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Montesano Groundwater Investigation of Leaking Underground Storage Tanks

October 2007 and April 2008

by
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Abstract

The surficial aquifer beneath downtown Montesano, Washington is contaminated with petroleum products.

The contamination is largely the result of releases from three identified source areas:

1. Tony's Short Stop/Grays Harbor Grange
2. Whitney's Inc./Key Bank (Sterling Savings)
3. Brumfield-Twidwell

To characterize the lateral extent of contamination, the Washington State Department of Ecology (Ecology) collected groundwater samples from 25 monitoring wells during October 2007 and April 2008. Samples were analyzed for benzene, toluene, ethylbenzene, and xylene (BTEX), total petroleum hydrocarbons as gasoline (TPH-G), and volatile organic compounds (VOCs).

The highest concentrations of gasoline-range petroleum hydrocarbons were detected in monitoring wells at or near the source areas. BTEX and TPH-G concentrations were higher than allowable Model Toxic Control Act (MTCA) cleanup levels for groundwater. Benzene and TPH-G reached concentrations of 14,000 µg/L and 236,000 µg/L, respectively. Free-phase petroleum product observed in wells at the source areas continue to serve as a source of dissolved-phase contamination.

Chlorinated solvents were also detected in wells within the study area. VOC concentrations were below MTCA cleanup levels for groundwater, except for tetrachloroethene in well KBMW-1. The presence of chlorinated compounds in wells at Key Bank, at Ecology well ESMW-7, and at the Grange suggests the possible presence of a VOC-contaminated plume in these parts of the study area.

Ecology also collected water samples from the city's storm drain and abandoned sanitary sewer to determine if these underground utilities were providing another contaminant migration pathway. Petroleum-related contaminants were detected. This is of concern since the storm drain empties into the Chehalis River system.

Because of the high concentrations of groundwater contamination and the potential for contaminants to continue to migrate from the source areas, additional investigations are being conducted to better define the nature and extent of the contamination. Some remediation has already been completed at Tony's Short Stop and Brumfield-Twidwell. Work on these projects is continuing.

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Background

Site History

The city of Montesano is located in Grays Harbor County in western Washington along U.S. Highway 12. Montesano offered a major stopping place for travelers prior to the repositioning of the highway south of town in the late 1960s. With the highway relocation, the demand for gas stations lessened and several of the downtown gas stations closed. Tanks from past and still-operating gas stations have leaked, creating large areas of soil and groundwater contamination beneath downtown Montesano.

With the number of known and suspected contaminated sites in downtown Montesano, Ecology began an area-wide investigation in 2004 to determine the extent of groundwater contamination underlying the city. The study area encompassed several blocks, primarily from Pioneer Avenue south along Main Street. Existing monitoring wells located on properties with known releases of petroleum were used in the early phases of this investigation. The wells are located at the following six locations: Tony's Short Stop, Grays Harbor Grange, Key Bank (Sterling Savings), P.J. MaxiMart, Montesano City Shop, and Brumfield-Twidwell (Figure 1).

Petroleum contamination was detected beneath all six of these locations.

During the 2004 monitoring, Ecology also detected chlorinated solvents in the groundwater at some of the well locations (Marti, 2006). Past or present activities within the study area that are potential sources of chlorinated solvents include auto repair and paint shops.

In 2005, Ecology contracted GeoEngineers, Inc. to conduct further investigations. Ground penetrating radar was used to locate any remaining underground storage tanks at Whitney's Chevrolet and Brumfield-Twidwell. Soil and groundwater samples were collected from direct push borings throughout the study area to determine if utility corridors were acting as preferential migration pathways for contaminants. Water samples were collected from the city's storm drain and abandoned sanitary sewer.

Results from the GeoEngineers investigation identified three source areas where petroleum releases have impacted the shallow aquifer:

1. Tony's Short Stop/Grays Harbor Grange
2. Whitney's Inc./Key Bank (Sterling)
3. Brumfield-Twidwell

The contamination at the three sites included the presence of light non-aqueous phase liquid (LNAPL) in the form of free-phase petroleum product (GeoEngineers, 2005).

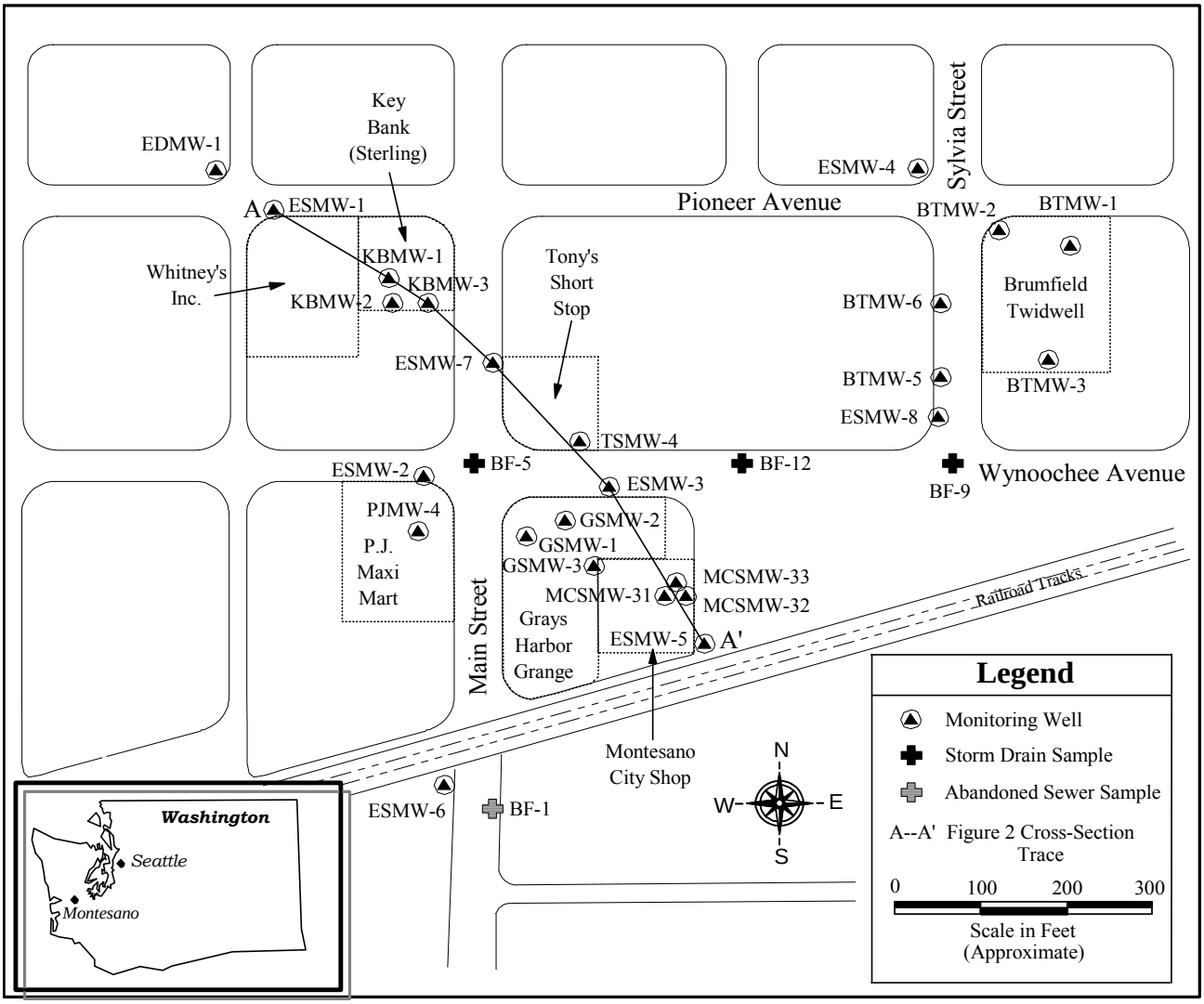

Figure 1. Montesano Groundwater Investigation Location and Site Map.

In the spring of 2006, Ecology contracted GeoEngineers to install nine additional wells (ESMW-1 to EDMW-1) between the three source areas to monitor off-site contaminant migration (GeoEngineers, 2006). These wells were added to Ecology's study-wide monitoring network (Marti, 2007).

In addition to the work Ecology has been conducting, investigations are being carried out by consultants at the three identified source areas (Tony's Short Stop, Grays Harbor Grange, Whitney's Inc., and Brumfield-Twidwell) to better define the nature and extent of the contamination. Some remediation work has already been completed at Tony's Short Stop and Brumfield-Twidwell. Work on these projects is continuing.

Setting/Physical Description

Downtown Montesano is situated on the north side of the Chehalis River valley. The ground surface in the study area generally slopes gently downward (south-southeast) to the Chehalis River over a distance of about 3,000 feet. Figure 2 shows a generalized geologic cross-section of the study area.

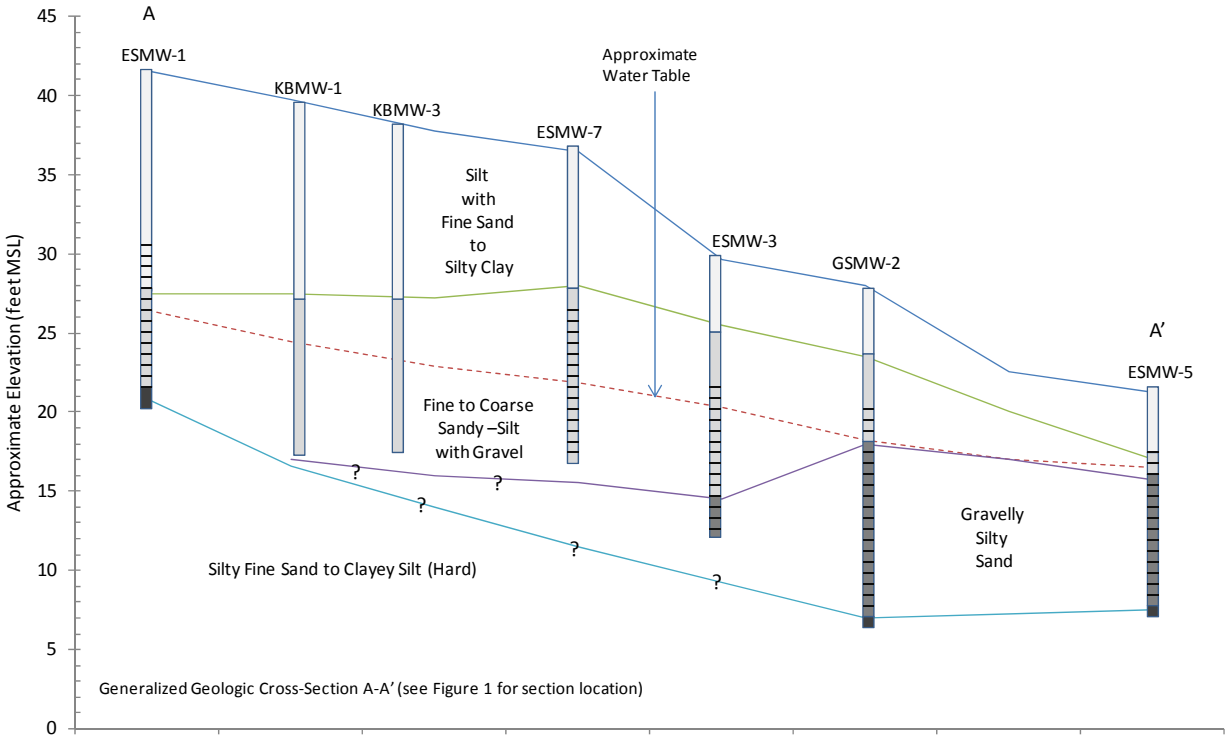

Figure 2. General Geologic Cross-Section of the Study Area.

The geology of the area is comprised mostly of alluvial deposits, consisting of unconsolidated to partly consolidated fluvial and glaciofluvial sand and gravels, with interbeds of clay and silt up to 20 feet thick. The uppermost unit consists of brown, moist, medium-dense silt with fine sand to medium-stiff silty clay. This is underlain by a brown, moist-to-wet, dense-to-very-dense fine sand with gravel which grades to a sandy gravel with interbeds of silty, sand layers. These layers are underlain by a gray-to-brown, medium-dense-to-dense, wet, gravelly silty sand unit. The alluvial deposits are underlain by a relatively impermeable silty fine sand or clayey silt unit of unknown thickness. Regional groundwater flow is to the south-southeast toward the Chehalis River. The water table occurs approximately 3 to 15 feet below the ground surface.

Methods

Groundwater Sampling

The primary contaminants of concern in the study area are gasoline-range hydrocarbons. Ecology collected and analyzed groundwater samples for the gasoline-range hydrocarbons of benzene, toluene, ethylbenzene, and xylene (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G). Samples were collected in October 2007 and April 2008 from the 25 monitoring wells shown in Figure 1. Samples were also collected and analyzed for 72 target volatile organic compounds (VOCs) from eight of the wells. These wells were selected based on their proximity to potential sources such as auto repair and paint shops.

The initial monitoring wells used in this study were installed on, or adjacent to, six sites with known releases: Tony's Short Stop, Grays Harbor Grange, Key Bank (Sterling), Brumfield-Twidwell, P.J. MaxiMart, and Montesano City Shop (Figure 1). The wells were installed between 1995 and 2006. These wells are constructed of either 2″ or 4″ PVC and range in depth from approximately 12 to 25 feet, with screen lengths of 10 and 15 feet.

In May 2006, Ecology had nine additional wells installed throughout the study area to address data gaps in the existing monitoring network. The Ecology wells are constructed of 2″ PVC and range in depth from about 15 to 22 feet, with 10 foot screen lengths. Well construction details are provided in Appendix A.

Static water levels were measured in wells that did not have LNAPL using a calibrated Solinst water level meter prior to well purging and sampling. Measurements were recorded to 0.01 foot and are accurate to 0.03 foot. The probe was rinsed with deionized water between measurements. In wells known to be contaminated, the probe was washed with laboratory grade detergent and rinsed with deionized water.

Ecology purged and sampled most of the 25 monitoring wells using a Grundfos® Redi-Flo2 stainless steel submersible pump, using low-flow sampling techniques. The pump intake was placed at the mid-screen interval in each well, and purged and sampled at a pump rate of 0.5 to 1-liter/ minute. Wells were purged through a continuous flow cell until pH, specific conductivity, dissolved oxygen, and temperature readings stabilized.

At the completion of purging, samples were collected directly from the dedicated pump discharge tubing into laboratory supplied containers. The pump was decontaminated between each well by circulating laboratory-grade detergent/water through the pump followed by a clean water rinse, with each cycle lasting five minutes. Rinsate blanks were collected to determine if the field cleaning procedures were sufficient to prevent cross-contamination of samples from the sample equipment.

Because of the recurring presence of free-phase petroleum product in the groundwater in wells TSMW-4 at Tony's Short Stop, KBMW-2 at Key Bank (Sterling), and BTMW-2 at Brumfield-Twidwell, these wells were purged and sampled with decontaminated Teflon bailers. At the completion of purging, samples were transferred from the bailer to the laboratory-supplied bottles using a bottom-emptying, controlled flow assembly. The bailers had been pre-cleaned with a Liquinox® wash and sequential rinses of hot tap water, 10% nitric acid, deionized water, and pesticide-grade acetone. After cleaning, the bailers were air-dried and wrapped in aluminum foil.

Well ESMW-6 was purged with the submersible pump but sampled with a bailer. This well typically purges dry and requires several hours to recover. In October and April, there was an insufficient amount of water to sample with the pump; consequently, a bailer was used to collect the samples.

Purge water from the wells was collected and stored in 55-gallon drums at a secure facility. Purge water is transported and disposed of in accordance with Washington State Dangerous Waste Regulations (Chapter 173-303 WAC).

Storm and Sewer Drain Sampling

In addition to the groundwater samples, Ecology collected water samples in October 2007 and April 2008 from the City of Montesano's storm drain and abandoned sanitary sewer system. Both of these drains appear to collect groundwater. To ensure the samples would be representative of groundwater leaking into the drains, samples were collected during periods of dry weather. Three samples were collected from manholes on the storm drain along Wynoochee Avenue, and one sample was collected from the abandoned sanitary sewer system on Main Street (Figure 1).

Samples from the storm and sewer drains were collected using pre-cleaned glass beakers that were lowered from manholes into the drain systems. The glass beakers were cleaned with a Liquinox® wash and sequential rinses of hot tap water, deionized water, and pesticide-grade acetone. After cleaning, the beakers were air-dried and wrapped in aluminum foil. Samples were transferred from the beakers into laboratory-supplied bottles. Water samples collected from the storm and sewer drains were analyzed for VOCs and TPH-G.

BTEX, TPH-G, and VOC samples were each collected free of headspace in three 40-mL glass vials with Teflon-lined septa lids and preserved with 1:1 hydrochloric acid. After sample collection and proper labeling, all samples were stored in ice-filled coolers. Samples were transported to Ecology's Operation Center in Lacey. Samples were kept in the walk-in cooler until taken by courier to Ecology/EPA Manchester Environmental Laboratory in Manchester, Washington. Chain-of-custody procedures were followed according to Manchester Laboratory protocols (Ecology, 2005).

Laboratory

Analytes, analytical methods, and detection limits for both field and laboratory parameters are listed in Table 1. Samples were analyzed for BTEX, TPH-G, and VOCs.

Table 1. Field and Laboratory Methods.

Field Measurements	Instrument Type	Method	Accuracy
Water Level	Solinst Water Level Meter	SOP EAP052	±0.03 feet
pH	Orion 25A Field Meter	EPA Method 150.1	±0.1 std. units
Dissolved Oxygen	VWR 4000 Dissolved Oxygen Meter	USGS National Field Manual – Sec. 6.2	±0.3 mg/L
Specific Conductance	YSI 3520 Conductivity Cell	EPA Method 120.1	±10 µmhos/cm
Temperature	YSI 3510 Temperature Probe	EPA Method 150.1	±0.1 ºC
Laboratory Analytes	Method	Reference	Reporting Limit
BTEX	EPA SW-846 Method 8021B	EPA 1996	1 µg/L
TPH-G	TPH-Gx	Ecology 2003	0.14 mg/L
VOCs	EPA SW-846 Method 8260B	EPA 1996	1-5 µg/L

SOP = standard operating procedure.
EAP = Environmental Assessment Program.
EPA = U.S. Environmental Protection Agency.
USGS = U.S. Geological Survey.

Data Quality

Quality control samples collected in the field consisted of blind field duplicate samples and equipment rinsate blanks. Field duplicates were collected by splitting the pump discharge between two sets of sample bottles, which provides a measure of the overall sampling and analytical precision. Precision estimates are influenced not only by the random error introduced by collection and measurement procedures, but also by the natural variability of the concentrations in the media being sampled.

Field duplicates were collected from wells ESMW-7 and ESMW-3 in October 2007, and wells ESMW-1, ESMW-7, and ESMW-3 in April 2008. These wells were selected to represent the range of concentrations found over the study area.

Tables 2 and 3 show results of the duplicate samples and the relative percent difference (RPD). RPD is calculated as the difference between sample results, divided by the mean and expressed as a percent.

Table 2. Relative Percent Difference (RPD) of Duplicate Sample Results (µg/L), October 2007.

