APPENDIX E

Zoning Map

According to the City of Mount Pleasant, copies of the copyrighted Zoning Map are not available for public distribution.

According to the City of Mount Pleasant, the subject Site and adjacent properties located to the north, east and south are zoned Central Business District (C-2). The property located to the west is zoned Industrial District (I-1).

APPENDIX F

Previous Reports

ISABELLA COUNTY

FACILITY: 0-009503
Michigan State Police - Mt. Pleasant
1011 N. Mission
Mt. Pleasant, 48858

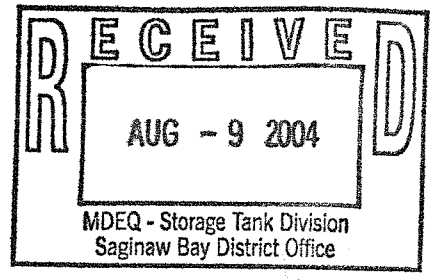
O-009503

PROJECT SUMMARY REPORT

FORMER MOUNT PLEASANT STATE POLICE POST
1011 NORTH MISSION STREET
MOUNT PLEASANT, MICHIGAN

PREPARED FOR:

MICHIGAN DEPARTMENT OF MANAGEMENT AND BUDGET
OFFICE OF FACILITIES
STEVENS T. MASON BUILDING
P.O. BOX 30026
LANSING, MICHIGAN 48909



PREPARED BY:

DLZ MICHIGAN, INC.
1425 KEYSTONE AVENUE
LANSING, MICHIGAN 48911

DLZ PROJECT NO. 9541-5068-03

AUGUST 2004

DLZ
ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

DLZ

ENGINEERS • ARCHITECTS • SCIENTISTS
PLANNERS • SURVEYORS

August 4, 2004

Mr. Larry Engelhart
Michigan Department of Environmental Quality
Remediation and Redevelopment Division
Saginaw Bay District Office
503 N. Euclid Avenue
Bay City, MI 48706-2965

RE: Former State Police Post Site
Mt. Pleasant, Michigan
DLZ Project No. 9541-5068-03

Dear Mr. Engelhart:

Enclosed please find a copy of the Project Summary Report prepared for the Former Mount Pleasant Police Post site, located in Mt. Pleasant, Michigan. The report was prepared in response to the meeting between the Michigan Department of Management and Budget (MDMB), Michigan Department of Environmental Quality (MDEQ) and DLZ personnel on February 4, 2004.

The report summarizes historical groundwater analytical results and groundwater flow diagrams for both the former State Police Post site and the suspected up gradient source property (TPI Petroleum), operation of the groundwater treatment system at the State Police Post site, and recommendations for obtaining closure for the State Police Post site.

Upon you review, the MDMB and DLZ would like to set up a meeting with the MDEQ to further discuss the information and determine the most efficient method for obtaining closure of the State Police Post site.

If you have any questions regarding this information, please give me a call.

Very truly yours,

DLZ MICHIGAN, INC.

Thomas M. Hutchinson
Project Manager

TMH/mrs

M:\PROJ\9541\5068\03\Correspondence\Engelhart - August 4, 2004.doc

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PROJECT SUMMARY REPORT

FORMER MOUNT PLEASANT STATE POLICE POST
1011 NORTH MISSION STREET
MOUNT PLEASANT, MICHIGAN

PREPARED FOR:

MICHIGAN DEPARTMENT OF MANAGEMENT & BUDGET
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AUGUST 2004

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DLZ

APPENDICES

1.0 INTRODUCTION

DLZ Michigan, Inc., was retained by the Michigan Department of Management and Budget (MDMB) to prepare a Project Summary Report for the former Mt. Pleasant State Police Post (Site), located in Mt. Pleasant, Michigan. This report summarizes historical site and surrounding area data, as well as, current supplemental remedial investigation activities that have occurred at the Site to determine whether groundwater contamination is migrating on-site from an up gradient source.

1.1 Site Background

The Site was formerly a State Police Post headquarters, and is currently vacant. The Site is located at 1011 North Mission Street in Mount Pleasant, Michigan. The Site location is depicted in Figure 1. Surrounding properties include a United Parcel Service (UPS) facility to the west, and an Ace Hardware Store to the south. South of the hardware store is J.W. Filmore's Restaurant. Pickard Street (M-20) is located south of the restaurant and a former gas station, TPI Petroleum, is located south of Pickard Street. The Site is bordered on the east by Mission Street. Wendel's Furniture store and a Meijer store parking lot are located east of Mission Street. A heavy equipment parts distributor, is located north of the Site, across the UPS access drive. The surrounding properties are depicted on Figure 2.

Two (2) 6,000-gallon underground storage tanks (USTs) were removed and a confirmed release was reported at the Site on June 17, 1992, by Testing Engineers and Consultants, after analytical results confirmed the presence of gasoline contaminants. Apparent contamination was reported around the piping run. The USTs were used to store unleaded gasoline. The quantity of the release was unknown and no free product was reported. At the time of the tank removal, approximately 150 cubic yards of contaminated soil were excavated and disposed of at a Type II landfill.

In 1995, DLZ (formerly SEG) was retained by the MDMB to conduct a Remedial Investigation (RI) at the Site to assess the extent of impacted soil and groundwater. Thirteen (13) borings and five (5) monitor wells were installed as part of this investigation. The results of the investigation were presented in the "Remedial Investigation/Feasibility Study and Corrective Action Work Plan" (SEG, September 1995). The RI results confirmed the presence of groundwater contaminants at concentrations above the Natural Resources and Environmental Protection Act, Michigan Public Act 451, Part 213 (Part 213), Residential and Commercial I, Tier I, Risk Based Corrective Action Screening Levels applicable at the time the investigation was conducted. Based on soil analytical results, it was determined that contamination was also present in the capillary fringe, in the source area, from approximately 8 to 10 feet below grade. A Feasibility Study (FS) which evaluated several groundwater remediation alternatives was included as part of the RI Report.

