POST CORRECTIVE ACTION QUARTERLY MONITORING REPORT
CHESTER RIVER HOSPITAL CENTER
100 BROWN STREET
CHESTERTOWN, MARYLAND 21620

DECEMBER 2012

Prepared For:

CHESTER RIVER HOSPITAL CENTER
100 Brown Street
Chestertown, Maryland 21620

Submitted To:

MDE – OIL CONTROL PROGRAM
1800 Washington Boulevard
Baltimore, MD 21230

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W.O. 2781

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1.0 EXECUTIVE SUMMARY

On behalf of the Chester River Hospital Center (CRHC), Earth Data Incorporated (Earth Data) collected gauging and groundwater quality data during the forth quarter of 2012 as required by the Maryland Department of the Environment – Oil Control Program (MDE-OCP). On October 1, November 5 and December 4, 2012, Earth Data gauged 46 monitoring, recovery and injection wells at the CRHC in Chestertown, Maryland. Gauging results showed a regional groundwater flow direction to the southeast towards the Chester River. As a result of the termination of the pumping from the remediation system's seven recovery wells in July 2012, the water-table contour at the site has returned to its natural flow pattern. On separate occasions during the quarter, product thicknesses of 0.09 and 0.02 feet were measured in two wells, MW-47 and RW-2D, respectively. Absorbent wicks were placed in each well to retrieve accumulated liquid product. Measurable thicknesses (>0.01') of liquid product were not detected in any other well gauged during this monitoring period. Petroleum sheens or films, however, were detected on water table in seven monitoring wells and six out of seven recovery wells at least once during this monitoring period.

On October 1 and November 5, 2012, samples were collected from eight downgradient monitoring wells for VOCs and TPH-DRO/GRO analysis as required by MDE-OCP. Results of the October and November 2012 sampling of the eight downgradient monitoring wells showed no significant concentrations of VOCs or TPH.

On December 4 and 5, 2012, groundwater samples were collected from 46 monitoring, recovery and injection wells for VOCs and TPH-DRO/GRO analysis. Gauging results from December 4, 2012 showed no measurable thickness of liquid

hydrocarbons (fuel oil) on the water-table in any of the wells. Analytical results showed detectable concentrations of TPH-DRO in 29 of the 46 wells sampled. Five monitoring wells south of Brown Street showed detectable concentrations of TPH-DRO.

Analytical results also showed that detectable concentrations of VOCs (primarily the petroleum related compounds, benzene, toluene, ethylbenzene, xylenes, isopropylbenzene and naphthalene) were present in 15 of the 46 wells sampled. In addition, low concentrations of acetone were found in samples collected from five wells. Low concentrations of tetrachloroethene (PCE) were also found in samples collected from two wells and low levels of chloroform were found in three wells. The data presented herein represents the second round of quarterly monitoring after the trial shutdown of the remediation/containment system at the CRHC.

Detectable concentrations of TPH-DRO were found in downgradient monitoring wells MW-18, MW-19, MW-23 and MW-24 for the first time since the remediation/containment system was shutdown in July 2012. As these wells are located at disparate points between Brown Street and Campus Avenue, it appears improbable that the source of the detected petroleum hydrocarbons is the CRHC property. More likely, the presence of petroleum hydrocarbons in the samples collected from these wells is due to a sampling anomaly. Monitoring wells MW-18, MW-19, MW-23 and MW-24 will be resampled during the January monthly monitoring visit to verify the assumption.

Due to the expansion of the CRHC building, monitoring wells MW-10 and MW-31 were replaced with new wells MW-10R and MW-31R in November 2012. In both cases, the new wells were installed within 20 feet of the old well locations. The old wells were properly abandoned in accordance with MDE protocol by an MDE-licensed well

driller. Groundwater samples were collected from the new wells during the December 2012 round of sampling.

It should be noted that, based on the gauging data collected while the remediation system was in operation, the hydraulic influence of the system extends down-gradient (south of Brown Street) to the vicinity of MW-34. As a consequence, if the dissolved hydrocarbon plume were to move past the location of MW-34, it may no longer be contained by the recovery system if it were to be restarted. Therefore, in an effort to more accurately delineate the leading edge of the dissolved phase hydrocarbon plume, Earth Data recommends installing additional monitoring wells down-gradient of MW-34. The recommendations for the placement of the wells was outlined in a separate letter to MDE (*CRHC - Work Plan for Proposed Well Abandonment and Replacement)* dated September 19, 2012. Finally, if monitoring results show the presence of free product or a significant increase in the dissolved hydrocarbon concentrations in MW-34 or adjacent monitoring wells, Earth Data will recommend reactivating the remediation system.

2.0 INTRODUCTION

2.1 Background

In May 1991, shortly after the discovery of the release of fuel oil from a supply line in the hospital's heating system, a groundwater remediation and containment system was installed. The system was designed not only to recover liquid phase fuel oil from the subsurface, but also to contain the product plume on-site. Plume containment is essential to protect Chestertown's well field, located approximately 1,200 feet down-gradient from the CRHC.

In 2001, an upgraded remediation system was installed to include both pump-and-treat and vacuum extraction components to reduce the levels of immiscible, dissolved and adsorbed hydrocarbons in the subsurface. The vacuum extraction portion of the system was never operated due to relatively high water-table elevations recorded during the past 10 years. The product recovery and containment (pump-and-treat) portion of the system consists of seven recovery wells (RW-1b, RW-2d, RW-3b, MW-4, MW-5, MW-6 and MW-22) that are installed with submersible water-table suppression pumps. A separate satellite system located in the basement boiler room used a converted monitoring well (MW-37) to recover liquid product and suppress the water-table at that location. This system was shut down and dismantled in September 2009 due to decreased oil recovery and excessive bio-fouling of the well.

To remove liquid hydrocarbons from each recovery well, Genie™ Controllerless Skimmers pump the liquid (free) product into an on-site aboveground storage tank located in the treatment building at the southeast corner of the hospital building. A

filtration system, which includes a series of pre-filters and Mycelx® filters, treats the groundwater pumped from the containment-and-recovery wells. After treatment, the recovered groundwater is discharged to the on-site storm sewer at the intersection of Roberts Drive and Brown Street. This system has typically been operated to withdraw between 100 and 120 gallons per minute of groundwater to maintain a sufficient depression in the water-table at the site to contain the dissolved and liquid product plume.

The remediation effort to date has resulted in the recovery of 83,452 gallons of fuel oil from the subsurface. During the past two years, the average rate of product recovery has dropped to below 2 gallons per month, indicating the practical completion of liquid product recovery from the subsurface with the current system.

2.2 Site Description

Located at 100 Brown Street in Chestertown, Maryland, the Chester River Hospital Center (CRHC) occupies approximately 7.1 acres east of Washington Street (Rt. 213) (Figure 1). The property was originally developed as a local general hospital around 1935. Prior to 1935, the property appears to have been farmland.

The CRHC property is bordered on the north, east and south by residential properties. To the west are lands of Washington College. The hospital and surrounding residential area including Washington College is served by public water and sewer provided by the Town of Chestertown.

2.3 Local Geology and Hydrogeology

Surface water from the CRHC property eventually drains into the Chester River through the local storm water collection system. The Chester River is a tidal tributary of

the Chesapeake Bay and enters the bay approximately 15 miles southwest of Chestertown.

Chestertown is located in south central Kent County on the Eastern Shore of Maryland. The Eastern Shore of Maryland is part of the Delmarva Peninsula, which is in of the Atlantic Coastal Plain physiographic province. The coastal plain is underlain by thick layers of unconsolidated sediments (sands, silts and clays), which dip and thicken towards the southeast.

The Pennsauken Formation, of Pleistocene or Pliocene age, comprises the surface sediments over much of the northern portion of the Delmarva Peninsula. In Kent County, this formation consists of yellowish brown sands, silty sands and clayey sands to a depth of approximately 30 feet below ground surface. The total thickness of the Pennsauken Formation ranges from 0 to 50 feet in Kent County. It appears to be very thin or absent under the CRHC property.

