DEPARTMENT OF PLANNING AND ENVIRONMENTAL PROTECTION

TECHNICAL REPORT SERIES

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A SECOND SURVEY OF THE OCCURRENCE AND DISTRIBUTION OF VOLATILE ORGANIC COMPOUNDS IN BROWARD COUNTY SURFACE WATERS

ENVIRONMENTAL MONITORING DIVISION

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EXECUTIVE SUMMARY

Broward County surface waters were tested on July 20 & 21, 1999 to assess the occurrence and distribution of volatile organic compounds (VOCs). VOCs are light molecular weight organic chemicals that include components of fuels, solvents and de-greasers. This testing was performed to confirm the findings of an initial survey of County surface waters performed July 28 & 29, 1998 when a variety of VOCs were detected. In general, the VOCs detected in both surveys fell into 3 groups: 1) petroleum hydrocarbons, 2) chlorinated hydrocarbons and 3) naturally-occurring VOCs.

Petroleum hydrocarbon VOCs detected in this survey are common components of motor fuels. A total of 104 VOC detections were recorded in the 1999 survey as compared to 42 detections in the 1998 survey. Improved analytical sensitivity was believed to partially account for the increased rate of detection. The tidal stage at the time of sampling may also have affected the detection rate.

One of the petroleum hydrocarbons detected in the survey, methyltertbutylether (MTBE), has recently been the subject of attention because of its detection in the drinking water supplies of communities across the nation. MTBE is added to gasoline to improve its octane rating. The sources of MTBE include gasoline-contaminated storm water runoff, 2-cycle recreational water craft and leaking underground storage tanks. The risk of MTBE contamination of Broward County drinking water supplies, however, is minimal because of regulatory and operational safeguards that have been in place for several years.

Chlorinated hydrocarbons were also detected in both surveys. While the range of concentrations found in both surveys were similar, the frequency of their detection was greater in the current study and may also be a result of improved analytical sensitivity. The chlorinated hydrocarbons included decomposition products which result from anaerobic bacterial reduction of parent compounds such as tri- and tetrachloroethene in ground water. They enter the surface waters through recharge from ground water. This mechanism was particularly evident in the vicinity of the business and industrial area on the periphery of the Fort Lauderdale-Hollywood International Airport where wide-spread contamination of ground water by vinyl chloride has been documented. However, detections in other areas suggest additional sources. Seepage of septic tank effluent contaminated with chlorinated hydrocarbons is a possibility.

The naturally-occurring VOC detected in this survey was bromoform. While it was detected less often in the 1999 study, its distribution was restricted to the Intracoastal Waterway as was the case in the 1998 survey. The results of the 1999 survey supported the proposition that bromoform, produced by marine algae in the ocean, entered the inland waters through tidal action. The reduced frequency of detection is believed to be due to the fact that sampling occurred at an earlier stage of the incoming tide than the 1998 survey, resulting in greater dilution by the inland water.

1.0 INTRODUCTION

This report summarizes the findings of a second survey of the occurrence of volatile organic compounds (VOCs) in Broward County surface waters.

The original survey was conducted on July 28-29, 1998 (DPEP, 1999). The VOCs detected during the 1998 survey were members of 3 general groups: petroleum hydrocarbons, chlorinated hydrocarbon decomposition products, and naturally-occurring VOCs.

The petroleum hydrocarbons included compounds commonly associated with fuels and included compounds such as benzene and toluene. Methyltertbutylether (MTBE), an octane enhancer added to gasoline, was also commonly detected. The sources of the MTBE were proposed to be outboard motor-powered vessels and storm water runoff.

The chlorinated hydrocarbon decomposition products included cis-1,2-dichloroethene and vinyl chloride. Septic tanks may have been a source of the parent compounds (e.g., trichloroethene and tetrachloroethene) of these compounds.

The naturally-occurring VOC was bromoform. It was found exclusively in the Intracoastal Waterway (ICW). Since bromoform is known to be produced by marine algae and that sampling occurred during the later stages of the incoming tide when the ICW was flooded with ocean water, the bromoform was proposed to have originated in the offshore waters.

This follow-up survey was performed to verify these initial findings.

2.0 METHODOLOGY

The protocols used in this survey were essentially the same as used in the 1998 survey. The only difference was in the sample introduction technique; automated in the 1998 survey and manual in the 1999 survey. All sampling and analyses were performed according to EPA-approved protocols as specified in the Environmental Monitoring Division's (EMD) Comprehensive Quality Assurance Plan (FDEP, 1992). Statistical analyses were performed using SigmaStat computer software (Jandel,1992-95).

Weather conditions during the sampling periods were generally sunny with less than ½" of rainfall recorded at any station during the 48 hour period prior to sampling. As a result, the data represent "ambient" water quality, essentially unimpacted by storm water runoff.

2.1 Sample Collection Procedures

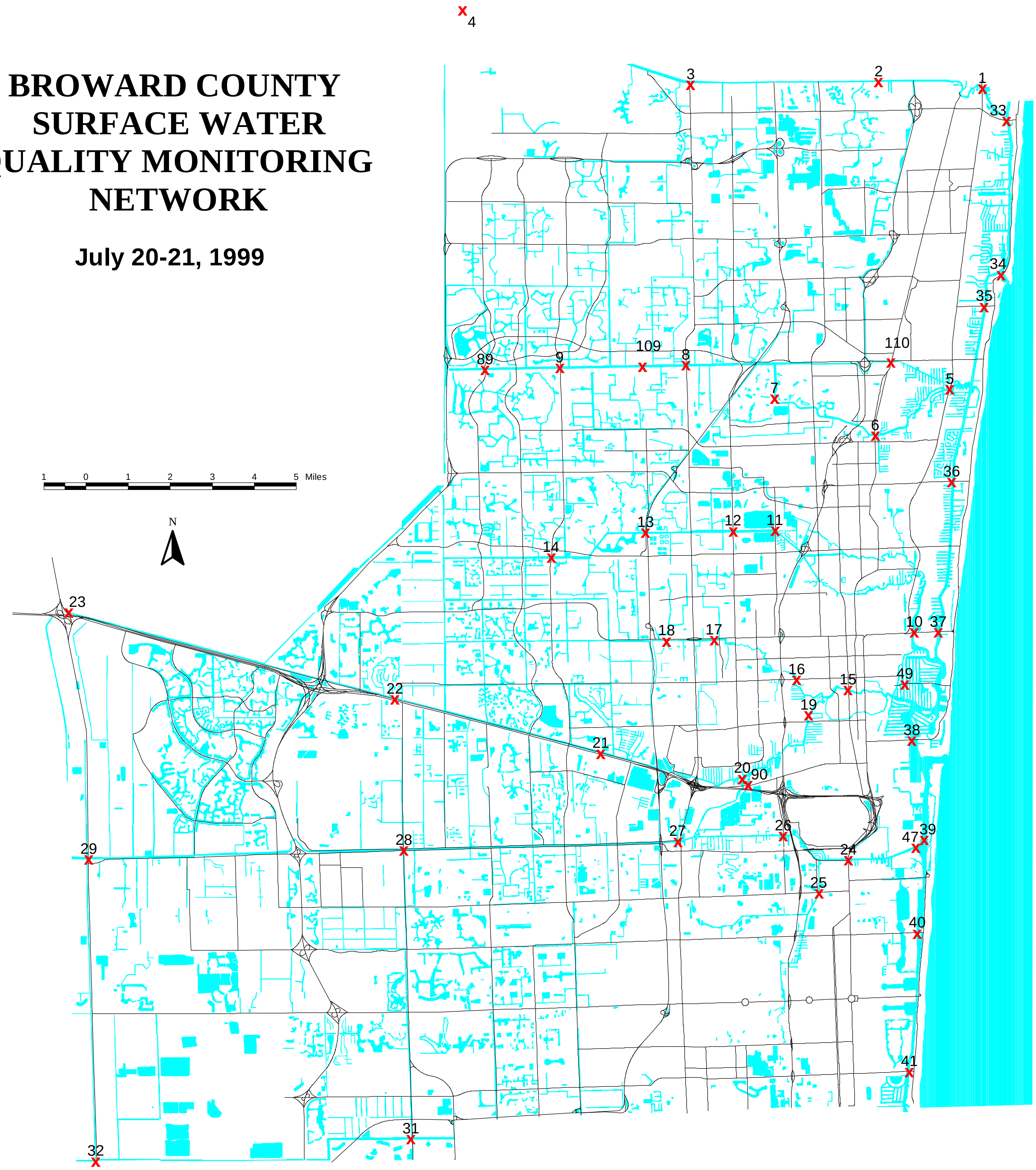
The collection of samples for this study occurred during the sampling of DPEP's 44-station surface water quality monitoring network (see Figure 1) on July 20 and 21, 1999. The times and dates of sampling coincided with the early stages of an incoming tide. All samples except those on the Intracoastal Waterway (ICW) were collected from bridges at approximately ½ meter below the surface of the water using a 2 liter Kemmerer sampling bottle. After sampling, water was carefully drained from the Kemmerer without aeration into pairs of 40 ml glass vials and sealed without air bubbles using Teflon-lined silicone septum caps. Samples collected from the ICW were collected from the side of a boat by dipping the 40 ml vials directly into the water. After collection, the vials were stored on ice for transport to the lab and were analyzed within 7 days.

Since the samples were collected near the surface, the reported values likely represent the highest levels in the water column. All of the VOCs tested in this survey, are immiscible with water so that any free product would float on the water surface, resulting in higher concentrations near the surface. MTBE, although immiscible with water, does have considerable solubility in water (50,000 mg/L). Thus in fresh water areas, concentrations at depth may be higher or lower than the surface. In marine water areas, the MTBE concentrations would likely be higher at the surface because fresh water would float on the surface of the more-dense salt water. Also, the solubility of MTBE in salt water is lower due to generally higher dissolved solids in marine water.

Figure 1

BROWARD COUNTY SURFACE WATER QUALITY MONITORING NETWORK

July 20-21, 1999



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For comparison purposes, the tides and sampling periods for both the 1998 and 1999 events are summarized in Table 1 below.

