



PILOT TEST WORK PLAN

Calvert Citgo (Former Alger Country Store)
2815 Northeast Road
Town of North East
Cecil County, Maryland
MDE Case No. 92-2616-CE

REPSG Project Reference No. 005977.130.01

July 31, 2012

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Calvert Citgo
July 31, 2012

Pilot Test Workplan
2815 North East Road, Town of North East
Cecil County, MD
MDE Case No. 92-2616-CE
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1.0 INTRODUCTION

React Environmental Professional Services Group, Inc. (REPSG, formerly “React Environmental Services Group, Inc.” or “React”) was retained by Country Stores, Inc. to complete a Pilot Test Workplan (PTW) at 2815 Northeast Road in the town of North East, Cecil County, Maryland (Site), known as Maryland Department of the Environment (MDE) Case No. 92-2616-CE. The Site is currently occupied by an active “Citgo” Gasoline Service Station. This Revised SIW has been prepared in general accordance with the *Maryland Environmental Assessment Technology for Leaking Underground Storage Tanks*, (MEAT LUST Guidance) produced by the Oil Control Program of the Waste Management Administration of the MDE (as revised February 2003). The specific scope of this PTW was designed to satisfy the conditions of a “Site Status Letter” prepared by MDE on May 1, 2012. This scope is defined in REPSG Proposal No. 011-9633.

The Site Status letter was issued by MDE in response to the August 2011 Active Remedial Technologies Report, the March 2012 Formal Request for Sampling Revision Letter, and the March 2012 Groundwater and Drinking Water Results. The Active Remedial Technologies Report evaluated the applicability of various remedial strategies for the Site. The report concluded that based on known Site conditions and available information that a combination of a soil vapor extraction (SVE) and in-situ bioremediation were best equipped to address Site hydrogeology and contamination at the Site. However, a specific remediation strategy and timeline could not be determined at the time of this report without first obtaining data from the recently installed on-Site deep monitoring well (MW-008D). REPSG recommended the completion of several rounds of groundwater sampling from MW-008D prior to selecting an appropriate remediation method.

The MDE requested the submittal of this PTW following the completion of these additional rounds of groundwater sampling. A formal request for an extension to the deliverable date for this PTW from June 15, 2012 to July 31, 2012 was submitted on May 11, 2012 by REPSG, and granted approval by the MDE via email correspondence received on May 22, 2012.

In addition to the quarterly groundwater sampling conducted at the Site, REPSG recommended in a *Formal Request for Sampling Program Revision* letter, dated March 2, 2012, that discrete zone sampling be conducted at on-Site deep monitoring well MW-008D and off-Site drinking water well DW-005, located at 2802 Northeast Road prior to the completion of the PTW. This discrete zone sampling utilized inflatable “straddle” packers positioned in the wells above and below specific sampling intervals in order to allow for the isolation of a sampling interval of interest to assist in the collection of discrete zone samples. In email correspondence dated June 28, 2012, the MDE approved

this discrete zone sampling following the submittal of a *Discrete Zone Sampling Methodology* letter dated May 25, 2012

2.0 SITE BACKGROUND

This section discusses Site location and features. Details regarding Site topography, geology, hydrogeology, regulatory and operational history, the continuing hydrogeological investigation, and the Site Conceptual Model which was previously updated in the December 2010 *Site Status Update*.

2.1 Site Location and Description

The Site consists of an irregularly shaped parcel of land located at the street address: 2815 Northeast Road, in the Town of North East, Cecil County, Maryland. The Site measures approximately 1.05 acres in area; it is bounded by Northeast Road (MD Route 272) to the east, several single family residences, including one that houses an in-home day care facility, across Northeast Road; Quaker Lane (old MD Route 272) and agricultural land to the west, an access road and agricultural land to the south, and a mixture of residential, commercial, and agricultural land to the north (see **Figure 1 in Attachment 1**).

The at-home day care facility (license No. 155668 for Cecil County, Region 11, and known as “Cammie Ginski”) is located at 2802 Northeast Road. This day care facility is licensed for up to ten (10) children, and is located east of the Site. The day care facility is housed within one of the residences currently included in REPSG’s off-Site potable well monitoring program (see **Figure 2 in Attachment 1**).

2.2 Site Features

Development at the Site consists of a single-story convenience store structure, located centrally at the Site, surrounded by landscaping, parking and drive areas typical of a service station. Gasoline and diesel pump islands are located east of the structure, parallel to Route 272. Gasoline is stored in one (1) 8,000-gallon underground storage tank (UST) and one (1) 12,000-gallon UST which are located in a single tank field to the north of the structure. A 12,000-gallon compartmentalized (two (2) 6,000-gallon compartments) diesel/kerosene fuel UST is situated beneath the diesel fuel pump island. A kerosene pump island is located adjacent to and directly north of the structure. An on-Site septic tank is located to the southwest of the existing building (see **Figure 2 in Attachment 1**). An on-Site potable well, labeled DW-001 for the purposes of this reporting, is located approximately 33 feet west of the existing structure at the Site. This potable well is actively used by the facility occupying the Site, and has an in-place carbon filtration system of its own (see **Figure 3 in Attachment 1**).

2.3 Area Topography

According to USGS topographic mapping (7.5-minute series, *Bay View, Maryland*

Quadrangle) the Site is located at an elevation of approximately 420 feet above mean sea level (MSL). Topography at the Site slopes very gently towards the east and southeast. See **Figure 1** in **Attachment 1**.

2.4 Physiographic Province & Regional Geology

Based on review of mapping prepared by the Maryland Geological Survey¹, the site lies within the Upland Section of the Piedmont Plateau Physiographic Province in Maryland. The Piedmont Plateau Province extends from the inner edge of the Coastal Plain westward to Catoclin Mountain, the eastern boundary of the Blue Ridge Province. The site is located in the eastern portion of the Piedmont Plateau, approximately 5 miles to the northwest of the boundary between the Piedmont and the Coastal Plain province.

The Piedmont Plateau has considerably more topographic relief than the Coastal Plain, with gently rolling uplands having as much as 500 ft. of local relief. Landforms within this province are generally underlain by extremely deformed and folded schist, gneiss and quartzite bedrock, with an overburden of unconsolidated material known as regolith. In several places these rocks have been intruded by granitic plutons and pegmatites. Differential erosion of these contrasting rock types has produced a distinctive topography in this part of the Piedmont.

Geologic mapping² indicates that the Site and its vicinity are underlain by the Pelitic Gneiss rock unit (formerly mapped as a section of the Wissahickon Formation) of metasedimentary rocks. The Pelitic Gneiss is described as “*lustrous, brown, medium to coarse-grained muscovite-biotite-quartz-plagioclase gneiss with... locally abundant red garnets... Unit has a streaked appearance due to... layers, veins, and stringers.*” Locally, the unit has an apparent thickness of up to 15,000 feet.

Based on Soil Survey mapping³ for the area, soil at the Site is mapped as Glenelg loam (GeB), with 3 to 8 percent slopes. This soil type occurs on hillslopes and is described as “loamy residuum weathered from schist and phyllite.” The Glenelg loam is further described as well drained, with moderately high to high permeability, and with a seasonal high water table greater than 80 inches from the surface.

2.5 Site Geology

2.5.1 Lithology

Based on the observations reported from REPSG’s recent soil investigations, and previous soil investigations at the Site, the shallow subsurface materials consist primarily of brown to yellow-brown silty to sandy clay, and brown sand and gravel from the surface to a depth of approximately 10 to 15 feet below grade (fbg). Beginning at the

¹ Physiographic Provinces and their Subdivisions in Maryland, MGS, 2001: <http://www.mgs.md.gov/esic/brochures/mdgeology.html>

² Geologic Map of Cecil County, Maryland Geological Survey, 1986

³ Natural Resources Conservation Service, Web Soil Survey, <http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx>

depth of 10 to 15 fbg, the boring logs indicate the presence of highly weathered, dense, clayey unconsolidated materials, with significant mica content, that retain the foliation and schistosity of underlying bedrock (i.e., saprolite). Saprolite was observed to approximately 40 fbg. Competent bedrock was observed at a depth of 98 fbg during construction of the on-Site deep monitoring MW-008D.

2.5.2 Other Geologic Structures

A downhole acoustic test was completed on MW-008D on October 3, 2011 by Advanced Geologic Services (AGS). The results of this test indicated that the most prominent borehole fractures observable within the deep well were at 103 fbg, 110 fbg, and 111 fbg. The fractures noted at 110 fbg and 111 fbg were indicative of the presence of a water bearing zone. In addition to these primary fractures, two secondary fractures were observed at 117 fbg and 120 fbg. These fractures did not appear to supply a significant amount of water.

2.6 Hydrogeology

2.6.1 Surface Water

No surface water bodies are present at the Site. The nearest body of water in the vicinity of the Site is a small pond connected to North East Creek and located approximately 1,695 feet southwest of the Site. Surface water drainage follows the general direction of the slope at the Site (southeasterly). Storm drain collection basins are located on the roads to the east and west the Site. No stormwater collection basins were observed on the Site.

2.6.2 Hydrology

The Site is underlain by the Piedmont crystalline-rock aquifer systems; fractured igneous and metamorphic rock aquifers. This crystalline rock tends to possess low primary porosity; groundwater occurs and flows primarily through secondary porosity, i.e., rock joints and fractures. Groundwater in the fractured rock aquifers may occur in either confined or unconfined conditions. Groundwater flow patterns are dependent on multiple factors including regional topography, and various characteristics of rock fracturing, including orientation, density, and connectivity of the fractures.

There is a shallow water table (i.e., unconfined) aquifer in the overburden and weathered rock layers above the top of competent fractured rock. Subsurface investigations at the site indicated that groundwater table was generally first observed in the fine-grained overburden materials at the Site at depths of 20 to 24.5 fbg. Depths to water of 14.18 to 16.88 fbg were measured in the eleven (11) groundwater monitoring wells on the Site during the most recent full groundwater monitoring event, conducted in May 2012.

Based on review of water elevations in groundwater monitoring wells at the Site, as calculated from measurements obtained during the last four (4) quarterly groundwater events (see **Figures 4 through 7 in Attachment 1**), shallow groundwater at the Site is

estimated to flow in a direction varying from easterly to southerly. It is not known whether variations in groundwater flow directions may be attributable to pumping in nearby potable wells, seasonal variations, or other factors.

2.7 Site Conceptual Model

Groundwater Characterization

Based on the groundwater characterizations that have been conducted within the full monitoring well network (MW-001, MW-001R, MW-002, MW-003, MW-003R, MW-005, MW-005R, MW-006, MW-007, MW-008, and MW-008D) at the Site, the following compounds continue to be compounds of concern (COCs) in Site groundwater:

- TPH-DRO; TPH-GRO; 1,1,2-trichloroethane; 1,2-dibromoethane; 1,2-dichloroethane; acetone; benzene; ethylbenzene; methyl chloride; methyl ethyl ketone (MEK); methyl tert-butyl ether (MTBE); naphthalene; tetrachloroethylene (PCE); toluene; and total xylenes

Upgradient monitoring well MW-005, situated at the southeast corner of the gasoline UST field has previously been identified as the source well at the Site. During the last four (4) quarterly sampling events, MW-005R, located adjacent to MW-005 demonstrated the greatest concentrations of TPH-DRO, TPH-GRO, 1,2-dibromoethane, acetone, benzene, MEK, toluene, and total xylenes at the Site; the greatest concentrations of ethylbenzene and methyl chloride were found in MW-005; the greatest concentration of 1,2-dichloroethane was found in MW-001, located at the center of the Site; and the greatest concentrations of 1,1,2-trichloroethane and MTBE at the Site were found in MW-008, located along the eastern boundary of the Site. With the exception of MW-008, which is a newly installed well, these wells have consistently maintained the highest concentrations of the respective compounds during the groundwater Site investigations conducted by REPSG. No discernible decrease in compound concentrations has been noted during this time.

