - September 2014**

EPA identified two possible underground storage tanks (USTs). EPA located one UST near the northwest corner of the former Impact Tool building and another near the southwest corner of the former Art's Dry Cleaners building. Old underground pipes may exist on the former Hoskins Manufacturing property where a tank used to be located to the north of the building. Additional anomalies detected to the south of the former Hoskins Manufacturing building are close to a mounded area covered with soil and grass.

#### **Charlevoix Municipal Well Site- December 2013 UST Confirmation Field Work – December 16, 2013**

EPA's START contractor conducted field activities to confirm the presence of two USTs detected during EPA's November 2013 geophysical survey. START confirmed the presence of one UST at the former Art's Dry Cleaners (UST-01) and one UST at the former Impact Tool.

#### **Draft Vapor Intrusion Assessment Report - July 31, 2014**

Soil sampling identified PCE concentrations near the former dry cleaners, the former Hoskins Manufacturing building, the former Impact Tool building, and the former Hooker's Dry Cleaners building above MDEQ VI soil screening levels. Although MDEQ remediated soil in these known source areas years ago, the results suggested residual soil contamination remains at levels that may continue to pose VI risk. Soils samples collected from the vicinity of the degreasing pit indicated the presence of PCE in 22 of 24 samples collected, at concentrations of 7.8 to 2,300 mg/kg.

The on-site TAGA mobile laboratory and off-site fixed laboratories analyzed soil gas samples. PCE exceeded the  $10^{-5}$  cancer risk VI screening levels (VISLs) in 70 of 238 soil gas samples and within all four areas (A, B, C and D). The investigation identified PCE at outer soil gas probes requiring further investigation.

Sub-slab sampling results indicated that vapors were traveling through the soil and collecting underneath foundations of structures. Soil gas concentrations beneath buildings were above VISLs for PCE in 10 of the 11 buildings. Several other compounds also exceeded sub-slab VISLs at these locations.

The sampling team collected indoor air samples at source area buildings and adjacent buildings. This included indoor air sampling and/or indoor air screening at 27 buildings during the June/July 2013 sampling event. Indoor air sampling and TAGA screening confirmed VOC detections in indoor air at several locations. Comparison of collocated indoor air and sub-slab data to VISLs indicated a potential risk to human health via VI in several buildings. START recommended additional sub-slab and indoor air sampling at select locations during winter months to evaluate VI risk.



Based on the 2013 sampling results, EPA collected additional sub-slab and indoor air sampling in 10 buildings during March 2014. START performed the winter sampling event to account for seasonal variation in VI risk. The winter event confirmed the 2013 sampling results including detections of PCE, benzene and chloroform in many of the buildings. The investigation concluded that, Buildings 1, 2, 4, 5, 11, 13, 15 and 21 present VI risks. START recommended additional investigation for Buildings 3 and 22.

The analysis performed on the samples collected from the USTs indicated that: two phases of liquids were present in UST-01 (former Art's Dry Cleaners) and a single phase of liquid was present in UST-02 (former Impact Tool). The clear phase of liquid from UST-01 contained PCE and TCE at 600,000,000 µg/L (i.e., 60%) and 1,000,000 µg/L, respectively. A colored phase of liquid from UST-01 contained PCE at 48,000,000 µg/L (i.e., 4.8%). The single phase of liquid present in UST-02 contained several petroleum-related VOCs. The highest detected VOC was xylene at 29,000 µg/L.

START did not find new TCE or PCE source areas during the investigation. They recommended additional investigation to delineate the vapor plume. Their report concluded that the presence of VOCs at elevated concentrations underground would continue to present VI risk near the former source areas and above their associated groundwater plumes. The USTs confirmed at two of the previously identified source areas contained liquids and could potentially serve as continuous VOC sources. Following the conclusion for the sampling, START and its subcontractor abandoned 43 soil gas locations and converted the remaining locations to permanent locations with flush-mount protective casings set in concrete collars.

## **Soil Gas Data Assessment**

### **Summary of Available Soil Gas Data**

EPA collected soil vapor samples at the Site as a part of several investigations. These investigations include the following:

- EPA collected soil gas samples from 19 temporary locations in 2012;
- In 2013, EPA installed 111 temporary soil gas probes with a track-mounted direct push unit; and,
- Since October 2014, EPA collected soil gas samples from 12 existing soil gas locations.

### **Contamination Indicated by Available Soil Gas Data**

EPA evaluated data at the Site in order to determine the extent of PCE and TCE in soil gas. PCE is the primary contaminant for soil gas in Areas A, B, C and D.

#### **Area A**

PCE concentrations in Area A ranged from ND to 53,000 µg/m<sup>3</sup>. PCE concentrations in the soil gas center on the former Impact Tool, the former Hoskins Manufacturing, and the former dry cleaner. The highest PCE concentrations in soil gas exist in the immediate vicinity of the buildings and concentrations decrease moving away from the buildings in all directions. The north/northeast component of the PCE soil gas plume has migrated the farthest from the buildings.

## **Area B**

PCE concentrations in Area B ranged from ND to 26,000 µg/m<sup>3</sup>. PCE concentrations in the soil gas center on the former Hooker's Dry Cleaners. The highest PCE concentrations in soil gas exist in the immediate vicinity of the building that housed the former Hooker's Dry Cleaners and concentrations decrease moving away from the building in all directions.

## **Area C**

PCE concentrations in Area C ranged from ND to 29,000 µg/m<sup>3</sup>. PCE concentrations in the soil gas are located around the former Art's Dry Cleaners. The highest PCE concentrations exist in the immediate area adjacent to the west side of the building that housed the former Art's Dry Cleaners.

## **Area D**

PCE concentrations in Area D ranged from ND to 730 µg/m<sup>3</sup>. PCE concentrations in the soil gas exist to the southwest of the intersection of Park Avenue and State Street (i.e., VP-024). The highest concentrations exist at soil gas location VP-024 and appear to be migrating to the northwest.

## **Soil Data Assessment**

### **Summary of Available Soil Data**

Multiple parties collected soil samples at the Site as a part of separate investigations. The following reports summarize these investigations:

- Remedial Investigation Report - February 1985.
- Remedial Investigation Report - August 1989.
- Data Summary Report - March 1995.
- Interim Response Phase 1 Source Soil and Groundwater Investigation & SVE/Groundwater Sparge Pilot Test - May 1998.
- Final Project Report Charlevoix Municipal Well Field (PCE) Site - March 2004.
- Soil, Soil Gas, and Groundwater Sampling Trip Report - August 2012.
- Draft Vapor Intrusion Assessment Report - July 31, 2014.
- POLREP #2, Charlevoix Municipal Well Field Superfund Site – February 11, 2015.

### **Contamination Indicated by Available Data**

EPA evaluated data collected to date at the Site in order to determine the extent of PCE and TCE-contaminated soil. The primary contaminants in soils are PCE and petroleum-related VOCs.

## **Area A**

PCE concentrations in soil in the outdoor locations sampled in Area A ranged from ND to 2,300 micrograms per kilogram ( $\mu\text{g/kg}$ ). EPA found elevated PCE concentrations in the soil in the outdoor locations sampled in Area A near the northwest corner of the former dry cleaners at 1,200  $\mu\text{g/kg}$  and along the west side of the former Impact Tool building at 1,500  $\mu\text{g/kg}$ . In addition, soils collected from within the former dry cleaners and the former Impact Tool indicated the presence of elevated PCE impacts (1,900  $\mu\text{g/kg}$  and 2,300  $\mu\text{g/kg}$ , respectively). The soil borings inside the buildings were limited to hand auger borings and shallow direct push borings.