Table 1
Sample Times and Tides for 1998 and 1999 Surveys
(Nautical Software, 1996)

	Hillsboro Inlet		Sampling Periods	Port Everglades	
	Low	**High**	**Begin-End**	**Low**	**High**
July 28, 1998	0620	1225	0910-1405	0607	1217
July 29, 1998	0704	1312	0945-1420	0651	1304
July 20, 1999	0930	1536	0955-1415	0845	1503
July 21, 1999	1023	1634	0910-1345	0936	1601

2.2 Sample Analysis Procedures
The samples were analyzed according to EPA Method 8260 following purge and trap extraction by EPA Method 5030 (USEPA, 1986). A gas-tight syringe was used to deliver a 25 ml sample aliquot to a Tekmar LSC 2000 purge and trap sampler. This is in contrast to the 1998 study when an auto-sampler was used to deliver samples to the trap. Because the analyst is better able to control delivery of the sample and other shortcomings of the auto-sampler design, precision was improved with manual sample delivery. Since the formula for computing the method detection limit (Federal Register, 1984) is directly related to analytical precision, the improved precision resulted in better detection limits.

The sample was purged with inert gas for 11 minutes. The purged VOCs were trapped on a 25 cm trap containing OV-1, charcoal, Tenax, and silica gel. The trapped VOCs were then de-sorbed for 4 minutes at 180 degrees Celsius (C).

The de-sorbed VOCs were then separated on a 75 m, 0.53 mm I.D. DB-624 fused-silica capillary column with a 3.0 µ film thickness contained in the oven of a Hewlett-Packard 5890 Series II gas chromatograph (GC). The GC was programmed to hold an initial temperature of 35° C for 8 minutes, ramped at 4° C/min. to 150°C and held for 5 minutes. The VOCs eluted from the column were introduced via jet separator into a Hewlett-Packard 5971 Series mass-selective detector programmed to delay 1 minute then to scan from 45-260 m/z at approximately 2 scans per second.

This system was calibrated for 61 environmentally-significant VOCs. A listing of these VOCs and associated precision, accuracy and detection limit data are listed in the appendix.

2.3 Detection Criteria
Because of the high sensitivity of the instrumentation used in this study, contamination of samples during sampling and analysis was a concern, particularly for common laboratory solvents that may also be target analytes. In order to assess the potential for contamination, blanks consisting of

reagent water were processed along with the actual samples. The results of these analyses were then used to identify those VOCs and concentrations that may be artifacts of the sample handling process. For each compound that was detected in the blanks, a range of concentrations (95% confidence interval) was determined that must be exceeded in the actual samples before it could be attributed to the sample. If only a single detection of a specific VOC was found, that level was used as the criteria. The compounds that were detected in the blanks and the values that must be exceeded in order to ensure that the compound was actually present in the samples appear in Table 2.

Table 2
Minimum Detection Criteria

Compound	# of detections	Criteria (single detection), ug/L	Criteria (95% confidence interval), ug/l
1,2,4-trimethyl benzene	1	0-0.105	NA
1,4-dichlorobenzene	3	NA	0-0.177
benzene	2	NA	0-0.530
chloroform (1 outlier)	4	NA	0-0.274
ethylbenzene	1	0-0.050	NA
m+p-xylene	2	NA	0-0.394
methylene chloride	5	NA	0-2.986
o-xylene	2	NA	0-0.300
styrene	1	0-0.750	NA
toluene	4	NA	0-0.316

The data were further screened to eliminate those concentrations that are below the *minimum detection limit* (MDL) of the system. The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero (Federal Register, 1984). For this report, only those compounds at concentrations that exceeded both the MDL and the detection criteria for the blanks will be discussed.

3.0 RESULTS

Table 2 below provides statistics on those detections that met the above criteria.

Table 3
VOC Detection Statistics

Compound	n	Mean, ug/L	Std Dev, ug/L	Median, ug/L	Min., ug/L	Max., ug/L	Freq., %	MDL, ug/L
Methyltertbutylether	23	0.978	0.568	0.970	0.250	1.990	52.3%	0.0748
Ethylbenzene	15	0.279	0.278	0.130	0.070	0.950	34.1%	0.0336
135 Trimethylbenzene	11	0.185	0.134	0.170	0.060	0.440	25.0%	0.0527
Toluene	11	0.953	0.503	0.850	0.370	1.980	25.0%	0.0783
Cis12Dichloroethene	10	0.147	0.150	0.095	0.040	0.530	22.7%	0.0320
124-Trimethylbenzene	10	0.635	0.461	0.520	0.180	1.580	22.7%	0.0370
N-Propylbenzene	9	0.107	0.064	0.080	0.040	0.220	20.5%	0.0354
Ortho Xylene	7	0.749	0.409	0.580	0.305	1.470	15.9%	0.0320
Meta/Para Xylene	6	0.832	0.360	0.800	0.410	1.380	13.6%	0.0500
Isopropyl Benzene	4	0.050	0.014	0.045	0.040	0.070	9.1%	0.0330
11 Dichloroethane	4	0.055	0.026	0.050	0.030	0.090	9.1%	0.0262
Naphthalene	4	0.442	0.050	0.460	0.370	0.480	9.1%	0.3050
Benzene	4	0.692	0.136	0.715	0.530	0.810	9.1%	0.0240
Vinyl Chloride	3	0.390	0.101	0.410	0.280	0.480	6.8%	0.0650
Bromoform	2	0.060	0.028	0.060	0.040	0.080	4.5%	0.0277
Tetrachloroethene	1	0.030	NA	0.030	0.030	0.030	2.3%	0.0220
13 Dichlorobenzene	1	0.050	NA	0.050	0.050	0.050	2.3%	0.0370
12 Dichlorobenzene	1	0.070	NA	0.070	0.070	0.070	2.3%	0.0466
Styrene	1	0.110	NA	0.110	0.110	0.110	2.3%	0.0400
Dichlorodifluoro-methane	1	0.230	NA	0.230	0.230	0.230	2.3%	0.0750

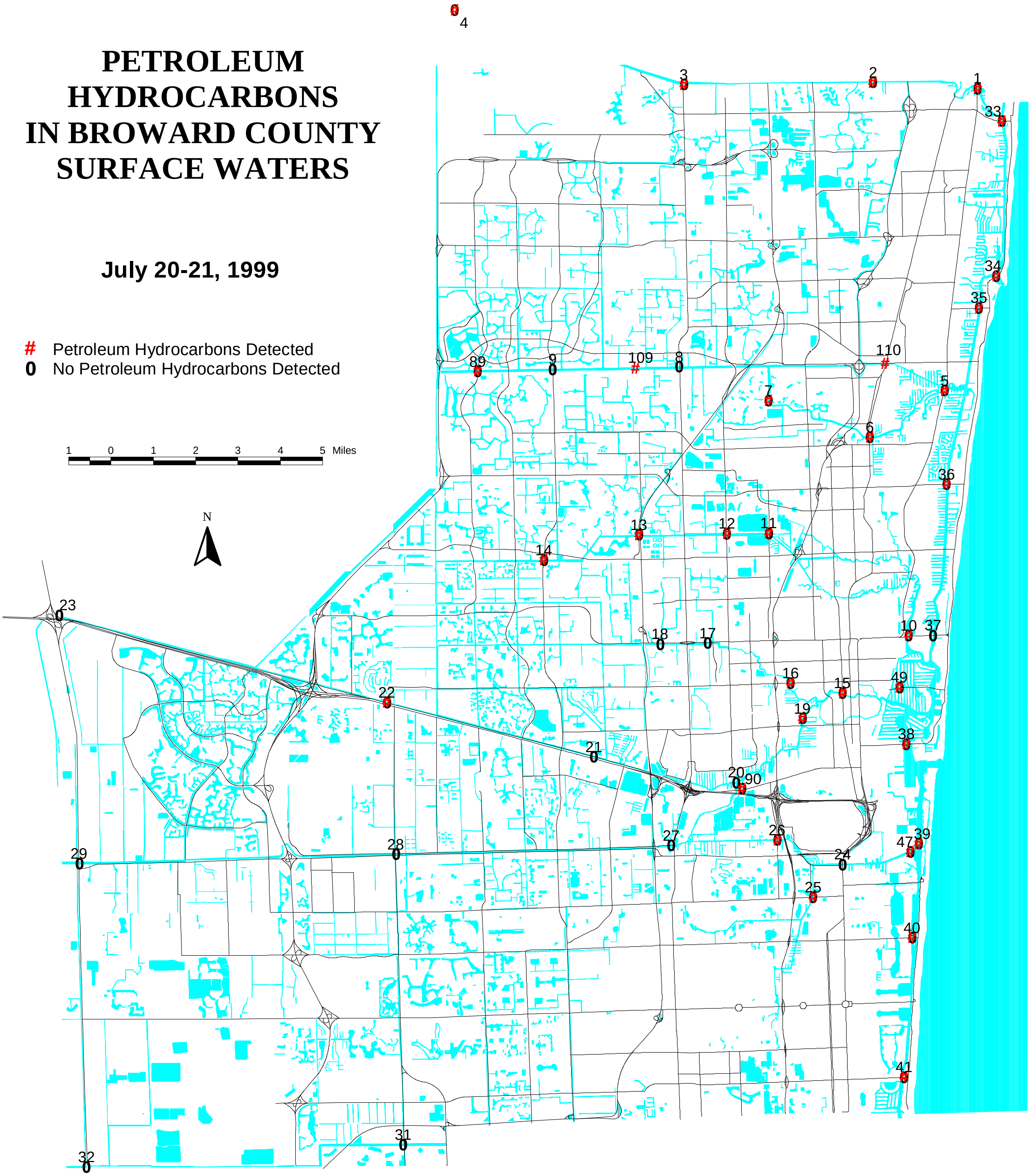
For comparison purposes, the VOCs detected in this study will be classified as in the previous study; petroleum hydrocarbons, chlorinated hydrocarbon decomposition products and naturally-occurring VOCs. Two additional VOCs were detected in this study, however, that don't fit well into the above classifications. For example, styrene was detected in one sample and dichlorodifluoromethane in another. The detections of these two compounds were not thought to be remarkable and are not discussed further.

