Quality Assurance Project Plan

Montesano Groundwater Investigation of Leaking Underground Storage Tank Sites

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Approvals

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Approved by:	October 22, 2004
Stewart Lombard, EAP Quality Assurance Officer	Date

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Abstract

Several Leaking Underground Storage Tanks (LUST) have created soil and groundwater contamination in the city of Montesano. Currently, there are 11 identified LUST sites in downtown Montesano, with the majority of these being located within a four block area. To determine the current extent of groundwater contamination, samples will be collected in fall 2004 and spring 2005 from approximately 35 existing monitoring wells for benzene, toluene, ethylbenzene and xylene, as well as total petroleum hydrocarbons as gasoline. Water level measurements from the wells will determine groundwater flow directions. This data will be helpful in determining which areas require additional investigation. This information also will be used when working with the local government to mitigate impacts that may be occurring as a result of contaminants from multiple sources creating an area-wide contaminant plume that's potentially impacting utilities and surface water.

Background

The city of Montesano, which is located in Western Washington, used to be a major stopover for tourists and others traveling to the Pacific Coast and Grays Harbor. During the time when the highway passed through the middle of town, numerous gasoline stations were opened to provide fuel to travelers. Later on, the highway was relocated to the outside of Montesano and most of the gasoline dealerships went out of business, some closing shop without removing fuel from their underground storage tanks (USTs). Most of those tanks, along with others that belong to currently-operating stations, have leaked and created soil and groundwater contamination.

Currently, there are 11 identified LUST sites in downtown Montesano, with the majority of the sites being located within a four block area (Appendix). Eight of the sites have monitoring wells which have been installed and sampled between 1991 and 2004. The wells have primarily been sampled for benzene, toluene, ethylbenzene and xylene, as well as total petroleum hydrocarbons as gasoline (TPH-G). Overall, concentrations for TPH-G range from near the detection limit (50 ug/L) to 30,000 ug/L. There are two wells located north of Wynooche Avenue that have been reported to have TPH-G concentrations of 79,000 ug/L and 192,000 ug/L. The Model Toxic Control Act (MTCA) cleanup level for TPH-G in groundwater is 800 ug/L. Wells with the highest contaminant concentrations are located near the intersection of Main Street and Wynooche Avenue. Table 1 lists the most recent analytical results available for these individual projects. However, the quality of this data is unknown since these studies were done without Ecology oversight.

There is concern that the old sanitary sewer may be providing preferential pathways for the contaminants to migrate away from their source areas. After it was determined that the old sanitary sewer system had deteriorated beyond repair, it was replaced in the late 1980s with a new pressurized *Step System* under a grant provided by Ecology. Both the abandoned sanitary system, which has remained in place, and the city's storm water system empty into nearby surface waterbodies.