The Paleocene age Aquia Formation, which underlies the Pennsauken Formation in the Chestertown area, typically consists of sands to a depth of approximately 120 feet below ground surface (Drummond, 1998). The Aquia Formation is underlain by silts and clays of the Monmouth Formation (Cretaceous aged) to a depth of approximately 220 feet below ground surface. Cretaceous age silts, sands and clays of the Matawan Formation underlie the Monmouth Formation to a depth of approximately 320 feet. Beneath the Matawan Formation lie sands and clays of the Magothy Formation to a depth of approximately 430 feet. The Monmouth, Matawan and Magothy Formations comprise sediments of the Chesapeake Group. The Cretaceous-aged Potomac Formation underlies the Chesapeake Group. The Potomac Formation consists of several sand layers separated

by relatively thick confining clay units. In the Chestertown area, the Potomac Formation extends from a depth of approximately 430 feet to 1,500 feet below ground surface. At 1,500 feet, crystalline bedrock would be encountered.

2.4 Aquifers and Water-Supply Wells

The CRHC property is directly underlain by the outcrop of the Aquia Formation. It extends from ground surface to a depth of approximately 120 feet and is characterized by layers of sand and silty sand. Some of the sand units are semi-cemented with iron oxide. Under non-pumping conditions, the water-table fluctuates seasonally between 30 feet and 55 feet below ground surface depending on location. Natural groundwater flow is to the southwest towards the Town of Chestertown well field and the Chester River. The aquifer under the property is unconfined though individual sand layers may exhibit semi-confined characteristics.

The containment/recovery system at the CRHC has depressed the water-table around the recovery wells causing a localized "cone of depression" to extend under much of the hospital property. This cone of influence has prevented liquid phase and dissolved phase hydrocarbons from moving off-site and also enabled the capture and recovery of liquid phase product.

The primary well field for the Town of Chestertown is located at the intersection of Kent Street and Byford Drive, approximately 1,750 feet southwest of the CRHC property. Many of the municipal water supply wells are screened in the same unconfined Aquia aquifer which underlies the CRHC property. The Town also operates two wells in the same well field that are screened in the deeper, confined Magothy aquifer.

Prior to the discovery of the fuel oil release at CRHC in 1991, the Town of Chestertown operated their Well No. 8, which is located at the intersection of Campus Avenue and Philosopher's Terrace approximately 850 feet down-gradient of the location of the release. Well No. 8 was taken out of service in 1991 shortly after the fuel oil release at the CRHC was reported. At that time, it was concluded that the continued operation of the town well would exacerbate recovery operations at the CRHC and might pull dissolved hydrocarbons into the well which would then require treatment or the well's abandonment. Because Well No. 8 had a high yield and excellent water quality, it was not abandoned. The Town of Chestertown plans to put Well No. 8 back into service when the remediation effort at the CRHC is competed.

2.5 Scope of Work

On October 1, November 5 and December 4, 2012, each monitoring and recovery well at the CRHC was gauged with an oil/water interface probe to determine the depth of the water-table and the presence, if any, of liquid hydrocarbons on the surface of the water-table aquifer. Figure 2 shows the location of each monitoring and recovery well plus the locations of monitoring and recovery wells that were abandoned in the past. Based on the gauging data for each date, water-table contour maps were prepared showing the groundwater flow direction (Figures 3, 4 and 5).

On October 1 and November 5, 2012, eight monitoring wells, immediately downgradient of the remediation/containment system, were sampled (MW-15, MW-16, MW-19, MW-20, MW-24, MW-33, MW-35 and MW-35) for laboratory analysis. These wells are located in and around the lower parking lot south of Brown Street.

On December 4 and 5, 2012, Earth Data personnel collected groundwater samples from 38 on-site monitoring wells, seven recovery wells and one injection well for laboratory analysis. Groundwater samples were collected from monitoring wells MW-1, MW-2, MW-3, MW-4, MW-5, MW-8, MW-9, MW-10R, MW-11, MW-12, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-21, MW-23, MW-24, MW-25, MW-28, MW-29, MW-31R, MW-32, MW-33, MW-34, MW-35, MW-37, MW-40, MW-41, MW-42, MW-43, MW-44, MW-45, MW-46 and MW-47, recovery wells RW-1B, RW-2D, RW-3B, RW-4, RW-5, RW-6 and MW-22 and injection well IW-1.

During each site visit, prior to sampling, each well was purged of at least three standing volumes of water to ensure that the sample collected was representative of the water in the surrounding formation. The purge water was filtered through granular activated carbon before being discharged on-site. Using dedicated disposable bailers for each well, the groundwater samples were collected in pre-labeled sample containers and placed on ice in a laboratory-supplied cooler. The samples were then sent via courier to an EPA-approved laboratory for analysis. Each groundwater sample was analyzed for volatile organic compounds (VOCs) plus oxygenates using EPA Method 8260 and total petroleum hydrocarbons – diesel range organics (TPH-DRO) and gasoline range organics (TPH-GRO) using EPA Method 8015.

3.0 SITE MONITORING RESULTS

3.1 Water-Table Measurements and Water-Table Contours

To document the return of natural water-table contours in the vicinity of the hospital after the trial shutdown of the remediation system, the monitoring well network was gauged on October 1, November 5, and December 4, 2012. Gauging data collected on all three dates show a groundwater flow direction towards the southeast and the Chester River. Using the December 2012 gauging data, the gradient of the water-table across the site was determined to be 0.0067 ft/ft. Similar gradients were found during the October and November site visits. The Earth Data well gauging reports and corresponding field reports may be found in Appendix A. Hydrographs for the entire history of the remediation showing depth to water and product thickness for each well are presented in Appendix B. Gauging data used to prepare the hydrographs may be found in Appendix C.

3.2 Groundwater Sampling and Analysis

On October 1 and November 5, 2012, Earth Data representatives collected groundwater samples from eight downgradient monitoring wells. As previously stated, the samples were analyzed for VOCs plus fuel oxygenates (EPA Method 8260) and TPH-DRO/GRO (EPA Method 8015). Figures 6 and 7 show the benzene, BTEX, MTBE and TPH-DRO/GRO concentrations for each well sampled in October and November 2012, respectively. The figures also identify those monitoring wells where measurable thicknesses of free product were found.

On December 4 and 5, 2012, Earth Data representatives collected groundwater

samples from each monitoring, recovery and injection well that did not contain measurable quantities of liquid hydrocarbons. As no wells showed measurable quantities of liquid hydrocarbons during the December gauging, all wells within the network were sampled. As with the samples collected in October and November 2012, the samples were analyzed for VOCs plus fuel oxygenates and TPH-DRO/GRO. Figure 8 shows the benzene, BTEX, MTBE and TPH-DRO/GRO concentrations for each well sampled in December 2012.

Laboratory analytical results of the samples collected from the eight downgradient monitoring wells in October and November 2012 show detectable concentrations of TPH-DRO in only one well (MW-20). The concentration of TPH-DRO found in MW-20 during the October and November 2012 sampling was 4.0 mg/l and 2.5 mg/l, respectively. No detectable concentrations of TPH-GRO were found in any of the downgradient monitoring wells sampled. Very low concentrations of several VOCs tested were found in samples collected from two of the downgradient monitoring wells. Isopropylbenzene was detected in the sample collected from MW-20 at 2.2 ug/l during the October 2012 sampling. The sample collected from MW-19 showed a detectable concentration (1.1 ug/l) of tetrachloroethylene (PCE) in October. In November, MW-19 showed a detectable concentration (2.8 ug/l) of chloroform. No other VOCs tested were detected in the samples collected from the downgradient monitoring wells in October and November 2012.

Diesel-range organics (TPH-DRO) were detected in 29 of 46 wells sampled in December. Detected concentrations of TPH-DRO ranged from 0.15 to 9,700 mg/L, depending on the well location. Monitoring well (MW-20) located south of Brown Street

(down-gradient of the remediation/containment system) showed detectable concentrations (1.9 mg/L) of TPH-DRO. Samples collected from MW-20 in the recent past have shown similar or greater concentrations of TPH-DRO. Four other monitoring wells located south of Brown Street also showed detectable concentrations TPH-DRO during the December sampling event. The TPH concentrations in the samples collected from monitoring wells MW-18, MW-19, MW-23 and MW-24 were found to be 0.23 mg/L, 0.86 mg/L, 11 mg/L and 0.25 mg/L, respectively. Monitoring well MW-19 is located along Brown Street immediately east of monitoring well MW-20. Monitoring well MW-24 is located along Riverside Street between Brown Street and Campus Avenue. Monitoring wells MW-18 and MW-23 are located along Campus Avenue.