3.1 Petroleum Hydrocarbons

The VOCs detected in this survey that were classified as petroleum hydrocarbons were MTBE, ethylbenzene, 1,3,5-trimethylbenzene, toluene, 1,2,4-trimethylbenzene, N-propylbenzene, ortho/meta/para-xylene, isopropyl benzene, naphthalene, and benzene. A total of 32 (73%) sites contained one of more of these compounds.

MTBE and ethylbenzene were the two most commonly detected petroleum hydrocarbons detected, occurring at 50% and 34% of the sites respectively. MTBE levels ranged from 0.25 to 1.99 ug/L. Ethylbenzene ranged from 0.07 to 0.95 ug/L. Figure 2 depicts the distribution of petroleum hydrocarbons in Broward County surface waters.

Figure 2



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3.2 Chlorinated Hydrocarbons

Six different chlorinated hydrocarbons, including related decomposition products, were detected in this survey. Three of these six compounds, tetrachloroethene, 1,3-dichlorobenzene and 1,2-dichlorobenzene are considered "parent" compounds of the related decomposition products and were only detected once each. The related decomposition product compounds, cis-1,2-dichloroethene, vinyl chloride and 1,1-dichloroethane, were detected with greater frequency.

Vinyl Chloride and cis-1,2-dichloroethene have been shown to be produced by bacterial decomposition of the parent compounds under anaerobic conditions (Wood et al, 1981) in ground water and are commonly detected in groundwater known to have been contaminated with trichloroethene and/or tetrachloroethene. Vinyl chloride was detected at 3 sites with concentrations ranging from 0.28 to 0.48 ug/L. Cis-1,2-dichloroethene was found at 10 sites at concentrations of 0.04 to 0.53 ug/L. Cis-1,2-dichloroethene was always found in the samples that contained vinyl chloride. Four detections of 1,1-dichloroethane (0.03 to 0.09 ug/L) occurred.

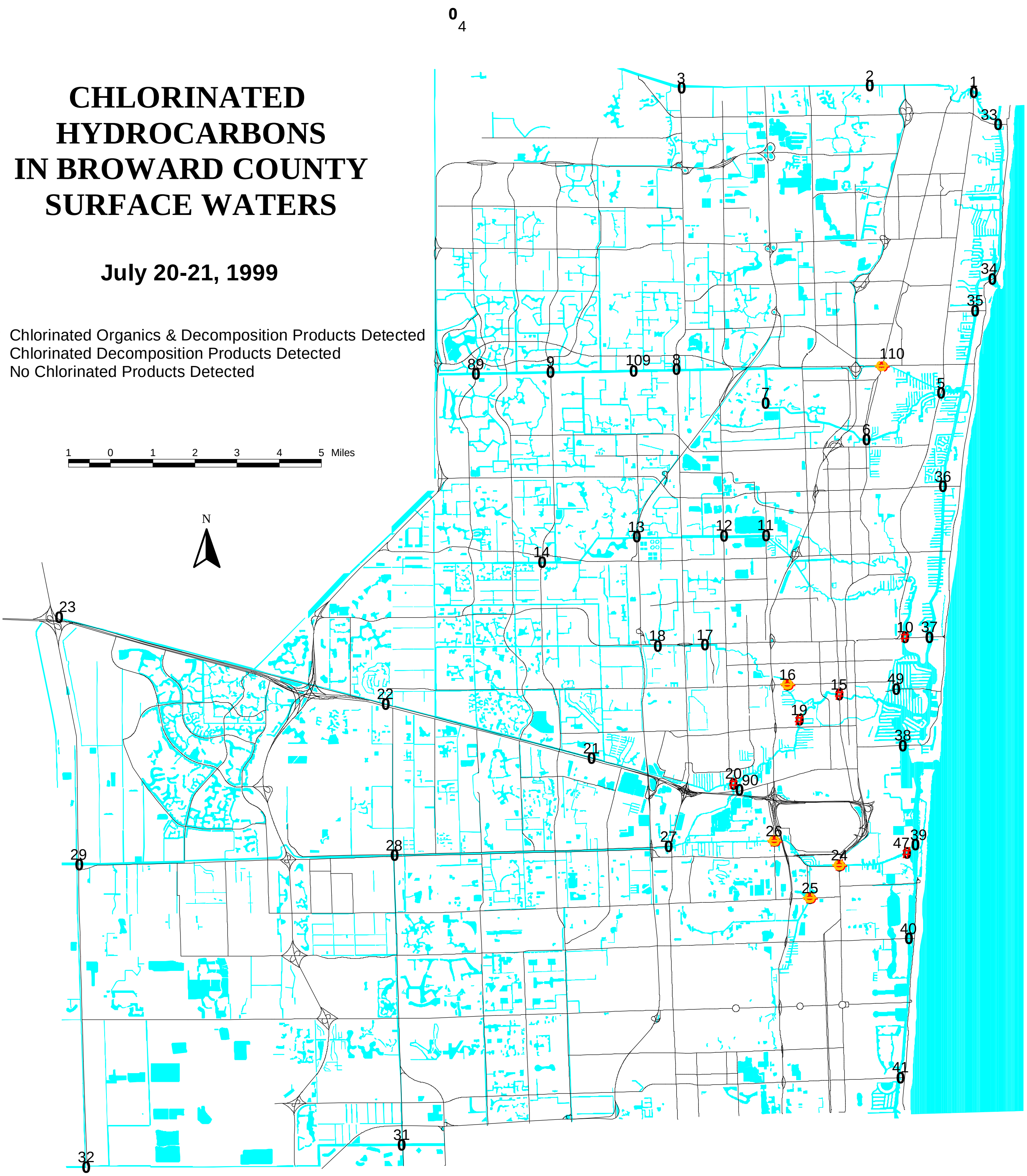
Figure 3 depicts the distribution of chlorinated hydrocarbon compounds in County surface waters.

Figure 3

CHLORINATED HYDROCARBONS IN BROWARD COUNTY SURFACE WATERS

July 20-21, 1999

- Chlorinated Organics & Decomposition Products Detected
- # Chlorinated Decomposition Products Detected
- 0 No Chlorinated Products Detected



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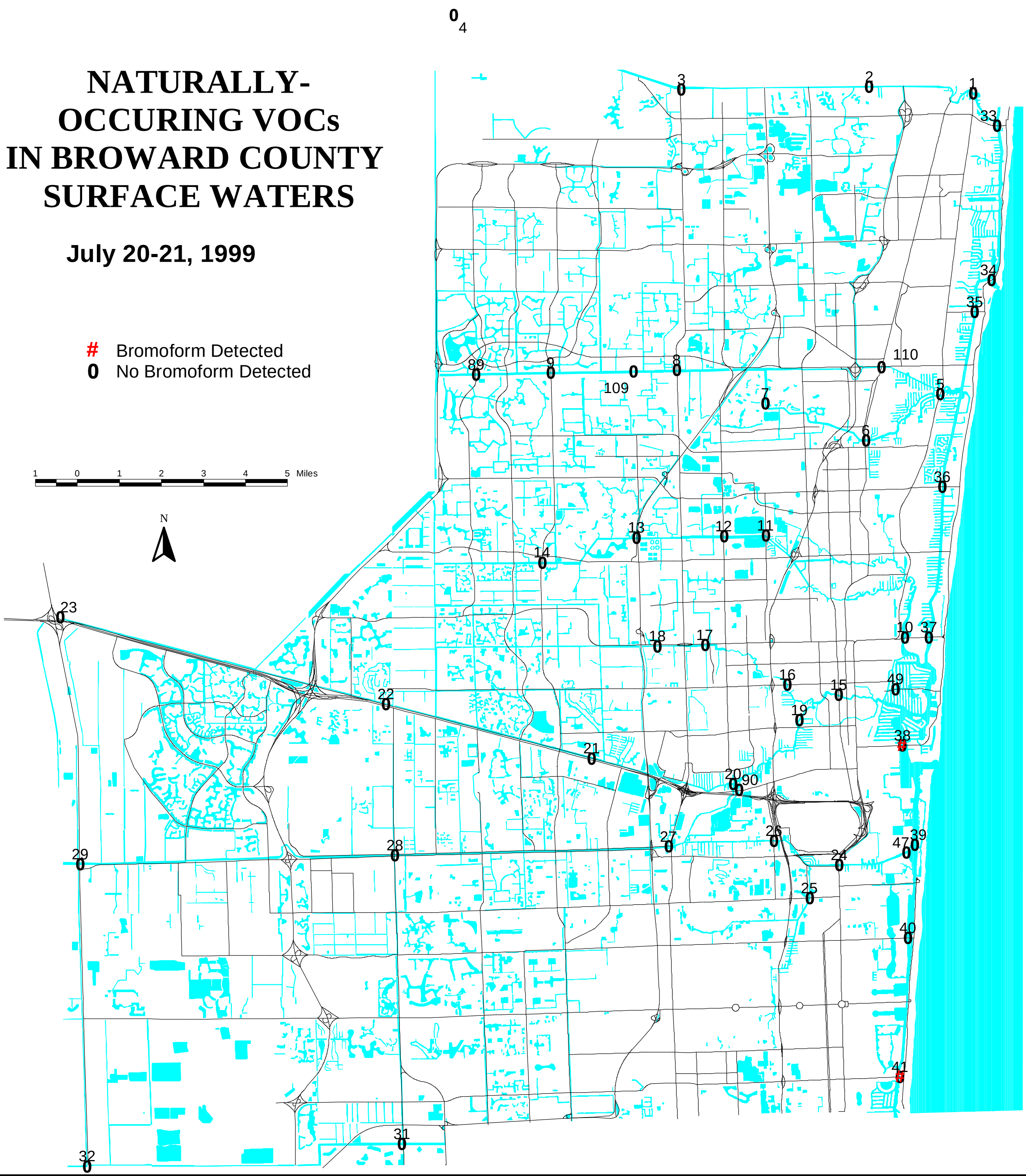
3.3 Naturally-Occurring VOCs

Brominated hydrocarbons can be produced naturally by macro algae in the marine environment (Manley, et al, 1992). Bromoform was detected in two samples with a range of concentration of 0.04 to 0.08 ug/L. Both samples were collected in the Intracoastal Waterway. Figure 4 depicts the distribution of naturally-occurring VOCs in County surface waters.

