

HEALTH CONSULTATION

THE FORMER MIRO GOLF COURSE:
ADDITIONAL ENVIRONMENTAL CONTAMINATION DATA

VILLAGE OF DOUGLAS, ALLEGAN COUNTY, MICHIGAN

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Prepared by

The Michigan Department of Community Health
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Agency for Toxic Substance and Disease Registry

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Abbreviations and Acronyms

µg/L	micrograms per liter
DWC	Drinking Water Criteria
EMEG	Environmental Media Evaluation Guide
EPA	Environmental Protection Agency
FS	Feasibility Study
GCC	Groundwater Contact Criteria
GCPC	Groundwater Contact Protection Criteria
GSI	Groundwater Surface Water Interface Criteria
GSIPC	Groundwater Surface Water Interface Protection Criteria
GVIIC	Groundwater Volatilization to Indoor Air Inhalation Criteria
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MRL	Minimal Risk Level
ppb	parts per billion
ppm	parts per million
RfD	Reference Dose
RI	Remedial Investigation
SVIIC	Soil Volatilization to Indoor Air Inhalation Criteria
SVOC	semivolatile organic compound
TCE	trichloroethylene
VOC	volatile organic compound

Summary

In 2003, the Michigan Department of Community Health (MDCH) released a health consultation for The Former Miro Golf Course in Allegan County, Michigan. Since the release of that document, the Michigan Department of Environmental Quality (MDEQ) has had a Remedial Investigation conducted at the site. The site is contaminated with metals, polycyclic aromatic hydrocarbons, and volatile organic compounds in surface waters, groundwater, and subsurface soils. The site poses no apparent current public health hazard via vapor intrusion. The future public health hazard for vapor intrusion is indeterminate. The site poses no apparent public health hazard regarding oral intake of area surface waters.

The Remedial Investigation did not address arsenic found in the soil at the former Miro Golf Course, discussed in the 2003 health consultation. This issue should be addressed by the owner of the property, under MDEQ oversight.

Purpose and Health Issues

The purpose of this document is to provide follow-up to the health consultation, “The Former Miro Golf Course, Village of Douglas, Allegan County, Michigan” (ATSDR 2003). In the previous health consultation, MDCH concluded that contaminated groundwater at the site posed an indeterminate public health hazard to future users of the Miro property. Arsenic contamination of the soil on the Miro property posed an indeterminate public health hazard to current and future users of the site.

Since the release of the previous health consultation, MDCH has received additional environmental contamination data from a Remedial Investigation (RI) conducted for the Michigan Department of Environmental Quality (MDEQ). The RI addressed only the soil and groundwater contamination originating from the former Chase Manufacturing (Chase) facility. It did not address the arsenic contamination of the soil on the former Miro Golf Course (Miro), west of the facility (Figure 1).

This consultation will re-examine three of the community health concerns addressed in the previous document:

1. What is the likelihood that trichloroethylene (TCE) in the groundwater beneath the Miro property could volatilize into the basements of future homes and present a health hazard to the residents of those homes?
2. Does the TCE in the groundwater present a health hazard to neighboring residents?
3. Does the TCE-contaminated groundwater discharging to area surface waters present a health hazard to persons exposed to those waters (e.g., golfers retrieving golfballs, children playing in the water)?

Background

Previous environmental sampling at and around Chase revealed that there were heavy metals in the soil and chlorinated solvents in the groundwater (ATSDR 2003). The state

regulatory agency determined that Chase was responsible for the contamination. Although some remediation was done on a county drain affected by effluent from the company's wastewater treatment plant, transfer of ownership of the Chase property prevented a comprehensive clean-up. (The property is now owned by Haworth Inc.)

Part of the contaminated groundwater plume flows under Miro, a former golf course, immediately west of Chase. The Miro property had been slated to be developed for residential and light commercial use and has been zoned as such. No construction has occurred, however some earth moving took place in 2002 before the owner halted activities. (The owner stopped development upon learning of the soil and groundwater contamination.) The future use of this land has yet to be finalized. For this discussion, MDCH is assuming that residential development will occur.

MDEQ contracted with Weston Solutions, Inc. (Weston) to conduct a Remedial Investigation and Feasibility Study (RI/FS) of the groundwater plume, its source at Chase, and its discharge into area surface waters. Weston finalized the RI report in December 2003. The report's findings are discussed in the "Environmental Contamination" section below. The final FS report is pending.

Discussion

Screening Levels

When evaluating environmental data, regulatory and health agencies use screening criteria to determine whether a particular chemical is not of concern or warrants further scrutiny. These criteria are generally human health-based, although some MDEQ criteria are based on the protection of terrestrial or aquatic life or consider aesthetic qualities (taste).

The area around Miro is served by municipal water from wells outside of the affected area. Therefore, people would not normally be exposed via the drinking water pathway. However, people swimming or playing in area surface waters, such as Wick's Creek or Kalamazoo Lake, might inadvertently swallow a small amount of water. The Great Lakes Initiative, as used by the MDEQ Water Bureau, bases its incidental ingestion rate of 10 ml/day on an assumption of 123 hours of recreational exposure per year and an average mouthful of water (30 ml) per hour of recreation (2002, D. Bush, MDEQ Water Bureau, personal communication). MDCH calculated the maximum chemical-specific 10-ml/day dose received from accidental swallowing of contaminated surface water and compared that dose to the lower (i.e., more protective) of the U.S. Environmental Protection Agency's (EPA's) Reference Dose (**RfD**) or ATSDR's Minimal Risk Value (**MRL**) for the chemical. The RfD and MRL are concentrations below which no adverse health effects should result following exposure (ATSDR 2002). The RfD refers to long-term (chronic) exposure whereas an MRL can refer to short-term (acute), intermediate, or chronic exposure.

MDCH also compared the highest analytical result to the lower of the MDEQ Residential and Commercial I Drinking Water Criterion (**DWC**) or the ATSDR drinking water Environmental Media Evaluation Guide (**EMEG**) for the chemical. Although, as already

stated, area surface waters are not a source of drinking water, MDCH used these screening levels to provide an informal comparison to assist in the evaluation of the degree of health risk. The DWC identifies a drinking water concentration protective of long-term daily consumption (MDEQ 2002a). The EMEG, which applies to a water concentration and not a dose, can refer to acute, intermediate, or chronic exposure (ATSDR 2002).

Although people living or playing in the area should not be exposed to the groundwater, the groundwater discharges into area surface waters, where people can be exposed by incidental ingestion during recreational activities (swimming, wading, etc.). To evaluate this potential exposure, MDCH compared groundwater data to the MDEQ Groundwater Surface-Water Interface criteria (**GSI**). The GSI identify groundwater concentrations that are protective of a receiving surface water. The criteria are based on the most protective value for aquatic life, terrestrial life, or human health (MDEQ 2004). For this discussion, MDCH used the value protective of human health for surface water that is not a normal source of drinking water.

Workers who enter subsurface excavations, such as utility crews entering sewers or construction workers excavating basements, might come into contact with contaminated groundwater or surface water accumulated in those areas. To evaluate this type of exposure, MDCH compared groundwater and surface water data to the MDEQ Groundwater Contact Criteria (**GCC**). These criteria identify groundwater concentrations that are protective against adverse health effects that may result from dermal exposure to chemicals in groundwater, such as could be experienced by workers in subsurface excavations. The criteria are only protective of chronic systemic human health effects and do not address flammability/explosivity or acute inhalation and dermal toxicity (MDEQ 2002b).