Sample ID:	ES MW-7	ES MW-7A	RPD	ES MW-3	ES MW-3A	RPD
	µg/L	µg/L	%	µg/L	µg/L	%
Benzene	648 [a]	572 [a]	12	14,300 [a]	12,800 [a]	11
Toluene	1270 [a]	1180 [a]	7	20,800 [a]	17,600 [a]	17
Ethylbenzene	1150 [a]	1060 [a]	8	2580 [a]	2840 [a]	10
m- & p-xylene	3240 [a]	2930 [a]	10	7410 [a]	7700 [a]	4
o-xylene	1170 [a]	1040 [a]	12	2600 [a]	2540 [a]	2
TPH-G	20,000 E	24,000 E	--	83,000 E	71,000 E	--

a – Analyzed by GC/MS SW8260B.
E – Concentration of the associated value exceeds the known calibration range.

Table 3. Relative Percent Difference (RPD) of Duplicate Sample Results (µg/L), April 2008.

Sample ID:	ES MW-1	ES MW-1A	RPD	ES MW-7	ES MW-7A	RPD	ES MW-3	ES MW-3A	RPD
	µg/L	µg/L	%	µg/L	µg/L	%	µg/L	µg/L	%
Benzene	16	14	13	789	820	4	5000	5300	6
Toluene	5.7 J	5	--	1000	1000	0	4100	5000	20
Ethylbenzene	59	57	3	1400	1500	7	904	896	1
m- & p-xylene	33	32	3	3100	3300	6	2900	2900	0
o-xylene	1.9	1.6	17	1100	1100	0	738	794	7
TPH-G	1700	1600	6	26,000	27,000	4	25,000	28,000	11

J – Analyte was positively identified. The associated numerical result is an estimate.

In October 2007, duplicate samples were collected from wells ESMW-7 and ESMW-3. The RPD for the October results were good and ranged from 2% to 17 %. Due to a laboratory equipment failure, eight BTEX samples, including the duplicate samples collected from wells ESMW-7 and ESMW-3, were not analyzed by PID Method 8021. Instead, these samples were analyzed by GC/MS Method 8260B. BTEX data analyzed using Method 8260B have been identified in the subsequent tables. Seven TPH-G samples are also qualified because of instrument failure. The reported data were outside the calibrated range of the instrument and are therefore qualified as estimates.

In April 2008, duplicate samples were collected from wells ESMW-1, ESMW-7, and ESMW-3. The RPDs for the April results were also good and ranged from 0% to 20%.

Results from wells with free-phase petroleum product should be used with caution since past duplicate results from these wells have had high RPDs. Because of the uncertainty introduced by the presence of a LNAPL, data from wells where free-phase petroleum product was encountered have been "J" qualified. This includes the October 2007 data from wells BTMW-2 and KBMW-2, as well as the October 2007 and April 2008 data from well TSMW-4.

Rinsate blanks were also collected in the field to determine if field cleaning procedures were sufficient to prevent cross-contamination of samples from the sample equipment. Rinsate blanks were collected by pumping deionized water through the submersible pump after the pump had been cleaned. BTEX and TPH-G were not detected in any of the rinsate blanks.

The October 2007 and April 2008 data met the measurement quality objectives established in the Quality Assurance Project Plan (Marti, 2004) and are considered good and usable as qualified.

A review of the data quality control and quality assurance from laboratory case narratives indicates that overall analytical performance was good. The reviews include descriptions of analytical methods, holding times, instrument calibration checks, blank results, surrogate recoveries, and laboratory control samples. As discussed previously, some analytes exceeded the upper calibration limit, and the associated results are qualified. No major problems were reported that compromised the usefulness or validity of the sample results; therefore, all results are usable as qualified. Quality assurance case narratives and laboratory reporting sheets are available upon request.

All field measurements and analytical result data are available in electronic format from Ecology's EIM data management system: www.ecy.wa.gov/eim/index.htm. Search study ID, PMART004.

Results

Field Observations

Depth-to-water of each monitoring well was measured prior to purging. End-of-purge pH, dissolved oxygen, and specific conductivity readings, as well as the total purge volume, are listed in Table 4. Temperature measurements recorded during purging were collected for comparative purposes only and have not been included in Table 4. Because temperatures are measured in a flow cell which is influenced by ambient air conditions, they are not considered to be representative of in-situ groundwater conditions.

Completion depths for the monitoring wells range from approximately 12 to 25 feet. Depth-to-groundwater below the land surface ranged from about 4 to 17 feet in October 2007 and about 4 to 16 feet in April 2008.

During the monitoring period, pH of the groundwater had an average of 6.4. Dissolved oxygen measurements from most of the wells were low, < 0.8 mg/L, suggesting anaerobic or reducing conditions. Specific conductivity measurements had a mean range of 101 to 1252 µmhos/cm. Groundwater temperatures measured in the flow cell averaged 16.9ºC in October and 14ºC in April. The higher temperatures in October are partly caused by the influence of warmer ambient air.

While purging at the lowest flow possible, water levels dropped in well KBMW-3, ESMW-1, ESMW-2, ESMW-3, ESMW-7, and EDMW-1 during both sample rounds. Well ESMW-6 purged dry in October and April and required several hours to recover for the well to have enough water for sample collection.

In October 2007, free-phase petroleum product was present in water bailed from Tony's Short Stop well TSMW-4, Key Bank (Sterling) well KBMW-2, and Brumfield-Twidwell well BTMW-2. Free-phase petroleum product was also present in water bailed from well TSMW-4 in April 2008. Although there was no discernible petroleum product present in wells BTMW-2 and KBMW-2 in April, the purge water did have a strong petroleum odor and a visible sheen on the surface. Approximate product thickness as measured in the bailer is listed in Table 4.

Table 4. Summary of Field Parameter Results, October 2007 and April 2008.

Well Sample ID	Total Depth (feet)[1]	Depth-to-Water Below Ground Surface (feet)		Water Table Elevation (feet msl)		pH (standard units)		Dissolved Oxygen (mg/L)		Specific Conductivity (umhos/cm)		Purge Volume (gallons)	
		10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
Brumfield-Twidwell													
BTMW-1	23.30	13.46	10.88	24.14	26.72	6.1	6.0	--	--	128	94	4	5
BTMW-2	24.9	Product (~1")	11.79	--	26.04	--	--	--	--	--	--	3	3
BTMW-3	22.28	11.97	10.74	18.40	19.63	6.2	6.5	0.4	0.48	195	249	4	4.5
BTMW-5	24	14.18	13.95	16.52	16.75	6.9	6.5	0.44	0.16	160	175	3.5	6.5
BTMW-6	24	12.64	12.18	21.80	22.26	6.8	--	0.32	0.16	255	235	5	5
Whitney's Inc./ Key Bank (Sterling)													
KBMW-1	21.97	17.62	15.82	22.10	23.90	6.7	5.9	0.31	0.67	214	224	3.5	5
KBMW-2	20.16	Product (~2.5")	14.35	--	24.15	--	--	--	--	--	--	3	3
KBMW-3	20.17	16.28	14.75	21.40	22.93	6.8	6.2	--	0.16	422	525	3[(3)]	4.5[(3)]
P.J. MaxiMart													
PJMW-4	20	12.01	11.18	19.17	20.00	6.4	5.9	1.87	1.21	174	168	4.5	7
Tony's Short Stop													
TSMW-4	--	Product (~4")	Product (~2.5")	--	--	--	--	--	--	--	--	3	3
Grays Harbor Grange													
GSMW-1	22.7	10.02	9.78	18.22	18.46	6.6	6.2	1.05	1.42	228	270	3.5	5
GSMW-2	21.74	9.89	9.67	18.03	18.25	6.7	6.1	0.24	0.21	265	191	4	6
GSMW-3	17.73	5.70	5.89	17.33	17.14	6.4	6.5	0.26	0.17	326	393	4.5	5
Montesano City Shop													
MCSMW-31	12.50	4.71	4.91	16.68	16.48	6.4	6.6	0.31	0.17	357	367	4.5	5
MCSMW-32	12.50	5.47	5.64	16.42	16.25	6.4	6.6	0.29	0.23	346	296	3.5	4
MCSMW-33	12.11	6.08	6.19	16.42	16.31	6.5	6.2	0.26	0.2	289	325	3.5	3.5
Ecology													
ESMW-1	20.08	16.83	15.06	24.68	26.45	6.8	6.3	0.41	0.21	179	208	3[(3)]	3.5[(3)]
ESMW-2	19.68	11.81	11.28	20.91	21.44	6.2	6.4	2.1	2.06	198	159	5[(3)]	4.5[(3)]
ESMW-3	17.53	10.25	9.22	19.31	20.34	6.4	6.3	--	0.17	404	348	3[(3)]	4[(3)]
ESMW-4	20.09	13.49	11.36	24.53	26.66	6.1	5.2	8.64	3.74	100	102	4.5	5.5
ESMW-5	14.73	4.23	4.70	16.98	16.51	5.9	6.4	0.65	0.26	158	211	5	6
ESMW-6	14.70	9.31	9.35	13.39	13.35	7.2	6.9	0.51	0.19	1072	1432	3.5[(2)]	4[(2)]
ESMW-7	19.53	15.62	14.56	20.83	21.89	6.8	6.3	0.76	0.42	325	383	3.5[(3)]	5[(3)]
ESMW-8	15.10	9.31	9.52	16.14	15.93	6.4	6.6	0.3	0.19	192	181	4.5	5.5
EDMW-1	22.61	14.67	13.55	27.64	28.76	6.7	6.9	--	0.28	178	199	6[(3)]	4.5[(3)]

-- Not measured. [1] Measured from top of casing. [2] Purged dry. [3] Water level dropped while purging.
Product: Free-phase petroleum product present in the groundwater with approximate bailed thickness.

A groundwater flow pattern for the study area for April 2008 is shown in Figure 3. The approximate location of the water-table contours was determined using a geostatistical gridding method known as kriging. The groundwater flow direction is approximately perpendicular to the contours. The overall flow direction appears to be to the south and southeast, toward the Chehalis River.

There are multiple factors in the study area that may affect water level measurement and should be taken into consideration. These include (1) the presence of free-phase petroleum product in or near wells KBMW-2, BTMW-2, and TSMW-4, (2) a vapor extraction system operating at P.J. MaxiMart, (3) excavation and removal of soils at Tony's Short Stop and Brumfield-Twidwell, and (4) the possible influence of the storm drain and abandoned sewer systems which appear to collect groundwater.

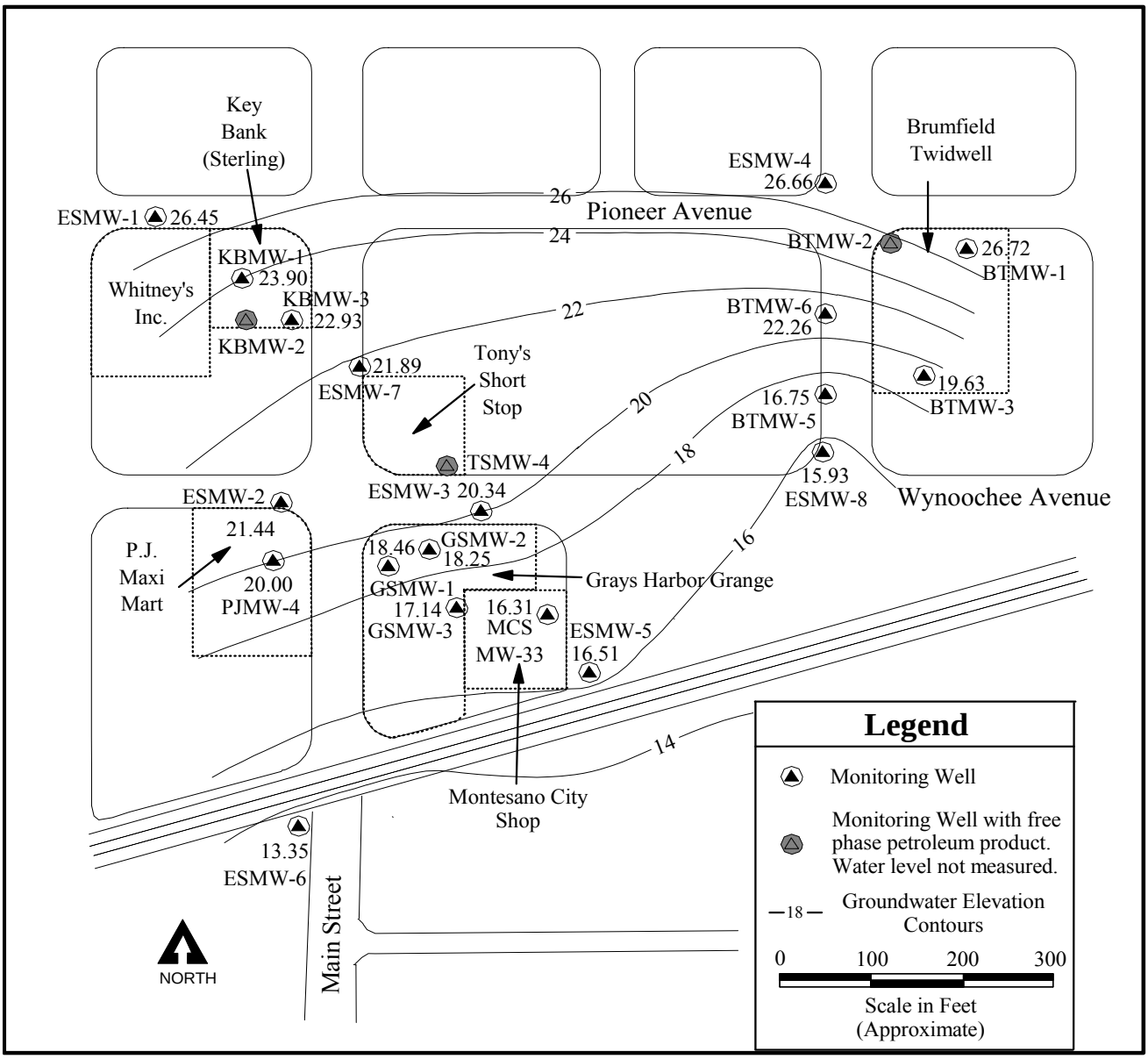

Figure 3. Water Table Elevation (feet) in the Study Area, April 2008.

Analytical Results

Analytical results, as well as MTCA cleanup levels for groundwater, for BTEX and TPH-G are summarized in Tables 5, 7, 9, and 11. For comparison, a summary of project data collected by Ecology since 2004 is presented in Appendix B. These data are also presented as graphs for select wells to illustrate seasonal variations in groundwater elevations and contaminant concentrations. Volatile organic results for October 2007 and April 2008 are summarized in Tables 6, 8, 10, 12, and 13. The tables list volatile organic compounds which have been detected since Ecology began collecting VOC samples in 2005. Project data for select volatile organics are also presented in Appendix C.

Project results have been separated into sections representing the three contaminant source areas, as identified in a previous study (GeoEngineers, 2005): Tony's Short Stop/Grays Harbor Grange, Whitney's Inc./Key Bank (Sterling), and Brumfield-Twidwell. Tables 11 and 12 present results for the remaining wells, which include wells at P.J. MaxiMart, Montesano City Shop, and the nine Ecology wells. Results are presented graphically in Figures 4 and 5. Table 13 presents results for the storm and sewer drain samples.

Tony's Short Stop/Grays Harbor Grange

The highest concentrations of petroleum-related contamination in the study area were detected in groundwater samples collected from monitoring well TSMW-4 at Tony's Short Stop. Well TSMW-4, which continues to have free-phase petroleum product in the groundwater, had BTEX and TPH-G concentrations which exceeded the MTCA Method A cleanup levels (Table 5).

Table 5. BTEX and TPH-G Results (µg/L) for Tony's Short Stop and Grays Harbor Grange, October 2007 and April 2008.

Analyte:	Benzene		Toluene		Ethylbenzene		m- & p-Xylene		o-Xylene		WTPH-G	
MTCA Cleanup Level:	5 µg/L		1000 µg/L		700 µg/L		1000 µg/L				800 (1000*) µg/L	
Date:	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
Tony's Short Stop												
TSMW-4	**11,600J**	**13,800J**	**29,700J**	**50,800E**	**4500J**	**5600J**	**10,200J**	**21,900J**	**3900J**	**8400 J**	**226,000 J**	**236,000 J**
Grays Harbor Grange												
GSMW-1	1 U	**11**	1 U	1 U	**1.4**	**9.7**	**2.9**	**59**	1 U	1 U	140 U	**480**
GSMW-2	**18**	**51**	1 U	10 U	1 U	**22**	2 U	**22**	1 U	10 U	140 U	**230**
GSMW-3	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U

* MTCA Method A cleanup level for TPH-G is 1,000 µg/L if benzene is not detectable in groundwater.
J – Analyte was positively identified. The associated numerical result is an estimate.
U – Analyte was not detected at or above the reported value.
E – Concentration of the associated value exceeds the known calibration range.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

Monitoring wells at the Grays Harbor Grange, GSMW-1 and GSMW-2 had much lower BTEX and TPH-G concentrations. Benzene concentrations exceeded the cleanup level in well GSMW-2 in October 2007 and both wells in April 2008. Ethylbenzene, m-& p-xylene, and TPH-G continue to be detected in these two wells.

Samples for VOCs were also collected from wells GSMW-1 and GSMW-2 during this monitoring period. VOC samples were collected from these wells because of the possible historical use of Tony's Short Stop as a service station and other possible upgradient sources. Table 6 is a summary of those results.

Table 6. Summary of VOC Results (µg/L) for Monitoring Wells at Grays Harbor Grange, October 2007 and April 2008.

Volatile Organic Compounds	GSMW-1		GSMW-2	
	10/07	4/08	10/07	4/08
Tetrachloroethene	**1.5 J**	**0.34 J**	**1.5 J**	**0.35 J**
Trichloroethene	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U
Vinyl Chloride	5 U	1 U	5 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	**0.51 J**
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U
4-Methyl-2-Pentanone	2 U	1 U	2 U	1 U
Benzene	1 U	**13**	**23**	**131**
Toluene	1 U	**0.28 J**	1 U	**0.33 J**
Ethylbenzene	1 U	**10**	1 U	**25**
m & p-Xylene	**2.5 J**	**63**	4 U	**36**
o-Xylene	2 U	**0.41 J**	2 U	**0.89 J**
Isopropylbenzene (Cumene)	**1.6 J**	**8.6**	2 U	**2.2**
n-Propylbenzene	**1.5**	**14**	1 U	**4.5**
1,3,5-Trimethylbenzene	1 U	**12**	1 U	**1.5**
Tert-Butylbenzene	2 U	1 U	2 U	1 U
1,2,4-Trimethylbenzene	**2.8**	**55**	1 U	**15**
Sec-Butylbenzene	2 U	**3.5**	2 U	1 U
p-Isopropyltoluene	2 U	1 U	2 U	1 U
n-Butylbenzene	2 U	**0.61 J**	2 U	1 U
Naphthalene	2 U	**6.7**	2 U	**2.9**

U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

Tetrachloroethene continues to be detected in wells GSMW-1 and GSMW-2 at concentrations near or below the practical quantitation limit (Table 6 and Appendix C).

Toluene and o-xylene were detected in the April VOC samples from wells GSMW-1 and GSMW-2 at concentrations below the practical quantitation limit of 1 µg/L. These two analytes were not detected in the BTEX analysis.