Of the 58 VOCs tested, eleven were found at detectable concentrations in some of the groundwater samples collected. Thirteen monitoring wells had detectable concentrations of naphthalene. Naphthalene concentrations ranged from 1.6 ug/L to 250 ug/L. Low to moderate concentrations of the dissolved petroleum hydrocarbons associated with fuels (benzene, ethylbenzene, xylenes and isopropylbenzene) were found in samples collected from eight wells (MW-2, MW-14, MW-19, MW-40, MW-41, MW-46, RW-3B and RW-4). Detectable concentrations of dissolved acetone were found in five water samples, with concentrations ranging from 10 ug/L to 97 ug/L. Tetrachloroethene (PCE) was found in two samples, with concentrations ranging from 1.1 ug/L to 1.6 ug/L. Chloroform concentrations ranging between 1.3 ug/L and 1.8 ug/L were found in samples collected from three monitoring wells.

A summary of the laboratory analytical results for the December sampling event may be found in Table 1. A summary of water quality for selected downgradient

monitoring wells with results of previous sampling events may be found in Table 2. Laboratory analytical reports for the groundwater samples collected at the site during this monitoring period may be found in Appendix D. For comparison purposes, analytical data for each monitoring well are presented in a time series format for all previous sampling events and may be found in Appendix E.

4.0 DISCUSSION

4.1 Water-Table Elevation and Contours

During the October 1 through December 31, 2012 monitoring period, two wells (RW-2D and MW-47) showed measurable thicknesses (0.02 and 0.09 feet) of liquid phase hydrocarbons. Oil-absorbent wicks were used to retrieve the liquid product from the surface of the water-table in these wells. No measurable thickness of liquid phase hydrocarbons were found in any of the wells gauged during the December 2012 site visit. Since ending the suppression of the water-table in July 2012, the groundwater flow pattern has returned to its natural state. The water-table contour maps prepared using the October 1, November 5 and December 4, 2012 gauging data showed little change in the water-table elevation, with a natural groundwater flow across the site to the southeast.

4.2 Water Quality

Analytical results of groundwater samples collected in October and November 2012 from eight downgradient monitoring wells does not suggest that dissolved and liquid phase hydrocarbon plumes have migrated south of Brown Street. The groundwater samples collected in December 2012; however, show detectable concentrations of TPH-DRO in four downgradient monitoring wells (MW-18, MW-19, MW-23 and MW-24) for the first time since the remediation/containment system was deactivated in July 2012. The varied location of these wells within the monitoring network suggests that the CRHC release is not the source of the TPH-DRO. The presence of TPH-DRO in these wells may be due to anomalies associated with sampling. To verify this premise, the four wells will be resampled for laboratory analysis during the January 2013 monitoring visit.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Since the shutdown of the remediation/containment system at the CRHC in July 2012, gauging data indicates that the water-table contour at the site has returned to its natural flow pattern. Data for each gauging event during this monitoring period show a groundwater flow across the site to the southeast. During the October 2012 gauging event, a measurable amount (0.09 feet) of liquid phase hydrocarbons was observed in monitoring well MW-47). Recovery well RW-2D showed a measurable thickness (0.02 feet) of liquid hydrocarbons during the November round of gauging. No measurable thicknesses of liquid product were observed in any other wells during the quarterly monitoring period. A petroleum sheen or film, however, was observed on the surface of the water-table in seven other monitoring wells and six of seven recovery wells at least once during the monitoring period.

On October 1 and November 5, 2012, eight monitoring wells located downgradient of the remediation/containment system were sampled for laboratory analysis as required in the September 5, 2012 MDE-OCP letter. Analytical results showed the presence of low concentrations of TPH-DRO in monitoring well MW-20 located directly across Brown Street from the remediation system during both sampling events. Low concentrations of TPH-DRO were regularly detected in MW-20 when the remediation system was in operation. No detectable concentrations of TPH-DRO were found in any of the other downgradient monitoring wells during the October and November 2012 sampling.

On December 4 and 5, 2012, all 46 wells at the CRHC were sampled for laboratory analysis. Analytical results showed detectable concentrations of TPH-DRO in

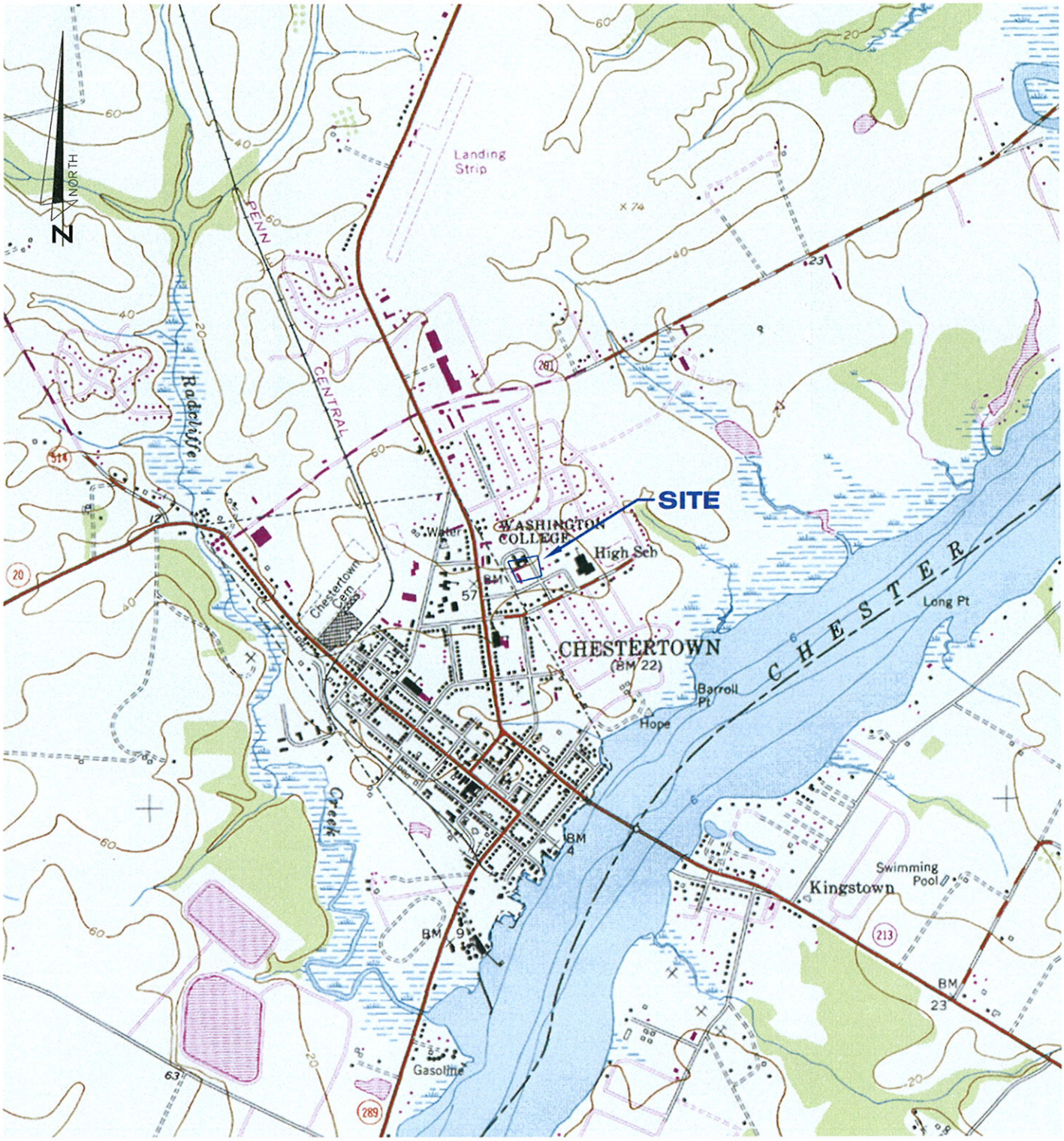
four downgradient monitoring wells for the first time since the beginning of the trial shutdown of the remediation system in July 2012. The widely varied location of the four affected wells suggests that the source of the TPH-DRO may be other than the release at the CRHC. The four wells will be resampled during the January 2013 round of monitoring to verify the presence of the TPH-DRO.

