USEPA MTBE Pilot Project– Objective 2
Investigate Potential Sources of MTBE Contamination on Long Island That Could Impact Water Supplies or Environmentally Sensitive Areas

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Executive Summary

Methyl tertiary butyl ether (MTBE) was legally used as a gasoline blending component in New York State from 1979 (USEPA, 1998) until its statewide ban on January 1, 2004 (USEPA, 2004) (NYSDAM, 2004). The expanding use of MTBE in gasoline during that period (USEPA, 1999) in conjunction with its physical and chemical properties (ITRC, 2005) resulted in significant MTBE impacts to the groundwater resource of Long Island (NYSDEC, 2000). Better understanding of the scope of the impact was of great importance to the New York State Department of Environmental Conservation (NYSDEC) as the Long Island aquifer system is the sole source of drinking water for over 2.7 million residents in Nassau and Suffolk Counties (US Census Bureau, 2007). Ninety-five percent of these residents receive their water from over 900 public water supply wells with the rest supplied by over 64,000 private wells (SCDHS, 2007).

Between December 2002 and December 2006, with funding provided by the United States Environmental Protection Agency (USEPA), the NYSDEC conducted a pilot study to better define the extent of MTBE contamination stemming from previously unidentified and/or unreported MTBE blended gasoline releases throughout the Long Island aquifer system. The study was intended to yield sufficient data to project the potential MTBE impacts upon drinking water source waters (groundwater) from unreported MTBE blended gasoline releases throughout the aquifers supplying the sole source of drinking water to the residents of Nassau and Suffolk Counties.

During the study, 52 gasoline retail stations in Nassau and Suffolk Counties (approximately 4.7% of the total number of stations in those counties) that had no known prior release of oxygenated gasoline underwent petroleum bulk storage inspections and groundwater sampling for MTBE. The study found that MTBE was nondetect or less than the New York State Department of Health drinking water standard and NYSDEC groundwater standard of 10 micrograms/liter (µg/L) at approximately 60% of sites investigated. Additionally, MTBE was found to have exceeded 10 µg/L at 34% and 53% of sites investigated in Suffolk and Nassau Counties, respectively. The MTBE concentrations in groundwater ranged from nondetect up to 240,000 µg/L in Nassau County and up to 63,000 µg/L in Suffolk County.

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1.0 Introduction

1.1 Purpose

Methyl tertiary butyl ether (MTBE) was legally used as a gasoline blending component in New York State first to replace tetra ethyl lead to achieve desired octane levels and later as a fuel oxygenate as early as 1979 (USEPA, 1998) until its statewide ban on January 1, 2004 (USEPA, 2004) (NYSDAM, 2004). Due to the physical and chemical properties of MTBE (ITRC, 2005) and the increased use of MTBE in gasoline (USEPA, 1999), there are significant MTBE impacts (NYSDEC, 2000) to the sole source drinking water aquifers on Long Island (USEPA, 1978). The sole source aquifers provide drinking water to over 2.7 million residents in Nassau and Suffolk Counties (US Census Bureau, 2007). Over 95% of these residents receive their water from over 900 public water supply wells throughout both counties (SCDHS, 2007).

The primary purpose of the pilot study was to provide sufficient data on previously unidentified MTBE impacts to groundwater at gasoline retail stations to project the potential MTBE impact upon drinking water source waters (groundwater) from unreported MTBE blended gasoline releases. To identify the frequency of MTBE impacts upon drinking water source water quality from unknown spills at gasoline stations, groundwater monitoring wells were installed at active gasoline retail stations with no reported history of MTBE blended gasoline releases and were situated near source water recharge areas of public drinking water supply wells. These wells were then monitored and the MTBE impacts were evaluated as the basis for projecting aquifer wide MTBE impacts. Funding to conduct this study was included in a pilot grant from the USEPA to the NYSDEC.

1.2 Background

MTBE is a manufactured chemical compound formed from the chemical reaction of methanol and isobutylene. It has been in use in the United States since 1979 when it was added to gasoline to replace lead additives at concentrations up to 8% by volume (USEPA, 1998). The 1990 Federal Clean Air Act (CAA) required the use of oxygenated gasoline in specific areas of the country in an effort to reduce air pollution. MTBE blended gasoline was supplied to New York State to meet the requirements of the CAA since the MTBE raises the oxygen content of gasoline and improves combustion thereby reducing air pollution from vehicle emissions. The use of MTBE nationwide increased with the start of the 1992 Winter Oxyfuel Program which required fuels to contain at least 2.7% oxygen by weight during the winter months in cities with elevated levels of carbon monoxide. In 1995, the Federal Reformulated Gasoline Program (RFG) required year round use of fuels containing at least 2% oxygen by weight in cities with high smog levels. Using MTBE as an oxygenate, approximately 11% by volume would be required to meet the minimum of 2% oxygen by mass and as much as 15% by volume in winter months. In 1999, over 200,000 barrels per day of MTBE were being produced in the United States (USEPA, 2006).

In September 1998, the NYSDEC determined that there was a need to assess the extent of MTBE contamination in groundwater of New York State. A survey of all active gasoline spill projects was implemented in order to determine which sites had the potential to impact groundwater with MTBE (see Appendix A). The survey spanned spills reported between July 1978 and September 1998. Of the 5,262 spills identified, 1,706 (32%) were found to have MTBE impacts to groundwater. The greatest percentage of spill sites with MTBE contamination (24%) as well as the greatest number of spill sites with MTBE groundwater contamination over 50 parts per billion were found to be on Long Island. Based on these results, NYSDEC determined that further study of MTBE contamination of groundwater on Long Island was warranted.

2.0 Study

2.1 Target Site Selection

The goal of the site selection process was to identify at least 60 retail gasoline stations on Long Island (Nassau and Suffolk Counties) without histories of MTBE blended gasoline releases situated within the source water recharge area of public supply wells deemed particularly sensitive to MTBE contamination. The hydrogeologic, chemical, and pumpage data from all public drinking water supply wells in Nassau and Suffolk Counties were evaluated. The first line public supply wells (i.e. annual average pumpage in excess of 1 million gallons per day) meeting the following criteria were identified as particularly sensitive to MTBE contamination:

- screened in the Upper Glacial or Magothy aquifers less than 400 feet below land surface;
- have a combined 14 year total pumpage in excess of 1 million gallons per day;
- exhibited detectable concentrations of MTBE.

The locations of the selected wells were imported into a geographic information system (GIS) software package which contained locations of active gasoline retail stations. Station selection was limited to sites meeting the following criteria:

- Groups of two or more stations situated in a circular well head protection zone up to 1.5 miles in radius of a particularly sensitive first line public drinking water supply well.
- Stations with no active NYSDEC spill numbers and/or current ground water quality indicating the presence of an MTBE blended gasoline release.

The selection criteria resulted in the identification of 75 retail gasoline stations.

To facilitate the tracking and mapping of the MTBE impacts detected during the study, the USEPA performed a global positioning system (GPS) survey of 256 stations in Nassau and Suffolk Counties, including the 75 stations identified above. USEPA contractors visited each site where GPS coordinates were obtained and provided to the NYSDEC. The GPS data was imported into a GIS program and mapped along with public supply well locations (see Appendix B for the USEPA gasoline station survey).

The USEPA survey and GIS mapping revealed that some of the 75 stations were found to be closed or otherwise did not meet the original selection criteria and were removed from the priority list. Therefore, the final draft list was comprised of 60 active gasoline retail stations. Follow up inspections of each of the 60 stations were conducted by NYSDEC representatives. Several of the inspections revealed nearby active gasoline service stations meeting the station selection criteria, but not on the list of 60 sites discussed above. These were added to the final list for a total of 63 sites (Appendix C)

2.2 Investigation Methods

2.2.1 Petroleum Bulk Storage Inspections

Each of the 63 stations was inspected for compliance with State and Federal Petroleum Bulk Storage (PBS) regulations and identification of potential releases by teams of three to four inspectors. As part of each inspection the following tasks were performed:

- Facility registration certificates were checked for expiration date and tank owner information.
- Daily inventory and 10-day inventory reconciliation records were checked for accuracy and those that indicated a potential problem were investigated further.
- Tank top sumps and fill ports were inspected for the presence of petroleum product, water, debris or presence of any breaches or pathways that could potentially lead to a petroleum release.
- Color coding of all fill ports, tank top sumps, and vapor recovery ports were visually inspected for compliance with PBS regulations.
- Dispenser nozzles were inspected for any tears or cracks that may lead to a vapor release to the environment.
- Shear valves were checked for proper mounting.
- Dispenser pans were checked for the presence of petroleum, water or other debris or contaminated soil.

NYSDEC spill numbers were generated for stations that exhibited visual or olfactory evidence of petroleum releases. Further details regarding these inspections are included in the USEPA MTBE Pilot Project Objective 5 Report in Appendix C.

2.2.2. Drilling and Sampling

NYSDEC sent a letter to each station owner to inform them of the study and to obtain access to the station property. NYSDEC utilized state standby contractors with existing investigation and remediation contracts to install the wells and collect data. Up to four 2 inch diameter standard PVC groundwater monitoring wells were installed on each of the stations or adjacent to stations including the downgradient boundary of each station and sampled to determine if there was any petroleum related impact to the groundwater supply. The direction of

groundwater flow near each station was considered when choosing monitoring well locations.

The well installations followed a boilerplate plan which included the installation of one upgradient well, one downgradient well, and one or two crossgradient wells. In most cases, the monitoring wells were installed as close as possible to potential source areas (i.e., tanks and pump islands). Wells were sampled and analyzed for BTEX and MTBE utilizing USEPA Method 602.

The NYSDEC did not obtain groundwater data from 11 of the 63 stations that were inspected. Of these 11 stations, nine were not active retail gasoline stations at the time of the drilling and sampling, one was found to no longer meet the selection criteria based upon historical groundwater quality data and one had property access issues. At their own expense, property owners for 23 of the 63 sites installed and sampled monitoring wells or sampled existing monitoring wells and provided investigation reports to the NYSDEC. The NYSDEC installed monitoring wells at the remaining 29 stations. Therefore, groundwater data was obtained from only 52 of the 63 sites selected. Upon completion, the contractors submitted reports which included site plans, measured groundwater flow directions, and analytical results for each station.

The approximate costs for well installation and sampling by NYSDEC contractors ranged from $2,800 to $29,000. Lowest costs were associated with sites where depth to water was 30 feet or shallower. Installation and sampling costs were highest where the depth to water was 125 feet. The average cost per site in Nassau and Suffolk County was $9,100 and $11,400, respectively. The average depth to water at these stations in both counties was 53 feet.

2.3 Summary of Study Design

(1) 52 gasoline retail stations in NYSDEC Region 1 (approximately 5.7% of the total number of stations in both counties) were selected, and underwent, PBS inspections and MTBE water quality impacts assessment based upon the following criteria:

- The stations were within a 1.5 mile radius of a 1 million gallon per day (MGD) public drinking water supply well deemed to be particularly sensitive to MTBE contamination;
- Two or more stations were situated with the same 1.5 mile radius; and
- The stations had no known prior release of oxygenated gasoline.

(2) A boilerplate investigation of water quality was implemented at each station:

- 23 of the investigations were undertaken by property owners.
- 29 of the investigation were undertaken by NYSDEC with costs ranging from $2,800 to $29,000 per site.

3.0 Results

3.1 MTBE Concentrations

MTBE concentrations in groundwater at the 52 sites ranged from nondetect to 240,000 micrograms/liter (µg/L). The highest detected MTBE concentrations in the two counties studied were 240,000 µg/L in Nassau County and 63,000 µg/L in Suffolk County. The frequencies of MTBE impacts were organized into three categories: less than 10 µg/L, greater than 10 µg/L, and greater than 5,000 µg/L. Table 3.1 is a summary of the categorized frequencies.