Whitney's Inc./Key Bank (Sterling)

Monitoring well KBMW-2, located at Key Bank (Sterling), also had high concentrations of BTEX and TPH-G in the groundwater samples (Table 7). In October 2007, free-phase petroleum product was present in groundwater from this well. Product is typically found in this well when depth-to-water is greater than 15 feet below ground surface. BTEX and TPH-G concentrations exceeded the MTCA cleanup levels during both sample rounds, with the exception of ethylbenzene in April. Benzene and TPH-G concentrations in well KBMW-3 also exceeded the cleanup levels during both sample rounds. BTEX and TPH-G concentrations in well KBMW-3 tend to increase in the fall, at the end of the dry season, when groundwater levels are lower (Appendix B). Benzene concentrations in well KBMW-1 continue to be detected and exceed the cleanup level in the spring (wet season) samples.

Table 7. BTEX and TPH-G Results (µg/L) for Key Bank (Sterling), October 2007 and April 2008.

Analyte:	Benzene		Toluene		Ethylbenzene		m- & p-Xylene		o-Xylene		WTPH-G	
MTCA Cleanup Level:	5 µg/L		1000 µg/L		700 µg/L		1000 µg/L				800 (1000*) µg/L	
Date:	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
KBMW-1	1 U	**16**	1 U	1 U	1 U	1 U	2U	2 U	1 U	1 U	140 U	**140**
KBMW-2	**520 J**	**274**	**2500 J**	**2600**	**700 J**	**540**	**2300 J**	**1900**	**930 J**	**900**	**46,000E**	**19,000**
KBMW-3	**86** [a]	**20 J**	**31** [a]	**3.7 J**	**355** [a]	**9.1 J**	**552** [a]	**7.9 J**	**210** [a]	**14 J**	**6900 E**	**1100**

* MTCA Method A cleanup level for TPH-G is 1,000 µg/L if benzene is not detectable in groundwater.
a - Analyzed by GC/MS SW8260.
U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
E – Concentration of the associated value exceeds the known calibration range.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

Samples were also collected for VOCs from two of the Key Bank (Sterling) wells (Table 8). The Key Bank site is located next to Whitney's Inc., which has an auto repair and painting shop. In 2003, Ecology found that waste solvents and waste oil were being stored in on-site fuel storage tanks. The tanks were decommissioned and cleaned. Chlorinated solvents have been detected in wells located on the Key Bank (Sterling) property (Ecology, 2007).

Table 8. Summary of VOC Results (µg/L) for Monitoring Wells at Key Bank (Sterling), October 2007 and April 2008.

Volatile Organic Compounds	KBMW-1		KBMW-3	
	10/07	4/08	10/07	4/08
Tetrachloroethene	2 U	**9**	20 U	1 U
Trichloroethene	1 U	1 U	10 U	**1.3**
Cis-1,2-Dichloroethene	1 U	1 U	**5.8 J**	**5.6**
Trans-1,2-Dichloroethene	1 U	1 U	10 U	1 U
Vinyl Chloride	5 U	1 U	50 U	1 U
1,1-Dichloroethane	1 U	1 U	10 U	1 U
1,1,1-Trichloroethane	1 U	1 U	10 U	1 U
1,2-Dichloroethane	**0.66 J**	**0.73 J**	10 U	1 U
4-Methyl-2-Pentanone	2 U	1 U	20 U	1 U
Benzene	1 U	**15**	**86**	**21**
Toluene	1 U	1 U	**31**	**4.2**
Ethylbenzene	1 U	1 U	**355**	**12**
m & p-Xylene	4 U	**0.71 J**	**552**	**9.8**
o-Xylene	2 U	**0.45 J**	**210**	**20**
Isopropylbenzene (Cumene)	2 U	**3.1**	**44**	**7.1**
n-Propylbenzene	1 U	**0.3 J**	**85**	**3.2**
1,3,5-Trimethylbenzene	1 U	**0.79 J**	**77**	**2.8**
Tert-Butylbenzene	2 U	1 U	20 U	**0.47 J**
1,2,4-Trimethylbenzene	1 U	**2.5**	**393**	**4.9**
Sec-Butylbenzene	**2**	**1.5**	20 U	**7.5**
p-Isopropyltoluene	2 U	**0.4 J**	20 U	**0.65 J**
n-Butylbenzene	2 U	**1.5**	**18 J**	**3.9**
Naphthalene	2 U	**3.9**	**219**	**55**

U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

In addition to other petroleum-related contaminants, some chlorinated compounds – such as tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, and 1,2-dichloroethane – were detected in wells KBMW-1 and KBMW-3 (Table 8). Tetrachloroethene concentrations in well KBMW-1 continue to be detected and exceed the MTCA Method A cleanup level for groundwater of 5 µg/L in the spring/wet season samples (Appendix C).

Acetone was tentatively identified in the April 2008 sample from well KBMW-1 at an approximate concentration of 21 µg/L. Acetone has been detected periodically in the three Key Bank (Sterling) wells during the project period of 2005 to 2008. Acetone is a common cleaning fluid used in a variety of industries. It is also as a common laboratory solvent.

Xylene was detected in the April VOC sample from well KBMW-1 at concentrations below the practical quantitation limits. These analytes were not detected in the BTEX analysis.

The October naphthalene concentration in well KBMW-3 also exceeded the MTCA Method A cleanup level of 160 µg/L.

Brumfield-Twidwell

Of the five wells sampled at the Brumfield-Twidwell site, monitoring wells BTMW-2, BTMW-5 and BTMW-6 contained BTEX and TPH-G in the groundwater samples (Table 9). Free-phase petroleum product was present in groundwater in well BTMW-2 in October 2007. Xylene exceeded the cleanup level in this well in October and TPH-G exceeded the cleanup level during both sample rounds. Of the petroleum-related contaminants detected in well BTMW-6, benzene and TPH-G exceeded the cleanup levels during both sample rounds. As shown in Table 9 and Appendix B, ethylbenzene and m-& p-xylene concentrations in well BTMW-6 increase significantly in samples collected during the wet season when groundwater levels are higher.

Table 9. BTEX and TPH-G Results (µg/L) for Brumfield-Twidwell, October 2007 and April 2008.

Analyte:	Benzene		Toluene		Ethylbenzene		m- & p-Xylene		o-Xylene		WTPH-G	
MTCA Cleanup Level:	5 µg/L		1000 µg/L		700 µg/L		1000 µg/L				800 (1000*) µg/L	
Date:	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
BTMW-1	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
BTMW-2	1 U[a]	10 U	**180 J**[a]	**38 J**	**642 J**[a]	**57**	**3190 J**[a]	**322**	**1380 J**[a]	**166**	**29,000 E**	**3900**
BTMW-3	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
BTMW-5	1 U	**1.6**	1 U	1 U	1 U	**1.3**	2 U	2 U	**1.7**	1 U	140 U	140 U
BTMW-6	**7**	**14**	**15**	**13 J**	**33**	**404**	2 U	**391**	**2.9**	10 U	**2300**	**3900**

* MTCA Method A cleanup level for TPH-G is 1,000 µg/L if benzene is not detectable in groundwater.

a - Analyzed by GC/MS SW8260.

U – Analyte was not detected at or above the reported value.

J – Analyte was positively identified. The associated numerical result is an estimate.

E – Concentration of the associated value exceeds the known calibration range.

Bold – Analyte was detected.

Underline – Free-phase petroleum product was present.

Shade – Values are greater than MTCA cleanup levels.

Well BTMW-6 was also sampled for VOCs during both sample rounds. VOCs had been detected in site soils during excavation and removal activities in 2006, and low concentrations of 1,2-dichloroethane were detected in groundwater samples from this well in March 2007. No chlorinated compounds were detected in this well during this 2007-08 monitoring period (Table 10).

Table 10. Summary of VOC Results (µg/L) for Monitoring Wells at Brumfield-Twidwell, October 2007 and April 2008.

Volatile Organic Compounds	BTMW-6	
	10/07	4/08
Tetrachloroethene	2 U	1 U
Trichloroethene	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U
Vinyl Chloride	5 U	1 U
1,1-Dichloroethane	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U
1,2-Dichloroethane	1 U	1 U
4-Methyl-2-Pentanone	2 U	1 U
Benzene	**8.5**	**3.5**
Toluene	**32**	**14**
Ethylbenzene	**262**	**418**
m & p-Xylene	**293**	**425**
o-Xylene	**7**	**5.8**
Isopropylbenzene (Cumene)	**43**	**38**
n-Propylbenzene	**50**	**86**
1,3,5-Trimethylbenzene	**36**	**50**
Tert-Butylbenzene	2 U	1 U
1,2,4-Trimethylbenzene	**86**	**182**
Sec-Butylbenzene	**5.2**	**5.2**
p-Isopropyltoluene	**2.8**	**2.5**
n-Butylbenzene	**3.9**	**4**
Naphthalene	**63**	**93**

U – Analyte was not detected at or above the reported value.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

Acetone was also tentatively identified in the April 2008 sample from well BTMW-6 at an approximate concentration of 36 µg/L. Acetone has not been detected in this well before.

As with the BTEX analysis, benzene, toluene, ethylbenzene, and xylene were detected in the VOC analysis in well BTMW-6. The October 2007 toluene, ethylbenzene, and xylene concentrations were considerably higher in the VOC analyzed samples than from the BTEX analyzed samples.

Remaining wells

Samples were also collected from the nine Ecology wells as well as wells located at P.J. MaxiMart and Montesano City Shop. Because the P.J. MaxiMart site has had additional groundwater monitoring as part of remedial activities, only well PJMW-4 was sampled in October 2007 and April 2008. Analytical results for the remaining wells for this monitoring period are shown in Tables 11 and 12.

Table 11. BTEX and TPH-G Results (µg/L) for Ecology Wells, P.J. MaxiMart, and Montesano City Shop, October 2007 and April 2008.

Analyte:	Benzene		Toluene		Ethylbenzene		m- & p-Xylene		o-Xylene		WTPH-G	
MTCA Cleanup Level:	5 µg/L		1000 µg/L		700 µg/L		1000 µg/L				800 (1000*) µg/L	
Date:	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
Ecology Wells												
ESMW-1	**11**	**16**	**4.7**	**5.7 J**	**20**	**59**	**10**	**33**	**3.6**	**1.9**	**550**	**1700**
ESMW-2	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
ESMW-3	**14,300** [a]	**5000**	**20,800** [a]	**4100**	**2580** [a]	**904**	**7410** [a]	**2900**	**2600** [a]	**738**	**83,000 E**	**25,000**
ESMW-4	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
ESMW-5	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
ESMW-6	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
ESMW-7	**648** [a]	**789**	**1270** [a]	**1000**	**1150** [a]	**1400**	**3240** [a]	**3100**	**1170** [a]	**1100**	**20,000 E**	**26,000**
ESMW-8	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
EDMW-1	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
P.J. MaxiMart												
PJMW-4	1 U	25 U	**25**	**66 J**	**57**	**243**	**9.9**	**1100**	**11**	**383**	**2200**	**6700**
Montesano City Shop												
MCSMW-31	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
MCSMW-32	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	140 U
MCSMW-33	**2.2**	1 U	1 U	1 U	1 U	1 U	2 U	2 U	1 U	1 U	140 U	**160**

* MTCA Method A cleanup level for TPH-G is 1,000 µg/L if benzene is not detectable in groundwater.
a - Analyzed by GC/MS SW8260.
U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
E – Concentration of the associated value exceeds the known calibration range.
Bold – Analyte was detected.
Shade - Values are greater than MTCA cleanup levels.

Elevated concentrations of petroleum-related contaminants were detected in three of the Ecology wells: ESMW-1, ESMW-7 and ESMW-3. Groundwater cleanup levels were exceeded for benzene and TPH-G in well ESMW-1. This well is near the intersection of Pioneer Avenue and 1st Street, where Whitney's Inc. is located. Historically, gasoline was stored and sold from this corner of the business. In 1995, three underground storage tanks were closed in place. Soil samples taken at the time showed high levels of BTEX (Ecology, 2007).

Well ESMW-7 is located along Main Street near the northwest corner of the Tony's Short Stop property. BTEX and TPH-G were detected in this well in both October 2007 and April 2008, exceeding the MTCA cleanup levels.

BTEX and TPH-G cleanup levels were also exceeded in well ESMW-3 in both October 2007 and April 2008. This well is located along Wynoochee Avenue, between Tony's Short Stop and Grays Harbor Grange. This well is less than 100 feet downgradient from well TSMW-4 which had free-phase petroleum product. With the exception of well TSMW-4, well ESMW-3 has the highest benzene concentrations in the study area.

Of the petroleum-related contaminants, all but benzene were detected in well PJMW-4 at the P.J. MaxiMart site (Table 11). In April 2008, xylene concentrations exceeded the MTCA cleanup level. TPH-G concentrations exceeded the cleanup level in this well during both sample rounds.

Of the three wells sampled at the Montesano City Shop, petroleum-related contaminants were only detected in well MCSMW-33 (Table 11). Low concentrations of benzene were detected in October 2007 and TPH-G in April 2008.

Samples for VOCs were collected from Ecology wells ESMW-1, ESMW-3, and ESMW-7 (Table 12). VOC samples were collected from these wells because the wells are located near properties where chlorinated solvents have been detected in the past.

High concentrations of petroleum contaminants in wells ESMW-3 and ESMW-7 in October 2007 caused the practical quantitation limits for the VOC analysis to range from 100 to 500 µg/L. Chlorinated compounds were not detected in either of these wells during this sample round. However, trichloroethene, cis-1,2-dichloroethene, 1,2-dichloroethane, and 4-methyl-2-pentanone were detected in well ESMW-7 in April 2008 (Table 12). Naphthalene exceeded the MTCA cleanup level of 160 µg/L in wells ESMW-3 and ESMW-7.

Acetone was also tentatively identified at approximate concentrations in the April 2008 samples from wells ESMW-1 (16 µg/L), ESMW-3 (73 µg/L), ESMW-7 (93 µg/L). This is the first reported occurrence of acetone in these wells.

BTEX and TPH-G results for the three source areas, P.J. MaxiMart, Montesano City Shop, and the nine Ecology wells, are shown in Figures 4 and 5. Figure 4 shows BTEX concentrations for the study area for October 2007 and April 2008. Figure 5 shows TPH-G concentrations for the same time period. Concentration graphs on the two figures have been plotted using a logarithmic scale to accommodate the wide range of concentrations present in the study area.

Table 12. Summary of VOC Results (µg/L) for Three Ecology Monitoring Wells, October 2007 and April 2008.

Volatile Organic Compounds	ESMW-1		ESMW-3		ESMW-7	
	10/07	4/08	10/07	4/08	10/07	4/08
Tetrachloroethene	2 U	1 U	200 U	1 U	200 U	1 U
Trichloroethene	1 U	1 U	100 U	1 U	100 U	**1.4**
Cis-1,2-Dichloroethene	1 U	1 U	100 U	1 U	100 U	**1.4**
Trans-1,2-Dichloroethene	1 U	1 U	100 U	1 U	100 U	1 U
Vinyl Chloride	5 U	1 U	500 U	1 U	500 U	1 U
1,1-Dichloroethane	1 U	1 U	100 U	1 U	100 U	1 U
1,1,1-Trichloroethane	1 U	1 U	100 U	1 U	100 U	1 U
1,2-Dichloroethane	1 U	1 U	100 U	1 U	100 U	**2**
4-Methyl-2-Pentanone	2 U	1 U	200 U	1 U	200 U	**4.3**
Benzene	**7.9**	**8.8**	**14,300**	**4590**	**648**	**829**
Toluene	**3.9**	**4.9**	**20,800**	**3710**	**1270**	**1060**
Ethylbenzene	**22**	**57**	**2580**	**988**	**1150**	**1580**
m & p-Xylene	**13**	**40**	**7410**	**2900**	**3240**	**3740**
o-Xylene	**4.2**	**2.8**	**2600**	**868**	**1170**	**1400**
Isopropylbenzene (Cumene)	**4.9**	**16**	**172 J**	**49**	**157 J**	**122**
n-Propylbenzene	**10**	**38**	**206**	**123**	**137**	**239**
1,3,5-Trimethylbenzene	**1.3**	1 U	**257**	**146**	**229**	**352**
Tert-Butylbenzene	2 U	1 U	200 U	1 U	200 U	1 U
1,2,4-Trimethylbenzene	**11**	**69**	**1090**	**493**	**994**	**1050**
Sec-Butylbenzene	**2.5**	**5.9**	200 U	**5.7**	200 U	**13**
p-Isopropyltoluene	**1.7 J**	**4.6**	200 U	**1.4**	200 U	**12**
n-Butylbenzene	**1.8 J**	**3.6**	200 U	**4.2**	200 U	**18**
Naphthalene	**4.5**	**76**	**182 J**	**96**	**568**	**1090**

U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

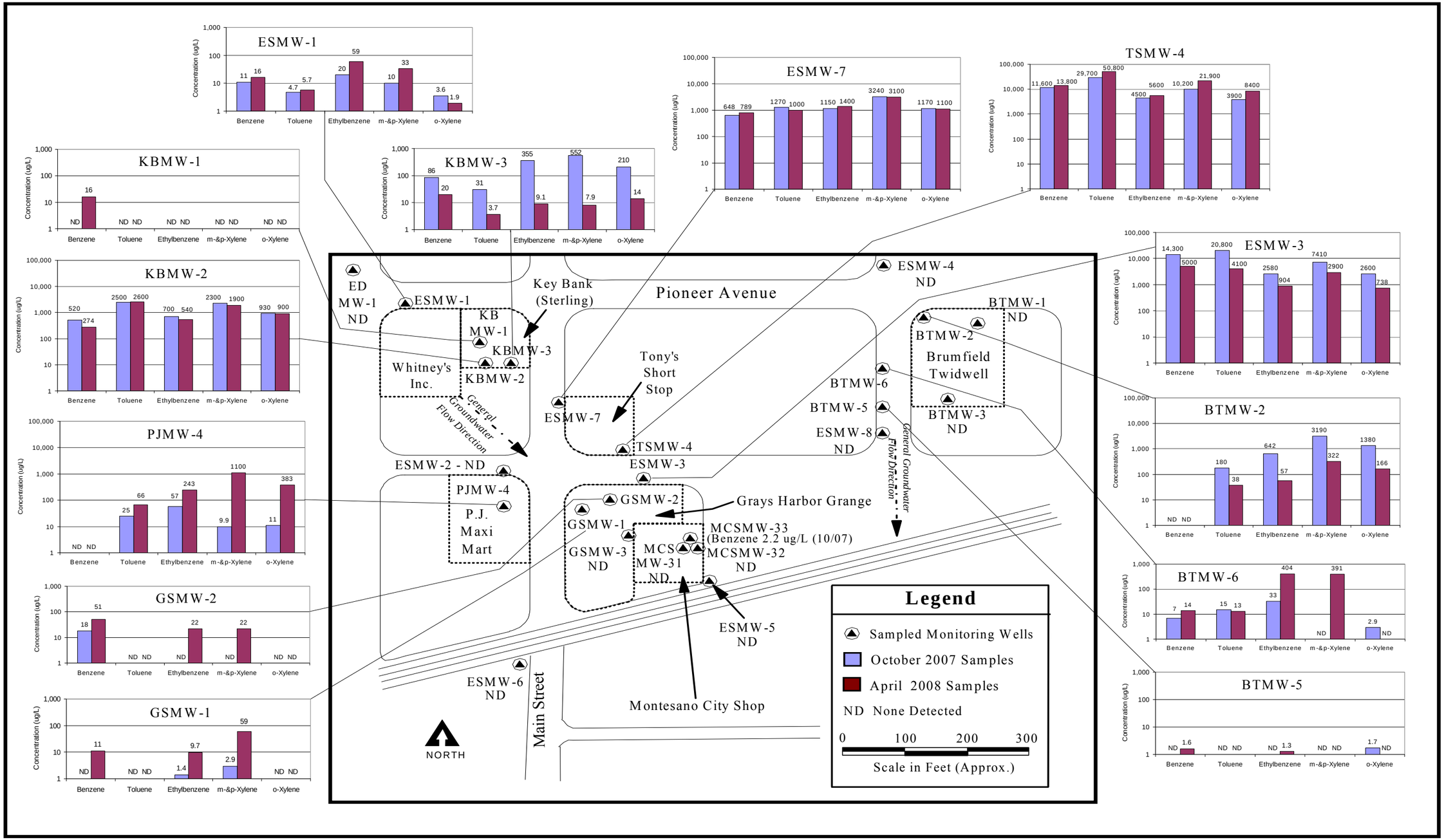

Figure 4. BTEX Results (ug/L- log scale), October 2007 and April 2008.

