**First Five-Year Review Report**

**for**

**Peerless Plating Site**

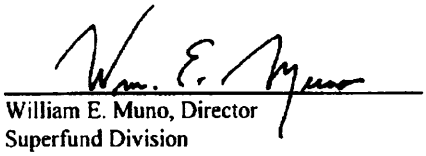
**Muskegon Township**
**Muskegon County, Michigan**

September 2002

PREPARED BY:

United States Environmental Protection Agency
Region 5
Chicago, Illinois

Approved by:



William E. Muno, Director
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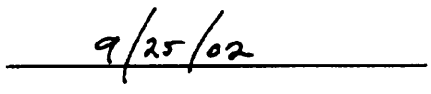
Date:



**Five-Year Review Report**

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# List of Acronyms

| | |
|---|---|
| ARAR | Applicable or relevant and appropriate requirement |
| CERCLA | Comprehensive Environmental Response Compensation Liability Act |
| CIC | Community Involvement Coordinator |
| DCE | Dichloroethane |
| EPA | Environmental Protection Agency |
| ESD | Explanation of Significant Difference |
| HWD | Hardware Distributors Inc. |
| LTRA | Long Term Remedial Action |
| MCL | Maximum Contaminant Level |
| MDNR | Michigan Department of Natural Resources |
| MDEQ | Michigan Department of Environmental Quality |
| mg/kg | Milligram Per Kilogram |
| MWQC | Michigan Water Quality Commission |
| NCP | National Contingency Plan |
| NPL | National Priorities List |
| O&M | Operation and Maintenance |
| ppb | Parts Per Billion |
| ppm | Parts Per Million |
| RA | Remedial Action |
| RD/RA | Remedial Design/Remedial Action |
| RI/FS | Remedial Investigation/Feasibility Study |
| ROD | Record of Decision |
| RPM | Remedial Project Manager |
| SRD | Substantive Requirements Document |
| SVE | Soil Vapor Extraction |
| TCE | Trichloroethylene |
| UST | Underground Storage Tank |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | Volatile Organic Chemical |

## Executive Summary

The remedy for the Peerless Plating Site in Muskegon. Michigan included four major components: 1)Demolition and disposal of the Peerless Plating building: 2) Air stripping and treatment of the volatile organic compounds in the groundwater followed by precipitation of inorganic compounds: 3) In-situ Vapor extraction of the organic compounds and stabilization of the inorganic compounds in the soil; 4) Institutional Controls. The trigger for the five year review was the actual start of construction in August 1997.

The assessment of this five-year review found that the remedy was constructed in accordance with the requirements of the Record of Decision (ROD). Two Explanation of Significant Difference (ESD) were issued, one in 1997 and one in 2001, to change soil cleanup standards and address treatment approaches for the soil. During the 1999 construction of the groundwater treatment system, previously unidentified soil contamination was discovered and found to be wide spread in the subsurface both vertically and horizontally, over a large portion of the site. It was also discovered that contaminated soils may also be present under an addition to the Hardware Distributor building directly adjacent to the site. Because of the difficulties and expense of excavating soil below the water table and underneath a building addition, contaminated soils that contained concentrations greater than the cleanup levels specified in the 1997 ESD were only excavated to the water table and/or left under the building addition. Deed restrictions are required because soil and groundwater contaminant concentrations remain on site and will exceed the cleanup criteria. The Peerless property will be limited to industrial/commercial use with no groundwater consumption or construction activities will be allowed that could potentially expose contaminated soils left in place.

The remedy is functioning as designed. The immediate threats have been addressed and the remedy is expected to be protective when groundwater cleanup goals are achieved through the pump and treat system, which is expected to require 10 years and institutional controls are put into place at the Peerless site as well as the adjacent Hardware Distributors. Inc. property.

# Five-Year Review Summary Form

| SITE IDENTIFICATION | | |
|---|---|---|
| **Site name *(from WasteLAN)*:** Peerless Plating | | |
| **EPA ID *(from WasteLAN)*:** *MID006031348* | | |
| **Region:** 5 | **State:** MI | **City/County:** Muskegon Township/Muskegon County |

| SITE STATUS | |
|---|---|
| **NPL status:** X Final □ Deleted □ Other (specify)_____ | |
| **Remediation status** (choose all that apply): Under Construction X Operating Complete | |
| **Multiple OUs?*** □ YES **X** NO | **Construction completion date:** 4/2002 |
| **Has site been put into reuse?** □ YES **X** NO | |

| REVIEW STATUS | |
|---|---|
| **Lead agency:** **X** EPA □ State □ Tribe □ Other Federal Agency _____ | |
| **Author name:** Linda Martin | |
| **Author title:** Remedial Project Manager | **Author affiliation:** U.S. EPA |
| **Review period:**** 04/2002 to 09/30/2002 | |
| **Date(s) of site inspection:** 07/25/2002 | |
| **Type of review:**<br>**X** Post-SARA □ Pre-SARA □ NPL-Removal only<br>□ Non-NPL Remedial Action Site □ NPL State/Tribe-lead<br>□ Regional Discretion | |
| **Review number: X** 1 (first) 2 (second) □ 3 (third) □ Other (specify) ▬▬▬ | |
| **Triggering action:**<br>Actual RA Onsite Construction_____ **X** Actual RA Start 04/1993<br>□ Construction Completion Previous Five-Year Review Report<br>□ Other (specify)_____ | |
| **Triggering action date *(from WasteLAN)*:** 08/01/1997 | |
| **Due date *(five years after triggering action date)*:** 09/30/2002 | |

* ["OU" refers to operable unit.]

** [Review period should correspond to the actual start and end dates of Five-Year Review in WasteLAN.]

## Five-Year Review Summary Form, cont'd.

**Issues:**

An erosion problem has been detected near the soil removal area at the Hardware Distributor property. This will be corrected under the Long Term Remedial Action contract.

Need for continual operation, maintenance and optimization of groundwater pump and treat system.

Institutional Controls need to implemented - Deed restrictions need to be added to the Site as well as the adjacent Hardware Distributor property to limit potential exposure to contaminates that remain in soils on site and under an addition that was built on Hardware Distributor building.

**Recommendations and Follow-up Actions:**

Develop and implement options to address the erosion problem near the soil removal area at the Hardware Distributor property.

Continue operating pump and treat system until cleanup goals have been met.

Write letters to the State and HWD property owners requesting the implementation of Institutional Controls.

**Protectiveness Statement(s):**

The remedy is protective of human health and the environment. There are no current exposure pathways and the remedy appears to be functioning as designed. The removal of the lagoon disposal areas and on site contaminated soils has achieved the remedial objectives to minimize the migration of contaminants to groundwater and prevent direct contact with or ingestion of contaminants.

**Long-term Protectiveness:**

The remaining component of the cleanup is groundwater containment and restoration by a pump and treat system. Operation and maintenance of the groundwater pump and treat system has, so far been effective. The groundwater pump and treat system is expected to be protective of human health and the environment upon attainment of groundwater cleanup goals within 10 years. Institutional controls on the properties will assure protectiveness from contaminated soils left on site below the water table and on an adjacent property under a building addition.

**Other Comments:**

None

# Five-Year Review Report

## I. Introduction

The purpose of five-year reviews is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The Agency is preparing this five-year review pursuant to CERCLA §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.*

The agency interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f)(4)(ii) 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 action no less often than every five years after the initiation of the selected remedial action.*

The United States Environmental Protection Agency (EPA) Region 5 has conducted a five-year review of the remedial actions implemented at the Peerless Plating Site, located in Muskegon County, Michigan. This review was conducted by the Remedial Project Manager (RPM) for the entire site from April 2002 to September 2002. This report documents the results of the review.

This is the first five-year review for the Peerless Plating Site. The triggering action for this statutory review is August 1997. This review is required because certain response actions are ongoing and hazardous substances, pollutants, or contaminants are or will be left on site above levels that allow for unlimited use and unrestricted exposure.

## II. Site Chronology

**Table 1: Chronology of Site Events**

| Event | Date |
|---|---|
| Initial discovery of problem or contamination | **12/01/1979** |
| State of Michigan Removal Action | **1979-1980** |
| NPL listing | **09/08/1983** |
| U.S. EPA Removal actions (removal of liquids, lagoon, soil, demolition and seal sewers) | **09/1983** |
| U.S. EPA Removal Action (remove additional liquids and sludges in underground storage tanks) | **03/13/1990** |
| Fund-lead Remedial Investigation/Feasibility Study complete | **06/1992** |
| ROD signature | **09/21/1992** |
| Actual Fund-Lead RA start | **4/1993** |
| Remedial Design complete | **05/1996** |
| On-Site Construction Start (soil excavation) | **08/1997** |
| Explanation of Significant Differences # l (to change soil cleanup levels) | **08/7/1997** |
| Explanation of Significant Differences #2 (Offsite treatment of soils and Institutional Controls) | **04/05/2001** |
| Final inspection of pump and treat system | **04/2002** |
| Construction completion date | **04/2002** |
| Site Inspection | **07/25/2002** |
| Next 5 year review | **09/30/2007** |

## III. Background

### Physical Characteristics

The Peerless Plating site is an abandoned electroplating facility located at 2554 Getty Avenue, Muskegon Township Muskegon, Michigan. The property covers approximately 1 acre in the southwest 1/4 of Section 33, T.10 N., R. 16 W Muskegon Township. The vicinity of the site is urban light industrial and residential. Lake Michigan supplies drinking water for residences and businesses within a three mile radius of the site. The site is located adjacent to Little Black Creek.

### Land and Resource Use

Electroplating operations were conducted at the Peerless Plating site from 1937 to 1983. The current land use of the surrounding area is light urban industrial and residential. In establishing cleanup requirements for the site, U.S. EPA considered the theoretical possibility of industrial development for the site. The site is fenced and contaminated soils were removed to 3 to 4 feet below the water table and back filled with clean fill.

The groundwater aquifer underlying the site occurs between 5 and 13 feet within lacustrine sands. Residents and businesses in the area receive their drinking water from Lake Michigan

### History of Contamination

Electroplating operations and processes conducted at Peerless Plating included copper, nickel, chromium, cadmium and zinc plating. Other associated activities such as burnishing, polishing, pickling, oiling, passivating, stress relieving, and dichromate dipping also occurred over the years of operation. Throughout the operations of the Site, waste was discharged to a seepage lagoon at the rear of the facility. While soil removal operations were conducted it was also discovered that a process pipe was not connected to anything and was discharging directly to groundwater.