It should also be noted that based on the gauging data collected while the remediation system was in operation, the hydraulic influence of the system only extends out to the vicinity of downgradient monitoring well MW-34. As a consequence, if the dissolved hydrocarbon plume were to move past the location of MW-34, it may not be contained by the remediation system if it were turned reactivated. Therefore, in an effort to more accurately delineate the leading edge of the dissolved phase hydrocarbon plume, Earth Data has recommended installing additional monitoring wells down-gradient of MW-34. The recommendation for the placement of these additional wells is outlined in a separate letter to MDE (*CRHC – Work Plan for Proposed Well Abandonment and Replacement*) dated September 19, 2012.

6.0 LIMITATIONS

The findings and conclusions presented in this report are the results of both fieldwork and data analysis by Earth Data Incorporated. Due to the limited scope of this study, Earth Data collected data from only a limited number of locations on the property and on limited occasions. Therefore, there may be environmental or subsurface conditions on the property not disclosed by our investigation. This report has been prepared using generally accepted environmental and hydrogeologic practices for the exclusive use of the Chester River Hospital Center and their representatives. No other warranty, expressed or implied, is made.

FIGURES



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GRAPHIC SCALE
(FEET)

* CREATED 1953 *
* MODIFIED 1973 *

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Earth Data
INCORPORATED

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FIGURE 1

LOCATION MAP
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

PROJ. MGR.:	A.BULLEN
DATE:	10/31/2011
SCALE:	AS SHOWN
EDI #:	2781
DRAWN BY:	T.COCHRUN

PORTION OF USGS 7.5 MINUTE QUADRANGLE FOR CHESTERTOWN, MARYLAND

Figure 1 – Portion of USGS Quadrangle for Chestertown showing the location of Chester River Hospital Center – Chestertown, Maryland.

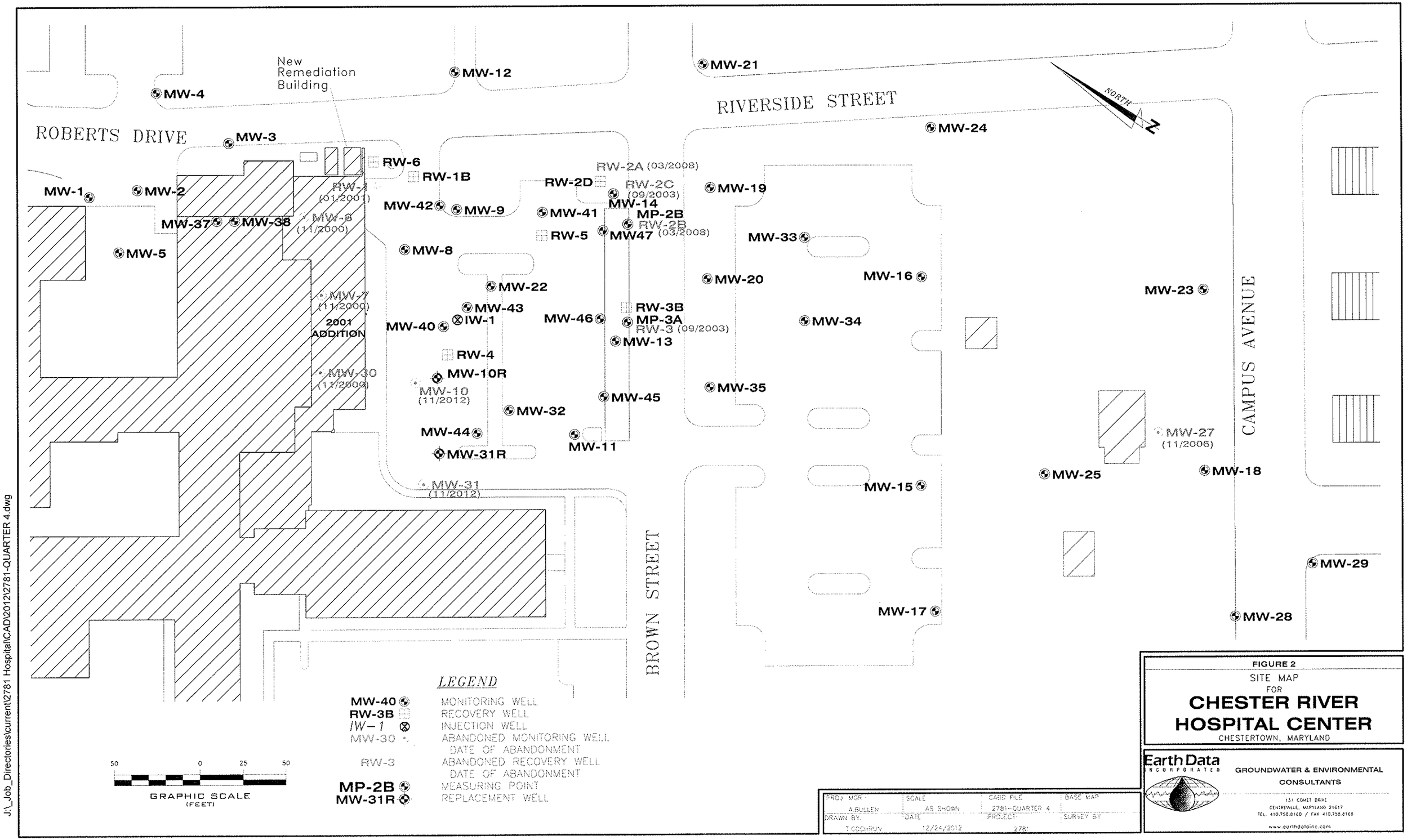

Figure 2 – Site map showing the location of monitoring wells and other pertinent features at the Chester River Hospital Center, Chestertown, Maryland.