Volatile organic compounds (VOCs) present in groundwater may volatilize (change to a gas form), pass through the soil, and enter indoor air through a crack in a building's foundation. This phenomenon, known as vapor intrusion, can cause indoor air levels of VOCs to reach unsafe levels. To evaluate this pathway, MDCH compared groundwater data to the MDEQ Groundwater Volatilization to Indoor Air Inhalation Criteria (**GVIIC**). This pathway is relevant only for volatile compounds. The criteria are *not* applicable if a structure does not contain materials, at or below grade, that limit vapor intrusion (poured cement walls versus soil basements or crawlspaces), there is an open sump, or depth to groundwater is less than 3 meters (about 10 feet) below grade (MDEQ 2002c).

Area residents and construction workers could have skin contact with the soil while working on their property (such as in landscaping or adding a deck) or in excavations, respectively. Alternatively, employees at Haworth (the former Chase facility) could be exposed to contaminated soil at their worksite. To evaluate these exposure pathways, MDCH compared subsurface soil data to the MDEQ Residential and Commercial I Direct Contact Criteria (**DCC**). (Although the Haworth facility is an industrial scenario, several of the sampling locations MDCH included in the Source Area evaluation were off-site and near residential properties.) The DCC identify soil concentrations that are protective

against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil (MDEQ 2002d).

Some chemicals have the ability to leach through soils and enter groundwater. The Groundwater Surface Water Interface Protection Criteria (**GSIPC**) identify soil concentrations of chemicals that are not expected to leach and contaminate groundwater at levels greater than the corresponding GSI criteria (MDEQ 2004). The Groundwater Contact Protection Criteria (**GCPC**) identifies soil concentrations that are not expected to contaminate groundwater at levels greater than the GCC (MDEQ 2002b).

VOCs in soil can volatilize and enter the indoor air of nearby buildings, possibly reaching unsafe concentrations. To evaluate this pathway, MDCH compared groundwater data to the MDEQ Soil Volatilization to Indoor Air Inhalation Criteria (**SVIIC**). These criteria identify soil concentrations that protect occupants from exposure to indoor air concentrations that may cause adverse health effects. The pathway is relevant only for volatile compounds. The criteria are *not* applicable if a structure does not contain materials, at or below grade, that limit vapor intrusion (poured cement walls versus soil basements or crawlspaces), or there is an open sump (MDEQ 2002c).

Environmental Contamination

Earth Tech, Inc., under contract with Weston, performed the field investigation in Douglas from April to July 2003. For this discussion, MDCH considered all sampling sites west of Ferry Street and those sites east of Ferry Street but north of Center Street as the “Plume Area.” MDCH considered the sampling sites east of Ferry Street and south of Center Street as the “Source Area” (Figure 2). (Therefore, the Plume Area as labeled by MDCH contains the Plume Investigation area as well as the Wick’s Creek Investigation area, as described in the RI report [Earth Tech, Inc. 2003]).

The investigation included groundwater and surface water samplings and subsurface soil samplings. Samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), and metals. Tables 1-3b show analytical results for chemicals detected in at least one environmental medium and comparisons to screening levels. The TCE groundwater plume isoconcentrations are depicted in Figure 3.

In addition to the chemicals listed in the tables, p-isopropyltoluene (or p-cymene) was detected (2.5 µg/L) in one groundwater sample taken in the Source Area. There are no MDEQ criteria nor an RfD or MRL for this compound. Therefore, this chemical is discussed further in the “Toxicological Evaluation” section of this document.

Chromium exists in several valence states. MDCH compared all chromium concentrations to the more-protective screening levels for the hexavalent form. If there were exceedances, MDCH further evaluated the findings, referring to the raw data (laboratory data sheets). The GSI and the GSIPC for trivalent chromium, the less toxic and more common form of the chemical, are 100 ppb and 2,900,000 ppm, respectively. Therefore, no GSI exceedances for trivalent chromium occurred in the April groundwater sampling results (and the only detection for hexavalent chromium did not exceed its

GSI). One groundwater sample, taken in July from the Source Area, exceeded the trivalent chromium GSI. (The sampling location for this exceedance was different than the location for the exceedance of the hexavalent chromium GSI, also taken in July.) There were no GSIPC exceedances for trivalent chromium in the July soil samples.

GSI exceedances suggest, and the detection of various chemicals in area surface water indicate, that groundwater contamination is discharging to area ponds, Wick's Creek, and Kalamazoo Lake. Although several metals exceeded their respective GSIs in groundwater samples, the 10-ml/day dose from surface water was well below the corresponding RfD or MRL.

The maximum surface water concentrations of cis-1,2-dichloroethylene and tetrachloroethylene exceeded their respective Drinking Water Criteria (DWC). The magnitude of the exceedances was not great (Table 1). (In general, an exceedance of more than 10 times the screening level is cause for concern.) Therefore, these concentrations are not of concern.

The maximum surface water concentrations of TCE and vinyl chloride exceeded their respective DWC by about 300 and 20 times, respectively, suggesting the need for further evaluation. The 10-ml/day dose of each chemical did not exceed its respective MRL. However, the MRL listed for TCE is for acute exposure, defined by ATSDR as that which occurs in less than two weeks' time. (There are no intermediate or chronic MRLs for TCE, and the RfD is currently under review by the EPA.) The degree of exposure to area surface waters is not known and might be greater than two weeks. The likelihood of exposure to surface waters is discussed further in the "Human Exposure Pathways" section.

Human Exposure Pathways

To determine whether nearby residents are, have been, or are likely to be exposed to contaminants associated with a property, ATSDR and MDCH evaluate the environmental and human components that could lead to human exposure. An exposure pathway contains five major elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. An exposure pathway is considered complete if all five elements are, have been, or will be present at the property. Alternatively, an exposure pathway is considered complete if probability of exposure is high. A pathway is considered either potential or incomplete if no evidence exists that at least one of the elements above is, has been, or will be present at the property, or if the probability of exposure is low. Table 4 shows the exposure pathways expected for the Miro property:

Table 4. Exposure pathways matrix for chemicals of concern on and near the Former Miro Golf Course, Douglas, Michigan.

Source	Environmental Transport and Media	Chemicals of Concern	Exposure Point	Exposure Route	Exposed Population	Time	Status
Former Chase facility	Ground-water	VOCs, metals	Area surface waters (especially Wick's Creek)	Dermal, oral, inhalation	Golfers, recreational users of local surface waters	Past	Potential
						Present	Potential
						Future	Potential
	Ground-water	VOCs, SVOCs	Water in subsurface excavations	Dermal, oral, inhalation	Construction or utility workers	Past	Potential
						Present	Potential
						Future	Potential
	Ground-water	VOCs	Indoor air	Inhalation	Current or future residents living over or near the plume, employees at Haworth	Past	Potential
						Present	Incomplete
						Future	Potential
	Soil	VOCs	Water in subsurface excavations	Dermal, oral, inhalation	Employees at or construction workers near Haworth	Past	Potential
						Present	Potential
						Future	Potential
	Soil	VOCs	Indoor air	Inhalation	Employees at Haworth	Past	Potential
						Present	Incomplete
						Future	Potential
NOTE: THE PRESENCE OF AN EXPOSURE PATHWAY IN THIS TABLE DOES NOT IMPLY THAT AN EXPOSURE WOULD BE SUBSTANTIVE OR THAT AN ADVERSE HEALTH EFFECT WOULD OCCUR.							

Surface Water Exposure

Golfers at Westshore Golf Club, on the northwest corner of Center and Ferry Streets (Figure 2), may enter Wick's Creek to retrieve golf balls. Children in the Miro area might play in area surface waters, although not on a regular basis. (Families looking for water-based recreational opportunities would more likely go to Lake Michigan, about two miles west of the site.) Sampling sites along Wick's Creek, starting at the point where the creek starts flowing northward (SW-4 on Figure 2), showed the highest concentrations of VOCs among all surface water samples. Concentrations seen for the ponds and Kalamazoo Lake were of lesser or no concern.