The recommended remediation alternative was groundwater extraction, followed by air stripping and vapor phase carbon adsorption. Treated groundwater was to be amended with nutrients and oxygen,

and re-injected into the aquifer through an infiltration gallery. The re-injected water would stimulate in-situ biodegradation of contaminants and flush contaminants in the capillary fringe. To assist in the design of the groundwater treatment system, one (1) additional monitor well and five (5) additional soil borings were installed at the Site in July and August 1996 to delineate the horizontal and vertical extent of contamination.

Upon completion of the additional investigation, Haley & Aldrich (formerly Techna Corporation), of Plymouth, Michigan installed a groundwater treatment system, which began operation on September 9, 1996. Due to operational problems (iron plugging the air stripper, the flow meter, and the infiltration gallery), the system was shut down on November 12, 1996. Haley & Aldrich installed an iron removal system to minimize iron precipitating in the air stripper diffuser tubes. The system was restarted in March 1998. The system operated on a regular basis from March 1998 to May 1999 and from March 2000 through January 2001. The system was shut down from May 1999 to March 2000 due to insufficient funding. The system operated intermittently from January 2001 through October 2001 due to necessary system repairs and leakage from the infiltration gallery to the surface. Muriatic acid was added to the treated groundwater prior to entering the infiltration gallery to alleviate plugging of the gallery. The plugging of the infiltration gallery was likely due to an accumulation of biomass within the gallery.

Due to frequent failure of the infiltration gallery, the groundwater remediation system was shut down in October 2001. A total of 5,081,566 gallons of groundwater were treated from September 1996 through October 2001. A detailed summary of the system operation and maintenance is included in the 1996-2001 Annual Performance Evaluation of Groundwater Remediation System Report prepared by DLZ (February 2002) and briefly summarized in Section 4.3.3. Groundwater samples collected from monitor wells on the Site at system shut down in October 2001 were all below current applicable Part 213/Part 201 Generic Residential/Commercial I Cleanup Criteria (GRCC).

In the spring of 2002, DLZ conducted a Supplemental Site Investigation to determine whether the groundwater contaminant plume had migrated off-site at concentrations exceeding current applicable Part 213/Part 201 GRCC and to evaluate potential closure options. Four (4) monitor wells were installed as part of this investigation. The results of the investigation were presented in a "Draft Supplemental Investigation Report" (DLZ, July 2002). The Supplemental Site Investigation results confirmed that groundwater contaminants, primarily BTEX, were present off-site to the west, on the UPS property and likely present on the commercial property across the UPS driveway to the north.

In the winter of 2002, DLZ conducted a Remedial Investigation/Soil Delineation to determine the extent of impacted soil remaining above the water table and to collect additional groundwater data to further characterize the distribution of contaminants in the aquifer. Twelve (12) borings were installed as part of this investigation. The results of the investigation were presented in a "Draft Remedial Investigation/Soil Delineation Report" (DLZ, December 2002). Based on the Remedial Investigation/Soil Delineation results, DLZ concluded the quantity of impacted soil present in the vadose and smear zones associated with the former USTs appeared to be minimal. Groundwater

within, side gradient (east), and down gradient of the former UST basin remained impacted with BTEX at concentrations exceeding current applicable Part 213/Part 201 GRCC. Methyl-tert butyl ether (MTBE) was detected within and down gradient of the former UST basin. During initial investigative activities, MTBE was not detected in any soil or groundwater samples. Additionally, MTBE was detected in several up gradient borings and an existing up gradient monitor well, indicating an up gradient plume likely was impacting the Site.

Under the Freedom of Information Act (FOIA), DLZ requested information from the Michigan Department of Environmental Quality (MDEQ) regarding a former gas station (TPI Petroleum, Inc.) located at 815 North Mission Street, approximately 400 feet south (up gradient), of the Site. The TPI Petroleum property is depicted on Figure 2. Information obtained through the FOIA request indicated groundwater contamination had migrated off the TPI Petroleum property in a northerly direction toward the Site. Additionally, MTBE was present in several monitor wells located between the former gas station and the Site.

1.2 Additional Reports

Reports associated with investigative and remedial activities at the Site since 1992 include:

- 20-Day Initial Abatement Report, Testing Engineers & Consultants, Inc. (TEC)
- 45-Day Characterization Report and Work Plan, TEC
- Specifications of Construction, Ground Water Remediation System, Snell Environmental Group, Inc. (SEG), August 1995
- Remedial Investigation/Feasibility Study and Corrective Action Work Plan, SEG, September 1995
- Final Assessment Report, SEG, October 1996
- 1999 Annual Performance Evaluation of Ground Water Remediation System, SEG, March 2000
- 2000 Annual Performance Evaluation of Ground Water Remediation System, DLZ, March 2001
- 1996-2001 Annual Performance Evaluation of Ground Water Remediation System, DLZ, February 2002
- Draft Supplemental Site Investigation Report, DLZ, July 2002
- Draft Remedial Investigation/Soil Delineation Report, DLZ, December 2002

2.0 OBJECTIVE AND SCOPE OF WORK

The objective of the Project Summary Report is to determine whether contamination is migrating on to the Site from an up gradient source. If it is determined that impacted groundwater is migrating on to the Site, the information will be used to determine the most cost-effective and feasible method of

remediating remaining contamination associated with the Site, without enhancing on-site migration and cleanup of the contaminant plume from the up gradient source.

To meet the objective, DLZ prepared a Supplemental Remedial Investigation Work Plan in February 2004. The following tasks were proposed in the Work Plan:

- Installation of two (2) additional monitor wells at the Site.
- Two (2) years of quarterly groundwater monitoring of existing and proposed monitor wells.
- Re-survey of the Site and TPI Petroleum-associated monitor wells upon obtaining access.
- Research relevant current and historical data associated with the Site, TPI Petroleum, and the surrounding area.

Following a review of the available data, including the first round of groundwater sampling (February and March 2004), DLZ concluded that re-surveying the Site and TPI Petroleum monitor wells was not necessary.

3.0 METHODOLOGIES

The following sub-sections describe the methods used to complete the supplemental remedial investigation, and historical data review.

3.1 Monitor Well Installation

On March 1, 2004, two (2) additional monitor wells were installed along the up gradient (southern edge) of the Site. The location of existing monitor wells MW-1 through MW-11 and newly installed monitor wells MW-12 and MW-13 are depicted on Figure 3. Boring logs for wells MW-12 and MW-13 are provided in Appendix A.