MTBE was detected at some stations below the NYSDOH drinking water and NYSDEC groundwater standard of 10 µg/L. Groundwater at these stations was resampled the following quarter to determine if MTBE concentrations had increased. If concentrations remained below the groundwater standard no further sampling was performed. MTBE was nondetect or less than 10 µg/L at approximately 60% of the sites with groundwater data.

MTBE exceeded the standard of 10 µg/L at 34% and 53% of sites with groundwater data in Suffolk and Nassau Counties, respectively. For the purpose of this study, the eight sites with MTBE concentrations greater than 5,000 µg/L were considered to have high levels of MTBE and required immediate active management and remediation. This accounted for approximately 11% of sites in Suffolk and 24% of sites in Nassau. The level of management and remediation required at two of such sites is described further in the following section.

Table 3.1
Frequencies of MTBE Detections in Groundwater by Category

# Sites	Frequency MTBE <10 µg/L	Frequency MTBE >10 µg/L	Frequency MTBE >5,000 µg/L
Nassau County (17)	47%	53%	24%
Suffolk County (35)	66%	34%	11%
Suffolk & Nassau (52)	60%	40%	15%

An additional finding of this study was the discovery of 33 new petroleum releases at the 52 sites. The new petroleum releases include those identified above as well as those not known to involve MTBE and/or impacts to groundwater.

3.2 Follow-up at Sites with High Levels of MTBE Contamination

The groundwater data from the eight stations where the high levels of MTBE were detected were immediately disclosed to the station owners for further investigation. At six of the stations, the owners proceeded with subsurface investigations and/or remediation as directed by the NYSDEC. The owners of two of the stations refused to perform remedial investigations;

therefore, the NYSDEC utilized contractors from its standby investigation and remediation contracts to perform the required investigations. Further details regarding these two investigations are provided below.

3.2.1 Liberty Station, Hempstead Turnpike, Elmont

During the PBS inspection at the aforementioned station, NYSDEC staff encountered light non-aqueous phase liquid (LNAPL) in two of the four tank bed monitoring wells. The station owner initially performed a limited subsurface investigation, but refused to perform a complete subsurface remedial investigation to delineate the groundwater contamination migrating off-site. The NYSDEC used one of its standby investigation and remediation contractors to complete the required investigation.

Based on the results of the investigation, the NYSDEC determined that MTBE plume extended almost 1,750 feet from the station in a southwesterly direction. A soil vapor extraction and air sparge remedial system was installed at the service station to address on-site contamination. Currently, a groundwater flow and chemical transport model is being developed to aid in plume conceptualization and management. The model includes the locations of all public drinking water supply wells in the vicinity of the station and will simulate future groundwater flow to determine if the MTBE contamination poses a threat to these wells. The NYSDEC will conduct further investigation and/or remediation if warranted to protect the public drinking water supply wells. Investigation and cleanup costs associated with this spill are projected to be approximately $750,000.

3.2.2 Getty Station, Portion Road, Ronkonkoma

Groundwater samples taken for this site showed MTBE at 49,300 µg/L. The station owner initially performed a limited on-site subsurface investigation, but refused to perform a complete subsurface remedial investigation to delineate the extent of groundwater contamination emanating from the property. In addition, NYSDEC discovered that the station owner was discharging potable water in the monitoring wells to dilute the contamination. The NYSDEC directed one of its standby contractors to completely define the nature and extent of the gasoline release.

DEC determined that the dissolved gasoline plume, primarily consisting of MTBE, extended at least 800 feet off site and was migrating towards a public drinking water supply well, which is located 1400 feet from the station. A soil vapor extraction and air sparge system was installed at the service station to address the on site contamination. A groundwater extraction and treatment system (low profile air stripper with Bio-GAC) has also been installed to prevent further migration of the contaminant plume and prevent impacts to the public drinking water supply well immediately downgradient. Investigation and cleanup costs associated with this spill are projected to be approximately $1,500,000.

4.0 Conclusions

The following is a summary of MTBE concentration data:

- MTBE was nondetect or less than 10 µg/L at approximately 60% of all sites.
- MTBE exceeded the NYSDOH drinking water standard and NYSDEC groundwater standard of 10 µg/L at 34% and 53% of sites investigated in Suffolk and Nassau Counties, respectively.
- MTBE concentrations exceeded 5,000 µg/L at approximately 11% of sites in Suffolk County and 24% of sites in Nassau County.
- The highest detected MTBE concentration in the two counties studied was 240,000 µg/L in Nassau County and 63,000 µg/L in Suffolk County.

The following is a summary of costs:

- The average cost to investigate groundwater quality at each site in Nassau and Suffolk County was $9,100 and $11,400, respectively.
- Two of the 52 sites had MTBE driven investigations and remedial costs in excess of $750,000 with the average cost being $1,125,000.

As a result of the PBS inspection and groundwater sampling efforts conducted under this objective, 33 petroleum releases were discovered that previously had not been reported. Each of these releases represent potential sources of MTBE contamination that could impact drinking water supplies or other environmentally sensitive areas. These new releases are also now undergoing investigation/remediation. Based upon the extent of the groundwater impacts suggested by this report, it is evident that MTBE contamination is still a potential threat to source water for public water supply wells on Long Island. In addition, based upon the data collected by the New York State Department of Agriculture and Markets since the MTBE ban, MTBE concentrations in gasoline distributed in the former RFG areas exceed the de minimus level of 0.5% by volume (NYSDAM 2003) at numerous locations sampled. Therefore, additional MTBE impacts cannot be discounted.

5.0 Recommendations

The results of the study show that unknown discharges of MTBE likely have significantly impacted groundwater and drinking water source waters of Long Island. Further groundwater sampling at active gasoline retail stations near public supply wells has been proven effective in detecting such impacts and is recommended. However, since MTBE was banned in 2004, the potential for MTBE contamination to migrate with groundwater flow beyond the station boundaries needs to be considered. In addition, continued routine monitoring of all public supply wells for MTBE is needed as a component of the ongoing assessment of potential sources

of MTBE impacts to drinking water.

Major recommendations stemming from the data collected during the study are as follows:

- MTBE is still a major contaminant of concern in groundwater. All samples, including public drinking water supply well and groundwater, should continue to be analyzed for MTBE and other fuel oxygenates;

- The boilerplate groundwater investigation plan should be applied to other gasoline stations in Nassau and Suffolk Counties, especially near potential sensitive receptors. Stations within the source water recharge areas of public drinking water supply wells should be investigated as the first step in this approach.

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APPENDIX A

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF ENVIRONMENTAL REMEDIATION
BUREAU OF SPILL PREVENTION AND RESPONSE

FINAL REPORT
SURVEY OF ACTIVE NEW YORK STATE GASOLINE REMEDIATION SITES WITH POTENTIAL MTBE CONTAMINATION

FEBRUARY 8, 2000

Background

Methyl tertiary butyl ether (MTBE) is being used in New York State (NYS) as a gasoline oxygenate which reduces air pollution. It does so by promoting a more complete combustion of the gasoline and by reducing exhaust emissions of carbon monoxide and the oxides of nitrogen. However, use of this gasoline additive raises concern for our water resources. When gasoline is spilled or released to the environment, the MTBE component tends to move through the soil quickly, dissolves in the groundwater and has the potential to travel considerable distances from the spill site. As a result, MTBE is often detected in public and private drinking water wells when other gasoline components are not detected. MTBE is a suspected human carcinogen. Additionally, MTBE has a strong turpentine-like odor and taste in water even at low concentrations. Due to the properties of MTBE, even relatively small spills can negatively impact groundwater and drinking water. In surface waters, the primary source of MTBE is from gasoline-powered water craft, particularly those with two-stroke engines such as jet skis and outboard engines.

The publishing of numerous reports, by such organizations as the Northeast States for Coordinated Air Use Management (NESCAUM), the University of California at Davis and the USEPA Blue Ribbon Panel, has focused national attention and public policy discussions on the MTBE issue. Along with this recent availability of information on MTBE has come an increased public awareness concerning MTBE impacts to their drinking water sources.

Objective

The Bureau of Spill Prevention and Response (BSPR), in the Division of Environmental Remediation, is responsible for the implementation of the New York State Department of Environmental Conservation's (DEC) oil spill cleanup and prevention programs. To enable BSPR to make informed decisions concerning MTBE impacts from petroleum spills and to provide additional information to interested parties, BSPR initiated a survey of the Oil Spill Program in September 1998. The objective of the survey was to provide a snapshot picture of the extent of groundwater impacted by MTBE in New York State.

Data Collection Efforts

The BSPR Spills Information Data System tracks information regarding the types of petroleum products that are spilled or released to the environment, but does not track site specific information regarding MTBE or other individual constituents of the petroleum products. This information is maintained in individual project records at DEC Regional Offices.

Approximately 15,000 reports of suspected leaks and spills are made to the New York State Department of Environmental Conservation's spill hotline each year. Information on over 200,000 reported spills is currently maintained in BSPR's Spill Information Data System.

To make this a manageable effort, BSPR looked at "active" gasoline spill projects in New York State – those where remediation is still underway, as the subset of spills that would have the greatest likelihood of having MTBE impacts to groundwater. A list was generated from the Spills Information Data System that identified a total of 5,262 spills that had the potential to impact groundwater with MTBE, which had been reported to DEC between July 1978 and September 1998 but had not been closed as of September 2, 1998.

Each Regional Office was sent a copy of this list and was asked to review each of their sites to identify if the spill was known to have resulted in an MTBE impact to groundwater. This effort usually entailed physically searching each spill project file for the requested information. A survey fact sheet was prepared for each site where MTBE groundwater contamination had been identified. The project completion deadline was extended due to workload considerations. The data collection effort was completed by October 23, 1998.

The following year, during August 13-26, 1999, the Regional Offices were asked to review the accuracy of the survey data and update it with current site information. The survey data was then checked for administrative accuracy and duplicate spill information was removed. The results of the survey are summarized in the attached Tables 1-5.

Observations Drawn From Survey

The BSPR has made the following observations from the survey data:

- Of the 5,262 spills with a strong potential for MTBE presence identified for this survey, 32% (1,706) were identified to have MTBE impacts to groundwater. This relatively low percentage can be attributed to New York's aggressive program for response to gasoline and petroleum spills and leaks. It is likely DEC's early response has thwarted the further migration of MTBE.

- The focus of the survey was on a representative subset of reported spills having the most probability for MTBE impacts, which included many sites in the active remediation phase. The survey results found 82% of the 1,706 identified sites had MTBE groundwater concentrations that exceeded the proposed cleanup objective of 10 ppb. This is to be expected, since those sites were still active.

- Although 866 private wells and 47 public water supply wells have observed MTBE impacts, the BSPR spill response program has protected the public by providing alternate sources of safe drinking water, such as whole house filter systems, bottled water, replacement wells and hookups to public water supply lines. In situations where MTBE has been found in a drinking water source, the affected parties have been notified and appropriate steps have been taken.

- The survey indicates that 72% of the 1,706 spills that were identified as having MTBE impacts to groundwater were from leaking steel underground storage tanks (USTs) and piping systems. Releases from UST systems are due to failures of unprotected tanks, leaks in delivery piping, leaks from vent pipes and fittings on top of the tank, and spill and overfill errors. The USEPA requirement for upgrading UST systems by December 22, 1998 was intended to address these issues by requiring tanks and piping systems to be corrosion resistant and the addition of spill and overfill prevention devices. It is too soon to see if these preventive measures will significantly reduce the number of spills from UST systems. BSPR inspectors are checking for compliance with both state leak detection requirements and federal upgrade requirements with the focus on facilities for which registration information and verification of tank tightness had not been submitted.