Contaminates found in the soils included arsenic, antimony beryllium, cadmium chromium, nickel, and cyanide. Contaminates in the groundwater also included the same inorganics as well as acetone, benzene, 1,2, DCE, TCE

### Initial Response

In 1972, a Stipulation was signed by the Michigan Water Quality Commission (MWQC), requiring Peerless Plating to monitor its waste discharge daily and to establish a schedule for

installation of a treatment system to meet specific effluent guidelines. In 1975, the owner was issued a Notice of Noncompliance and Order to Comply. These indicated violations of all aspects of the 1972 Stipulation.

In 1976, the Stipulation was superseded when the MWQC issued a State permit to discharge, requiring Peerless Plating to meet reduced effluent limitations and to construct appropriate treatment facilities. Peerless Plating violated this permit by failing to meet effluent guidelines, by failing to construct appropriate treatment facilities, and by failing to maintain a daily sampling and analysis program.

A suit was filed by the Michigan Department of Natural Resources (MDNR) and the MWQC, enjoining Peerless from further discharge and requiring compliance with the MWQC permit

In 1976, MDNR reported high cyanide concentrations in Little Black Creek sediments adjacent to the seepage lagoons. A Water Quality and Biological survey of Little Bear Creek was conducted in 1977 by the MDNR water quality division. Extremely high concentrations of heavy metals in stream sediments and surface water were attributed to seepage from the waste disposal lagoons on the Peerless property.

In 1978, a hydro geologic study was conducted by MDNR to define the extent of groundwater and surface water contamination. This study resulted in the installation of 7 monitoring wells. Cadmium and cyanide were detected in groundwater samples taken from the wells. In 1980, the seepage lagoon sludges were removed and disposed of and the excavated lagoon area was backfilled and capped.

In 1982, the MDNR Water Quality Division conducted a second study of sediment, surface water, and biota in Little Bear Creek in the vicinity of Peerless Plating. The resampling was conducted to determine if the removal of contaminated sediments was necessary. Cadmium concentrations in both water and sediments remained high, although substantial reductions occurred since 1977. However, cadmium in sediments near the site were not markedly different from concentrations upstream or downstream. Leaching of plating waste contaminates from the seepage lagoons was concluded to be greatly reduced. Improvement in stream quality was indicated by the increased number of general biota categories. Sediment removal from Little Black Creek was not recommended because upstream sources and urban runoff continued as significant heavy metal sources, and sediment removal would eliminate most available animal habitat.

In 1983, the MDNR conducted an investigation into the operating practices at the site and sampled materials in and around the plant. The MDNR found that treatment facilities still had not been upgraded and discharge limitations were still being exceeded for chromium, cyanide, cadmium, and zinc. The MDNR determined that manholes inside the plant did not connect to the sanitary sewer or plant treatment systems, so wastes were discharged directly to the ground under the building.

In 1983, The MDNR and the Michigan Attorney General again filed a suit against Peerless for failure to meet county ordinances discharge limitations.

In June 1983, Peerless Plating closed as a result of regulatory actions, labor problems, and financial difficulties. The owner declared bankruptcy. The plant was abandoned and the plating solutions, raw materials and drummed wastes were left throughout the building.

State Agencies contacted the U.S. EPA Region V Spill Response section requesting that the site be considered for emergency action under CERCLA. In the fall 1983, a Site Assessment was conducted and the U.S. EPA determined the Peerless Plating facility was an immediate threat to human health and the environment.

From September 6 until October 7, 1983, the U.S. EPA carried out an Emergency Response Action at the site. The objectives of the emergency response action included the removal and disposal of hazardous waste and decontamination of the facility. This action resulted in the removal of 37,000 gallons of hazardous liquids including sulfuric acid, nitric acid, hydrochloric acid, chromic acid, cyanide plating solution, chromium plating solutions and trichloroethylene. Lagoons were drained, soil was removed from the lagoons area, soils and sludges were removed from the building interior vats, lines, tanks, sumps, floorboards and walls were decontaminated. Sewer lines were sealed, virgin and proprietary chemicals were removed and on site neutralization of cyanides and nitric acid occurred.

In 1984, the U.S. EPA conducted a Preliminary Assessment (PA) and reported that groundwater was contaminated with trichloroethylene (TCE), perchloroethane (PCE) and Chloroform, and that surface water and sediment in Little Bear Creek were contaminated with heavy metals. The building structure was reported to be unsound and site access restriction was inadequate. Recommendations included performing a site inspection to confirm whether all on site liquids and containers had been removed during the 1983 emergency response action and to assess groundwater, soil and surface water contamination.

A Site Inspection was conducted in 1985 to further determine the extent of contamination. A hydrogeolgic study was conducted also in 1985 to further determine the extent of groundwater contamination. Results indicated contamination of groundwater by heavy metals and volatile organics associated with activities at a plating operation.

In June 1988, the Peerless Plating site was proposed to the National Priority List. From 1990 through 1992, a Remedial Investigation/feasibility Study (RI/FS) was conducted to determine the nature and extent of contamination at the site. Based on these findings, a Record of Decision was issued for the site in September 1992.

**Basis for Taking Action**

**Contaminants**
Hazardous substances that have been released at the site in each media include:

| **Soil** | **Groundwater** |
|---|---|
| arsenic | arsenic |
| antimony | cadmium |
| cadmium | Chromium |
| chromium | copper |
| copper | Nickel |
| lead | Cyanide |
| nickel | Acetone |
| cyanide | Benzene |
| benzene | Trichloroethane |
| 1,1 Dichloroethane | Vinyl chloride |
| ethylbenzene | |
| Tetrachloroethene | |
| toluene | |
| vinyl chloride | |
| xylene | |

Exposure to soil and groundwater are associated with significant human health risks due to exceedances of EPA's risk management criteria for the reasonable maximum exposure scenarios. The carcinogenic risks were highest for exposure to contaminated soil and groundwater exceeded the acceptable risk range of 1 X10-4 to 1 X 10-6.

## IV. Remedial Actions

**Record of Decision**

On September 21, 1992, U.S. EPA issued a Record of Decision (ROD) that called for the following actions:

- Demolition and disposal of the Peerless Plating Building in order to facilitate additional soil sampling underneath the building and around the perimeter during the remedial design phase.

- Air stripping and treatment of the volatile organic compounds in the groundwater, followed by precipitation of inorganic compounds. The treated groundwater will be discharged into Little Black Creek.

– In-situ Vapor Extraction for the organic compounds and stabilization of inorganic compounds in the soil. The treated soil will be disposed of off site.

The selected remedy would use permanent treatment systems to eliminate the principal threat posed to human health and the environment by removing contaminated soils and the source of further groundwater contamination in the subsurface soil. The selected remedy would also eliminate a principal threat by extracting and treating the groundwater contaminant plume.

The Record of Decision established groundwater cleanup standards based on Safe Drinking Water Act Maximum Contaminant Levels (MCLs), risk-based levels, and State of Michigan criteria for protection of groundwater quality. Two ESDs were issued following the approval of the ROD that changed the soil cleanup standards at the site and required the use of institutional controls because some contaminated soils would be left on site as well as on adjacent property under a building addition.

The first ESD issued in 1997 was based on the collection of site specific data that had not been collected previously. The cleanup standards in the ROD were based on background concentrations from a single sample collected at another Superfund site. Also, the State of Michigan promulgated new cleanup standards for land use-based remediation. Using this information, new soil cleanup standards were generated.

A second ESD was issued in 2001. This was issued to allow for contaminated soils to remain on site above the cleanup levels because the ROD indicated that all contaminated soils would be excavated and stabilized on site to allow for unrestricted site use. This ESD also allowed for excavation of contaminated soils within 2 feet of Little Black Creek. This would maintain the integrity of the stream bank and reduce any impact to the Creek. The ESD required that deed restrictions be placed on the property because contaminated soils were being left on site as well as on adjacent property.

## Remedial Action

### Remedy Selection/Remedy Implementation

A ROD was signed for the site on September 21, 1992. The Remedial Action objectives were developed as a result of the data collected during the RI and post ROD design phase. Activities at the site included multiple removal activities to eliminate the source of contamination from the site and to contain and remediate the contaminated groundwater. These included:

Soil remediation construction activities There were three phases of soil remediation construction activities. Phase 1 occurred from August 1977 until January 1999 and included SVE treatment; soil excavation, treatment, and disposal; and removal of an underground storage tank (UST) on site. Phase 2 took place from December 1999 through October 2000 and included additional soil excavation , treatment and disposal off site and to the east of the site. Phase 3 lasted from October 2000 to February 2001 and included off-site soil excavation, treatment and disposal of

soils on the Hardware Distributors and Asphalt paving properties. A total of 16, 404 tons of soil was treated and disposed off site during this action.

During soil excavation activities it was determined that soil exceeding the cleanup standards 2 feet below the groundwater table would not be excavated and would be left in place. Phase 1 excavation activities required that some areas on site be left above cleanup standards. Confirmatory sampling during this phase showed that levels of cadmium and TCE were detected at concentrations greater than their cleanup standards.

All confirmatory samples collected during Phase 2 and Phase 3 were below cleanup standards. However, soils were only removed up to the building on the Hardware Distributor property, and it is assumed that an addition to this building is built over contaminated soils.

Groundwater remediation construction activities. Groundwater remediation construction activities were conducted from November 1999 through April 2002. This involved constructing a groundwater extraction and treatment systems and conducting performance testing. A Pre-final inspection was conducted on February 10, 2001, and determined that the contractors did construct the remedy in accordance with the remedial design plans and specifications.

The groundwater pumping (extraction) system includes six wells. These wells are six inches in diameter and have approximately five feet of screen, extending from approximately 55 to 60 feet. Following treatment groundwater is discharged into Little Black Creek.

The site achieved construction completion status when the Preliminary Closeout Report was signed in April 2001.

EPA and the State have determined that all RA construction activities were performed according to specifications. It is expected that cleanup levels for the groundwater contaminants will have been reached within approximately ten years. After groundwater cleanup levels have been met, EPA will issue a Final Close Out Report.