Figure 4 is a photograph, taken from Center Street, of the area of Westshore Golf Club where surface water sample SW-4 was taken. It is unlikely that a child would spend much time in Wick's Creek at this location because the child would be at risk of being hit by a golf ball. A child wanting to play or explore in the creek would likely choose a more secluded, upstream (to the left in the photograph) location, off the golf course. No VOCs were detected in the surface water samples taken upstream of SW-4. Exposure to

VOCs in Wick's Creek is not expected to result in adverse health effects due to the infrequency of expected exposure.

Figure 4. Westshore Golf Course, southeast corner, near Center and Ferry Streets, Douglas, Michigan.



Indoor Air Exposure

TCE found in the groundwater in the Source Area might volatilize, travel through the soil, and enter the indoor air at the Haworth plant or at residences located in the Source Area. (To be protective, MDCH compared all analytical results for groundwater to the Residential/Commercial I Groundwater Volatilization to Indoor Air Inhalation Criterion [GVIIC]. The Industrial GVIIC for TCE is 97,000 ppb.) Only one sampling location, out of a maximum of 26, exceeded the GVIIC. That location was near the current Haworth plant. Groundwater depth near the plant is about 35 feet (Earth Tech Inc. 2003). The MDEQ criterion assumes that depth to groundwater is 10 feet, meaning that, as depth increases, so should the criterion. The maximum TCE concentration found (23,000 ppb) is less than twice the Residential/Commercial I GVIIC of 15,000 ppb. Because the magnitude of the exceedance is not significant and because a site-specific criterion could be greater than 23,000 ppb, it is unlikely that any vapors currently originating from the TCE in the groundwater would accumulate in indoor air to a degree that would cause health effects. However, future underground construction could lead to preferential pathways along which vapors could easily migrate.

The TCE groundwater plume has its highest concentrations at Chase (Figure 3). The concentrations decrease as the plume spreads outward and flows toward its discharge points in area surface waters. No exceedances of the GVIIC or its soil counterpart, the SVIIC, occurred in the Plume Area, suggesting current residents are not being exposed to harmful concentrations of TCE in the indoor air. However, as argued for the Source Area, future underground construction could lead to preferential pathways along which vapors could easily migrate.

Vinyl chloride was not detected in subsurface soil samples and the highest groundwater concentration found (560 ppb) was about half the GVIIC of 1,100 ppb. Therefore, there likely is no current exposure via vapor intrusion and health effects via this pathway should not occur. However, as discussed for TCE, future construction activities could result in preferential pathways along which vapors could migrate.

Exposure in Excavations

Contaminated groundwater may seep into subsurface excavations at this site. Several semi-volatile organic compounds (SVOCs) as well as TCE exceeded their respective Groundwater Contact Criteria (GCC) in the Source Area. However, the magnitude of these exceedances was not significant (less than 3 times the respective criterion). As well, only one sampling location, out of a maximum of 26, contained all of the exceedances. Utility workers would likely be wearing personal protective equipment when entering subsurface excavations, minimizing exposure. Construction workers might not have appropriate protective gear. However, the duration of their exposure would be less than that of utility workers, who routinely enter sewers and pipes. Therefore, this exposure pathway is not expected to result in adverse health effects.

Toxicological Evaluation

No significant exposure to the chemicals detected in the surface water, groundwater, and subsurface soil is expected occur. Therefore toxic effects are not expected to occur.

p-Isopropyltoluene

p-Isopropyltoluene is a solvent used as a thinner for lacquers and varnishes and as a fragrance. It can be manufactured from toluene or terpenes, and also occurs naturally. It is a clear, colorless liquid with a sweet, aromatic odor. As a liquid, it can irritate the skin and eyes upon contact. It is not an irritant in its vapor form (HSDB 2004). Because contamination was limited (only one sample contained the chemical), it is not likely that the presence of p-isopropyltoluene in the Miro area would cause adverse health effects.

ATSDR Child Health Considerations

In general, children may be at greater risk than are adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as playing outdoors and hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than are most adults, and therefore breathe dust, soil, and vapors closer to the ground. Their lower body weight and higher intake rate result in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high

enough during critical growth stages. Even before birth, children are forming the body organs they need to last a lifetime. Injury during key periods of growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death. Exposure of the pregnant mother could lead to exposure of the fetus via the placenta, or injury or illness sustained by the mother could affect the fetus (ATSDR 1998). The obvious implication for environmental health is that children can be more susceptible to toxicant exposures in soils, water, or air compared to adults.

Although children in the Miro area might play or wade in area surface waters, exposure to any chemicals in the water should be infrequent. Additionally, children likely would not enter Wick's Creek, the surface water with the highest concentrations of TCE, where the creek runs through the golf course. If children enter the creek, they would probably do so upstream and away from the golf course. VOCs were not detected along this section of the creek. Therefore, children should not experience adverse health effects as a result of entering Wick's Creek or other surface waters.

Community Health Concerns

1. What is the likelihood that TCE in the groundwater beneath the Miro property could volatilize into the basements of future homes and present a health hazard to the residents of those homes?

According to the environmental data in the RI, concentrations of TCE in the plume under the former Miro Golf Course, where homes may be built in the future, are below the MDEQ criterion that deals with vapor intrusion (GVIIC). However, EPA is re-evaluating the toxicology data for TCE, which might result in lower criteria in the future. As well, it is possible that subsurface construction activities involving the laying of cable or pipe may lead to the development of preferential pathways along which underground vapors can migrate. Therefore, developers should exercise due care during construction and consider preventative measures, such as installing sub-slab depressurization systems. These systems are used in radon mitigation situations and are increasingly used to address vapor intrusion by VOCs.

2. Does the TCE in the groundwater present a health hazard to neighboring residents?

No. Although part of the TCE plume flows under residential properties north of Haworth, the concentrations are well below those of concern. The plume does not appear to affect properties west of the former Miro Golf Course.

3. Does the TCE-contaminated groundwater discharging to area surface waters present a health hazard to persons exposed to those waters (e.g., golfers retrieving golfballs, children playing in the water)?

No. Exposure is expected to be insignificant.

Conclusions

There is no apparent current public health hazard via inhalation of indoor air, however the hazard is indeterminate for the future. It is likely that, due to the depth to groundwater, VOC vapors cannot enter indoor air at Haworth to an extent that would be harmful. Future construction activities in the area near and above the plume, however, could result in preferential vapor pathways leading toward structures.

There is no apparent public health hazard posed by incidental ingestion of local surface waters. Exposure is expected to be infrequent and insignificant.

As mentioned in the “Purpose and Health Issues” section of this document, the arsenic in soil at the former Miro Golf Course was not addressed by the RI. Nonetheless, arsenic remains a concern. If this area is developed, the arsenic must be addressed, dependent on proposed land use.

Recommendations

1. The contamination of the groundwater, and resulting contamination of area surface waters, should be addressed, per MDEQ’s mandate to protect the environment.
2. The arsenic contamination in the soil at the former Miro Golf Course should be addressed.

Public Health Action Plan

1. MDEQ will determine appropriate clean-up actions and oversee their implementation.
2. The owner of the former Miro Golf Course will characterize the property soil for arsenic and address the contamination, under MDEQ oversight.

New environmental data or information concerning the future use of this property may require future health consultations.

If any citizen has additional information or health concerns regarding this health consultation, please contact the Michigan Department of Community Health, Environmental and Occupational Epidemiology Division, at 1-800-648-6942.