The solvent PCE, a non-petroleum related groundwater COC, is the only solvent detected in Site groundwater at concentrations above the applicable MDE VCP standards. Solvent trichloroethylene (TCE), a breakdown compound of PCE, has been detected in Site groundwater at concentrations below the applicable MDE VCP standards, but above the laboratory MDLs. No other solvents were detected in Site groundwater at concentrations above the applicable MDE VCP standards. No solvents have been identified in Site soils at concentrations above the laboratory MDLs. The southernmost well, MW-006, has exhibited the only concentration of PCE above the applicable MDE VCP standards at the Site. Based on Site soil investigations (which have not indicated the presence of PCE above MDE VCP standards) it does not appear that PCE has migrated into groundwater from on-Site conditions, however. Additional investigation of the soils is required before a determination regarding the source of PCE can be made. This could be accomplished

via soil sampling of the septic leach field.

The source area of the petroleum related groundwater impacts at the Site appears to be the gasoline UST field located in the north- central portion of the Site, to the northwest of monitoring wells MW-005 and MW-005R. No on-Site sources for PCE in groundwater were identified. Compounds with concentrations above the applicable EPA DW standards (1,1-dichloroethane and MTBE) are present at two of the off-Site potable wells (DW-004 and DW-005). While the source of these impacts has not yet been established, contaminant flow appears to be via the shallow aquifer in the unconsolidated residuum overlying bedrock, and not via the bedrock aquifer.

No discernable trend in concentrations of compounds present in groundwater has yet been observed.

3.0 DEEP MONITORING WELL GROUNDWATER CHARACTERIZATION

On August 8, 2011, a six-inch diameter on-Site deep monitoring well, MW-008D, was completed down to a depth of 125 fbg. The overburden material, in the upper 98 feet of the well, is cased off with 6-inch diameter steel piping, while the lower 27 feet (from 98 fbg to 125 fbg) is completed as an open rock well. A copy of the well construction log for MW-008D is included as **Attachment 2** of this workplan.

Four (4) quarters of groundwater gauging and sampling have been conducted at the Site since the installation of the on-Site deep monitoring well, MW-008D in August 2011. The deep monitoring well was gauged and sampled via purge-method sampling. All purged water was drummed and stored at the Site, per the MDE's request, before being removed and disposed of properly by a licensed disposal facility.

Depth to water information for each sampling event is presented in **Table 1**. Monitoring well and measuring point locations are shown in **Figure 3** of **Attachment 1**.

Table 1 – Well Construction and Sample Gauging Data

Site ID	Construction Date	Measuring Point Elevation	Depth to Top of Open Well Zone (fbg)	Date of Gauging	Groundwater Elevation (fbg)	Depth to Water (fbg)
MW-008D	8/8/2011	416.5	98	9/16/2011	102.6	13.85
				10/27/2011	102.5	13.95
				2/28/2012	103.2	13.26
				5/7/2012	102.3	14.18

All groundwater samples collected were analyzed for VOCs plus MTBE and TBA via EPA method 8260, and TPH-DRO and TPH-GRO via EPA method 8015D. Samples were submitted, packed on ice and under chain of custody, to Analytical Laboratory services, Inc. of Middletown, PA.

Results of the groundwater investigation laboratory analyses were compared against the applicable MDE VCP groundwater standards (see **Attachment 2**). The results of this groundwater characterization have indicated concentrations of TPH-DRO and TPH-GRO at levels above the applicable MDE VCP groundwater standards in MW-008D (see **Table 2** and **Attachment 2**).

Table 2 – Compounds with Concentrations above the MDE VCP Groundwater Standards

Compound		TPH-DRO	TPH-GRO
Unit		ug/l	ug/l
Standard		47	47
Sample ID	Sampling Date		
MW-008D	9/15/2011	280	36.8
	10/26/2011	470	56
	2/28/2011	240	16.2
	5/8/2012	180	ND

*Exceedences of the regulatory standard are printed in **bold**. ND = Compound not detected above laboratory method detection limit.

4.0 DISCRETE ZONE TESTING

On July 12-13, 2012 in order to conduct discrete zone testing (i.e., “packer testing”) at the on-Site deep monitoring well (MW-008D) and at the off-Site residential drinking water well (DW-005) located at 2802 Northeast Road. The objective of this testing was to evaluate well yield and water quality in specific depth intervals within the two (2) wells, that had been identified based on previously performed downhole geophysical logging of MW-008D as well as review of the drilling logs from DW-005, as fractured zones likely to yield relatively high water discharge rates and also likely potential zones of contaminant transport.

The methods employed for discrete zone sampling includes the use of “straddle” packers. Straddle packers consisted of two (2) inflatable packers that were positioned above and below a two (2) specific sampling intervals in each well. Positioning these straddle packers above and below specific sampling intervals allowed REPSG to isolate the sampling intervals of interest in order to collect discrete samples for analysis. The specific methodology was previously detailed in the May 2012 *Discrete Sampling Methodology* letter (included as part of Attachment 4 of this workplan).

Two (2) specific intervals of interest were identified and isolated in MW-008D: 98 fbg to 113 fbg and 114 fbg to 129 fbg. One (1) set of samples was collected at each interval and analyzed for TPH-DRO and TPH-GRO using Method 8015B and Volatile Organic Compounds VOC’s (including BTEX, Naphthalene, and MTBE) using Method 8260B.

The results of MW-008D discrete zone sampling indicated:

- Concentrations of TPH-DRO above the applicable MDE VCP Groundwater Standards in one sample (see **Table 3** and **Attachment 2**);
- No concentrations of VOCs at levels above the applicable MDE VCP

Groundwater Standards; and

- A Low water yield of less than 5 gallons per minute (gpm) in the lower depth interval, and a robust water yield of greater than 10 gpm from the upper depth interval.

Table 3 – Compounds with Concentrations above the MDE VCP Groundwater Standards in MW-008D during Discrete Zone Testing

Compound		<i>TPH-DRO</i>
Unit		ug/l
Standard		47
Sample ID	Sampling Interval Depth (fbg)	
MW-008D	98-114	ND
MW-008D	113-129	76J

*Exceedences of the regulatory standard are printed in **bold**. ND = Compound not detected above laboratory method detection limit. J = Estimated Value.

The off-Site drinking water well, DW-005, was sampled on July 12, 2012. Two (2) specific intervals of interest were isolated for discrete zone testing: 85 fbg to 101 fbg and 222 fbg to 238 fbg. One (1) set of samples was collected at each interval and analyzed for Volatile Organic Compound VOC's by Method 524. A third interval, from 116 fbg to 132 fbg was isolated, but unable to be sampled due to an inadequate water yield.

The results of the off-Site drinking water well, DW-005, discrete zone sampling indicated concentrations of 1,2-Dichloroethane and MTBE above the applicable EPA Drinking Water Standards in both samples (see **Table 4** and **Attachment 2**).

Table 4 – Compounds with Concentrations above the EPA Drinking Water Standards in DW-005 during Discrete Zone Testing

Compound		<i>1,2-Dichloroethane</i>	<i>Methyl tert-butyl ether</i>
Unit		ug/l	ug/l
Standard		5	20
Sample ID	Sampling Interval Depth (fbg)		
DW-005	85-101	10.7	1120
DW-005	222-238	8	567

*Exceedences of the regulatory standard are printed in **bold**. ND = Compound not detected above laboratory method detection limit.

5.0 PILOT TEST WORKPLAN

The *Active Remedial Technologies Report* evaluated the applicability of various remedial strategies for the Site. The report concluded that based on known Site conditions and available information that a combination of a soil vapor extraction (SVE) and in-situ bioremediation were best equipped to address Site hydrogeology and contamination at the Site. However, since the completion of the four (4) quarters of groundwater sampling on the on-site deep monitoring well, as well as the completion of the discrete zone groundwater and drinking water well testing, an alternative active remedial technology -

dual-phase extraction (DPE) - has been selected for further evaluation and pilot testing at the Site. The remedial technology was modified in response to changes in the Site Conceptual Model (SCM) based upon the results of the groundwater monitoring of the onsite deep well MW-008D, and the on-Site and off-Site discrete zone testing. The current SCM considers that:

- The great majority of petroleum contaminant mass currently exists in free, residual, adsorbed, and dissolved phases within the unconsolidated overburden and, specifically, within the upper 40 feet of soils. Within that zone, the upper approximately 20 feet is in unsaturated conditions. The lower approximately 20 feet is under saturated, semi-confined conditions.
- The primary route of transport of dissolved-phase VOCs from the Site to the potable wells of the residences to the east is via groundwater transport in the shallow aquifer, and not via flow through bedrock fractures.
- Aggressive removal of contaminant mass from the source area is seen as the most advantageous opportunity to a) reduce or eliminate offsite migration of contaminants and b) protect offsite sensitive receptors from future impacts.

The following section, **Section 5.1**, details the specifics of DPE while **Section 5.2** provides specific detail regarding REPSG's proposed on-Site pilot test utilizing this technology.

5.1 Selected Remedial Technology - Dual-Phase Extraction⁴

Dual-Phase Extraction (DPE) (also referred to as Multi-phase Extraction, or Bioslurping) is an in-situ technology that employs pumping systems to extract VOCs (primarily) from the subsurface in the various phase in which the VOCs occur: soil gases, dissolved in groundwater, and as liquid phase hydrocarbons (LPH). Because DPE can be used to help remove LPH it can help to reduce concentrations of dissolved petroleum hydrocarbons in both the unsaturated and saturated subsurface zones.

While DPE technologies can generally be divided into two categories, depending on whether subsurface liquids and soil vapor are extracted together or whether the subsurface liquids and soil vapor are extracted separately using two or more pumps, for the purposes of this pilot test, the DPE technology that will be utilized at the Site will be a single-pump system that extracts subsurface liquids and soil vapor simultaneously. Groundwater is removed as droplets entrained by the air flow into the pump, frequently by using a down-well drop tube. Groundwater extraction is normally of sufficient rate to to depress the groundwater table or potentiometric surface, which in turn helps to provide

⁴ Information gathered by the EPA (http://www.epa.gov/oust/pubs/tum_ch11.pdf and <http://www.epa.gov/oust/cat/dualphas.htm>), AEC (<http://www.clu-in.org/download/techfocus/mpe/MPE-Royal-Farms-96-2011.pdf>), and the MDE (http://www.mde.state.md.us/programs/Land/MarylandBrownfieldVCP/ERRP_Superfund/Documents/COA%20IM%20Work%20Plan%20Rev%203.pdf).

both control over groundwater migration and to increase the effectiveness of the vapor extraction.

The effectiveness of DPE at a Site is determined by:

- Soil permeability: The higher the permeability of the soil, the faster the rate of air, vapor, and groundwater movement, which in turn leads to increased extraction results.
- Soil stratification and structure: Structural characteristics, such as fractures, can result in preferential pathway conditions, which can impede vapor and groundwater flow or cause a significant increase in remediation time if the induced air flow occurs outside the area of contamination.
- Soil moisture content: As high soil moisture content can reduce soil permeability, it can thereby reduce the effectiveness of DPE by restricting the air flow through soil pores. In addition, fine-grained soils can create a thicker capillary fringe than coarse-grained soils.
- Volatility: The ability of the contaminants being remediated to volatilize is a limiting factor.

The known advantages of the implementation of a DPE system at a Site are:

- Can be used at Sites with free product.
- Increases groundwater extraction rates considerably while reducing the cost of groundwater treating via air stripping within vacuum extraction tubes.
- Treatment times are comparatively short, usually requiring only 6 months to 2 years under optimal conditions.
- Installation and use requires minimal disturbance to Site operations.
- The technology has a proven performance record under a wide range of conditions, and requires no downhole pumps (though it is flexible enough to utilize them if they are deemed appropriate).

The known disadvantages of DPE technology are:

- It is difficult to implement at Sites with fluctuating water tables unless water table depression pumps are utilized.
- The large volumes of water that may be extracted via the technology may require treatment.
- It is not as effective at Sites with low soil permeability, and can be expensive to implement at Sites with medium to high-permeability soils.

- Treatment of extracted vapors and for oil-water separation can be costly.
- Specialized equipment with complex monitoring and operational control is required.