Two ESDs were signed on August 7, 1997, and April 5, 2001. The 1997 ESD established site appropriate cleanup goals for the soil on-site. The 2001 ESD addressed off site stabilization of soils instead of on-site stabilization of soils as indicated in the ROD and included the need for the addition of institutional controls (Deed restrictions) because soils and groundwater concentrations remain on site and exceed cleanup criteria.

Cleanup goals for the site are:

**TABLE 2**

| Contaminant of Concern | Groundwater (ug/l) | Soil (mg/kg) |
|---|---|---|
| Arsenic | 0.2 | 10.7 |

| | | |
|---|---|---|
| Cadmium | 4.0 | 210 |
| Aluminum | 50 | No criteria |
| Antimony | 30 | 150 |
| Barium | 2,000 | 30,000 |
| Chromium III | 7,000 | 69,000 |
| Chromium VI | 2.0 | 180 |
| Lead | 5.0 | 400 |
| Mercury | 2.0 | 130 |
| Nickel | 57 | 960 |
| Silver | 0.1 | 350 |
| Thallium | 0.5 | 28 |
| Cyanide | 4.0 | 9,300 |
| Benzene | 1.0 | 78 |
| 1,1 Dichloroethane | 700 | 13,000 |
| Chloroform | 6.0 | 270 |
| Trichloroethylene (TCE) | 3.0 | 160 |
| Vinyl Chloride | 0.2 | 1.2 |
| 1,2 Dichloroethane | 0.4 | 25 |
| Ethylbenzene | 30 | 6,700 |
| Toluene | 100 | 11,000 |
| 1,1,1 -Trichloroethane | 117 | 3,100 |
| Xylenes | 59 | 130,000 |

## System Operation/Operation and Maintenance

### System Operation and Maintenance (O&M)

O&M activities are being conducted for the groundwater pump and treat system and long-term groundwater monitoring for the Peerless site. O&M activities began in June 2002 following system

acceptance from the construction contractor. The primary activities associated with O&M at the Peerless Plating site include:

- Operation of the treatment plant 24 hours per day, seven days per week while treating water from all active extraction wells
- Inspection and maintenance of all groundwater extraction and monitoring wells
- Inspection, maintenance, and operation of the groundwater treatment system
- Weekly and monthly monitoring of groundwater treatment system influent and effluent to ensure compliance with the Substantive Requirements Document (SRD) No. MIU990007 issued by the MDEQ.
- Semiannual monitoring of groundwater
- Monthly reporting of treatment system monitoring

The groundwater treatment system has been operating from early June 2002. Performance testing of the groundwater treatment system was conducted from June through August 2001. Due to the subcontractor's difficulty in consistently achieving the discharge limit for cadmium, a request was submitted to MDEQ to review and modify the SRD effluent limitations to include the most recent discharge permitting guidelines. In January 2002, MDEQ issued a revised SRD that increased the cadmium discharge limit from a monthly average of 0.72 microgram per liter (ug/L) to 12 ug/L and increased discharge limits for other metals as well. Additional performance testing was conducted to demonstrate the groundwater treatment system's ability to meet the revised cadmium permit limit. Performance testing was completed in March 2002 and the final inspection was conducted in April 2002.

Although the system has been operating for a short period of time, some potential cost saving areas have been identified to decrease O&M costs in the future. First, the concentrations of VOCs either are not detected or are detected at very low concentrations well within the SRD discharge limitations in the influent to the treatment system. Based on the first month of full-time treatment and treatment system performance testing, the system can be operated without the air stripper and groundwater can be bypassed directly to the metals precipitation units. Second, the system requires filter cartridges instead of bag filters for filtration. The cartridge filters are expensive and the bag filters have a very short service life. As a result, the filtration system should be reviewed to identify alternate solutions, such as larger pore size cartridge filters or other means, to reduce filtration costs.

Because the system has only been in operation for two months, reliable O&M costs are not available. The estimated annual O&M costs as generated from two months worth of operations are provided in Attachment 5.

## V. Progress Since the Last Review

This is the first Five Year Review.

## VI. Five-Year Review Process

### Administrative Components

MDEQ was notified of the initiation of the five-year review in May 2002. The five year review team was led by Linda Martin of EPA and included George Carpenter with MDEQ.

From May 2002 to September 31, 2002, the RPM established the review schedule. Its components included:
* Community Notification
* Document Review
* Data Review
* Site Inspections
* Five-Year Review Report Development and Review.

### Community Involvement

Activities to involve the community in the five-year review were initiated with a meeting in early 2002 between the RPM and the Community Involvement Coordinator (CIC) for the Peerless Plating Superfund Site. A notice was sent to one local newspaper that a Five-Year Review was to be conducted. The notice was published on August 22, 2002 and invited the public to provide input to EPA. The results of the review and the report were made available at the Norton Shores Branch Library in the Peerless Plating Superfund site information repository.

Since the notice and press release were issued, no member of the community voiced any interest or opinion concerning the five-year review process.

### Document Review

This five-year review consisted of a review of relevant documents (See Attachment 2). Applicable soil and groundwater cleanup standards, as listed in the ROD and ESDs were also reviewed (See Table 2).

### Data Review

Six rounds of groundwater sampling were conducted following the soil remediation and before the startup of the groundwater treatment system. Dates of groundwater sampling are presented below.

| ROUND | Sampling Dates |
|---|---|
| Round 1 | February 4-5, 1999 |

| | |
|---|---|
| Round 2 | July 15-16, 1999 |
| Round 3 | September 29-30,1999 |
| Round 4 | December 16-17, 1999 |
| Round 5 | October 5-6, 2000 |
| Round 6 | February 13-14, 2001 |

Attachment 4 includes the sampling results from each of the rounds along with a well location map. Indicator chemicals of known contaminants at the site and that are suspected to be the primary chemicals in plating solutions and solvents released to the environment at the site were identified. These chemical include cadmium, nickel, zinc, cyanide and trichloroethylene (TCE). The results are discussed below for each of the monitoring wells and monitoring wells clusters: WT02A/PZ02B, WT04A/PZ04B, M14013, M14014/M14015, PZ05A/PZ05B/PZ05C, and PZ06A/PZ06B/PZ06C.

The WT02A/PZ02B monitoring well cluster is located on the northwest portion of the Peerless site on the Peerless property. The cluster is down gradient of the former Peerless building. Indicator chemicals were present at elevated levels in the shallow, water table well (WT02A). Concentrations appear to have decreased in general over the sampling periods.

The WT04A/PZ04B monitoring well cluster was located on the northeast portion of the Peerless site on the Peerless Property. The cluster is in the location of the former lagoons at the Peerless site. Indicator chemicals are present at elevated levels in the shallow water table well (WT04A). Concentration do not appear to have decreased over the time period of sampling.

The M104013 monitoring well is located on the south-central portion of the Peerless site on the Peerless property. The well is a shallow water table well down gradient of the former lagoons. All indicator parameters are present at concentrations exceeding cleanup standards. Levels were constant through out the sampling events until round 6. The decrease in this well could most likely be due to soil removal during phase 2 of the soil remediation.

The M14014/M14105 monitoring well cluster is located on the southeast portion of the Peerless site on the property. The cluster is down gradient of the former lagoons at the Peerless site. The monitoring results show that all indicator inorganic parameters are present at concentrations exceeding cleanup standards in the shallow well (M14014). Some of the contaminates have decreased over the sampling time however, zinc, cyanide, and TCE concentrations have remained constant.

The PZ05A/PZ05B/PZ05C monitoring well cluster is located on the Hardware Distributor property south of the Peerless site. All indicator parameters except cyanide are present in

Monitoring well PZ05A at concentrations exceeding cleanup standards. These levels do not appear to be decreasing over the sampling period. Well PZ05B contains cadmium that is above clean up levels and has not decreased over time. However, in the deep well (PZ05C) concentrations of parameter compounds are below cleanup standards.

The PZ06A/PZ06B/PZ06C monitoring well cluster is located on the Asphalt Paving property south of the peerless site. This well cluster is down gradient of the Peerless site and across Little Black Creek. No indicator chemicals have been detected at concentration greater than cleanup standards during baseline groundwater monitoring.

Groundwater monitoring will continue on a semi-annual basis during operation and maintenance of the site.

**Site Inspection**

A Site Inspection was conducted at the site on July 25, 2002. The site inspection was conducted by Linda Martin of EPA. Also present were George Carpenter of MDEQ, Eduardo Gasca of Tetra Tech Inc., and Timothy Fish, Tetra Tech CRI, treatment system operator. At the time of the inspection the treatment system was operational and running. One of the pumping wells was down due to a pump malfunction however, capture of the groundwater appeared to be consistent. An area on the Hardware Distributors property was observed to have an erosion problem near a concrete pad that was installed after soil removal operations. It was determined that this problem would be addressed under the Long Term Remedial Action Contract once operation of the pump and treat system was switched over.

## VII. Technical Assessment

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

The review of documents, ARARs, risk assumptions and the results of the site inspection indicates that the remedy is functioning as intended by the ROD, as modified by two ESDs.

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

There have been no changes in the physical conditions of the site that would affect the protectiveness of the remedy.

Changes in Standards

As the remedial work has been completed, most ARARs for soil contamination cited in the ROD

and/or amended by ESDs have been met. The removal of contaminated soils to the water table has achieved the remedial objective to minimize the contamination to groundwater and prevent direct contact with soil. A list of ARARs are included in Attachment 3.

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

No new information came to light that could call into question the protectiveness of the remedy. No weather-related events have affected the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

**Technical Assessment Summary**

There have been no changes in the physical conditions of the site that would effect the protectiveness of the remedy. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy.

## VIII. Issues

**Table 3: Issues**

| Issues | Affects Current Protectiveness (Y/N) | Affects Future Protectiveness (Y/N) |
|---|---|---|
| Evidence of incomplete groundwater plume capture | N | N |
| Optimization of the groundwater extraction system | N | Y |
| Trespassing | N | N |
| Deed restrictions | N | Y |
| Erosion problem on HWD property | N | Y |

## IX. Recommendations and Follow-up Actions

| Issue | Recommendations/ Followup actions | Party Responsible | Oversite Agency | Milestone Date | Affects Protectiveness (Y/N) |
|---|---|---|---|---|---|
| Erosion | Correct under LTRA | USEPA | USEPA/ State | Spring 2003 | Current N Future Y |
| Pump and Treat O&M | Continue operating pump and treat system until cleanup goals have been met.<br><br>Continue to identify and implement opportunities to optimize operation of the groundwater system | EPA/State | EPA/ State | Until Cleanup goals are met | Current N Future N |
| Deed Restrictions | letter to State and HWD property owners | State/HWD property owner | EPA/ State | Spring 2003 | Current N Future Y |

## X. Protectiveness Statement

The remedy is protective of human health and the environment in the short term. There are no current exposure pathways and the remedy appears to be functioning as designed. The removal of onsite contaminated soils has achieved the remedial objective to minimize the migration of contaminates to the groundwater and prevent direct contact with and ingestion of, contaminants in the soil.