Figure 4

NATURALLY-OCCURING VOCs IN BROWARD COUNTY SURFACE WATERS

July 20-21, 1999



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4.0 DISCUSSION

Compared to the 1998 survey, the 1999 survey found a much higher rate of petroleum hydrocarbon detections, slightly more chlorinated hydrocarbon detections and fewer naturally-occurring hydrocarbon detections.

4.1 Petroleum Hydrocarbons

Petroleum hydrocarbon molecules typically contain from 1 to >40 carbon atoms and range from highly volatile to non-volatile. The analytical methodology applied in this study will detect only those compounds with significant volatility at standard temperature and pressure. Therefore, although there are many other potentially harmful petroleum hydrocarbons (e.g., polynuclear aromatic hydrocarbons), discussion will be restricted to volatile organic compounds.

In general, many more petroleum hydrocarbon compound detections occurred during the 1999 survey than 1998 (104 v. 42). This may be partially due to the fact that detection limits for the current survey were typically 2-3 times lower than the original survey. However, this would only account for 12 of the additional detections because most of the detections in 1999 were above the detection limits in effect in 1998.

Another explanation for the increased frequency of detection of petroleum hydrocarbons in the 1999 survey may be that since sampling occurred at an earlier stage of the incoming tide in 1999 as compared to the 1998 survey, there was less dilution of contaminated inland water with “clean” ocean water. If this mechanism was in effect, detections in marine water sites would be less frequent while the frequency in fresh water sites would be similar. In fact, this proposal is weakly supported by the observation that one or more petroleum hydrocarbons were detected at 24 marine water sites in 1999 versus 20 in 1998. In contrast, one or more petroleum hydrocarbons were detected in 11 fresh water sites in 1999 versus 13 in 1998.

Benzene was the only petroleum hydrocarbon detected for which a surface water regulatory standard exists (71 ug/L as an annual average). The standard is approximately 88 times higher than the maximum benzene concentration detected (0.81 ug/L).

As was the case in the 1998 survey, MTBE was the most commonly detected petroleum hydrocarbon. The frequency of detection of MTBE during the 1999 survey was lower than 1998 (52% v. 73%) although the median concentration was similar (0.97 v. 1.37 ug/L). MTBE is an octane enhancer for fuels. It has a significant solubility in water and is believed to enter surface water from the exhaust of 2-cycle engines, storm water runoff and rainfall (Zogorski, 1998).

Figure 5 depicts the distribution of MTBE in surface waters. In general, MTBE was detected less frequently and at lower levels in the 1999 survey as compared to 1998. While higher levels were detected in the ICW below Port Everglades, little to none was detected north of the Port. The lower detection rate of MTBE of the 1999 survey compared to the 1998 survey is surprising since the 1999 survey was performed during a stage of the tide when dilution of inland waters by seawater would have been less as compared to the 1998 study. The increased frequency of detection of other petroleum hydrocarbons in this study as compared to the initial study is also peculiar. With lower levels of MTBE detected, the other less water-soluble petroleum hydrocarbons would be expected to be less common while in fact, the inverse was observed. One possible cause for this observation is that the water was more recently contaminated with petroleum products which permitted detection of the less soluble compounds before they had an opportunity to evaporate from the surface of the water. The improved detection limits of this study may also be a factor.

MTBE has come under increased scrutiny throughout the country, especially where surface water reservoirs are used as potable water supplies. In these circumstances, rainfall, storm water runoff and 2-cycle outboard motors are thought to contribute to contamination of the drinking water supply. Since Broward County relies exclusively on groundwater, such sources are less likely here although surface water and ground water are closely tied. However, underground petroleum storage tanks do present potential risks.

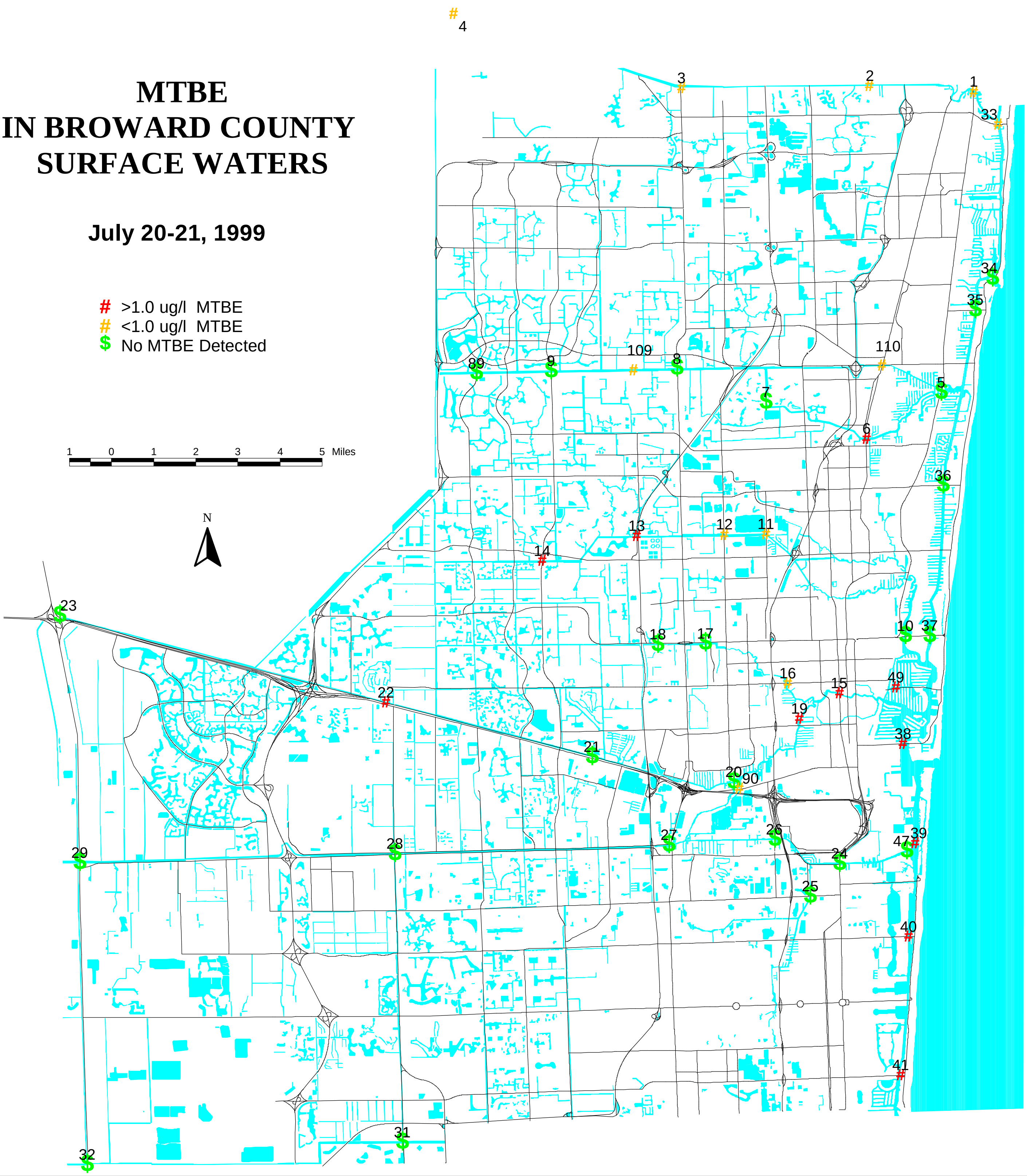
Fortunately, Broward County has in place operational and regulatory safeguards to prevent contamination from underground storage tanks. The Broward County Department of Planning and Environmental Protection maintains an on-going inspection program where trained and certified inspectors examine facilities with hazardous materials or underground storage tanks. This helps ensure the potential for contamination is resolved before it occurs and focuses specifically on a storage tank's release detection systems, designed to provide a clear warning if leaks occur.

Along with the inspection program, the Broward County Commission has passed one of the state's few ordinances developed to ensure protection of our drinking water. Promulgated more than fifteen years ago, this ordinance is designed to prevent the release of contaminants into our drinking water, placing special restrictions on businesses near the County's drinking water supplies. As such, only certain types of businesses may operate close to wells and even those businesses are automatically considered high risk and are inspected at least twice a year. Further, public drinking water utilities are required to sample their water supplies routinely. In addition, Broward County requires businesses located near utility wells to install groundwater monitoring systems that are tested quarterly for the hazardous materials they use or generate.

Finally, Broward County maintains an aggressive contamination cleanup program designed first to prevent the magnification of any groundwater contamination and second to clean up existing contamination.

Based upon the data collected during routine, quarterly sampling to date and in light of the preemptive steps outlined above, MTBE is currently not a problem in Broward County's drinking water.

Figure 5



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4.2 Chlorinated Hydrocarbons

Compared to 1998, these compounds were detected slightly more commonly in 1999 but the range of concentrations were very similar. The distribution pattern was also similar. One difference was the increased frequency of detection of the parent chlorinated hydrocarbons that was evident in the 1999 survey. The lower detection limits of the current study may explain this observation.

Tetrachloroethene was the only chlorinated hydrocarbon detected for which a surface water regulatory standard exists (8.85 ug/L as an annual average). The standard is approximately 295 times higher than the maximum tetrachloroethene concentration detected (0.03 ug/L).

We proposed in the 1998 survey report that the source of the chlorinated hydrocarbon decomposition products might be the result of precursors such as tri- and tetrachloroethene entering the groundwater via seepage from septic tanks. Subsequent to the publication of the report on the 1998 survey, it was revealed that these compounds are widely distributed in the ground water under the business and industrial areas on the periphery of the Fort Lauderdale-Hollywood International Airport (Frearson, 1999). As can be seen in Figure 3, these compounds were also seen in the waterways surrounding this area. Although the source of the compounds in the groundwater has not been established, it is likely that chlorinated hydrocarbon-contaminated groundwater is entering the surface waters in this area.