- The survey results showed that of the 1,706 active spill sites with MTBE, approximately 57% were reported prior to 1994. These data confirm the characteristic resistance of MTBE to biodegradation once it dissolves in groundwater. In addition, it could also be inferred that the reduced number of MTBE contaminated sites reported in recent years could be a result of the tank replacement and upgrading effort by the industry in compliance with federal and state requirements. However, further investigation is needed to confirm this observation. BSPR anticipates that the strong leak preventive measures, including state-of-the-art tanks, vigilant site monitoring and proper maintenance and regulatory oversight will continue to prevent spills in the future.

- 20% of the 1,706 identified spills with MTBE impacts to groundwater were from unknown sources. The cause of these spills could possibly be from small surface spills and atmospheric deposition, which is consistent with information reported by other states.

Survey Conclusions

The BSPR has made the following conclusions based on the results of the survey:

- The extent of MTBE impacts to groundwater in New York State is similar with that experienced in other states where MTBE has been used as a gasoline additive. These impacts include contamination of groundwater and drinking water supplies, and impacts from vapors migrating through soil. Although some water supplies have been impacted, New York State has not had shutdowns of large public water supply

systems as a result of MTBE contamination, as occurred in Santa Monica, California. Strict reporting requirements of the Department, its aggressive response to spills, enforcement of federal and state UST upgrade requirements, and cleanup actions to protect public water supplies have prevented more far-reaching problems from occurring.

- BSPR programs to protect the environment and water resources are working. The BSPR has implemented safeguards to protect the public from spill impacts to their drinking water by screening each spill site to identify possible receptors. If it is determined that drinking water standards may be or have been exceeded, the affected public is notified of the situation and alternate sources of drinking water are provided. The vigilant enforcement of the state's Petroleum Bulk Storage program for storage tanks, has provided a front line of protection against catastrophic events.

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TABLE 1

NYSDEC - BUREAU OF SPILL PREVENTION AND RESPONSE
NUMBER OF SURVEY SITES IDENTIFIED FROM THE LIST OF POTENTIAL SITES AS HAVING MTBE CONTAMINATION

REGION	POTENTIAL MTBE CONTAMINATION SITES			CONFIRMED MTBE CONTAMINATION SITES		
	SPILLS TO GW	SPILLS TO LAND	TOTAL POTENTIAL SITES	MTBE PIN SITES	MTBE NON-PIN SITES	TOTAL MTBE SITES
1	580	255	835	115	290	405
2	420	858	1,278	16	106	122
3	300	482	782	57	203	260
4	91	210	301	46	129	175
5	110	127	237	60	106	166
6	277	191	468	78	151	229
7	175	210	385	27	79	106
8	281	432	713	32	114	146
9	149	114	263	27	70	97
TOTAL	2,383	2,879	5,262	458	1,248	1,706

Notes: (1) Table modified November 10, 1999 to reflect administrative corrections and removal of duplicate addresses.

(2) Table prepared November 10, 1999.

(3) Survey data for identified sites updated August 1999.

(4) PIN Sites are funded by the New York State Oil Spill Fund. NON-PIN Sites are funded by the responsible party.

(5) GW is defined as groundwater.

TABLE 2

NYSDEC - BUREAU OF SPILL PREVENTION AND RESPONSE
SPILL SOURCES AT SURVEY SITES WITH MTBE CONTAMINATION

REGION	STEEL UST	PIPING	NOT IDENTIFIED	FIBERGLASS UST	ABOVE-GROUND ST	OTHER	
1	167	36	200	22	1	19	
2	48	42	43	0	1	20	
3	162	121	49	5	1	32	
4	119	74	35	3	0	12	
5	114	66	28	2	3	13	
6	185	135	23	0	15	5	
7	71	53	17	2	3	1	
8	91	37	44	5	0	1	
9	63	30	19	5	2	2	
TOTAL # SOURCES	1020	594	458	44	26	105	2247
% TOTAL	46%	26%	20%	2%	1%	5%	

Notes: (1) Table modified November 10, 1999 to reflect administrative corrections and removal of duplicate addresses.
(2) Table prepared November 10, 1999.
(3) Survey data for identified sites updated August 1999.
(4) UST defined as Underground Storage Tank.
(5) Each spill site may have multiple spill sources.

TABLE 3

NYSDEC - BUREAU OF SPILL PREVENTION AND RESPONSE
SURVEY SITES WITH MTBE CONTAMINATION
RANGE OF MTBE CONCENTRATIONS

REGION	> 50 PPB	10-50 PPB	< 10 PPB	
1	288	56	61	
2	104	9	9	
3	210	29	21	
4	125	19	31	
5	87	21	58	
6	137	38	54	
7	59	22	25	
8	96	13	37	
9	72	6	19	
TOTAL # OF SITES	1178	213	315	1706
% TOTAL	69%	13%	18%	

Notes: (1) Table modified November 10, 1999 to reflect administrative corrections and removal of duplicate addresses.

(2) Table prepared November 10, 1999.

(3) Survey data for identified sites updated August 1999.

(4) PPB defined as concentration in parts per billion.

TABLE 4

NYSDEC - BUREAU OF SPILL PREVENTION AND RESPONSE
NUMBER OF WATER SUPPLY WELLS WITH MTBE IMPACTS AND ALTERNATIVE WATER SUPPLIES PROVIDED

REGION	WATER SUPPLY IMPACTS			ALTERNATIVE WATER SUPPLIES PROVIDED				
	PRIVATE WELLS IMPCTD	PUBLIC WELLS IMPCTD	# PEOPLE AFFECTED (ESTIMATED)	WHFS INSTLD	REPLCMNT WELLS INSTALLED	WATER MAIN EXT	# HOOK-UP	BOTTLED WATER
1	129	9	24,425	16	21	9	158	46
2	2	3	40,004	2	0	0	0	0
3	309	25	112,482	255	5	12	121	37
4	97	0	657	68	2	3	56	21
5	137	1	314	82	5	2	4	31
6	129	9	623	90	20	4	22	27
7	15	0	71	8	1	0	0	10
8	18	0	50	13	4	0	0	0
9	30	0	45	24	1	0	0	0
TOTAL	866	47	178,671	558	59	30	361	172

Notes: (1) Table modified November 10, 1999 to reflect administrative corrections and removal of duplicate addresses.

(2) Table prepared November 10, 1999.

(3) Survey data for identified sites updated August 1999.

TABLE 5

NYSDEC - BUREAU OF SPILL PREVENTION AND RESPONSE
NUMBER OF SURVEY SITES WITH MTBE CONTAMINATION
IDENTIFIED BY FISCAL YEAR

REGION	FY 98	FY 97	FY 96	FY 95	FY 94	FY 93-89	< FY 89	TOTAL
1	8	22	31	33	26	187	98	405
2	6	11	19	18	8	38	22	122
3	10	28	25	19	18	113	47	260
4	14	17	24	12	20	64	24	175
5	13	27	24	22	18	47	15	166
6	2	10	15	15	25	120	42	229
7	8	23	7	9	10	38	11	106
8	8	16	23	15	17	57	10	146
9	5	17	12	12	16	26	9	97
TOTAL	74	171	180	155	158	690	278	1706
% TOTAL	4%	10%	11%	9%	9%	41%	16%	

Notes: (1) Table modified November 10, 1999 to reflect administrative corrections and removal of duplicate addresses.

(2) Table prepared November 10, 1999.

(3) Survey data for identified sites updated August 1999.

(4) Fiscal Year dates are April 1 through March 31.

APPENDIX B

MTBE Site Survey and Remediation Prioritization in Nassau and Suffolk Counties

Summer 2002

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Division of Enforcement and Compliance Assistance

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Introduction

Purpose

Our purpose was to facilitate the allocation of $1 million within Long Island, NY to sites most vulnerable to MTBE groundwater contamination. We surveyed gasoline retail locations throughout Nassau and Suffolk counties as part of an EPA project, announced in July of 2000, targeting areas of the most serious MTBE contamination.

Brief Overview of MTBE

Since 1979, methyl tertiary-butyl ether (MTBE) has been used instead of lead as an enhancer of octane. Although the addition of MTBE to gasoline makes combustion more complete, which reduces emissions that reduce air quality, MTBE has subsequently been found to harm aquifers. In Long Island, specifically Suffolk and Nassau counties, the underground sources of drinking water (USDW) are very close to the surface of the soil, and thus vulnerable to contamination by MTBE via leaking underground storage tanks (LUSTs). Santa Monica, California has similar conditions and thus is also receiving $1 million in Federal Aid to help take care of its MTBE contamination. Seven of the eleven groundwater wells in Santa Monica have been shut down thus far because of groundwater contamination.

MTBE contamination of the USDWs results in undrinkable water due to offensive odors and taste, and, in higher concentrations of 20 micrograms per liter, may be carcinogenic, although there is not yet conclusive evidence. (See section 2-48 of the "Interagency Assessment of Oxygenated Fuels," National Science and Technology Council, Committee on Environmental and Natural Resources, June 1997.)

Figure1: NY & NJ Aquifers (http://www.epa.gov/safewater/swp/ssa/reg2.html)

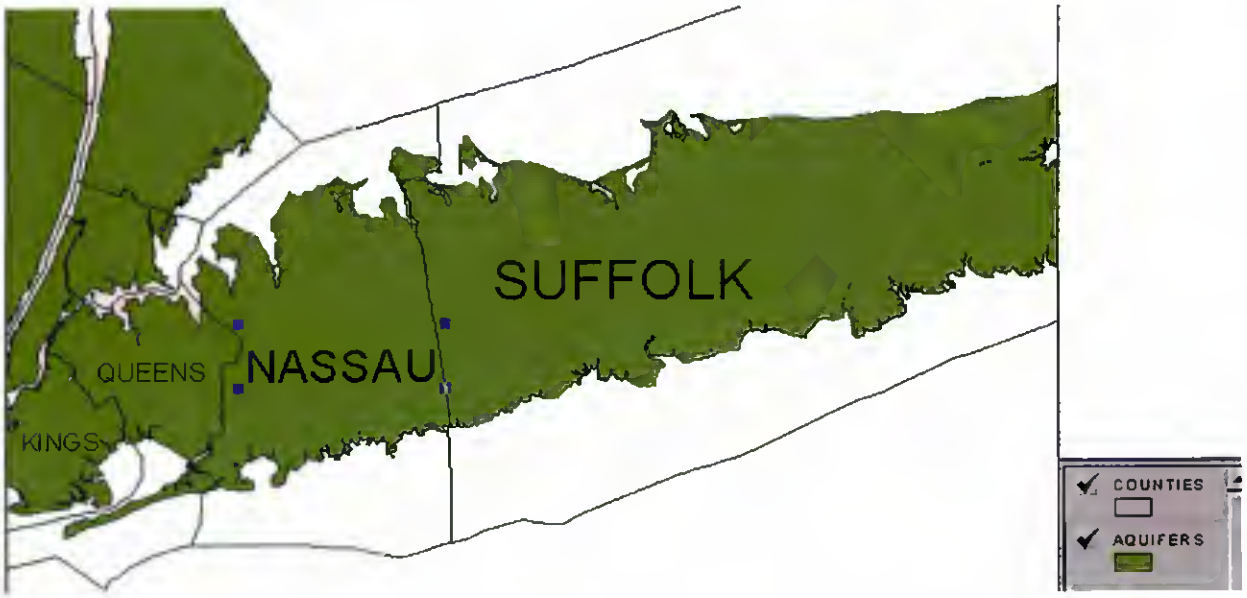

Figure 2: L.I. County Aquifers

Objectives of the project

- To survey gasoline retail locations within or immediately adjacent to the source water recharge area for sensitive first line public drinking water supply wells using GPS equipment.

- To identify those areas most vulnerable to MTBE contamination using GIS mapping techniques in order to assist in the allocation of funds for compliance enforcement and clean-ups.

- To update the NYS DEC database on USTs in Nassau and Suffolk counties.