## **Area B**

PCE concentrations in soil in the outdoor locations sampled in Area B ranged from ND to 458  $\mu\text{g/kg}$ . The elevated PCE concentrations in soil exist to the south of the building that housed the former Hooker's Dry Cleaners.

## **Area C**

Soil data associated with the closure of the USTs outside the former Art's Dry Cleaners indicated the presence of PCE in shallow soils (i.e., 3 to 4 feet bgs) at up to 2,000  $\mu\text{g/kg}$ .

## **Area D**

EPA is planning the collection of soil data for Area D in 2016 - 2017.

## **Groundwater Data Assessment**

### **Summary of Available Groundwater Data**

Groundwater samples collected at the Site were part of several investigations. The following reports summarize these investigations:

- Remedial Investigation Report - February 1985.
- Remedial Investigation Report - August 1989.
- Data Summary Report - March 1995.
- Interim Response Phase 1 Source Soil and Groundwater Investigation & SVE/Groundwater Sparge Pilot Test - May 1998.
- Final Project Report Charlevoix Municipal Well Field (PCE) Site - March 2004.
- Contaminant Distribution and Groundwater Sampling Analysis - February 2008.
- Soil, Soil Gas, and Groundwater Sampling Trip Report - August 2012.

### **Contamination Indicated by Available Data**

EPA evaluated data collected to date at the Site to determine the extent of impacted groundwater. The primary contaminants in groundwater include PCE and petroleum-related VOCs.

## **Area A**

Historical sampling results indicated detections of up to 3,400 µg/L (MW-407) of PCE in groundwater. Groundwater appears to have been impacted by PCE both in the immediate vicinity and down-gradient (i.e., north) of the former dry cleaner, the former Impact Tool, and the former Hoskins Manufacturing. In addition, a separate source of elevated PCE in groundwater has previously been detected down-gradient (i.e., north) in MW-11 and MW-402 at up to 1,300 µg/L and 800 µg/L, respectively. Historical vertical groundwater profiling indicated that PCE has affected shallow groundwater down to 10 feet below the water table near three buildings and concentrations decreased with depth. Groundwater analytical data from 2015 indicates TCE concentrations remain below the MCL at MW-2, MW-212 and MW-320 with a slight increase at MW-2. In addition, PCE concentrations in groundwater increased in several wells. For example, the concentration of PCE increased from 40 to 110 ug/L at MW-402.

## **Area B**

Historically, PCE detected in groundwater has been up to 1,280 µg/L (MW-102S). Vertical groundwater profiling was performed at three locations and indicated that PCE has primarily affected shallow groundwater. Concentrations of PCE decreased with depth near the former MW-103, MW-104S and the soil vapor extraction (SVE) well. Sometime between 2006 and 2008, MDEQ abandoned five wells at the former Hooker's Dry Cleaners (MW-102D, MW-102S, MW-103, MW-104D and MW-104S).

## **Area C**

PCE detections in groundwater have been up to 180 µg/L (MW-603), historically. MW-603 is located side-gradient (i.e., east) of the former Art's Dry Cleaners building.

## **Area D**

PCE has historically been detected in groundwater up to 24 µg/L (GW-12, middle vertical interval); however it should be noted that no groundwater data has been collected near the highest soil gas concentration. Vertical groundwater profiling was performed at two locations and indicated that PCE has affected the shallow, middle and deep groundwater regimes.

## **Vapor Intrusion Data Assessment**

### **Summary of VI Data**

VI investigations of the site included the following:

- In 1984 - 1985, EPA investigated soil vapors in and near nine buildings and the Newman Street dump;
- In 2013, EPA collected sub-slab soil gas, indoor air and outdoor air samples around suspected source areas; and,
- Since October 2014, EPA collected sub-slab soil gas, indoor air, and outdoor air samples from 54 residential and commercial properties and installed sixteen SSD mitigation systems.

## **Contamination Indicated by VI Data**

The following is a summary of results for the 54 locations where EPA compared sample results to sub-slab and indoor air VISLs. It should be noted that each of the levels identified below is present in each area sampled (i.e., Area A, B, and C).

- Less than 10<sup>-6</sup> excess lifetime cancer risk VISL at nine locations
- Between 10<sup>-6</sup> and 10<sup>-5</sup> excess lifetime cancer risk VISL at twenty-four locations
- Between 10<sup>-5</sup> and 10<sup>-4</sup> excess lifetime cancer risk VISL at nine locations
- Greater than the 10<sup>-4</sup> excess lifetime cancer risk VISL at twelve locations

## **Site Inspection**

EPA inspected the Site for the FYR on 1/5/2016. In attendance were Matthew Ohl, EPA and Nic Dawson, MDEQ. The purpose of the inspection was to assess the protectiveness of the remedy.

During the inspection, the team completed the following activities:

- Viewed the conditions around selected monitoring wells;
- Checked properties near source areas for signs of well installations; and,
- Discussed impact of local utility and parking improvements on monitoring wells and vapor probes.

Due to snow cover, the team did not take photographs during the inspection and did not inspect most monitoring wells. The wells near the Pine River Channel have aboveground protective casings and are in good condition.

The team did not identify any private well installations near the source areas.

The City of Charlevoix is improving its streets and other infrastructure in the area of the site. The team identified numerous road cuts from previous waterline repairs just west of the improved areas. EPA will work with the City of Charlevoix during the process to maintain the integrity of groundwater and soil gas monitoring points, if practicable.

## **Interviews**

EPA did not conduct interviews during the FYR process. During previous community involvement efforts, including public availability sessions and meetings with individual property owners EPA did not identify significant issues.

## **IV. TECHNICAL ASSESSMENT**

### **Question A: Is the remedy functioning as intended by the decision documents?**

Yes, the remedy is functioning as intended by the 1984 and 1985 RODs. A new municipal drinking water supply provides clean water and groundwater use restrictions prevent exposure to the groundwater contaminant plume. However, sample results continue to show both PCE and TCE in groundwater and soil vapor, and groundwater may not achieve cleanup levels within a reasonable timeframe.

The 1985 ROD stated, “[T]he data gathered during the RI indicate that there is not a current identifiable source of contamination, and that the origin of the contaminated groundwater was likely a single spill incident or a source that was subsequently removed. Because the source(s) of TCE and PCE contamination are believed to no longer exist, only remedial actions for management of migration of contaminated groundwater were evaluated.”

However, since the signing of the 1985 ROD new information regarding two contaminant source areas (the former Art’s Dry Cleaner located at 207 W. Garfield Street and the former Impact Tool facility at 204 W. Lincoln Avenue) led to additional response actions. Under a State cleanup program, MDEQ has performed an interim response action to control the contaminant source. MDEQ installed an SVE and groundwater treatment system (air sparging) to clean source area soil and groundwater in 1997 and operated it until July 2003.

Following additional groundwater, soil, and VI investigations conducted over 2012-2014, in an Action Memorandum signed on September 19, 2014, EPA determined that a time-critical removal action was necessary to address immediate health threats. EPA removed the contents of three USTs from the former Art’s Dry Cleaner and removed contaminated soils. SSD systems were installed at most non-commercial buildings where contaminant levels exceeded VI screening levels.

