Vacuum-Enhanced Recovery Feasibility Study Report of Results Perryman Generating Station 900 Chelsea Road, Perryman, MD

Prepared for

Exelon Generation
1005 Brandon Shores Road
Baltimore MD 21226

Prepared by

EA Engineering, Science, and Technology, Inc.
1311 Continental Drive, Suite K
Abingdon, Maryland 21009
(410) 671-6051

December 2013
EA Project No. 1436916

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20 December 2013

Michael Phillips
Project Geologist

Date

20 December 2013

Michael Hertz, PG, PMP
Project Manager

Date

December 2013
EA Project No. 1436916

EXECUTIVE SUMMARY

EA Engineering, Science, and Technology, Inc. (EA) was tasked to conduct a Feasibility Study to assess the effectiveness of vacuum-enhanced recovery (VER), an aggressive technology for the recovery of liquid-phase hydrocarbon (LPH). The study was conducted in accordance with the Feasibility Study Work Plan (EA 2012) prepared in response to a request from the Maryland Department of the Environment (MDE) Oil Control Program (OCP) in a letter dated 3 April 2012. The objective of the VER program was to recover LPH which has been observed in limited areas of the site during monthly gauging activities and the 2011 laser-induced fluorescence (LIF) investigation (EA 2011). The feasibility study implementation of VER generated additional data for LPH recoverability and transmissivity within the area of LPH occurrence. These data were utilized to assess LPH recoverability and will provide the basis for recommendations to be included in a Corrective Action Plan.

Two additional recovery wells, RW-6 and RW-7, were installed prior to beginning VER events. RW-6 was installed at the location of LIF-10 where free-phase LPH was observed during the 2011 LIF investigation (EA 2011). RW-7 was installed south of RW-6 between MW-13 and MW-19. A total of eight observation wells were installed to allow for monitoring of vacuum influence and LPH thickness during VER.

VER events were conducted on a monthly basis for 6 months at MW-14, MW-19, RW-6, and RW-7. LPH transmissivity and recoverability were assessed using data from LPH baildown and recovery tests performed prior to beginning the VER events, after the third VER event, and after all six VER events were completed.

A total of 29,656 gal of total liquids were recovered during the VER program, including approximately 135.5 gal of LPH. Generally, both transmissivity and recoverability of LPH were found to have been reduced by VER. The Interstate Technology Regulatory Council (ITRC 2009) defines the lower limit for practical LPH recovery as a LPH transmissivity in the range of 0.1 to 0.8 ft^2/day.Transmissivity assessment results show that LPH has been removed to the maximum extent practicable at MW-14 (0.04 ft^2/day) and MW-19 (0.07 ft^2/day), indicating further active LPH recovery is not warranted. A Corrective Action Plan has been prepared as an Addendum to this Report of Results to address the recoverable LPH at RW-6 (1.55 ft^2/day) and RW-7 (1.57 ft^2/day).

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ACRONYMS AND ABBREVIATIONS

amsl	Above Mean Sea Level
API	American Petroleum Institute
AST	Aboveground Storage Tank
bgs	Below Ground Surface
DRO	Diesel Range Organics
DTP	Depth to Petroleum
DTW	Depth to Water
EA	EA Engineering, Science, and Technology, Inc.
EPA	U.S. Environmental Protection Agency
ft	feet (foot)
ft^2/day	square feet per day
FS	Feasibility Study
gal	Gallon(s)
GRO	Gasoline Range Organics
IDM	Investigation Derived Materials
in.	Inch(es)
ITRC	Interstate Technology Regulatory Council
LIF	Laser-Induced Fluorescence
LNAPL	Light Non-Aqueous Phase Liquid
LPH	Liquid-Phase Hydrocarbons
MDE	Maryland Department of the Environment
Mg/kg	Milligrams per kilogram
OCP	Oil Control Program
ppm	Parts per million
PVC	Polyvinyl Chloride
ROI	Radius of Influence
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
TVOC	Total Volatile Organic Compounds
VER	Vacuum-Enhanced Recovery

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1. INTRODUCTION

EA Engineering, Science, and Technology, Inc. (EA) has prepared this Feasibility Study (FS) Report of Results on behalf of Exelon Generation (formerly Constellation Power Source Generation) to assess vacuum-enhanced recovery (VER), an aggressive technology for the recovery of liquid phase hydrocarbons (LPH) at the Perryman Generation Facility located in Harford County, Maryland. The Feasibility Study Work Plan was requested in a letter dated 3 April 2012 from the Maryland Department of the Environment (MDE) Oil Control Program (OCP). The Feasibility Study Work Plan was approved by MDE OCP in a letter dated 20 November 2012.