Background

Characteristics of MTBE

MTBE ($C_5H_{12}O$) is a clear liquid with a turpene odor which is classified as an oxygenate, because it raises the oxygen content of gasoline. It is made by combing methanol, a derivative of natural gas, and isobutylene, a by-product of petroleum. The Comprehensive Environmental Response Compensation Liability Act (CERCLA) or Superfund reports MTBE as a hazardous substance and considers it a potential human carcinogen.

MTBE travels faster and farther in the ground than other components of gasoline because of its physical properties. In water, it is about 30 times more soluble than benzene (extremely soluble), and it does not absorb easily to organic carbon contained in the soil. These characteristics mean that MTBE is more likely to contaminate the USDW. In addition, MTBE is less disposed towards natural bio-degradation than other gasoline components, so once contaminated, the groundwater levels of MTBE generally remain constant over several years. There are methods for removing MTBE from groundwater, such as air stripping, activated oxidation technologies, and Granular Activated Carbon treatment, but they are costly.

The History of MTBE Use

In 1990, the Congress passed the Clean Air Act Amendments, which required gasoline to fulfill certain oxygen content requirements, designed to improve air quality in cities. The oxygen provided by the addition of MTBE displaces some part of harmful gasoline components like benzene and sulfur, as well as increasing oxidation during burning. There are two oxygenate-adding programs: the Winter Oxy-fuel Program, implemented in 1992, which requires oxygenated fuel, that is, gasoline with at least 2.7 percent oxygen by weight, to

be used during the winter in cities with elevated levels of carbon monoxide, and the Year-round Reformulated Gasoline Program (RFG), implemented in 1995, requiring RFG (at least 2 percent oxygen by weight) year-round in the most smog-filled cities. According to the U.S. EPA's Office of Underground Storage tanks, ethanol is primarily used in the Winter Oxy-fuel Program, but MTBE is sometimes used at a concentration of 15 percent by volume. MTBE is used in about 87 percent of RFG.

To fulfill the requirements of the CAA Amendments, higher concentrations of MTBE–11 to 15 percent by volume versus about 8 percent–are now used, than were previously used when MTBE served simply as an octane enhancer. (Several cities, such as Denver, did use MTBE at higher concentrations in the late 1980s during the wintertime in a program similar to the present Winter Oxy-fuel Program.). Other oxygenates, such as ethanol, a fuel made from corn, may be used, but reformulation with MTBE has become the predominant method because it is cheaper, can be shipped via existing pipelines, and is easier to blend than the alternatives. It also has a lower vapor pressure, so it is less volatile, an important consideration in warm weather.

Today, about 30 percent of gasoline in the United States is reformulated gasoline (RFG). The EPA reports that, annually, toxics in the air are being reduced by at least 24 thousand tons and the pollutants that form smog are being reduced by at least 105 thousand tons.

In May of 2001, Governor George Pataki of New York signed a bill banning the sale, use, and importation of fuels containing MTBE starting in 2004. At that time, he also instructed the New York State Energy Planning Board to research alternatives to MTBE. This decision followed California Governor Gray Davis's delay of a ban on MTBE that was originally going to take effect in December of 2002. The ban, approved by the Governor in 1999, was postponed because of concerns that the banning of MTBE would force refiners

to import a more expensive oxygenate, ethanol, which could cause gas prices to jump to $3 per gallon.

A Blue Ribbon Panel, appointed by former EPA administrator Carol Browner, recommended removing the requirement that RFG contain 2 percent oxygen, which would reduce the use of MTBE nationwide. The Panel also urged the improvement of both EPA water protection programs and private well protection programs and further research of MTBE's effects on the environment and on human health. Starting in 2001, all large public water systems are required to monitor for MTBE in groundwater and surface water. Representative samples of small public water systems are also required to perform this monitoring.

In April 2002, the Senate approved a proposal called the Renewable Fuels Standard that will phase out use of MTBE over the next four years as part of a larger Senate Energy Bill. The bill requires that the use and production of ethanol reach five billion gallons per year by 2012, three times the quantity produced in 2001. Presently the bill is in a House-Senate conference committee.

Methodology

Picking the Sites

The first seventy-five sites chosen for the project were gasoline retail locations in Nassau and Suffolk counties in Long Island. They were all within or immediately adjacent to the source water recharge area for particularly sensitive first line public dirking water supply wells. Such wells have a depth of less than 300 feet BLS or had already undergone MTBE contamination, and have combined 14 year pumpage in excess of 1,000,000 gallons. One hundred and eighty ones sites were added by reviewing lists of gas stations provided by the New York State Department of Environmental Conservation (NYDEC), to provide further data for the map.

Taking the Readings

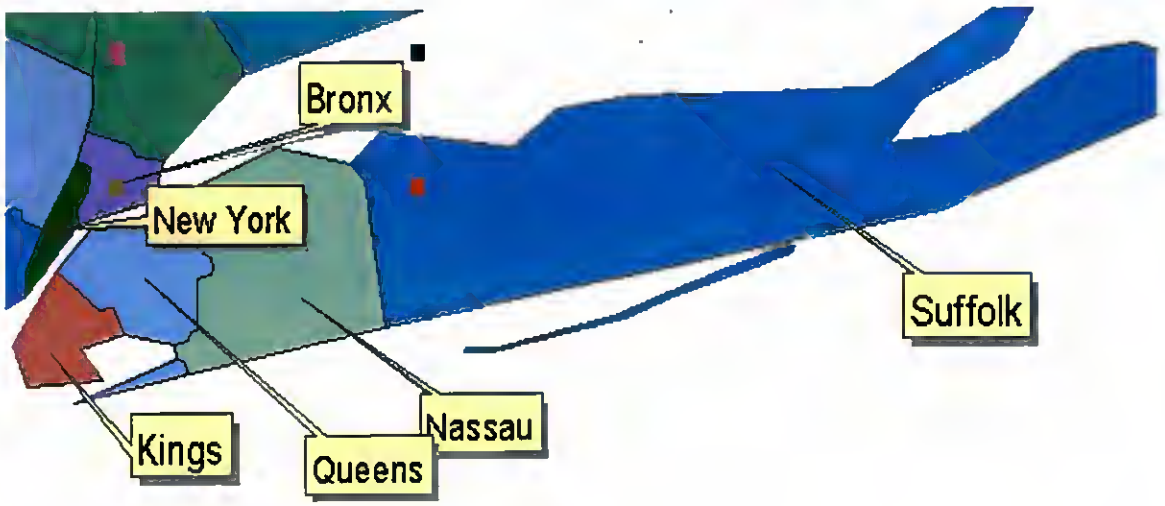

Figure:3 Map of Long Island Counties (Arcview GIS Version 3.2)

The sites were sorted by county, township, and town. Maps of Nassau

and Suffolk counties were reviewed to plot out the most efficient routes to the sites. At the sites, the Magellan GPS 315 was employed to find the latitude and longitude of each location in both degrees, minutes, and hundredths of minutes and NY UTM NAD 83. The readings were taken either at the front door of the service station or as close to the tank bed as possible. The field team waited a few minutes before recording each reading in order to let the GPS equipment get a fix on satellites overhead and make sure that the data was not fluctuating irregularly because of shifting fixes on satellites. The site was sketched, with the location of nearby cross streets noted.

How GPS works

GPS, or Global Positioning System, is a radio-navigation system that uses 24 satellites orbiting all around the globe to provide users with information about position, velocity, and time. Designed in 1973, the system is run by the US Department of Defense and requires the coordination of three segments:

- the satellites and the Delta rockets that launch the satellites,

- the control segment, which includes the master control station at Falcon Air Force Base in Colorado Springs, Colorado, and monitor stations in the Atlantic, Pacific, and Indian Oceans

- the user, who operates the receiver.

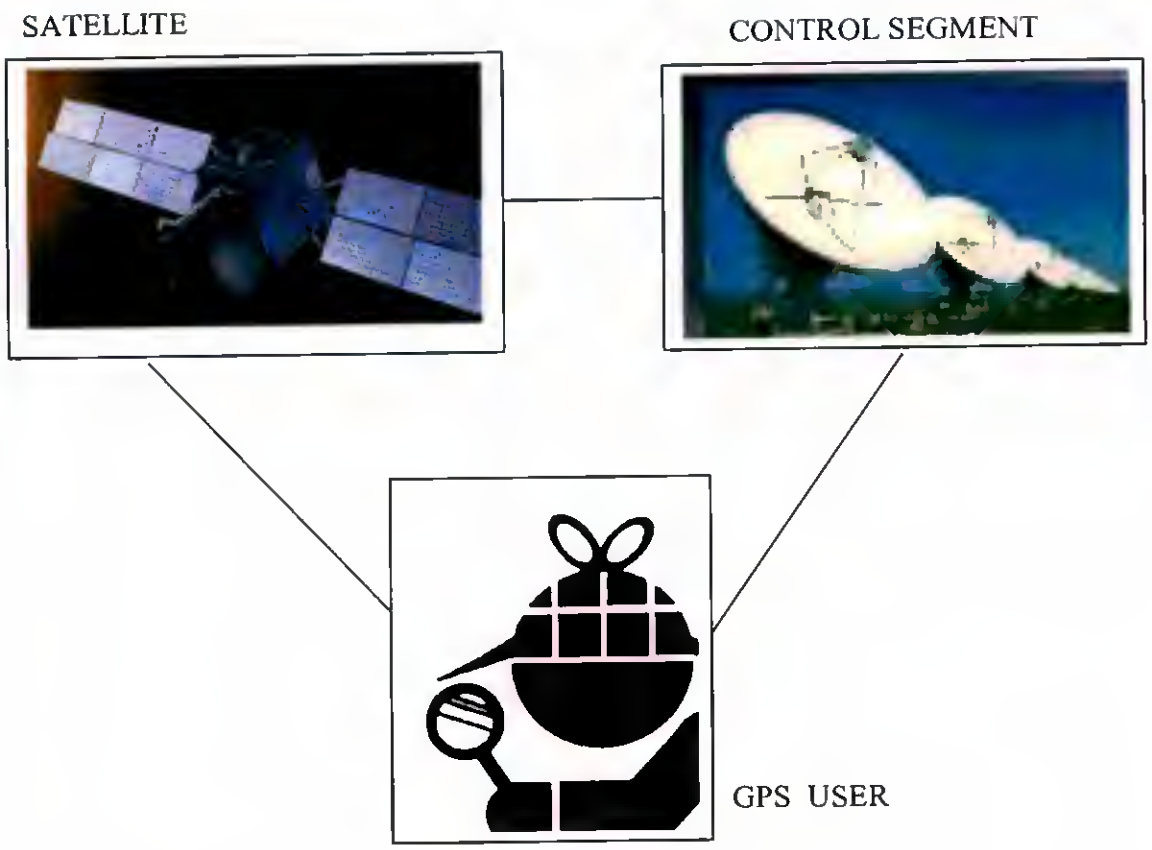

Figure: 4 Global Positioning System (GPS)

The satellites fly in orbits around the Earth at an altitude of about 12, 500km and complete one full orbit every 12 hours. Satellites keep their antennas pointed towards the Earth and their solar cells pointed towards the sun by making adjustments as it rotates. The satellites are monitored by the control segment, which predicts the behavior of the orbit and clock of each satellite. The control segment transmits this information to the satellites themselves for transmission to users and ensures that the orbits and clocks are within the permitted ranges.

Each satellite has four atomic clocks on board. The satellite transmits the time, according to these clocks, to the receiver. The receiver computes the

location of the satellite in relation to receiver by noting the time difference between the time of signal reception and the time of broadcast. The receiver must also take into account what are called propagation delays--the slowing of the signal from the satellite due to the atmosphere, specifically the ionosphere and the troposphere. Four satellite fixes are required for a receiver to compute its position, or three if it contains an atomic clock that is synchronized to GPS.