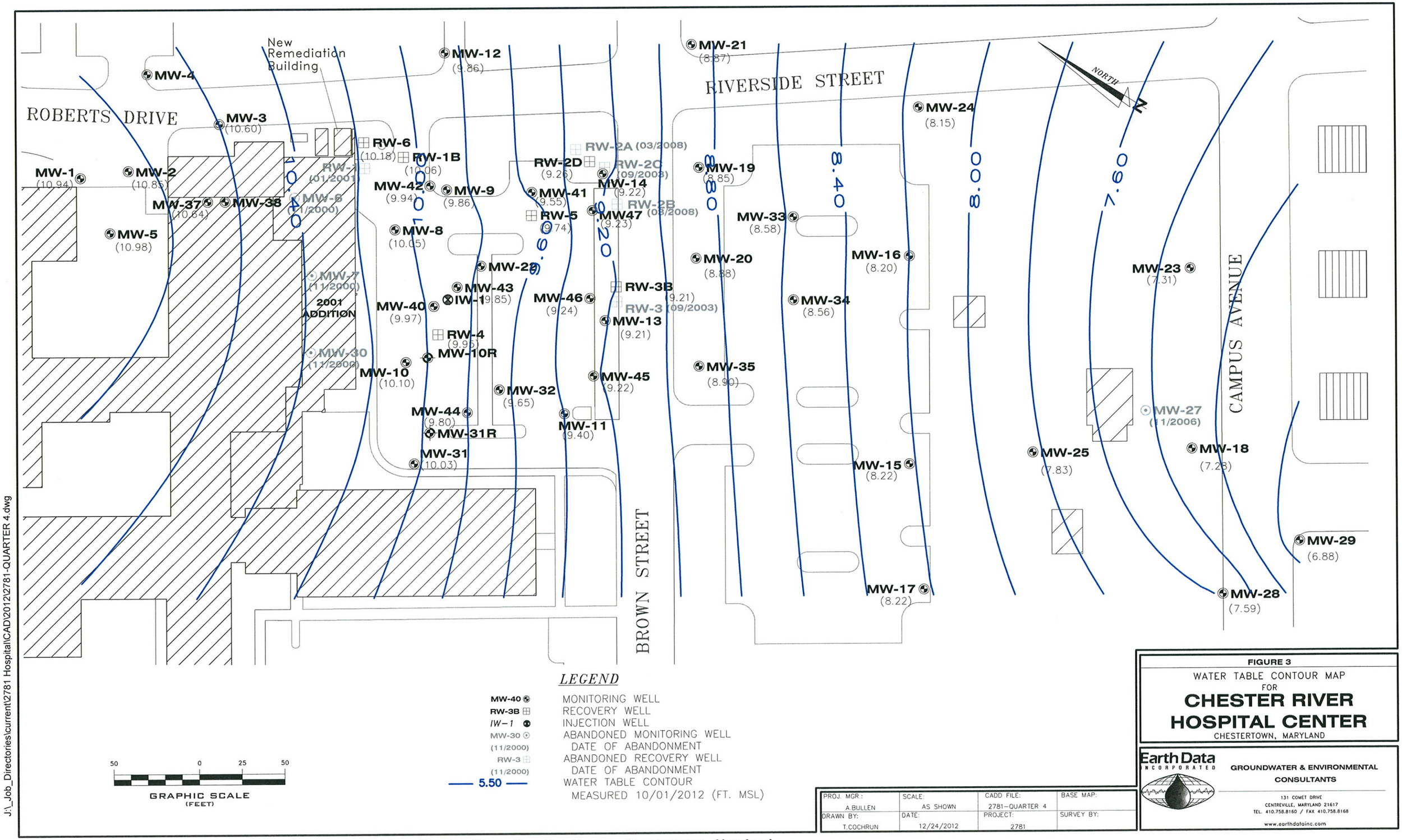

Figure 3 – Water table contour map, October 1, 2012 – Chester River Hospital Center, Chestertown, Maryland.

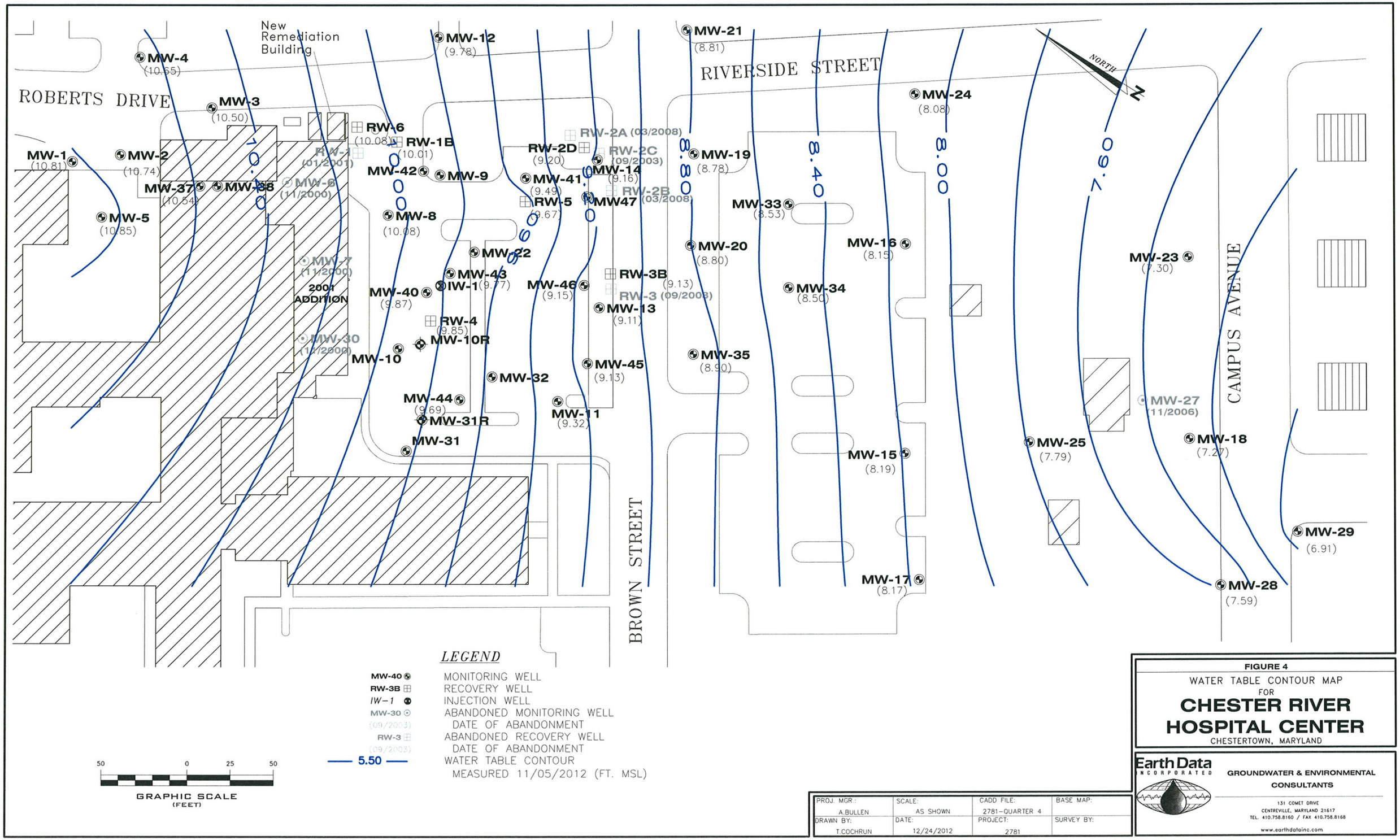

FIGURE 4

WATER TABLE CONTOUR MAP
FOR
CHESTER RIVER HOSPITAL CENTER
CHESTERTOWN, MARYLAND

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PROJ. MGR.:	SCALE:	CADD FILE:	BASE MAP:
A.BULLEN	AS SHOWN	2781-QUARTER 4	
DRAWN BY:	DATE:	PROJECT:	SURVEY BY:
T.COCHRUN	12/24/2012	2781	

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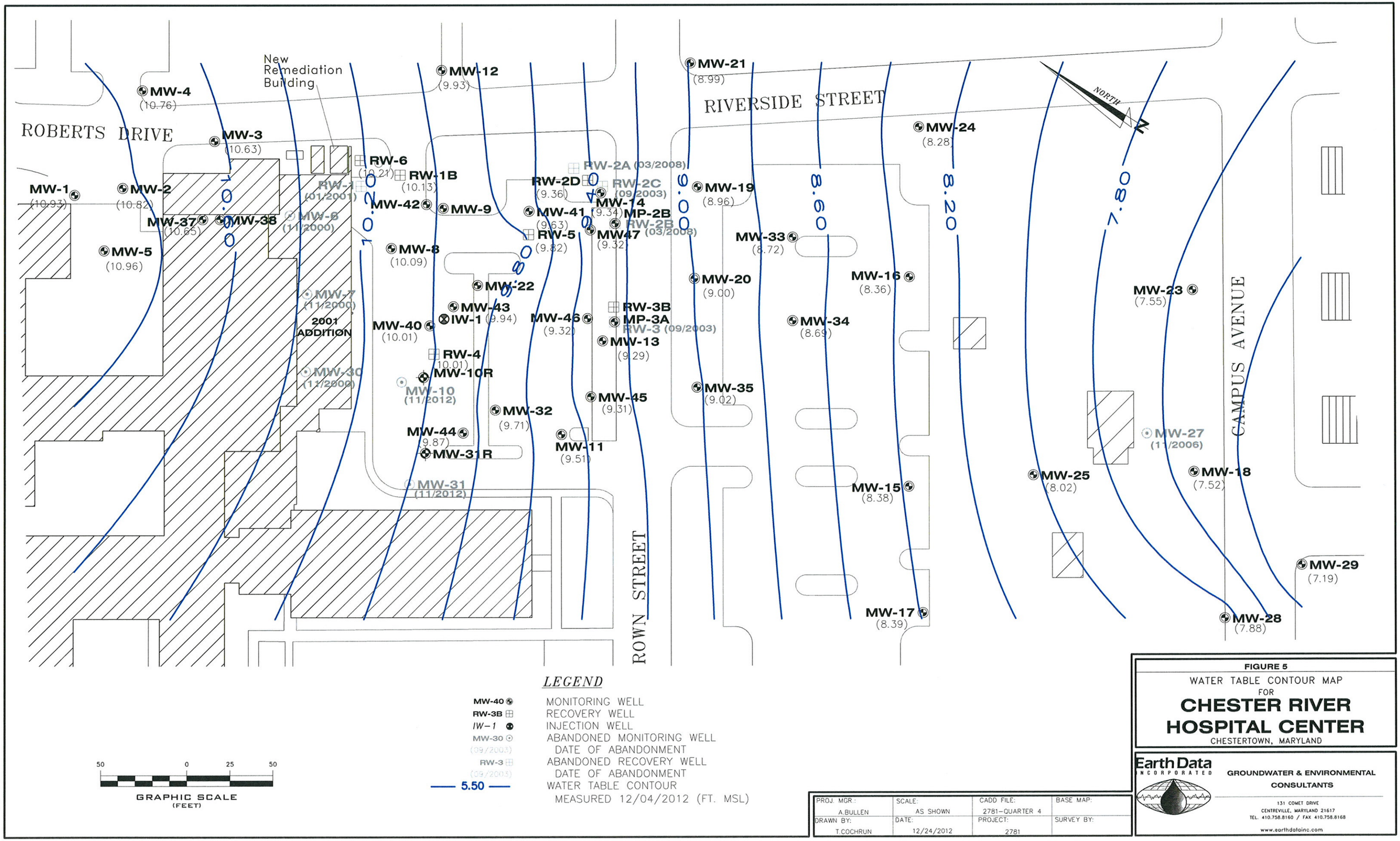
Figure 4 - Water table contour map, November 5, 2012 - Chester River Hospital Center, Chestertown, Maryland.