The objective of the VER feasibility study was to assess the effectiveness of the technology to recover LPH which had been observed in limited areas of the site during monthly gauging activities and the 2011 laser-induced fluorescence (LIF) investigation (EA 2011). The 2011 LIF investigation identified only discontinuous pockets of free-phase (i.e., liquid, mobile) LPH existing at the site that are generally located in the area of wells MW-14 and MW-19, and the LIF investigation boring location LIF-10. Two new recovery wells, RW-6 and RW-7, were installed for the purpose of this study in the area of LIF-10 to aid overall LPH assessment and recovery at the site.

VER events were conducted on monthly basis for 6 months from April to September 2013 at MW-14, MW-19, RW-6, and RW-7. LPH recoverability and transmissivity was assessed at the recovery wells before, at the midpoint, and after completion of the VER program. These data were used to evaluate the effectiveness of VER as a remedial technology at the site and to provide the basis for recommendations for supplemental LPH remediation.

2. METHODOLOGY

2.1 Additional Recovery and Observation Well Installation

EA installed two additional recovery wells (i.e., RW-6 and RW-7) and eight temporary observation wells associated with the four recovery wells (i.e., RW-6, RW-7, MW-14, and MW-19) during two mobilizations: 25 February – 1 March 2013, and 25 – 29 March 2013 (**Figure 1**).

The newly installed recovery wells (i.e., RW-6 and RW-7) were constructed of 4-in. inside diameter Schedule 40 polyvinyl chloride (PVC) flush-thread casing with 20-ft 0.02-in. slotted screen to a total depth of approximately 30 ft below ground surface (bgs). The observation wells, located 5-ft and 10-ft from each recovery well, were constructed of 2-in. inside diameter Schedule 40 PVC flush-thread casing with 20-ft 0.02-inch slotted screen to a total depth of approximately 30-ft bgs. All wells were installed with filter packs of #2 quartz sand placed to 2-ft above the top of the screen, followed by a 2-ft bentonite pellet seal, then the boreholes filled to the surface with a 20:1 cement:bentonite grout. Flush-mount vaults were installed over the casings at ground surface except at the MW-19 observation wells, where the metallic vaults would present an electrical hazard due totheir location within the BGE substation. Well

lithologic logs are included in Attachment A; well completion diagrams are included in Attachment B.

The wells were developed by a Maryland-licensed well driller (EA's subcontractor DTCI Drilling) from 28 February to 1 March 2013 and 27 to 29 March 2013. Each well was surged using a tight-fitting surge block and purged until the water cleared sufficiently. Purged groundwater from development was drummed, properly labeled, and staged onsite for later disposal. The development water was removed for proper disposal on 24 April 2013 by Clean Venture, Inc. as coordinated by Exelon Generation.

Soil cuttings from the drilling were field-screened for total volatile organic compounds (TVOCs) using a photoionization detector. Soil cuttings observed to have less than 10 parts per million (ppm) TVOCs were broadcast on the ground surface; cuttings with greater than 10 ppm TVOCs were drummed for later disposal. A total of seven drums of drill cuttings were generated. Soil cuttings drums were staged on pallets within the fuel oil tank containment berm as requested by the control room operator. For disposal planning purposes, EA collected a composite sample of the soil cuttings for analysis of benzene and total petroleum hydrocarbons (TPH)-diesel range organics (DRO) / gasoline range organics (GRO) by U.S. Environmental Protection Agency (EPA) Methods 8260b and 8015, consistent with investigation derived material (IDM) characterization under MDE OCP. The sample was non-detect for benzene; however, TPH-DRO was detected at a concentration of 1,120 mg/kg and TPH-GRO was detected at a concentration of 53.7 mg/kg. Analytical results, included in Attachment C, were provided to David Ciotti, Senior Environmental Specialist for Exelon Generation, on 23 May 2013 for disposal coordination. Following a review of the analytical results, Exelon Generation arranged for disposal of the drummed cuttings.