5.2 Pilot Test Objectives

The objectives of the pilot test are to:

- Determine the radius of influence (ROI) for vacuum and soil vapor flow at the Site utilizing various extraction conditions;
- Accumulate data in order to determine optimal remedial technology design considerations such as vapor flow rates (cfm), soil vapor vacuum pressures (mmHg), soil vapor recovery well spacing, and extraction well depth;
- Determine the appropriate methods of treating recovered soil vapors and contaminated fluids from the final implemented remedial system;
- Estimate expected contaminant mass removal rates; and
- Evaluate possible pathway elimination measures such as the reconstruction/reinstallation of off-Site drinking water wells.

5.3 Pilot Test Location Selection

The overall results of the soil and groundwater characterization conducted at the Site have indicated on-Site monitoring well MW-005R, located approximately 10 feet from the southeast corner of the gasoline UST field as the source well at the Site. For the purposes of this pilot test, REPSG plans to utilize this well as the DPE well at the Site.

5.4 Well Abandonment

Monitoring wells MW-001, MW-003, and MW-005 were determined to have been installed with well screens beneath the water table/potentiometric surface and so were replaced with wells MW-001R, MW-003R, and MW-005R, located adjacent to the original wells in November 2010, and have been successfully integrated into the groundwater monitoring program at the Site. Wells MW-001R, MW-003R, and MW-005R will serve as key observation wells for the pilot test. However, the original set of three wells, which no longer provide groundwater information of value, will be abandoned prior to the pilot testing in order to avoid interference with the vapor ROI measurements in the replacement wells.

5.5 Pilot Test Procedures

Prior to the initiation of the DPE pilot test at the Site, REPSG will install three (3) vapor monitoring points (VMP-001 through VMP-003) located 10 feet, 20 feet, and 30 feet from monitoring well MW-005R (see **Figure 8** in **Attachment 1**). These three (3) vapor

monitoring points, along with groundwater monitoring wells MW-001R, MW-003R, and MW-005R (and potentially other on-Site groundwater wells) will be monitored, for vacuum pressure and VOC vapor concentration, throughout the pilot test.

Vapor concentrations will be measured and recorded on a frequent basis with field instruments (e.g., PID); in addition, samples will be collected from the VMPs on an approximately 12-hour cycle, for laboratory analyses of volatile organic compounds (VOCs) via TO-15. Vacuum and soil vapor flow in the VMPs will be measured periodically with vacuum meters and calibrated flow meter(s) or pitot tube(s). Soil vapor samples from these three VMPs will be collected via 8-hour summa canisters at the completion of the pilot test and submitted for analysis.

The pilot test is planned to cover a duration period of 24 hours. The vacuum pump, water knockout system, flow and pressure gauges, etc. will be mounted on a self-contained trailer designed specifically for multi-phase extraction pilot testing, to be supplied by a vendor. The testing will include two main components:

- Stepped increases in applied vacuum from the pump, with corresponding measurement of vapor flow, vacuum pressure and water levels in the VMPs and selected monitoring wells (collectively, “the monitoring points”). When practicable, the applied vacuum will be maintained until flow and vacuum conditions in the monitoring points reach or approach a steady state, and then will be increased to the next step.
- Stepped increases in the groundwater extraction rate, with corresponding measurement of groundwater levels in surrounding groundwater monitoring wells.

Field data via the installed transducers and other equipment, such as a photo-ionization device (PID) and vacuum monitors, will be recorded throughout the course of this test in order to provide data regarding the effectiveness of the technology at the Site.

All recovered investigative-derived waste materials will be properly contained throughout the course of the pilot test, and disposed of upon completion.

5.6 Schedule

Initiation of the investigations proposed in this PTW will commence following Department approval of this plan.

5.7 Reporting

The results of the Pilot Test will be summarized in a *Pilot Test Results Report* to be submitted to the Department. This report will include a discussion regarding the final selection and implementation of the most appropriate method of remediation to be implemented at the Site.

Calvert Citgo
July 31, 2012

Pilot Test Workplan
2815 North East Road, Town of North East
Cecil County, MD
MDE Case No. 92-2616-CE
REPSG Project Reference No. 005977.130.01

ATTACHMENT 1: FIGURES

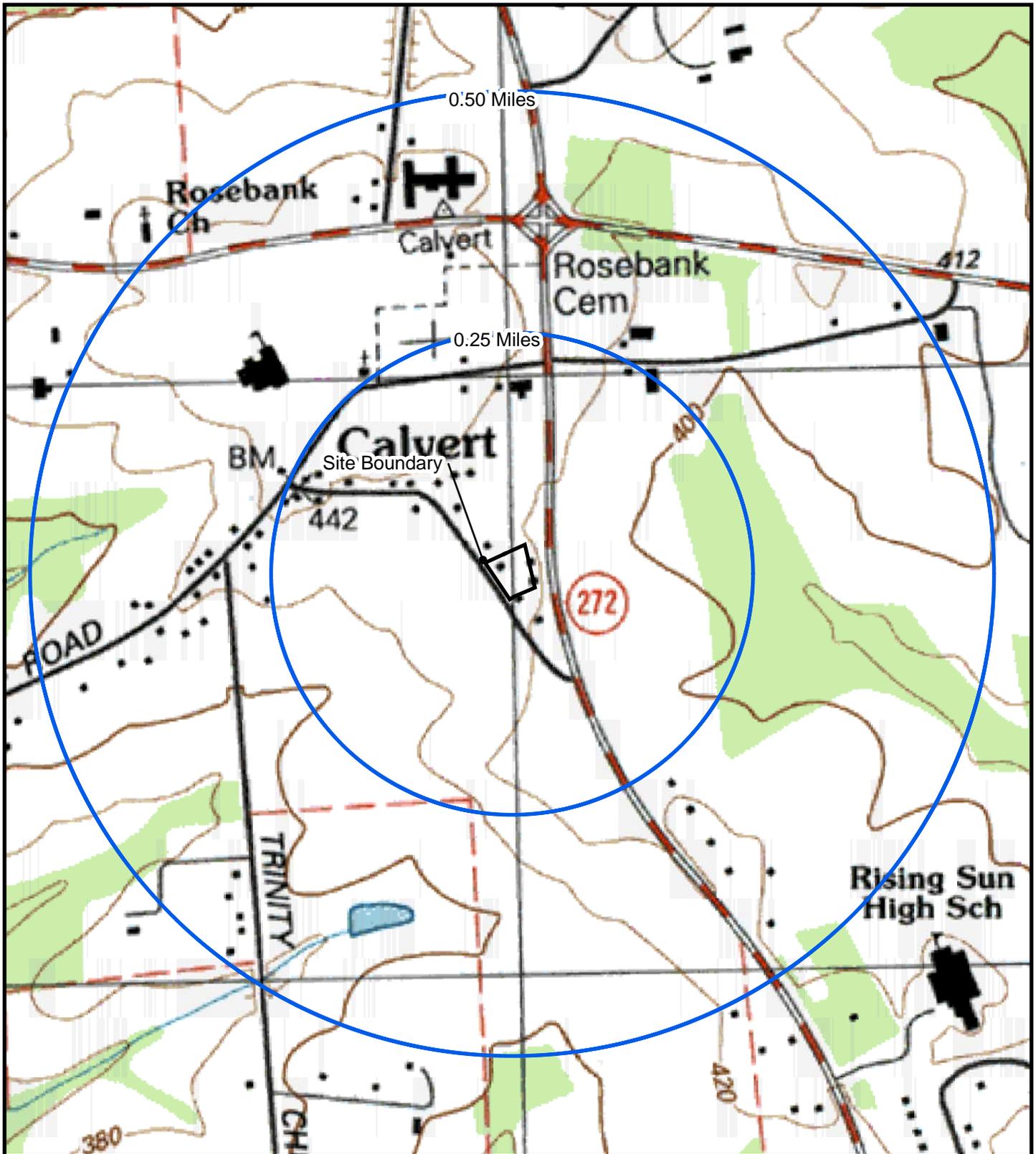


Figure 1: Site Location



REPSG
 React Environmental
 Professional Services Group, Inc.