Each monitor well was installed with a rotary drill rig using 4.25-inch inside diameter hollow stem augers. Both wells were constructed of flush-threaded, 2-inch diameter, 5-foot long, 10-slot PVC screens with PVC riser pipe. Well screens were set to straddle the water table (8-13 feet below grade). A fine silica sand pack was placed around each well screen to approximately 2 feet above the top of the screen. Bentonite chips filled the remaining borehole annulus. A flush-mount, traffic rated, protective cover was set in a concrete pad at grade.

Following construction, each well was developed until the water was relatively sediment free. The drilling contractor properly decontaminated all equipment between each boring. All water and soil cuttings produced during this investigation were containerized for future off-site disposal. After installation, the monitor wells were surveyed for position and elevation.

3.2 Monitor Well Sampling

Groundwater samples were collected from ten (10) existing and two (2) newly installed monitor wells using low-flow sampling techniques on February 23, 2004 or March 1, 2004. Existing monitor well MW-2 was dry and could not be sampled. Groundwater samples collected from the monitor wells were sent to Brighton Analytical, LLC, Brighton, Michigan, for volatile organic compounds (VOC) analysis by EPA Method 8260.

3.3 Historical Records Review

Readily available regulatory information was reviewed to assess the possible risk for environmental liabilities from regulatory action, hazardous material spills, or documented hazardous waste disposal at the Site or surrounding properties. This information was obtained from a review of information included in the Radius Map Report provided by Environmental Data Resources, Inc. (EDR) and correspondence with local government officials.

Regulatory Records Review
EDR was retained by DLZ to perform a regulatory agency database search to evaluate the possible presence of federal and state listed sites of environmental concerns that are located within one mile of the Site. A list of federal and state databases researched by EDR is presented in the EDR – Radius Map report and supplemental information provided by EDR. The entire EDR report is included in Appendix B.

Aerial Photograph Review
Aerial photographs for the area, provided by EDR, were obtained for the years 1938, 1958, 1965, 1972, 1982, and 1992. The aerial photographs are included in Appendix B.

Topographic Map Review/Physical Features
The United States Geological Survey (USGS) topographical map for the Mount Pleasant Quadrangle, 15-minute series for the year 1919 and 7.5-minute series for the year 1973 were reviewed. The topographical maps are included in Appendix B.

Sanborn Fire Insurance Maps
No coverage of historical Sanborn Maps was identified for the Site.

City Directory Abstract
City directories provided by EDR were reviewed at approximately five-year intervals for the years between 1930 and 2002. The City Directory abstracts are included in Appendix B.

3.4 Freedom of Information Act – TPI Petroleum Property File Review

DLZ requested a FOIA disclosure of official files from the MDEQ- Remediation and Redevelopment Division (RRD) for the TPI Petroleum property. The TPI Petroleum property is located at 815 North Mission Street, approximately 400 feet south of the Site. Information in the MDEQ file indicated that several environmental response and investigation activities have occurred at the TPI Petroleum property.

4.0 FINDINGS

The following sub-sections summarize the findings from the historical records review, TPI Petroleum FOIA review, and the analytical results from previous investigations at the Site and at the TPI Petroleum property. Analytical results were compared to current applicable Part 213/Part 201 GRCC.

4.1 Historical Data Review

Information obtained from a review of readily available regulatory information and historical records includes the following.

The EDR-Radius Map Report identified thirty-six (36) sites in the area with environmental concerns. Ten (10) sites were listed with registered USTs. Nine (9) sites were listed with leaking USTs. Five (5) sites were listed on the Environmental Protection Agency (EPA) database of sites that generate more than 100 kg of hazardous waste per month. Six (6) sites were listed on the State Hazardous Waste Sites database which includes sites planned for cleanup using state funds (state equivalent of Superfund) and sites where clean up will be paid for by potentially responsible parties. Five (5) sites were listed on the Baseline Environmental Assessment (BEA) database and one (1) site was listed on the Former Manufactured Gas (Coal Gas) database.

The Site was identified in the EDR-Radius Map Report. The EDR– Radius Map Report indicated that two (2) registered 6,000-gallon USTs used for gasoline storage, were reported as being installed in March 1971. The USTs were removed from the ground on June 1, 1992. A confirmed release date of June 16, 1992 was identified in the EDR- Radius Map Report.

TPI Petroleum (Station #4312) was identified as an orphan site in the EDR-Radius Map Report. Information in the EDR-Radius Map Report indicates the TPI Petroleum property had four (4) registered USTs (one 12,000 gallon and three 6,000 gallon capacity tanks) that contained gasoline. The EDR- Radius Map Report indicated that all four tanks were removed from the ground on February 23, 1999. A notice of confirmed release was issued on that date.

Four additional sites (all in the registered USTs database), are listed in the EDR-Radius Map Report within 1/8 mile of the Site, and are summarized below. All tanks from these sites have been removed from the ground and no release was reported.

- **Lease Management, Inc.**
  1012 North Kinney Avenue (west-southwest of Site)
  -1,000 and 2,000-gallon capacity USTs installed in April 1966 and removed from the ground in January 1989.
  -Contained gasoline and diesel.
- **Lease Management, Inc.**
  1104 North Kinney Avenue (west of Site)
  -1,000 and 2,000-gallon capacity USTs installed in December 1979 and removed from the ground in January 1988 and 1989.
  -Unknown contents.
- **Olson Tire Service**
  704 East Pickard Avenue (south of Site)
  -1,500-gallon capacity UST installed in May 1978 and removed from the ground in October 1991.
  -Contained gasoline.
- **Fabiano Brothers, Inc.**
  1224 North Kinney Avenue (northwest of Site)
  -1,000-gallon capacity UST installed in May 1978 and removed from the ground in May 1991.
  -Unknown contents.

Aerial Photograph Review

The existing Site structure is visible in every aerial photograph provided by EDR except the 1938 photograph. The primary land use observed on the aerial photographs near the Site is commercial/residential. The 1965 photograph depicts the current adjoining UPS building to the west. The TPI Petroleum station building and canopy is apparent in the 1982 and 1992 photographs. No potential environmental issues associated with the Site could be discerned from the aerial photographs.