On 3 April 2013, vertical top-of-casing (TOC) elevations for the new monitoring wells were surveyed. The previously surveyed TOC elevations for MW-5, MW-14, and MW-19 were used to calculate TOC elevations for the 10 new wells. Post-development gauging was also performed on this date. **Table 1** includes the TOC elevations and horizontal coordinates for each monitoring well, as well as the gauging results.

Table 1 – Recovery and Observation Well Survey and Gauging Results

Well	Survey Results			Post-Development Gauging		
	TOC elevation	Easting	Northing	DTP (ft TOC)	DTW (ft TOC)	LPH Thickness (ft)
RW-6	30.10	1296980.2	14325203.2	19.98	21.53	1.55
RW6-OW1-N	29.94	1296980.0	14325208.5	20.04	20.04	< 0.01
RW6-OW2-E	29.99	1296990.0	14325203.5	20.08	20.08	< 0.01
RW-7	29.83	1296990.7	14325130.4	19.81	19.88	0.07
RW7-OW1-S	29.81	1296990.5	14325120.6	19.72	20.39	0.67
RW7-OW2-W	29.91	1296985.5	14325130.6	19.82	21.49	1.67
MW-14	31.77	1296908.8	14324975.9	22.02	22.98	0.96
MW14-OW1-N	29.81	1296908.2	14324985.9	20.09	20.89	0.80
MW14-OW2-E	29.74	1296913.2	14324975.9	19.98	20.97	0.99
MW-19	32.99	1296826.7	14325099.4	23.44	23.66	0.22
MW19-OW1-SW	32.64	1296819.4	14325092.0	23.14	23.14	< 0.01
MW19-OW2-NE	32.80	1296830.0	14325102.6	23.29	23.29	< 0.01

NOTE: DTP = Depth to Petroleum
DTW = Depth to Water
TOC elevations in ft above mean sea level (amsl)
Coordinates NAD 1983 UTM Zone 18 in US feet
Post-development gauging conducted 3 April 2013

2.2 VER Event Methodology

VER events were conducted on a monthly basis for 6 months at MW-14, MW-19, RW-6, and RW-7 from April to September 2013. VER is an aggressive LPH recovery technology that allows for maximum LPH recovery per event while also producing LPH recoverability data for each of the wells. During VER, a vacuum is induced in the well using a vacuum truck equipped with a high-vacuum pump capable of producing up to 28-in. of mercury vacuum. An airtight well seal is installed in conjunction with a drop tube to simultaneously induce LPH, groundwater, and vapor removal. VER was performed on one well at a time, for up to 8 hours or up to 3,000 gal of fluid recovery, which was calculated to provide a radius of influence (ROI) of 10 to 16-ft.

At the end of the event, each VER well was gauged and the final LPH thickness recorded. The total volume of fluid extracted from each well was recorded, and the volume of LPH was estimated based on the thickness of the LPH layer observed in the vacuum truck tank after completing VER at each well. A summary of the data to be collected during each VER event is presented in **Table 2**. VER field data sheets are included in **Attachment D**.

Table 2. Data Collection for VER Events

Data Type	Location	Data Source	Frequency
Groundwater and LPH Levels	Recovery Well	Interface Probe	Beginning & end of VER event
	Piezometers	Interface Probe	60 Minutes
Vacuum	Recovery Well	Vacuum Gauge	30 Minutes
	Piezometers	Vacuum Gauge	60 Minutes
Groundwater Recovery Volume	Vacuum Truck Tank	Vacuum Truck Operator	End of VER event
LPH Recovery Volume	Vacuum Truck Tank	Vacuum Truck Operator	End of VER event

2.3 LPH Baildown and LPH Manual Skimming Tests

LPH baildown tests and LPH recovery tests were performed prior to beginning the VER events, after the third VER event, and after all six VER events were completed. LPH baildown tests were utilized to assess LPH transmissivity, while manual skimming tests provided an assessment of both transmissivity and the potential rate of LPH recovery. The baildown test was performed first, and when the LPH had recovered to 80 to 90 percent of the measured LPH thickness prior to the baildown test, the LPH manual skimming test was performed. Both baildown and manual skimming tests were conducted in accordance to ASTM E2856: *Standard Guide for Estimation of Light Non-Aqueous Phase Liquid (LNAPL) Transmissivity* (ASTM 2012).