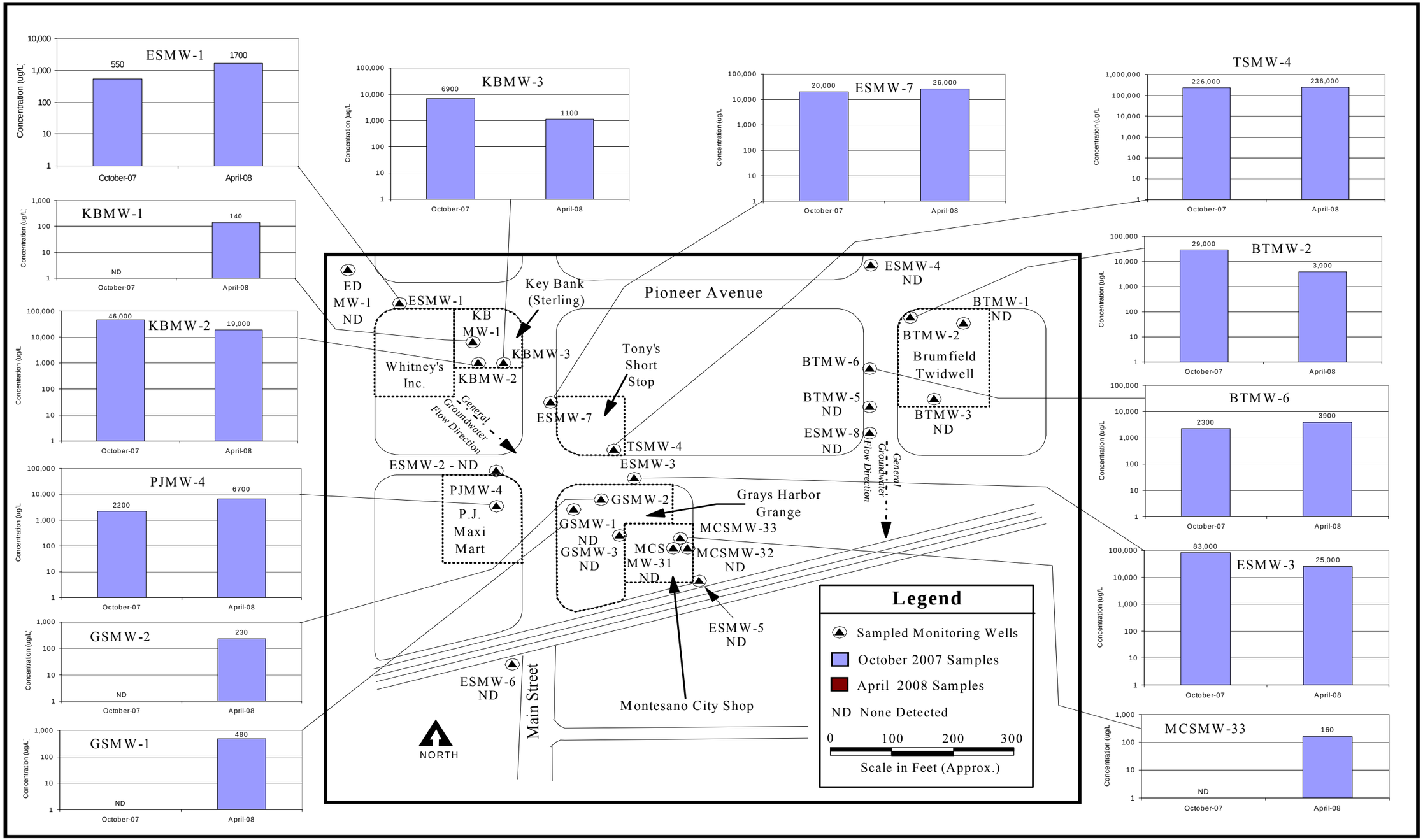

Figure 5. TPH-G Results (ug/L- log scale), October 2007 and April 2008.

Storm and sewer drains

Water samples were collected from the City of Montesano's storm drain and abandoned sanitary sewer system to determine if these underground utility corridors are providing preferential pathway for the migration of the contaminated groundwater. Samples were collected and analyzed for VOCs and TPH-G (Table 13).

Table 13. Summary of VOC and TPH-G Sample Results (µg/L) for the City of Montesano Storm Drain and Abandoned Sanitary Sewer, October 2007 and April 2008.

Volatile Organic Compounds	BF-1		BF-5		BF-12		BF-9	
	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
Tetrachloroethene	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
Trichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	5 U	1 U	5 U	1 U	5 U	1 U	5 U	1 U
1,1-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,1-Trichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Methyl-2-Pentanone	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
Benzene	1 U	**0.39 J**	1 U	**1.3**	1 U	**8.7**	1 U	**4.5**
Toluene	1 U	**0.26 J**	1 U	**5.1**	1 U	**30**	1 U	**16**
Ethylbenzene	1 U	**0.84 J**	1 U	**3.5**	1 U	**6.6**	1 U	**4.4**
m & p-Xylene	4 U	**2.4**	4 U	**10**	**1.9 J**	**22**	**1.7 J**	**14**
o-Xylene	2 U	**0.72 J**	2 U	**5.8**	2 U	**11**	2 U	**7.4**
Isopropylbenzene (Cumene)	2 U	1 U	2 U	**0.33 J**	2 U	**0.51 J**	2 U	**0.4 J**
n-Propylbenzene	**0.71 J**	**0.48 J**	1 U	**0.6 J**	1 U	**1.1**	1 U	**0.81 J**
1,3,5-Trimethylbenzene	1 U	**0.33 J**	1 U	**1.2**	1 U	**2.2**	1 U	**1.8**
Tert-Butylbenzene	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
1,2,4-Trimethylbenzene	1 U	**1**	1 U	**3.3**	1 U	**5.5**	1 U	**4.2**
Sec-Butylbenzene	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
p-Isopropyltoluene	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
n-Butylbenzene	2 U	1 U	2 U	1 U	2 U	1 U	2 U	1 U
Naphthalene	2 U	**0.7 J**	2 U	**2.7**	2 U	**2.5**	2 U	**3.6**
TPH-G	140 U	140 U	140 U	**110 J**	140 U	**210**	140 U	**140**

U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

Three samples were collected from the storm drain along Wynoochee Avenue, and one sample was collected from the abandoned sanitary sewer system on Main Street (Figure 1). Water in the storm drain along Wynoochee Avenue flows west to east. Sample BF-5 was collected from the manhole at the intersection of Main Street and Wynoochee Avenue. Sample BF-12 was collected from the manhole east of well ESMW-3. Sample BF-9 was collected from the manhole at the intersection of Wynoochee Avenue and Sylvia Street. The manhole at this intersection accesses the storm drain along Wynoochee Avenue and a north-south storm drain along Sylvia Street.

Petroleum-related contaminants were detected primarily in the April 2008 samples collected from the storm drain along Wynoochee Avenue. Benzene was the only analyte to exceed the MTCA cleanup level in the April sample from station BF-12. Contaminant concentrations were higher in samples collected from station BF-12 which is located approximately 200 feet east of wells TSMW-4 and ESMW-3. TPH-G was also detected in the three storm drain samples collected in April.

As with some of the monitoring wells, acetone was identified at estimated concentrations in the April 2008 storm drain samples. Concentrations were 9.9 µg/L (BF-5), 11 µg/L (BF-12), and 11 µg/L (BF-9). Acetone was used in the cleaning procedures of the beakers used to collect the water samples from the storm drains.

One sample (BF-1) was collected from the abandoned sanitary sewer on south Main Street. Petroleum-related contaminants were detected primarily in the April sample, but at concentrations near or below the practical quantitation limits. TPH-G was not detected in this sample.

Discussion

High concentrations of gasoline-range petroleum hydrocarbons are present throughout the surficial aquifer underlying downtown Montesano. LNAPL in the form of free-phase petroleum product is present at the three identified source areas: Tony's Short Stop, Whitney's/Key Bank (Sterling), and Brumfield-Twidwell.

Table 14 provides a summary of those wells where BTEX and TPH-G concentrations exceeded MTCA groundwater cleanup levels in October 2007 and April 2008. Analytical results are discussed, along with past project data for comparison. Project data collected by Ecology since 2004 is presented as tables and graphs in Appendices B and C. Figure 6 shows estimated TPH-G concentration contours in groundwater for the 2007-08 monitoring period.

Petroleum Contamination

Table 14. BTEX and TPH-G Concentrations (µg/L) that Exceeded MTCA Method A Cleanup Levels for Groundwater during October 2007 and April 2008.

Analyte:	Benzene		Toluene		Ethylbenzene		m- & p-Xylene		o-Xylene		WTPH-G	
MTCA Cleanup Level:	5 µg/L		1000 µg/L		700 µg/L		1000 µg/L		1000 µg/L		800 (1000*) µg/L	
Date:	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08	10/07	4/08
Tony's Short Stop												
TSMW-4	**11,600 J**	**13,800 J**	**29,700 J**	**50,800 EJ**	**4500 J**	**5,600 J**	**10,200 J**	**21,900 J**	**3900 J**	**8,400 J**	**226,000 J**	**236,000 J**
Grays Harbor Grange												
GSMW-1	1 U	**11**	1 U	1 U	**1.4**	**9.7**	**2.9**	**59**	1 U	1 U	140 U	**480**
GSMW-2	**18**	**51**	1 U	10 U	1 U	**22**	2 U	**22**	1 U	10 U	140 U	**230**
Whitney's Inc./Key Bank (Sterling)												
KBMW-1	1 U	**16**	1 U	1 U	1 U	1 U	2U	2 U	1 U	1 U	140 U	**140**
KBMW-2	**520 J**	**274**	**2500 J**	**2600**	**700 J**	**540**	**2300 J**	**1900**	**930 J**	**900**	**46,000 E**	**19,000**
KBMW-3	**86** [a]	**20 J**	**31** [a]	**3.7 J**	**355** [a]	**9.1 J**	**522** [a]	**7.9 J**	**210** [a]	**14 J**	**6900 E**	**1100**
Brumfield-Twidwell												
BTMW-2	1 U [a]	10 U	**180 J** [a]	**38 J**	**642 J** [a]	**57**	**3190 J** [a]	**322**	**1380 J** [a]	**166**	**29,000 E**	**3900**
BTMW-6	**7**	**14**	**15**	**13 J**	**33**	**404**	2 U	**391**	**2.9**	10 U	**2300**	**3900**
Ecology Wells												
ESMW-1	**11**	**16**	**4.7**	**5.7 J**	**20**	**59**	**10**	**33**	**3.6**	**1.9**	**550**	**1700**
ESMW-3	**14,300** [a]	**5000**	**20,800** [a]	**4100**	**2580** [a]	**904**	**7410** [a]	**2900**	**2600** [a]	**738**	**83,000 E**	**25,000**
ESMW-7	**648** [a]	**789**	**1270** [a]	**1000**	**1150** [a]	**1400**	**3240** [a]	**3100**	**1170** [a]	**1100**	**20,000 E**	**26,000**

* MTCA Method A cleanup level for TPH-G is 1,000 µg/L if benzene is not detectable in groundwater.
a – Analyzed by GC/MS SW8260.
U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
E – Concentration of the associated value exceeds the known calibration range.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

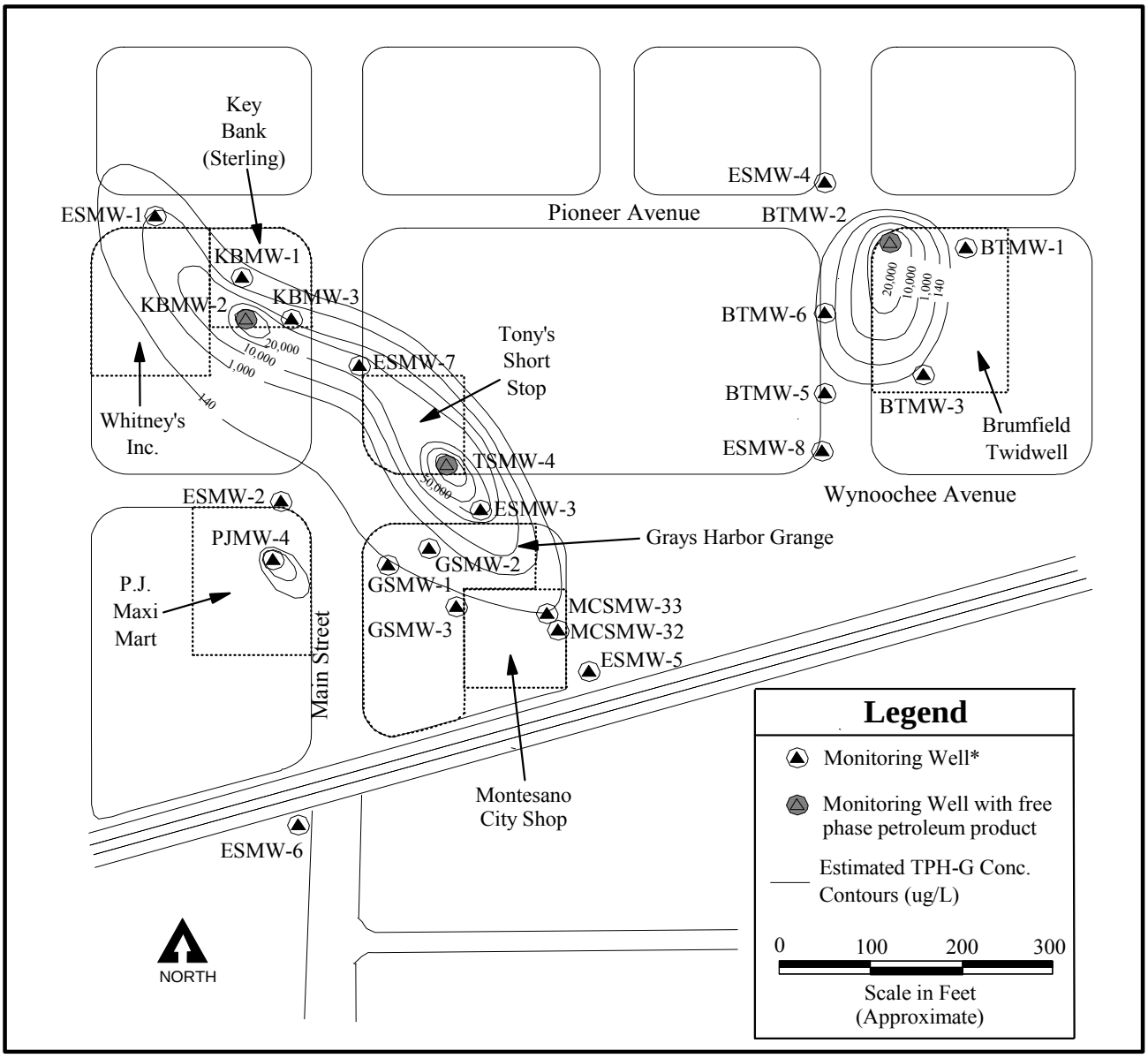

Figure 6. Estimated Dissolved TPH-G Groundwater Concentration Contours (µg/L).

Well ESMW-1 at the northwest corner of Whitney's Inc. confirms that the shallow groundwater is contaminated with petroleum products in this part of the study area. Historically gasoline was stored and sold from this corner of the business. Soil contamination was discovered in this area when three underground tanks were closed in place in 1995 (Ecology, 2007). At this time, Ecology has not established any other potential sources in the area other than Whitney's Inc.

Groundwater flow direction in this part of the study area appears to be to the southeast, suggesting that the three wells located at Key Bank (Sterling) are downgradient of Whitney's Inc. Free-phase petroleum product has been present in well KBMW-2 during most sample events since Ecology began monitoring in October 2004. The presence of LNAPL appears to depend on the groundwater elevation in the well. The LNAPL continues to serve as a source

area for the dissolved-phase plume. Consequently, high concentrations of BTEX and TPH-G are detected in well KBMW-3. Benzene has also been detected seasonally in well KBMW-1 at concentrations above the cleanup level (Appendix B).

Well ESMW-7 was installed to provide information between two of the identified source areas, Whitney's Inc. and Tony's Short Stop. BTEX and TPH-G concentrations detected in this well are consistently above the MTCA cleanup levels. Since well ESMW-7 appears to be located upgradient of the primary source of fuel contamination at Tony's Short Stop, it seems to suggest that contamination from Whitney's Inc. has migrated to this part of the study area.

The primary source of fuel contamination at Tony's Short Stop was identified during a remedial investigation in 2006. During the removal of the old tanks in May 2006, contractors encountered free product on the north edge of the excavation pit where the old product line trench was located. It was concluded that the primary source of contamination at the site appeared to be the old product lines in the southeast quarter of the property (AEG, 2007). Well TSMW-4 is downgradient of the former tank and lines. Free-phase petroleum product has been present in this well during each monitoring event, and BTEX and TPH-G concentrations continue to be the highest detected in the study area. The LNAPL at this location also continues to serve as a source area for a dissolved-phase plume.

Well ESMW-3, located along Wynoochee Avenue, is less than 100 feet downgradient from well TSMW-4 which has free-phase petroleum product. BTEX and TPH-G concentrations in this well were also some of the highest detected in the study area. Contamination from the former lines and tank area at Tony's Short Stop appears to have migrated off-site as indicated by contaminant concentrations in well ESMW-3 (Appendix B).

Since monitoring began in October 2004, wells GSMW-1 and GSMW-2, which appear to be downgradient of Tony's Short Stop, have had much lower BTEX and TPH-G concentrations as compared to wells TSMW-2, TSMW-4, and ESMW-3. However, benzene concentrations in well GSMW-2 have consistently exceeded the MTCA cleanup levels since monitoring began in October 2004.

The wells located at Montesano City Shop also appear to be hydraulically downgradient of Tony's Short Stop/Grays Harbor Grange (Marti, 2006). Two wells, MCSMW-32 and MCSMW-33, had elevated benzene concentrations when monitoring began in 2004 (Appendix B). Since then, benzene concentrations have decreased considerably in these wells. The continued presence of low concentrations of benzene and TPH-G in well MCSMW-33, and the absence of contaminants in downgradient wells MCSMW-32 and ESMW-5, possibly suggest the front edge of the contaminated plume.

The presence of LNAPL and related high BTEX and TPH-G concentrations at Whitney's/ Key Bank (Sterling) and Tony's Short Stop , along with groundwater flow direction in this part of the study area, suggest that petroleum contamination from these two source areas may have co-mingled to form a large plume across downtown Montesano. It is possible that the plume extends from monitoring well ESMW-1 to as far as well MCSMW-33 at Montesano City Shop.