Table 1: City of Montesano Groundwater Results

Site Name	Address	Date of Last Sampling	Well #	Benzene (ug/L)	Toluene (ug/L)	Ethyl-benzene (ug/L)	Xylene (ug/L)	WTPH-G (ug/L)
MTCA Method A Cleanup Level				5	1000	700	1000	800*
Grays Harbor County Shops	310 Spruce Ave.		MW-1	Data is not available.				
Jackpot Station 392	501 W. Pioneer	Apr-04	MW-1	1 U	1 U	1 U	3 U	50 U
(Time Oil)		Apr-04	MW-2	1 U	1 U	**2**	**5**	**88**
		Apr-04	MW-4S	**18**	1 U	**14**	**6**	**1600**
		Apr-04	MW-4D	**12**	1 U	1 U	3 U	50 U
		Apr-04	MW-5	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-6	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-7	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-8	1 U	1 U	1 U	3 U	50 U
		Apr-04	RW-3	**12**	1 U	**32**	**54**	**870**
Key Bank	301 S. Main		MW-1					
(Sterling Savings Bank)			MW-2	Data is not available.				
			MW-3					
Tony's Short Stop	326 S. Main	Jul-98	MW-1	**21,750**	**23,425**	**2,650**	**15,500**	**192,250**
		Jul-98	MW-2	**11,200**	**10,300**	**780**	**4,580**	**79,600**
Grays Harbor Grange Supply	412 S. Main	Jan-04	MW-1	1 U	1 U	1 U	1 U	100 U
(Monte Farm & Home)		Jan-04	MW-2	**1000**	**6.9**	1 U	**170**	**2700**
		Jan-04	MW-3	**3.3**	1 U	1 U	1 U	**270**
City of Montesano City Shop	201 S. River		MW-31					
			MW-32	Data is not available.				
			MW-33					
Brumfield-Twidwell	301 E. Pioneer	Dec-02	MW-1	1 U	**4.1**	1 U	1 U	ND
		Dec-02	MW-2	**35**	**170**	**430**	**2,400**	**30,000**
		Dec-02	MW-3	1 U	1 U	1 U	1 U	ND
		Dec-02	MW-4	1 U	1 U	1 U	1 U	ND
PJ's Maximart	405 S. Main	Apr-04	MW-1	1 U	1 U	1 U	3 U	50 U
(Montesano 76 Delimart)		Apr-04	MW-2	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-3	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-4	**14**	**540**	**390**	**2,200**	**12,000**
		Apr-04	MW-5	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-6	**1**	**16**	**24**	**74**	**450**
		Apr-04	MW-7	1 U	1 U	**1**	3 U	**180**
		Apr-04	MW-8	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-9	1 U	1 U	1 U	3 U	50 U
		Apr-04	MW-10	1 U	1 U	1 U	3 U	50 U

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

U = The analyte was not detected at or above the reported limit. ND = Not Detected

The quality of this data is unknown since it was collected without Ecology oversight.

The geology of the area is comprised mostly of alluvial deposits, including the Montesano Terrace deposits, an unconsolidated to partly consolidated fluvial and glaciofluvial sand and gravel with minor amounts of silt and clay. Study area groundwater flows in a south-southeast direction toward the Chehalis River and occurs approximately three to 15 feet below the ground surface.

Project Description

Groundwater beneath the city of Montesano has been contaminated by multiple leaking underground storage tank sources. The primary goal of this project is to provide the Toxics Cleanup Program (TCP) with current groundwater data of known quality to help evaluate the extent of groundwater contamination in the downtown area. This will be accomplished by using consistent sampling techniques and analytical methods. This data will assist TCP in determining which areas in downtown Montesano have concentrations above MTCA cleanup levels and if there are areas that require additional investigation or remedial actions.

Tasks to meet these objectives are:

- Collect groundwater samples in fall 2004 and spring 2005 from approximately 35 monitoring wells and analyze for benzene, toluene, ethylbenzene and xylene (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-Gx) (Appendix). In addition, three wells at the corner of Main Street and Pioneer Avenue will be sampled and analyzed for volatile organics (VOAs).

- Determine groundwater flow direction by measuring water levels in all the monitoring wells over a short period of time using recent survey data.

- Prepare groundwater contour maps, a plume map, and a technical memorandum at the completion of all sampling summarizing significant findings.

At the time of the groundwater sampling, TCP staff may collect samples from the old sanitary sewer line to help determine if it is providing a contaminant pathway to local surface water. TCP staff may also have additional monitoring wells installed in locations where data gaps are identified based on the findings of this study or other data review.

Organization, Schedule and Analytical Costs

The project will be organized with key personnel performing the following functions:

Name	Duties	Phone
Pam Marti	Project Lead	(360)407-6768
Marv Coleman	TCP Lead; QAPP and Report Review	(360)407-6243
Martha Maggi	TCP Hydrogeologist Technical Assistance	(360)407-6248
Ewan Whitaker	GIS Mapping	(360)407-7214
Dean Momohara	Analysis Supervisor	(360)871-8820
Pam Covey	Sample Tracking	(360)871-8827
Darrel Anderson	QAPP and Report Review	(360)407-6453
Will Kendra	QAPP and Report Review	(360)407-6698
Stewart Lombard	QAPP Review and Technical Assistance	(360)895-6148
Stuart Magoon	Laboratory Director	(360)871-8801

This project is scheduled to be completed in one year. Project milestones and projected dates of completion are listed below. At the end of one year, all data will be evaluated and summarized in a technical memorandum.