During a baildown test, LPH is manually bailed from the well until the thickness of the LPH remaining in the well is less than 0.01 ft. LPH thickness and depth to water are then gauged using an oil/water interface probe and are recorded until LPH thickness equilibration was acheived. Baildown testing field forms are included in **Attachment E**. LPH baildown tests were performed only at wells containing a minimum of 0.5 ft measured LPH at the time of the tests.

Transmissivity calculations for the baildown test were performed using the American Petroleum Institute (API) spreadsheet program: *API LNAPL Transmissivity Workbook* dated September 2012. The API spreadsheet was developed using the equations presented in the ASTM guidance (2012). The baildown test data are entered into the API spreadsheet, which performs calculations using three different models for unconfined conditions.

For the LPH manual skimming tests, LPH was bailed out initially and then repeatedly extracted before approximately 25 percent of the initial LPH thickness had recovered into the well. LPH volume and elapsed time were carefully recorded for each bailing cycle. Bailing was repeated until the volume/time ratio had stabilized to within 25 percent over three consecutive readings. Stabilization required up to four days depending on the time elapsed between bailing cycles. Manual skimming test field forms are included in **Attachment F**.

For this method, transmissivity is calculated by the following analytical equation from ASTM E2856: *Standard Guide for Estimation of LNAPL Transmissivity* (ASTM 2012) where the recovery rate is used as an input to the equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

*A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$ as recommended by ASTM (2012)

3. RESULTS AND DISCUSSION

3.1 VER Event Results

Over the 6-month course of the VER program, a total of 29,656 gal of total liquids were recovered. The total recovered volume of LPH, as calculated from measured thickness within the vacuum truck tank, was approximately 135.5 gallons. VER was performed on each recovery well for a total of approximately 8 hours per monthly event. LPH recovery per month is summarized in **Table 3**.

Table 3. VER Event Results Summary

Well	April LPH Recovered (gal)	May LPH Recovered (gal)	June LPH Recovered (gal)	July LPH Recovered (gal)	August LPH Recovered (gal)	September LPH Recovered (gal)	Total Recovery/ Well
RW-7	7.1	< 14.1	< 6.0	< 6.5	< 34	< 14.2	45.4
MW-19	< 5	7	< 6.8	< 5.0	< 6.5	< 6.8	22.1
MW-14	6	10.8	< 5.4	<4.3	< 14	< 5.8	33.2
RW-6	6.4	< 11.5	< 7.1	< 9.8	< 18.2	< 5.0	34.8
Recovery/Month	22	30.6	12.7	12.8	36.4	15.9	135.5
Total LPH Recovered: approximately 135.5 gal Total Liquids: 29,656 gal							

The ROI for both water table depression and vacuum during VER activities was determined to be greater than 10-ft at each recovery well. No extrapolation of the ROI could be made from the 5-ft and 10-ft observation wells from the recovery well, as the results of drawdown and vacuum

influence were similar. The minimal, but measurable, drawdown and vacuum readings noted at MW-19 indicate that VER influence is reduced at this location when compared to the other recovery wells. This can be attributed to the recovery well construction (2-in well rather than 4-in at the other three locations) or variations in the lithologic composition of the aquifer. A summary of LPH thickness and vacuum influence readings is presented in **Table 4**. Field observations of depth to groundwater, LPH thickness, and vacuum at the observation wells are included in **Attachment D**.

Groundwater surface depression was observed during VER at all four wells included in this FS. The observation wells for both MW-14 and RW-7 were found to contain measurable LPH under static conditions; on all occasions VER removed all measurable LPH in the observation wells within each 8-hour event. Vacuum influence was noted at all observation wells during VER, though readings were minimal at MW-19.

Table 4.
Perryman Generation Facility
Field Observation Summary
2013 VER Feasibility Study

	April				May				June			
	LPH (ft)				LPH (ft)				LPH (ft)			
Well	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)
MW-14	0.91	0	18.5		0.88	0	17		0.51	0	9	
MW14-OW1-N	0.65	<0.01		6.6	0.67	0		6.8	0.46	0		8.5
MW14-OW2-E	0.87	<0.01		9.2	0.87	0		9.4	0.57	0		11
MW-19	0.22	0	24		0.15	<0.01	23		0.14	0.01	23	
MW19-OW1-SW	0	0		0.3	0	0		1.5	0	0		0.8
MW19-OW2-NE	0	0		0.4	0	0		1.5	0	0		1.2
RW-6	1.39	0	16		1.39	0.01	17		0.97	0	26	
RW6-OW1-N	<0.01	0		9.5	<0.01	0		9	0	0		10.5
RW6-OW2-S	<0.01	0		3.9	<0.01	0		2.3	0	0		7.7
RW-7	0.07	<0.01	21.5		0.24	<0.01	17		0.36	<0.01	7	
RW7-OW1-S	0.59	<0.01		11.3	0.69	0		8.9	0.21	0		12.2
RW7-OW2-W	1.50	<0.01		10.9	1.92	0		9.6	1.16	0		12.8