While these actions have reduced contaminant levels, the remaining levels in the soil and the groundwater will act as a continuing source of contamination. Contaminated groundwater may take longer than the estimated period of 50 years to naturally discharge to Lake Michigan. The remedy requires additional evaluation to determine the potential timeframe to meet MCLs.

In addition, long-term protectiveness will require completion of an effective remedial action that addresses the remaining contamination. Further investigation of soil, soil vapor and groundwater is necessary to support selection of additional response actions. To select any necessary remedial action, EPA will issue a memorandum to the file, Explanation of Significant Differences or ROD Amendment, as appropriate.

**Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives (RAOs) used at the time of the remedy section still valid?**

#### **Changes in Standards and TBCs**

No. The standards should specifically include MCLs and the state’s cleanup criteria for groundwater based on the protection of surface water resources from hazardous substances in venting groundwater, commonly referred to as groundwater surface water interface (GSI) criteria. These criteria were established pursuant to Section 20120a (15) of Part 2011 and R 299.5716 of the Michigan Administrative Code. The actual numerical GSI criteria are contained in R 299.5744.

The ROD discussed that MCLs would be applicable if EPA selected an active groundwater cleanup. The ROD also mentioned that the level related to a  $10^{-6}$  excess lifetime cancer risk for TCE and PCE were 2.7 ppb and 0.8 ppb, respectively, and estimated it would take 30 years to achieve these levels with active groundwater treatment.

The MCLs for TCE and PCE have remained at 5 µg/L since 1985. To better define the terms "useable state" in the ROD, MCLs would likely be relevant and appropriate cleanup levels. Therefore, EPA has not recalculated the 10<sup>-6</sup> cancer risk level based on recent toxicological information.

The 1985 ROD also required monitoring of surface water, but did not establish specific cleanup goals. The federal criteria for the protection of freshwater aquatic life are orders of magnitude higher than the estimated concentrations for TCE and PCE in the lake water. Based on the review of current GSI criteria and current groundwater data, it appears that the remaining contamination is not likely to present unacceptable risks through the surface water pathway.

Table 4: Current Soil and Groundwater Criteria for TCE and PCE

	Groundwater Criteria		Soil Criteria
	MCL (Drinking Water Criteria)	Part 201 GSI Criteria *	Part 201 GSI Protection Criteria *
TCE	5 µg/L	200 µg/L	4,000 µg/kg
PCE	5 µg/L	45 µg/L	900 µg/kg

\* The GSI criterion shown in the generic cleanup criteria tables is not protective for surface water for drinking water use. For a groundwater discharge to the Great Lakes and their connecting waters or discharge in close proximity to a water supply intake in inland surface waters, the generic GSI criterion shall be the surface water human drinking water value (HDV). The HDV for TCE is 29 µg/L and for PCE is 11 µg/L. The soil GSI protection criteria for the HDV are 580 µg/kg for TCE and 220 µg/kg for PCE.

### Changes in Exposure Pathways

VI is a new exposure pathway confirmed through investigations conducted since the last FYR.

### Changes in Toxicity and Other Contaminant Characteristics

EPA revised the health assessment information for PCE on February 10, 2012 and TCE on September 28, 2011. EPA does not expect these changes to affect the remedy because the 1985 ROD did not calculate specific cleanup values.

### Changes in Risk Assessment Methods

EPA does not expect changes to standard risk assessment methods would affect the protectiveness of the remedy.

### Expected Progress Toward Meeting RAOs

The 1985 ROD states, "[T]he objective of remedial action at the site was identified as minimizing the potential risk to the public from direct consumption of the contaminated ground water through inadvertent use of private wells by individuals unaware of the hazard." The 1985 ROD also predicted that groundwater should be returned to a "useable state after 50 years," or by 2035. Depending on the outcome of additional investigations, EPA may establish an additional objective to prevent exposures to contaminated vapors.

### Are there newly identified contaminants or contaminant sources?

Yes. As previously discussed, the former Art's Dry Cleaner and former Impact Tool facility are contaminant sources. Although the time critical removal action addressed the immediate threats posed by these source areas, ongoing investigations are underway.

### Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Other than the issues already mentioned under Question A and Question B, no other information has come to light that would call into question the protectiveness of the remedy.

### Technical Assessment Summary

According to the data and information reviewed, the remedies selected in the 1984 and 1985 RODs have been effective in preventing the consumption of contaminated groundwater. The characterization of the PCE sources and the persistence of the PCE contamination have led to a concern of potential VI issues that could affect the protectiveness of the remedy. There were no chemical-specific numerical cleanup goals established in the 1985 ROD. However, the 1985 ROD stated that the groundwater should return to a useable state after 50 years, or by 2035.

Since the last FYR, sample results continue to show both PCE and TCE in groundwater and soil vapor samples. Contaminated groundwater may take longer than the estimated period of 50 years to naturally discharge to Lake Michigan. In addition, the potential VI threat needs to be mitigated in a manner that provides long-term protection and reliability.

The remedy requires additional evaluation to determine whether it is functioning as intended by the decision documents for groundwater. Further investigation of soil, soil vapor and groundwater is necessary to support selection of additional response actions for potential VI threats. Any necessary remedial action would be selected in a memorandum to the file, Explanation of Significant Differences or ROD Amendment, as appropriate.

## V. ISSUES/RECOMMENDATIONS AND FOLLOW-UP ACTIONS

Table 5: Issues and Recommendations/Follow-up Actions

OU #	Issue	Recommendations/ Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date	Affects Protectiveness? (Y/N)	
						Current	Future
2	VOC contamination remains underground as a source for VI and groundwater contamination.	Complete the VI and source investigations.	EPA	EPA/State	1/31/2019	No	Yes



## VI. PROTECTIVENESS STATEMENT

Protectiveness Statement(s)		
<i>Operable Unit:</i> 01	<i>Protectiveness Determination:</i> Protective	
<i>Protectiveness Statement:</i> The remedy at OU 1 is protective of human health and the environment. The new water supply drawing water from Lake Michigan provides safe drinking water to the City.		
<i>Operable Unit:</i> 02	<i>Protectiveness Determination:</i> Protectiveness Deferred	<i>Addendum Due Date:</i> 1/31/2020
<i>Protectiveness Statement:</i> A protectiveness determination for the remedy at OU 2 cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.		

Sitewide Protectiveness Statement	
<i>Protectiveness Determination:</i> Protectiveness Deferred	<i>Addendum Due Date:</i> 1/31/2020
<i>Protectiveness Statement:</i> The Sitewide protectiveness determination cannot be made at this time until further information is obtained. Further information will be obtained by taking the following actions: complete the VI and source investigations. It is expected that these actions will take approximately 3 ¼ years to complete, at which time a protectiveness determination will be made.	

## VII. NEXT REVIEW

The next five-year review report for the Charlevoix Municipal Well Superfund Site is required five years from the completion date of this review.