Processing of Data

The latitude and longitude and the UTM coordinates of the gas stations were entered into a database. This database was imported into Arcview GIS Version 3.2 so that the location of the gas stations could be plotted. Shapefiles containing data such as underground water source locations and aquifer locations, as well as context information such as L.I Railroad Routes and town names were also added to the Arcview project. The overlay of the gas stations and UDWS indicated that these locations were all within the 1000ft distance of the ground water sources. Such stations will be made the highest priority for compliance enforcement to ensure adherence to UST regulations that prevent spills and clean-ups of previous spills. In addition, gas stations identified by this query that are now closed will be the first targeted for efforts to ensure proper permanent closure of USTs.

Results

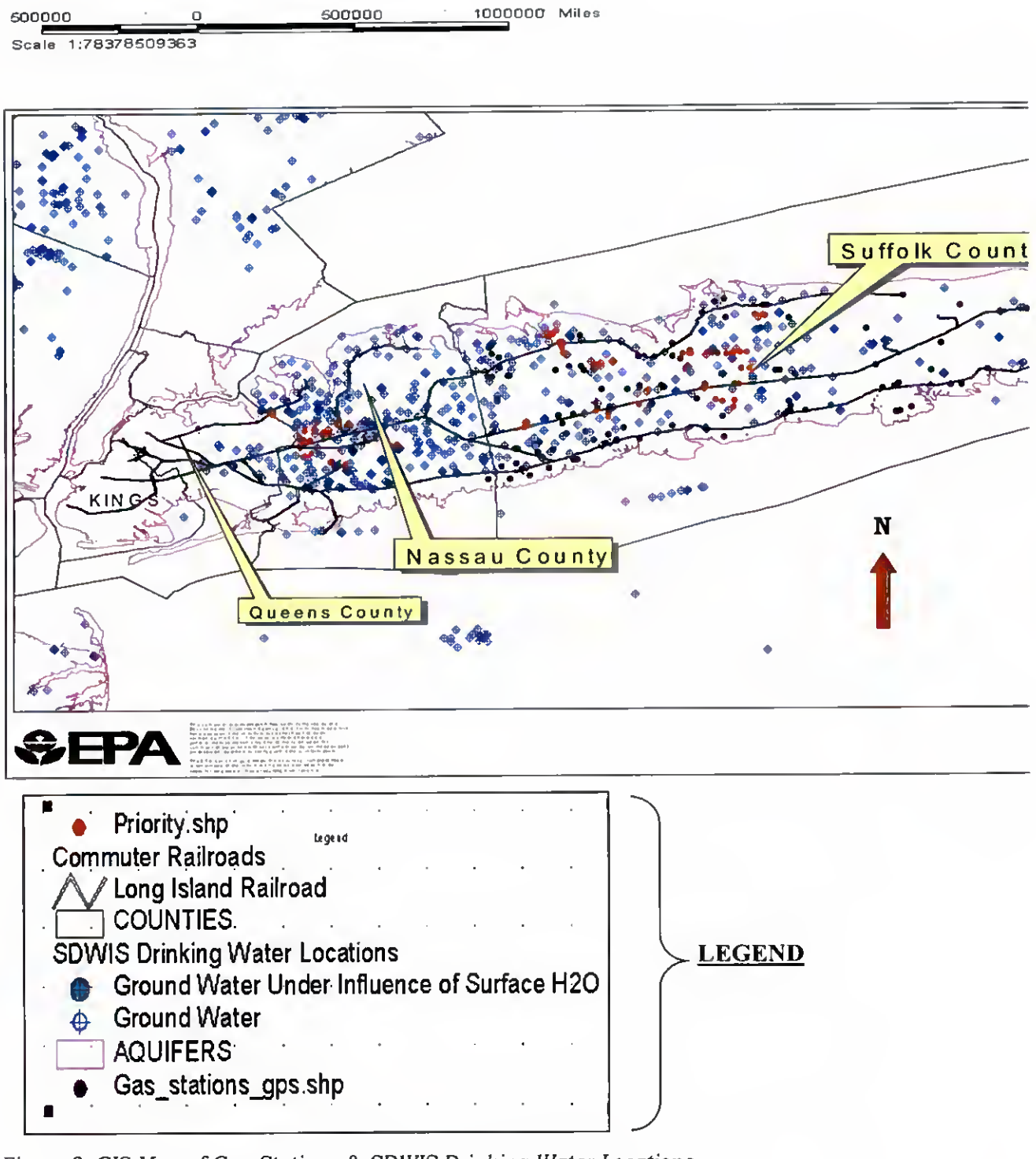

Figure 3: GIS Map of Gas Stations & SDWIS Drinking Water Locations

Table 1: List of Facilities & Coordinates

( )- previous name or name listed in NYSDEC database

Priority Locations- [redacted] *initial 75 locations (NYSDEC)*

LOCATION NAME	ADDRESS	COMMUNITY	LAT	LONG	UTM/NAD 83	
[redacted] SHELL	60 NORTHERN BLVD	GREAT NECK	40.774	73.732	18606983E	4514423N
[redacted] CITGO	200 NORTHERN BLVD	GREAT NECK	40.776	73.729	18607247E	4514675N
[redacted] EXXON	1019 TULIP AVE	FRANKLIN SQ	40.713	73.673	18611713E	4507761N
[redacted] COSTAL	1501 JERICHO TPKE	NEW HYDE PARK	40.734	73.680	18611478E	4510055N
[redacted] SHELL	1500 JERICHO TPKE	NEW HYDE PARK	40.734	73.680	18611507E	4510017N
[redacted] AMOCO	205 JERICHO TPKE	NEW HYDE PARK	40.731	73.692	18610416E	4509754N
[redacted] VACANT (SHELL)	140 LAKEVILLE RD	NEW HYDE PARK	40.735	73.688	18610771E	4510187N
[redacted] MOBIL(PALM BEACH SVC)	1338 HEMPSTEAD TPKE	ELMONT	40.708	73.690	18610625E	4507196N
[redacted] LIBERTY PETROLEUM (GETTY)	1278 HEMPSTEAD TPKE	ELMONT	40.709	73.687	18610855E	4507244N
[redacted] COMPLETE AUTO SVC.(FILLING SVC STATION)	10 COUNTY CT HSE RD	NEW HYDE PARK	40.744	73.660	18613145E	4510973N
[redacted] EXXON	2399 HEMPSTEAD TPKE	NEW HYDE PARK	40.743	73.661	18613073E	4511048N
[redacted] EXXON (BP AMOCO)	649 JERICHO TPKE	MINEOLA	40.743	73.656	18613430E	4511144N
[redacted] GETTY (OLYMPUS SVC STATION)	449 JERICHO TPKE	MINEOLA	40.743	73.653	18613690E	4511307N
[redacted] AMOCO	1599 HILLSIDE AVE	NEW HYDE PARK	40.748	73.686	18610962E	4511655N
[redacted] GULF(BP)	2099 HILLSIDE AVE	NEW HYDE PARK	40.752	73.674	18611967E	4512067N
[redacted] EXXON,TAL'S AUTO SVC	41 HILLSIDE AVE	WILLISTON PK	40.758	73.641	18614741E	4512777N
[redacted] VACANT (EXXON)	263 E. JERICHO	MINEOLA	40.754	73.625	18616032E	4512378N
[redacted] AMOCO	400 E JERICHO TPKE	MINEOLA	40.756	73.622	18616293E	4512629N
[redacted] AMOCO(COASTAL)	771 PENINSULA AVE	HEMPSTEAD	40.693	73.632	18615608E	4505587N
[redacted] CENTRAL AUTO SVC (LNB SVC CNTR)	693 PENINSULA AVE	HEMPSTEAD	40.695	73.631	18615688E	4505842N

CITGO	300 HEMPSTEAD AVE	W HEMPSTEAD	40.700	73.649	18614163E	4506376N
MAJESTIC SVC	371 HEMPSTEAD AVE	W HEMPSTEAD	40.699	73.652	18613909E	4506266N
SHELL (GETTY)	2148 HEMPSTEAD TPKE	E. MEADOW	40.725	73.558	18621810E	4509203N
AMOCO	1883 FRONT ST	E. MEADOW	40.720	73.564	18621251E	4508685N
AMOCO	1878 HEMPSTEAD TPKE	E. MEADOW	40.724	73.567	18621012E	4509085N
AMOCO	1007 W. JERICHO TPKE	SMITHTOWN	40.848	73.252	18647349E	4523333N
PIT STOP	2039 JERICHO TPKE	COMMACK	40.845	73.273	18645580E	4523024N
AMOCO GASOLINE HEAVEN	2088 JERICHO TPKE	COMMACK	40.844	73.277	18645243E	4522867N
SHELL (KC OIL)	2104 JERICHO TPKE	COMMACK	40.844	73.279	18645073E	4522852N
OK PETROLEUM ELI'S AUTO (STRAIGHT PATH S/S)	4 COLONIAL SPRINGS RD	WYANDANCH	40.757	73.375	18637196E	4513012N
COASTAL	10 LONG IS AVE	WYANDANCH	40.749	73.380	18636724E	4512169N
AMOCO	1672 5TH AVE	BAY SHORE	40.762	73.262	18646684E	4513805N
TEXACO	195 PINE AIRE DR	BAY SHORE	40.772	73.279	18645272E	4514909N
CLOSED (SUNOCO)	610 LARKFIELD RD	E. NORTHPORT	40.873	73.324	18641250E	4526024N
CITGO (COSTAL)	236 LARKFIELD RD	E. NORTHPORT	40.877	73.325	18641133E	4526463N
BRIGHTSIDE COMPLETE AUTO REPAIR (BP)	71 LARKFIELD RD	E. NORTHPORT	40.880	73.325	18641104E	4526758N
LAUREL SVC CNTR	69 LAUREL RD	E. NORTHPORT	40.882	73.326	18641038E	4527000N
MOBIL	450 LARKFIELD RD	E. NORTHPORT	40.865	73.322	18641453E	4525126N
HAPPY BROS. AMOCO	687 FORT SALONGA RD	NORTHPORT	40.895	73.336	18640138E	4528399N
GETTY	831 FORT SALONGA RD	NORTHPORT	40.899	73.332	18640535E	4528867N
MOBIL VERNON VALLEY SVC STATION	840 FORT SALONGA RD	NORTHPORT	40.899	73.330	18640693E	4528925N
MOBIL (AMOCO)	539 FORT SALONGA RD	NORTHPORT	40.893	73.337	18640070E	4528263N
CLOSED (SHELL)	540 FORT SALONGA RD	NORTHPORT	40.893	73.337	18640104E	4528249N
TEXACO (COW HARBOR S/S)	851 FORT SALONGA RD	NORTHPORT	40.897	73.344	18639483E	4528007N