The detection of chlorinated hydrocarbons and their decomposition products in areas to the north, however, cannot be easily attributed to the groundwater contamination to the south. Because sites 15, 16 and 19 are downstream of surface waters and down-gradient of ground water of unsewered areas to the west, the detection of chlorinated hydrocarbons at these sites may result from seepage from septic tanks. The analysis of samples of shallow groundwater in this area would be useful in determining if septic tanks could be a source. The source of the compounds at sites 10 and 110 is more mysterious because it is far from the airport and in an area served by sanitary sewers.

Dry cleaning facilities use tetrachloroethene which is known to decompose in ground water into vinyl chloride, cis-1,2-dichloroethene and trans-1,2-dichloroethene and thus are potential sources of these compounds.

4.3 Naturally-Occurring VOCs

As was the case in the 1998 survey, bromoform was detected in the ICW in 1999 but at a much lower frequency; 2 sites in 1999 versus 6 in 1998. It was proposed in the report of the 1998 survey that the bromoform was produced by macro algae in the open ocean and carried inland by the tide (DPEP, 1999). The lower frequency of detection in the 1999 survey can be explained by the difference in the time of sampling relative to tidal stage. Since sampling for the 1999 survey occurred at an earlier stage of the incoming tide, bromoform-laden seawater would not have entered the ICW to the same extent as during the 1998 survey which was done at a later stage of the incoming tide.

The surface water regulatory standard for bromoform is 360 ug/L as an annual average. This concentration is 4500 times higher than the maximum bromoform concentration detected in the survey.

5.0 CONCLUSIONS

The VOCs detected in this survey fell into 3 general categories; petroleum hydrocarbons, chlorinated hydrocarbons and naturally-occurring hydrocarbons. While the exquisite sensitivity of the instrumentation used for the analyses resulted in the common detection of a variety of VOCs, none of the VOCs were detected at concentration levels even close to surface water regulatory standards.

5.1 Petroleum Hydrocarbons

While the finding of this study that MTBE is more commonly detected and at higher levels in the eastern areas of the county supports the suggestion that outboard engines are a significant source of this compound in county waterways, the lack of detection in areas north of Port Everglades was perplexing. Other factors, however, such as marine traffic, weather, and tidal stage during sampling may be factors.

The increased frequency of detection of other petroleum hydrocarbons in this study as compared to the initial study is also peculiar. With lower levels of MTBE detected, the other less water-soluble petroleum hydrocarbons would be expected to be less common while in fact, the inverse was observed. One possible cause for this observation is that the water was more recently contaminated with petroleum products which permitted detection of the less soluble compounds before they had an opportunity to evaporate from the surface of the water. Another explanation could be that ambient surface water, contaminated with MTBE from outboard engines had begun to move out with the tide. Subsequently, surface water runoff, contaminated with additional petroleum hydrocarbons, moved east with the outgoing tide. This "older" outgoing tide water then might represent an integration of upland sources while the more saline "newer" water exhibited a greater impact from outboard engines. Additional testing of storm water for VOCs might shed light on the viability of this mechanism

Because of Broward County’s pro-active stance on industries handling hazardous materials in the vicinity of drinking water well fields, MTBE is not currently a problem in the county’s drinking water supply.

5.2 Chlorinated Hydrocarbons

The potential sources of the chlorinated hydrocarbon decomposition products detected in this survey include contaminated groundwater under the business and industrial areas on the periphery of airport and septic tank seepage. However, the detection of these compounds in other areas suggests an as yet unidentified source. The release of tetrachloroethene from dry cleaning facilities, presently or historically, is a possible source.

5.3 Naturally-Occurring VOCs

Although bromoform was detected less frequently and at lower levels in the 1999 as compared to 1998, the fact that sampling was performed earlier in the incoming tide provides a reasonable explanation for the observation. The only samples that contained bromoform were collected in the Intracoastal Waterway. The results of this survey further support the hypothesis that bromoform, produced by marine algae, enters the Intracoastal Waterway from the ocean.

6.0 LITERATURE CITED

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APPENDIX
Parameter List and Data Quality Objectives

PARAMETER	PRECISION, %RD	ACCURACY, % REC.	MDL	UNITS
1,1-DICHLOROETHENE	0-7.1	75.1-112.9	0.064	UG/L
1,1-DICHLOROPROPENE	0-7.85	71.9-124.1	0.050	UG/L
1,1-DICHLOROETHANE	0-10.7	78.0-130.3	0.026	UG/L
1,1,1-TRICHLOROETHANE	0 -7.0	74.3-121.7	0.099	UG/L
1,1,1,2 TETRACHLOROETHANE	0-7.1	71.7-128.3	0.029	UG/L
1,1,2-TRICHLOROETHANE	0-7.25	81.2-126.8	0.050	UG/L
1,1,2,2 TETRACHLOROETHANE	0-10.8	73.9-108.1	0.103	UG/L
1,2-DIBROMOETHANE(EDB)	0-7.60	90.0-114.0	0.024	UG/L
1,2-DICHLOROPROPANE	0-7.3	79.3-114.7	0.017	UG/L
1,2-DICHLOROBENZENE	0-8.5	75.6-110.4	0.047	UG/L
1,2-DICHLOROETHANE	0-9.6	89.8-107.9	0.024	UG/L
1,2-DIBROMO-3-CHLOROPROPANE	0-8.7	79.1-104.0	0.139	UG/L
1,2,3-TRICHLOROBENZENE	0-12.7	80.8-137.2	0.087	UG/L
1,2,3-TRICHLOROPROPANE	0-8.8	78.0-138.0	0.270	UG/L
1,2,4-TRICHLOROBENZENE	0-7.2	81.0-135.0	0.036	UG/L
1,2,4-TRIMETHYLBENZENE	0-14.7	75.0-123.0	0.037	UG/L
1,3-DICHLOROPROPANE	0-128	78.9-113.1	0.080	UG/L
1,3-DICHLOROBENZENE	0-15.1	78.6-119.4	0.037	UG/L
1,3,5-TRIMETHYLBENZENE	0-15.3	71.6-120.4	0.053	UG/L
1,4-DICHLOROBENZENE	0-8.9	83.2-122.8	0.060	UG/L
2-CHLOROTOLUENE	0-118	73.2-106.8	0.039	UG/L
2-CHLOROETHYL VINYL ETHER	0-12.4	94.4-107.6	0.071	UG/L
2,2-DICHLOROPROPANE	0-4.8	56.0-115.0	0.052	UG/L
4-CHLOROTOLUENE	0-8.2	74.4-123.6	0.028	UG/L
BENZENE	0-10.5	87.1-110.9	0.024	UG/L
BROMOBENZENE	0-9.9	83.5-116.5	0.033	UG/L
BROMOCHLOROMETHANE	0-7.2	72.9-107.1	0.031	UG/L
BROMODICHLOROMETHANE	0-129	86.3-103.7	0.053	UG/L
BROMOFORM	0-8.9	81.8-120.2	0.028	UG/L
BROMOMETHANE	0-6.0	71.6-118.4	0.312	UG/L
C-1,2-DICHLOROETHENE	0-5.2	80.9-121.1	0.032	UG/L
C-1,3-DICHLOROPROPENE	0-6.00	89.0-106.9	0.031	UG/L
CARBON TETRACHLORIDE	0-23.5	61.8-106.2	0.077	UG/L
CHLOROBENZENE	0-6.30	80.6-115.4	0.026	UG/L
CHLOROETHANE	0-10.4	65.0-113.0	0.101	UG/L
CHLOROFORM	0 -1.77	73.5-106.5	0.067	UG/L
CHLOROMETHANE	0-6.4	68.1-117.9	0.099	UG/L
DIBROMOCHLOROMETHANE	0-9.80	72.5-111.5	0.047	UG/L
DIBROMOMETHANE	0-7.8	83.2-116.8	0.026	UG/L
DICHLORODIFLUOROMETHANE	0-14.8	69.3-110.7	0.075	UG/L
ETHYLBENZENE	0-8.0	73.8-124.2	0.034	UG/L
HEXACHLOROBUTADIENE	0-15.9	79.6-120.4	0.073	UG/L
ISOPROPYL BENZENE	0-16.8	78.9-119.1	0.033	UG/L
META/PARA XYLENE	0-37.7	80.0-128.0	0.050	UG/L
METHYLENE CHLORIDE(DICHLOROMETHANE)	0-8.9	80.0-110.0	0.686	UG/L
METHYLTERTBUTYLETHER	0-11.1	76.7-115.3	0.075	UG/L
N-PROPYLBENZENE	0-15.9	82.6-117.4	0.035	UG/L
N-BUTYL BENZENE	0-14.4	77.2-122.8	0.046	UG/L
NAPHTHALENE	0-11.1	78.2-129.8	0.305	UG/L
ORTHO XYLENE	0-8.4	80.8-125.2	0.032	UG/L
PARA-ISOPROPYL TOLUENE	0-9.3	78.9-119.1	0.047	UG/L
SEC-BUTYLBENZENE	0-5.30	77.2-122.8	0.047	UG/L
STYRENE	0-6.1	80.1-123.9	0.040	UG/L
T-1,3-DICHLOROPROPENE	0-7.1	89.4-106.2	0.026	UG/L
T-1,2-DICHLOROETHENE	0-8.4	77.4-108.6	0.041	UG/L
TERT-BUTYLBENZENE	0-15.7	79.8-124.2	0.044	UG/L
TETRACHLOROETHENE	0-5.60	71.0-107.0	0.022	UG/L
TOLUENE	0-8.0	77.7-126.3	0.078	UG/L
TRICHLOROETHENE	0-4.1	70.5-109.5	0.021	UG/L
TRICHLOROFLUOROMETHANE	0-14.5	67.4-110.6	0.042	UG/L
VINYL CHLORIDE	0-7.0	78.5-117.5	0.065	UG/L