	July				August				September			
	LPH (ft)				LPH (ft)				LPH (ft)			
Well	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)	initial	final	Maximum vacuum (in Hg)	Maximum vacuum (in H2O)
MW-14	0.49	0	10		0.82	0.11	15		0.74	0.01	11	
MW14-OW1-N	0.50	0		8	0.18	0		7.1	0.73	0		7.9
MW14-OW2-E	0.62	0		9.8	0.64	0		10.1	0.79	0		9.6
MW-19	0.07	0	23		0.06	0	22		0.27	<0.01	21	
MW19-OW1-SW	0	0		0.7	0	0		0.7	0	0		0.6
MW19-OW2-NE	0	0		2.8	0	0		0.8	0	0		1.9
RW-6	0.95	<0.01	22		0.90	0.10	10		1.47	<0.01	22	
RW6-OW1-N	0	0		9	0	0		9.9	0	0		7.4
RW6-OW2-S	0	0		2.2	0	0		3.9	0	0		1.4
RW-7	0.56	<0.01	13		1.58	0.05	22		1.11	0	17	
RW7-OW1-S	0.48	0		4.8	0.13	0.08		15.2	1.11	0		6.8
RW7-OW2-W	1.41	0		11.3	0.34	<0.01		15.4	2.04	0		12.7

VER was performed for approximately 8 hours at each well per month

1 in Hg = 13.60 in H2O

3.2 Baildown and Manual Skimming Test Results

LPH transmissivity and recoverability, as quantified through analysis of the baildown and manual skimming test field data, have generally declined as a result of the VER program. The skimming test data are expected to produce results more accurately reflecting sustainable transmissivity and recoverability values when compared to the limited data set from short-duration baildown tests. Manual skimming test data were collected over a prolonged period of time with LPH thickness maintained at less than 25 percent of static through multiple bailing events, as opposed to baildown test data reflecting LPH thickness recovery from a single bailing event.

Manual skimming test results are summarized in **Table 5**. Calculations and results for both baildown and manual skimming tests are detailed in **Attachment G**.

Table 5. LPH Transmissivity and Recoverability Results Summary

Monitoring Well	Date	Skimming Test Transmissivity Results (ft^2/d)	Skimming Test Stabilized Recovery Rate (gal/day)
MW-14	3/18/2013	4.80	4.10
	6/25/2013	1.30	1.00
	9/23/2013	0.04	0.43
MW-19	3/18/2013	0.31	0.11
	6/25/2013	0.006	0.00
	9/23/2013	0.07	0.07
RW-6	3/18/2013	4.61	7.66
	6/27/2013	4.65	2.65
	9/23/2013	1.55	1.10
RW-7	3/18/2013	0.10	0.05
	6/25/2013	1.17	0.39
	9/26/2013	1.57	1.74

In general, a direct correlation was observed between a decrease in LPH transmissivity and decrease in recoverability. The Interstate Technology Regulatory Council (ITRC 2009) has defined the lower limit for practical LPH recovery as a LPH transmissivity between 0.1 and 0.8 ft^2/day. The LPH recoverability for MW-14 and MW-19 was within this range by the end of the 6-month VER program and active LPH recovery would not be cost-effective and would result in minimal LPH recovery. This was validated during this VER study; in that, aggressive VER produced no more than 7 gal of LPH at each well when compared to the over 1,200 gal of water produced.

Transmissivity values at RW-6 have also declined as a result of VER program. RW-7 has exhibited an increase in transmissivity, likely a result of the "development" effect of the aggressive VER technology combined with the seasonal water table drop observed near the end of the program. Transmissivity values at RW-7 are expected to decrease over time with continued remediation and return of normal water table conditions. LPH transmissivity results are presented graphically in **Figure 2**.