BTEX and TPH-G concentrations in Brumfield-Twidwell well BTMW-2 also continue to be among the highest in the study area. Free-phase petroleum product has been present in groundwater from this well since October 2006. The LNAPL continues to serve as a source area for a dissolved-phase plume. Benzene concentrations have increased from 75 µg/L in October 2004 to 520 µg/L in October 2007 (Appendix B). Since Ecology began monitoring, activities at this site have included the removal of several underground storage tanks and contaminated soil, as well as the construction of a new building at the location of the former Brumfield-Twidwell building.

BTEX and TPH-G have also been detected in well BTMW-6, indicating that petroleum contamination may be migrating from the Brumfield-Twidwell site. Well BTMW-6 is located west of Brumfield-Twidwell and is near the storm drain that runs down Sylvia Street. Based on petroleum contaminants detected in samples from station BF-9 and the mapped groundwater contours it appears that the storm drain is influencing groundwater flow in this portion of the study area. The storm drain is possibly acting as a hydraulic barrier to contaminant migration to the west, but also as a possible preferential pathway for contaminants to the south.

Overall, BTEX and TPH-G concentrations in well PJMW-4 at P.J. MaxiMart have had a decreasing trend since monitoring began in October 2004, although the April 2008 concentrations increased. This site is being remediated with a vapor extraction system.

Water samples were collected from the City of Montesano's storm drain and abandoned sanitary sewer system to determine if these underground utility corridors are providing a preferential pathway for the contaminant migration. Petroleum-related contaminants were primarily detected in the April 2008 samples collected from the storm drain along Wynoochee Avenue. Benzene exceeded the MTCA cleanup level in the April sample from station BF-12. TPH-G was also detected in the three storm drain samples collected in April. The presence of petroleum-related contaminants in storm drain samples collected during dry weather suggests that contaminated groundwater is entering the storm drain.

One sample was collected from the abandoned sanitary sewer on south Main Street. Petroleum-related contaminants were detected in this sample but at concentrations near or below the practical quantitation limits.

The presence of contaminants in the city's storm drain and abandoned sewer system indicate that these utilities may be providing preferential pathways for contaminants. This is of concern since the storm drain empties into the Chehalis River system.

Chlorinated Compound Contamination

Chlorinated compounds have been detected in some wells in the study area. VOC data are presented in Appendix C. Most VOC concentrations were near or below the laboratory practical quantitation limits. However, wells KBMW-1 and KBMW-2 continue to have the highest concentrations of tetrachloroethene since VOC monitoring began in March 2005. These wells are located adjacent to Whitney's Inc. which has an auto repair and paint shop. It was reported in 2003 that waste solvents and waste oil were being improperly stored in underground tanks on

the site (Ecology, 2007). The presence of these chlorinated solvents in these wells suggests a VOC-contaminated plume is present in this portion of the study area.

Trichloroethene, cis-1,2-dichloroethene, 1,2-dichloroethane, and 4-methyl-2-pentanone were detected in the April 2008 samples from well ESMW-7 at concentrations near the practical quantitation limit of 1 µg/L. Well ESMW-7 appears to be located hydraulically between Whitney's Inc./Key Bank (Sterling) and Tony's Short Stop. The presence of chlorinated solvents in this well suggests the possible migration of a VOC-contaminated plume.

Tetrachloroethene also continues to be detected in wells GSMW-1 and GSMW-2 at concentrations near the practical quantitation limit of 1 µg/L. These wells are downgradient of Whitney's Inc. and Tony's Short Stop. In the past, solvents may have been used at Tony's Short Stop when it was a service station. Chlorinated compounds have not been detected in wells TSMW-2 or TSMW-4. However, because of the high petroleum contaminant concentrations in these wells, the laboratory reporting limits have been high and may have masked low levels of other organic compounds.

Conclusions and Recommendations

Conclusions

Water quality results over the 2007-08 monitoring period confirm the contamination of the surficial aquifer with gasoline-range petroleum hydrocarbons throughout the study area. The contaminants present at the various sites are believed to have come from leaking tanks and piping over time.

Analytical data show that the highest contaminant concentrations remain in the vicinity of three source areas: Tony's Short Stop/Grays Harbor Grange, Whitney's Inc./Key Bank (Sterling), and Brumfield-Twidwell. The presence of free-phase petroleum product in the areas of wells TSMW-4, KBMW-2, and BTMW-2 continue to serve as sources of dissolved-phase contamination.

Petroleum contamination from Whitney's/Key Bank (Sterling) and Tony's Short Stop has possibly co-mingled to form a large plume across downtown Montesano. Groundwater flow direction in this part of the study area appears to be to the southeast. The contaminated plume may extend from Whitney's Inc. to as far as the Montesano City Shop. The presence of chlorinated compounds in the wells at Whitney's Inc./Key Bank, at Ecology well ESMW-7, and at Grange wells GSMW-1 and GSMW-2 also suggests the possible presence of a VOC- contaminated plume in these parts of the study area.

Because of the level of the groundwater contamination, investigations continue to be conducted at the three source areas to better define the nature and extent of the contamination across the study area.

Recommendations

Based on the results of this 2007-2008 monitoring, the following recommendations are provided:

- Investigations should continue at the three source areas –Tony's Short Stop, Whitney's Inc., and Brumfield-Twidwell – to determine the extent of the free-phase petroleum product and the associated contaminated plumes. Areas of the LNAPLs should be removed or remediated since they continue to serve as sources for dissolved-phase contamination.
- Additional investigation is needed at the Whitney's/Key Bank (Sterling) site to determine the source of the chlorinated compounds and the extent of the contamination. The existing monitoring wells may not be deep enough to adequately characterize the VOC plume. Deeper wells may need to be installed since chlorinated compounds are DNAPLs.
- Additional wells east and southeast of well ESMW-3 should be installed to better define the southern portion of the contaminated plume.
- The storm drain appears to be providing another contaminant migration pathway. Because the storm drain discharges to the Chehalis River system, samples should be collected at the pipe discharge or as close to the discharge point as possible.

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Appendices

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Appendix A. Well Construction Details

Table A-1. Well Construction Details.

Well #	Latitude (degrees)	Longitude (degrees)	Completed Well Depth (feet)	Casing Diameter (inches)	Tag/ Rim Elevation (feet)	PVC Elevation	Groundwater Level (feet bls)	Water Table Elevation (feet msl)	Groundwater Level (feet bls)	Water Table Elevation (feet msl)
							October 2007		April 2008	
BTMW-1	46-58-46.108	-123-35-52.159	23.30	2	37.60	37.39	13.46	24.14	10.88	26.72
BTMW-2	46-58-46.112	-123-35-53.435	24.9	2	37.83	37.44	Product	--	11.79	26.04
BTMW-3	46-58-44.489	-123-35-53.040	22.28	2	30.37	30.08	11.97	18.40	10.74	19.63
BTMW-5	46-58-44.220	-123-35-54.600	24	2	30.70	30.30	14.18	16.52	13.95	16.75
BTMW-6	46-58-45.156	-123-35-54.600	24	2	34.44	34.04	12.64	21.80	12.18	22.26
KBMW-1	46-58-45.2164	-123-36-04.770	21.97	2	39.72	39.37	17.62	22.10	15.82	23.90
KBMW-2	46-58-44.7979	-123-36-04.798	20.16	2	38.50	38.17	Product	--	14.35	24.15
KBMW-3	46-58-44.7976	-123-36-03.698	20.17	2	37.68	37.31	16.28	21.40	14.75	22.93
PJMW-4	46-58-41.867	-123-36-04.117	20	4	31.18	30.97	12.01	19.17	11.18	20.00
TSMW-4	46-58-43.186	-123-36-00.973	--	2	--	--	Product	--	Product	--
GSMW-1	46-58-41.866	-123-36-02.078	22.70	2	28.24	27.95	10.02	18.22	9.78	18.46
GSMW-2	46-58-42.094	-123-36-01.187	21.74	2	27.92	27.29	9.89	18.03	9.67	18.25
GSMW-3	46-58-41.248	-123-36-00.713	17.73	2	23.03	22.60	5.70	17.33	5.89	17.14
MCSMW-31	46-58-41.127	-123-35-59.462	12.42	2	21.39	21.17	4.71	16.68	4.91	16.48
MCSMW-32	46-58-41.176	-123-35-59.107	11.87	2	21.89	21.43	5.47	16.42	5.64	16.25
MCSMW-33	46-58-41.342	-123-35-59.344	12.11	2	22.50	22.34	6.08	16.42	6.19	16.31
ESMW-1	46-58-45.9498	-123-36-06.84437	20.08	2	41.51	41.14	16.83	24.68	15.06	26.45
ESMW-2	46-58-42.5028	-123-36-03.7656	19.68	2	32.72	32.32	11.81	20.91	11.28	21.44
ESMW-3	46-58-42.5726	-123-36-00.46377	17.53	2	29.56	29.27	10.25	19.31	9.22	20.34
ESMW-4	46-58-46.4124	-123-35-54.6567	20.09	2	38.02	37.66	13.49	24.53	11.36	26.66
ESMW-5	46-58-40.4508	-123-35-58.0532	14.73	2	21.21	20.85	4.23	16.98	4.70	16.51
ESMW-6	46-58-38.6616	-123-36-03.46933	14.70	2	22.70	22.31	9.31	13.39	9.35	13.35
ESMW-7	46-58-44.2068	-123-36-02.65674	19.53	2	36.45	35.96	15.62	20.83	14.56	21.89
ESMW-8	46-58-43.1724	-123-35-54.4704	15.10	2	25.45	25.20	9.31	16.14	9.52	15.93
EDMW-1	46-58-46.5780	-123-36-07.7976	22.61	2	42.31	41.92	14.67	27.64	13.55	28.76

VERTICAL DATUM: N.A.V.D '88.
HORIZONTAL DATUM: NAD '83/'91.
bls = below land surface.
feet msl = feet relative to mean sea level.

Appendix B. BTEX and TPH-G Results, October 2004 to April 2008

Table B-1. BTEX and TPH-G Results (µg/L), October 2004 to April 2008.

Analyte:	Benzene							
MTCA Cleanup Level:	5 ug/L							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	10 U	10 U	1 U	1 U	**1.1**	**1.4**	1 U	25 U
PJMW-6	1 U	5 U	1 U	1 U	--	--	--	--
PJMW-7	**0.92 J**	1 U	1 U	1 U	--	--	--	--
BTMW-1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-2	**75**	20 U	**48**	**170**	**155 J**	**405 J**	1 U [a]	10 U
BTMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-5	--	--	--	--	1 U	**1.8**	1 U	**1.6**
BTMW-6	--	--	--	--	1 U	**14**	**7**	**14**
KBMW-1	1 U	**2.2**	1 U	**12**	1 U	**48**	1 U	**16**
KBMW-2	--	**338**	**510**	**360**	**360**	**850**	**520**	**274**
KBMW-3	**160**	**118**	**220**	**56**	R	**40**	**86** [a]	**20 J**
TSMW-2	**8500**	--	**8400**	--	**2600**	--	--	--
TSMW-4	--	--	--	--	--	**28,300**	**11,600**	**13,800**
GSMW-1	**5.1**	10 U	**420**	1 U	**51**	1 U	1 U	**11**
GSMW-2	**54**	**140**	**54**	**394**	**140**	**120**	**18**	**51**
GSMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-31	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-32	1 U	1 U	**149**	1 U	1 U	1 U	1 U	1 U
MCSMW-33	**980 J**	**1500**	**294**	1 U	**67**	**3**	**2.2**	1 U
ESMW-1	--	--	--	--	**25**	**49**	**11**	**16**
ESMW-2	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-3	--	--	--	--	**4900**	**8300**	**14,300** [a]	**5000**
ESMW-4	--	--	--	--	1 U	**3.1**	1 U	1 U
ESMW-5	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-6	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-7	--	--	--	--	**640**	**290**	**648** [a]	**789**
ESMW-8	--	--	--	--	1 U	1 U	1 U	1 U
EDMW-1	--	--	--	--	1 U	1 U	1 U	1 U

U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
R – Result has been rejected because duplicate samples did not meet data quality objectives.
-- Not Sampled.
a – Analyzed by GC/MS SW8260.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

Table B-1 (continued).

Analyte:	Toluene							
MTCA Cleanup Level:	1000 ug/L							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	**120**	**65**	**3.5**	**12**	**14**	**28**	**25**	**66 J**
PJMW-6	1 U	**11**	1 U	1 U	--	--	--	--
PJMW-7	1 U	1 U	1 U	1 U	--	--	--	--
BTMW-1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-2	**23**	20 U	**31**	**150**	**200 J**	**880 J**	**180** [a]	**38 J**
BTMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-5	--	--	--	--	1 U	1 U	1 U	1 U
BTMW-6	--	--	--	--	1 U	**18**	**15**	**13 J**
KBMW-1	1 U	1U	1 U	1U	1 U	**1.4**	1 U	1 U
KBMW-2	--	**3320**	**3200**	**2400 E**	**1500 J**	**7900**	**2500**	**2600**
KBMW-3	**82**	**58 J**	**110**	**14**	R	**2.5**	**31** [a]	**3.7 J**
TSMW-2	**13,000 J**	--	**15,400**	--	**4500 E**	--	--	--
TSMW-4	--	--	--	--	--	**91,300**	**29,700**	**50,800 E**
GSMW-1	1 U	10 U	**690**	1 U	**33 J**	1 U	1 U	1 U
GSMW-2	2 U	10 U	1 U	**4.6**	2 U	1 U	1 U	10 U
GSMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-31	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-32	**3.7**	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-33	10 U	50 U	1 U	1 U	**1.9**	1 U	1 U	1 U
ESMW-1	--	--	--	--	**2.1 J**	**70**	**4.7**	**5.7 J**
ESMW-2	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-3	--	--	--	--	**4100**	**9000**	**20,800** [a]	**4100**
ESMW-4	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-5	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-6	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-7	--	--	--	--	**1300 J**	**470**	**1270** [a]	**1000**
ESMW-8	--	--	--	--	1 U	1 U	1 U	1 U
EDMW-1	--	--	--	--	1 U	1 U	1 U	1 U

U – Analyte was not detected at or above the reported value.
E – Concentration of the associated value exceeds the known calibration range.
J – Analyte was positively identified. The associated numerical result is an estimate.
R – Result has been rejected because duplicate samples did not meet data quality objectives.
-- Not Sampled.
a – Analyzed by GC/MS SW8260.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

Table B-1 (continued).

Analyte:	Ethylbenzene							
MTCA Cleanup Level:	700 ug/L							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	**130**	**73**	1 U	**26**	**25**	**58**	**57**	**243**
PJMW-6	**0.78 J**	**45**	**2.8**	**2.1**	--	--	--	--
PJMW-7	**25**	1 U	1 U	1 U	--	--	--	--
BTMW-1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-2	**430**	**58**	**275**	**650**	**955 J**	**1800 J**	**642** [a]	**57**
BTMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-5	--	--	--	--	1 U	1 U	1 U	**1.3**
BTMW-6	--	--	--	--	**1.6**	**280**	**33**	**404**
KBMW-1	1 U	**0.82 J**	1 U	1U	1 U	**3.1**	1 U	1 U
KBMW-2	--	**654**	**610**	**460**	**430**	**1900**	**700**	**540**
KBMW-3	**430**	**331**	**700**	**75**	R	**4.5**	**355** [a]	**9.1 J**
TSMW-2	**1300**	--	**1500**	--	**2400**	--	--	--
TSMW-4	--	--	--	--	--	**10,000**	**4500**	**5600**
GSMW-1	**1.3**	**91**	**370**	**6.3**	**37**	1 U	**1.4**	**9.7**
GSMW-2	2 U	**15**	1 U	**33**	2 U	**34**	1 U	**22**
GSMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-31	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-32	1 U	1 U	**1.1**	1 U	1 U	1 U	1 U	1 U
MCSMW-33	10 U	**56**	1 U	1 U	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	**8.6**	**110**	**20**	**59**
ESMW-2	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-3	--	--	--	--	**1700**	**950**	**2580** [a]	**904**
ESMW-4	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-5	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-6	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-7	--	--	--	--	**1100**	**410**	**1150** [a]	**1400**
ESMW-8	--	--	--	--	1 U	1 U	1 U	1 U
EDMW-1	--	--	--	--	1 U	1 U	1 U	1 U

U - Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
R – Result has been rejected because duplicate samples did not meet data quality objectives.
-- Not Sampled.
a – Analyzed by GC/MS SW8260.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA Cleanup Levels.

Table B-1 (continued).

Analyte:	m- & p-Xylene							
MTCA Cleanup Level:	1000 ug/L (total xylene)							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	**550**	**340**	**33**	**151**	**62 E**	**280**	**9.9**	**1100**
PJMW-6	**1.9 J**	**100**	**3**	2 U	--	--	--	--
PJMW-7	**11**	2 U	2 U	2 U	--	--	--	--
BTMW-1	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BTMW-2	**1280**	**300**	**905**	**2000 E**	**2450 J**	**7650 J**	**3190** [a]	**322**
BTMW-3	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BTMW-5	--	--	--	--	2 U	2 U	2 U	2 U
BTMW-6	--	--	--	--	**5.2**	**380**	2 U	**391**
KBMW-1	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
KBMW-2	--	**2290**	**1900**	**1300**	**1200**	**6800**	**2300**	**1900**
KBMW-3	**700 J**	**354**	**1400**	**68**	R	**2.1**	**552** [a]	**7.9 J**
TSMW-2	**5300**	--	**5900**	--	**1700**	--	--	--
TSMW-4	--	--	--	--	--	**37,500**	**10,200**	**21,900**
GSMW-1	**9.6**	**180**	**930**	**11**	**39**	2 U	**2.9**	**59**
GSMW-2	4 U	20 U	2 U	**23**	4 U	**63**	2 U	**22**
GSMW-3	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
MCSMW-31	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
MCSMW-32	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
MCSMW-33	20 U	100U	2 U	**2.2**	2 U	2 U	2 U	2 U
ESMW-1	--	--	--	--	2 U	**360**	**10**	**33**
ESMW-2	--	--	--	--	2 U	2 U	2 U	2 U
ESMW-3	--	--	--	--	**1700**	**2900**	**7410** [a]	**2900**
ESMW-4	--	--	--	--	2 U	2 U	2 U	2 U
ESMW-5	--	--	--	--	2 U	2 U	2 U	2 U
ESMW-6	--	--	--	--	2 U	2 U	2 U	2 U
ESMW-7	--	--	--	--	**2200**	**1100**	**3240** [a]	**3100**
ESMW-8	--	--	--	--	2 U	2 U	2 U	2 U
EDMW-1	--	--	--	--	2 U	2 U	2 U	2 U

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E – Concentration of the associated value exceeds the known calibration range.
J – Analyte was positively identified. The associated numerical result is an estimate.
R – Result has been rejected because duplicate samples did not meet data quality objectives.
-- Not Sampled.
a – Analyzed by GC/MS SW8260.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.

Table B-1 (continued).