## APPENDIX A – EXISTING SITE INFORMATION

### A. SITE CHRONOLOGY

Table 5: Site Chronology

Event	Date
Initial discovery of problem or contamination: TCE contamination discovered in the City of Charlevoix (City) municipal water supply.	July 1, 1982
Pre-NPL responses: The City installed a temporary diffusion aeration system in the municipal well to remove some of the VOCs.	December 1982
The Michigan Department of Public Health (MDPH) issued a Departmental Order to the City in reaction to the continued presence of TCE in the City water supply.	August 1983
Final NPL listing	September 8, 1983
Focused Feasibility Study (FFS)	May 1984
Interim Action ROD Signature - This Interim Action ROD resulted in construction of a new municipal water supply system for the City.	June 12, 1984
Remedial Design start	June 13, 1984
Superfund State Contract (SSC) for Interim Action Remedy	June 1984
On-site remedial action construction start: Interim Remedial Action start	August 28, 1984
Remedial Investigation (RI) Report	February 7, 1985
Remedial Investigation/Feasibility Study complete: Feasibility Study (FS) Report	June 10, 1985
Remedial Design complete: Phase I Construction (Water Intake Structure)	August 4, 1985 to November 11, 1985
Phase II Construction (Water Treatment Plant)	August 15, 1985 to October 28, 1988
Final Remedy ROD Signature - This ROD included groundwater monitoring and restriction on groundwater use.	September 30, 1985
City begins operation of new water system	March 31, 1987
Cooperative Agreement - between EPA and the State of Michigan for the first year of O&M on the water intake system	June 1, 1987
Second SSC	March 28, 1991
Construction of New Water Intake Structure	April to May 1992
City begins full scale operation of new intake system	June 3, 1992
Preliminary Close-Out Report	September 16, 1992
RA Construction completion	September 16, 1992
Final Close-out Report	July 12, 1993
Deletion from NPL	December 2, 1993
First FYR Report	September 14, 1994
SSC Reconciliation and Termination Agreement	January 27, 1997

Second FYR Report	May 15, 2001
ICs: City of Charlevoix passes Ordinance No. 732 of 2008 – Expanding the area under the water use restriction	July 21, 2008
Third FYR Report	September 23, 2011
Removal actions	2013-2014

## **B. BACKGROUND**

### **Physical Characteristics**

The Site is located in the City of Charlevoix, Charlevoix County, Michigan. The geographic coordinates of the approximate center of the investigation area are 45°18'50.88" north latitude and 85°15'44.22" west longitude (**Figure 1-1**). For the purpose of this FYR, the Site area is bounded by the Pine River Channel, also known as the Round Lake Channel, to the north; Round Lake to the northeast, May Street to the east; Crain Street and Wood Avenue to the south; and Sheridan Street to the west and Lake Michigan to the northwest (**Figure 1-2**).

### **Geology**

The site is located over fine to coarse sands to a depth of about 120 to 150 feet. The site is at the southwest edge of a northwest-southeast oriented glacial channel that extends to a depth of at least 450 feet. Within about one-quarter mile to the west-southwest of the site, Devonian shale and limestone is within 25 to 30 feet of the surface. Limestone is approximately 1100 feet south of the site at a depth of 120 feet.

### **Hydrology**

The water table under the site is approximately 55 feet. Groundwater flow direction is predominantly to the north-northeast. A north-south trending groundwater divide is present between approximately State and Grant Streets. Deep sheet pilings installed along the banks of the Pine River Channel deflect northerly groundwater flow. Both Round Lake and Lake Michigan receive the deflected groundwater flow.

Hydraulic conductivity of the sandy soils ranges from 20 to 140 feet/day or  $7 \times 10^{-3}$  to  $5 \times 10^{-2}$  cm/second. An estimate of the effective porosity of the sand is 25%.

### **Land and Resource Use**

The Site is located in a small tourist community on the shore of Lake Michigan in northwest Michigan. The City's permanent population of 3,500 swells to about 10,000 people during the summer tourist season, with more than one-half of the community's income derived from tourism. The land use is mostly residential mixed with a few business or commercial properties.

The municipal water source is Lake Michigan. A city ordinance and health department's groundwater well permitting program make potable use of groundwater less likely in the future.

## **History of Contamination**

Releases from dry cleaning and manufacturing businesses appear to be sources of Site contamination. In September 1981, while conducting tests for chemicals in the City's chlorinated water supply, MDPH detected TCE ranging in concentrations from 13 to 30 ppb in the City water supply. A new monitoring program continued to detect gradually rising levels of TCE in the raw water. In December 1982, concentrations of TCE exceeded 100 ppb. At that point, the City installed a temporary diffused aeration system in the municipal well to remove some of the VOCs. This aeration system was only partially effective in removing contaminants from the water.

## **Initial Response**

In November 1981, the City drilled four of the six monitoring wells that it would install in its effort to identify the source and extent of TCE contamination in the aquifer. The City placed the four wells around the City's pump house in hopes of intercepting the TCE contamination and establishing its direction of approach. Sampling results from these monitoring wells verified that the source of the contamination in the municipal well was groundwater rather than surface water. EPA's Technical Assistance Team (TAT) conducted a hydrogeological study in June and July 1982. The TAT installed an additional nine groundwater monitoring wells near the municipal well. Although sampling of the test wells found varying amounts of TCE, the source of contamination could not be located. In addition, during the study TAT identified PCE in a number of the monitoring wells. In 1982 and 1983, the Michigan Department of Natural Resources (MDNR) sampled soils to locate the source of contamination.

## **Basis for Taking Action**

EPA began its RI during September 1983. Analysis of groundwater samples taken from the monitoring wells identified TCE and PCE as contaminants of concern. The data indicated that concentrations of TCE in the groundwater moving toward the municipal well were much higher than previously measured. The increased threat posed by the higher concentrations resulted in a decision by EPA to prepare a Focused Feasibility Study (FFS) to evaluate potential remedies for the contaminated water supply while work on the RI continued. The FFS prepared by EPA in May 1984 concluded that the continued deterioration of the municipal well presented an unacceptable public health risk. The FFS recommended construction of a water intake structure in Lake Michigan and a water treatment plant to provide the City with a new water supply.

The results from December 1983 indicated that the highest concentrations of TCE in the groundwater occurred near the Charlevoix Middle School, now the Charlevoix Public Library. The second major phase of the RI study began in July 1984 and included soil and groundwater sampling and air testing. The objective of this phase of the RI work was to locate and identify the source of TCE and more information on the PCE plume.

Although the RI included soil borings in the middle school area, it did not identify discrete sources of TCE contamination such as underground tanks or buried drums. In addition, soil samples above the water table were not contaminated. These results indicated that there was no current, identifiable source of TCE contamination and that the origin of the TCE-contaminated groundwater was likely either a single spill or a removed source.

The RI did not fully define the extent of the PCE contamination, nor did it locate all additional remaining sources of the PCE contamination. The Endangerment Assessment in the 1985 FS concluded, "the only potential future exposure for humans to high carcinogenic levels of TCE and PCE would be direct consumption of contaminated groundwater from wells located in the contaminated groundwater plumes." The Endangerment Assessment concluded the following conclusions:

- The potential for exposure of humans to TCE and PCE via surface waters at toxic concentrations is remote;
- No adverse impacts on the biota are anticipated for the no action alternative; and,
- The potential future exposure of humans to toxic or carcinogenic concentrations of TCE or PCE vapors is also slight since sampling efforts did not reveal any high concentrations.

## **C. REMEDIAL ACTIONS**

### **Remedy Selection**

EPA selected interim and final remedies for the site.

### **Interim Remedy**

EPA issued a ROD on June 12, 1984, for an interim action for a new water supply to replace the contaminated municipal well (1984 ROD). The 1984 ROD stated that the objective of the interim action was to provide a safe drinking water supply to meet the City's needs, until EPA implemented final remedial measures. The selected interim action included the following two components:

- Construction of a lake water intake line and a two million gallons per day direct filtration water treatment plant to provide a clean water supply; and,
- Future O&M activities to ensure the continued effectiveness of the interim remedy.