With regards to the projected recoverablity rates, these rates are forecasted for when active LPH recovery is initiated. However, based on the lithology at the site (generally silt and silty sands), it is not expected that these rates would be sustainable, but would decrease over time as remediation decreases the LPH saturation in the aquifer.

4. CONCLUSIONS

Based on the results of the VER feasibility study performed from 25 February to 26 September 2013, VER has proven to be an effective remedial option for the site. VER events were conducted on a monthly basis for 6 months at MW-14, MW-19, RW-6, and RW-7. A total of 29,656 gal of total liquids were recovered during the VER program, including approximately 135.5 gal of LPH.

LPH transmissivity and recoverability were assessed using data from LPH baildown and manual skimming tests performed prior to beginning the VER events, after the third VER event, and after all six VER events were completed. Generally, both transmissivity and recoverability of LPH were found to have been reduced by VER. At the conclusion of the FS, LPH transmissivity at MW-14 and MW-19 had been reduced to within the lower limit of hydraulic recoverability of 0.1 to 0.8 ft^2/day as defined by ITRC (2009). Additional active LPH recovery is not warranted at MW-14 and MW-19 as LPH has been removed to the maximum extent practical.

LPH transmissivity results for RW-6 and RW-7 indicate further remediation will be required to recover LPH to the greatest extent practicable at these isolated pockets of LPH. The LPH transmissivity data were utilized to assess LPH recoverability and provide the basis for recommendations in a Corrective Action Plan for the site (**Attachment H**).

5. REFERENCES

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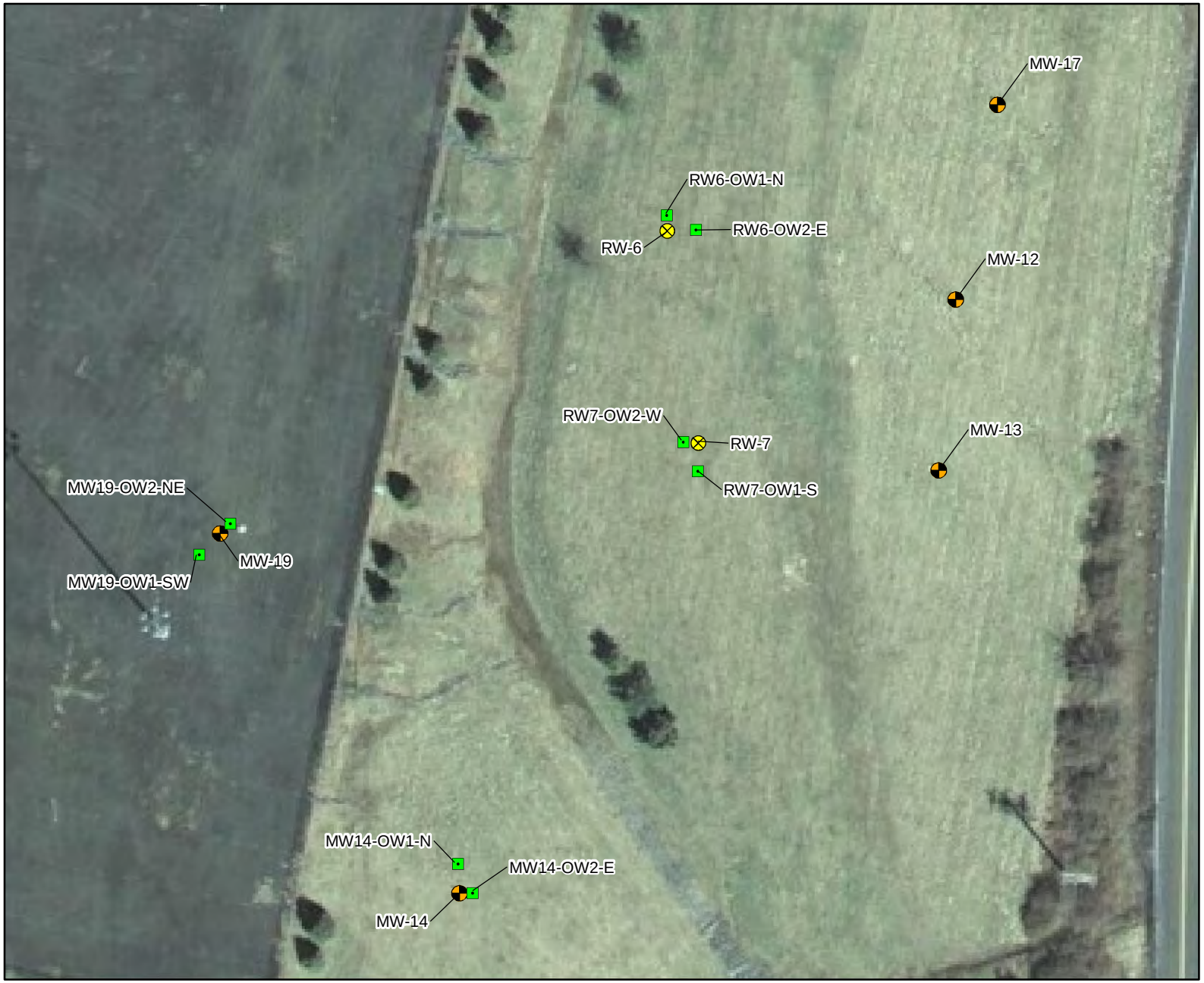
Figures