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Table 1. Surface water concentration data for Plume Area at the Former Miro Golf Course, Douglas, Michigan.										
	April 2003 sampling		July 2003 sampling							
Chemical	No. detections / No. samples	Concentration range	No. detections / No. samples	Concentration range	maximum ug/L	10 ml/d dose (mg/kg/d)	RfD or MRL (mg/kg/d)	A, I, C	DWC or EMEG (ug/L)	GCC (no. exceedances April, July)
1,1,1-Trichloroethane	4 / 13	1.1 - 2.9	4 / 13	1.3 - 13	13	1.3E-05	NA		200	1,300,000 (0,0)
1,1-Dichloroethane	2 / 13	1.1 - 3.1	1 / 13	4.1	3.1	3.1E-06	2.0E-01	I	880	2,400,000 (0,0)
1,1-Dichloroethylene	3 / 13	1.2 - 1.9	0 / 13	ND	1.9	1.9E-06	9.0E-03	C	7	11,000 (0,0)
1,2,4-Trimethylbenzene	0 / 13	ND	0 / 13	ND						56,000
1,2-Dichloroethane	0 / 13	ND	0 / 13	ND						19,000
1,3,5-Trimethylbenzene	0 / 13	ND	0 / 13	ND						61,000
2,4-Dimethylphenol	NT	-	NT	-						520,000
2-Methylnaphthalene	0 / 13	ND	0 / 13	ND						ID
Arsenic	4 / 13	1.1 - 1.2	NT	-	1.2	1.2E-06	3.0E-04	C	3	4,300 (0,0)
Barium	13 / 13	30 - 88	NT	-	88	8.8E-05	7.0E-02	C	700	14,000,000 (0,0)
Benzo(a)anthracene	NT	-	NT	-						9.4
Benzo(a)pyrene	NT	-	NT	-						2
Benzo(b)fluoranthene	NT	-	NT	-						5
Benzo(g,h,i)perylene	NT	-	NT	-						5
Benzene	0 / 13	ND	0 / 13	ND						11,000
bis(2-Ethylhexyl)phthalate	NT	-	NT	-						320
Bromodichloromethane	0 / 13	ND	0 / 13	ND						14,000
Butylbenzyl phthalate	NT	-	NT	-						2,700
Cadmium	1 / 13	0.52	NT	-	0.52	5.2E-07	2.0E-04	C	2	190,000 (0,0)
Chloroethane	0 / 13	ND	0 / 13	ND						440,000
Chloroform	0 / 13	ND	0 / 13	ND						150,000
Chloromethane	2 / 13	1.2 - 1.4	0 / 13	ND	1.4	1.4E-06	NA		260	490,000 (0,0)
Chromium	0 / 13	ND	NT	-						460,000
Chrysene	NT	-	NT	-						5
cis-1,2-Dichloroethylene	7 / 13	1.8 - 89	7 / 13	1.2 - 350	350	3.5E-04	NA		70	200,000 (0,0)
Copper	1 / 13	11	NT	-	11	1.1E-05	2.0E-02	A,I	200	7,400,000 (0,0)
Dibromochloromethane	0 / 13	ND	0 / 13	ND						18,000
Di-n-butyl phthalate	NT	-	NT	-						11,000
Ethylbenzene	0 / 13	ND	0 / 13	ND						170,000
Fluoranthene	NT	-	NT	-						210
Hexavalent chromium	0 / 13	ND	NT	-						460,000
Indeno(1,2,3-cd)pyrene	NT	-	NT	-						2
Isopropylbenzene	0 / 13	ND	0 / 13	ND						56,000
Lead	0 / 13	ND	NT	-						ID
Manganese	0 / 13	ND	NT	-						9,100,000
Mercury	0 / 13	ND	NT	-						56

Table 2a. Groundwater concentration data for Plume Area at the Former Miro Golf Course, Douglas, Michigan.									
	April 2003 sampling		July 2003 sampling						
Chemical	No. detections / No. samples	Concentration range	No. detections / No. samples	Concentration range	GSI (no. exceedances April, July)	GCC (no. exceedances April, July)	R/C GV/IC (no. exceedances April, July)		
1,1,1-Trichloroethane	14 / 51	1.3 - 59	3 / 42	2.9 - 62	200 (0,0)	1,300,000 (0,0)	660,000 (0,0)		
1,1-Dichloroethane	18 / 51	1.2 - 150	4 / 42	1 - 6.3	740 (0,0)	2,400,000 (0,0)	1,000,000 (0,0)		
1,1-Dichloroethylene	16 / 51	1.2 - 110	0 / 42	ND	65 (3,0)	11,000 (0,0)	200 (0,0)		
1,2,4-Trimethylbenzene	0 / 51	ND	0 / 42	ND	17	56,000	56,000		
1,2-Dichloroethane	0 / 51	ND	0 / 42	ND	360	19,000	9,600		
1,3,5-Trimethylbenzene	0 / 51	ND	0 / 42	ND	45	61,000	61,000		
2,4-Dimethylphenol	NT	-	0 / 1	ND	380	520,000	NLV		
2-Methylnaphthalene	0 / 51	ND	0 / 42	ND	ID	ID	25,000		
Arsenic	26 / 40	1.3 - 78	1 / 1	6.2	150 (0,0)	4,300 (0,0)	NLV		
Barium	39 / 40	12 - 2,400	1 / 1	180	670 (1,0)	14,000,000 (0,0)	NLV		
Benzo(a)anthracene	NT	-	0 / 1	ND	ID	9.4	NLV		
Benzo(a)pyrene	NT	-	0 / 1	ND	ID	2	NLV		
Benzo(b)fluoranthene	NT	-	0 / 1	ND	NA	5	NLV		
Benzo(g,h,i)perylene	NT	-	0 / 1	ND	NA	5	NLV		
Benzene	4 / 51	1.4 - 2.1	0 / 42	ND	200 (0,0)	11,000 (0,0)	5,600 (0,0)		
bis(2-Ethylhexyl)phthalate	NT	-	0 / 1	ND	32	320	NLV		
Bromodichloromethane	0 / 51	ND	2 / 42	2 - 2.5	ID	14,000 (0,0)	4,800 (0,0)		
Butylbenzyl phthalate	NT	-	0 / 1	ND	14	2,700	NLV		
Cadmium	6 / 40	0.61 - 170	0 / 11	ND	3 (2,0)	190,000 (0,0)	NLV		
Chloroethane	0 / 51	ND	0 / 42	ND	ID	440,000	5,700,000		
Chloroform	4 / 51	1.3 - 2.8	2 / 42	7.8 - 8.8	170 (0,0)	150,000 (0,0)	28,000 (0,0)		
Chloromethane	4 / 51	1 - 2.6	0 / 42	ND	ID	490,000	8,600		
Chromium	11 / 40	7.3 - 90	0 / 1	ND	11 (9,0)	460,000 (0,0)	NLV		
Chrysene	NT	-	0 / 1	ND	ID	5	ID		
cis-1,2-Dichloroethylene	33 / 51	1.5 - 35,000	12 / 42	1.9 - 1,800	620 (9,2)	200,000 (0,0)	93,000 (0,0)		
Copper	7 / 40	11 - 88	0 / 1	ND	13 (4,0)	7,400,000 (0,0)	NLV		
Dibromochloromethane	0 / 51	ND	2 / 42	1.1	ID	18,000 (0,0)	14,000 (0,0)		
Di-n-butyl phthalate	NT	-	0 / 1	ND	9.7	11,000	NLV		
Ethylbenzene	0 / 51	ND	0 / 42	ND	18	170,000	110,000		
Fluoranthene	NT	-	0 / 1	ND	5	210	210		
Hexavalent chromium	1 / 40	9	0 / 1	ND	11 (0,0)	460,000 (0,0)	NLV		
Indeno(1,2,3-cd)pyrene	NT	-	0 / 1	ND	ID	2	NLV		
Isopropylbenzene	0 / 51	ND	0 / 42	ND	ID	56,000	56,000		
Lead	9 / 40	3.3 - 69	1 / 1	3.5	16 (3,0)	ID	NLV		
Manganese	16 / 40	73 - 33,000	1 / 1	97	2,800 (2,0)	9,100,000 (0,0)	NLV		
Mercury	1 / 40	8.4	0 / 1	ND	0.0013 (1,0)	56 (0,0)	56 (0,0)		