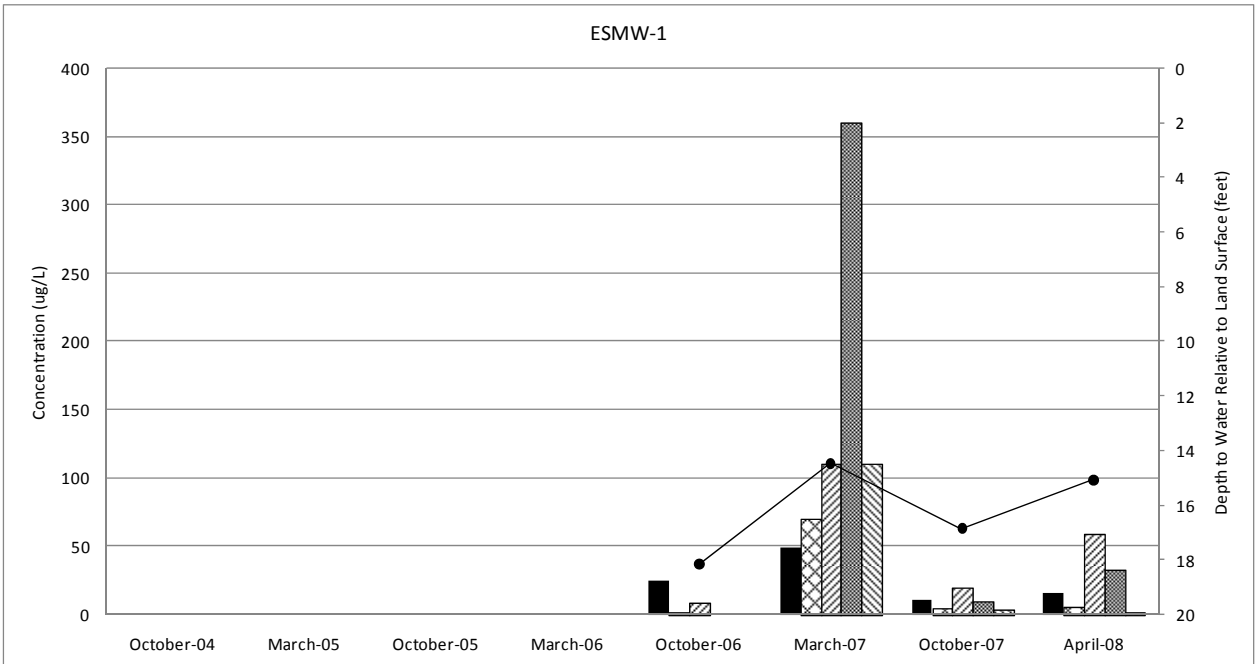
Analyte:	o-Xylene							
MTCA Cleanup Level:	1000 ug/L (total xylene)							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	**210**	**130**	**33**	**28**	**37 E**	**110**	**11**	**383**
PJMW-6	1 U	**38**	**1.6**	1 U	--	--	--	--
PJMW-7	1 U	1 U	1 U	1 U	--	--	--	--
BTMW-1	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-2	**310**	**160**	**330**	**770E**	**985 J**	**3500J**	**1380** [a]	**166**
BTMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
BTMW-5	--	--	--	--	1 U	1 U	**1.7**	1 U
BTMW-6	--	--	--	--	1 U	10 U	**2.9**	10 U
KBMW-1	1 U	1U	1 U	1U	1 U	**1.3**	1 U	1 U
KBMW-2	--	**977**	**910**	**660**	**550**	**3300**	**930**	**900**
KBMW-3	**280**	**218**	**570**	**64**	R	**8**	**210** [a]	**14 J**
TSMW-2	**2000**	--	**2400**	--	**1900 E**	--	--	--
TSMW-4	--	--	--	--	--	**15,200**	**3900**	**8400**
GSMW-1	1 U	**120**	**420**	**9.1**	**32 J**	1 U	1 U	1 U
GSMW-2	2 U	10 U	1 U	**11**	**26**	**5.5**	1 U	10 U
GSMW-3	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-31	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-32	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MCSMW-33	10 U	50 U	1 U	**1.1**	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	1 U	**110**	**3.6**	**1.9**
ESMW-2	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-3	--	--	--	--	**1400**	**1100**	**2600** [a]	**738**
ESMW-4	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-5	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-6	--	--	--	--	1 U	1 U	1 U	1 U
ESMW-7	--	--	--	--	**1000**	**470**	**1170** [a]	**1100**
ESMW-8	--	--	--	--	1 U	1 U	1 U	1 U
EDMW-1	--	--	--	--	1 U	1 U	1 U	1 U

U - Analyte was not detected at or above the reported value.
E – Concentration of the associated value exceeds the known calibration range.
J – Analyte was positively identified. The associated numerical result is an estimate.
R – Result has been rejected because duplicate samples did not meet data quality objectives.
-- Not Sampled.
a – Analyzed by GC/MS SW8260.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA Cleanup Levels

Table B-1 (continued).

Analyte:	WTPH-G							
MTCA Cleanup Level:	800 (1000*) ug/L							
Date:	10/04	3/05	10/05	3/06	10/06	3/07	10/07	4/08
PJMW-4	**4200**	**3300**	**340**	**800**	**770**	**2000**	**2200**	**6700**
PJMW-6	140 U	**1100**	140 U	140 U	--	--	--	--
PJMW-7	**650**	**310**	140 U	140 U	--	--	--	--
BTMW-1	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
BTMW-2	**14,000**	**1,500J**	**11,000**	**15,000**	**32,500 J**	**81,000 J**	**29,000 E**	**3900**
BTMW-3	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
BTMW-5	--	--	--	--	140 U	140 U	140 U	140 U
BTMW-6	--	--	--	--	140 U	**3700**	**2300**	**3900**
KBMW-1	140 U	140 U	140 U	**240**	140 U	**560**	140 U	**140**
KBMW-2	--	**56,000**	**26,000**	**15,000**	**19,000**	**74,000**	**46,000 E**	**19,000**
KBMW-3	**12,000**	**4700**	**17,000**	**3000**	**16,000**	**1200**	**6900 E**	**1100**
TSMW-2	**81,000**	--	**78,000**	--	**140,000E**		--	--
TSMW-4	--	--	--	--	--	**490,000**	**226,000**	**236,000**
GSMW-1	**110 J**	**2200**	**7700**	**200**	**550**	140 U	140 U	**480**
GSMW-2	140 U	**170**	140 U	**340**	280 U	**390 J**	140 U	**230**
GSMW-3	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
MCSMW-31	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
MCSMW-32	140 U	140 U	140 U	140 U	140 U	140 U	140 U	140 U
MCSMW-33	**220**	**730**	**160**	140 U	**250**	140 U	140 U	**160**
ESMW-1	--	--	--	--	140 U	**9300**	**550**	**1700**
ESMW-2	--	--	--	--	140 U	140 U	140 U	140 U
ESMW-3	--	--	--	--	**86,000**	**43,000**	**83,000 E**	**25,000**
ESMW-4	--	--	--	--	140 U	140 U	140 U	140 U
ESMW-5	--	--	--	--	140 U	140 U	140 U	140 U
ESMW-6	--	--	--	--	140 U	140 U	140 U	140 U
ESMW-7	--	--	--	--	**21,000**	**7100**	**20,000 E**	**26,000**
ESMW-8	--	--	--	--	140 U	140 U	140 U	140 U
EDMW-1	--	--	--	--	140 U	140 U	140 U	140 U

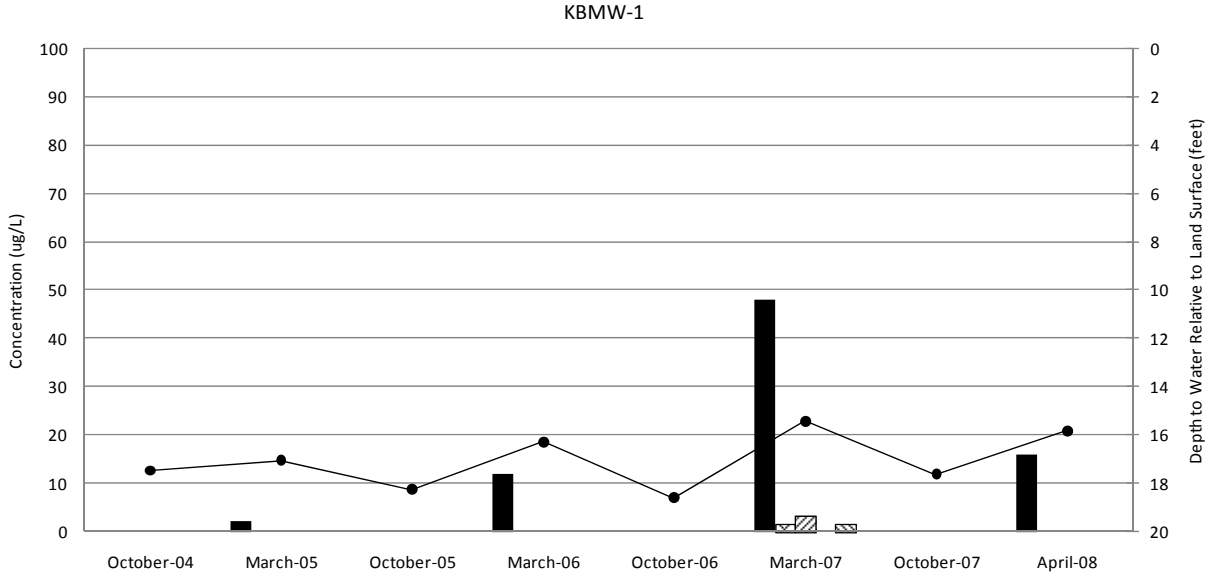
* MTCA Method A cleanup level for TPH-G is 1000 ug/L if benzene is not detectable in groundwater.
U – Analyte was not detected at or above the reported value.
J – Analyte was positively identified. The associated numerical result is an estimate.
E – Concentration of the associated value exceeds the known calibration range.
-- Not Sampled.
Bold – Analyte was detected.
Underline – Free-phase petroleum product was present.
Shade – Values are greater than MTCA cleanup levels.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene					25	49	11	16
Toluene					2.1	70	4.7	5.7
Ethylbenzene					8.6	110	20	59
m-&p-Xylene					0	360	10	33
o-Xylene					0	110	3.6	1.9
DTW					18.15	14.45	16.83	15.06

0 - Analyte was not detected at or above the laboratory reporting value.
Blank - not sampled.

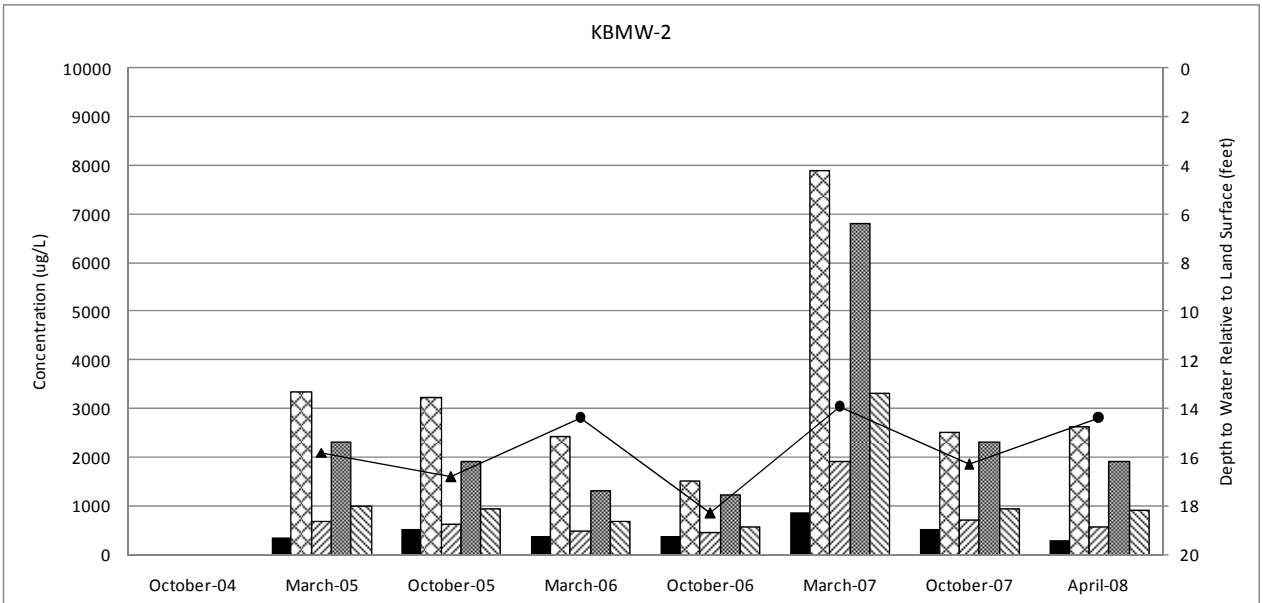
Figure B-1. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well ESMW-1, October 2006 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	0	2.2	0	12	0	48	0	16
Toluene	0	0	0	0	0	1.4	0	0
Ethylbenzene	0	0	0	0	0	3.1	0	0
m-&p-Xylene	0	0	0	0	0	0	0	0
o-Xylene	0	0	0	0	0	1.3	0	0
DTW	17.48	17.05	18.25	16.29	18.61	15.42	17.62	15.82

0 - Analyte was not detected at or above the laboratory reporting value.

Figure B-2. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well KBMW-1, October 2004 to April 2008.



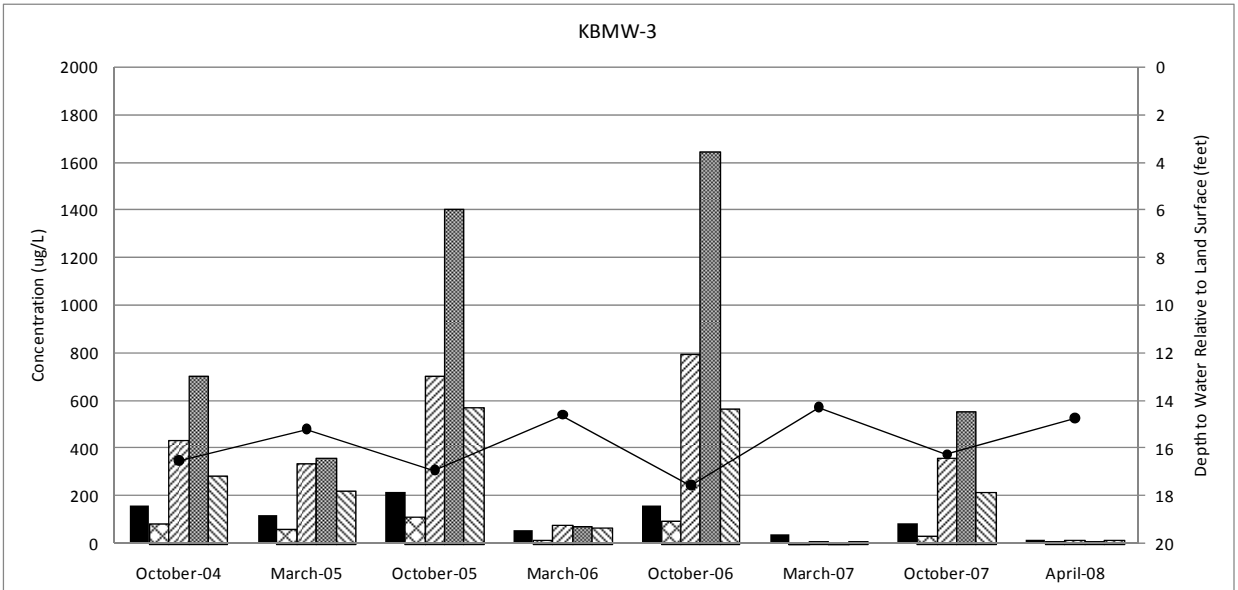
	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	0	338	510	360	360	850	520	274
Toluene	0	3,320	3200	2400	1500	7900	2500	2600
Ethylbenzene	0	654	610	460	430	1900	700	540
m-&p-Xylene	0	2290	1900	1300	1200	6800	2300	1900
o-Xylene	0	977	910	660	550	3300	930	900
DTW		15.8	16.80	14.37	18.3	13.9	16.3	14.35

0 – Not sampled.

Blank - not sampled.

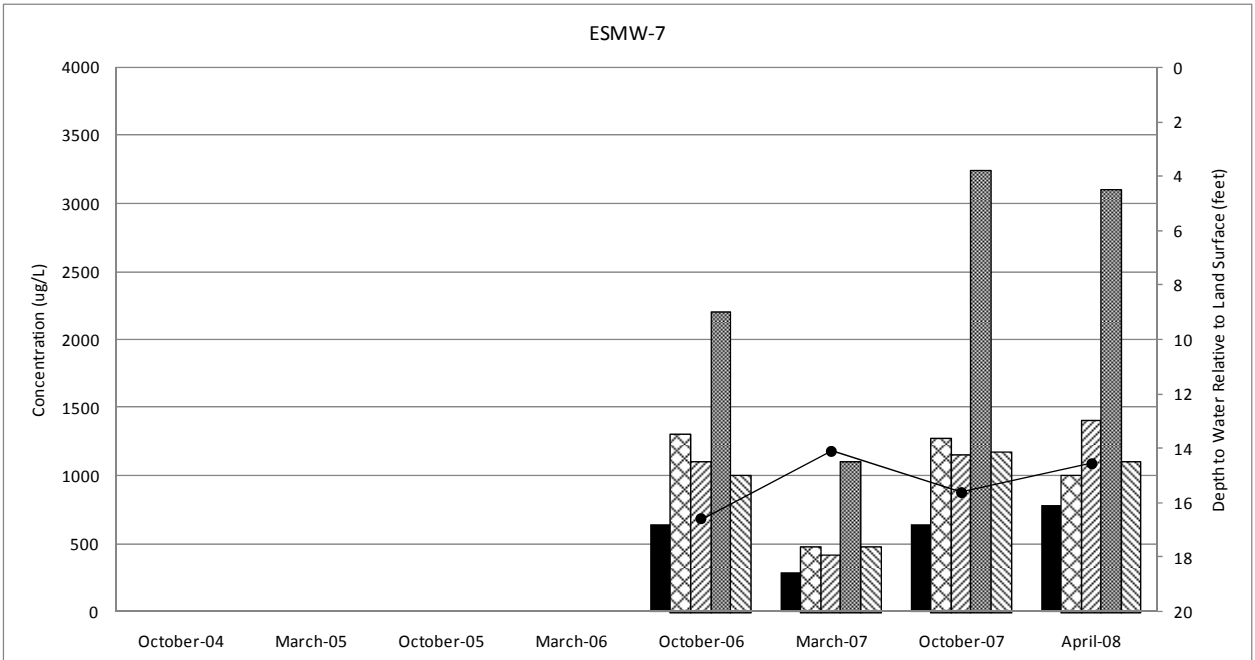
▲ - Free-phase petroleum product present. Depth-to-water is estimated.