PAUL'S TRUCK & AUTO STOP(K&H GASOLINE)	1573 ISLIP AVE	CENTRAL ISLIP	40.787	73.217	18650440E	4515989N
AMOCO	204 WHEELER RD	HAUPPAUGE	40.803	73.203	18650699E	4518437N
EXXON	2309 MIDDLE COUNTRY RD	CENTEREACH	40.858	73.093	18660745E	4524815N
OK PETROLEUM	2117 MIDDLE COUNTRY RD	CENTEREACH	40.859	73.087	18661251E	4524827N
MOBIL (FIRST SVC STATION)	2033 MIDDLE COUNTRY RD	CENTEREACH	40.859	73.084	18661528E	4524841N
SHELL	2822 MIDDLE COUNTRY RD	LAKE GROVE	40.860	73.113	18659054E	4524902N
VACANT LOT UNDER CONSTRUCTION(MOBIL)	3089 MIDDLE COUNTRY RD	LAKE GROVE	40.862	73.121	18658348E	4525093N
TEXACO	209 SMITHTOWN BLVD	NESCONSET	40.835	73.151	18655889E	4522110N
AMOCO	679 MIDDLE COUNTRY RD	ST. JAMES	40.861	73.154	18655595E	4525051N
GULF (A&A ST. JAMES)	889 MIDDLE COUNTRY RD	ST. JAMES	40.861	73.143	18656467E	4525037N
SUNOCO	1740 MIDDLE COUNTRY RD	CENTEREACH	40.860	73.074	18662358E	4524981N
SHELL	1537 MIDDLE COUNTRY RD	CENTEREACH	40.86	73.065	18663054E	4525206N
COASTAL MORRIS & SONS INC	913 PORTION RD	RONKONKAMA	40.834	73.074	18662375E	4522165N
AMOCO J&J SVC STATION	1090 PORTION RD	RONKONKAMA	40.835	73.063	18663299E	4522233N
SUNOCO	1080 MAIN ST	HOLBROOK	40.810	73.078	18662115E	4519461N
EMPIRE SVC CNTR./BOHEMIA AUTO CNTR	4173 VETERANS HWY	RONKONKAMA	40.783	73.101	18660249E	4516454N
ANGELO SVC. STATION	1360 LINCOLN AVE	HOLBROOK	40.785	73.085	18661600E	4516613N
GETTY	3821 VETERANS MEM. HWY	RONKONKAMA	40.786	73.114	18659361E	4516670N
HESS (TEXACO)	3415 VETERANS MEM. HWY	RONKONKAMA	40.804	73.126	18658118E	4516878N
GETTY	1164 RTE 112	PORT JEFFERSON STAT	40.919	73.040	18665077E	4531597N
SUNOCO	240 TERRYVILLE RD	PORT JEFFERSON STAT	40.920	73.053	18663979E	4531684N
GETTY (MOBIL)	46 GOOD GROUND RD	HAMPTON BAYS	40.875	72.530	18708164E	4527842N
SHELL	172 W. MONTAUK HWY	HAMPTON BAYS	40.877	72.534	18707785E	4527975N
QUOGUE SINCLAIR FUEL OIL	161 W. MONTAUK HWY	HAMPTON BAYS	40.875	72.536	18707645E	4527781N

CLOSED (SHELL)	195 KNICERBOCKER AVE	BOHEMIA	40.775	73.087	18661432E	4515574N
JOE'S AUTO REPAIR (GAS STATION)	1041 LITTLE E.NECK	W BABYLON	40.725	-73.360	18638544E	4509548N
DO GAS INC –SHELL	1985 DEER PK AVE	DEER PK	40.766	-73.331	18640902E	4514093N
PILOT (IKE & MAT SVS STAT)	585 RTE 27 MONTAUK	COPIAGUE	40.668	-73.433	18635291E	4503144N
HESS	1255 RTE 27 SUNRISE	COPIAGUE	40.693	-73.393	18635742E	4505963N
GAS & DIESEL (GAS STATION)	990 WELLWOOD AVE	LINDENHURST	40.715	-73.393	18635743E	4508398N
ROB'S TOWING SVC.(GETTY)	561 WEST HOFFMAN	LINDENHURST	40.683	-73.385	18636456E	4504850N
HESS	1690 DEERK PARK AVE	DEER PARK	40.753	-73.326	18641283E	4512720N
AMOCO	1970 DEER PK AVE	DEER PARK	40.765	-73.331	18640837E	4514034N
MOBIL	1238 DEER PK AVE	N BABYLON	40.738	-73.321	18641780E	4510976N
AMOCO(TASKALE)	234 RTE 112 MEDFORD	E PATCHOGUE	40.775	-73.008	18668088E	4515722N
SUNOCO	310 NEIGHBORHOOD RD	MASTIC BEACH	40.763	-72.854	18681115E	4514642N
EXXON S/S	286 EXPRESS DR SOUTH	MEDFORD	40.823	-72.998	18668852E	4521017N
COASTAL	267 RTE 27 E MONTAUK HWY	PATCHOGUE	40.766	-73.007	18688238E	4514722N
OCEAN	980 RTE 27 A MONTAUK	SHIRLEY	40.802	-72.861	18680460E	4518983N
OCEAN	577 RTE 27 A MONTAUK	E MORICHE	40.802	-72.768	18688312E	4519174N
VACANT (CITGO)	1099 HORSEBLOCK RD	FARMINGVILLE	40.835	-73.062	18663401E	4522278N
GULF (TITAN)	2691 RTE 25 MIDDLE COUNTRY RD	CENTEREACH	40.859	-73.108	186594457 E	4524857N
COASTAL	1651 RTE 27A	MASTIC	40.806	-72.854	18682407E	4519517N
MOBIL (MOBIL)	3003 N OCEAN AVE	FARMINGVILLE	40.831	-73.021	18666898E	4529853N
EXXON	401 RTE 112	PATCHOGUE	40.782	-73.008	18668076E	4516416N
EXXON	90 RTE 25 A NORTH	E SETAUKET	40.940	-73.109	18659186E	4533820N
PASE	450 NEIGHBORHOOD RD	MASTIC BEACH	40.762	-72.860	18680642E	4514517N
AMOCO S/S	367 RTE 25A	ROCKY POINT	40.945	-72.942	18673248E	4534741N

GETTY	999 RTE 25 A NORTH	STONYBROOK	40.923	-73.127	18657712E	4531935N
MOBIL S/S	RTE 25 MIDDLE COUNTRY RD	RIDGE	40.894	-72.897	18677164E	4529101N
MOBIL	770 RTE 27A MONTAUK	PATCHOGUE	40.767	-72.986	18669963E	4514868N
SUNOCO	669 OLD TOWN RD	TERRYVILLE	40.898	-73.046	18664602E	4529241N
SUNOCO	114 RTE 110 BROAD	MELVILLE	40.790	-73.416	18633667E	4516632N
AMOCO	272 RTE 25	HUNTINGTON	40.829	-73.400	18634940E	4520985N
AMOCO S/S	311 RTE 25 WEST JERICHO	HUNTINGTON	40.829	-73.423	18633011E	4520970N
ONE TEN SHELL	1010 WALT WHITMAN	MELVILLE	40.793	-73.416	18633647E	4517000N
LARKFIELD S/S	714 LARKFIELD RD	ELWOOD	40.843	-73.315	18642068E	45227725 N
SUNOCO	1888 RTE 25	HUNTINGTON	40.837	-73.333	18640513E	4522011N
EXXON S/S	341 RTE 25 JERICHO	HUNTINGTON	40.829	-73.428	18632567E	4520961N
JORGENSEN S/S	110 NEW YORK AVE	HUNTINGTON	40.879	-73.422	18632994E	4526545N
AMOCO	246 PULASKI RD	E. NORTHPORT	40.877	-73.324	18641171E	4526477N
7 ELEVEN	329 RTE 25 JERICHO	HUNTINGTON	40.830	-73.399	18635030E	4521130N
T& C SVS STATION	230 COMMACK RD	COMMACK	40.837	-73.294	18643810E	4522056N
SUNOCO	160 RTE 110 NEW YORK	HUNTINGTON	40.876	-73.423	18632896E	4523279N
GETTY	564 RTE 27 MONTAUK	W ISLIP	40.697	-73.307	18643053E	4506462N
MOBIL	435 WHEELER RD	HAUPPAUGE	40.811	-73.217	18650390E	4519258N
MOBIL	409 RTE 27 A MONTAUK	W ISILIP	40.697	-73.313	18642534E	4506500N
EXXON	3309 RTE 27 SUNRISE	ISLIP TERRACE	40.747	-73.172	18654302E	4512323N
CITGO	1050 UDALLS RD	BAY SHORE	40.740	-73.295	18643915E	4511254N
EXXON (TEXACO)	750 MOTOR PKWY	BRENTWOOD	40.806	-73.234	18648926E	4518726N
EMPIRE(AJ&J SHELL INC.)	1087 FIFTH AVE	BAY SHORE	40.736	-73.263	18646670E	4510857N
VACANT (EXXON)	1750 5TH AVE	BAY SHORE	40.768	-73.262	18646724E	4514476N

HESS STATION	3072 VETERAN'S HWY	BOHEMIA	40.788	-73.137	18657183E	4516862N
COASTAL(METRO)	255 RTE 27 A MONTAUK	W SAYVILLE	40.729	-73.101	18660325E	4510374N
EXXON	4909 RTE 27 SUNRISE	BOHEMIA	40.760	-73.103	18660126E	4513806N
EXXON	4560 EXPRESS DR SO.	RONKONKAMA	40.811	-73.125	18658123E	4519493N
AMOCO	1670 VETERANS HWY	ISLANDIA	40.807	-73.182	18653315E	4518874N
GULF	1400 BRENTWOOD RD	BAY SHORE	40.745	-73.241	18648472E	4511967N
CITGO S/S	626 MAIN ST.	RIVERHEAD	40.918	-72.673	18695955E	4532280N
MOBIL	13 NORTH HWY	S. HAMPTON	40.897	-72.399	18719107E	4530552N
AMOCO	679 RTE 25 MIDDLE	ST. JAMES	40.861	-73.154	18655570E	4524969N
AMOCO	115 VETERANS HWY	COMMACK	40.839	-73.280	18645048E	4522355N
MOBIL	90 VANDERBILT MOTOR PKWY	COMMACK	40.806	-73.270	18645945E	4518667N
EXXON S/S	705 RTE 347 NESCONSET	NESCONSET	40.877	-73.170	18654300E	4523397N
AMOCO S/S	762 RTE 347 NESCONSET	SMITHTOWN	40.852	-73.159	18655154E	4523971N
GULF	137 VETERANS HWY	COMMACK	40.838	-73.278	18645157E	4522253N
SHELL S/S	9 MORICHES RIVERHEAD RD (LAKE AVE)	RIVERHEAD	40.914	-72.663	18696796E	4531880N
VACANT (GAS STATION)	500 COMMACK RD	DEER PARK	40.767	-73.311	18642557E	4514266N
RED'S AUTO BODY (GAS STATION S/S)	380 RTE 27 A MONTAUK HWY	LINDENHURST	40.674	-73.374	18637460E	4503889N
ISLAND AUTO (GAS STATION)	720 RTE 27 SUNRISE HWY	WEST BABYLON	40.713	-73.341	18640104E	4508255N
SNUG HARBOR AUTO REPAIR (GAS STATION S/S)	35 RTE 27 A MONTAUK HWY	COPIAGUE	40.668	-73.403	18634948E	4503119N
SUNRISE DELIMART(CONVENIENCE STORE S/S)	215RTE 27 SUNRISE HWY	AMITYVILLE	40.688	-73.413	19634099E	4505382N
HASSELL AUTO BODY (JOES AUTO REPAIR S/S)	350 RTE 109 FARMINGDALE RD	WEST BABYLON	40.710	-73.362	18638352E	4507826N
SERIGANO CHEVRON S/S	901 RTE 109 FARMINGDALE RD	WEST BABYLON	40.716	-73.390	18636022E	4508443N