Table 2b. Groundwater concentration data for Source Area at the Former Miro Golf Course, Douglas, Michigan.									
Chemical	April 2003 sampling		July 2003 sampling		GSI (no. exceedances April, July)	GCC (no. exceedances April, July)	R/C GVHC (no. exceedances April, July)		
	No. detections / No. samples	Concentration range	No. detections / No. samples	Concentration range					
1,1,1-Trichloroethane	3 / 12	7.3 - 78	5 / 26	2.9 - 210	200 (0,1)	1,300,000 (0,0)	660,000 (0,0)		
1,1-Dichloroethane	3 / 12	1.9 - 61	2 / 26	11 - 160	740 (0,0)	2,400,000 (0,0)	1,000,000 (0,0)		
1,1-Dichloroethylene	3 / 12	13 - 15	3 / 26	2.9 - 94	65 (0,1)	11,000 (0,0)	200 (0,0)		
1,2,4-Trimethylbenzene	0 / 12	ND	4 / 26	1.1 - 1,000	17 (0,2)	56,000 (0,0)	56,000 (0,0)		
1,2-Dichloroethane	0 / 12	ND	1 / 26	1.8	360 (0,0)	19,000 (0,0)	9,600 (0,0)		
1,3,5-Trimethylbenzene	0 / 12	ND	3 / 26	3.5 - 260	45 (0,1)	61,000 (0,0)	61,000 (0,0)		
2,4-Dimethylphenol	0 / 10	ND	1 / 14	62	380 (0,0)	520,000 (0,0)	NLV		
2-Methylnaphthalene	0 / 12	ND	1 / 26	85	ID	ID	25,000 (0,0)		
Arsenic	8 / 12	1.4 - 22	12 / 14	2.1 - 64	150 (0,0)	4,300 (0,0)	NLV		
Barium	11 / 12	22 - 220	14 / 14	18 - 1,500	670 (0,1)	14,000,000 (0,0)	NLV		
Benzo(a)anthracene	1 / 10	3.4	0 / 14	ND	ID	9.4 (0,0)	NLV		
Benzo(a)pyrene	1 / 10	5.2	0 / 14	ND	ID	2 (1,0)	NLV		
Benzo(b)fluoranthene	1 / 10	8.8	0 / 14	ND	NA	5 (1,0)	NLV		
Benzo(g,h,i)perylene	0 / 10	ND	0 / 14	ND	NA	5	NLV		
Benzene	0 / 12	ND	0 / 26	ND	200	11,000	5,600		
bis(2-Ethylhexyl)phthalate	2 / 10	9.7 - 12	0 / 14	ND	32 (0,0)	320 (0,0)	NLV		
Bromodichloromethane	0 / 12	ND	3 / 26	1.4 - 2.3	ID	14,000 (0,0)	4,800 (0,0)		
Butylbenzyl phthalate	0 / 10	ND	0 / 14	ND	14	2,700	NLV		
Cadmium	2 / 12	1.1 - 3.5	5 / 14	0.47 - 8.4	3 (1,2)	190,000 (0,0)	NLV		
Chloroethane	1 / 12	16	0 / 26	ND	ID	440,000 (0,0)	5,700,000 (0,0)		
Chloroform	1 / 12	1.7	3 / 26	5.1 - 8.7	170 (0,0)	150,000 (0,0)	28,000 (0,0)		
Chloromethane	0 / 12	ND	0 / 26	ND	ID	490,000	8,600		
Chromium	4 / 12	11 - 29	7 / 14	6.8 - 410	11 (4,5)	460,000 (0,0)	NLV		
Chrysene	0 / 10	ND	0 / 14	ND	ID	5	ID		
cis-1,2-Dichloroethylene	9 / 12	2.8 - 2,300	17 / 26	1.1 - 1,100	620 (2,2)	200,000 (0,0)	93,000 (0,0)		
Copper	1 / 12	32	6 / 14	3.5 - 330	13 (1,2)	7,400,000 (0,0)	NLV		
Dibromochloromethane	0 / 12	ND	1 / 26	1.2	ID	18,000 (0,0)	14,000 (0,0)		
Di-n-butyl phthalate	0 / 10	ND	0 / 14	ND	9.7	11,000	NLV		
Ethylbenzene	0 / 12	ND	4 / 26	1.2 - 620	18 (0,3)	170,000 (0,0)	110,000 (0,0)		
Fluoranthene	1 / 10	13	0 / 14	ND	5 (1,0)	210 (0,0)	210 (0,0)		
Hexavalent chromium	0 / 12	ND	3 / 10	8 - 33	11 (0,1)	460,000 (0,0)	NLV		
Indeno(1,2,3-cd)pyrene	1 / 10	5	0 / 14	ND	ID	2 (1,0)	NLV		
Isopropylbenzene	0 / 12	ND	2 / 26	1.8 - 48	ID	56,000 (0,0)	56,000 (0,0)		
Lead	4 / 12	3.1 - 27	6 / 14	2.8 - 160	16 (2,4)	ID	NLV		
Manganese	6 / 12	49 - 7,700	14 / 14	61 - 21,000	2,800 (1,2)	9,100,000	NLV		
Mercury	0 / 12	ND	0 / 14	ND	0.0013	56	56		

Table 3a. Subsurface soil concentration data for Plume Area at the Former Miro Golf Course, Douglas, Michigan.