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977

DATE: MARCH 2010

MAP SCALE: 1 inch = 750 feet



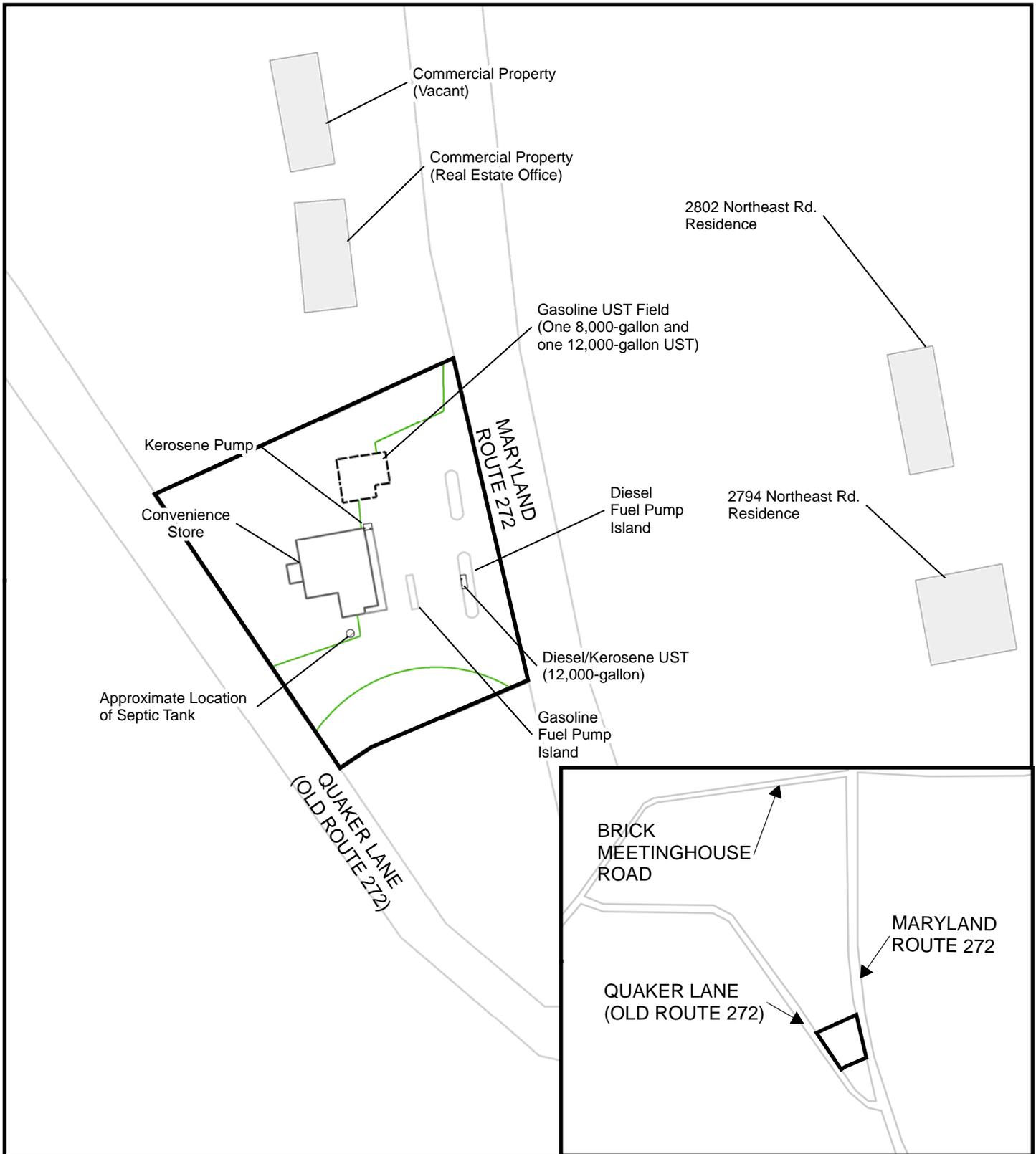


Figure 2: Site Diagram

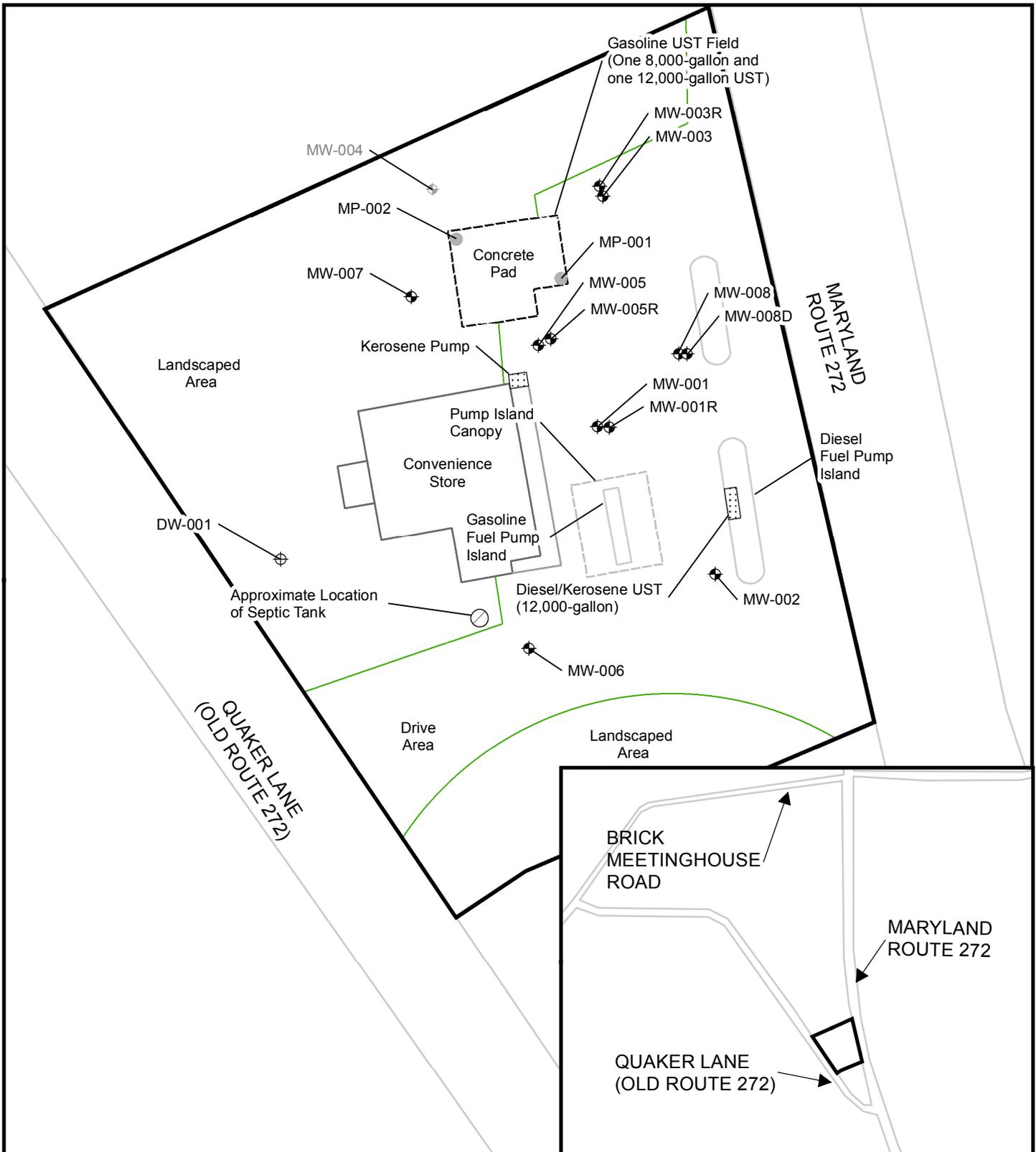
 Site Boundary



MAP SCALE: 1 inch = 100 feet
0 20 40 80 120 160 Feet

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: DECEMBER 2010



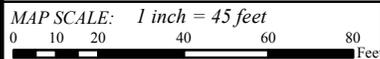


Ilk wtg'5<I tqwpfy cvgt'Sco rrig'Nqecwqpu

- ⊕ Lost/Abandoned Monitoring Well
- Leak Detection Well
- ⊕ Potable Well
- ⊕ Monitoring Well
- ▭ Site Boundary



PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: MAY 2012



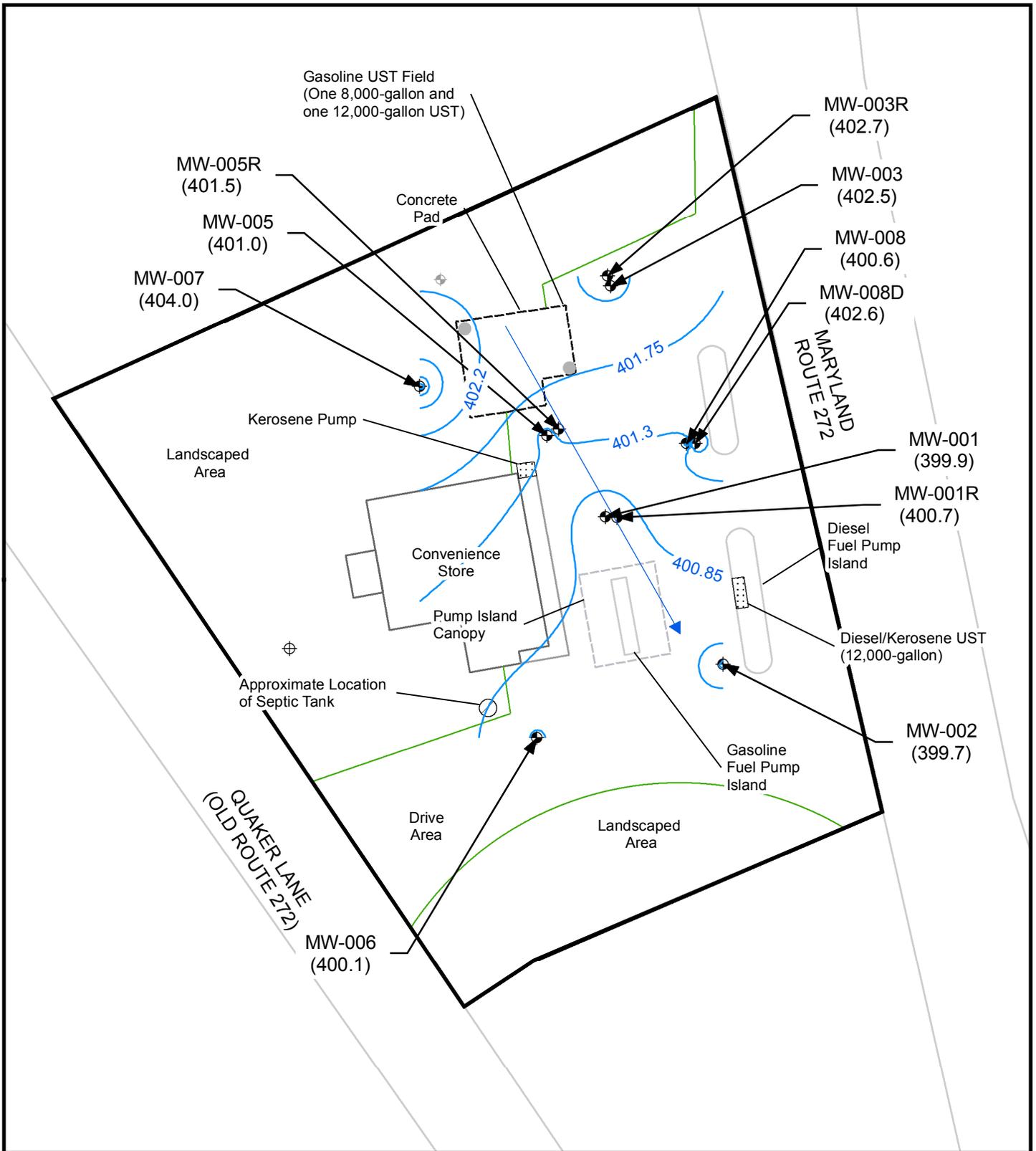


Figure 4: Groundwater Contour Map (September 15-16, 2011) ———> Groundwater Directional Flow

MW-001	Site ID	⊕	Monitoring Well (Measured)	●	Leak Detection Well
(176.01)	Groundwater Elevation (feet above datum)	⊕	Monitoring Well (Lost)	⊕	Potable Well

REPSG
 React Environmental
 Professional Services Group, Inc.

MAP SCALE: 1 inch = 45 feet

0 10 20 40 60 80 Feet

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: SEPTEMBER 2011



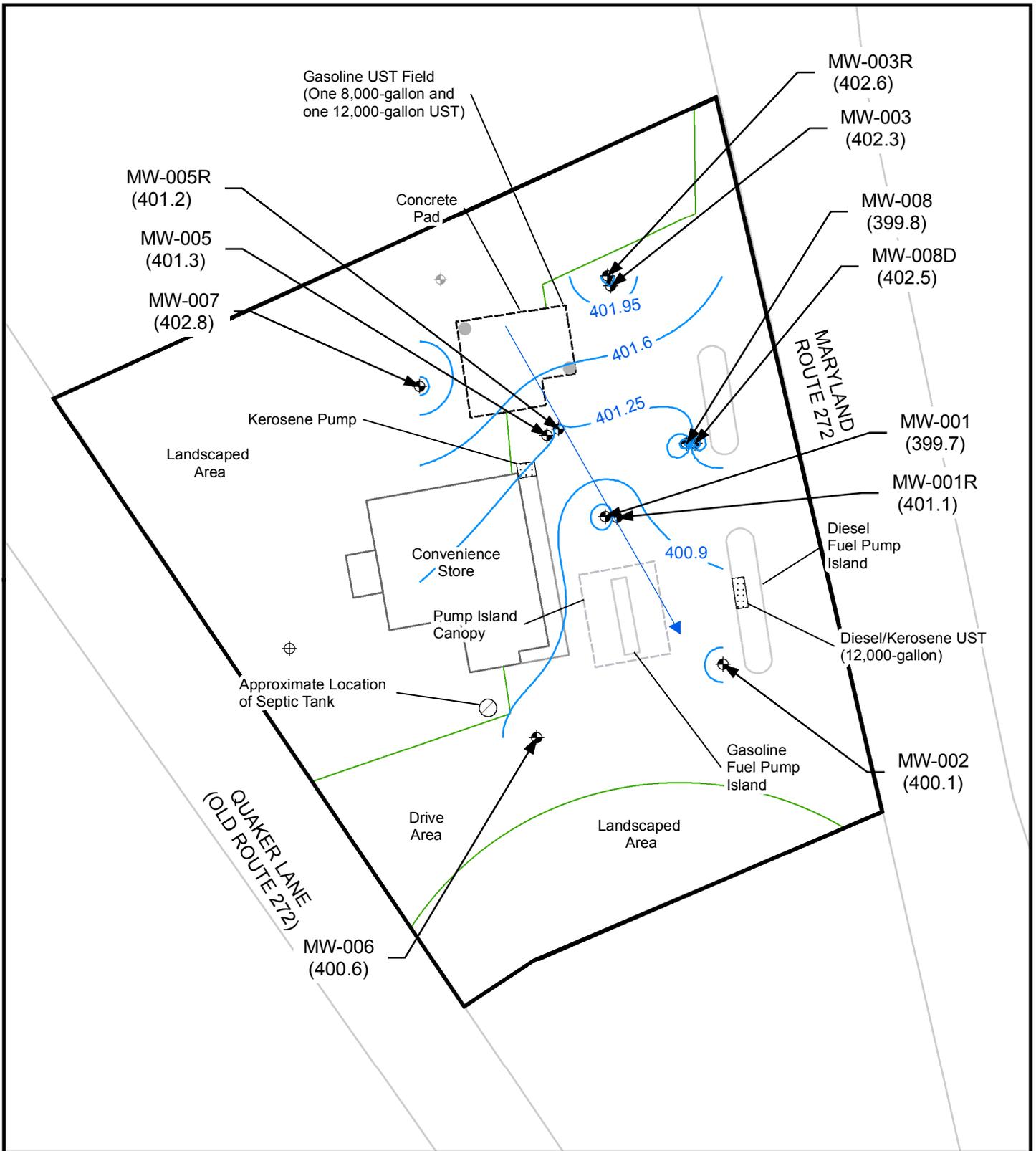


Figure 5: Groundwater Contour Map (October 25-27, 2011)

—▶ Groundwater Directional Flow

MW-001	Site ID	⊕	Monitoring Well (Measured)	●	Leak Detection Well
(176.01)	Groundwater Elevation (feet above datum)	⊕	Monitoring Well (Lost)	⊕	Potable Well

REPSG
 React Environmental
 Professional Services Group, Inc.