LEGEND

- Existing Well Location
- New Recovery Well Location
- Temporary Observation Well Location

N

0 25 50
Feet

0 10 20
Meters

EA Engineering, Science, and Technology, Inc.

Map Date: December 5, 2013

Data Sources:
Constellation Energy

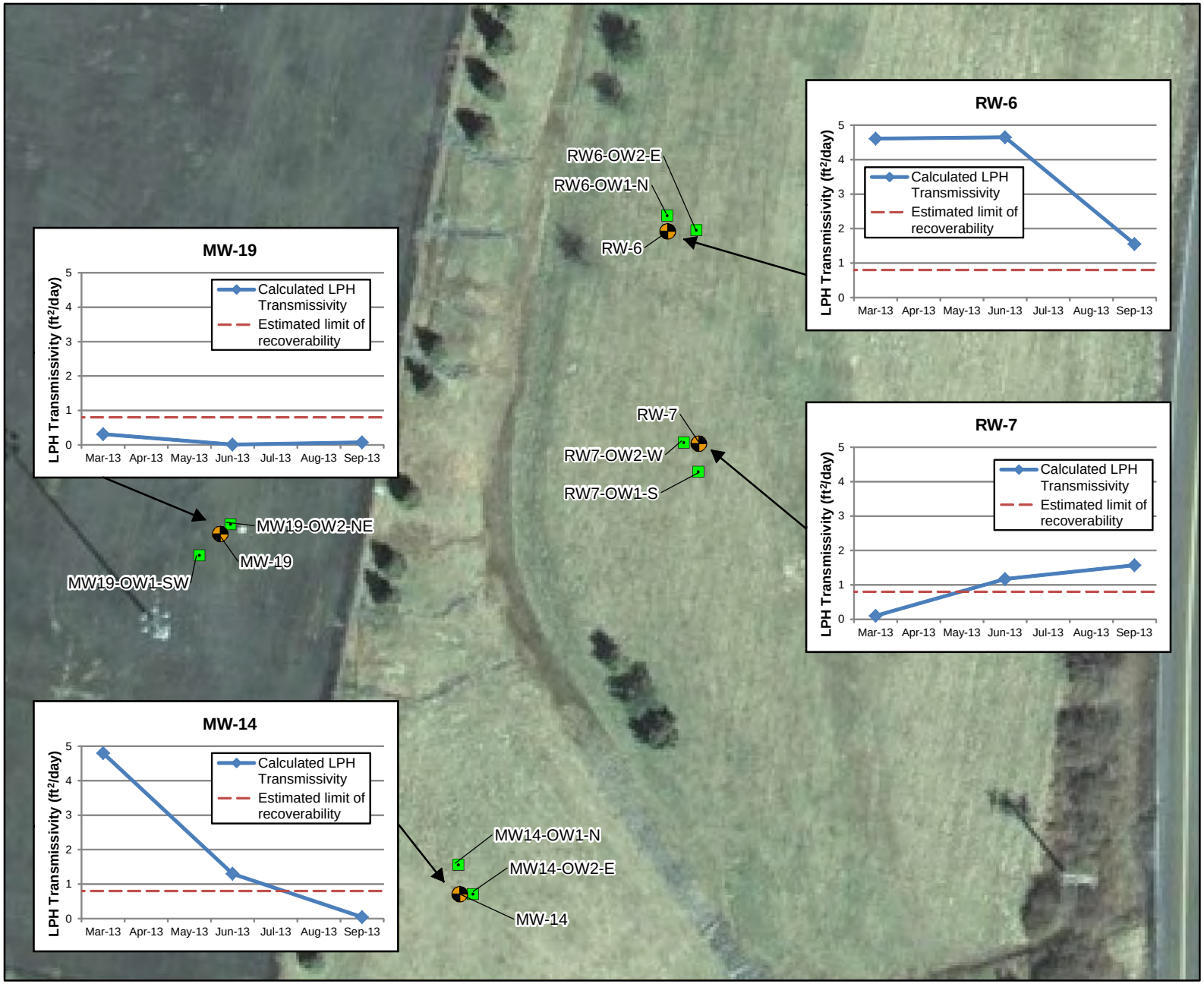
Map Projection:
NAD 1983 UTM Zone 18N (feet)