Chemical	April 2003 sampling		R/C DCC (no. exceedances)	GSIPC (no. exceedances)	GCPC (no. exceedances)	R/C SVIIC (no. exceedances)
	No. detections / No. samples	Concentration range				
1,1,1-Trichloroethane	0 / 3	ND	460	4	460	250
1,1-Dichloroethane	0 / 3	ND	890	15	890	230
1,1-Dichloroethylene	0 / 3	ND	200	1.3	220	0.062
1,2,4-Trimethylbenzene	0 / 3	ND	110	0.57	110	110
1,2-Dichloroethane	0 / 3	ND	91	7.2	380	2.1
1,3,5-Trimethylbenzene	0 / 3	ND	94	1.1	94	94
2,4-Dimethylphenol	NT	-	11,000	7.6	10,000	NLV
2-Methylnaphthalene	0 / 3	ND	8,100	ID	5,500	ID
Arsenic	3 / 3	0.84 - 1.5	7.6 (0)	70 (0)	2,000 (0)	NLV
Barium	3 / 3	5.4 - 14	37,000 (0)	440 (0)	1,000,000 (0)	NLV
Benzo(a)anthracene	NT	-	20	NLL	NLL	NLV
Benzo(a)pyrene	NT	-	2	NLL	NLL	NLV
Benzo(b)fluoranthene	NT	-	20	NLL	NLL	NLV
Benzo(g,h,i)perylene	NT	-	2,500	NLL	NLL	NLV
Benzene	0 / 3	ND	180	4	220	1.6
bis(2-Ethylhexyl)phthalate	NT	-	2,800	NLL	NLL	NLV
Bromodichloromethane	0 / 3	ND	110	ID	280	1.2
Butylbenzyl phthalate	NT	-	310	26	310	NLV
Cadmium	3 / 3	0.05 - 0.092	550 (0)	3.6 (0)	230,000 (0)	NLV
Chloroethane	0 / 3	ND	950	ID	950	950
Chloroform	0 / 3	ND	1,200	3.4	1,500	7.2
Chloromethane	0 / 3	ND	1,100	ID	1,100	2.3
Chromium	3 / 3	2.6 - 3.6	2,500 (0)	3.3 (2)	140,000 (0)	NLV
Chrysene	NT	-	2,000	NLL	NLL	NLV
cis-1,2-Dichloroethylene	0 / 3	ND	640	12	640	22
Copper	3 / 3	1.3 - 2.3	20,000 (0)	75 (0)	1,000,000 (0)	NLV
Dibromochloromethane	0 / 3	ND	110	ID	360	3.9
Di-n-butyl phthalate	NT	-	760	11	760	NLV
Ethylbenzene	0 / 3	ND	140	0.36	1.4	87
Fluoranthene	NT	-	46,000	5.5	730	1,000,000
Hexavalent chromium	0 / 3	ND	2,500	3.3	140,000	NLV
Indeno(1,2,3-cd)pyrene	NT	-	20	NLL	NLL	NLV
Isopropylbenzene	0 / 3	ND	390	ID	390	390
Lead	3 / 3	2.7 - 3.6	400 (0)	2,800 (0)	ID	NLV
Manganese	3 / 3	31 - 64	25,000 (0)	440 (0)	180,000 (0)	NLV
Mercury	3 / 3	0.025 - 0.042	160 (0)	0.13 (0)	47 (0)	48 (0)
Methylene chloride	3 / 3	0.37 - 0.46	1,300 (0)	19 (0)	2,300 (0)	45 (0)
Napthalene	0 / 3	ND	16,000	0.87	2,100	250
n-Butylbenzene	0 / 3	ND	2,500	ID	120	ID
Nickel	3 / 3	1.7 - 2.5	40,000 (0)	76 (0)	1,000,000 (0)	NLV
n-Propylbenzene	0 / 3	ND	2,500	NA	300	ID
Phenanthrene	NT	-	1,600	5.3	1,100	2,800
Pyrene	NT	-	29,000	ID	480	1,000,000
sec-Butylbenzene	0 / 3	ND	2,500	ID	88	ID
Selenium	0 / 3	ND	2,600	0.41	78,000	NLV
Styrene	0 / 3	ND	400	2.2	270	250
Tetrachloroethylene	0 / 3	ND	88	0.9	88	11
Toluene	0 / 3	ND	250	2.8	250	2,800
trans-1,2-Dichloroethylene	0 / 3	ND	1,400	30	1,400	23
Trichloroethylene	0 / 3	ND	500	4	440	7.1
Vinyl chloride	0 / 3	ND	3.8	0.3	20	0.27
Xylenes	0 / 3	ND	150	0.7	150	150
Zinc	3 / 3	8.9 - 17	170,000 (0)	170 (0)	1,000,000 (0)	NLV

Table 3a. Subsurface soil concentration data for Plume Area at the Former Miro Golf Course, Douglas, Michigan.

<u>Acronyms/Abbreviations:</u>						
GCPC	Groundwater Contact Protection Criteria					
GSIPC	Groundwater Surface Water Interface Protection Criteria					
ID	insufficient data to determine criterion					
NA	not available					
ND	not detected					
NLL	not likely to leach					
NLV	not likely to volatilize					
NT	not tested for in this medium on this date					
R/C DCC	Residential and Commercial I Direct Contact Criteria					
R/C SVIIC	Residential and Commercial I Soil Volatilization to Indoor Air Inhalation Criteria					
<u>Notes:</u>						
1. All concentrations in ppm (mg/kg).						
2. All chemicals listed were detected in at least one environmental medium. Chemicals in bold were detected in groundwater. Shaded chemicals had detections greater than screening levels (exceedances).						
3. Chromium criteria shown are for the hexavalent form. These criteria are more protective than those for the trivalent form.						
Reference:						
EarthTech, Inc. 2003						

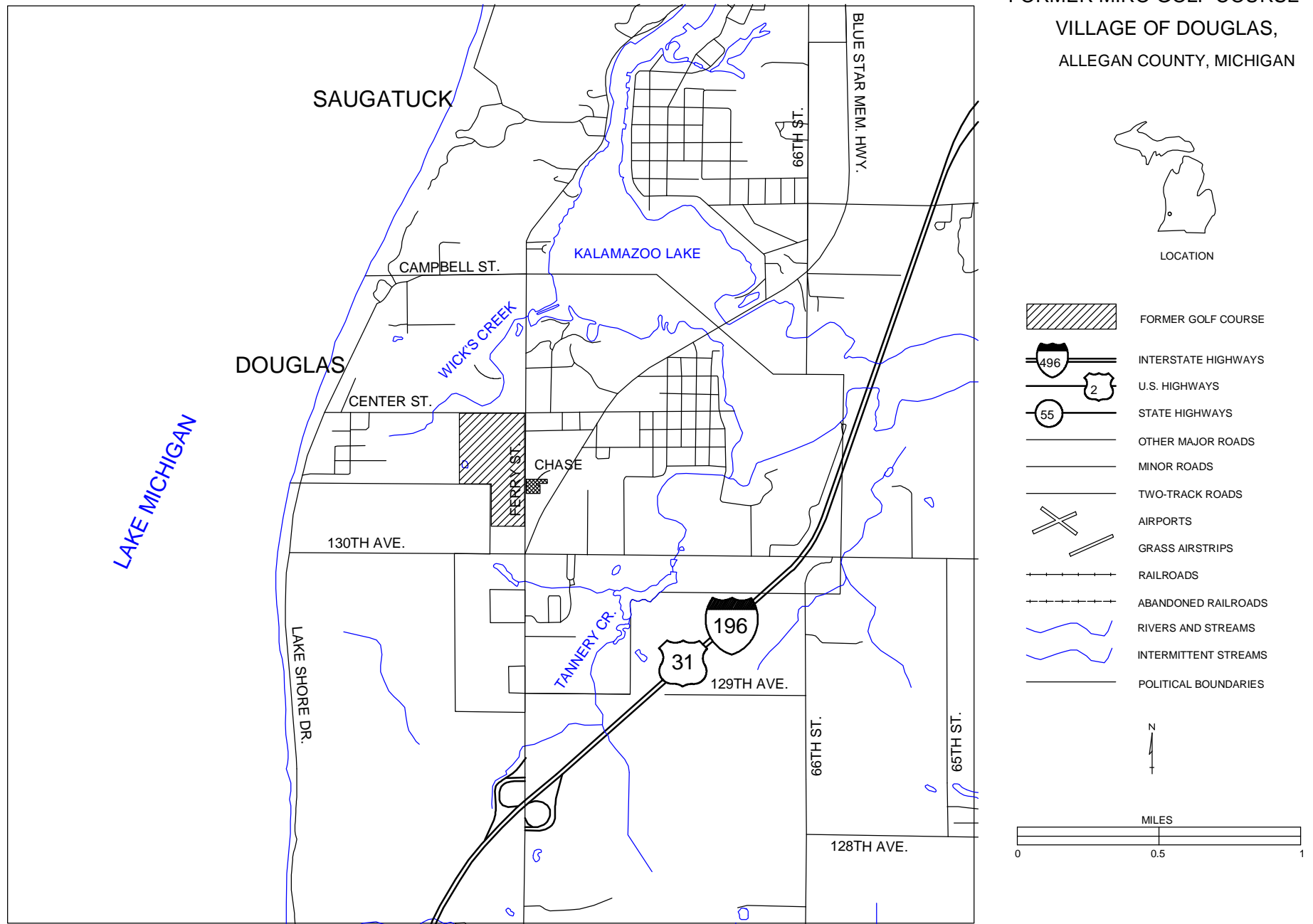
Table 3b. Subsurface soil concentration data for Source Area at the Former Miro Golf Course, Douglas, Michigan.