MAP SCALE: 1 inch = 45 feet

0 10 20 40 60 80 Feet

PROJECT NAME: CALVERT CITGO
 PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
 PROJECT NUMBER: 005977
 DATE: NOVEMBER 2011



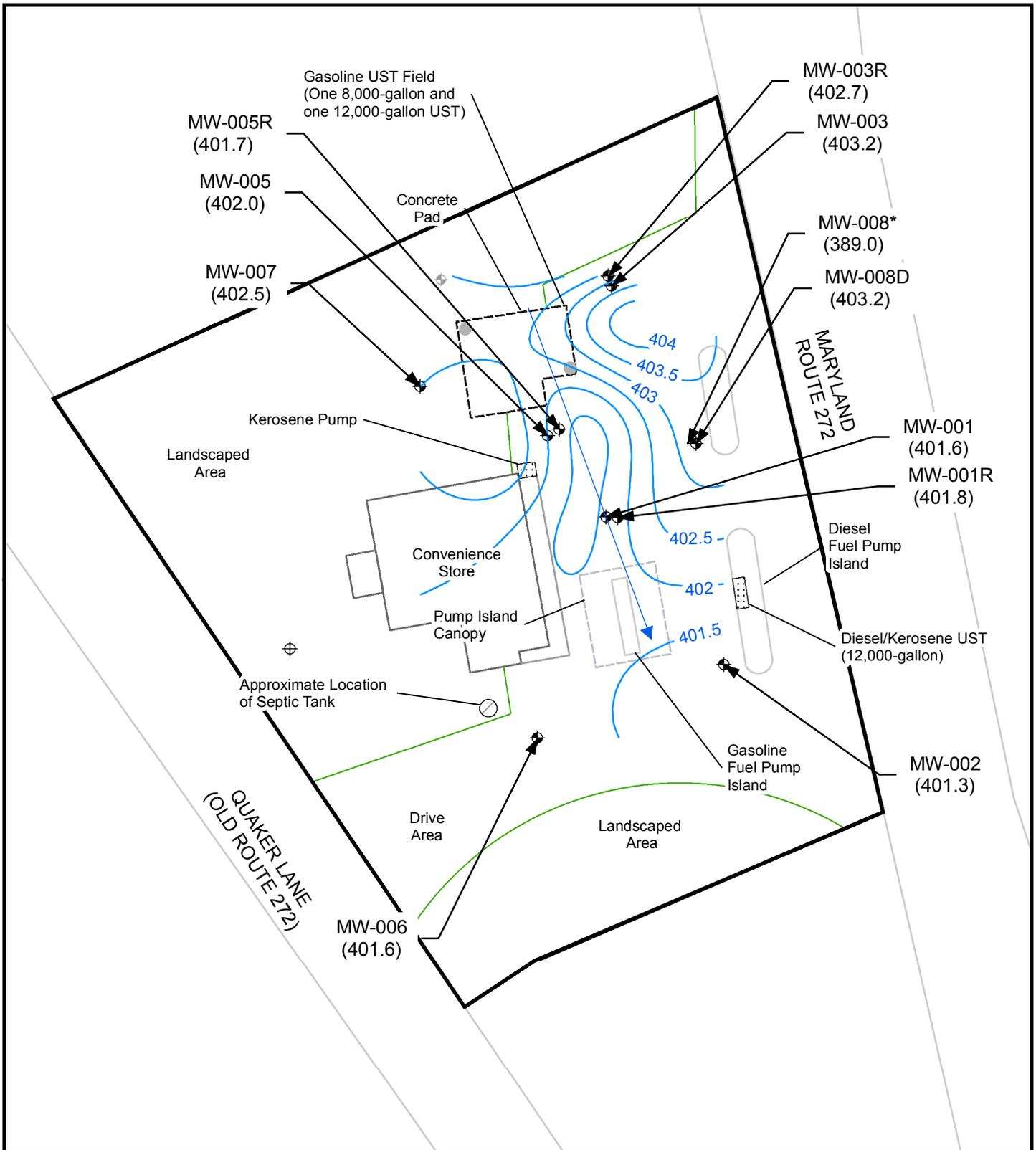


Figure 6: Groundwater Contour Map (February 26-28, 2012)* ———> Groundwater Directional Flow

MW-001	Site ID	⊕	Monitoring Well (Measured)	●	Leak Detection Well
(176.01)	Groundwater Elevation (feet above datum)	⊕	Monitoring Well (Lost)	⊕	Potable Well

REPSG
 React Environmental
 Professional Services Group, Inc.

MAP SCALE: 1 inch = 45 feet

0 10 20 40 60 80 Feet

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: MARCH 2012



*Monitoring well MW-008 was excluded from this groundwater contour map due to anomalous gauging data results.

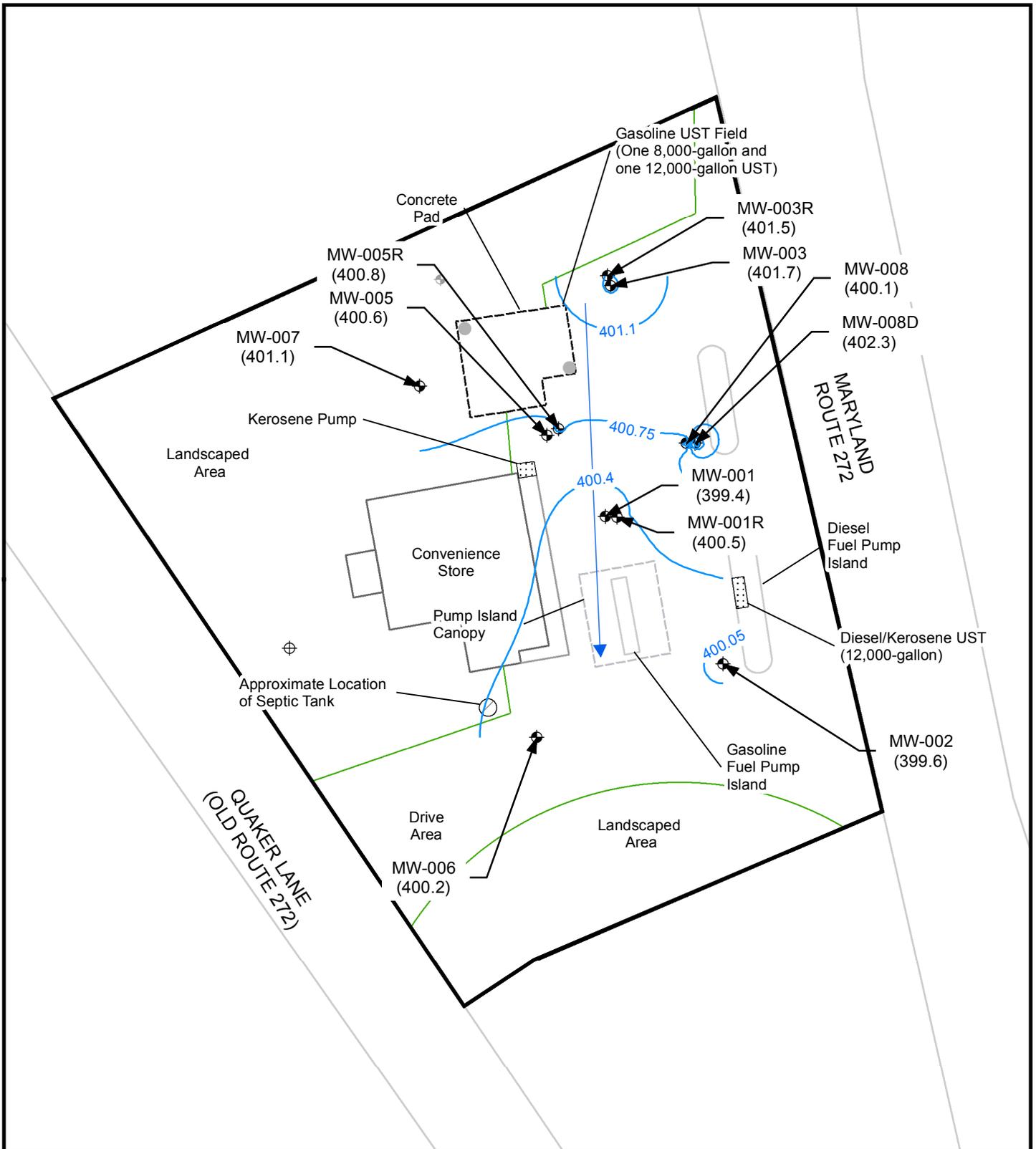


Figure 7: Groundwater Contour Map (May 7-8, 2012) ———> Groundwater Directional Flow

MW-001	Site ID	⊕	Monitoring Well (Measured)	●	Leak Detection Well
(176.01)	Groundwater Elevation (feet above datum)	⊕	Monitoring Well (Lost)	⊕	Potable Well

REPSG
 React Environmental
 Professional Services Group, Inc.

MAP SCALE: 1 inch = 45 feet

0 10 20 40 60 80 Feet

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: JUNE 2012



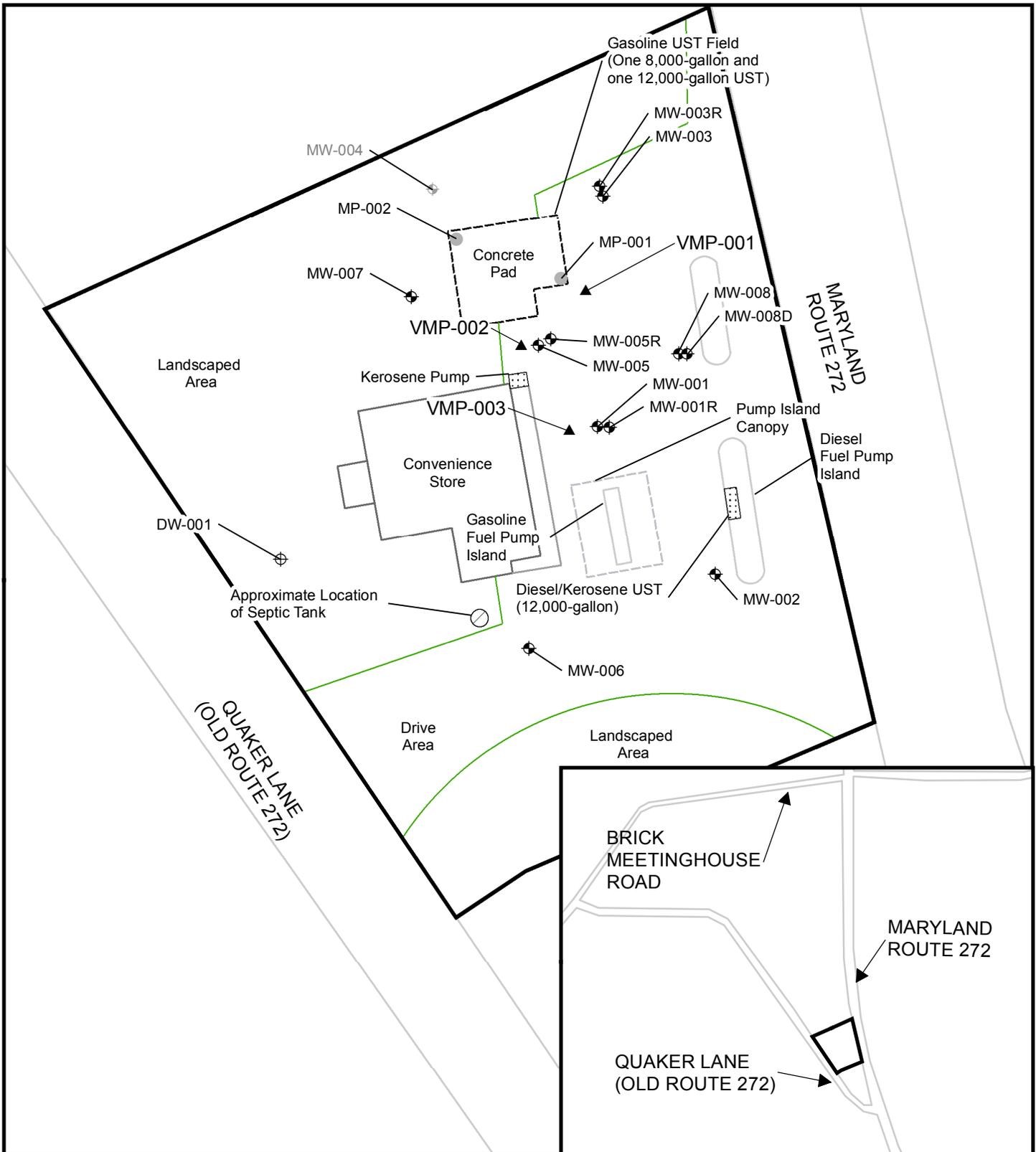


Figure 8: Proposed Vapor Monitoring Points

- ▲ Proposed Vapor Monitoring Points
- Leak Detection Well
- ⊕ Potable Well
- ⊕ Lost/Abandoned Monitoring Well
- ⊕ Monitoring Well
- ▭ Site Boundary

REPSG
 React Environmental
 Professional Services Group, Inc.