EPA estimated the capital cost for the interim remedy to be \$1,954,000, with O&M costs of \$118,000. The State of Michigan agreed with the interim remedy selected in the 1984 ROD.

### **Final Remedy**

After completing the RI, EPA issued a second ROD on September 30, 1985 (1985 ROD). The 1985 ROD selected a remedy for the groundwater contamination. The 1985 ROD states that the "objective of remedial action at the site was identified as minimizing the potential risk to the public from direct consumption of the contaminated ground water through inadvertent use of private wells by individuals unaware of the hazard." The 1985 ROD further states that groundwater will return to a "useable state after 50 years." While the 1985 ROD did not clearly define the term "useable," it does clarify that for ground water defined as Class 1 under the Ground Water Protection Policy (aquifer of drinking water quality) the MCL standards promulgated under the Safe Drinking Water Act (SDWA) would be the applicable standard for cleanup.

The 1985 ROD selected a remedy consisting of three distinct elements:

1. Allow the contaminant plumes to discharge under natural flow conditions to Lake Michigan.
2. Continue long-term monitoring of the plumes during the natural purging period.

3. Provide institutional restrictions on the installation of private wells in the contaminated aquifer enforced by local health officials through an existing well permitting program.

The Endangerment Assessment concluded that the natural discharge of contaminated groundwater to Lake Michigan did not pose unacceptable risks to human health or aquatic life. Based on studies during the RI, the 1985 ROD stated the aquifer would return to a usable state after 50 years and ICs would be required during that 50-year purging period. The 1985 ROD stated that the necessary ICs were already in place, specifically the existing well permitting program in Charlevoix County. The 1985 ROD also stated that "because the source(s) of TCE and PCE contamination are believed to no longer exist, only remedial actions for management of migration of contaminated ground water were evaluated." The 1985 ROD included no capital costs and estimated the O&M costs at \$17,000 per year for the required semi-annual groundwater monitoring and sampling of surface water in Lake Michigan and Round Lake.

The State of Michigan did not immediately concur with the selected final remedy but instead requested EPA to consider a groundwater restoration remedy. The Governor of Michigan sent a letter to the EPA Regional Administrator on December 2, 1985, withholding concurrence and requesting that EPA reconsider the selected remedy. On May 1, 1986, the Governor of Michigan sent a letter to the Administrator of EPA requesting it select an active groundwater remedy. After failing to get EPA to consider groundwater restoration, on December 4, 1986, the Director of the MDNR sent a letter to EPA in which the state decided to "accept the ROD"; although the state did "not find the limited action alternative, as described in the ROD, to be adequate for a final remedy."

The 1985 ROD noted that there were a number of former or currently operating commercial facilities up-gradient with possible PCE use, including dry cleaners and the Charlevoix airport. The 1985 ROD discussed that the state had identified PCE contamination in soils underlying a former dry cleaner in 1983, but that it appeared unrelated to the PCE plume. The 1985 ROD also stated, "[MDNR] is presently evaluating whether to address PCE contamination from this, and other suspected sources through its state Superfund Program (Act 307)." The 1985 ROD concluded that these potential PCE sources were not sources of the PCE groundwater plume. The TCE and PCE appeared to be two separate plumes that originated from different sources. Even though portions of the PCE plume overlapped with the TCE plume, EPA had not fully defined the sources of contamination during the RI/FS. As EPA noted in the 1993 Close-Out Report, "[T]he results were less conclusive regarding the origin of the PCE contamination, but indicated an area up-gradient of the intersection of Hurlbut and State Streets."

On January 30, 1986, the state scored and listed the PCE plume as a state cleanup site known as the Charlevoix Municipal Well Field (PCE) Site on the state's list of contaminated sites. The state conducted an RI and issued a RI report dated August 1989. The Charlevoix Municipal Well Field (PCE) Site includes three adjacent source areas: PCE sources at 204 W. Lincoln and 207 W. Garfield, and a petroleum source at 206 W. Lincoln. The PCE sources identified by the state are immediately up-gradient of the PCE plume area identified in the 1985 ROD. Based on current data the PCE releases at 204 W. Lincoln and 207 W. Garfield are clearly contributing sources to the PCE plume identified by the EPA's RI. The state conducted an interim action between 1997 and 2003 at these source areas reducing the levels of contamination; however, PCE remains in the soil and groundwater.

The state also conducted interim actions at Art's Dry Cleaners from 1994 to 1995, and Hooker's Cleaners from 2001 to 2002.

## **Remedy Implementation**

In June 1984, EPA entered into an Interagency Agreement (IAG) with the U.S. Army Corps of Engineers (USACE) to review the design of the intake structure prepared for the City and to complete the design of the water treatment plant. EPA and the state of Michigan executed a SSC for the interim remedy on June 12, 1984. The SSC provided that the state pay 10 percent of the interim remedy costs. EPA and the state amended the SSC to increase the state's costs based on actual awarded construction contracts.

USACE awarded the construction contract for the water intake structure on September 10, 1984, and the contractor completed the work on November 11, 1985. USACE accepted the work on September 17, 1986. USACE awarded the construction contract for the water treatment plant on August 15, 1985. The City began operating the plant on March 31, 1987. The contractor completed all site work and punch list work on October 6, 1987. A minor modification (riprap along the shoreline to protect the plant) changed the completion date to October 25, 1988. USACE accepted the work on January 4, 1989. The USACE submitted a Remedial Action Report on January 23, 1989. The report signified the successful completion of all construction activities. The final construction cost of the Remedial Action was \$3,105,832.64.

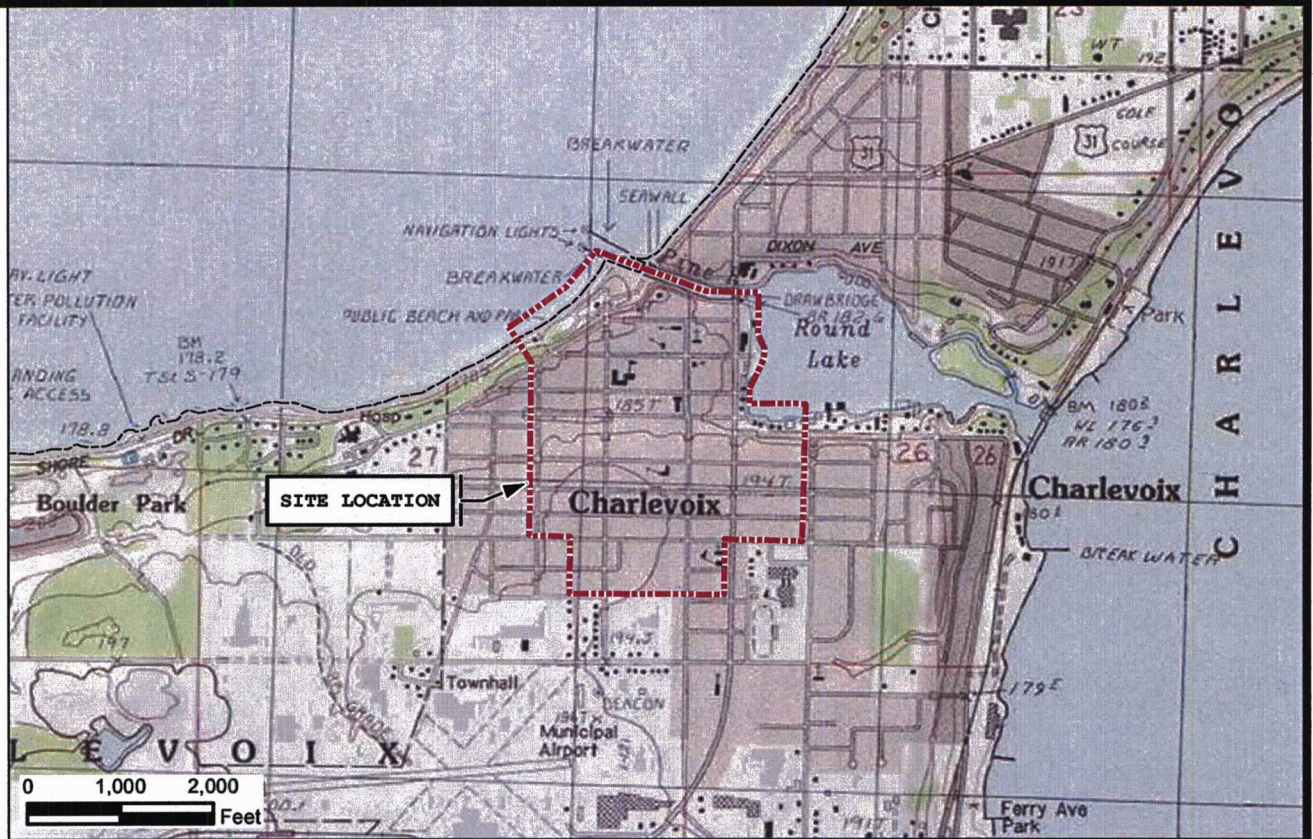
## **System Operation/Operation and Maintenance**