Figure B-3. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well KBMW-2, March 2005 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	160	118	220	56	159	40	86	20
Toluene	82	58	110	14	92	2.5	31	3.7
Ethylbenzene	430	331	700	75	792	4.5	355	9.1
m-&p-Xylene	700	354	1400	68	1640	2.1	552	7.9
o-Xylene	280	218	570	64	565	8	210	14
DTW	16.55	15.2	16.94	14.61	17.58	14.29	16.28	14.75

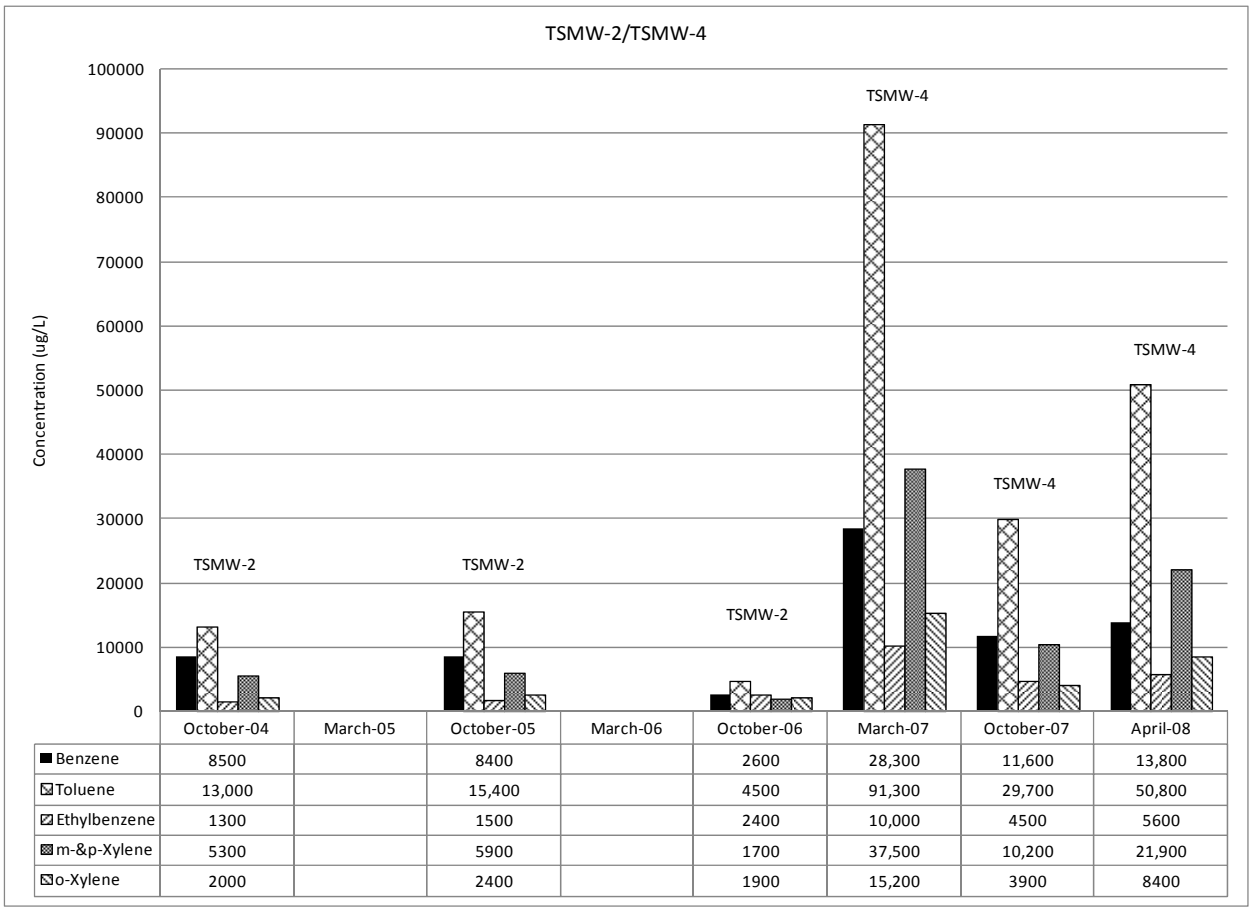
Figure B-4. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well KBMW-3, October 2004 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene					640	290	648	789
Toluene					1300	470	1270	1000
Ethylbenzene					1100	410	1150	1400
m-&p-Xylene					2200	1100	3240	3100
o-Xylene					1000	470	1170	1100
DTW					16.61	14.09	15.62	14.56

Blank - not sampled.

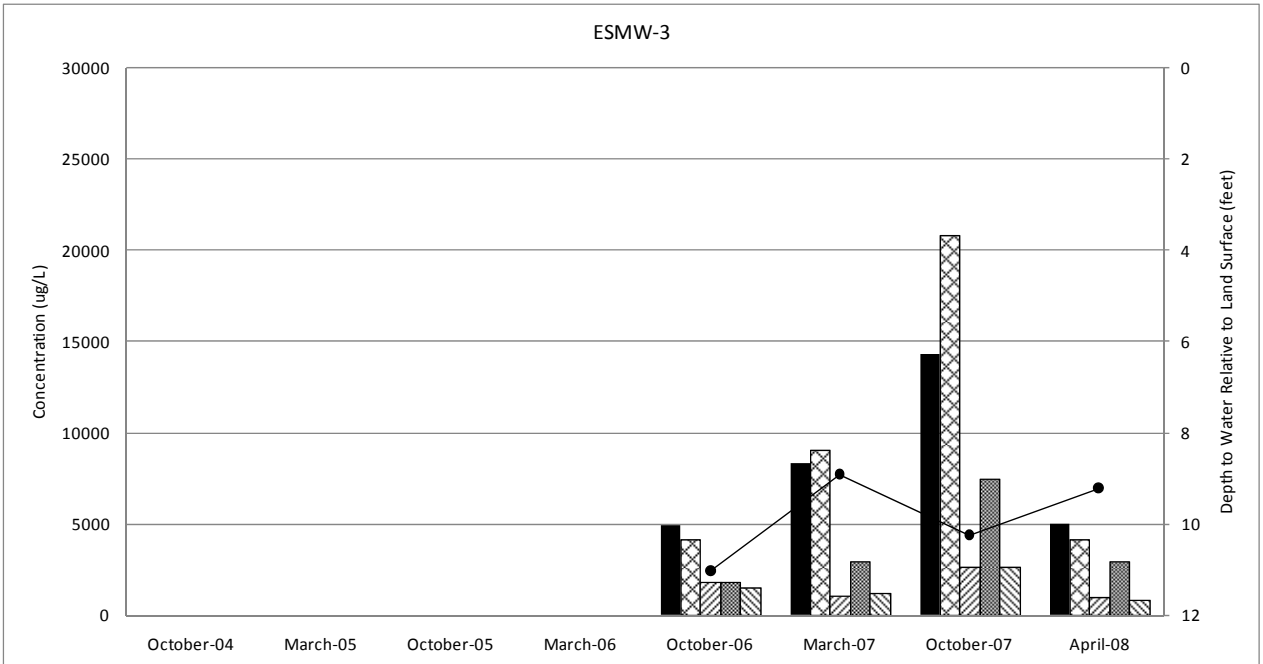
Figure B-5. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well ESMW-7, October 2006 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	8500		8400		2600	28,300	11,600	13,800
Toluene	13,000		15,400		4500	91,300	29,700	50,800
Ethylbenzene	1300		1500		2400	10,000	4500	5600
m-&p-Xylene	5300		5900		1700	37,500	10,200	21,900
o-Xylene	2000		2400		1900	15,200	3900	8400

Blank - not sampled.

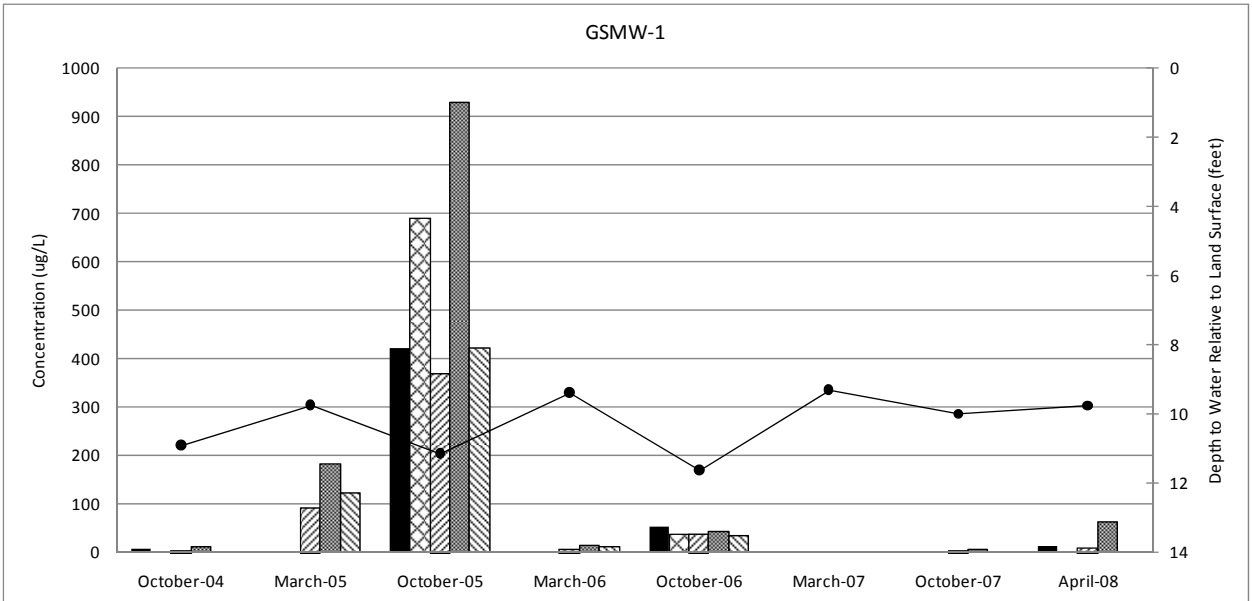
Figure B-6. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Wells TSMW-2/ TSMW-4, October 2004 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene					4900	8300	14,300	5000
Toluene					4100	9000	20,800	4100
Ethylbenzene					1700	950	2580	904
m-&p-Xylene					1700	2900	7410	2900
o-Xylene					1400	1100	2600	738
DTW					11.03	8.92	10.25	9.22

Blank - not sampled.

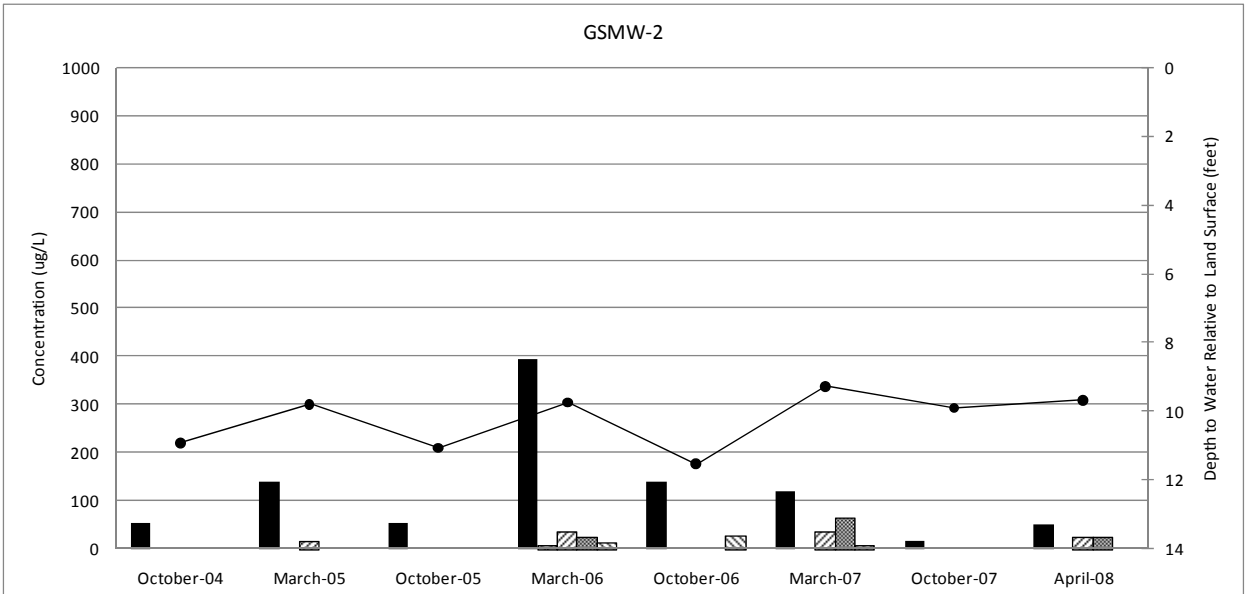
Figure B-7. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well ESMW-3, October 2006 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	5.1	0	420	0	51	0	0	11
Toluene	0	0	690	0	33	0	0	0
Ethylbenzene	1.3	91	370	6.3	37	0	1.4	9.7
m-&p-Xylene	9.6	180	930	11	39	0	2.9	59
o-Xylene	0	120	420	9.1	32	0	0	0
DTW	10.93	9.76	11.17	9.41	11.64	9.32	10.02	9.78

0 - Analyte was not detected at or above the laboratory reporting value.

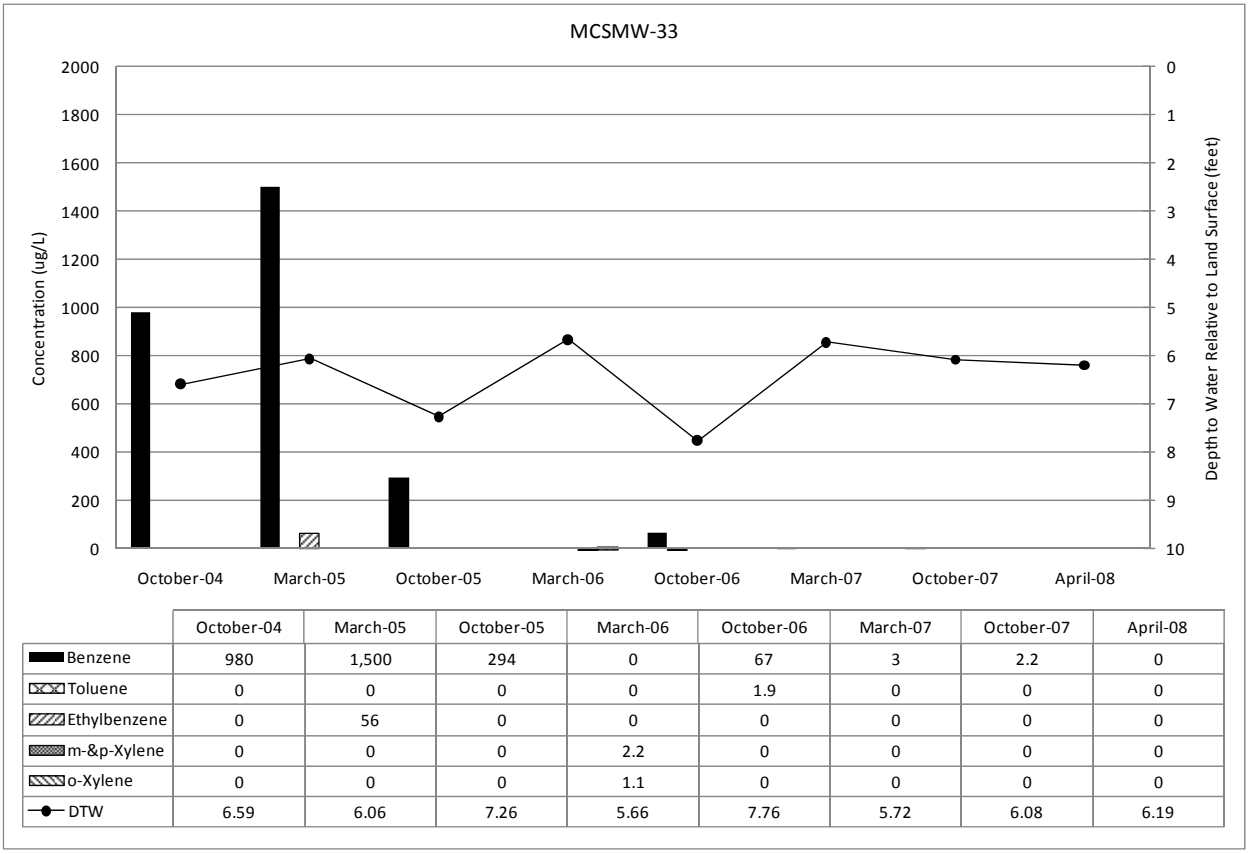
Figure B-8. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well GSMW-1, October 2004 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	54	140	54	394	140	120	18	51
Toluene	0	0	0	4.6	0	0	0	0
Ethylbenzene	0	15	0	33	0	34	0	22
m-&p-Xylene	0	0	0	23	0	63	0	22
o-Xylene	0	0	0	11	26	5.5	0	0
DTW	10.92	9.79	11.06	9.73	11.54	9.26	9.89	9.67

0 - Analyte was not detected at or above the laboratory reporting value.

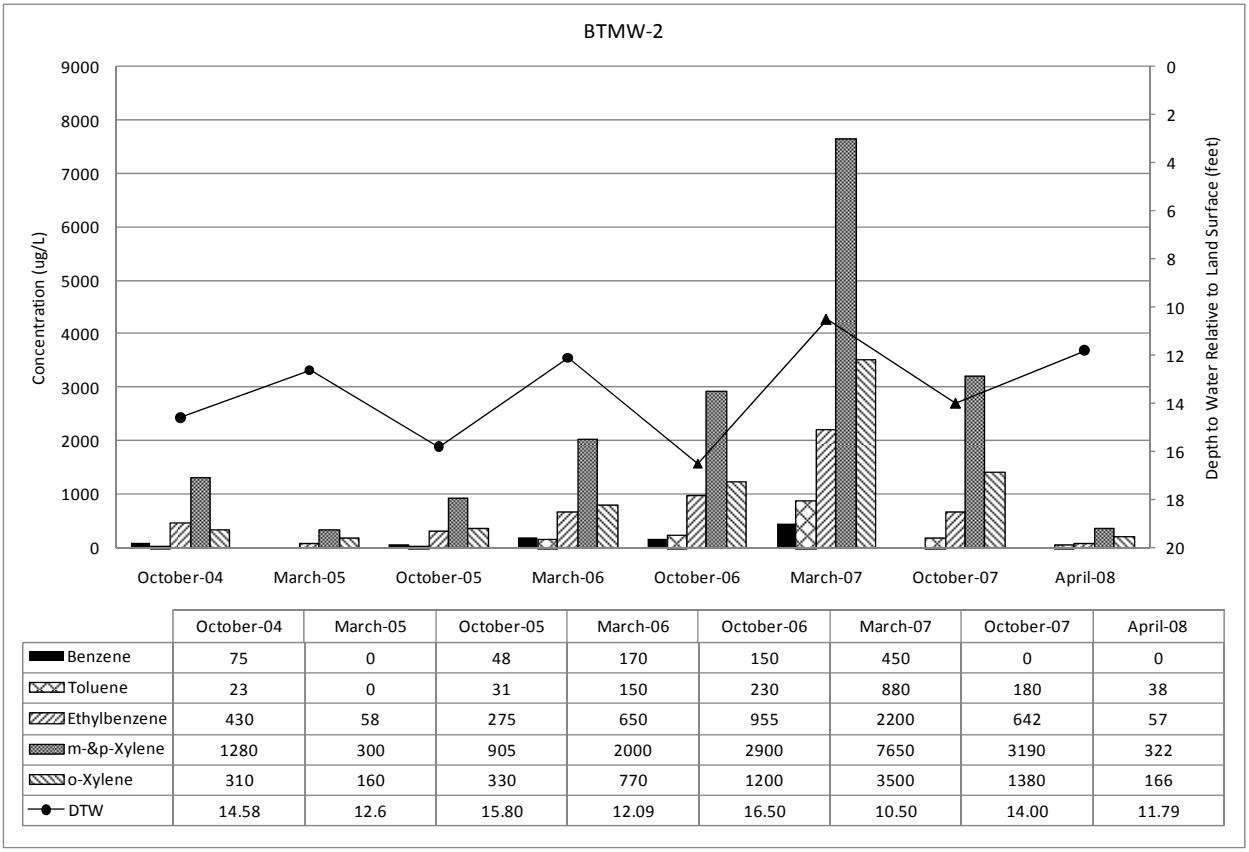
Figure B-9. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well GSMW-2, October 2004 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	980	1,500	294	0	67	3	2.2	0
Toluene	0	0	0	0	1.9	0	0	0
Ethylbenzene	0	56	0	0	0	0	0	0
m-&p-Xylene	0	0	0	2.2	0	0	0	0
o-Xylene	0	0	0	1.1	0	0	0	0
DTW	6.59	6.06	7.26	5.66	7.76	5.72	6.08	6.19

0 - Analyte was not detected at or above the laboratory reporting value.