MAP SCALE: 1 inch = 45 feet

0 10 20 40 60 80 Feet

PROJECT NAME: CALVERT CITGO
PROJECT ADDRESS: 2815 NORTH EAST ROAD, NORTH EAST, MD
PROJECT NUMBER: 005977
DATE: JULY 2012



Calvert Citgo
July 31, 2012

Pilot Test Workplan
2815 North East Road, Town of North East
Cecil County, MD
MDE Case No. 92-2616-CE
REPSG Project Reference No. 005977.130.01

ATTACHMENT 2: WELL CONSTRUCTION LOGS



REPSG

React Environmental
Professional Services Group, Inc.

Well ID: MW-008D

Calvert Citgo 2815 Northeast Rd
REPSG Project No.: 005977

Installation Date: 8/8/11

Drilling Contractor: BL Meyers

Drilling Method: Air Rotary

Logged By: B.Musser

Notes: _____

Borehole Dm.: 6 in.

Total Depth: 125 ft.

Water Level (ATD): 120 ft.

Water Level (AD): NA

North (ft): 741122.38

East (ft): 1599638

Surface Elevation (ft.): NA

NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)

DEPTH (ft)	ELEV (ft)	CORE SAMPLE	RECOVERY	REMARKS	FID (ppm)	PID (ppm)	GRAB SAMPLE	GRAPHIC LOG	MATERIAL DESCRIPTION	WATER LEVEL	WELL DIAGRAM
0.0											Casing Type: PVC Sch 40
2.0									(CL-ML) Low Plasticity Silty Clay brown, loose, dry		Bentonite
4.0											
6.0											
8.0											
10.0											
12.0											
14.0											
16.0											
18.0											
20.0						18			(CL) Low Plasticity Clay light brown, medium dense, very moist		
22.0						25					
24.0						50					
26.0						50					
28.0						18					
30.0											
32.0											
34.0											
36.0						15.4					
38.0											
40.0											
42.0											
44.0											
46.0											
48.0											
50.0											
52.0											
54.0											
56.0											
58.0											
60.0											
62.0											
64.0											
66.0											
68.0											
70.0											
72.0											
74.0											
76.0											
78.0											
80.0											
82.0											
84.0											
86.0											
88.0											
90.0											
92.0											
94.0											
96.0											
98.0											
100.0											
102.0											
104.0											
106.0											
108.0											
110.0											
112.0											
114.0											
116.0											
118.0											
120.0											
122.0											
124.0											

Competant Bedrock at 98 ft.
Bottom of borehole at 125 ft.

Calvert Citgo
July 31, 2012

Pilot Test Workplan
2815 North East Road, Town of North East
Cecil County, MD
MDE Case No. 92-2616-CE
REPSG Project Reference No. 005977.130.01

ATTACHMENT 3: ANALYTICAL SUMMARY TABLES

Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Dates: 09/15/2011-05/08/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D	MW-008D	MW-008D	MW-008D
			Date:	09/15/2011	10/26/2011	02/28/2012	05/08/2012
			Depth (ft):	0	0	0	0
<i>Not Otherwise Specified</i>							
DBCP	ug/l	0.2		<1.5U#	<1.5U#	<1.5U#	<1.5U#
Tert-Amyl Methyl Ether	ug/l	**		<0.2U	<0.2U	<0.2U	<0.2U
<i>Petroleum Screening Parameters</i>							
Diesel Range Organics (DRO)	ug/l	47		280	470	240	180
Gasoline Range ORGANICS(GRO)	ug/l	47		36.8J	56J	16.2J	<13.9U
<i>Volatile Organic Compounds (VOCs)</i>							
1,1,1-trichloroethane	ug/l	200		<0.22U	<0.22U	<0.22U	<0.22U
1,1,2,2-Tetrachloroethane	ug/l	0.053		<0.34U#	<0.34U#	<0.34U#	<0.34U#
1,1,2-Trichloroethane	ug/l	5		<0.33U	<0.33U	<0.33U	<0.33U
1,1-Dichloroethane	ug/l	90		<0.28U	<0.28U	<0.28U	<0.28U
1,1-Dichloroethylene	ug/l	7		<0.29U	<0.29U	<0.29U	<0.29U
1,2-Dibromoethane	ug/l	0.05		<0.28U#	<0.28U#	<0.28U#	<0.28U#
1,2-Dichloroethane	ug/l	5		<0.32U	<0.32U	<0.32U	<0.32U
1,2-Dichloropropane	ug/l	5		<0.24U	<0.24U	<0.24U	<0.24U
2-Hexanone	ug/l	**		<1.3U	<1.3U	<1.3U	<1.3U
Acetone	ug/l	550		4J	5.3J	<3.1U	3.5J
Benzene	ug/l	5		0.46J	0.29J	0.33J	0.23J
Bromodichloromethane	ug/l	80		<0.27U	<0.27U	<0.27U	<0.27U
Bromoform	ug/l	80		<0.4U	<0.4U	<0.4U	<0.4U

Print Date: 07/27/2012

Page 1

** No Applicable Regulatory Standard

Exceedences of the regulatory standard are printed in bold. # = Reporting limit exceeds regulatory standard. NOC = Not of Concern.

QUALIFIERS: U = Constituent not detected above Method Detection Limit (MDL). J = Estimated Value. <= Indicates that the reported concentration is the Method Detection Limit (MDL). D = Compound identified at a secondary dilution factor. B = Analyte reported in associated field or trip blank. N = Tentatively Identified Compound (TIC). Y = Tentatively Identified Compound (TIC) also identified in Method Blank. E = Reported result is over instrument calibration range. This result is an estimate; the true result may be higher. C = Calibration verification recovery was above the method control limit for this analyte. Analyte not detected, data not impacted.

Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Dates: 09/15/2011-05/08/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D	MW-008D	MW-008D	MW-008D
			Date:	09/15/2011	10/26/2011	02/28/2012	05/08/2012
			Depth (ft):	0	0	0	0
Carbon disulfide	ug/l	100		<0.23U	<0.23U	<0.23U	<0.23U
Carbon tetrachloride	ug/l	5		<0.31U	<0.31U	<0.31U	<0.31U
Chlorobenzene	ug/l	100		<0.19U	<0.19U	<0.19U	<0.19U
Chlorobromomethane	ug/l	**		<0.32U	<0.32U	<0.32U	<0.32U
Chloroethane	ug/l	3.6		<0.33U	<0.33U	<0.33U	<0.33U
Chloroform	ug/l	80		<0.21U	<0.21U	<0.21U	<0.21U
cis-1,2-Dichloroethylene	ug/l	70		<0.32U	<0.32U	<0.32U	<0.32U
cis-1,3-Dichloropropene	ug/l	0.44		<0.31U	<0.31U	<0.31U	<0.31U
Dibromochloromethane	ug/l	80		<0.45U	<0.45U	<0.45U	<0.45U
Ethyl tert-butyl ether	ug/l	**		<0.19U	<0.19U	<0.19U	<0.19U
Ethylbenzene	ug/l	700		<0.34U	<0.34U	<0.34U	<0.34U
Isopropyl Ether	ug/l	**		<0.25U	<0.25U	<0.25U	<0.25U
m/p-xylene	ug/l	**		<0.52U	<0.52U	<0.52U	<0.52U
Methyl bromide	ug/l	0.85		<0.39U	<0.39U	<0.39U	<0.39U
Methyl chloride	ug/l	19		<0.31U	<0.31U	<0.31U	<0.31U
Methyl ethyl ketone	ug/l	700		<1.8U	<1.8U	<1.8U	<1.8U
Methyl isobutylketone (MIBK)	ug/l	630		<1.5U	2.1J	<1.5U	<1.5U
Methyl tert-butyl ether	ug/l	20		1.8	1.4	1.2	0.99J
Methylene chloride	ug/l	5		<0.45U	<0.45U	<0.45U	<0.45U
o-Xylene	ug/l	**		<0.33U	<0.33U	<0.33U	<0.33U
Styrene	ug/l	100		<0.24U	<0.24U	<0.24U	<0.24U

Print Date: 07/27/2012

Page 2

** No Applicable Regulatory Standard

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Dates: 09/15/2011-05/08/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D	MW-008D	MW-008D	MW-008D
			Date:	09/15/2011	10/26/2011	02/28/2012	05/08/2012
			Depth (ft):	0	0	0	0
Tert-Amyl alcohol	ug/l	**		<6.6U	<6.6U	<6.6U	<6.6U
Tert-Amyl Ethyl Ether	ug/l	**		<0.29U	<0.29U	<0.29U	<0.29U
tert-Butylalcohol	ug/l	**		<2.2U	<2.2U	9.6J	<2.2U
Tetrachloroethylene	ug/l	5		<0.35U	<0.35U	<0.35U	<0.35U
Toluene	ug/l	1000		1.1	0.93J	0.49J	0.23J
trans-1,2-Di-chloroethylene	ug/l	100		<0.26U	<0.26U	<0.26U	<0.26U
trans-1,3-Dichloropropene	ug/l	0.44		<0.29U	<0.29U	<0.29U	<0.29U
Trichloroethylene	ug/l	5		<0.33U	<0.33U	<0.33U	<0.33U
Vinyl chloride	ug/l	2		<0.3U	<0.3U	<0.3U	<0.3U
Xylene (total)	ug/l	10000		<0.66U	<0.66U	<0.66U	<0.66U

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water
Sample Date: 07/13/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D:113-129	MW-008D:98-114
			Date:	07/13/2012	07/13/2012
			Depth (ft):	0	0
<i>Not Otherwise Specified</i>					
2-Nitropropane	ug/l	**		<1.7U	<1.7U
Acrylonitrile	ug/l	**		<1.2U	<1.2U
Allyl chloride	ug/l	**		<0.26U	<0.26U
DBCP	ug/l	0.2		<1.5U#	<1.5U#
Dichlorofluoromethane	ug/l	**		<0.37U	<0.37U
Ethyl cyanide	ug/l	**		<2.6U	<2.6U
Ethyl methacrylate	ug/l	**		<0.32U	<0.32U
Isopropanol	ug/l	**		<7.1U	<7.1U
Methacrylonitrile	ug/l	**		<0.55U	<0.55U
Methyl iodide	ug/l	**		<0.42U	<0.42U
Methyl methacrylate	ug/l	**		<0.5U	<0.5U
n-Hexane	ug/l	**		<0.37U	<0.37U
Tert-Amyl Methyl Ether	ug/l	**		<0.2U	<0.2U
trans-1,4-Dichloro-2-butene	ug/l	**		<0.86U	<0.86U
Vinyl Acetate	ug/l	**		<1.6U	<1.6U