Soon after operation of the lake water intake and water treatment plant began, the City experienced a capacity diminishment problem. In 1990, MDPH declared the system to be an unreliable source of water for the City. EPA, upon reviewing new data, concluded that some combination of unforeseen conditions, present during construction and/or routine operation, rendered the structure unable to perform as envisioned. EPA entered into an IAG with the USACE to oversee the augmentation of the intake structure to achieve the original design capacity. The contractor began construction of the new intake in April 1992 and completed it on June 3, 1992. On September 1, 1992, EPA received a letter from the City stating that the new water intake was functioning very well. On September 24, 1992, the USACE submitted a Remedial Action Report signifying successful completion of intake construction activities. The total contract cost for this action was \$408,297.55. EPA accepted the work on October 13, 1992. EPA signed a Final Close-Out Report for the Site on July 12, 1993. EPA deleted the Site from the NPL on December 2, 1993. There have been no known problems with the system since the last FYR.

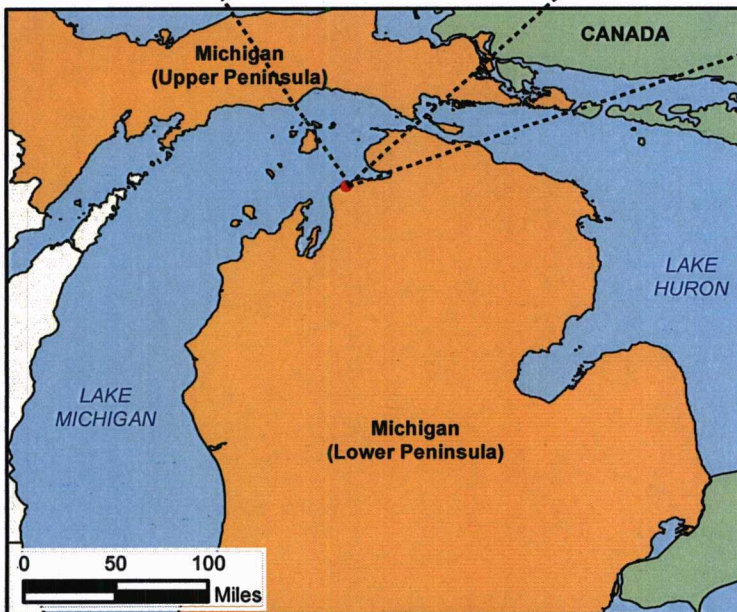




## **APPENDIX B – MAPS, DATA, FIGURES OR TABLES FOR REFERENCE**



Source: USGS 7.5' Quadrangles - Charlevoix and Iropton, Michigan.



US Army Corps  
of Engineers  
Buffalo District

U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
BUFFALO, NY

## SITE LOCATION MAP

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Date Saved: 25 Aug 2015  
Time Saved: 11:23:41 AM



CHARLEVOIX MUNICIPAL WELL SITE  
CHARLEVOIX, MICHIGAN

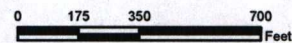
FIGURE 1-1





**Legend**

-  Site Boundary
-  Areas



U.S. ARMY ENGINEER DISTRICT  
CORPS OF ENGINEERS  
Buffalo District  
Buffalo, NY