LEGEND

MW-40	MONITORING WELL
RW-3B	RECOVERY WELL
IW-1	INJECTION WELL
MW-30 (09/2003)	ABANDONED MONITORING WELL DATE OF ABANDONMENT
RW-3 (09/2003)	ABANDONED RECOVERY WELL DATE OF ABANDONMENT
5.50	WATER TABLE CONTOUR MEASURED 12/04/2012 (FT. MSL)

PROJ. MGR.:	SCALE:	CADD FILE:	BASE MAP:
A.BULLEN	AS SHOWN	2781-QUARTER 4	
DRAWN BY:	DATE:	PROJECT:	SURVEY BY:
T.COCHRUN	12/24/2012	2781	

FIGURE 5

WATER TABLE CONTOUR MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

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Figure 5 - Water table contour map, December 4, 2012 - Chester River Hospital Center, Chestertown, Maryland.

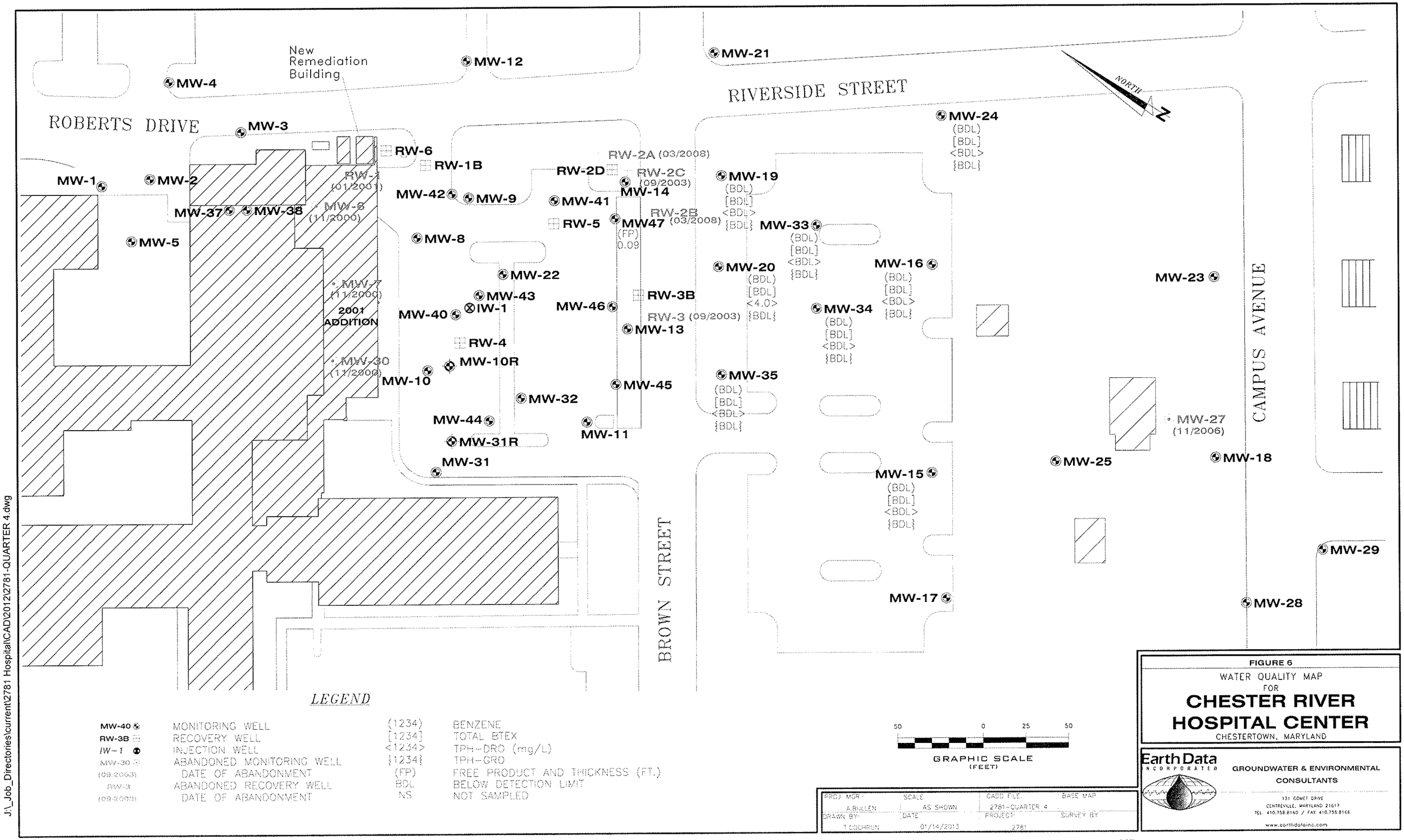


Figure 6– Water quality map showing dissolved BTEX, and total petroleum hydrocarbon (TPH) concentrations, October 1, 2012, – Chester River Hospital Center, MD.