Topographic Map Review/Physical Features

The USGS maps depict the surface topography near the Site as relatively flat with elevations ranging from 760 to 770 feet above mean sea level (MSL). The surface topography gently slopes from southwest (higher) to northeast (lower) near the Site, while also sloping regionally toward the Chippewa River, located to the west-northwest. The Chippewa River is located approximately ½ mile west of the Site and flows in a northeasterly direction.

City Directory Abstract Review

City directories for various years indicate a mixture of residential and commercial businesses along North Mission Street. The Site address is listed as the State Police Post from 1953 through 1992.

4.2 Geology and Hydrogeology of the Former Mt. Pleasant State Police Post Site

The Site is topographically level. Locally the topography gradually decreases in elevation, in a northwesterly direction, towards a lowland area, which directs surface water flow to the Chippewa River. The Chippewa River is located approximately ½ mile northwest of the Site.

Regionally, the soils are generally glacial lacustrine, fine to medium sands with lenses of fine gravel. Clay layers are also found within the glacial deposits. Regionally the glacial drift is estimated to be 100-200 feet in thickness (Hydrogeologic Atlas of Michigan, Western Michigan University, 1992). However, area water well logs indicate that the unconsolidated glacial drift material is approximately 283 feet in thickness.

Soil material encountered at the Site consists generally of a fine sand to fine silty sand from a depth ranging between 0.5 and 35 feet below grade. Sandy clay soils were present below the sand unit at approximately 35 feet bgs at the two deepest boring locations.

Static water levels measurements indicate that groundwater is present under unconfined conditions at an average depth of approximately 9-feet below grade. Historical groundwater flow calculations indicate groundwater flow at the Site is towards the north-northwest, towards the Chippewa River. This flow direction is generally consistent with the groundwater flow direction determined during an investigation conducted by Geraghty and Miller, Inc., on the adjacent UPS property. The most recent groundwater elevation data (April 2004) indicates groundwater flow at the Site is primarily towards the north. Figure 5 depicts the calculated groundwater flow in April 2004.

Based on slug test data, the average aquifer hydraulic conductivity was determined to be approximately 47.5 ft/day. The horizontal hydraulic gradient was determined to be 0.002 feet/foot, while average aquifer effective porosity was estimated to be 35%. Based on a range of possible effective porosity (between 25% and 35%), groundwater flow velocity at the Site is estimated at between 0.388 ft/day and 0.277 ft/day, respectively.

4.3 Subsurface Characterization of the Former Mt. Pleasant State Police Post Site

The following subsections summarize the characterization and remedial activities conducted at the Site.

4.3.1 Delineation of Impacted Soil

Soil samples collected from the Site prior to installation of the groundwater remediation system are detailed below. Complete laboratory analytical results associated with these investigations are included in the respective reports.

1995 Remedial Investigation/Feasibility Study Report

Soil borings GP-1 through GP-13 were advanced in June 1995 during the RI. Samples were generally collected in each boring from 6-8 feet and 8-10 feet below grade and analyzed at a fixed laboratory for BTEX, MTBE, and lead. Soil detected above Part 213/Part 201 GRCC, applicable at the time the investigation was conducted, was limited to two borings (GP-1 and GP-4), both within close proximity to the former UST basin. Soil samples were not analyzed from borings GP-10 through GP-13. Figure 6 depicts boring locations GP-1 through GP-13 and associated BTEX and MTBE concentrations. Lead was detected in most samples but none were reported above the Statewide Default Background Level of 21,000 *ug*/kg. MTBE was not detected in any soil sample analyzed during this RI. Analytical results are summarized in Appendix C.

1996 Final Assessment Report

Soil borings GP-101 through GP-105 were advanced in July 1996 on the UPS property to the west of the Site to determine the down gradient extent of contamination. Soil samples, generally collected from 7-8 feet below grade, were analyzed for BTEX compounds by an on-site mobile laboratory. No reported results were in exceedance of Part 213/Part 201 GRCC applicable at the time the investigation was conducted. No soil data was available for borings GP-101, GP-104, and GP-105.

4.3.2 Delineation of Impacted Groundwater

As part of the 1995-1996 RI, groundwater samples were collected from several soil boring locations to define the extent of groundwater impact at the Site and to assist in determining the placement of permanent monitor wells (MW-1 through MW-5). Groundwater samples were analyzed for BTEX and MTBE with an on-site mobile laboratory (Fibertec). Selected samples were submitted to SEG Laboratories, Inc., for confirmatory analyses of BTEX, MTBE, and dissolved lead. BTEX concentrations were detected in the groundwater samples analyzed by the mobile laboratory exceeding current and applicable Part 213/Part 201 GRCC at four (4) boring locations. Two (2) borings (GP-1 and GP-13) were located within the former UST basin and two (2) borings were located directly north (down gradient) of the former UST basin (GP-10 and GP-11). MTBE was detected in one sample analyzed by the mobile laboratory; however, a confirmatory sample submitted to the fixed laboratory was non-detect for MTBE. Dissolved lead was not detected in any of the confirmatory samples analyzed at the fixed laboratory. Groundwater analytical results from the 1995 and 1996 investigations are summarized in Appendix C.

Following well installation, 'baseline' groundwater samples were collected from monitoring wells MW-1 through MW-5, in June 1995. Figure 7 depicts the analytical results from groundwater

samples collected during the 1995 remedial investigation and the baseline groundwater analysis from monitor wells MW-1 through MW-5. The samples were analyzed for BTEX, MTBE, and dissolved lead by a fixed laboratory. BTEX concentrations in two (2) of the five (5) wells (MW-4 and MW-5) exceeded Part 213/Part 201 GRCC applicable at the time the wells were sampled. MW-5 is located within the former UST basin and MW-4 is located directly north (down gradient) of the former UST basin. MTBE and dissolved lead were not detected above laboratory reporting limits in any sample analyzed.