Long-term protectiveness will be achieved when groundwater cleanup goals are met. Operation and maintenance of the groundwater pump and treat system has been effective so far. Monitoring of the system began in August 2002.

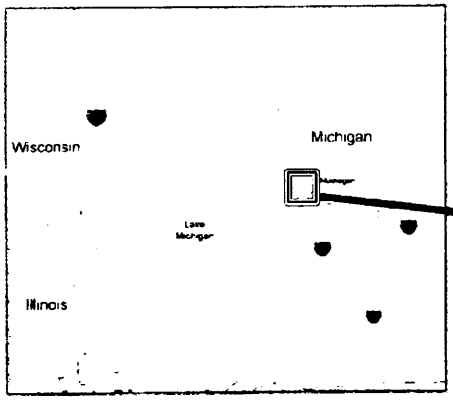
## XI. Next Review

The next five-year review for the Peerless Plating Site is required by September 2007, five years from the date of this review.

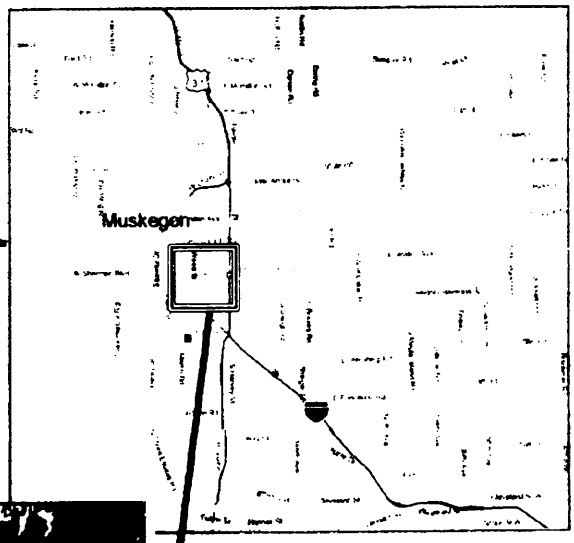
**Attachment 1**

# Peerless Plating Co. Superfund Site
# Muskegon County, Michigan

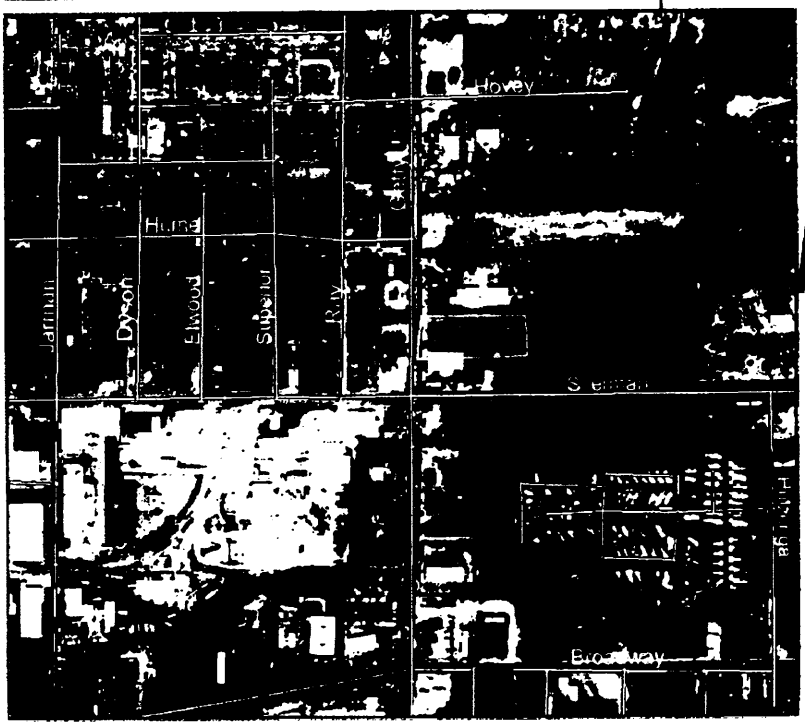
1) State




2) City of Muskegon




3) Peerless Plating Co. Superfund Site



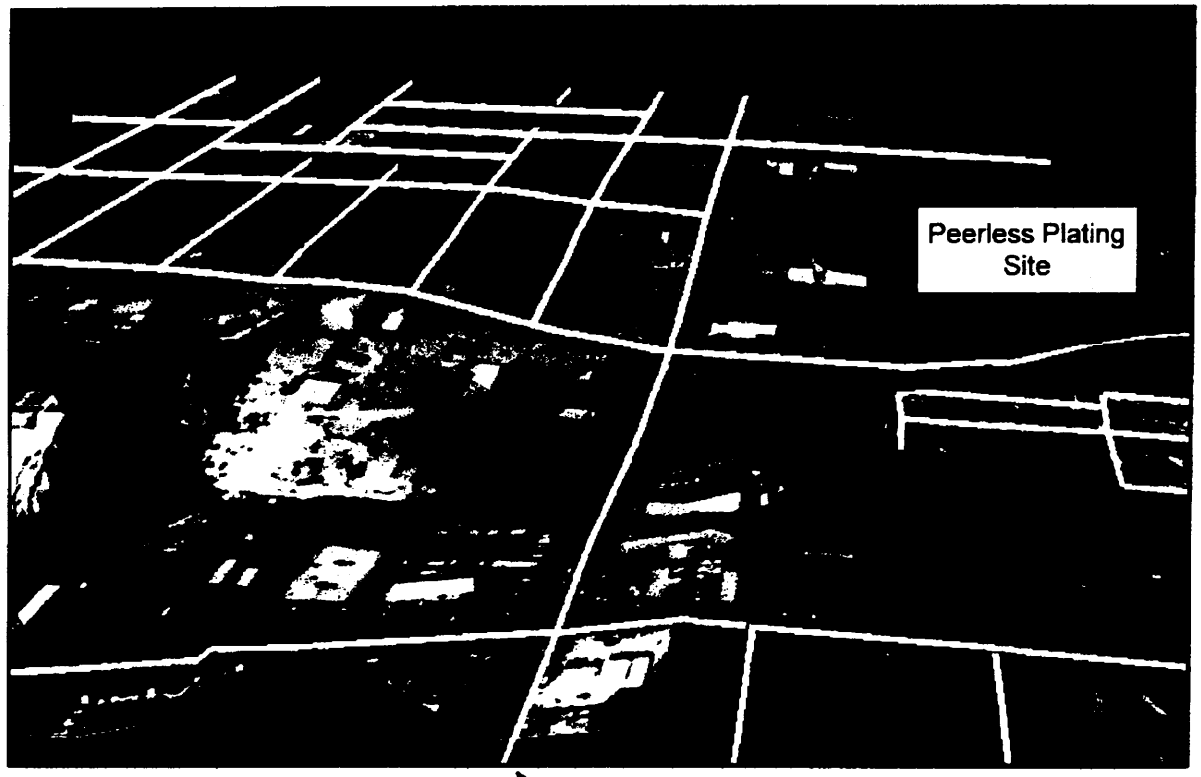

N

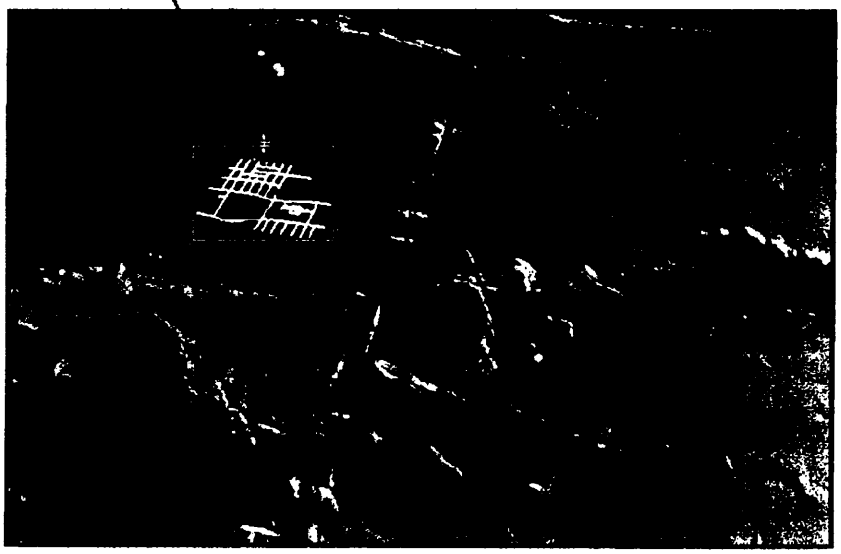
Plot created by Dave Wilson U.S. EPA Region 5 on 9-12-2002
B&W image Date 5/4/1997