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

		Site #>>	Blank	Blank	Blank	Blank	Blank	1	2	3	4	5	6	7	7-DUP
		DetectionDate>>>>	990720	990720	990721	990721	990720	990720	990720	990720	990720	990720	990720	990720	990720
	MDL	Criteria Time>>>>	1022	1005	945	945	955	1100	1245	1315	1345	1100	1140	1325	1335
		Lab ID#>	68196	68197	68198	68199	68200	68201	68202	68203	68204	68205	68206	68207	68251
1,1-dichloroethane	0.026	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	0.063	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloropropene	0.050	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethane	0.099	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-tetrachloroethane	0.029	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-trichloroethane	0.050	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-tetrachloroethane	0.103	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromo-3-chloropropan	0.140	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromoethane	0.030	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichlorobenzene	0.047	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	0.024	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloropropane	0.017	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichlorobenzene	0.087	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichloropropane	0.270	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	0.036	0.105	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trimethylbenzene	0.037	NA	ND	ND	0.105	ND	ND	0.130	ND	ND	0.070	1.120	ND	ND	ND
1,3-dichlorobenzene	0.037	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-dichloropropane	0.080	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-trimethylbenzene	0.053	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.330	ND	ND	ND
1,4-dichlorobenzene	0.060	0.177	ND	0.090	0.115	ND	0.140	ND	ND	ND	ND	ND	ND	ND	ND
2-chloroethylvinylether	0.071	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chlorotoluene	0.039	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-dichloropropane	0.052	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-chlorotoluene	0.028	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzene	0.024	0.530	0.050	ND	0.120	ND	ND	0.100	ND	ND	0.040	0.630	0.030	0.040	0.040
brombenzene	0.035	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromochloromethane	0.031	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromodichloromethane	0.053	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromoform	0.028	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromomethane	0.312	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
carbon tetrachloride	0.077	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chlorobenzene	0.026	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroethane	0.101	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	0.067	0.274	0.270	0.300	0.215	0.230	0.210	ND	ND	ND	0.070	0.100	ND	0.080	0.080
chloromethane	0.099	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	0.032	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,3-dichloropropene	0.031	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromochloromethane	0.047	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromomethane	0.026	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dichlorodifluoromethane	0.075	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ethylbenzene	0.034	0.050	ND	ND	0.050	ND	ND	0.050	ND	ND	ND	0.600	ND	ND	ND
hexachloro-1,3-butadiene	0.073	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
isopropylbenzene	0.033	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.040	ND	ND	ND
meta/para-xylene	0.050	0.394	0.120	ND	0.160	ND	ND	0.180	ND	ND	0.090	2.210	ND	ND	ND
methylene chloride	0.686	2.986	2.930	2.520	2.020	1.290	2.350	ND	ND	ND	ND	ND	ND	ND	ND
methyltertbutylether	0.075	NA	ND	ND	ND	ND	ND	0.470	0.300	0.250	0.270	5.200	1.160	2.660	2.700

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

			Site #>>	Blank	Blank	Blank	Blank	Blank	1	2	3	4	5	6	7	7-DUP
			DetectionDate>>>>	990720	990720	990721	990721	990720	990720	990720	990720	990720	990720	990720	990720	990720
	MDL	Criteria	Time>>>>	1022	1005	945	945	955	1100	1245	1315	1345	1100	1140	1325	1335
			Lab ID#>	68196	68197	68198	68199	68200	68201	68202	68203	68204	68205	68206	68207	68251
naphthalene	0.305	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.370	ND	ND	ND
n-butylbenzene	0.046	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-propylbenzene	0.035	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.150	ND	ND	ND
ortho-xylene	0.032	0.300		0.060	ND	0.095	ND	ND	0.080	ND	ND	0.040	0.920	ND	ND	ND
para-isopropyltoluene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-butylbenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
styrene	0.040	0.750		ND	ND	0.075	ND	ND	ND	ND	ND	ND	0.110	ND	ND	ND
tert-butylbenzene	0.044	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
toluene	0.078	0.316		0.220	0.270	0.395	0.080	0.090	0.300	ND	ND	0.170	2.500	ND	0.530	0.380
trans-1,2-dichloroethene	0.041	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-dichloropropene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichlorofluoromethane	0.042	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
vinyl chloride	0.065	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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			Site #>>	10	11	12	13	13-Dup.	14	15	16	16-DUP	17	18	19	20
			DetectionDate>>>>	990720	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721
	MDL	Criteria	Time>>>>	1025	910	940	1010	1015	1100	1040	1115	1122	1155	1345	1055	1100
			Lab ID#>	68210	68211	68212	68213	68252	68214	68215	68216	68254	68217	68218	68219	68220
1,1-dichloroethane	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	0.063	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloropropene	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-tetrachloroethane	0.029	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-trichloroethane	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-tetrachloroethane	0.103	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromo-3-chloropropan	0.140	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromoethane	0.030	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichlorobenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	0.024	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloropropane	0.017	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichlorobenzene	0.087	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichloropropane	0.270	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	0.036	0.105		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trimethylbenzene	0.037	NA		0.230	0.040	ND	ND	ND	0.120	0.060	ND	ND	ND	ND	0.040	ND
1,3-dichlorobenzene	0.037	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-dichloropropane	0.080	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-trimethylbenzene	0.053	NA		0.080	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-dichlorobenzene	0.060	0.177		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chloroethylvinylether	0.071	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chlorotoluene	0.039	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-dichloropropane	0.052	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-chlorotoluene	0.028	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzene	0.024	0.530		0.150	ND	ND	0.030	ND	0.110	0.140	ND	ND	ND	ND	0.100	0.060
brombenzene	0.035	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

			Site #>>	10	11	12	13	13-Dup.	14	15	16	16-DUP	17	18	19	20
			DetectionDate>>>>	990720	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721	990721
	MDL	Criteria	Time>>>>	1025	910	940	1010	1015	1100	1040	1115	1122	1155	1345	1055	1100
			Lab ID#>	68210	68211	68212	68213	68252	68214	68215	68216	68254	68217	68218	68219	68220
bromochloromethane	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromodichloromethane	0.053	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromoform	0.028	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromomethane	0.312	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
carbon tetrachloride	0.077	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chlorobenzene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroethane	0.101	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	0.067	0.274		0.090	0.140	0.130	0.100	0.120	0.140	0.100	ND	ND	ND	ND	0.100	ND
chloromethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	0.032	NA		0.040	ND	ND	ND	ND	ND	0.040	0.200	0.200	ND	ND	0.050	0.050
cis-1,3-dichloropropene	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromochloromethane	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromomethane	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dichlorodifluoromethane	0.075	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ethylbenzene	0.034	0.050		0.130	ND	ND	ND	ND	0.070	0.050	ND	ND	ND	ND	ND	ND
hexachloro-1,3-butadiene	0.073	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
isopropylbenzene	0.033	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
meta/para-xylene	0.050	0.394		0.410	0.050	ND	ND	ND	0.230	0.160	ND	ND	ND	ND	0.070	0.100
methylene chloride	0.686	2.986		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
methyltertbutylether	0.075	NA		2.310	0.480	0.630	1.370	0.970	1.050	1.530	0.270	0.280	ND	ND	1.260	2.340
naphthalene	0.305	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-butylbenzene	0.046	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-propylbenzene	0.035	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ortho-xylene	0.032	0.300		0.180	ND	ND	ND	ND	0.100	0.070	ND	ND	ND	ND	ND	0.050
para-isopropyltoluene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-butylbenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
styrene	0.040	0.750		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylbenzene	0.044	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	0.030	0.030	ND	ND	ND	ND
toluene	0.078	0.316		1.240	0.100	ND	ND	ND	0.290	0.310	ND	ND	ND	ND	0.150	0.150
trans-1,2-dichloroethene	0.041	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-dichloropropene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichlorofluoromethane	0.042	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
vinyl chloride	0.065	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.280

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			Site #>>	21	22	23	24	25	26	27	28	29	31	32	33	33-Dup.
			DetectionDate>>>>	990721	990721	990721	990720	990720	990720	990720	990720	990721	990720	990720	990720	990720
	MDL	Criteria	Time>>>>	1125	1145	1335	1415	1345	1315	1230	1140	1300	1055	1005	1042	1049
			Lab ID#>	68221	68222	68223	68224	68225	68226	68227	68228	68229	68231	68232	68233	68250
1,1-dichloroethane	0.026	NA		ND	ND	ND	0.030	0.040	0.090	ND	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	0.063	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloropropene	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-tetrachloroethane	0.029	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-trichloroethane	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

	MDL	Criteria	Site #>>	21	22	23	24	25	26	27	28	29	31	32	33	33-Dup.
			DetectionDate>>>>	990721	990721	990721	990720	990720	990720	990720	990720	990721	990720	990720	990720	990720
			Time>>>>	1125	1145	1335	1415	1345	1315	1230	1140	1300	1055	1005	1042	1049
			Lab ID#>	68221	68222	68223	68224	68225	68226	68227	68228	68229	68231	68232	68233	68250
1,1,2,2-tetrachloroethane	0.103	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromo-3-chloropropan	0.140	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromoethane	0.030	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichlorobenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	0.024	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloropropane	0.017	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichlorobenzene	0.087	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichloropropane	0.270	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	0.036	0.105		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trimethylbenzene	0.037	NA		ND	0.190	ND	0.040	0.520	1.000	ND	ND	ND	ND	ND	0.170	0.150
1,3-dichlorobenzene	0.037	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-dichloropropane	0.080	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-trimethylbenzene	0.053	NA		ND	ND	ND	ND	0.170	0.360	ND	ND	ND	ND	ND	ND	0.060
1,4-dichlorobenzene	0.060	0.177		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chloroethylvinylether	0.071	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chlorotoluene	0.039	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-dichloropropane	0.052	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-chlorotoluene	0.028	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzene	0.024	0.530		ND	0.080	ND	0.080	0.430	0.810	ND	ND	ND	ND	ND	0.160	0.170
brombenzene	0.035	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromochloromethane	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromodichloromethane	0.053	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromoform	0.028	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromomethane	0.312	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
carbon tetrachloride	0.077	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chlorobenzene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroethane	0.101	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	0.067	0.274		0.070	ND	0.090	ND	0.100	ND	ND	ND	ND	0.090	ND	ND	0.070
chloromethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	0.032	NA		ND	ND	ND	0.100	0.530	0.220	ND	ND	ND	ND	ND	ND	ND
cis-1,3-dichloropropene	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromochloromethane	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromomethane	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dichlorodifluoromethane	0.075	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ethylbenzene	0.034	0.050		ND	0.050	ND	ND	0.430	0.740	ND	ND	ND	ND	ND	0.100	0.100
hexachloro-1,3-butadiene	0.073	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
isopropylbenzene	0.033	NA		ND	ND	ND	ND	0.040	0.050	ND	ND	ND	ND	ND	ND	ND
meta/para-xylene	0.050	0.394		ND	0.600	ND	0.070	1.380	2.330	ND	ND	ND	ND	ND	0.330	0.320
methylene chloride	0.686	2.986		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
methyltertbutylether	0.075	NA		2.470	1.990	ND	2.170	3.920	3.880	ND	ND	ND	ND	ND	0.540	0.690
naphthalene	0.305	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-butylbenzene	0.046	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-propylbenzene	0.035	NA		ND	0.050	ND	ND	0.110	0.180	ND	ND	ND	ND	ND	0.040	ND
ortho-xylene	0.032	0.300		ND	0.200	ND	0.040	0.580	1.020	ND	ND	ND	ND	ND	0.140	0.140
para-isopropyltoluene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-butylbenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