Petroleum Screening Parameters

Diesel Range Organics (DRO)	ug/l	47		76J	<14U
Gasoline Range ORGANICS(GRO)	ug/l	47		<13.9U	<13.9U

Semi-Volatile Organic Compounds (SVOCs)

Print Date: 07/26/2012

Page 1

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D:113-129	MW-008D:98-114
			Date:	07/13/2012	07/13/2012
			Depth (ft):	0	0
Hexachloroethane	ug/l	4.8		<0.51U	<0.51U
Nitrobenzene	ug/l	0.35		<4U#	<4U#
<i>-----</i>					
<i>Volatile Organic Compounds (VOCs)</i>					
1,1,1,2-Tetrachloroethane	ug/l	**		<0.35U	<0.35U
1,1,1-trichloroethane	ug/l	200		<0.22U	<0.22U
1,1,2,2-Tetrachloroethane	ug/l	0.053		<0.34U#	<0.34U#
1,1,2-Trichloroethane	ug/l	5		<0.33U	<0.33U
1,1-Dichloroethane	ug/l	90		<0.28U	0.54J
1,1-Dichloroethylene	ug/l	7		<0.29U	<0.29U
1,1-Dichloropropene	ug/l	**		<0.27U	<0.27U
1,2,3-Trichlorobenzene	ug/l	**		<0.93U	<0.93U
1,2,3-Trichloropropane	ug/l	**		<0.6U	<0.6U
1,2-Dibromoethane	ug/l	0.05		<0.28U#	<0.28U#
1,2-Dichloroethane	ug/l	5		<0.32U	<0.32U
1,2-Dichloropropane	ug/l	5		<0.24U	<0.24U
1,3-Dichloropropane	ug/l	**		<0.27U	<0.27U
1,3-Dichloropropene	ug/l	**		<0.47U	<0.47U
1,4-Dioxane	ug/l	**		<58.9U	<58.9U
2-Hexanone	ug/l	**		<1.3U	<1.3U
Acetone	ug/l	550		<3.1U	<3.1U
Benzene	ug/l	5		<0.23U	<0.23U

Print Date: 07/26/2012

Page 2

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D:113-129	MW-008D:98-114
			Date:	07/13/2012	07/13/2012
			Depth (ft):	0	0
Benzene, 1,2,4-trimethyl	ug/l	**		<0.25U	<0.25U
Benzene, 1,3,5-trimethyl-	ug/l	**		<0.2U	<0.2U
Bromobenzene	ug/l	**		<0.32U	<0.32U
Bromodichloromethane	ug/l	80		<0.27U	<0.27U
Bromoform	ug/l	80		<0.4U	<0.4U
Carbon disulfide	ug/l	100		<0.23U	<0.23U
Carbon tetrachloride	ug/l	5		<0.31U	<0.31U
Chlorobenzene	ug/l	100		<0.19U	<0.19U
Chlorobromomethane	ug/l	**		<0.32U	<0.32U
Chloroethane	ug/l	3.6		<0.33U	<0.33U
Chloroform	ug/l	80		<0.21U	<0.21U
cis-1,2-Dichloroethylene	ug/l	70		<0.32U	<0.32U
cis-1,3-Dichloropropene	ug/l	0.44		<0.31U	<0.31U
Cymene	ug/l	**		<0.32U	<0.32U
Dibromochloromethane	ug/l	80		<0.45U	<0.45U
Dichlorodifluoromethane	ug/l	**		<0.33U	<0.33U
Diethyl ether	ug/l	**		0.41J	0.58J
Ethyl tert-butyl ether	ug/l	**		<0.19U	<0.19U
Ethylbenzene	ug/l	700		<0.34U	<0.34U
Isopropyl benzene	ug/l	66		<0.22U	<0.22U
Isopropyl Ether	ug/l	**		<0.25U	<0.25U

Print Date: 07/26/2012

Page 3

** No Applicable Regulatory Standard

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D:113-129	MW-008D:98-114
			Date:	07/13/2012	07/13/2012
			Depth (ft):	0	0
m/p-xylene	ug/l	**		<0.52U	<0.52U
Methyl bromide	ug/l	0.85		<0.39U	<0.39U
Methyl chloride	ug/l	19		<0.31U	<0.31U
Methyl ethyl ketone	ug/l	700		<1.8U	<1.8U
Methyl isobutylketone (MIBK)	ug/l	630		<1.5U	<1.5U
Methyl tert-butyl ether	ug/l	20		<0.33U	0.41J
Methylene bromide	ug/l	**		<0.31U	<0.31U
Methylene chloride	ug/l	5		<0.45U	<0.45U
n-Butylbenzene	ug/l	**		<0.6U	<0.6U
n-Propylbenzene	ug/l	**		<0.33U	<0.33U
o-Chlorotoluene	ug/l	**		<0.26U	<0.26U
o-Xylene	ug/l	**		<0.33U	<0.33U
p-Chlorotoluene	ug/l	**		<0.33U	<0.33U
sec-Butylbenzene	ug/l	**		<0.31U	<0.31U
sec-Dichloropropane	ug/l	**		<0.32U	<0.32U
Styrene	ug/l	100		<0.24U	<0.24U
Tert-Amyl alcohol	ug/l	**		<6.6U	<6.6U
Tert-Amyl Ethyl Ether	ug/l	**		<0.29U	<0.29U
tert-Butylalcohol	ug/l	**		<2.2U	<2.2U
tert-Butylbenzene	ug/l	**		<0.44U	<0.44U
Tetrachloroethylene	ug/l	5		<0.35U	<0.35U

Print Date: 07/26/2012

Page 4

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

Maryland Department of the Environment (MDE) Voluntary Cleanup Program (VCP): Generic Numeric Cleanup Standards for Groundwater for Type I & II Aquifers, Tables 1 and 2 (March 2008).

Constituent	Unit	*Standard	Location:	MW-008D:113-129	MW-008D:98-114
			Date:	07/13/2012	07/13/2012
			Depth (ft):	0	0
Tetrahydrofuran	ug/l	**		<1.6U	<1.6U
Toluene	ug/l	1000		<0.23U	<0.23U
trans-1,2-Di-chloroethylene	ug/l	100		<0.26U	<0.26U
trans-1,3-Dichloropropene	ug/l	0.44		<0.29U	<0.29U
Trichloroethylene	ug/l	5		<0.33U	<0.33U
Trichlorofluoromethane	ug/l	**		<0.24U	<0.24U
Vinyl chloride	ug/l	2		<0.3U	<0.3U
Xylene (total)	ug/l	10000		<0.66U	<0.66U
<i>Volatile/Semi-Volatile Organic Compounds (V/SVOCs)</i>					
1,2,4-Trichlorobenzene	ug/l	70		<0.82U	<0.82U
Hexachlorobutadiene	ug/l	0.86		<1U#	<1U#
m-Dichlorobenzene	ug/l	1.8		<0.25U	<0.25U
Naphthalene	ug/l	0.65		<0.34U	<0.34U
o-Dichlorobenzene	ug/l	600		<0.38U	<0.38U
p-Dichlorobenzene	ug/l	75		<0.27U	0.42J

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

EPA National Primary Drinking Water Standards: Office OF Water. June 2003

Constituent	Unit	*Standard	Location:	DW-005:222-238	DW-005:85-101
			Date:	07/13/2012	07/13/2012
			Depth (ft):	222-238	85-101
<i>Not Otherwise Specified</i>					
1,1,-dichloropropanone	ug/l	**		<2.2U	<2.2U
2-Nitropropane	ug/l	**		<0.8U	<0.8U
Acrylonitrile	ug/l	**		<0.88U	<0.88U
Allyl chloride	ug/l	**		<0.17U	<0.17U
Chloroacetonitrile	ug/l	**		<0.88U	<0.88U
Chlorobutane, 1-	ug/l	**		<0.28U	<0.28U
DBCP	ug/l	0.2		<0.23U#	<0.23U#
Dichlorofluoromethane	ug/l	**		<0.21U	<0.21U
Ethyl cyanide	ug/l	**		<0.7U	<0.7U
Ethyl methacrylate	ug/l	**		<0.16U	<0.16U
Isopropanol	ug/l	**		<3.9U	<3.9U
Methacrylonitrile	ug/l	**		<0.23U	<0.23U
Methyl acrylate	ug/l	**		<0.21U	<0.21U
Methyl iodide	ug/l	**		<0.19U	<0.19U
Methyl methacrylate	ug/l	**		<0.2U	<0.2U
n-Hexane	ug/l	**		<11U	<11U
Pentachloroethane	ug/l	**		<0.23U	<0.23U
Tert-Amyl Methyl Ether	ug/l	**		6.4	10.5
trans-1,4-Dichloro-2-butene	ug/l	**		<0.27U	<0.27U
Vinyl Acetate	ug/l	**		<0.22U	<0.22U

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Page 1

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

EPA National Primary Drinking Water Standards: Office OF Water. June 2003

Semi-Volatile Organic Compounds (SVOCs)

Hexachloroethane	ug/l	**	<0.32U	<0.32U
Nitrobenzene	ug/l	**	<1.8U	<1.8U

Volatile Organic Compounds (VOCs)

1,1,1,2-Tetrachloroethane	ug/l	**	<0.22U	<0.22U
1,1,1-trichloroethane	ug/l	200	<0.15U	<0.15U
1,1,2,2-Tetrachloroethane	ug/l	**	<0.13U	<0.13U
1,1,2-Trichloroethane	ug/l	5	<0.2U	<0.2U
1,1-Dichloroethane	ug/l	**	0.19J	<0.11U
1,1-Dichloroethylene	ug/l	7	<0.22U	<0.22U
1,1-Dichloropropene	ug/l	**	<0.24U	<0.24U
1,2,3-Trichlorobenzene	ug/l	**	<0.23U	<0.23U
1,2,3-Trichloropropane	ug/l	**	<0.28U	<0.28U
1,2-Dibromoethane	ug/l	**	<0.15U	<0.15U
1,2-Dichloroethane	ug/l	5	8	10.7
1,2-Dichloropropane	ug/l	**	<0.19U	<0.19U
1,3-Dichloropropane	ug/l	**	<0.14U	<0.14U
1,3-Dichloropropene	ug/l	**	<0.23U	<0.23U
1,4-Dioxane	ug/l	**	<1.5U	<1.5U
2-Hexanone	ug/l	**	<0.82U	<0.82U
Acetone	ug/l	**	<2.2U	4.5J
Benzene	ug/l	5	<0.07U	<0.07U
Benzene, 1,2,4-trimethyl	ug/l	**	<0.11U	<0.11U

Print Date: 07/23/2012

Page 2

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

EPA National Primary Drinking Water Standards: Office OF Water. June 2003

Constituent	Unit	*Standard	Location:	DW-005:222-238	DW-005:85-101
			Date:	07/13/2012	07/13/2012
			Depth (ft):	222-238	85-101
Benzene, 1,3,5-trimethyl-	ug/l	**		<0.11U	<0.11U
Bromobenzene	ug/l	**		<0.19U	<0.19U
Bromodichloromethane	ug/l	**		<0.22U	<0.22U
Bromoform	ug/l	**		<0.23U	<0.23U
Carbon disulfide	ug/l	**		<0.21U	<0.21U
Carbon tetrachloride	ug/l	5		<0.2U	<0.2U
Chlorobenzene	ug/l	100		<0.14U	<0.14U
Chlorobromomethane	ug/l	**		<0.2U	<0.2U
Chloroethane	ug/l	**		<0.24U	<0.24U
Chloroform	ug/l	**		3.1	<0.19U
cis-1,2-Dichloroethylene	ug/l	70		<0.19U	<0.19U
cis-1,3-Dichloropropene	ug/l	**		<0.15U	<0.15U
Cymene	ug/l	**		<0.11U	<0.11U
Dibromochloromethane	ug/l	**		<0.18U	<0.18U
Dichlorodifluoromethane	ug/l	**		<0.22U	<0.22U
Diethyl ether	ug/l	**		0.37J	<0.21U
Ethyl tert-butyl ether	ug/l	**		<0.19U	<0.19U
Ethylbenzene	ug/l	700		<0.18U	<0.18U
Isopropyl benzene	ug/l	**		<0.14U	<0.14U
Isopropyl Ether	ug/l	**		5.6	9
m/p-xylene	ug/l	**		<0.21U	<0.21U