Figure 1

EPA Region

# Peerless Plating Superfund Site
# 3D Surface Terrain Model



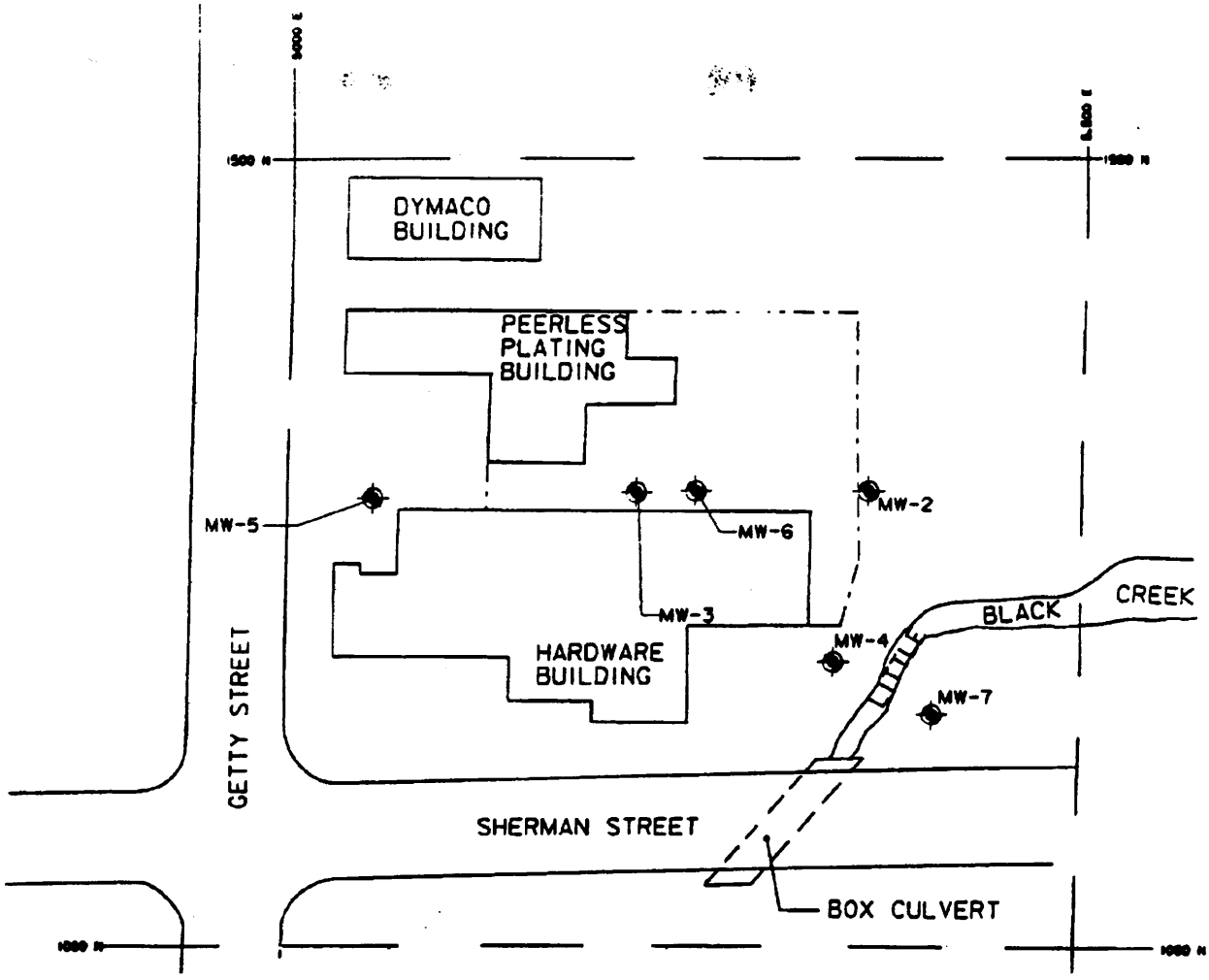
Elevation Feet
660 - 671
650 - 660
640 - 650
630 - 640
620 - 630
610 - 620
600 - 610
580 - 600
580

N

Plot created by David Wilson U.S. EPA Region 5 on 8/17/2004
B&W image Date 5/4/1997

SEPA Region 5

Figure 2




MAY 1991

# FIGURE 1-2
## MEINERT STUDY WELL LOCATIONS
## PEERLESS PLATING SUPERFUND SITE
MUSKEGON, MICHIGAN

20023.070

Donohue ENGINEERS ARCHITECTS SCIENTISTS

Attachment 2

Documents Reviewed

Peerless Plating Record of Decision - September 21, 1992
Explanation of Significant Difference - August 7, 1997
Explanation of Significant Difference - April 5, 2001
Groundwater Treatment System Performance Test Technical Memorandum -April 2002
Superfund Preliminary Closeout Report for Peerless Plating - April 2001
Baseline Groundwater Monitoring Report Peerless Plating - May 31, 2001
Final Inspection Report Peerless Plating - May 6, 2002
Groundwater Capture Zone Evaluation Technical Memorandum - July 29, 2002
Remedial Action Report Draft Report Peerless Plating - September 2002
Final Remedial Action Investigation Report - September 1991
Attachment 5

**ATTACHMENT 3**

B) Compliance with ARARs

The selected remedy shall comply with Federal or more stringent State applicable or relevant and appropriate requirements (ARARs) listed below:

1) Chemical-Specific ARARs

Chemical-specific ARARs regulate the release to the environment of specific substances having certain chemical characteristics. Chemical-specific ARARs typically determine the extent of cleanup at a site.

a) Groundwater

Federal ARARs

At the Peerless Plating site, MCLs and MCLGs are not applicable because the site is not a municipal water supply servicing 25 or more people. MCLs are relevant and appropriate since the aquifer in the area of contamination is suitable for use as a source of drinking water in the future. MCLGs are also relevant and appropriate when the standard is set at a level greater than zero (for non-carcinogens). The point of compliance for groundwater cleanup purposes shall be throughout the contaminated groundwater plume.

State ARARs

The U.S. EPA has determined that Rules 705(2) and (3), 707 - 715, 717(2), 719(1), and 723 of the Michigan Environmental Response Regulations are relevant and appropriate to the Peerless Plating site in compliance with Section 121(d)(2) of CERCLA. The cleanup standards presented in Table 7, which shall be attained by the selected remedy, were calculated pursuant to Act 307 Type B criteria.

b) Surface Water

Federal ARARs

Surface water quality standards for the protection of human health and aquatic life were developed under Section 304 of the Clean Water Act (CWA). The Federal Ambient Water Quality Criteria (AWQC) are non-enforceable guidelines that set pollutant concentration limits to protect surface waters.

Pursuant to Section 121 (d) of CERCLA, the Federal AWQC may be relevant and appropriate under the circumstances or a release or threatened release, depending on the designated or potential uses of the surface water, the environmental media affected by the releases or potential releases, and the latest information available. Since the treated groundwater will be discharged to Little Black Creek, designated as a coldwater fishery, the AWQC for protection of freshwater aquatic organisms are relevant and appropriate.

State ARARs

Part 4 of the Water Resources Commission Act (Act 245) establishes rules for water quality standards for surface water in the State of Michigan based on the Federal AWQC. The substantive requirements of Part 4 are applicable to Little Black Creek.

2) Location-Specific ARARs

Location-specific ARARs are those requirements that relate to the geographical position of a site.

Federal ARARs

Executive order 11988 and 40 CFR Section 264.18, Protection of Flood Plains, are relevant and appropriate for this site. The Order and regulation requires that the groundwater treatment system be located above the 100-year flood plain elevation and be protected from erosional damage. Any portion of the remedy that is constructed in the 100-year flood plain must be adequately protected against a 100-year flood event (e.g., geotextiles should be used to secure topsoil, etc.)

Section 404 of the CWA regulates the discharge of dredged or fill material to waters of the United States. Construction of a surface water discharge point may be regulated under Section 404 of the CWA; therefore, the substantive requirements of Section 404 are applicable to the remedial action at the site.

State ARARs

The Inland Lakes and Streams Act (Act 346) regulates inland lakes and streams in the State. Act 346 would be applicable to any dredging or filling activity on Little Black Creek bottomlands.

The Soil Erosion and Sedimentation Control Act (Act 347) regulates earth changes which involves more than 1 acre or is within 500 feet of a lake or stream. Act 347 would be applicable to the soil excavation activities as the site is within 500 feet of Little Black Creek. Appropriate erosion and sedimentation control measures shall be planned.

3) Action-Specific ARARs

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances.

Federal ARARs

RCRA Subtitle C requirements regulate the treatment, storage, and disposal of hazardous waste. Because the inorganic contaminants in the soils and sludges are from a listed waste, RCRA Subtitle C requirements are applicable to the treatment, storage, or disposal of these soils and sludges. In addition, the groundwater contains organic contaminants. If, due to the filtering of the organic contaminants in the air stripping and ISVE processes, the spent carbon contains organic contaminants exceeding RCRA toxicity characteristic levels, RCRA Subtitle C requirements are applicable to the treatment or disposal of this material.

RCRA Land Disposal Restrictions (LDRs), 40 CFR Part 268, place restrictions on the land disposal of RCRA hazardous waste. LDRs are applicable to the storage/disposal of the stabilized soil, inorganic sludges from the groundwater precipitation, and possibly the building debris, which are to be disposed at an off-site RCRA Subtitle C facility. The soil, which is contaminated with inorganic contaminants from listed waste (electroplating wastes - F006, F007, F008, and F009), shall comply with LDRs through a treatability variance to the extent that such soils can not be treated to meet the LDR treatment standards. A treatablilty variance is justified because the LDR treatment standards are based on treating less complex matrices of industrial process wastes, as provided for under 40 CFR Section 268.44. The stabilized soil shall be tested to ensure that alternate treatment standards are met prior to disposal at a RCRA subtitle C facility. The inorganic sludges, which are contaminants from listed waste, shall be treated to meet LDR treatment standards prior to disposal at a RCRA Subtitle C facility. The building debris shall be tested to determine if it is contaminated with a listed waste or

is characteristic. If it is determined to be a hazardous waste, it shall be handled as a hazardous waste and shall comply with LDRs through a treatability variance for the debris that can not be treated to meet the LDR treatment standards, as provided for under 40 CFR Section 268.44. The treated debris shall meet alternate treatment standards prior to disposal at a RCRA Subtitle C facility.

RCRA, Guideline for the Land Disposal of Solid Wastes, 40 CFR Part 241 is applicable to the disposal of the building debris, if it is determined not to be a hazardous waste through TCLP tests.

The following RCRA requirements are also ARARs:

40 CFR Part 260 - Hazardous Waste Management System: General;

40 CFR Part 261 - Identification and Listing of Hazardous Waste;

40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste; and,

40 CFR Part 264 - Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal (TDS) Facilities.

The Clean Water Act Section 402 is applicable to the remedial action at this site. The National Pollution Discharge Elimination System (NPDES) program is the national program for issuing, monitoring, and enforcing permits for direct discharges to surface water bodies. The NPDES program is implemented under 40 CFR Parts 122 - 125. The discharge of treated groundwater to Little Black Creek shall comply with the substantive requirements of the NPDES program.

The Clean Air Act protects and enhances the quality of the nation’s air resources by regulating emissions into the air. Pursuant to Section 109 of the Clean Air Act, National Ambient Air Quality Standards have been promulgated in 40 CFR Part 50. These requirements include standards for particulate matter equal or less than 10 microns which is relevant and appropriate to the excavation of the soils at Peerless Plating.