	MDL	Criteria														
			Site #>>	21	22	23	24	25	26	27	28	29	31	32	33	33-Dup.
			DetectionDate>>>>	990721	990721	990721	990720	990720	990720	990720	990720	990721	990720	990720	990720	990720
			Time>>>>	1125	1145	1335	1415	1345	1315	1230	1140	1300	1055	1005	1042	1049
			Lab ID#>	68221	68222	68223	68224	68225	68226	68227	68228	68229	68231	68232	68233	68250
styrene	0.040	0.750		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylbenzene	0.044	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
toluene	0.078	0.316		ND	ND	ND	0.170	1.980	3.540	ND	ND	ND	ND	ND	1.040	0.820
trans-1,2-dichloroethene	0.041	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-dichloropropene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichlorofluoromethane	0.042	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
vinyl chloride	0.065	NA		ND	ND	ND	ND	0.410	0.480	ND	ND	ND	ND	ND	ND	ND

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	MDL	Criteria														
			Site #>>	34	35	36	37	38	39	40	41	41-Dup.	47	49	89	90
			DetectionDate>>>>	990720	990720	990720	990720	990721	990721	990721	990721	990721	990721	990721	990721	990721
			Time>>>>	1155	1230	1320	1435	945	1030	1115	1245	1250	1037	1000	1135	1045
			Lab ID#>	68234	68235	68236	68237	68238	68239	68240	68241	68253	68247	68249	68289	68290
1,1-dichloroethane	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloroethene	0.063	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-dichloropropene	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1-trichloroethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,1,2-tetrachloroethane	0.029	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2-trichloroethane	0.050	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2-tetrachloroethane	0.103	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromo-3-chloropropan	0.140	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dibromoethane	0.030	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichlorobenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloroethane	0.024	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-dichloropropane	0.017	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichlorobenzene	0.087	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3-trichloropropane	0.270	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trichlorobenzene	0.036	0.105		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-trimethylbenzene	0.037	NA		0.180	0.150	0.600	0.060	0.130	ND	ND	0.370	0.450	0.520	ND	1.580	ND
1,3-dichlorobenzene	0.037	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3-dichloropropane	0.080	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-trimethylbenzene	0.053	NA		0.060	0.060	0.180	ND	ND	ND	ND	0.110	0.120	0.180	ND	0.440	ND
1,4-dichlorobenzene	0.060	0.177		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chloroethylvinylether	0.071	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-chlorotoluene	0.039	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,2-dichloropropane	0.052	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-chlorotoluene	0.028	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
benzene	0.024	0.530		0.130	0.180	0.530	0.080	0.110	0.130	ND	0.260	0.300	0.290	ND	0.800	0.040
brombenzene	0.035	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromochloromethane	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromodichloromethane	0.053	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
bromoform	0.028	NA		ND	ND	ND	ND	0.040	ND	ND	0.040	0.120	ND	ND	ND	ND
bromomethane	0.312	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
carbon tetrachloride	0.077	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chlorobenzene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

	MDL	Criteria	Site #>>	34	35	36	37	38	39	40	41	41-Dup.	47	49	89	90
			DetectionDate>>>>	990720	990720	990720	990720	990721	990721	990721	990721	990721	990721	990721	990721	990721
			Time>>>>	1155	1230	1320	1435	945	1030	1115	1245	1250	1037	1000	1135	1045
			Lab ID#>	68234	68235	68236	68237	68238	68239	68240	68241	68253	68247	68249	68289	68290
chloroethane	0.101	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
chloroform	0.067	0.274		ND	ND	ND	ND	0.080	ND	ND	ND	0.070	ND	0.070	0.160	ND
chloromethane	0.099	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-dichloroethene	0.032	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	0.090	ND	ND	ND
cis-1,3-dichloropropene	0.031	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromochloromethane	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dibromomethane	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
dichlorodifluoromethane	0.075	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
ethylbenzene	0.034	0.050		0.100	0.100	0.280	ND	0.080	0.080	ND	0.160	0.180	0.280	ND	0.950	ND
hexachloro-1,3-butadiene	0.073	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
isopropylbenzene	0.033	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.070	ND
meta/para-xylene	0.050	0.394		0.370	0.350	1.010	0.110	0.260	0.280	ND	0.550	0.640	1.000	ND	3.280	ND
methylene chloride	0.686	2.986		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
methyltertbutylether	0.075	NA		2.280	3.940	5.770	3.000	1.820	1.270	1.380	1.790	1.940	2.030	1.620	3.380	0.940
naphthalene	0.305	NA		ND	ND	0.450	ND	ND	ND	ND	ND	0.470	ND	ND	0.480	ND
n-butylbenzene	0.046	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-propylbenzene	0.035	NA		ND	ND	0.080	ND	ND	ND	ND	0.050	0.050	0.080	ND	0.220	ND
ortho-xylene	0.032	0.300		0.170	0.150	0.520	0.050	0.110	0.150	ND	0.270	0.340	0.430	ND	1.470	ND
para-isopropyltoluene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-butylbenzene	0.047	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
styrene	0.040	0.750		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tert-butylbenzene	0.044	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
tetrachloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
toluene	0.078	0.316		0.730	0.740	1.500	0.190	0.410	0.370	ND	0.780	0.920	1.280	ND	3.990	ND
trans-1,2-dichloroethene	0.041	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,3-dichloropropene	0.026	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichloroethene	0.022	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
trichlorofluoromethane	0.042	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
vinyl chloride	0.065	NA		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

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	MDL	Criteria	Site #>>	109	110
			DetectionDate>>>>	990720	990720
			Time>>>>	1425	1205
			Lab ID#>	68309	68310
1,1-dichloroethane	0.026	NA		ND	0.060
1,1-dichloroethene	0.063	NA		ND	ND
1,1-dichloropropene	0.050	NA		ND	ND
1,1,1-trichloroethane	0.099	NA		ND	ND
1,1,1,2-tetrachloroethane	0.029	NA		ND	ND
1,1,2-trichloroethane	0.050	NA		ND	ND
1,1,2,2-tetrachloroethane	0.103	NA		ND	ND
1,2-dibromo-3-chloropropan	0.140	NA		ND	ND
1,2-dibromoethane	0.030	NA		ND	ND
1,2-dichlorobenzene	0.047	NA		ND	0.070
1,2-dichloroethane	0.024	NA		ND	ND
1,2-dichloropropane	0.017	NA		ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

	MDL	Criteria	Site #>> / DetectionDate>>>> / Time>>>> / Lab ID#>	109 / 990720 / 1425 / 68309	110 / 990720 / 1205 / 68310
1,2,3-trichlorobenzene	0.087	NA		ND	ND
1,2,3-trichloropropane	0.270	NA		ND	ND
1,2,4-trichlorobenzene	0.036	0.105		ND	ND
1,2,4-trimethylbenzene	0.037	NA		0.120	ND
1,3-dichlorobenzene	0.037	NA		ND	0.050
1,3-dichloropropane	0.080	NA		ND	ND
1,3,5-trimethylbenzene	0.053	NA		ND	ND
1,4-dichlorobenzene	0.060	0.177		ND	0.120
2-chloroethylvinylether	0.071	NA		ND	ND
2-chlorotoluene	0.039	NA		ND	ND
2,2-dichloropropane	0.052	NA		ND	ND
4-chlorotoluene	0.028	NA		ND	ND
benzene	0.024	0.530		0.090	ND
brombenzene	0.035	NA		ND	ND
bromochloromethane	0.031	NA		ND	ND
bromodichloromethane	0.053	NA		ND	ND
bromoform	0.028	NA		ND	ND
bromomethane	0.312	NA		ND	ND
carbon tetrachloride	0.077	NA		ND	ND
chlorobenzene	0.026	NA		ND	ND
chloroethane	0.101	NA		ND	ND
chloroform	0.067	0.274		0.080	ND
chloromethane	0.099	NA		ND	ND
cis-1,2-dichloroethene	0.032	NA		ND	0.150
cis-1,3-dichloropropene	0.031	NA		ND	ND
dibromochloromethane	0.047	NA		ND	ND
dibromomethane	0.026	NA		ND	ND
dichlorodifluoromethane	0.075	NA		ND	0.230
ethylbenzene	0.034	0.050		0.070	ND
hexachloro-1,3-butadiene	0.073	NA		ND	ND
isopropylbenzene	0.033	NA		ND	ND
meta/para-xylene	0.050	0.394		0.200	ND
methylene chloride	0.686	2.986		ND	ND
methyltertbutylether	0.075	NA		0.710	0.260
naphthalene	0.305	NA		ND	ND
n-butylbenzene	0.046	NA		ND	ND
n-propylbenzene	0.035	NA		ND	ND
ortho-xylene	0.032	0.300		0.090	ND
para-isopropyltoluene	0.047	NA		ND	ND
sec-butylbenzene	0.047	NA		ND	ND
styrene	0.040	0.750		ND	ND
tert-butylbenzene	0.044	NA		ND	ND
tetrachloroethene	0.022	NA		ND	ND
toluene	0.078	0.316		0.250	ND
trans-1,2-dichloroethene	0.041	NA		ND	ND
trans-1,3-dichloropropene	0.026	NA		ND	ND