Milestone	Date
QAPP Approved	October 2004
Groundwater Sampling	October 2004 and March 2005
Draft Technical Report	July 2005
Final Technical Report	September 2005
EIM Data Entry Due Date	September 2005

Table 2 below summarizes the anticipated analytical costs for groundwater sampling of the monitoring wells.

Table 2: Estimated Laboratory Cost by Parameter

Parameter	Predicted Number of Samples(1)	Cost per Sample (2)	Cost per Parameter
BTEX/TPH-G	80	$100	$8,000
VOAs	4	$150	$600
Estimate Total Lab Cost			$8,600

(1) Assumes 35 monitoring wells, 3 duplicates for BTEX/TPH-H and 1 duplicate for VOAs, 2 quality assurance samples for 2 sample rounds.
(2) Assumes MEL *planned* price (50% discount).

Data Quality Objectives

For this project to succeed, the bias (systematic error) and precision (random error) must be low to reveal variability in concentrations between samples. Sampling bias will be minimized by using standard procedures for sampling, preservation, transportation, and storage of the samples.

The precision and bias routinely obtained by the analysis methods for all target parameters will be adequate for this project. The measurement quality objectives (maximum acceptable values) for this project are listed in Table 3.

Table 3: Measurement Quality Objectives

Parameter	Recovery Precision for LCS	Precision for Duplicate Samples (RPD)	Matrix Spike Recoveries	Precision for Duplicate Matrix Spikes	Required Reporting Limit
BTEX	70-130%	50%	70-130%	50%	1 ug/L
NWTPH-Gx	50-150%	50%	50-150%	50%	0.14 mg/L
VOAs	75-125%	30%	70-130%	50%	1-5 ug/L

Goals for BTEX, NWTPH-Gx, and VOAs are based on performance characteristics of measurements done by the Manchester Environmental Laboratory. Analytical and field quality control samples are discussed in the Quality Control Procedures section below.

Sampling Design and Field Procedures

Groundwater samples will be obtained in fall 2004 and spring 2005 to determine the extent and nature of groundwater contamination in the downtown area. Samples will be collected from approximately 35 monitoring wells (Appendix) for benzene, toluene, ethylbenzene and xylene (BTEX), as well as total petroleum hydrocarbons as gasoline (TPH-G). Samples will also be collected for volatile organics (VOAs) from the three wells at the corner of Main Street and Pioneer Avenue. Samples will be assumed to be representative of the groundwater quality of the site.

The monitoring wells to be sampled are associated with eight identified LUST sites and have been installed between 1991 and 2004. The majority of the wells are constructed of 2" PVC and range in depth from 8 to 25 feet with varying screen lengths. The wells have primarily been sampled for benzene, toluene, ethylbenzene and xylene, as well as total petroleum hydrocarbons as gasoline. Table 1 lists the most recent analytical results. Table 4 lists well construction details.

To determine groundwater flow direction, water levels will be measured from all the monitoring wells over a short period of time. Water levels will be measured from a surveyed measuring point using a Solinst water level meter. Measurements will be recorded to 0.01 foot and will be accurate to 0.03 foot. The probe will be washed with laboratory grade detergent and rinsed with deionized water between measurements. Water levels will be measured again in each well prior to sampling. Well volumes will be calculated using the height of water in the well casing above the bottom of the well.