RCRA Subpart AA restablishes air emission standards for process vents in 40 CFR Section 264.1030 - 264.1036. These requirements limit organic emissions and are applicable to the air stripping process.

State ARARs

The State of Michigan administers RCRA within the State. Under the Hazardous Waste Management Act (Act 64), the State regulates the generation, transport, treatment, storage, and disposal of hazardous waste. As with RCRA Subtitle C, above, Act 64 is applicable at the site.

The Michigan Solid Waste Management Act (Act 641) regulates the disposal of non-hazardous solid waste. Act 641 is applicable to the removal and disposal of non-hazardous treatment residue and non-hazardous debris from the site.

Parts 4, 9, and 21 of the Water Resources Commission Act (Act 245) establishes rules for water quality and administers discharge standards as promulgated by the Federal NPDES program. These parts are applicable to discharges of treated groundwater to Little Black Creek. Because the discharge shall occur on-site, a permit is not required, but the discharge must meet the substantive requirements of an NPDES permit.

Michigan's Air Pollution Control Act (Act 348) regulates air quality and is relevant and appropriate at the site.

The Michigan Environmental Response Act (Act 307) provides for the identification, risk assessment, and evaluation of contaminated sites within the State. The U.S. EPA has determined that Rules 705(2) and (3), 707 - 715, 717(2), 719(1), and 723 are applicable to the Peerless Plating site in compliance with section 121(d)(2) of CERCLA. The Act 307 rules require that remedial actions shall be protective of human health, safety, the environment, and the natural resources of the State. To achieve this standard of protectiveness, the Act 307 rules require that a remedial action achieve a degree of cleanup under either Type A (cleanup to background levels), Type B (cleanup to risk-based levels), or Type C (cleanup to risk-based levels under site-specific considerations) criteria. U.S. EPA has determined that the Type B criteria are necessary to be protective and are, therefore, applicable to the Peerless Plating site.

4) To Be Considered

In implementing the selected remedy, U.S. EPA considers the CERCLA Off-Site Policy. This directive, which is not legally binding, establishes CERCLA's policy for off-site

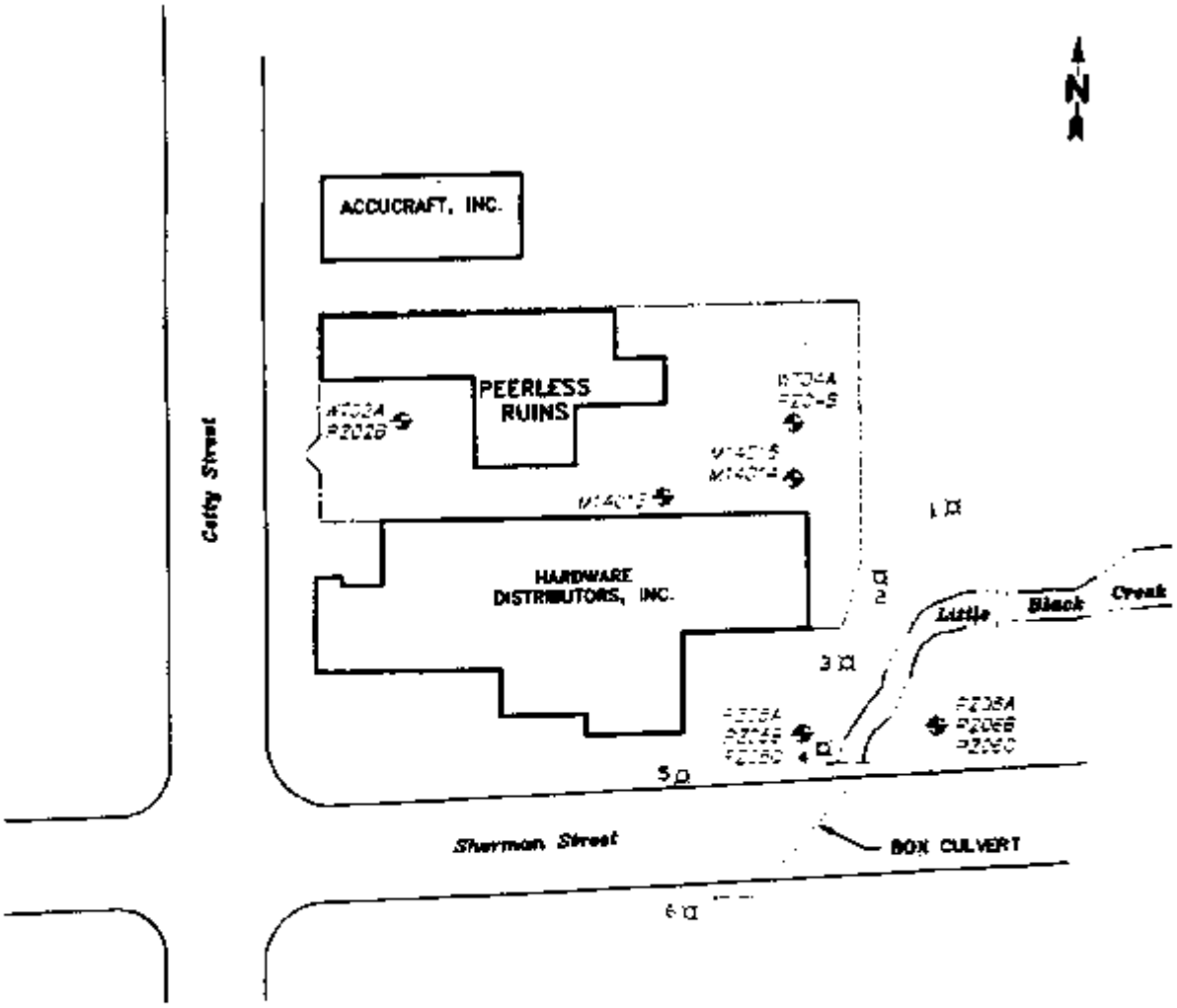
legally binding, establishes CERCLA's policy for off-site disposal of CERCLA-related wastes. U.S. EPA will follow the CERCLA Off-Site Policy.

The promulgating notice for process vents (40 CFR Part 264 Subpart AA, 55 FR 25454 - June 20, 1990) states that appropriate controls should be applied to in-situ treatment if necessary. Therefore, the emission standards of RCRA Subpart AA are to be considered for the emissions resulting from the ISVE process.

**Attachment 4**

**FIGURE 1**

**GROUNDWATER MONITORING WELL LOCATIONS**



## TABLE 1 BASELINE GROUNDWATER MONITORING RESULTS FOR WT02A

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Dec-99 | Oct-00 | Feb-01 |
|---|---|---|---|---|---|---|---|
| Aluminum | 50 | 60.8 J | 89.5 J | 25.0 | 23.8 J | 28.6 | 98.4 |
| Antimony | 3 | 5.0 U | 3.0 UJ | 2.1 UJ | 2 U | 2.5 U | 2.5 U |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3 U | 3.4 U | 4.2 U |
| Barium | 2000 | 23.5 | 13.8 | 36.4 | 19.2 | 17.4 | 15.6 |
| Beryllium | | 1 U | 0.40 U | 0.20 J | 1 U | 0.21 J | 0.17 J |
| Cadmium | 4 | 132 | 1,100 J | 196 | 167 | 121 | 93.5 |
| Calcium | | 72900 | 53,100 J | 75700 | 71700 | 59600 | 48800 |
| Chromium | 7000 | 5 U | 2.5 | 16.8 | 4 J | 5.4 J | 4.4 |
| Cobalt | | 3 U | 2.2 U | 2.6 J | 1 U | 0.76 | 4.5 |
| Copper | | 63.5 | 3.0 | 224 | 118 | 116 | 76.0 |
| Iron | | 51.5 | 127 J | 245 | 62 J | 18.4 J | 53.9 J |
| Lead | 5 | 1 J | 1.7 U | 1.5 J | 2 U | 2.1 U | 1.7 U |
| Magnesium | | 14500 | 17,800 J | 14000 | 13800 | 11400 | 9400 J |
| Manganese | | 34.4 | 304 J | 124 | 73.5 | 37.3 | 19.9 J |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.26 J | 0.10 U | 0.10 U |
| Nickel | 37 | 35.2 | 113 J | 71.7 J | 57.8 | 43.2 | 27.0 |
| Potassium | | 6030 | 2,520 | 5980 | 5370 J | 5780 | 3700 |
| Selenium | | 2.3 J | 2.3 U | 2.7 | 3 U | 4.3 U | 4.8 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 1 U | 0.40 U | 0.50 U |
| Sodium | | 134000 | 48,700 J | 116000 J | 134000 J | 95400 | 66000 |
| Thallium | 0.5 | 1 U | 3.4 | 2.1 U | 4 U | 5.7 U | 6.2 U |
| Vanadium | | 3 U | 1.4 U | 5.2 | 1.7 | 2.7 | 1.8 |
| Zinc | | 1010 | 766 J | 1710 | 1470 | 1030 | 782 |
| Cyanide | 4 | 39.9 | 83.8 J | 196 J | 50.2 | 20.3 | 13.3 |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 10 U | 2 J | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 U | 10 UJ | 10 U | 10 U |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| Acetone | | 10 U | 10 UJ | 11 | 10 U | 120 | 10 J |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| Methyl Acetate | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | | 20 J | 10 U | 10 U | 10 U | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 UJ | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 18 | 10 | 10 U | 5 J | 6 J |
| Methylcyclohexane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 2 J | 10 U | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UJ |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| Isopropylbenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| Total 1,2-Dichloroethene | | 10 U | 13 | NA | NA | NA | NA |