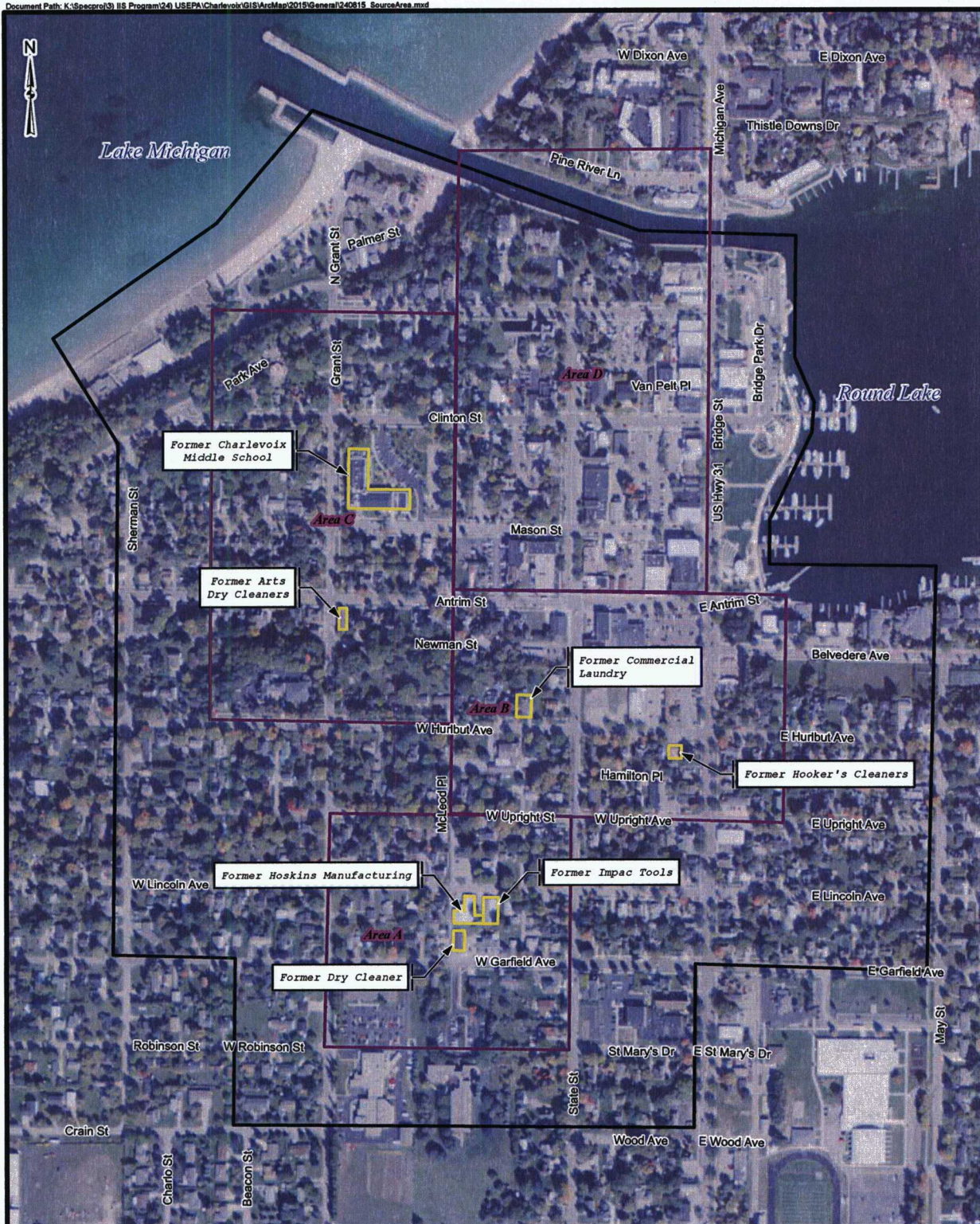
**SITE PLAN**

Document Name: 240615\_SiteBoundary.mxd  
Drawn By: H5TDESPM  
Date Saved: 24 Sep 2015  
Time Saved: 7:22:32 AM

CHARLEVOIX MUNICIPAL WELL SITE  
CHARLEVOIX, MICHIGAN

FIGURE 1-2





- Legend**
- Areas
  - Potential Source Area
  - Site Boundary

0 175 350 700  
Feet



U.S. ARMY ENGINEER DISTRICT  
U.S. Army Corps of Engineers  
BUFFALO, NY  
Buffalo District

POTENTIAL SOURCE AREAS AND BOUNDARIES  
OF THE STUDY AREA

Document Name: 240815\_SourceArea.mxd  
Drawn By: H5TDESPM  
Date Saved: 25 Aug 2015  
Time Saved: 3:05:30 PM

CHARLEVOIX MUNICIPAL WELL SITE  
CHARLEVOIX, MICHIGAN

FIGURE 1-3



**CITY OF CHARLEVOIX**  
**Ordinance No.732 of 2008**

AN ORDINANCE TO AMEND SECTION 2.71(3) OF CHAPTER 22A: CITY WATER SERVICE-EXCLUSIVE WATER SOURCE OF TITLE II OF THE CODE OF THE CITY OF CHARLEVOIX BY REVISING THE LEGAL DESCRIPTION OF THE IMPACT AREA CONTAINED IN SECTION 2.71 (3)

THE CITY OF CHARLEVOIX ORDAINS:

**SECTION 1. Amendment of Section 2.71 (3) of Chapter 22A of the City Code.**

A. Section 2.71 (3) of Chapter 22A is amended to read as follows:

- (3) "Impact area" means the property located within the City of Charlevoix, Charlevoix County, Michigan, and described as follows (and also illustrated in the attached map):

In the City and Township of Charlevoix, Charlevoix County, Michigan.

Commencing at the North 1/4 corner of Section 35, Town 34 North, Range 8 West; thence South on North and South 1/4 line of said section 1138.50 feet; thence South 89°39'00" East 303.00 feet, more or less, to the Westerly line of the former C&O Railroad right-of-way, being the POINT OF BEGINNING of this description; thence continuing South 89°39'00" East 350 feet, more or less, to the shore of Lake Charlevoix; thence Southerly along said shore to the thread of Stover Creek; thence Westerly along the thread of Stover Creek to the Easterly line of former Highway M-66; thence Northerly along said highway 469.20 feet, more or less, to the centerline of Stover Road; thence West along said centerline of Stover Road to a point which is 1162.26 feet East of the centerline of May Street; thence North 330.00 feet; thence East 62.44 feet; thence North 165.00 feet; thence East 260.75 feet to the Northwestern line of the former C&O Railroad right-of-way; thence Northeasterly along said railroad right-of-way to the POINT OF BEGINNING; being a part of Government Lot 1, Section 35, Town 34 North, Range 8 West. The above described property extends to the water's edge of Lake Charlevoix. (This area is called Impact Area A on the attached map)

AND ALSO:

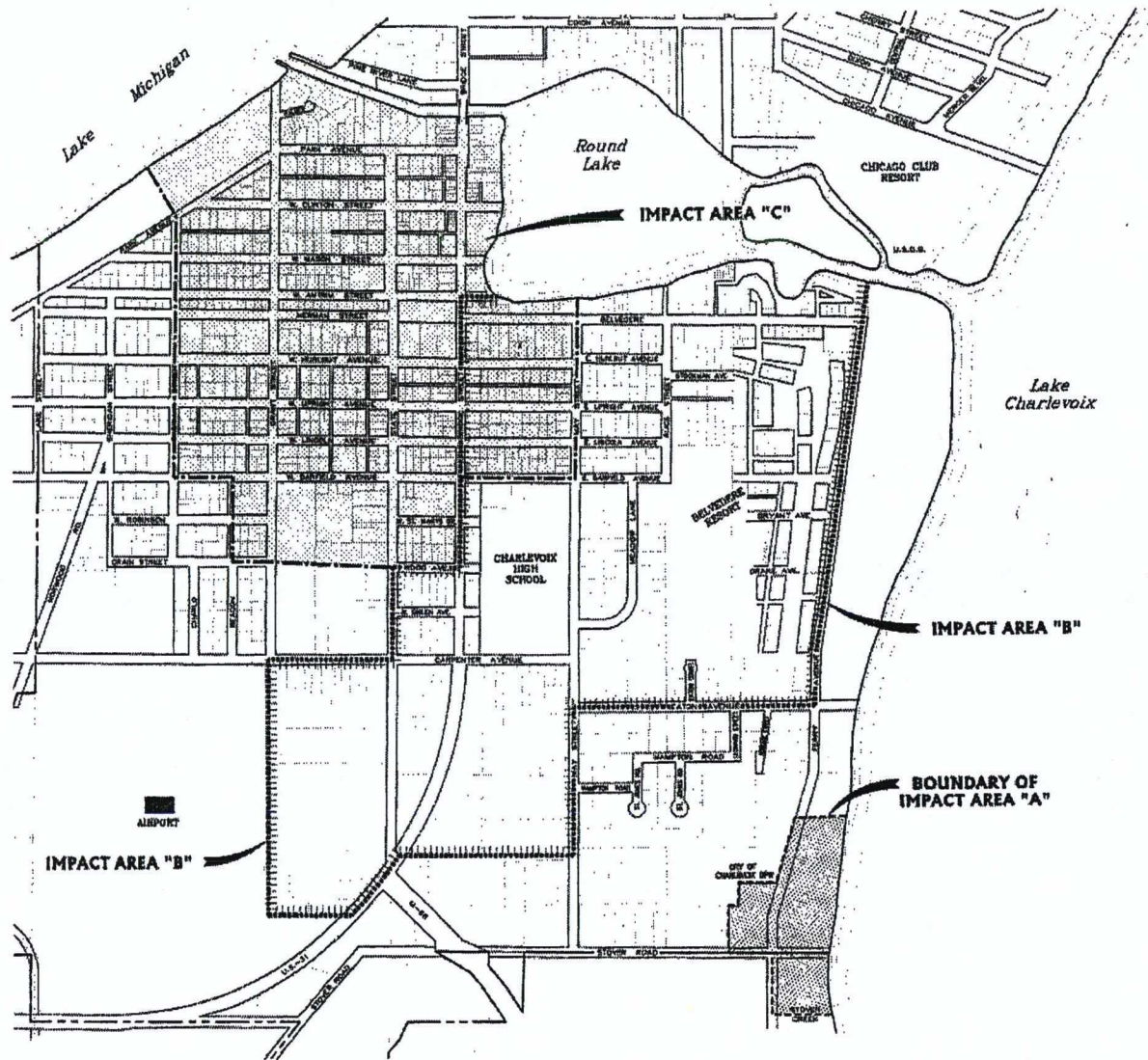
Part of Sections 26, 34 and 35, T34N, R8W, City of Charlevoix, Charlevoix County, Michigan, more fully described as: BEGINNING at the Northeast corner of Section 34, said corner being at the intersection of State Street and Carpenter Avenue; thence West along the centerline of Carpenter Avenue to the intersection of Grant Street; thence South 1906 feet; thence East to the centerline of US-31; thence northeasterly along the centerline of US-31 to a point that is 1419 feet south of the North line of Section 35; thence East, parallel with the North line of Section 35 to the centerline of May Street; thence North along the centerline of May Street to the intersection of Eaton Avenue; thence East along the centerline of Eaton Avenue to the intersection of Ferry Avenue; thence northerly along the centerline of Ferry Avenue and its extension to the south shore of channel between Lake Charlevoix and Round Lake; thence westerly along said south shore to the intersection of Antrim Street extended; thence West along the centerline of Antrim Street to the intersection of Bridge Street; thence South along the centerline of Bridge Street to the intersection of Wood Avenue; thence West along the centerline of Wood Avenue to the intersection of State Street; thence South along the centerline of State Street to the intersection of Carpenter Avenue and the POINT OF BEGINNING. (This area is called Impact Area B on the attached map)