7-11 (7-ELEVEN S/S)	660 RTE 27 A MONTAUK HWY	WEST BABYLON	40.685	-73.346	18639746E	4505162N
LIRR RAILROAD YARD (PORT JEFF CHEVRON S/S)	1127 RTE 25 A	MOUNT SINAI	40.933	-73.041	18664924E	45331138 N
GAS STATION	123 RTE 27 A MONTAUK HWY	EAST MORICHES	40.802	-72.783	18687052E	4519080N
AMOCO S/S	443 RTE 25 MIDDLE COUNTRY RD	CORAM	40.869	-73.007	18667959E	4526116N
FARMINGVILLE LAUNDRY (GAS STATION S/S)	875 CNTY RD 16 HORSE BLOCK RD	FARMINGVILLE	40.831	-73.026	18666436E	4521861N
CDM ENGINEER CONTRACTORS (GETTY S/S)	19 BELLE MEADE TERMINAL RD	SETAUKET	40.916	-73.094	18660525E	4531216N
CITGO	1430CNTY RD 46 WILLIAM FLOYD	SHIRLEY	40.836	-72.885	18678295E	4522668N
GETTY S/S #00431	400 NEIGHBORHOOD RD	MASTIC BEACH	40.762	-72.858	18680804E	4514571N
GAS STATION	145 RTE 27 A MONTAUK HWY	PATCHOGUE	40.766	-73.012	18667783E	4514718N
7-ELEVEN S/S	RTE 347 & RTE 25 A	MOUNT SINAI	40.933	-73.034	18665560E	4533123N
PORT JEFF. LOBSTER HSE(GAS STATION S/S)	1 NORTH COUNTRY RD	PORT JEFFERSON	40.913	-73.005	18663612E	4533579N
AMOCO (GAS STATION)	681 RTE 25 A	ROCKY POINT	40.948	-72.919	18675173E	4535077N
GAS STATION	608 RTE 27 A MONTAUK HWY	SHIRLEY	40.800	-72.877	18679115E	4518759N
GAS STATION S/S	48 DIVISION ST	PATCHOGUE	40.761	-73.016	18667486E	4514145N
GILES S/S	348RTE 25 A NORTH COUNTRY RD	EAST SETAUKET	40.944	-73.095	18660338E	4534269N
EXXON S/S	5106 EXPRESSWAY DR SOUTH	HOLBROOK	40.810	-73.083	18661636E	4519913N
7-ELEVEN S/S	RTE 111 & CHAPMAN RD	MANORVILLE	40.869	-72.794	18685944E	4526517N
OK PETROLEUM	2117 RTE 25 MIDDLE COUNTRY RD	CENTEREACH	40.859	-73.086	18661275E	4524842N
VICTOR'S AUTO (GAS STATION S/S)	267 CNTY RD 16 PORTION RD	LAKE RONKONKOMA	40.827	-73.103	18659996E	4521312W
TERRYVILLE SERVICE CENTER S/S	618 BICYCLE PATH	PORT JEFF. STATION	40.917	-73.039	18665103E	4531421N
EASTPORT MOBIL S/S	520 RTE 27 A MONTAUK HWY	EASTPORT	40.826	-72.731	18691316E	4521914N

HESS S/S	285 WADING RIVER RD	MANORVILLE	40.825	-72.809	18684765E	4521608N
GAS STATION -OOB-	1593 RTE 27 A MONTAUK HWY	BELLPORT	40.773	-72.950	18672982E	4515607N
MASTIC BEACH SERVICE STATION	123WHITTIER RD	MASTIC BEACH	40.769	-72.838	18682441E	4515310N
CONEY'S MARINE(GAS STATION S/S)	36 RTE 110 NEW YORK AVE	HUNTINGTON	40.882	-73.420	18633118E	4526810N
COMMACK TOWN PLAZA (GAS STATION S/S)	6300 RTE 25 JERICHO TPKE	COMMACK	40.843	-73.297	18643598E	4522673N
VACANT (GAS STATION S/S)	984NEW YORK AVE	DIX HILLS	40.858	-73.413	18633771E	4524188N
NEW YORK AVE S/S	1626 RTE 110 NEW YORK AVE	HUNTINGTON STATION	40.843	-73.412	18633886E	4522508N
1ST NAT'L BANK OF LI(GALLO S/S)	253 RTE 110 NEW YORK AVE	HUNTINGTON	40.874	-73.426	18632670E	4525956N
HAROLDS SERVICE CTR	514 RTE 110 NEW YORK AVE	HUNTINGTON	40.865	-73.423	18632898E	4524950N
GETTY S/S	500 LARKFIELD RD	EAST NORTHPORT	40.865	-73.321	18641466E	4525084N
WEST ISLIP S/S	590 RTE 27 SUNRISE HWY	WEST ISLIP	40.727	-73.284	19644908E	4509857N
TEXACO (JOHNNYS GAS & FOOD MART)	3260 RTE 27	EAST ISLIP	40.747	-73.173	18654226E	4512240N
HUNTER GETTY	781 UDALL RD	WEST ISLIP	40.892	-73.299	18643653E	4509707N
HESS S/S	236 BAY SHORE RD	BAY SHORE	40.726	-73.252	18645273E	4510570N
DAVID MICHAEL'S AUTO REP (JIMMYS GARAGE S/S)	225 FOURTH AVE	BAY SHORE	40.726	-73.252	18647598E	4509765N
MOBIL S/S	360 RTE 111 WHEELER RD	HAUPPAUGE	40.808	-73.217	18650351E	4518968N
ELEVEN S/S	113 4TH AVE & UNION BLVD	BAY SHORE	40.725	-73.251	18647682E	4509690N
UNIQUE AUTO (MARCHS S/S)	131 CNTY RD 17 CARLETON AVE	CENTRAL ISLIP	40.782	-73.200	18651846E	4516126N
7-ELEVEN S/S	876 JOHNSON AVE	RONKONKOMA	40.807	-73.125	18658176E	4519058N
EXXON S/S	1460 VETERANS HWY	HAUPPAUGE	40.810	-73.187	18652931E	4519226N
GAS STATION S/S	260 RTE 27 A MONTAUK HWY	ISLIP	40.728	-73.218	18650466E	4510085N
VACANT(DELVECCHIO GAS STATION S/S)	172 ORINOCO DR	BAYSHORE	40.721	-73.266	18646483E	4509236N
GAS STATION S/S	432 SUFFOLK AVE	BRENTWOOD	40.778	-73.259	18646951E	4515571N
COASTAL (ROLLIN MOBILE S/S)	4143 RTE 25 RIVER RD	CALVERTON	40.927	-72.765	18688189E	4533083N

LOUS AUTOMOTIVE SERVICES S/S	6308 RTE 25 A	WADING RIVER	40.944	-72.845	18681363E	4534788N
AUGIE'S GARAGE (U S A S/S)	378 RTE 25 MIDDLE COUNTRY RD	SMITHTOWN	40.856	-73.169	18654338E	4524412N
LAHAMM'S AUTO BODY (CORIOS S/S)	540 ARTE 25 WEST JERICHO TPKE	SMITHTOWN	40.857	-73.217	18650315E	4524412N
MAZDA REPAIR SHOP (CONKLIN'S AUTO SVC)	873 RTE 25 MIDDLE COUNTRY RD	SAINT JAMES	40.865	-73.144	18656381E	4525040N
JIMMY SCAFAS & SON AUTO (GULF S/S)	9 BANK AVE	SMITHTOWN	40.856	-73.195	18652176E	4524342N
RESIDENCE (GAS STATION S/S)	850 RTE 25 MIDDLE COUNTRY RD	SAINT JAMES	40.861	-73.145	18656330E	4525006N
JIFFY LUBE (VANTAGE S/S)	2064 RTE 25 JERICHO TPKE	COMMACK	40.844	-73.275	18645412E	4522902N
CLOSED S/S	48 BELL AVE	FLANDERS	40.908	-72.638	18698962E	4531238N
AUTOMOTIVE (AMOCO S/S)	RTE 24 FLANDERS RD & BAY	FLANDERS	40.904	-72.613	18701060E	4530868N
CASA BASSO REST.(GAS STATION)	47 RTE 27 A MONTAUK HWY	WESTHAMPTON	40.822	-72.663	18697086E	4521577N
COASTAL S/S	415 RTE 24 FLANDERS RD	FLANDERS	40.912	-72.647	18698145E	4531647N

Conclusions

All of the objectives of the project were completed. A total of 256 gasoline retail locations in Nassau and Suffolk counties were surveyed and the resulting information logged both on paper forms and in a database.

Arcview GIS 3.2 was used to plot the gas stations on a map with SDWIS drinking water and general aquifer locations, as well as to identify those gas stations lying within 1000 feet of groundwater sources of drinking water. The sites fitting this criterion will be the first to be inspected for compliance to UST regulations. They will also be primary recipients of funds to clean up previous spills and to permanently close the USTs of gas stations that are no longer in business.

The survey revealed the importance of updating the DEC database, as many of the gas stations had come under new ownership, changed names, or both. Others had been closed or left vacant, while still others had been leveled to make way for stores and other commercial buildings. Occasionally, the database was so flawed that no intelligible address could be puzzled out from it or the sites listed appeared to be nonexistent. Thus the database of the locational data of gas stations surveyed includes fewer gas stations than were listed as survey targets.

The design of some gas stations prevented the procurement of GPS readings from the location of tank beds and front doors. Overhangs prevented the GPS receiver's communication with the satellites in those cases. The readings at such sites were taken at the point closest to the tank bed or the front door with unobstructed access to the satellites.

In summary, the survey of gas stations in Nassau and Suffolk counties was successfully completed, resulting in locational data for the gas stations. The information from the survey will be used to prioritize the use of EPA

resources for the prevention and treatment of MTBE contamination of the Nassau and Suffolk county aquifers and update the DEC database.

Acknowledgments

We would like to thank Ben Singh and Rob Ferri for overseeing the project, David Bernstein for taking us out on inspections and ensuring that we learned all about USTs, Linda Timander and Bill Hansen for providing GIS training and assistance and our section chief, John Kushwara, and our acting section chief, Charles Hillenbrand for their support.

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Figure 1 Reported chemcial and physical properties of oxygenates and their degredation products.

Property	MeOH	EtOH	TBA	MTBE	ETBE	TAME	DIPE	TBF
Molecular weight (g/mole)	32.04	46.07	74.12	88.15	102.18	102.18	102.18	102.13
Specific gravity	0.796	0.794	0.791	0.744	0.73	0.77	0.736-0.7491	0.886
Boiling temp., °C	64.7	78-79	82.9	53.6-55.2	67	86	91 68-69	82
Water solubility, ($C_{s_{aq}}$), mg/L	infinitely soluble	infinitely soluble	infinitely soluble	43,000-54,300 50,000	~26,000	~20,000	9,000 @ 20°C 2,039	~40,000
Vapor pressure @ 25°C, mm Hg	121.58	49-56.5	40-42	245-256	152	68.3	149-151@ 20°C	81@20°C
Log K_{ow}	-0.75	-0.16 -0.31	0.35	1.20	1.74		1.52	
Henry's Law constant, (H), (atm-m^3)/(g-mole)	4.42E-06	6.17E-6 5.13E-6 6.29E-6	1.175E-5 1.19E-5 1.04E-5 1.47E-5	5.87E-4 1.1E-3 1.4E-3 3E-3	2.66E-3	1.27E-3	9.97E-3 4.77E-3 5.87E-3	2.72E-4
Dimenssionless Henry's Law constant (H/RT)	1.087E-4	2.522E-4 2.097E-4 2.571E-4	4.803E-4 4.864E-4 4.251E-4 5.927E-4 4.8E-4	2.399E-2 4.496E-2 5.722E-2 1.226E-1 2.6E-2 0.018 @ 20°C	1.087E-1	5.191E-2	4.075E-1 1.95E-1 2.399E-1	1.111E-2
Log Koc	0.921 0.44	1.21 0.20	1.57	1.091 1.035 1.049	2.2 0.95	2.2 1.27	1.82 1.46	1.11
CAS no.	67-56-1	64-17-5	75-65-0	1634-04-4	637-92-3	994-05-8	108-20-3	762-75-4

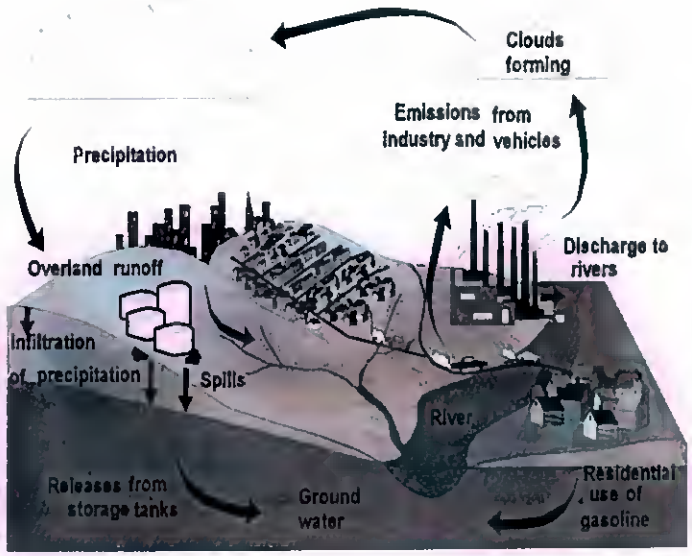

Figure 2: Transport of MTBE. National Science and Technology Council, Committee on Environment and Natural Resources, June 1997.