## TABLE 3 BASELINE GROUNDWATER MONITORING RESULTS FOR PZ04B

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Dec-99 |
|---|---|---|---|---|---|
| Aluminum | 50 | 20 U | 103 J | 66.8 J | 8 U |
| Antimony | 3 | 50 U | 3.0 UJ | 2.1 UJ | 2 U |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3 U |
| Barium | 2000 | 90.6 | 16.3 | 94.0 | 104 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 1 U |
| Cadmium | 4 | 2 U | 157 J | 2.4 J | 1 U |
| Calcium | | 62100 | 66,900 J | 56800 | 62800 |
| Chromium | 7000 | 5 U | 2.2 | 1.0 J | 1.7 J |
| Cobalt | | 3 U | 2.2 U | 0.60 U | 1 U |
| Copper | | 2 U | 168 | 1.1 J | 2.6 J |
| Iron | | 20 U | 104 J | 18.6 U | 23.6 J |
| Lead | 5 | 1 U | 1.7 U | 1.1 U | 2 U |
| Magnesium | | 18100 | 12,000 J | 16500 | 18900 |
| Manganese | | 1 U | 69.1 J | 2.4 U | 1 U |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.1 UJ |
| Nickel | 57 | 10 U | 54.6 J | 1.3 U | 1 U |
| Potassium | | 1150 | 5,120 | 954 | 1370 J |
| Selenium | | 1 U | 2.3 U | 1.8 U | 3 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 1 U |
| Sodium | | 31300 | 70,900 J | 35700 J | 38900 J |
| Thallium | 0.5 | 1 U | 3.3 U | 2.2 | 4 U |
| Vanadium | | 3 U | 2.0 U | 0.50 U | 1 U |
| Zinc | | 10.5 J | 1,320 J | 12.9 U | 5.1 J |
| Cyanide | 4 | 5 U | 0.90 J | 3.1 J | 2 U |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 UJ | 10 UJ |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 UJ |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 UJ | 11 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 UJ |
| Acetone | | 10 U | 10 UJ | 28 | 15 |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 UJ |
| Methyl Acetate | | NA | NA | 10 U | 10 U |
| Methylene Chloride | | 10 U | 1 J | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 117 | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | | NA | NA | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 3 J | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 39 | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 UJ |
| Isopropylbenzene | | NA | NA | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 UJ |
| Total 1,2-Dichloroethene | | 10 U | 10 U | NA | NA |

## TABLE 5 BASELINE GROUNDWATER MONITORING RESULTS FOR MI4013

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Dec-99 | Oct-00 | Feb-01 |
|---|---|---|---|---|---|---|---|
| Aluminum | 50 | 168 | 114 J | 69.9 J | 8.6 J | 27.1 U | 33.1 U |
| Antimony | 3 | 50 U | 3.0 UJ | 2.1 UJ | 2 U | 3.1 U | 2.5 U |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3 U | 3.4 U | 4.2 U |
| Barium | 2000 | 12.6 | 12.3 | 21.2 | 19.4 | 26.5 | 8.0 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 1 U | 0.20 U | 0.10 U |
| Cadmium | 4 | 2100 | 1.820 J | 1980 | 2110 | 2130 | 911 |
| Calcium | | 55.000 | 50.200 J | 65500 | 74400 | 78700 | 38200 |
| Chromium | 7000 | 29 | 8.1 | 2.8 J | 3.7 J | 5.8 J | 4.0 |
| Cobalt | | 3 U | 2.2 U | 3.1 J | 2 | 2.5 | 1.0 |
| Copper | | 4.3 | 5.0 | 2.4 J | 2.5 J | 2.9 | 1.9 J |
| Iron | | 156 | 124 J | 18.6 U | 24.5 J | 16.8 J | 20.8 J |
| Lead | 5 | 1.2 J | 1.7 U | 1 U | 2 U | 2.1 U | 1.7 U |
| Magnesium | | 9.330 | 8.450 J | 10200 | 12100 | 11900 | 5350 J |
| Manganese | | 400 | 390 J | 403 | 516 | 476 | 185 J |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.25 J | 0.10 U | 0.10 U |
| Nickel | 57 | 128 | 120 J | 121 J | 130 | 140 | 65.6 |
| Potassium | | 3110 | 3.020 | 3660 | 3540 J | 6260 | 1660 |
| Selenium | | 1 UJ | 2.3 U | 1.8 U | 3 U | 4.3 U | 4.8 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 1 U | 0.40 U | 0.50 U |
| Sodium | | 12800 | 7.220 J | 23500 J | 17800 J | 27900 | 10700 |
| Thallium | 0.5 | 1 U | 3.3 U | 2.1 U | 4 U | 5.7 U | 6.2 U |
| Vanadium | | 3 U | 1.4 U | 0.50 U | 1 U | 0.85 | 0.70 U |
| Zinc | | 979 | 1.110 J | 1020 J | 1160 | 1120 | 527 |
| Cyanide | 4 | 32.4 | 19.8 J | 7.3 J | 2.8 | 10.4 | 17.7 |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 10 U | 2 J | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 UJ | 10 UJ | 10 U | 10 U |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 UJ | 10 U | 10 U | 10 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| Acetone | | 10 U | 10 UJ | 39 | 43 | 93 | 16 J |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| Methyl Acetate | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Methylene Chloride | | 10 U | 1 J | 10 U | 10 U | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 5 J | 16 | 8 J | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 117 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 33 | 120 | 120 | 100 | 6 J |
| Methylcyclohexane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 2 J | 10 U | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 UJ |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| Isopropylbenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 UJ | 10 U | 10 U |
| Total 1,2-Dichloroethene | | 10 U | 4 J | NA | NA | NA | NA |

## TABLE 7 BASELINE GROUNDWATER MONITORING RESULTS FOR MI4015

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Dec-99 |
|---|---|---|---|---|---|
| Aluminum | 50 | 23.4 J | 11.* J | 62.4 J | 8.1 J |
| Antimony | 2.3 | 50 U | 3.0 UJ | 2.1 UJ | 2 U |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3 U |
| Barium | 2000 | 27.9 | 18.1 | 24.8 | 35.7 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 1 U |
| Cadmium | 4 | 391 | 243 J | 218 | 153 |
| Calcium | | 75,100 | 48,900 J | 78800 | 90000 |
| Chromium | 7000 | 15.8 | 56.8 | 37.7 | 35.1 |
| Cobalt | | 3 U | 2.2 U | 0.60 U | 1 U |
| Copper | | 2 U | 3.4 | 1.2 J | 2 J |
| Iron | | 94.7 | 123 J | 96.2 | 129 J |
| Lead | 5 | 1 U | 4.2 J | 1.1 U | 2 U |
| Magnesium | | 16,300 | 11,500 J | 17700 | 21200 |
| Manganese | | 268 | 111 J | 105 | 6.6 |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.1 J |
| Nickel | 57 | 32.4 | 28.6 J | 14.1 J | 8.2 |
| Potassium | | 4150 | 3,450 | 3500 | 5160 J |
| Selenium | | 1 U | 2.3 U | 1.8 U | 3 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 1 U |
| Sodium | | 63400 | 21,600 J | 35100 J | 77400 J |
| Thallium | 0.5 | 1 U | 4.6 | 2.1 U | 4 U |
| Vanadium | | 3 U | 1.4 U | 0.50 U | 1 U |
| Zinc | | 137 | 134 J | 89.3 J | 67.4 |
| Cyanide | 4 | 24.5 | 156 J | 81.9 J | 61.6 |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 U | 10 UJ |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 UJ |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 U | 11 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 UJ |
| Acetone | | 10 U | 10 UJ | 17 | 10 U |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 UJ |
| Methyl Acetate | | NA | NA | 10 U | 10 U |
| Methylene Chloride | | 10 U | 1 J | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 24 | 7 J | 3 J |
| 1,1,1-Trichloroethane | 11.7 | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | | NA | NA | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 4 J | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 2 J | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 UJ |
| Isopropylbenzene | | NA | NA | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 UJ |
| Total 1,2-Dichloroethene | | 10 U | 10 U | NA | NA |

## TABLE 9 BASELINE GROUNDWATER MONITORING RESULTS FOR PZ05B

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Dec-99 | Oct-00 |
|---|---|---|---|---|---|---|
| Aluminum | 50 | 24 J | 28.6 J | 104 J | 15 J | 2 J U |
| Antimony | 3 | 50 U | 3.0 UJ | 2.1 UJ | 2 U | 4.5 J |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3 U | 3.4 U |
| Barium | 2000 | 64.3 | 74.1 | 78.1 | 76.2 | 71.1 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 1 U | 0.24 J |
| Cadmium | 4 | 24.2 | 30.1 J | 27.5 | 25.6 | 31.2 |
| Calcium | | 49,100 | 50,400 J | 52700 | 52700 | 50700 |
| Chromium | 7000 | 5 U | 2.0 | 2.4 J | 3.5 J | 4.4 J |
| Cobalt | | 3 U | 2.2 U | 0.60 U | 1 U | 0.60 U |
| Copper | | 2 | 3.5 | 1.8 J | 1.7 J | 1.0 |
| Iron | | 20 U | 19.0 J | 75.0 J | 30.3 J | 10.6 U |
| Lead | 5 | 1 U | 1.7 U | 1.1 U | 2 U | 2.1 U |
| Magnesium | | 14,400 | 14,900 J | [illegible]0 | 15800 | 14700 |
| Manganese | | 1 U | 3.5 J | 2.4 U | 1 U | 0.10 U |
| Mercury | 2 | 0.1 U | 0.10 UJ | 0.10 U | 0.1 J | 0.10 U |
| Nickel | 57 | 10 U | 5.0 J | 3.9 J | 3.5 | 7.0 J |
| Potassium | | 826 | 1,430 | 944 | 1280 J | 1420 |
| Selenium | | 1 U | 2.3 U | 1.8 U | 3 U | 4.3 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 1 U | 0.40 U |
| Sodium | | 53600 | 53,900 J | 58900 J | 59700 J | 55700 |
| Thallium | 0.5 | 1 U | 3.3 U | 2.1 U | 4 U | 5.7 U |
| Vanadium | | 3 U | 1.4 U | 0.60 J | 1 U | 0.70 U |
| Zinc | | 25.3 J | 41.8 J | 31.0 | 30.5 | 34.6 |
| Cyanide | 4 | 6.5 | 2.3 J | 7.2 J | 2.7 | 5.0 J |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 UJ | 10 U |
| Chloromethane | | 10 U | 10 U | 10 U | 10 U | 3 J |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 UJ | 10 UJ | 10 U |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 UJ | 10 U |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 UJ | 10 U |
| Acetone | | 10 U | 10 UJ | 22 | 5 J | 120 |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 UJ | 10 U |
| Methyl Acetate | | NA | NA | 10 U | 10 U | 10 U |
| Methylene Chloride | | 10 U | 1 J | 10 U | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 4 J | 3 J | 10 U | 3 J |
| 1,1,1-Trichloroethane | 117 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 1 J | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 5 J | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 UJ | 10 U |
| Isopropylbenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 UJ | 10 U |
| Total 1,2-Dichloroethene | | 10 U | 10 U | NA | NA | NA |