AND ALSO:

A part of the West ½ of Section 26, and a part of the East ½ of Section 27, all in T.34N.-R.8W., City of Charlevoix, Charlevoix County, Michigan, described as follows; Commencing at the South Section Corner common to said Sections 26 and 27, also being the intersection of the centerline of State Street with the centerline of West Carpenter Avenue; thence North along the Section Line common to said Sections 26 and 27, which is also the centerline of State Street, 672.9 feet to the centerline of Wood Avenue and the POINT OF BEGINNING of this description; thence West 898.5 feet to the intersection of the centerline of Grant Street with centerline of Crain Street; thence continuing West along the centerline of Crain Street 288.1 feet to centerline of Beacon Street; thence North parallel with Grant Street 614.5 feet to the centerline of West Garfield Avenue; thence West along the centerline of West Garfield Avenue 474.9 feet to the centerline of Sherman Street; thence North along the centerline of Sherman Street 1930.1 feet to the centerline of Park Avenue; thence N.34°W. to the shore of Lake Michigan; thence Northeasterly along the shore of Lake Michigan extended to the south bulkhead of the Pine River channel; thence Southeasterly along the south bulkhead of the Pine River channel to Round Lakes' westerly bulkhead; thence Southerly along said bulkhead to the southerly bulkhead of Round Lake; thence Easterly along the southerly bulkhead and/or shore of Round Lake to the north extension of the centerline of May Street; thence South along said north extension of the centerline of May Street to the intersection of the centerline of May Street with the centerline of Belvedere Avenue; thence continuing South along the centerline of May Street 1165.5 feet to the centerline of East Garfield Avenue; thence West along the centerline of East Garfield Avenue 837.3 feet to the centerline of Bridge Street; thence South along the centerline of Bridge Street 643.5 feet to the centerline of Wood Avenue; thence West along the centerline of Wood Avenue 487.1 feet to the centerline of State Street and the POINT OF BEGINNING. (This area is called Impact Area C on the attached map)

Subject to the rights of the public and of any governmental unit in any part thereof taken, used or deeded for street, road or highway purposes.

# IMPACT AREA MAP



City of Charlevoix

SITE PLAN

200 400 600  
FOOT SCALE 1" = 400'



NOTES: THIS MAP REPRESENTS AN ILLUSTRATION OF A PORTION OF THE CITY OF CHARLEVOIX AND IMPACT AREA "A", "B", AND "C" AS INCLUDED IN CHAPTER 22A OF THE CHARLEVOIX CITY CODE. THESE IMPACT AREAS ILLUSTRATIONS ARE CONSIDERED GENERALLY ACCURATE AND ARE BASED ON THE LOCAL DESCRIPTIONS PROVIDED IN CHAPTER 22A. MEASUREMENTS ON THIS MAP ARE NOT EXACT.

Project No.  
2000006-01



City of Charlevoix  
City Engineer  
Name  
Date

Scale  
1" = 400'

City of Charlevoix  
City Engineer  
Name  
Date

IMPACT AREAS A, B, & C  
Chapter 22A of the Charlevoix City Code

Project No.  
2000006-01  
Sheet  
1 of 1

**SECTION 2. Severability.**

No other portion, paragraph or phase of the Code of the City of Charlevoix, Michigan shall be affected by this Ordinance except as to the above sections, and in the event any portion, section or subsection of this Ordinance shall be held in valid for any reason, such invalidation shall not be construed to affect the validity of any other part of portion of this ordinance or of the Code of the City of Charlevoix, Michigan.

**SECTION 3. Effective Date.**

This Ordinance shall become effective thirty (30) days after its enactment.

ENACTED this 21<sup>st</sup> day of July, 2008.

Ordinance No. 732-2008 was adopted on the 21<sup>st</sup> day of July 2008, by the Charlevoix City Council as follows:

Motion by: Councilmember Sherrn Chamberlain  
Seconded by: Councilmember Gabe Campbell

Yeas: Picha, Stevens, Campbell, Chamberlain, Gennett, Kusina  
Nays: None  
Absent: None

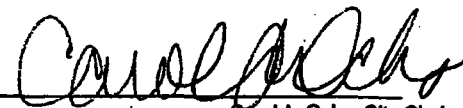
STATE OF MICHIGAN       )  
                                      ) ss  
CITY OF CHARLEVOIX     )

  
\_\_\_\_\_  
Carol A. Ochs, City Clerk

  
\_\_\_\_\_  
Norman L. Carlson, Jr., Mayor

I certify that this is a true copy of Ordinance No. 732 that was adopted at a regular meeting of the Charlevoix City Council on July 21, 2008 and published in the *Charlevoix Courier* on July 30, 2008.


Dated: 7/30/08

  
\_\_\_\_\_  
Carol A. Ochs, City Clerk

**CERTIFICATION**

I, the undersigned, the Clerk of the City of Charlevoix, Charlevoix County, Michigan, do hereby certify that the foregoing is a true and complete copy of Ordinance No. 732 of 2008 adopted by the City Council of the City of Charlevoix, County of Charlevoix, State of Michigan, at a regular meeting held on July 21<sup>st</sup>, 2008 and published in the *Charlevoix Courier* on July 30<sup>th</sup>, 2008, the original of which is on file in my office and available to the public. Public notice of said meeting was given pursuant to and in full compliance with the Open Meetings Act, being Act 267 of the Michigan Public Acts of 1976.

Dated: 08/06/2008

  
\_\_\_\_\_  
Carol A. Ochs, Clerk