APPENDIX C

MTBE GRANT I DEC FACILITY INSPECTIONS
NASSAU COUNTY

SITE #	SPILL #	High MTBE Conc (ppb)	SITE NAME	STREET ADDRESS	COMMUNITY	INSPECTION DATE	WELL INSTALL DATE	GRANT FUNDED?	REMARKS
N-1	0425212	53	**Citgo**	200 Northern Blvd	Great Neck	12/3/2002	7/15/2004	Y	Investigation for BTEX Contamination; MTBE <25 ppb
N-2	0425100	**5400**	**Exxon**	1019 Tulip Ave	Franklin Square	1/15/2003	5/5/2004	N	Investigation/remediation tracked under Objective 1
N-3	0425086	ND	**Valero**	1501 Jericho Tpk	New Hyde Park	3/2/2004	5/27/2004	N	Investigation for BTEX Contamination; MTBE non-detect
N-4		ND	**Shell**	1500 Jericho Tpk	New Hyde Park	12/3/2002	12/31/2002	N	no contamination found
N-5		2	**Amoco**	205 Jericho Tpk	New Hyde Park	12/3/2002	9/4/2003	Y	no contamination found
N-6	0225350	14	**Mobil(Palm Beach)**	1338 Hempstead Tpk	Elmont	12/5/2002	9/9/2003	N	Investigation/remediation tracked under Objective 1
N-7	0225349	**240,000**	**Liberty Petroleum**	1278 Hempstead Tpk	Elmont	12/5/2002	8/13/2003	N	Investigation/remediation tracked under Objective 1
N-8		N/A	**Complete Auto Service**	10 County Court House Rd	Garden City Park	12/4/2002	**No tanks per DEC inspection**		
N-9		ND	**Exxon**	2399 Jericho Tpk	Garden City Park	12/4/2002	5/6/2004	Y	no contamination found
N-10	0225398	**73,000**	**Exxon(BP Amoco)**	549 Jericho Tpk	Mineola	1/15/2003	4/15/2003	N	Investigation/remediation tracked under Objective 1
N-11		1	**Getty(Olympus Svc Sta)**	449 Jericho Tpk	Mineola	12/3/2002	9/3/2004	N	no contamination found
N-12	0425162	245	**Amoco**	1599 Hillside Ave	New Hyde Park	12/4/2002	3/11/2004	N	Investigation for low MTBE contamination
N-13	0310482	ND	**Gulf (BP)**	2099 Hillside Ave	New Hyde Park	12/4/2002	12/9/2003	N	Investigation/remediation tracked under Objective 1
N-14		N/A	**Exxon(Tal's Auto Svc)**	41 Hillside Ave	Williston Park	12/3/2002	**No tanks per DEC inspection**		
N-15	0325187	ND	**Amoco (Coastal)**	771 Peninsula Ave	Hempstead	12/4/2002	6/2/2003	N	Investigation/remediation tracked under Objective 1
N-16		N/A	**Central Auto(LNB Svc)**	693 Peninsula	Hempstead	12/4/2002	**No tanks per DEC inspection**		
N-17		ND	**Citgo**	300 Hempstead Ave	West Hempstead	12/3/2002	6/3/2003	Y	no contamination found
N-18		N/A	**Majestic Svc**	371 Hempstead Ave	West Hempstead	12/3/2002	**No tanks per DEC inspection**		
N-19	0303985	360	**Shell**	2138 Hempstead Tpk	East Meadow	12/3/2002	Aug-03	N	Investigation/remediation tracked under Objective 1
N-20	0311755	**11,300**	**Amoco**	1883 Front St	East Meadow	12/3/2002	11/17/2003	N	Investigation/remediation tracked under Objective 1
N-21	0325312	74	**Amoco**	1878 Hempstead Tpk	East Meadow	12/3/2002	9/2/2003	Y	Investigation/remediation tracked under Objective 1

MTBE GRANT I DEC FACILITY INSPECTIONS
SUFFOLK COUNTY

SITE #	SPILL #	High MTBE Conc (ppb)	SITE NAME	STREET ADDRESS	COMMUNITY	INSPECTION DATE	WELL INSTALL DATE	GRANT FUNDED?	REMARKS
S-1	0425001	35	**Amoco**	1007 West Jericho Tpk	Smithtown	1/16/2003	9/18/2003	Y	wells resampled; MTBE <5 ppb
S-2	0225403	35	**Pit Stop**	2039 Jericho Tpk	Commack	1/16/2003	8/4/2004	Y	Investigation/remediation tracked under Objective 1
S-3	0325243	4	**Amoco (Gasoline Heaven)**	2088 Jericho Tpk	Commack	12/3/2002	8/13/2003	N	Investigation for BTEX Contamination; MTBE <20 ppb
S-4		N/A	**Shell (KC Oil)**	2104 Jericho Tpk	Commack	12/3/2002	none	N	Tanks removed; no wells installed
S-5		2	**OK Petro Eli's Auto**	4 Colonial Springs Road	Wyandanch	4/21/2003	10/9/2003	Y	no contamination found
S-6		ND	**Coastal**	10 Long Island Ave	Wyandanch	4/21/2003	10/8/2003	Y	no contamination found
S-7	0325110	**49,000**	**Amoco**	1672 5th Ave	Bay Shore	12/5/2002	4/10/2003	N	Investigation/remediation tracked under Objective 1
S-8	0325109	**63,000**	**Texaco**	195 Pine Aire Dr	Bay Shore	12/5/2002	4/10/2003	N	Investigation/remediation tracked under Objective 1
S-9		N/A	**Citgo (Coastal)**	236 Larkfield Rd	East Northport	12/3/2002	NA	NA	no access to site to install wells
S-10		N/A	**Brightside Auto (BP)**	71 Larkfield Rd	East Northport	4/14/2003	**no tanks per DEC inspection**		
S-11		N/A	**Laurel Svc Cntr**	69 Laurel Rd	East Northport	4/14/2003	**no tanks per DEC inspection**		
S-12	0225368	14	**Mobil**	450 Larkfield Rd	East Northport	12/5/2002	2/20/2003	N	Investigation/remediation tracked under Objective 1
S-13	0325164	16	**Amoco (Happy Bros)**	687 Fort Salonga Rd	Northport	12/4/2002	4/15/2003	N	Resampled; MTBE <5 ppb
S-14		ND	**Getty**	831 Fort Salonga Rd	Northport	12/3/2002	4/23/2003	Y	no contamination found
S-15	0225369	5	**Mobil (Vernon Valley Svc)**	840 Fort Salonga Rd	Northport	12/4/2002	6/14/2004	N	Investigation/remediation tracked under Objective 1
S-16		6	**Mobil**	539 Fort Salonga Rd	Northport	12/5/2002	4/9/2003	Y	no contamination found
S-17		N/A	**Texaco (Cow Harbor)**	351 Fort Salonga Rd	Northport	12/5/2002	NA	N	Tanks removed
S-18	0325047	2	**Paul's Truck&Auto(K&H)**	1573 Islip Ave	Central Islip	4/21/2003	7/7/2004	Y	no contamination found
S-19	0325048	ND	**Amoco**	204 Wheeler Rd	Hauppauge	4/21/2003	12/8/2003	N	no contamination found
S-20		ND	**Exxon**	2309 Middle Country Rd	Centereach	1/16/2003	4/8/2004	Y	no contamination found
S-21		ND	**OK Petroleum**	2117 Middle Country Rd	Centereach	12/3/2002	5/8/2003	Y	no contamination found
S-22	0325506	**19,000**	**Mobil (First Svc Sta)**	2033 Middle Country Road	Centereach	12/4/2002	1/2/2004	Y	Investigation/remediation tracked under Objective 1
S-23	0210623	2	**Shell**	2822 Middle Country Rd	Lake Grove	12/4/2002	1/6/2003	N	Investigation/remediation tracked under Objective 1
S-24		ND	**Texaco**	209 Smithtown Blvd	Nesconset	12/4/2002	12/10/2003	Y	no contamination found
S-25	0313100	8	**Amoco**	679 Middle Country Rd	St. James	2/3/2003	12/18/2003	N	Investigation for BTEX Contamination; MTBE <10 ppb
S-26	0325481	ND	**Gulf (A&A St. James)**	889 Middle Country Rd	St. James	2/3/2003	2/19/2004	N	Investigation/remediation tracked under Objective 1
S-27	9008701	5	**Sunoco**	1740 Middle Country Rd	Centereach	12/5/2002	has wells	N	Previous active remediation site with MTBE contamination
S-28	0210370	ND	**Shell**	1537 Middle Country Rd	Centereach	1/16/2003	has wells	N	Investigation/remediation tracked under Objective 1
S-29	0225404	**49,300**	**Getty (Morris & Sons)**	913 Portion Rd	Ronkonkoma	1/17/2003	has wells	N	Investigation/remediation tracked under Objective 1
S-30	0425015	11	**Amoco (J&J Svc Sta)**	1090 Portion Rd	Ronkonkoma	1/17/2003	3/16/2004	Y	resampled; MTBE <10 ppb
S-31		3	**Sunoco**	1080 Main St	Holbrook	1/17/2003	11/24/2003	Y	resampled; MTBE non-detect
S-32	0325013	1,750	**Empire (Bohemia Auto)**	4173 Veterans Hwy	Ronkonkoma	1/16/2003	8/6/2004	N	Investigation/remediation tracked under Objective 1
S-33		N/A	**Angelo Svc Sta**	1360 Lincoln Ave	Holbrook	1/16/2003	**no tanks per DEC inspection**		
S-34		ND	**Getty**	3821 Veterans Mem Hwy	Ronkonkoma	1/16/2003	9/2/2004	N	no contamination found
S-35	0202448	N/A	**Hess (Texaco)**	3415 Veterans Mem Hwy	Ronkonkoma	1/16/2003	has wells	N	Resampled; MTBE <5 ppb
S-36	0406658	114	**Getty**	1164 Rte 112	Port Jefferson Sta	1/23/2003	8/3/2004	N	Investigation handled by responsible party
S-37		2	**Sunoco**	240 Terryville Rd	Port Jefferson Sta	12/3/2002	7/28/2003	N	no contamination found
S-38		2	**Metro**	670 Fort Salonga Rd	Northport	4/14/2003	9/11/2003	Y	no contamination found
S-39		5	**Mobil**	46 Good Ground Rd	Hampton Bays	10/2/2003	5/10/2004	Y	no contamination found
S-40		ND	**Shell (former)**	Rte 25A and Laurel Ave.	Northport	NA	7/15/2003	N	tanks removed
S-41		2	**Hess**	412 Fort Salonga Rd	Northport	4/16/2004	9/4/2004	N	no contamination found
S-42	0480100	21	**Coastal**	950 Portion Rd	Ronkonkoma	4/16/2004	7/23/2004	N	low BTEX; MTBE <25 ppb