In July 1996, to determine the down gradient extent of the groundwater plume, groundwater samples were collected from soil borings GP-101 through GP-105, located on the UPS property. Samples were generally collected from 8-10 feet below grade and analyzed for BTEX, MTBE, and dissolved lead by a fixed laboratory. Benzene was the only compound present in groundwater samples collected from three (3) of the borings (GP-102, GP-103, and GP-104), in exceedance of Part 213 GRCC applicable at the time the investigation was completed. No other VOCs were detected in the groundwater samples collected from borings GP-101 through GP-105. The location and groundwater contaminant concentrations are depicted on Figure 7. MTBE and dissolved lead were not detected above laboratory reporting limits.

Based on the June 1995 and July 1996 groundwater sampling results, the parameters of concern for remedial design and monitoring purposes were determined to be BTEX. No MTBE or dissolved lead was detected during these investigations. Therefore, these parameters were not considered contaminants of concern when selecting the groundwater treatment system for the Site. However, as part of the exemption for groundwater discharge, the parameter naphthalene was to be sampled along with BTEX during system operation and maintenance.

Based on total BTEX concentrations detected in groundwater samples collected in June 1995 and July 1996, the extent of impacted groundwater had been defined. Figure 7 depicts the extent of the impacted groundwater. The BTEX plume at that time was approximately 120 feet long by 105 feet wide. The leading edge of groundwater contamination had extended down gradient (northwest) onto the neighboring UPS property. Based on analytical results from groundwater samples collected from three (3) vertical aquifer profile borings, the vertical extent of BTEX contamination extends to approximately 35 feet bgs, directly above a clay confining layer. However, based on quarterly sampling of monitoring well MW-3, which is screened from 30-35 feet bgs, it appears the contamination present in the initial vertical aquifer profile borings installed in 1995 may have been a result of "drag down". No BTEX contamination has been present in MW-3, which is located down gradient of the tank basin and adjacent to a purge well, since the first quarter of sampling.

A contaminant mass estimate was calculated to determine the amount of dissolved BTEX in the groundwater. The mass was estimated to be approximately 16 pounds of BTEX, based upon the plume dimensions and the concentrations determined from 1995 and 1996 data.

4.3.3 Groundwater Remediation System

The recommended remediation alternative for cleanup of contaminated groundwater at the Site was groundwater extraction, followed by air stripping and vapor phase carbon adsorption. Treated groundwater was to be amended with nutrients and oxygen, and re-injected into the aquifer through an infiltration gallery. The re-injected water would stimulate *in-situ* biodegradation of contaminants and flush contaminants in the capillary fringe.

Haley & Aldrich of Plymouth, Michigan installed a groundwater treatment system, which began operation on September 9, 1996. Due to frequent operational problems (iron plugging the air stripper, the flow meter, and the infiltration gallery) and/or lack of funding, the system operated intermittently from 1996 through October 2001, when it was shut down.

A detailed summary of the system operation and maintenance is included in the 1996-2001 Annual Performance Evaluation of Groundwater Remediation System Report prepared by DLZ (February 2002). Analytical results from groundwater samples collected from monitor wells on the Site at system shut down in October 2001 were all below current applicable Part 213/Part 201 GRCC.

Groundwater Flow and Capture

Using pumping data, the Site was modeled using the program FLOWPATH (Version 4.1, Waterloo Hydrogeologic), to determine the capture zones of the purge wells. The two (2) purge wells (PW-1 and PW-2) were simulated to pump at a rate of 1.75 gpm each (3.5 gpm total flow). The computer model also simulated the existing groundwater treatment system discharge of 3.5 gpm into the infiltration gallery located in the southwestern portion of the site. Other input parameters included a retardation factor of 4.0, a hydraulic conductivity of 47.5 ft/day, and an effective porosity of 30%, obtained from the 1995 RI Report. All parameters were assumed homogeneous throughout the aquifer.

The model results indicate that the purge well locations provided sufficient capture of the plume; the entire volume of discharge through the infiltration gallery was captured by the purge wells; and the capture zone did not influence any potential up gradient source area. The calculated groundwater capture zone is depicted on Figure 8.

Groundwater elevation data collected during the operation of the groundwater treatment system indicates the cones of depression created by the two (2) purge wells, PW-1 and PW-2, were adequately capturing existing on-site VOCs present in the groundwater. The groundwater elevation data is included in Appendix C. Several figures included in the 1996-2001 Performance Report depict the cones of depression near the purge wells and the change in overall groundwater flow from the natural northwesterly flow to a north-northeasterly flow due to the influence of the purge wells.

Over the course of the entire remedial system operation, from September 1996 through October 2001, a total of 5,081,566 gallons of contaminated groundwater were treated. The system had a design flow rate of 10 gallons per minute (gpm), which would have potentially allowed a total of 14,500,800 gallons to be treated. Therefore, groundwater was extracted at approximately 35 percent of the design flow rate (3.5 gpm compared with 10 gpm design flow rate).

Groundwater Quality

Mass removal estimate calculations from 1996-1999 (8.98 pounds of BTEX for 2,190,292 gallons of treated groundwater) and 2000-2001 (2.58 pounds of BTEX for 2,891,274 gallons of treated groundwater) and the decrease in monitor well concentrations from 1996-1999 and 2000-2001 indicate the highest levels of dissolved BTEX contamination associated with the Site have been removed.

Total BTEX concentrations in groundwater samples collected from monitor well MW-4, located near PW-2, had decreased on average from 12,650 ug/L (1996-1999) to 9,840 ug/L (2000-2001). The total BTEX concentration in the groundwater sample collected from monitor well MW-4 on October 9, 2001, following system shut down was 135 ug/L.

Total BTEX concentrations in groundwater samples collected from monitor well MW-5, located near the former tank basin, had decreased on average from 1,473 ug/L (1996-1999) to 173 ug/L (2000-2001). The total BTEX concentration in the groundwater sample collected from monitor well MW-5 on October 9, 2001 following system shut down was 50 ug/L.

Total BTEX, along with naphthalene concentrations, had also decreased in the other monitor wells located on the Site. As of October 9, 2001, all remaining BTEX and naphthalene concentrations were below current, applicable Part 213/Part 201 GRCC. A detailed description of contaminant concentration trends including associated figures and tables is included in the 1996-2001 Performance Report. The analytical summary tables are included Appendix C. Groundwater contaminant concentrations at system shutdown are depicted on Figure 9.