## TABLE 11 BASELINE GROUNDWATER MONITORING RESULTS FOR PZ06A

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Oct-00 | Feb-01 |
|---|---|---|---|---|---|---|
| Aluminum | 50 | 98.1 J | 38.9 J | 118 J | 1220 | 46.0 J |
| Antimony | 3 | 50 U | 3.0 UJ | 2.1 UJ | 4.4 J | 2.5 U |
| Arsenic | 0.2 | 1 U | 3.0 U | 2.2 U | 3.4 U | 4.2 U |
| Barium | 2000 | 90.3 | 75.0 | 84.3 | 111 | 91.8 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 0.29 J | 0.21 J |
| Cadmium | 4 | 2 U | 0.84 J | 1.0 J | 1.0 J | 0.60 U |
| Calcium | | 64,300 | 47,400 J | 50400 | 60500 | 60500 |
| Chromium | 7000 | 5 U | 1.7 | 2.2 J | 7.9 J | 1.8 J |
| Cobalt | | 3 U | 2.2 U | 0.60 U | 1.6 | 0.70 U |
| Copper | | 2.4 | 2.9 | 2.8 J | 19.7 | 1.1 J |
| Iron | | 88.4 | 57.3 J | 53.6 J | 1800 | 14.2 UJ |
| Lead | 5 | 1 J | 1.7 U | 1.1 U | 2.1 U | 1.7 U |
| Magnesium | | 18,700 | 13,800 J | 15100 | 17600 | 18000 J |
| Manganese | | 7.6 | 2.2 J | 3.8 | 184 | 0.10 UJ |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U |
| Nickel | 57 | 10 U | 3.8 J | 4.4 J | 26.6 J | 4.7 |
| Potassium | | 1270 | 1,180 | 962 | 1820 | 1440 |
| Selenium | | 1 U | 2.3 U | 1.8 U | 4.3 U | 4.8 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.50 J | 0.40 U | 0.50 U |
| Sodium | | 33000 | 30,400 J | 40700 J | 42000 | 40300 |
| Thallium | 0.5 | 1 U | 3.3 U | 2.4 | 5.7 U | 6.2 U |
| Vanadium | | 3 U | 1.4 U | 0.60 J | 2.7 | 1.1 |
| Zinc | | 4 U | 7.8 J | 12.9 U | 1.8 J | 1.1 UJ |
| Cyanide | 4 | 5 U | 0.90 J | 1.5 J | 1.8 J | 0.65 J |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 2 J | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 UJ | 10 U | 10 U |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 U | 10 U |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 U | 10 U |
| Acetone | | 10 U | 10 UJ | 33 | 110 | 13 J |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methyl Acetate | | NA | NA | 10 U | 10 U | 10 U |
| Methylene Chloride | | 10 U | 2 J | 10 U | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 117 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 2 J | 4 J | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U | 10 UJ |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Isopropylbenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| Total 1,2-Dichloroethene | | 10 U | 10 U | NA | NA | NA |

## TABLE 13 BASELINE GROUNDWATER MONITORING RESULTS FOR PZ06C

| Analyte | Cleanup Standard | Feb-99 | Jul-99 | Sept-99 | Oct-00 | Feb-01 |
|---|---|---|---|---|---|---|
| Aluminum | 50 | 33.2 J | 37.0 J | 70.8 J | 2.1 U | 15.1 U |
| Antimony | 3 | 3.0 U | 3.0 UJ | 2.1 UJ | 2.3 U | 2.5 U |
| Arsenic | 0.2 | 4.8 | 5.3 | 9.9 | 3.5 J | 5.3 |
| Barium | 2000 | 50.1 | 47.9 | 43.2 | 74.6 | 64.7 |
| Beryllium | | 1 U | 0.40 U | 0.10 U | 0.20 U | 0.10 UJ |
| Cadmium | 4 | 2 U | 0.50 J | 0.40 J | 0.30 U | 0.60 U |
| Calcium | | 36,100 | 31,000 J | 28300 | 44300 | 44100 |
| Chromium | 7000 | 5 U | 1.0 U | 0.30 U | 2.6 J | 0.50 U |
| Cobalt | | 3 U | 2.2 U | 0.60 U | 0.60 U | 0.70 U |
| Copper | | 2 U | 2.5 U | 0.50 U | 0.90 U | 0.70 U |
| Iron | | 133 | 162 J | 148 | 370 | 108 J |
| Lead | 5 | 1 U | 1.7 U | 1.1 U | 2.1 U | 1.7 U |
| Magnesium | | 9,780 | 8,510 J | 0 | 11800 | 12000 J |
| Manganese | | 65.3 | 64.8 J | 70.2 | 231 | 84.4 J |
| Mercury | 2 | 0.1 U | 0.10 U | 0.10 U | 0.10 U | 0.10 U |
| Nickel | 57 | 10 U | 2.5 J | 1.3 U | 2.9 J | 1.3 U |
| Potassium | | 670 | 743 | 488 | 851 | 807 |
| Selenium | | 1 U | 2.3 U | 1.8 U | 4.3 U | 4.8 U |
| Silver | 0.1 | 3 U | 1.4 U | 0.40 U | 0.40 U | 0.50 U |
| Sodium | | 9480 | 7,780 J | 8340 J | 13100 | 12800 |
| Thallium | 0.5 | 1 U | 3.3 U | 2.1 U | 5.7 U | 6.2 U |
| Vanadium | | 3 U | 1.4 U | 0.50 U | 0.70 U | 0.70 U |
| Zinc | | 4 U | 5.4 J | 12.9 U | 1.2 UJ | 1.1 UJ |
| Cyanide | 4 | 5 U | 0.90 J | 0.90 J | 2.2 J | 0.87 J |
| Dichlorodifluoromethane | | NA | NA | 10 U | 10 U | 10 UJ |
| Chloromethane | | 10 U | 10 U | 10 U | 2 J | 10 U |
| Vinyl Chloride | 0.2 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromomethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroethane | | 10 U | 10 UJ | 10 UJ | 10 U | 10 U |
| Trichlorofluoromethane | | NA | NA | 10 U | 10 U | 10 U |
| 1,1-Dichloroethene | | 10 U | 10 U | 10 UJ | 10 U | 10 U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | | NA | NA | 10 U | 10 U | 10 U |
| Acetone | | 10 U | 10 UJ | 24 | 68 | 9 J |
| Carbon Disulfide | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methyl Acetate | | NA | NA | 10 U | 10 U | 10 U |
| Methylene Chloride | | 10 U | 1 J | 10 U | 10 U | 10 U |
| trans-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| Methyl tert-Butyl Ether | | NA | NA | 10 U | 10 U | 10 U |
| 1,1-Dichloroethane | 700 | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,2-Dichloroethene | | NA | NA | 10 U | 10 U | 10 U |
| 2-Butanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Chloroform | 6 | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,1-Trichloroethane | 117 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Cyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| Carbon Tetrachloride | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Benzene | 1 | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dichloroethane | 0.4 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Trichloroethene | 3 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Methylcyclohexane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichloropropane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromodichloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| cis-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 4-Methyl-2-pentanone | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Toluene | 100 | 10 U | 3 J | 10 U | 10 U | 10 U |
| trans-1,3-Dichloropropene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,1,2-Trichloroethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Tetrachloroethene | | 10 U | 10 J | 10 U | 10 U | 10 U |
| 2-Hexanone | | 10 U | 10 U | 10 U | 10 U | 10 UJ |
| Dibromochloromethane | | 10 U | 10 U | 10 U | 10 U | 10 U |
| 1,2-Dibromoethane | | NA | NA | 10 U | 10 U | 10 U |
| Chlorobenzene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Ethylbenzene | 30 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Xylenes (total) | 59 | 10 U | 10 U | 10 U | 10 U | 10 U |
| Styrene | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Bromoform | | 10 U | 10 U | 10 U | 10 U | 10 U |
| Isopropylbenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,1,2,2-Tetrachloroethane | | 10 U | 10 UJ | 10 U | 10 U | 10 U |
| 1,3-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,4-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| 1,2-Dibromo-3-chloropropane | | NA | NA | 10 U | 10 U | 10 U |
| 1,2,4-Trichlorobenzene | | NA | NA | 10 U | 10 U | 10 U |
| Total 1,2-Dichloroethene | | 10 U | 10 U | NA | NA | NA |

**ATTACHMENT 5**
**ESTIMATED ANNUAL OPERATION AND MAINTENANCE COST**
**PEERLESS PLATING SUPERFUND SITE**
**MUSKEGON, MICHIGAN**

| Item | Unit Cost | Units | Extended Cost |
|---|---|---|---|
| **Labor** | | | |
| Operator, **hr** | $55.63 | 2340 | $130,174 |
| | | **Subtotal** | **$130,174** |
| **Equipment/Disposables** | | | |
| Computer equipment, month | $350.00 | 12 | $4,200 |
| Lift, month | $750.00 | 12 | $9,000 |
| Office supplies, month | $100.00 | 12 | $1,200 |
| Telephones/pager, month | $150.00 | 12 | $1,800 |
| Ferrous sulfate, month | $1,400.00 | 12 | $16,800 |
| Lime, month | $1,150.00 | 12 | $13,800 |
| Polymer, month | $75.00 | 12 | $900 |
| Sulfuric acid, month | $100.00 | 12 | $1,200 |
| Filter cartridges, each | $94.00 | 1536 | $144,384 |
| Sludge disposal, month | $2,500.00 | 12 | $30,000 |
| Sampling supplies and shipping, | $300.00 | 12 | $3,600 |
| Trash disposal, month | $200.00 | 12 | $2,400 |
| Grounds maintenance, month | $250.00 | 12 | $3,000 |
| Facilities maintenance, month | $500.00 | 12 | $6,000 |
| Equipment maintenance, month | $1,200.00 | 12 | $14,400 |
| Laboratory equipment | $100.00 | 12 | $1,200 |
| | | **Subtotal** | **$253,884** |
| **Other Direct Costs** | | | |
| Electric, month | $4,000.00 | 12 | $48,000 |
| Gas, month | $350.00 | 12 | $4,200 |
| Water, month | $150.00 | 12 | $1,800 |
| | | **Subtotal** | **$54,000** |
| | | **TOTAL** | **$438,058** |