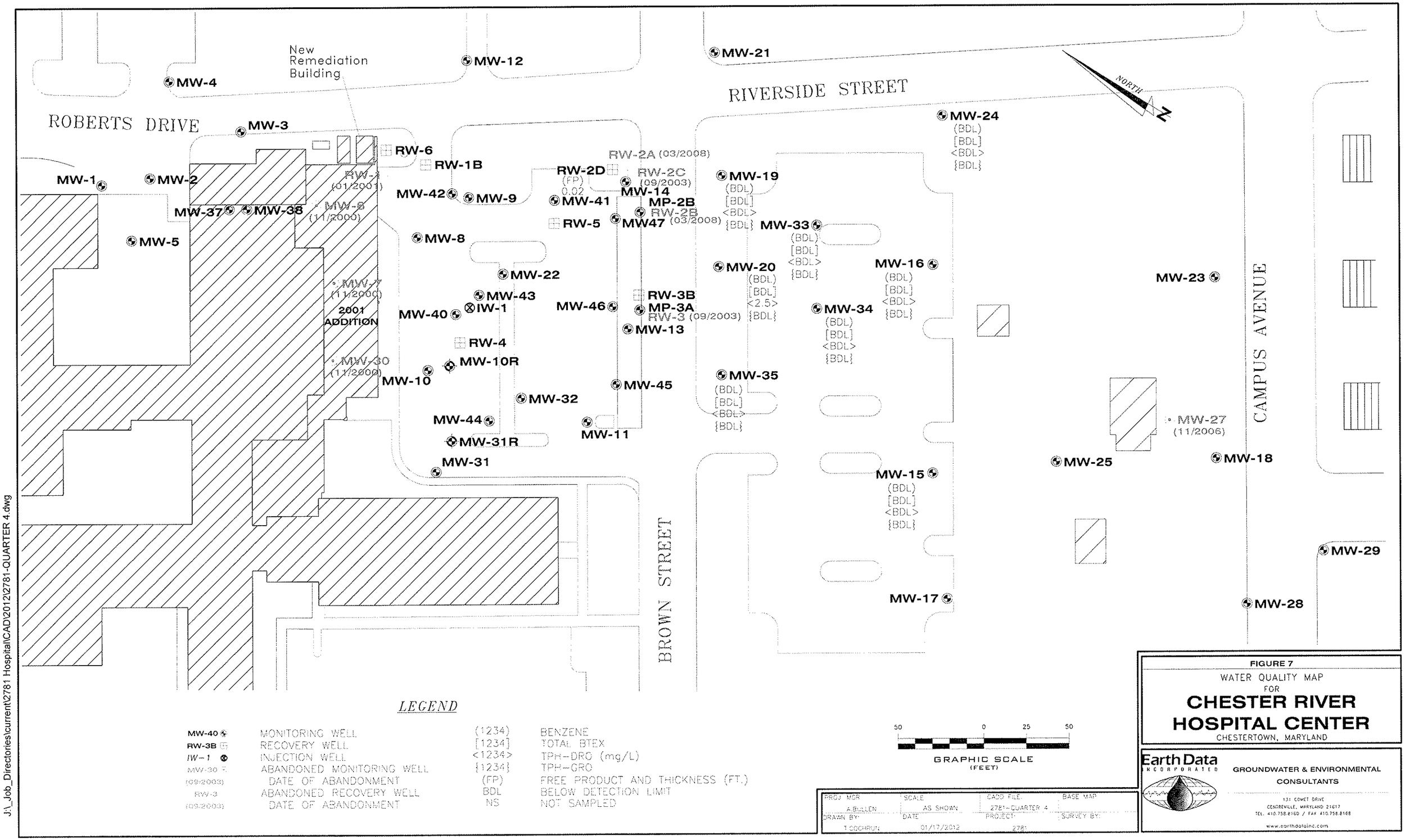
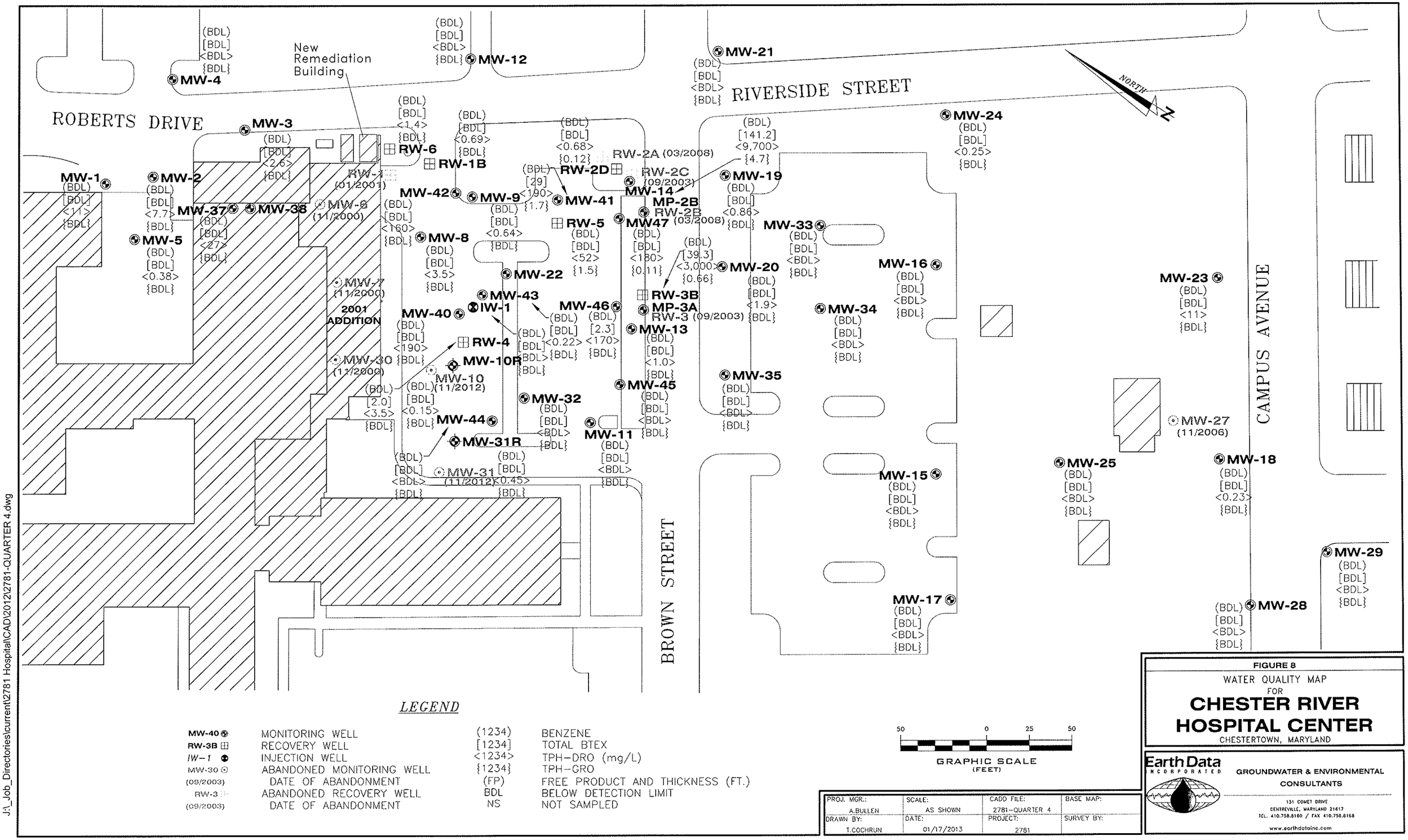


Figure 7– Water quality map showing dissolved BTEX, and total petroleum hydrocarbon (TPH) concentrations, November 5, 2012, – Chester River Hospital Center, MD.



LEGEND

MW-40	MONITORING WELL	(1234)	BENZENE
RW-3B	RECOVERY WELL	[1234]	TOTAL BTEX
IW-1	INJECTION WELL	<1234>	TPH-DRO (mg/L)
MW-30	ABANDONED MONITORING WELL	{1234}	TPH-GRO
(09/2003)	DATE OF ABANDONMENT	(FP)	FREE PRODUCT AND THICKNESS (FT.)
RW-3	ABANDONED RECOVERY WELL	BDL	BELOW DETECTION LIMIT
(09/2003)	DATE OF ABANDONMENT	NS	NOT SAMPLED

PROJ. MGR.:	SCALE:	CADD FILE:	BASE MAP:
A.BULLEN	AS SHOWN	2781-QUARTER 4	
DRAWN BY:	DATE:	PROJECT:	SURVEY BY:
T.COCHRUN	01/17/2013	2781	

FIGURE 8

WATER QUALITY MAP FOR

CHESTER RIVER HOSPITAL CENTER

CHESTERTOWN, MARYLAND

Earth Data INCORPORATED
GROUNDWATER & ENVIRONMENTAL CONSULTANTS
131 COMET DRIVE
CENTREVILLE, MARYLAND 21617
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J:_Job_Directories\current\2781 Hospital\CAD\2012\2781-QUARTER 4.dwg

Figure 8– Water quality map showing dissolved BTEX, and total petroleum hydrocarbon (TPH) concentrations, December 4&5, 2012, – Chester River Hospital Center, MD.