4.3.4 Post-Groundwater Remediation System Shutdown Investigations

In May 2002, additional groundwater data was collected to determine if the residual groundwater contaminant plume had migrated off-site in exceedance of current, applicable Part 213/Part 201 GRCC following shut down of the groundwater remediation system and to evaluate potential closure options. The results of this investigation indicated BTEX, MTBE, and/or trimethylbenzenes (TMBs) were present on the Site and off-site to the west, on the UPS property, at concentrations exceeding current, applicable Part 213/Part 201GRCC.

Soil borings GP-1 through GP-12 were advanced in October 2002 to determine the extent of impacted soil located above the water table to determine whether impacted soil was acting as a continuing secondary source. Samples were generally collected in each boring from 4-5 feet, 9-10

feet, and 10-11 feet below grade and analyzed for BTEX and MTBE with an on-site mobile laboratory. Only one soil sample located near the former UST basin and collected from the capillary fringe (GP-3, 11-11.5 feet below grade), contained VOCs at concentrations exceeding current applicable Part 213/Part 201 GRCC. The locations of soil borings installed during the October 2002 investigation are depicted on Figure 10. The analytical results are summarized in Appendix C. MTBE was not detected in any soil sample analyzed during the 2002 Remedial Investigation/Soil Delineation investigation.

Additional groundwater data was collected during the investigation to further characterize the distribution of contaminants in the aquifer. Groundwater samples were collected at the water table and at 5-7 feet below the water table. Samples were analyzed for BTEX and MTBE with an on-site mobile laboratory. Findings revealed groundwater side gradient (to the east) of the former UST basin, remained impacted with benzene and/or xylene exceeding current applicable Part 213/201 GRCC. In addition, MTBE was detected within, up gradient, and down gradient of the former UST basin. Nine (9) groundwater samples collected up gradient of the former UST basin, including up gradient monitor well MW-1, contained only MTBE at concentrations exceeding current applicable Part 213/Part 201 GRCC. Analytical results and boring locations from soil and groundwater samples collected during the additional investigation are depicted on Figures 10 and 11, respectively.

In April 2002, DLZ proposed to install additional borings on two properties (Ace Hardware and J.W. Filmore's Restaurant) located between the Site and the TPI Petroleum property to determine whether TPI Petroleum's groundwater plume was migrating onto the State Police Post Site. Access to the Ace Hardware property was denied; therefore the additional borings were not installed.

The existing monitor wells located on the Site were sampled in June 2002, June 2003, December 2003, February/March 2004, and April 2004. All analytical results for groundwater samples collected from Site monitor wells are summarized in Appendix C. February/March and April 2004 analytical results are depicted on Figure 12. Complete laboratory analytical data from June 2002, to April 2004 is included in Appendix D.

BTEX concentrations decreased in the majority of monitor wells during the June 2002 through March 2004 groundwater sampling events. However, the concentration of MTBE increased in several monitor wells and significantly increased in monitor wells MW-9, MW-10, PW-1, and PW-2 located on the northwestern portion of the Site. Also, up gradient monitor well MW-1, which never had reportable concentrations of BTEX in over eight (8) years of sampling, contained benzene at 11 *ug*/L in December 2003 and at 25 *ug*/L in February/March 2004. MTBE has also been detected in MW-1 since June 2002. Newly installed monitor well MW-12 (March 2004) located near the southwest corner of the property, contained benzene at 21 *ug*/L and MTBE at 25 *ug*/L during the February/March 2004 sampling event. Up gradient wells MW-1, MW-12, and MW-13 were also sampled in April 2004. Analytical results indicated that benzene in MW-1 had increased to 28 *ug*/L. MTBE was detected at 10 *ug*/L in MW-1 and at 20 *ug*/L in MW-12.

4.4 Characterization of the TPI Petroleum Property

The following information was obtained from a FOIA review of MDEQ files associated with the TPI Petroleum property.

In February 1999, during removal of four (4) USTs at the TPI Petroleum property, a release of petroleum products was identified. During the course of the excavation of the USTs, free product was identified floating on the groundwater. All excavated soils were placed back in the excavation following UST removal. All buildings and UST systems have subsequently been removed from the Property. Figure 4 depicts the locations of the former structures including the location of the former USTs. The property is currently owned by Olson Tire Service and is used as a service drive for their retail tire facility located to the west of the former TPI Petroleum property. The property is currently covered with concrete and asphalt.

The TPI Petroleum 2001 Annual Site Status Report (Compliance, April 2002) indicates the J.W. Filmore's Restaurant property was formerly a retail gasoline station. Conversations by Compliance, Inc. with local residents indicated a retail gasoline station owned and operated by Hafer Oil Company existed on this property through approximately the mid-1960s. The TPI Petroleum report indicated aerial photographs on file at the Mt. Pleasant Department of Public Works depicts what appears to be a retail gasoline station on the J.W. Filmore's property.

4.4.1 Delineation of Impacted Soil

Following a confirmed release in February 1999, soil borings SS-1 through SS-9 were advanced at the TPI Petroleum property. Samples were generally collected from 3 feet below grade and analyzed for BTEX, MTBE, TMBs, 2-methylnaphthalene, naphthalene, 1,2-dibromoethane (EDB), 1,2-dichloroethane (1,2-DCA), and lead. BTEX, TMBs, naphthalene, and/or lead were detected at concentrations exceeding current and applicable Part 213/Part 201 GRCC in three (3) soil samples (SS-3, SS-5, and SS-6). All three (3) sampling locations were near former dispensers. Figure 13 depicts the location and contaminant concentrations from borings SS-1 through SS-9.