Chemical	July 2003 sampling		R/C DCC (no. exceedances)	GSIPC (no. exceedances)	GCPC (no. exceedances)	R/C SVIIC (no. exceedances)
	No. detections / No. samples	Concentration range				
1,1,1-Trichloroethane	0 / 16	ND	460	4	460	250
1,1-Dichloroethane	0 / 16	ND	890	15	890	230
1,1-Dichloroethylene	0 / 16	ND	200	1.3	220	0.062
1,2,4-Trimethylbenzene	2 / 16	0.074 - 0.24	110 (0)	0.57 (0)	110 (0)	110 (0)
1,2-Dichloroethane	0 / 16	ND	91	7.2	380	2.1
1,3,5-Trimethylbenzene	1 / 16	0.091	94 (0)	1.1 (0)	94 (0)	94 (0)
2,4-Dimethylphenol	1 / 16	0.93	11,000 (0)	7.6 (0)	10,000 (0)	NLV
2-Methylnaphthalene	1 / 16	0.35	8,100 (0)	ID	5,500 (0)	ID
Arsenic	16 / 16	0.6 - 4.8	7.6 (0)	70 (0)	2,000 (0)	NLV
Barium	16 / 16	2.7 - 770	37,000 (0)	440 (1)	1,000,000 (0)	NLV
Benzo(a)anthracene	1 / 16	0.3	20	NLL	NLL	NLV
Benzo(a)pyrene	0 / 16	ND	2	NLL	NLL	NLV
Benzo(b)fluoranthene	0 / 16	ND	20	NLL	NLL	NLV
Benzo(g,h,i)perylene	1 / 16	0.45	2,500 (0)	NLL	NLL	NLV
Benzene	0 / 16	ND	180	4	220	1.6
bis(2-Ethylhexyl)phthalate	3 / 16	0.3 - 4.0	2,800 (0)	NLL	NLL	NLV
Bromodichloromethane	0 / 16	ND	110	ID	280	1.2
Butylbenzyl phthalate	1 / 16	0.36	310 (0)	26 (0)	310 (0)	NLV
Cadmium	1 / 16	7.4	550 (0)	3.6 (1)	23,000 (0)	NLV
Chloroethane	0 / 16	ND	950	ID	950	950
Chloroform	0 / 16	ND	1,200	3.4	1,500	7.2
Chloromethane	0 / 16	ND	1,100	ID	1,100	2.3
Chromium	12 / 16	2.6 - 210	2,500 (0)	3.3 (9)	14,000 (0)	NLV
Chrysene	1 / 16	0.53	2,000 (0)	NLL	NLL	NLV
cis-1,2-Dichloroethylene	0 / 16	ND	640	12	640	22
Copper	14 / 16	2.2 - 54	20,000 (0)	75 (0)	1,000,000 (0)	NLV
Dibromochloromethane	0 / 16	ND	110	ID	360	3.9
Di-n-butyl phthalate	1 / 16	0.16	760 (0)	11 (0)	760 (0)	NLV
Ethylbenzene	1 / 16	0.16	140 (0)	0.36 (0)	140 (0)	87 (0)
Fluoranthene	3 / 16	0.18 - 2.4	46,000 (0)	5.5 (0)	730 (0)	1,000,000 (0)
Hexavalent chromium	1 / 16	0.93	2,500 (0)	3.3 (0)	140,000 (0)	NLV
Indeno(1,2,3-cd)pyrene	1 / 16	0.43	20 (0)	NLL	NLL	NLV
Isopropylbenzene	0 / 16	ND	390	ID	390	390
Lead	4 / 16	5.1 - 120	400 (0)	2,800 (0)	ID	NLV
Manganese	16 / 16	26 - 210	25,000 (0)	440 (0)	180,000 (0)	NLV
Mercury	0 / 16	ND	160	0.13	47	48
Methylene chloride	0 / 16	ND	1,300	19	2,300	45
Napthalene	0 / 16	ND	16,000	0.87	2,100	250
n-Butylbenzene	2 / 16	0.091-0.1	2,500 (0)	ID	120 (0)	ID
Nickel	5 / 16	5 - 130	40,000 (0)	76 (1)	1,000,000 (0)	NLV
n-Propylbenzene	0 / 16	ND	2,500	NA	300	ID
Phenanthrene	4 / 16	0.13 - 1.6	1,600 (0)	5.3 (0)	1,100 (0)	2,800 (0)
Pyrene	2 / 16	0.14 - 2.0	29,000 (0)	ID	480 (0)	1,000,000 (0)
sec-Butylbenzene	0 / 16	ND	2,500	ID	88	ID
Selenium	0 / 16	ND	2,600	0.41	78,000	NLV
Styrene	0 / 16	ND	400	2.2	270	250
Tetrachloroethylene	0 / 16	ND	88	0.9	88	11
Toluene	0 / 16	ND	250	2.8	250	2,800
trans-1,2-Dichloroethylene	0 / 16	ND	1,400	30	1,400	23
Trichloroethylene	5 / 16	0.075 - 0.6	500 (0)	4 (0)	440 (0)	7.1 (0)
Vinyl chloride	0 / 16	ND	3.8	0.3	20	0.27
Xylenes	1 / 16	0.85	150 (0)	0.7 (1)	150 (0)	150 (0)
Zinc	13 / 16	5.1 - 6,500	170,000 (0)	170 (3)	1,000,000 (0)	NLV

Table 3b. Subsurface soil concentration data for Source Area at the Former Miro Golf Course, Douglas, Michigan.

Acronyms/Abbreviations:						
GCPC	Groundwater Contact Protection Criteria					
GSIPC	Groundwater Surface Water Interface Protection Criteria					
ID	insufficient data to determine criterion					
NA	not available					
NLL	not likely to leach					
NLV	not likely to volatilize					
R/C DCC	Residential and Commercial I Direct Contact Criteria					
R/C SVIIC	Residential and Commercial I Soil Volatilization to Indoor Air Inhalation Criteria					
Notes:						
1. All concentrations in ppm (mg/kg).						
2. All chemicals listed were detected in at least one environmental medium. Chemicals in bold were detected in groundwater. Shaded chemicals had detections greater than screening levels (exceedances).						
3. Chromium criteria shown are for the hexavalent form. These criteria are more protective than those for the trivalent form.						
Reference:						
EarthTech, Inc. 2003						

Figure 1.



"Plume" and "Source" Investigation Areas, Village of Douglas, Allegan County, Michigan