APPENDIX
Data Table
All Concentrations in Micrograms/Liter

	MDL	Criteria		Site #>>	109	110
				DetectionDate>>>>	990720	990720
				Time>>>>	1425	1205
				Lab ID#>	68309	68310
trichloroethene	0.022	NA			ND	ND
trichlorofluoromethane	0.042	NA			ND	ND
vinyl chloride	0.065	NA			ND	ND

APPENDIX
Sample Site Descriptions

Site #	Latitude	Longitude	Description
1	26 19 30.0	080 05 27.6	HILLSBORO CANAL; FEDERAL HIGHWAY (US 1) - HILLSBORO CANAL
2	26 19 40.8	080 07 51.6	HILLSBORO CANAL; W SIDE OF SALINITY CONTROL STRUCTURE - HILLSBORO CANAL
3	26 19 37.2	080 12 10.8	HILLSBORO CANAL; STATE RD. 7 (US 441) - HILLSBORO CANAL
4	26 21 10.8	080 17 24.0	HILLSBORO CANAL; BRIDGE TO SOUTHEAST GROWERS' ASSOCIATION -HILLSBORO CANAL
5	26 13 19.2	080 06 14.4	POMPANO CANAL; FEDERAL HIGHWAY (US 1) - POMPANO CANAL
6	26 12 21.6	080 07 58.8	CYPRESS CREEK CANAL; DIXIE HIGHWAY BRIDGE - CYPRESS CREEK CANAL
7	26 13 08.4	080 10 15.6	CYPRESS CREEK CANAL; SOUTH PALMAIRE DRIVE - CYPRESS CREEK CANAL
8	26 13 48.0	080 12 18.0	POMPANO CANAL; STATE RD 7 - POMPANO CANAL
9	26 13 48.0	080 15 10.8	POMPANO CANAL; UNIVERSITY DRIVE - POMPANO CANAL
10	26 08 16.8	080 07 04.8	MIDDLE RIVER; E SUNRISE BLVD - MIDDLE RIVER
11	26 10 22.8	080 10 15.6	MIDDLE RIVER; NW 21ST AVE BRIDGE - MIDDLE RIVER
12	26 10 22.8	080 11 13.2	MIDDLE RIVER; NW 31ST AVE - MIDDLE RIVER
13	26 10 22.8	080 13 15.6	MIDDLE RIVER; ROCK ISLAND RD - MIDDLE RIVER
14	26 09 00.4	080 15 25.2	MIDDLE RIVER; UNIVERSITY DRIVE - MIDDLE RIVER
15	26 07 04.8	080 08 38.4	NEW RIVER; ANDREWS AVE BRIDGE - NEW RIVER
16	26 07 15.6	080 09 46.8	NORTH FORK NEW RIVER; BROWARD BLVD - NORTH FORK NEW RIVER

APPENDIX

Sample Site Descriptions

Site #	Latitude	Longitude	Description
17	26 08 06.0	080 11 42.0	PLANTATION CANAL; W SIDE OF SALINITY CONTROL STRUCTURE - PLANTATION CANAL
18	26 08 06.0	080 12 46.8	PLANTATION CANAL; NW 9TH DRIVE - PLANTATION CANAL
19	26 06 32.4	080 09 32.4	S FORK NEW RIVER; RIVER REACH CONDO - SEAWALL E SIDE OF S FORK OF NEW RIVER
20	26 05 13.2	080 11 02.4	NORTH FORK NEW RIVER; BRADFORD MARINA DOCK - NORTH FORK NEW RIVER
21	26 05 49.2	080 14 16.8	NORTH NEW RIVER CANAL; W SIDE OF FLOOD CONTROL STRUCTURE ON THE NORTH NEW RIVER CANAL 1/4 MI W OF TURNPIKE
22	26 06 57.6	080 19 01.2	NORTH NEW RIVER CANAL; SW 125TH AVE BRIDGE OVER NORTH NEW RIVER CANAL (C15)
23	26 07 19.2	080 20 34.8	NORTH NEW RIVER CANAL; US 27 AT NORTH NEW RIVER CANAL
24	26 03 32.4	080 08 38.4	DANIA CUTOFF CANAL; US 1 BRIDGE OVER DANIA CUTOFF CANAL
25	26 02 52.8	080 09 18.0	HOLLYWOOD CANAL; STIRLING ROAD BRIDGE OVER THE HOLLYWOOD CANAL (E OF BRYAN BLVD)
26	26 04 04.8	080 10 08.4	DANIA CUTOFF CANAL; RAVENSWOOD ROAD BRIDGE OVER THE DANIA CUTOFF CANAL
27	26 03 57.6	080 12 32.4	SOUTH NEW RIVER CANAL; WEST SIDE OF FLOOD CONTROL STRUCTURE ON SOUTH NEW RIVER CANAL
28	26 03 46.8	080 18 50.4	SOUTH NEW RIVER CANAL; FLAMINGO ROAD BRIDGE OVER THE SOUTH NEW RIVER CANAL
29	26 03 39.6	080 26 02.4	SOUTH NEW RIVER CANAL; US 27 BRIDGE OVER THE SOUTH NEW RIVER CANAL
31	25 57 50.4	080 18 43.2	SNAKE CREEK CANAL; FLAMINGO ROAD BRIDGE OVER THE SNAKE CREEK CANAL

32	25 57 25.2	080 25 55.2	SNAKE CREEK CANAL; US 27 BRIDGE OVER THE SNAKE CREEK CANAL
33	26 18 50.4	080 04 55.2	ICW; HILLSBORO BLVD BRIDGE OVER THE INTRACOASTAL WATERWAY
34	26 15 39.6	080 05 02.4	ICW; HILLSBORO INLET; 100' N OF MARKER 71; 50' W OF E BANK
35	26 15 00.0	080 05 27.6	ICW; 100' N OF NE 14TH STREET BRIDGE; E FENDER; 100' W OF EAST BANK
36	26 11 20.4	080 06 14.4	ICW; 100' N OF COMMERCIAL BLVD BRIDGE E FENDER; 100' W OF EAST BANK
37	26 08 16.8	080 06 32.4	ICW; 100' N OF SUNRISE BLVD BRIDGE E FENDER; 100' W OF E BANK
38	26 06 00.0	080 07 12.0	ICW; 100' N OF 17TH STREET CAUSEWAY BRIDGE E FENDER 100' W OF E BANK
39	26 03 57.6	080 06 54.0	ICW; 300' N OF MARKER #35; 50' W OF E BANK
40	26 02 02.4	080 07 04.8	ICW; 100' N OF SHERIDAN STREET BRIDGE E FENDER; 50' W OF E BANK; WEST LAKE PROJECT SITE #W-3.
41	25 59 09.6	080 07 15.6	ICW; 100' N OF HALLANDALE BEACH BLVD BRIDGE E FENDER; 50' W OF E BANK
47	26 03 46.8	080 07 04.8	DANIA CUTOFF CANAL; DANIA CUTOFF CANAL; 200' W OF ICW
49	26 07 12.0	080 07 19.2	SOSPIRO CANAL; LAS OLAS ISLE BRIDGE OVER SOSPIRO CANAL
89	26 05 06.0	080 10 55.2	POMPANO CANAL; CENTER OF CANAL W SIDE OF NOB HILL ROAD BRIDGE OVER POMPANO CANAL N OF SOUTHGATE ROAD
90	26 13 44.4	080 16 55.2	S FORK NEW RIVER; E BANK OF S FORK NEW RIVER ABOUT 15 METERS N OF SERVICE ROAD
109	26 13 19.2	080 13 48.0	CANAL; POMPANO. AT ROCK ISLAND ROAD BRIDGE OVER THE POMPANO CANAL . SAMPLE FROM EAST SIDE OF BRIDGE.
110	26 13 52.0	080 07 38.0	CANAL; POMPANO. AT DIXIE HIGHWAY. SAMPLE FROM CULVERT WEST OF DIXIE HIGHWAY AT ATLANTIC BLVD.

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10. SUPPLEMENTARY NOTES

11. ABSTRACT

Broward County surface waters were tested in 1999 to determine the occurrence and distribution of volatile organic compounds (VOCs). This testing was performed to confirm the findings of an initial survey performed in 1998 when a variety of VOCs were detected. In general, the VOCs detected in both surveys fell into 3 groups: 1) petroleum hydrocarbons, 2) chlorinated hydrocarbons and their decomposition products and 3) naturally-occurring VOCs.

Petroleum hydrocarbon VOCs detected in the 1999 survey are common components of motor fuels. A total of 104 VOC detections were recorded in the 1999 survey as compared to 42 detections in the 1998 survey. The increased frequency of detection is believed to be due to an inprovement in the analytical methodology used in the 1999 survey.

One of the petroleum hydrocarbons detected in both surveys, methyl tert butyl ether (MTBE), has recently been the subject of attention because of its detection in the drinking water supplies in communities across the nation. The risk of MTBE contamination of Broward County drinking water supplies, however, is minimal because of safeguards that have been in place for several years.

Chlorinated hydrocarbons and their decomposition products were also detected in both surveys. While the range of concentrations found in both surveys were similarly, the frequency of their detection was greater in the 1999 study and is also believed to be the result of the improved analytical methodology. These VOCs enter surface water through recharge by contaminated ground water. This mechanism was particularly evident in the vicinity of the airport where wide-spread contmaination of ground water by vinyl chloride has been documented.

The naturally-occurring VOC was bromoform. While it was detected less often in the 1999 study, its distribution was restricted to the Intracoastal Waterway. The results of the current 1999 supported the proposition that bromoform, produced by marine algae in the ocean, entered the inland waters through tidal action.

12. KEY WORDS

Surface Water
Petroleum Hydrocarbons
Outboard Motors
Methyltertbutylether
MTBE

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