In April 1999, four (4) additional borings (SB-1 through SB-4) were advanced to 9.5 feet below grade to assist with delineating the extent of soil contamination from known "hot spot" (SS-6). Two (2) of the four (4) soil samples were in exceedance of Part 213 GRCC applicable at the time the investigation was conducted, for BTEX and TMBs. Samples collected in February and April 1999 that exceeded Part 213 GRCC, applicable at the time the investigation was conducted, were also analyzed by the synthetic precipitant leachate procedure (SPLP) test. Of the five (5) samples submitted for this test, SS-6 and SB-4 exceeded SPLP cleanup criteria. These samples leached benzene, xylenes, TMBs, and/or naphthalene above applicable Part 213 GRCC. To address this impact, 100 cubic yards of highly impacted soil was excavated in July 1999.

No confirmatory samples were collected in conjunction with either the UST removal in February 1999 or the subsequent soil excavation activities near the dispensers, in July 1999. To date, no known additional soil samples have been collected.

In a Final Assessment Report (FAR) prepared for the TPI Petroleum property, Compliance, Inc., indicated the extent of soil impact above Residential Leaching to Groundwater criteria was defined. However, only a limited portion of the site to a minimal depth (between 3 and 4 feet below grade) was ever evaluated. It appears the extent of soil impact for the TPI Petroleum property is largely unknown, as is the potential for these soils to continue to act as a secondary source of on-going groundwater contamination.

4.4.2 Delineation of Impacted Groundwater

Following the reported release at the site, four monitor wells (MW-1 through MW-4) were installed on-site in April 1999. The location of monitor wells MW-1 through MW-4 is depicted on Figure 4. Groundwater samples were collected from these wells and analyzed for VOCs in April 1999. Hazardous substances were present in all four (4) groundwater samples at concentrations exceeding Part 213 GRCC applicable at the time the investigation was conducted.

Eleven additional wells (MW-5 through MW-15) were installed between July 1999 and November 2000 to further define the horizontal extent of dissolved phase groundwater contamination and define the extent of free product. Groundwater samples were collected in August 1999, March 2000, and November/December 2000 and analyzed for VOCs. Hazardous substances at concentrations exceeding current and applicable Part 213/Part 201 GRCC were identified in on-site wells and four (4) off-site wells located on the property to the north (down gradient).

Currently, the TPI Petroleum plume boundary is not defined to the north (down gradient) or south (up gradient). The owners to the north (Hafer Ace Hardware) and south (Car-Quest) have refused access for monitor well installation. Analytical results from the TPI Petroleum property, obtained from the FOIA search, are included in Appendix E.

Based on the review of the MDEQ file associated with the TPI Petroleum property, the groundwater flow direction at the property has been consistently toward the north–northwest. Figures 14, 15, and 16 depict calculated groundwater flow from 2001, 2002, and 2003 respectively. The water table was encountered across the site at a depth of approximately 9-11 feet below grade. Dissolved phase groundwater contaminant concentrations from 1999-2003 have generally increased as the water table elevation decreased. The fluctuations in concentrations appear to be the result of capillary fringe smear zone desorbing to the groundwater as the water table fluctuates.

Quarterly groundwater monitoring began on a regular basis beginning in March 2001. Quarterly groundwater monitoring results identified an increasing BTEX and MTBE concentration trend in

down gradient off-site wells. The concentration of benzene increased in monitor well MW-6 from 130 *u*g/L in March 2000 to 1,300 *u*g/L in March 2003.

In October/November 2002, monitor wells MW-16, MW-17, and MW-18 were installed to define the eastern and northern plume boundaries. Groundwater analyses of samples from wells MW-16 and MW-17 were non-detect for all parameters analyzed. However, concentrations of BTEX, MTBE, and TMBs were detected in MW-18 (the northernmost monitor well). The concentration of benzene in MW-18 increased from 390 *u*g/L in November 2002 to 750 *u*g/L in March 2003 while MTBE increased from <4 *u*g/L to 7 *u*g/L during the same time period.

It appears the TPI Petroleum plume boundary has been defined to the east and the west, but not to the north (down gradient) and south (up gradient). Because no deep wells have been installed at this property, the depth to the bottom of the water bearing layer and the vertical extent of dissolved phase groundwater contamination has also not been determined.

In February/March 2003, monitor wells MW-20 and MW-21 were installed down gradient of MW-11, at the northern property line, to aid in the delineation of the free product plume at the site. Free product was identified in these newly installed wells upon completion, as well as every subsequent monthly monitoring event to date.

4.4.3 Groundwater Remediation/Free Product Removal

On May 24, 1999, an Initial Assessment Report (IAR) was prepared by Compliance on behalf of TPI Petroleum, and submitted to the MDEQ. In the IAR, Compliance calculated groundwater velocity at the TPI Petroleum site between 0.04 to 0.06 feet per day (15 feet to 22 feet per year) towards the north-northwest. This range was determined by estimating the effective porosity of the site soils (0.30) and the hydraulic conductivity (in the range of 1×10^{-2} to 1×10^{-3} cm/sec). A lateral hydraulic gradient of 0.02 feet/foot was determined from the static water level data collected on May 12, 1999.

Free product was discovered in on-site well MW-2 in May 1999 and on-site well MW-3 in March 2000. Intermittent product recovery was conducted on both of these wells. In September 2000, free product was discovered in an off-site, down gradient well (MW-10) located on the J.W. Filmore's Restaurant property. Free product has since been sporadically encountered in this well.

In September 2000, Compliance initiated more aggressive free product recovery measures using a vacuum recovery truck coupled to a Multi Arrayed Vacuum (MAV) product recovery system. Recovery events using the MAV system were conducted on a monthly basis when measurable product was present in any of the on-site wells.

Based on the most recent Quarterly Free Product Recovery Status Report, dated January 28, 2004, a total of 36,430 gallons of free product and water have been removed from the ground at the TPI Petroleum property. No additional information beyond January 28, 2004 was available from the

FOIA file review. Free product has since been discovered in other on-site wells (MW-11, MW-20, and MW-21), predominantly in the northwest corner of the property.