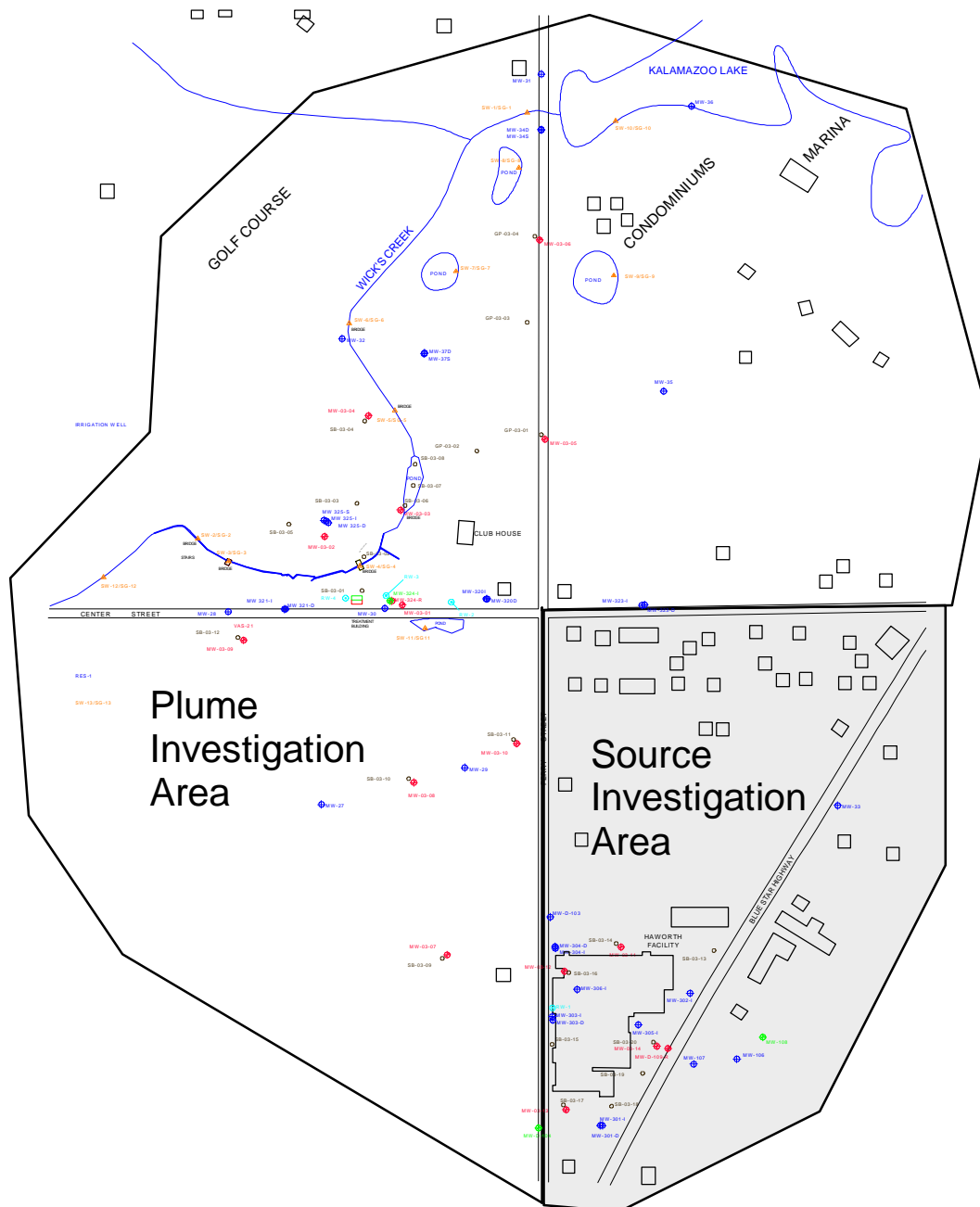
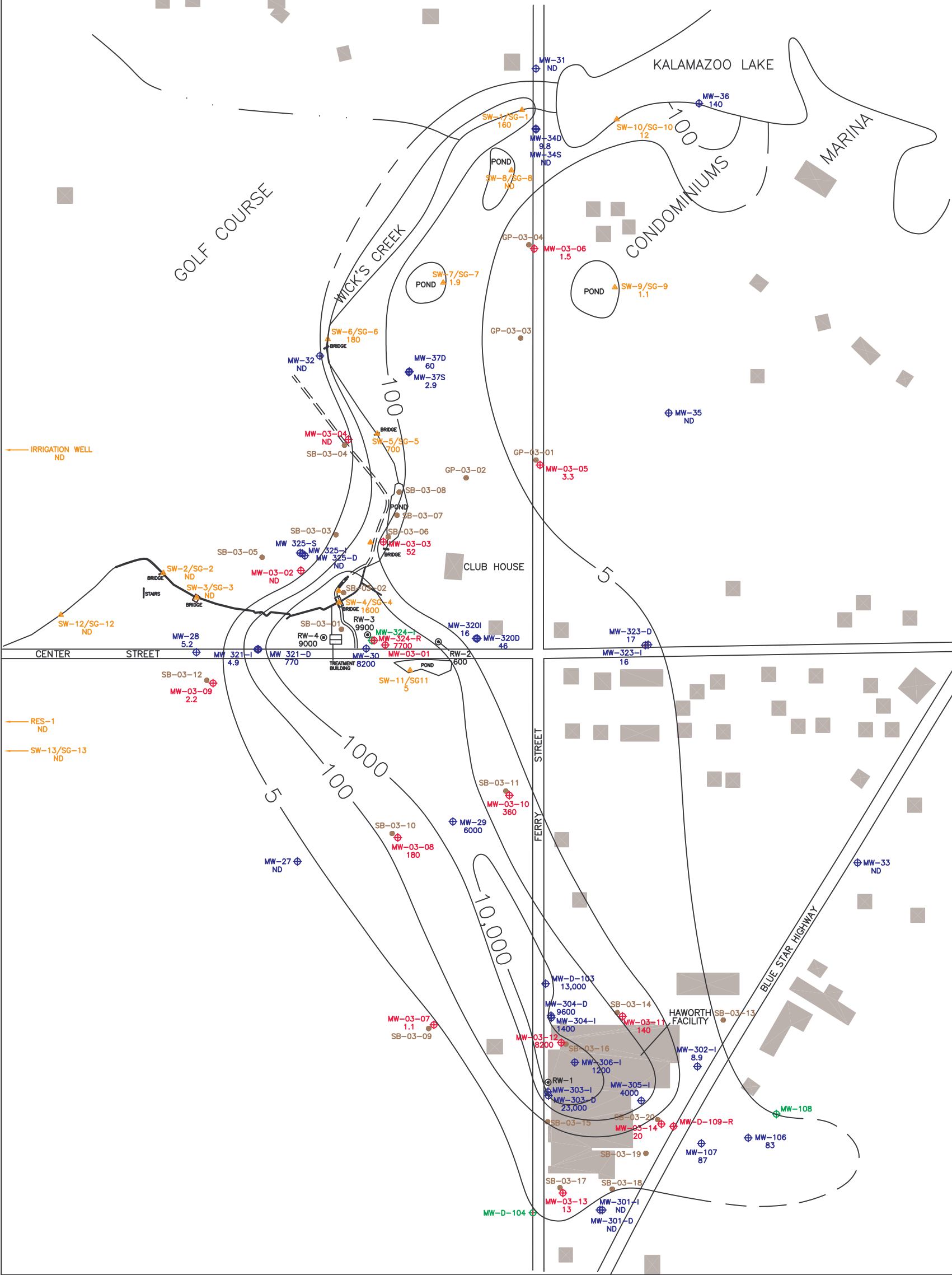


Figure 2.



LEGEND

- MW-03-12 — RI MONITORING WELL (2003)
- MW-30 — EXISTING MONITORING WELL
- MW-108 — ABANDONED/DESTORYED MONITORING WELL
- RW-4 — RECOVERY WELL
- SB-03-07 — SOIL BORING
- SW-2/SG-2 — SURFACE WATER SAMPLING LOCATION
- 8200 — TCE CONCENTRATION (ug/L)

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FILE NAME: 65766-TCEISO	

FIGURE 25

TCE ISOCONCENTRATION MAP

VILLAGE OF DOUGLAS
DOUGLAS, MICHIGAN

PROJECT NUMBER	65766.01	SCALE: 1" = 400'
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Certification

This **Former Miro Golf Course Health Consultation: Additional Environmental Contamination Data** document was prepared by the Michigan Department of Community Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with ATSDR-approved methodology and procedures the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

(Technical Project Officer, State Programs Section, SSAB, DHAC, ATSDR)

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

(Chief, State Programs Section, SSAB, DHAC, ATSDR)