Table 4: City of Montesano Monitoring Well Construction and Groundwater Depth

Site Name	Address	Wells Installed	Well #	Well Type	Total Depth (feet)	Screen Interval (feet)	Date of Water Level	Depth to Water bgs (feet)
Grays Harbor County Shops	310 Spruce Ave.	1991	MW-1	2" PVC	~8	2.5-7.5	May-91	2.6
Jackpot Station 392	501 W. Pioneer	2004	MW-1	2" PVC	14.5	4.5-14.5	Jan-04	7
(Time Oil)		2004	MW-2	2" PVC	15	4.5-14.5	Jan-04	8.5
		2004	MW-4S	2" PVC	15	5'-15'	Jan-04	9.5
		2004	MW-4D	2" PVC	25	20'-25'	Jan-04	14.5
		2004	MW-5	2" PVC	15.5	5'-15'	Jan-04	5
		2004	MW-6	2" PVC	14.5	4.5-14.5	Jan-04	4
		2004	MW-7	2" PVC	15.5	5.5-15.5	Jan-04	9
		2004	MW-8	2" PVC	13.5	5-13.5	Jan-04	7
		2004	RW-3	4" PVC	14.5	5'-15'	Jan-04	8.5
Key Bank	301 S. Main		MW-1	2" PVC	21.97		Sep-04	17.4
(Sterling Savings Bank)			MW-2	2" PVC	20.16		Sep-04	
			MW-3	2" PVC	20.17		Sep-04	16.08
Tony's Short Stop	326 S. Main	1996	MW-1	2" PVC	14.74	5'-20'	Jul-98	12.7
		1996	MW-2	2" PVC	18.77	5'-20'	Jul-98	12.4
Grays Harbor Grange Supply	412 S. Main	2003	MW-1	2" PVC	22.7	7'-22'	Jan-04	9.06
(Monte Farm & Home)		2003	MW-2	2" PVC	21.74	7'-21'	Jan-04	8.91
		2003	MW-3	2" PVC	17.73	6'-17'	Jan-04	5.35
City of Montesano City Shop	201 S. River		MW-31	2" PVC	12.42		Sep-04	6.09
			MW-32	2" PVC	11.87		Sep-04	6.54
			MW-33	2" PVC	12.85		Sep-04	7.28
Brumfield-Twidwell	301 E. Pioneer	2000	MW-1	2" PVC	~25	10'-25'	Dec-02	~11
		2000	MW-2	2" PVC	~25	10'-25'	Dec-02	~11
		2000	MW-3	2" PVC	~25	10'-25'	Dec-02	~11
		2000	MW-4	2" PVC	~25	10'-25'	Dec-02	~11
PJ's Maximart	405 S. Main	1995	MW-1	4" PVC	19.77	5'-20'	Apr-04	10.97
(Montesano 76 Delimart)		1995	MW-2	4" PVC	20	5'-20'	Apr-04	11.23
		1995	MW-3	4" PVC	19.92	5'-20'	Apr-04	11.95
		1995	MW-4	4" PVC	20	8'-20'	Apr-04	11.6
		1995	MW-5	4" PVC	16.45	6'-16'	Apr-04	11.5
		1995	MW-6	2" PVC	22.5	3'-20'	Apr-04	11.19
		1995	MW-7	2" PVC	18	2'-17.5'	Apr-04	8.22
		1995	MW-8	2" PVC	18.5	3.5'-18.5'	Apr-04	8.98
		1995	MW-9	2" PVC	18	3.5'-18.5'	Apr-04	8.84
		1995	MW-10	2" PVC	15	5'-15'	Apr-04	7.43

The monitoring wells will be purged and sampled using a Grundfos Redi-Flo2 stainless steel submersible pump and dedicated tubing. The pump intake will be placed at the middle of the screened interval in each monitoring well and purged at a pump rate of 0.5 to 1-liter/minute. Wells will be purged through a continuous flow cell until pH, specific conductivity, and temperature readings stabilize or a minimum of three well volumes have been purged. Purge water from the wells will be stored off-site in 55-gallon drums. This waste will be transported and disposed of in accordance with state of Washington regulations (Chapter 173-340-400 WAC). Samples will be collected from the monitoring wells directly from the pump discharge line after purging. The pump will be decontaminated between each well by circulating laboratory grade detergent/water through the pump followed by a tap water rinse, each cycle lasting five minutes. To minimize the possibility of cross-contamination, the wells will be sampled from least to most contaminated as determined from past data.

Results from the samples collected with the submersible pump should be comparable to results from previous Ecology studies in which this standard procedure was used.

BTEX/TPH-G samples will be collected free of headspace in three 40-mL glass vials with Teflon lined septa lids and preserved with 1:1 hydrochloric acid. Three additional 40-mL glass vials will be collected free of headspace and preserved with 1:1 hydrochloric acid for the volatile organics analysis. Upon sample collection and proper labeling, all samples will be stored in an ice-filled cooler. Samples will be transported to the Ecology's Operation Center in Lacey. Samples will be kept in the walk-in cooler until picked up by the laboratory courier for transport to Ecology/EPA Manchester Environmental Laboratory in Manchester, Washington. Chain-of-custody procedures will be followed according to Manchester Environmental Laboratory protocol (Ecology, 2003). In the event that a sample is damaged during transit or testing, a new sample may be collected and submitted for analysis. The laboratory should notify the project lead as soon as possible when a sample is unsuitable. Samples will be analyzed within the maximum acceptable holding time of 14 days.