TABLES

	MW-1	MW-2	MW-3	MW-4	MW-5	MW-8	MW-9	MW-10R	MW-11	MW-12	MW-13	MW-14
	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	6.2
Toluene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	31
Total Xylenes (ug/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	104
TOTAL BTEX (ug/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	141.2
Isopropylbenzene (ug/L)	<1	1.2	<1	<1	<1	<1	<1	<1	<1	<1	<1	20
Naphthalene (ug/L)	<1	8.0	2.8	<1	<1	1.6	<1	<1	<1	<1	<1	250
Acetone (ug/L)	<10	<10	<10	<10	<10	28	<10	<10	<10	<10	<10	12
Chloroform (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Butanone (MEK) (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylcyclohexane (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-Methyl-2-pentanone (ug/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TPH-DRO (mg/L)	11	7.7	2.6	<0.1	0.38	3.5	0.64	0.15	<0.1	<0.1	1.0	9,700
TPH-GRO (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	4.7

	MW-15	MW-16	MW-17	MW-18	MW-19	MW-20	MW-21	MW-23	MW-24	MW-25	MW-28	MW-29
	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	<1	<1	<1	1.1	<1	<1	<1	<1	<1	<1	<1
Naphthalene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acetone (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroform (ug/L)	<1	1.3	<1	<1	1.8	<1	1.8	<1	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	1.1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Butanone (MEK) (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylcyclohexane (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-Methyl-2-pentanone (ug/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TPH-DRO (mg/L)	<0.1	<0.1	<0.1	0.23	0.86	1.9	<0.1	11	0.25	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

	MW-31R	MW-32	MW-33	MW-34	MW-35	MW-37	MW-40	MW-41	MW-42	MW-43	MW-44	MW-45
	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12	4-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	9.0	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	<2	<2	<2	<2	<2	1.2	20	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	<2	<2	<2	<2	<2	1.2	29	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	9.3	<1	<1	<1	<1
Naphthalene (ug/L)	<1	<1	<1	<1	<1	6.1	2.1	82	2.6	<1	<1	<1
Acetone (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chloroform (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
2-Butanone (MEK) (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Methylcyclohexane (ug/L)	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
4-Methyl-2-pentanone (ug/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
TPH-DRO (mg/L)	0.45	<0.1	<0.1	<0.1	<0.1	27	190	190	160	0.22	<0.1	<0.1
TPH-GRO (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.7	<0.1	<0.1	<0.1	<0.1

	MW-46	MW-47	IW-1	RW-1B	RW-2D	RW-3B	RW-4	RW-5	RW-6	MW-22
	4-Dec-12	4-Dec-12	4-Dec-12	5-Dec-12	5-Dec-12	5-Dec-12	5-Dec-12	5-Dec-12	5-Dec-12	5-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Toluene (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	9.7	<1	<1	<1	<1
Total Xylenes (ug/L)	2.3	<2	<2	<2	<2	29.6	2.0	<2	<2	<2
TOTAL BTEX (ug/L)	2.3	<2	<2	<2	<2	39.3	2.0	<2	<2	<2
Isopropylbenzene (ug/L)	<1	<1	<1	<1	<1	11	1.9	<1	<1	<1
Naphthalene (ug/L)	6.5	1.7	<1	<1	<1	120	35	1.6	<1	<1
Acetone (ug/L)	<10	<10	<10	<10	23	97	<10	<10	10	<10
Chloroform (ug/L)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	<1	<1	<1	1.6	<1	<1	<1	<1	<1
2-Butanone (MEK) (ug/L)	<10	<10	<10	<10	28	47	<10	<10	<10	<10
Methylcyclohexane (ug/L)	<10	<10	<10	<10	<10	10	<10	<10	<10	<10
4-Methyl-2-pentanone (ug/L)	<5	<5	<5	<5	<5	11	<5	<5	<5	<5
TPH-DRO (mg/L)	170	180	<0.1	0.69	68	3,000	3.5	52*	1.4	200
TPH-GRO (mg/L)	<0.1	0.11	<0.1	<0.1	0.12	0.66	<0.1	1.5	<0.1	0.45

* TPH-DRO sampled collected from RW-5 on 10 Dec 2012

Table 1. Summary of water quality data for monitoring wells sampled at Chester River Hospital Center, Chestertown, Maryland, December 2012.

	MW-15					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	NS	<1	<1	<1	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-16					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	1.9	<1	<1	1.3
Tetrachloroethene (ug/L)	<1	NS	1.1	<1	<1	1.1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-18					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	NS	NS	<1
Toluene (ug/L)	<1	NS	<1	NS	NS	<1
Ethylbenzene (ug/L)	<1	NS	<1	NS	NS	<1
Total Xylenes (ug/L)	<2	NS	<2	NS	NS	<2
TOTAL BTEX (ug/L)	<2	NS	<2	NS	NS	<2
Isopropylbenzene (ug/L)	<1	NS	<1	NS	NS	<1
Naphthalene (ug/L)	<1	NS	<1	NS	NS	<1
Acetone (ug/L)	<10	NS	<10	NS	NS	<10
Chloroform (ug/L)	<1	NS	<1	NS	NS	<1
Tetrachloroethene (ug/L)	<1	NS	<1	NS	NS	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	NS	NS	0.23
TPH-GRO (mg/L)	NS	NS	NS	NS	NS	<0.1

	MW-19					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	1.1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	<1	<1	2.8	1.8
Tetrachloroethene (ug/L)	<1	NS	<1	1.1	<1	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	0.86
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-20					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1
Toluene (ug/L)	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	<2	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	<2	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	<1	<1	2.2	<1	<1
Naphthalene (ug/L)	<1	<1	<1	<1	<1	<1
Acetone (ug/L)	<10	<10	<10	<10	<10	<10
Chloroform (ug/L)	<1	<1	1.5	<1	<1	<1
Tetrachloroethene (ug/L)	<1	<1	1.2	<1	<1	<1
TPH-DRO (mg/L)	1.3	1.9	1.8	4.0	2.5	1.9
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-23					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	NS	NS	<1
Toluene (ug/L)	<1	NS	<1	NS	NS	<1
Ethylbenzene (ug/L)	<1	NS	<1	NS	NS	<1
Total Xylenes (ug/L)	<2	NS	<2	NS	NS	<2
TOTAL BTEX (ug/L)	<2	NS	<2	NS	NS	<2
Isopropylbenzene (ug/L)	<1	NS	<1	NS	NS	<1
Naphthalene (ug/L)	<1	NS	<1	NS	NS	<1
Acetone (ug/L)	<10	NS	<10	NS	NS	<10
Chloroform (ug/L)	<1	NS	<1	NS	NS	<1
Tetrachloroethene (ug/L)	<1	NS	<1	NS	NS	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	NS	NS	11
TPH-GRO (mg/L)	NS	NS	NS	NS	NS	<0.1

	MW-24					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	NS	<1	<1	<1	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	0.25
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-33					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	NS	<1	<1	<1	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-34					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	<1	<1	<1	<1	<1
Toluene (ug/L)	<1	<1	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	<1	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	<2	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	<2	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	<1	<1	<1	<1	<1
Naphthalene (ug/L)	<1	<1	<1	<1	<1	<1
Acetone (ug/L)	<10	<10	<10	<10	<10	<10
Chloroform (ug/L)	<1	<1	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	<1	<1	<1	<1	<1
TPH-DRO (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

	MW-35					
	5-Jun-12	27-Jul-12	5-Sep-12	1-Oct-12	5-Nov-12	4-Dec-12
Benzene (ug/L)	<1	NS	<1	<1	<1	<1
Toluene (ug/L)	<1	NS	<1	<1	<1	<1
Ethylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Total Xylenes (ug/L)	<2	NS	<2	<2	<2	<2
TOTAL BTEX (ug/L)	<2	NS	<2	<2	<2	<2
Isopropylbenzene (ug/L)	<1	NS	<1	<1	<1	<1
Naphthalene (ug/L)	<1	NS	<1	<1	<1	<1
Acetone (ug/L)	<10	NS	<10	<10	<10	<10
Chloroform (ug/L)	<1	NS	<1	<1	<1	<1
Tetrachloroethene (ug/L)	<1	NS	<1	<1	<1	<1
TPH-DRO (mg/L)	<0.1	NS	<0.1	<0.1	<0.1	<0.1
TPH-GRO (mg/L)	NS	NS	NS	<0.1	<0.1	<0.1

Table 2. Summary of water quality data for selected downgradient monitoring wells at Chester River Hospital Center, Chestertown, Maryland.