In the quarterly Free Product Recovery Status Report, January 2004, Compliance indicated that the free product present in well MW-10, located on the J.W. Filmore's property, has likely resulted from a release at the former gas station located on the property. Compliance indicates the former gas station is the likely source of free product in this well based on the following information:

- Free product should be present in monitor wells MW-6 and MW-7, which are located between MW-10 and the free product plume on the TPI Petroleum site, but is not.
- Dissolved lead is present in well MW-10, but has not been detected in other monitor wells associated with the release at the TPI Petroleum station.
- Groundwater in MW-15 on the J.W. Filmore's property is perched on a clay layer approximately 4 feet higher than the surrounding water table and this well is impacted with petroleum hydrocarbons.
- MTBE has not been detected in water samples collected from MW-15, but MTBE is present in other wells associated with the TPI Petroleum release.

4.4.4 Groundwater Quality

Concentration maps for the years 1999, 2000, 2001, 2002, and 2003 are depicted on Figures 17 through 20, respectively. These figures illustrate the groundwater plume has migrated in a northwesterly direction (consistent with groundwater flow from the TPI Petroleum property) over the 4-year sampling period. The lateral distribution of impacted groundwater exceeding current, applicable Part 213/Part 201 GRCC is depicted on each figure.

Compliance concluded the dissolved phase plume migrating in a northerly direction from the former TPI Petroleum property might be co-mingling with a potential plume located on the J.W. Filmore's property. Compliance also indicated the plume migrating off the TPI Petroleum property may have migrated onto the State Police Post Site. Compliance proposed to complete a FOIA file review for the State Police Post and request permission from the State of Michigan to sample selected wells along the southern property boundary (up gradient from the release area on the former State Police Post property) to determine if the TPI Petroleum plume has migrated onto the Site.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the review of historical information for the Site and the TPI Petroleum property, DLZ concludes and recommends the following:

Site Soils

The quantity of impacted soil present in the vadose and smear zones associated with the former USTs at the Mt. Pleasant State Police Post Site appears to be minimal. The current concentrations of

BTEX present in the vadose and smear zones are below current applicable Part 213/201 GRCC in all but one location, which is slightly in excess of the current, applicable Part 213/Part 201 Residential Drinking Water Protection Criteria. MTBE was not detected in soil samples collected from the vadose and smear zones during the 2002 Remedial Investigation/Soil Delineation and MTBE was not detected in soil samples collected during initial RI activities conducted in 1995 and 1996. The leaching of contaminants remaining in the vadose zone at the Site appears to be minimal, if present. The Site soils do not appear to be contributing to the recent impact at the Site.

Based on the findings and conclusions, DLZ recommends no further remedial activities associated with the Site soils.

Site Groundwater

BTEX concentrations have decreased in the majority of monitoring wells sampled from June 2002 to April 2004. Benzene and MTBE are the only compounds that have shown significant increases in concentrations. Groundwater in up gradient monitoring well MW-1 has historically been non-detect for BTEX. However, since 2002, MTBE has been present and benzene concentrations have increased in monitor well MW-1 from non-detect to 25 μg/L. Benzene and MTBE are also present in newly installed up gradient monitor well MW-12. Based on the presence of MTBE and the increase in benzene concentrations, especially in wells up gradient from the source area at the Site, it appears the Site is being impacted by an up gradient source.

Because the overall concentrations of BTEX have significantly decreased since the system start up and have continued to decrease since system shutdown, it appears the majority of the plume associated with the release at the Site has been remediated and is now naturally attenuating. The increase in benzene and MTBE concentrations appears to be associated with an up gradient source.

Based on the remaining concentrations of BTEX associated with the release at the Site, it does not appear upgrading and operating the groundwater treatment system is a cost effective method of remediating the remaining contamination associated with the Site. Because BTEX concentrations have continued to decrease in the majority of on-site monitoring wells since system shutdown, DLZ recommends monitored natural attenuation and/or implementation of deed restrictions as the remedial alternative for closing the Site.

Up Gradient Contaminant Sources

The suspected up gradient source of groundwater contamination impacting the Site is the former TPI Petroleum property located approximately 400 feet up gradient from the Site. Additionally, information reviewed during the FOIA request of the TPI Petroleum property indicates the J.W. Filmore's Restaurant, located up gradient, was also formerly a retail gas station.

No information was available regarding the former gas station located on the J.W. Filmore's property. However, information reviewed regarding the TPI Petroleum property indicates a

dissolved phase plume is migrating from the TPI Petroleum property on to the Site, including the following:

- The extent of soil impact at the TPI Petroleum property is largely unknown, as is the potential for these soils to continue to act as a secondary source of on-going contamination.
- Free product is often present in monitor wells MW-2, MW-3, MW-11, MW-20, and MW-21. These wells are located predominantly in the northwest corner of the TPI Petroleum property, down gradient of the source area and up gradient of the Site.
- Groundwater flow direction at TPI Petroleum property has been consistently toward the north – northwest, in the direction of the Site.
- The TPI Petroleum plume boundary is not defined to the north (down gradient) or south (up gradient).
- The TPI Petroleum remedial activities do not capture the plume and therefore do not control off-site migration towards the Site.
- TPI Petroleum's consultant concludes the dissolved phase plume emanating from the former gas station may be co-mingling with a plume located on the J.W. Filmore's property and this mixed plume has likely migrated onto the State Police Post Site.
- Concentrations of BTEX, MTBE, and TMBs exceeding current, applicable Part 213/Part 201 GRCC were detected in MW-18 (the northernmost TPI Petroleum monitor well). The concentration of benzene increased from 390 *u*g/L in November 2002 to 750 *u*g/L in March 2003. Similarly, the concentration of MTBE increased from <4 *u*g/L to 7 *u*g/L during the same time period.
- The concentration of benzene in MW-6, located directly down gradient of the former tank basins at the TPI Petroleum property and up gradient from the Site, increased ten-fold from 130 *u*g/L in March 2000 to 1,300 *u*g/L in March 2003.
- The only parameters of concern at the former State Police Post Site were BTEX compounds. MTBE was not detected in any samples collected during the initial remedial investigation activities conduct in June 1995 or July 1996.

Based on the presence of free product, groundwater contour maps indicating groundwater flow in a northerly direction, and monitoring well analytical results down gradient of the TPI Petroleum property (up gradient of the Site), it appears the Site is being impacted by the TPI Petroleum property. DLZ recommends TPI Petroleum take immediate action to control the continuing off-site migration of dissolved phase VOCs.