Laboratory Procedures

All groundwater samples will be analyzed for BTEX using EPA SW846 Method 8021B (U.S. EPA 1996), with a reporting limit of 1 µg/L. Total petroleum hydrocarbons as gasoline will be analyzed using method NWTPH-Gx (Ecology 2003) with a reporting limit of 0.14 mg/L. The volatile organic samples will be analyzed using EPA SW846 Method 8260 (U.S. EPA 1996), with a reporting limit of 1 to 5 ug/L. The reporting limits obtained with these analytical methods are necessary for this project to meet the Model Toxics Control Act (MTCA) requirements.

Quality Control Procedures

Field Quality Control

Field quality control will consist of collecting field replicates and a rinsate blank. Field replicates are two (duplicates) or more samples collected at the same time and place. Replicate results provide an estimate of the total random varibaility (precision) of individual results. Three field replicates will be collected from three different monitoring wells which are known to produce positive results. The replicate samples will be collected by filling two sets of bottles at each selected well at the same time. The Relative Percent Difference (RPD) will be calculated for each duplicate set and will be used to estimate overall precision. A rinsate blank will be collected by running deionized water through the submersible pump after it has been decontaminated. The results will provide a check on the effectiveness of the cleaning procedures.

Lab Quality Control

Routine quality control procedures will be adequate to demonstrate that the Measurement Quality Objectives (MQOs) for this project have been met. Laboratory quality control tests consist of method blanks, matrix spikes, as well as duplicate and check standards (lab control standards). Surrogate recoveries will also be included for the volatile organics analysis. Surrogate recoveries will be used to judge the accuracy for analysis of similar target analytes. Analytical precision can be estimated from duplicate and check standards, duplicate sample analysis, and duplicate spiked sample analyses. Analytical bias will be estimated from matrix spikes, matrix spike duplicates, and check standards. Recoveries from check standards provide an estimate of bias due to calibration. Mean percent recoveries of spiked sample analyses provide an estimate of bias due to interference. Results of quality control analyses will be reported in the same units as expressed for the MQOs. Laboratory staff will conduct quality assurance review of all analytical data generated at Manchester Environmental Laboratory prior to releasing the data to the project lead.

Data Review and Validation

At the completion of each sampling event, all field data and laboratory analytical data will be compiled and evaluated against the project measurement quality objectives. Data review will follow the procedures outlined in Manchester Environmental Laboratory Users Manual (Ecology 2000). Lab results will be checked for questionable or missing data. Analytical precision will be evaluated using standard statisitical techniques Relative Percent Difference (RPD), Standard Deviation (s), Pooled Standard Deviation (sp), or Percent Relative Standard Deviation (%RSD)] as appropriate. The RPD for field duplicates will be used to assess data quality.

Data Quality Assessment and Reporting

Once the data have been reviewed and validated, the project lead will determine if the data can be used toward the project goals and objectives. During the project, groundwater level measurements and data summary sheets will be sent to the project manager at the completion of each sample event. A technical memorandum will be prepared at the completion of all sampling and will include the following:

- Maps of the study area showing sample sites, groundwater contours, and contaminant plumes.
- Descriptions of field and laboratory methods.
- Discussion of data quality and the significance of any problems encountered in the analyses.
- Summary tables of field and chemical data.
- Observations on significant or potentially significant findings.
- Recommendations based on project goals.

At the completion of the project, data suitable for archiving will be transitioned to the Environmental Information Management (EIM) database.

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Appendix

Montesano Groundwater Investigation Map

Montesano Ground Water Investigation

- Existing Monitoring Well
- LUST Site with Well(s)
- LUST Site w/o Well(s)

Aerial Photo: WSDOT Negative ID 1405-0-10, Image 20-53
Date of Photo: 07-19-1999

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