Figure B-10. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well MCSMW-33, October 2004 to April 2008.

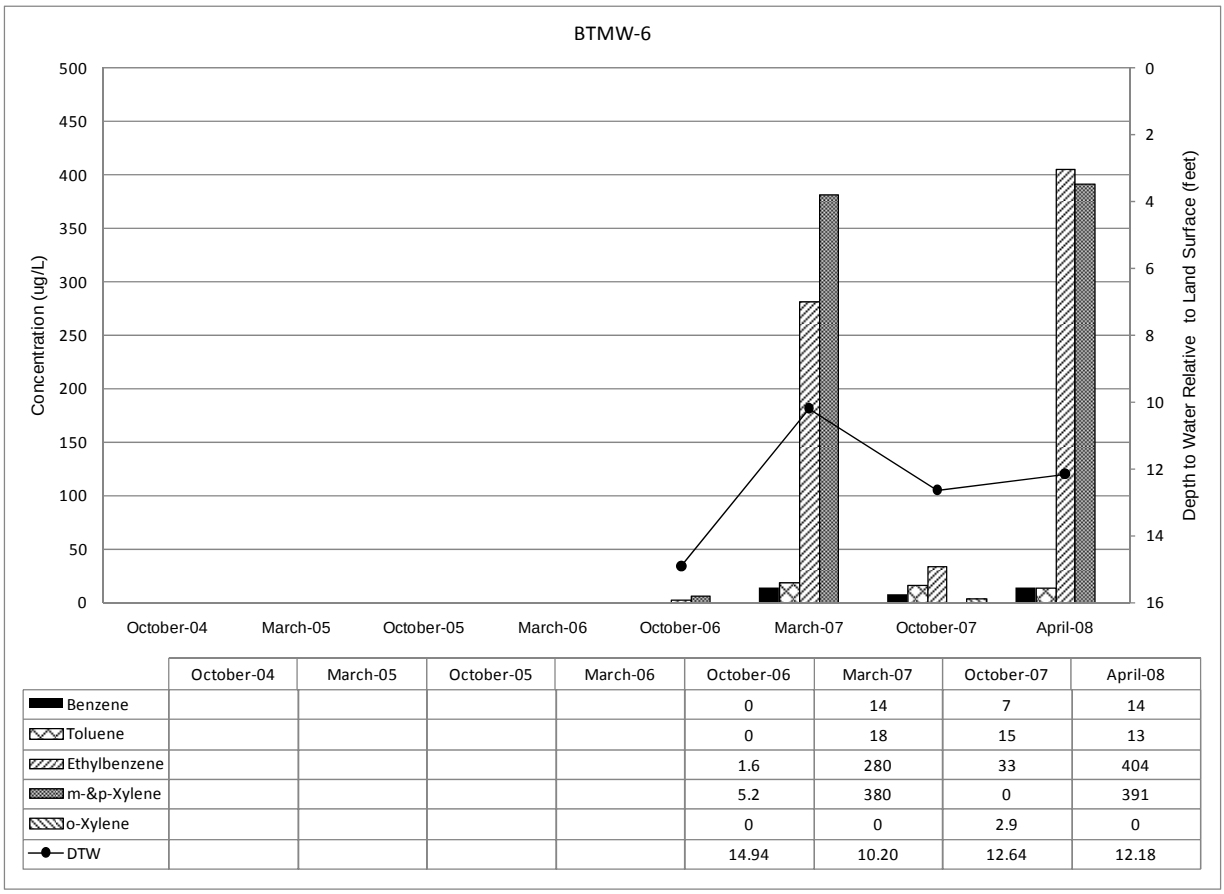


	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	75	0	48	170	150	450	0	0
Toluene	23	0	31	150	230	880	180	38
Ethylbenzene	430	58	275	650	955	2200	642	57
m-&p-Xylene	1280	300	905	2000	2900	7650	3190	322
o-Xylene	310	160	330	770	1200	3500	1380	166
DTW	14.58	12.6	15.80	12.09	16.50	10.50	14.00	11.79

0 - Analyte was not detected at or above the laboratory reporting value.

▲ - Free-phase petroleum product present. Depth-to-water is estimated.

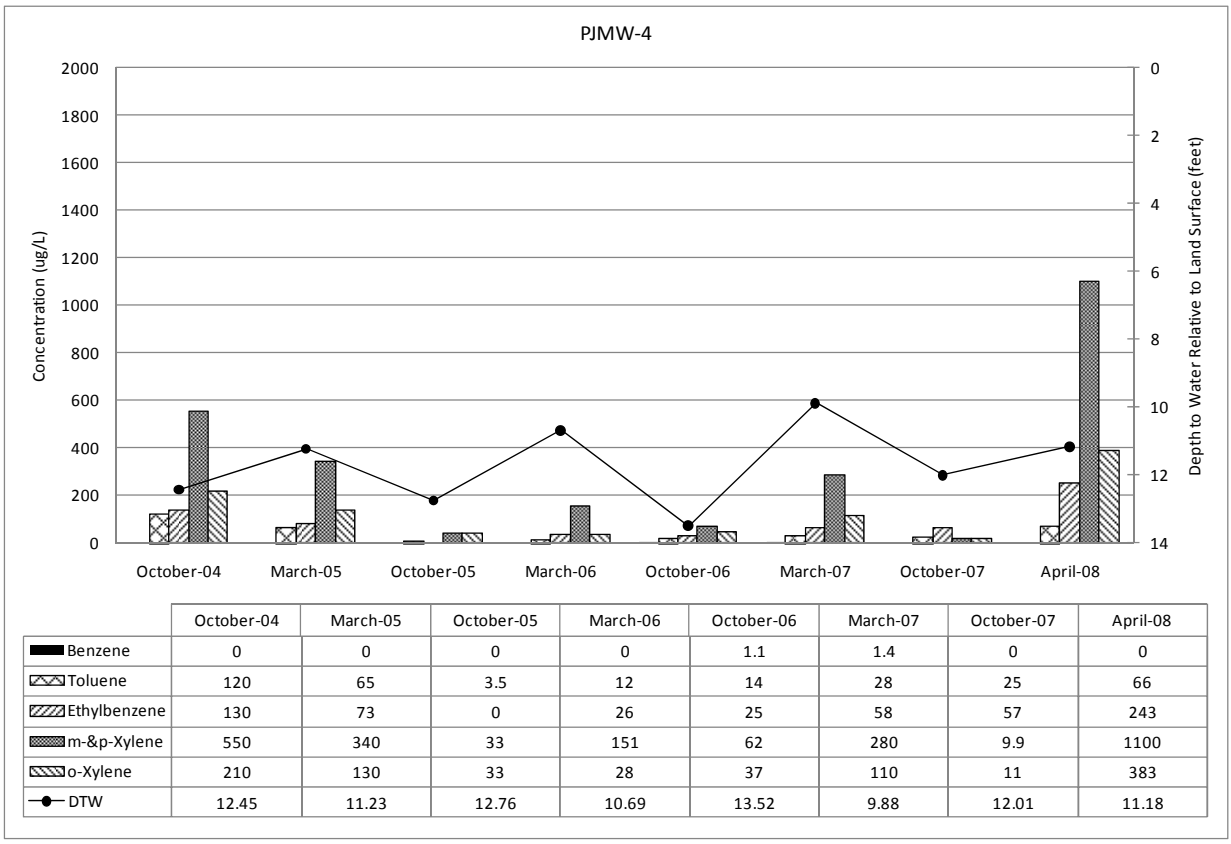
Figure B-11. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well BTMW-2, October 2004 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene					0	14	7	14
Toluene					0	18	15	13
Ethylbenzene					1.6	280	33	404
m-&p-Xylene					5.2	380	0	391
o-Xylene					0	0	2.9	0
DTW					14.94	10.20	12.64	12.18

0 - Analyte was not detected at or above the laboratory reporting value.
Blank - not sampled.

Figure B-12. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well BTMW-6, October 2006 to April 2008.



	October-04	March-05	October-05	March-06	October-06	March-07	October-07	April-08
Benzene	0	0	0	0	1.1	1.4	0	0
Toluene	120	65	3.5	12	14	28	25	66
Ethylbenzene	130	73	0	26	25	58	57	243
m-&p-Xylene	550	340	33	151	62	280	9.9	1100
o-Xylene	210	130	33	28	37	110	11	383
DTW	12.45	11.23	12.76	10.69	13.52	9.88	12.01	11.18

0 - Analyte was not detected at or above the laboratory reporting value.

Figure B-13. BTEX Results (ug/L) and Depth-to-Water Measurements (feet) for Well PJMW-4, October 2004 to April 2008.

Appendix C. VOC Results, March 2005 to April 2008

Table C-1. VOC Results (µg/L), March 2005 to April 2008.

Analyte:	Tetrachloroethene						
MTCA Method A Cleanup Level:	5 ug/L						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	2 U	**0.34 J**	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	2 U	1 U
KBMW-1	**0.69 J**	2 U	**8.7**	1 U	**14 J**	2 U	**9**
KBMW-2	**8.1 J**	**9.2 J**	**8.1**	--	20 U	--	--
KBMW-3	1 UJ	20 UJ	1 U	1 U	1 U	20 U	1 U
TSMW-2	--	40 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	**1 J**	**0.51 J**	**1.2**	**0.62 J**	**1.5 J**	**0.34 J**
GSMW-2	--	**1 J**	**1.2**	**2**	**1 J**	**1.5 J**	**0.35 J**
ESMW-1	--	--	--	--	2 U	2 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	200 U	1 U
ESMW-7	--	--	--	--	20 U	200 U	1 U
BF-1	--	--	--	--	1 U	2 U	1 U
BF-5	--	--	--	--	--	2 U	1 U
BF-9	--	--	--	--	5 U	2 U	1 U
BF-12	--	--	--	--	10 U	2 U	1 U

Analyte:	Trichloroethene						
MTCA Method A Cleanup Level:	5 ug/L						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	2 U	1 U	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	1 U	1 U
KBMW-1	1 U	2 U	**0.44 J**	1 U	2 U	1 U	1 U
KBMW-2	1 UJ	40 UJ	1 U	--	20 U	--	--
KBMW-3	1 UJ	20 UJ	**4**	**1.7**	1 U	10 U	**1.3**
TSMW-2	--	40 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	40 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	4 U	**0.26 J**	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	2 U	1 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	**1.4**
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

U – Analyte was not detected at or above the reported value.
UJ – Analyte was not detected at or above the approximate reported quantitation limit.
J – Analyte was positively identified. The associated numerical result is an estimate.
-- Not Sampled.
Bold – Analyte was detected.
Shade – Values are greater than MTCA cleanup levels.

Table C-1 (continued).

Analyte:	Cis-1,2-Dichloroethene						
MTCA Method A Cleanup Level:	70 ug/L						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	2 U	1 U	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	1 U	1 U
KBMW-1	1 U	2 U	1 U	1 U	2 U	1 U	1 U
KBMW-2	1 UJ	40 UJ	1 U	--	20 U	--	--
KBMW-3	**4.2 J**	**8 J**	**3.4**	**5.8**	**5.9**	**5.8 J**	**5.6**
TSMW-2	--	40 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	40 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	4 UJ	1 U	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	2 U	1 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	**1.4**
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

Analyte:	1,2-Dichloroethane						
MTCA Method A Cleanup Level:	5 ug/L						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	2 U	1 U	1 U	5 U	--	--
BTMW-6	--	--	--	1 U	**1.6 J**	1 U	1 U
KBMW-1	**0.99 J**	**1.1 J**	**0.92 J**	**0.87 J**	**2.3 J**	**0.66 J**	**0.73 J**
KBMW-2	**3.5 J**	40 UJ	**2.7**	--	20 U	--	--
KBMW-3	**1.4 J**	20 UJ	**1.2**	**2.3**	**0.98 J**	10 U	1 U
TSMW-2	--	40 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	40 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	4 UJ	1 U	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	5 U	1 U	1 U
ESMW-2	--	--	--	--	5 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	**2**
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

U – Analyte was not detected at or above the reported value.
UJ – Analyte was not detected at or above the approximate reported quantitation limit.
J – Analyte was positively identified. The associated numerical result is an estimate.
-- Not Sampled.
Bold – Analyte was detected.

Table C-1 (continued).

Analyte:	1,1,1-Trichloroethane						
MTCA Method A Cleanup Level:	200 ug/L						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	5 U	1 U	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	1 U	1 U
KBMW-1	1 U	5 U	1 U	1 U	2 U	1 U	1 U
KBMW-2	1 UJ	100 UJ	1 U	--	20 U	--	--
KBMW-3	1 UJ	50 UJ	1 U	1 U	1 U	10 U	1 U
TSMW-2	--	100 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	100 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	10 U	**0.38 J**	1 U	**0.45 J**	1 U	1 U
ESMW-1	--	--	--	--	2 U	1 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	1 U
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

Analyte:	1,1-Dichloroethane						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	1 U	1 U	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	1 U	1 U
KBMW-1	1 U	1 U	1 U	1 U	2 U	1 U	1 U
KBMW-2	1 UJ	20 UJ	1 U	--	20 U	--	--
KBMW-3	1 UJ	10 U	1 U	1 U	1 U	10 U	1 U
TSMW-2	--	20 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	20 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	2 UJ	**0.37 J**	**0.48 J**	**0.46 J**	1 U	**0.51 J**
ESMW-1	--	--	--	--	2 U	1 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	1 U
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

U – Analyte was not detected at or above the reported value.
UJ – Analyte was not detected at or above the approximate reported quantitation limit.
J – Analyte was positively identified. The associated numerical result is an estimate.
-- Not Sampled.
Bold – Analyte was detected.

Table C-1 (continued).

Analyte:	Trans-1,2-Dichloroethene						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	1 U	1 U	1 U	2 U	--	--
BTMW-6	--	--	--	1 U	2 U	1 U	1 U
KBMW-1	1 U	1 U	1 U	1 U	2 U	1 U	1 U
KBMW-2	1 UJ	20 UJ	1 U	--	20 U	--	--
KBMW-3	0.33 UJ	10 U	**0.50 J**	**0.69 NJ**	**0.42 J**	10 U	1 U
TSMW-2	--	20 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	1000 U	--	--
GSMW-1	--	20 U	1 U	1 U	1 U	1 U	1 U
GSMW-2	--	2 UJ	1 U	1 U	1 U	1 U	1 U
ESMW-1	--	--	--	--	2 U	1 U	1 U
ESMW-2	--	--	--	--	2 U	--	--
ESMW-3	--	--	--	--	20 U	100 U	1 U
ESMW-7	--	--	--	--	20 U	100 U	1 U
BF-1	--	--	--	--	1 U	1 U	1 U
BF-5	--	--	--	--	--	1 U	1 U
BF-9	--	--	--	--	5 U	1 U	1 U
BF-12	--	--	--	--	10 U	1 U	1 U

Analyte:	4-Methyl-2-Pentanone						
Date:	3/05	10/05	3/06	10/06	**3/07**	10/07	4/08
BTMW-3	--	10 U	2 U	2 U	4 U	--	--
BTMW-6	--	--	--	2 U	4 U	2 U	1 U
KBMW-1	2 U	10 U	**0.73 J**	2 U	4 UJ	2 U	1 U
KBMW-2	2 UJ	200 UJ	**11**	--	**20 J**	--	--
KBMW-3	**3.6 J**	100 UJ	**0.57 J**	**2.1**	2 U	20 U	1 U
TSMW-2	--	200 UJ	--	--	--	--	--
TSMW-4	--	--	--	--	2000 U	--	--
GSMW-1	--	200 U	2 U	2 U	2 U	2 U	1 U
GSMW-2	--	20 UJ	2 U	2 U	2 U	2 U	1 U
ESMW-1	--	--	--	--	**5**	2 U	1 U
ESMW-2	--	--	--	--	4 U	--	--
ESMW-3	--	--	--	--	40 U	200 U	1 U
ESMW-7	--	--	--	--	40 U	200 U	**4.3**
BF-1	--	--	--	--	2 U	2 U	1 U
BF-5	--	--	--	--	--	2 U	1 U
BF-9	--	--	--	--	10 U	2 U	1 U
BF-12	--	--	--	--	20 U	2 U	1 U

U – Analyte was not detected at or above the reported value.
UJ – Analyte was not detected at or above the approximate reported quantitation limit.
J – Analyte was positively identified. The associated numerical result is an estimate.
NJ – Analyte is tentatively identified. The associate numerical result is an estimate.
-- Not Sampled.
Bold – Analyte was detected.

Table C-1 (continued).

Analyte:	Acetone						
Date:	3/05	10/05	3/06	10/06	3/07	10/07	4/08
BTMW-3	--	4 U	10 U	4 U	4 UJ	--	--
BTMW-6	--	--	--	4 U	4 UJ	4 U	**36 NJ**
KBMW-1	10 U	4 U	**12**	4 U	4 UJ	4 U	**21 NJ**
KBMW-2	**73 J**	80 UJ	10 U	--	200 U	--	--
KBMW-3	**55 J**	40 U	**42**	4 U	10 U	40 U	5 UJ
TSMW-2	--	80 UJ	--	--	--	--	--
TSMW-3	--	--	--	--	10,000 UJ	--	--
GSMW-1	--	80 U	10 U	4 U	10 U	4 U	5 UJ
GSMW-2	--	8 UJ	10 U	4 U	10 U	4 U	5 UJ
ESMW-1	--	--	--	--	4 UJ	4 U	**16 NJ**
ESMW-2	--	--	--	--	4 UJ	--	--
ESMW-3	--	--	--	--	20 UJ	400 U	**73 J**
ESMW-7	--	--	--	--	200 U	400 U	**93 NJ**
BF-1	--	--	--	--	10 U	4 U	5 U
BF-5	--	--	--	--	--	4 U	**9.9 J**
BF-9	--	--	--	--	50 U	4 U	**11 J**
BF-12	--	--	--	--	100 U	4 U	**11 J**

U – Analyte was not detected at or above the reported value.
UJ – Analyte was not detected at or above the approximate reported quantitation limit.
J – Analyte was positively identified. The associated numerical result is an estimate.
NJ – Analyte is tentatively identified. The associate numerical result is an estimate.
-- Not Sampled.
Bold – Analyte was detected.

Appendix D. Acronyms and Abbreviations

BTEX	Benzene, toluene, ethylbenzene, and xylene
DNAPL	Dense non-aqueous phase liquid
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
feet/msl	Feet relative to mean sea level
GC/MS	Gas chromatography – mass spectrometry
LNAPL	Light non-aqueous phase liquid
MTCA	Model Toxic Control Act
PVC	Polyvinyl chloride
RPD	Relative percent difference
SOP	Standard operating procedure
TPH-G	Total petroleum hydrocarbons as gasoline
USGS	U.S. Geological Survey
VOC	Volatile organic compounds