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Page 3

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

EPA National Primary Drinking Water Standards: Office OF Water. June 2003

Constituent	Unit	*Standard	Location:	DW-005:222-238	DW-005:85-101
			Date:	07/13/2012	07/13/2012
			Depth (ft):	222-238	85-101
Methyl bromide	ug/l	**		<0.13U	<0.13U
Methyl chloride	ug/l	**		<0.22U	<0.22U
Methyl ethyl ketone	ug/l	**		<1.3U	<1.3U
Methyl isobutylketone (MIBK)	ug/l	**		<0.56U	<0.56U
Methyl tert-butyl ether	ug/l	20		567	1120
Methylene bromide	ug/l	**		<0.24U	<0.24U
Methylene chloride	ug/l	5		<0.32U	<0.32U
n-Butylbenzene	ug/l	**		<0.13U	<0.13U
n-Propylbenzene	ug/l	**		<0.1U	<0.1U
o-Chlorotoluene	ug/l	**		<0.23U	<0.23U
o-Xylene	ug/l	**		<0.12U	<0.12U
p-Chlorotoluene	ug/l	**		<0.16U	<0.16U
sec-Butylbenzene	ug/l	**		1.1	1.2
sec-Dichloropropane	ug/l	**		<0.18U	<0.18U
Styrene	ug/l	100		<0.11U	<0.11U
Tert-Amyl alcohol	ug/l	**		<80U	<80U
Tert-Amyl Ethyl Ether	ug/l	**		<0.12U	<0.12U
tert-Butylalcohol	ug/l	**		1530	3250
tert-Butylbenzene	ug/l	**		<0.24U	<0.24U
Tetrachloroethylene	ug/l	5		<0.17U	<0.17U
Tetrahydrofuran	ug/l	**		<0.81U	<0.81U

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Page 4

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Analytical Chemistry Report

Calvert Citgo 2815 Northeast Rd North East, Maryland

Project No.: 005977

Matrix: Water

Sample Date: 07/13/2012

Regulatory Standard*:

EPA National Primary Drinking Water Standards: Office OF Water. June 2003

Constituent	Unit	*Standard	Location:	DW-005:222-238	DW-005:85-101
			Date:	07/13/2012	07/13/2012
			Depth (ft):	222-238	85-101
Toluene	ug/l	1000		2.4	0.78
trans-1,2-Di-chloroethylene	ug/l	100		<0.19U	<0.19U
trans-1,3-Dichloropropene	ug/l	**		<0.1U	<0.1U
Trichloroethylene	ug/l	5		<0.21U	<0.21U
Trichlorofluoromethane	ug/l	**		<0.18U	<0.18U
Vinyl chloride	ug/l	2		<0.23U	<0.23U
Xylene (total)	ug/l	10000		<0.27U	<0.27U
<i>Volatile/Semi-Volatile Organic Compounds (V/SVOCs)</i>					
1,2,4-Trichlorobenzene	ug/l	70		<0.14U	<0.14U
Hexachlorobutadiene	ug/l	**		<0.24U	<0.24U
m-Dichlorobenzene	ug/l	**		<0.11U	<0.11U
Naphthalene	ug/l	**		<0.15U	<0.15U
o-Dichlorobenzene	ug/l	600		<0.13U	<0.13U
p-Dichlorobenzene	ug/l	75		0.59	0.66

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Page 5

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Calvert Citgo
July 31, 2012

Pilot Test Workplan
2815 North East Road, Town of North East
Cecil County, MD
MDE Case No. 92-2616-CE
REPSG Project Reference No. 005977.130.01

ATTACHMENT 4: REPSG STANDARD OPERATING PROCEDURES

GROUNDWATER SAMPLING PROTOCOL

The following is the standard sampling procedure used by React Environmental Professional Services Group, Inc. (REACT) for the purpose of monitoring well development and sampling groundwater from monitoring wells.

Scope and Application

The purpose of this standard operating procedure (SOP) is to provide an overview of monitoring well development and sampling techniques. The theory behind well development is to remove as much of the fine grained sediments (fines) from the vicinity of the well screen as possible.

There are two techniques that are used to develop and sample wells. The first is overpumping, which involves purging the well at a rapid rate as to draw the water level as low as possible; and then allowing the well to recharge itself to its original level. The process is repeated until the water is clear and sediment-free.

Bailing consists of placing a manually operated check-valve bailer to remove water from the well. As is the case with the overpumping, the bailing should be continued until the water is sediment-free. Bailing works best for wells that are shallow or recharge slowly.

Method Summary

Before sampling takes place, a general overview of the site should be conducted. The overview should include conditions of the well(s) to ensure that no damage has occurred. Examples of damage may be, but are not limited to, missing well caps or locks, or any damage to the well casing itself. If damage is observed, repairs should be made in a timely manner, but not longer than 14 days after the damage is noticed.

Once the well is installed, development using one of the aforementioned techniques should occur as soon as possible, preferably shortly after installation. The method used for development should not interfere with the setting of the well seal.

There are a number of activities that must take place prior to well development. The well must first be opened and initial measurements should be taken, including water level and depth to bottom. At this time, well volume should be calculated using *Equation 1* below and the pertinent information should be documented as well.

Equation 1:

A. Well Depth (ft) _____

B. Depth to Water (ft) _____

C. Liquid Level (ft) = (A-B) _____

D. Casing Diameter:

a. 2 inches (D=0.163)

b. 4 inches (D=0.653)

c. 6 inches (D=1.469)

E. Well Volume (CxD) _____

F. Total Purge Volume: _____

[E x total number of well volumes (3)]

Purge Start Time (24 hour) _____

Sample Time (24 hour) _____

Sampling Method (Circle One):

Tap

Submersible Pump

Bailer

Number of Samples Collected _____

These recordings should be logged on groundwater sampling data sheets. Once this is completed, development of the wells should commence.

Using either the bailer or overpumping method, the wells should be purged until the water is clear and sediment-free, or until the parameters (pH, Turbidity, Specific Conductivity, Dissolved Oxygen, Temperature) are stabilized for three (3) consecutive readings. The water being pulled from the well should be run through activated carbon filters to clean the water of contaminants or be drummed for disposal at a later time.

Once the well is running clear and sediment-free, the equipment should be pulled from the well and decontaminated before using in any other sampling.

Sample Preservation, Containers, Handling and Storage

All equipment and bottleware associated with said wells are kept away from possible sources of contamination during transportation to and from site, as well as while on-site.

Once samples are collected, they are to be kept in a cooler on ice until picked-up by courier or taken to field trailer where they will be placed into a refrigerator.

Latex gloves are used to prevent cross-contamination and are always changed between wells.

Potential Problems

Overpumping is the most desirable method for monitoring well development, as it causes less destruction to the well pack compared to other forms.

Small submersible pumps, such as 2 inch diameter, are susceptible to clogging when used to develop wells due to the high amounts of fine materials.

Wells may run dry and recharge slowly, causing long delays in the development process. Wells should be purged until dry several times before development is considered complete.

Well Sampling Procedures

Coordinate site access and gain entry through necessary contacts and/or keys.

Once the well is opened, an air reading must be taken using a photoionization detector (PID) to analyze for volatile organic compounds (VOCs). If PID readings indicate a possible health and safety issues, please refer to trigger levels for appropriate PPE selection and other health and safety issues (i.e. air monitoring, respirators, evacuation.)

Using liquid level, gauge water level and total depth of the well and record on appropriate groundwater sampling data sheets.

Determine the water volume of the well.

Begin purging of the well, using a submersible pump, and take initial pH, temperature, turbidity, and specific conductivity of the water. Take note of the initial color, clarity and odor(s) of the water.

Continue purging of the well until three (3) consecutive readings of the above mentioned parameters are constant in succession. Once readings are taken, water should be run through an activated carbon filtration unit to remove potential contaminants.

Note: If developing a well, purge the well until the water is clear or the turbidity is below 50 NTUs.

Once the parameters are held constant, samples may be taken.

At this point the pump should be removed from the well, along with the tubing.

Using a disposable bailer, water should be taken from the well and deposited in the necessary bottleware, according to the specific regulations.

After the sampling is complete, equipment should be decontaminated before use in any other wells.

Samples should be labeled, placed in a cooler and sent to the lab for analysis.



May 25, 2012

Maryland Department of the Environment
1800 Washington Blvd.
Baltimore MD 21230
Attention: Ms. Jeannette DeBartolomeo, Case Manager

RE: Discrete Zone Sampling Methodology
Calvert Citgo (Former Alger Country Store)
2802 Northeast Road (Ginski Residence)
2794 Northeast Road (O'Brien Residence)
North East, Maryland 21901
Facility No. 5678
REPSG Project Reference No. 005977.130.01

Dear Ms. DeBartolomeo,

Following up on the May 1, 2012 Site Status Letter, REPSG is providing information pertaining to the methodology and techniques associated with the discrete zone sampling proposed at the Site.

REPSG is proposing that one (1) round of discrete zone testing to be conducted at the on-Site deep monitoring well (MW-008D) located at 2815 Northeast Road and at the off-Site residential drinking water well (DW-005) located at 2802 Northeast Road. The sample from the on-Site monitoring well will be collected at 130 feet below grade (fbg) and analyzed for TPH-DRO and TPH-GRO using Method 8015B and Volatile Organic Compounds VOC's (including BTEX, Naphthalene, and MTBE) using Method 8260B. The residential drinking water well will be sampled at 80 fbg, 125 fbg, and 230 fbg and analyzed for Volatile Organic Compound VOC's by Method 524.

The methods employed for discrete zone sampling includes the use of "straddle" packers. Straddle packers consist of two (2) inflatable packers that may be positioned above and below a specific sampling interval. Positioning these straddle packers above and below a specific sampling interval will allow REPSG to isolate the sampling interval of interest in order to collect discrete samples for analysis.

The straddle packers that will be used at the Site will be designed and built to be used within 6" boreholes, will be composed of steel skeleton ("mandrel") encased in a malleable-rubber gland and will include rubber shoulders, retaining rigs, and lock nuts on each end. Steel components

Maryland Department of the Environment
May 25, 2011

Formal Request
Calvert Citgo (Former Alger Country Store)
2815 Northeast Road
North East, Cecil County, MD
REPSG Project Reference No: 005977.130.01

(such as mandrels, retaining rings and lock nuts) will be custom built, with all non-metallic components obtained from the Roctest Telemac product line of *YEP 4.75"* sliding head packers.

Each mandrel will consist of a steel head located at either end, through which any tubing and cable may pass. Specifically, the heads of the upper packer will be drilled and tapped to accommodate two (2) 1/2" pneumatic lines, one 5/8" discharge line, three (3) 1/4" pneumatic lines and a power supply cable for the electrical submersible pump. The lower packer heads may alternatively be drilled and tapped for one 1/4" packer inflation line and stainless-steel tubing used for all tubing passed through the upper packer.

Electrical splices made within each packer are immobilized using a polymer resin in order to prevent the introduction of air into the packer. Individual wires are wrapped with heat-shrinking tubing in order to prevent damage caused by packer under-inflation under high hydrostatic pressures.

Once in place, packers are inflated using compressed nitrogen from two (2) 300-cubic-foot air tanks, which will be located on a support truck near the well being sampled. The minimal interval distance of 10' is limited by the length of the pump shroud located between the upper and lower packers; however, if necessary, the interval distance can be lengthened by adding sections of 1" black pipe between the bottom of the shroud and the top of the lower packer.

This work is tentatively scheduled for July 5th and 6th, 2012.

If you have any questions or concerns, please do not hesitate to contact our office at 215-729-3220.

Sincerely,



Suzanne Shourds
Environmental Risk Analyst



Brenda MacPhail Kellogg
Project Manager

React Environmental Professional Services Group, Inc.

Cc: Ms. Susan Bull, MDE