Perryman Generation Facility

Perryman, Maryland

Figure 1
2013 Well Installation Locations

Exelon Generation.



LEGEND

- LPH Monitoring/Recovery Wells
- Temporary Observation Well Location

N

0 25 50
Feet

0 10 20
Meters

EA Engineering, Science, and Technology, Inc.

Map Date: December 5, 2013

Data Sources:
Constellation Energy

Map Projection:
NAD 1983 UTM Zone 18N (feet)

Perryman Generation Facility

Perryman, Maryland

Figure 2
Transmissivity Results

Exelon Generation.

Attachment A

Lithologic Logs

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Job No. 1436916	Client: Exelon		Location: Perryman Generation Facility
Drilling Method: hollow-stem auger			Boring No. **RW-7**
Sampling Method: 5 ft. Macrocore			Sheet 1 of 1
Coordinates: NA			Drilling
Surface Elevation:	Water Level	NA	Start 830 / Finish 1130
Casing Below Surface:	Time		
Reference Elevation:	Date		
Reference Desc:	Reference		

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-0.2' topsoil
			ML		0	0.2-3.8' yellowish brown (10YR5/6) silt with little clay, stiff, low plasticity, moist
					0	
3					0	
			ML		0	3.8-5.0' grayish brown (10YR5/2) silt with little clay, stiff, low plasticity, moist
					0	
	5.0/5.0		ML		0	5.0-5.8' grayish brown (10YR5/2) silt with little clay, stiff, low plasticity, moist
6			ML		0	5.8-8.0' yellowish brown (10YR5/6) silt, stiff, low plasticity, moist
					0	
			GW		0	8.0-8.2' light yellowish brown (10YR6/4)well-graded sandy subrounded gravel up to
					0	22mm, dense, moist
9			SP		0	8.2-9.2' strong brown (7.5YR5/6) medium sand with some silt, medium dense, moist
			ML		0	9.2-10.0' yellowish brown (10YR5/6) silt with little clay and fine sand, stiff, moist
	5.0/5.0		ML		0	10.0-11.2' yellowish brown (10YR5/6) silt with little clay and fine sand, stiff, moist
			SP		0	11.2-15.0' brownish yellow (10YR6/8)fine sand with little silt, medium dense, moist;
12					0	dark brown staining 14.6-15.0', no LPH odor
					0	
					0	
					0	
15	5.0/5.0		SP		0	15.0-17.8' brownish yellow (10YR6/8)fine sand with little silt, medium dense, moist
					0	
					0	
			SP		0	17.8-20.0' very pale brown (10YR7/4) medium sand, medium dense, moist, slight LPH
18					0	odor noted
					1.6	
					21.7	
	5.0/5.0		SM		6	20.0-21.5' yellowish brown (10YR5/8) silty very fine sand, dense, moist
21					75.4	
			SP		45.7	21.5-25.0' pale brown (10YR6/3) fine sand with little silt, medium dense, saturated, LPH
					3	odor noted
					0	
24					0	
	5.0/5.0		SP		0	25.0-29.8' pale brown (10YR6/3) medium sand with little subrounded gravel up to 20mm,
					0	medium dense, saturated
					1.4	
27					2.6	
					0	
					0	
			ML		0	29.8-30.0' yellowish brown (10YR5/6) silt with some very fine sand, stiff, low plasticity,
30					0	moist
						EOB 30.0' bgs

Logged by: M Phillips Date: 2/26/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method: hollow-stem auger		Boring No. **RW-6**
Sampling Method: 5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

				Drilling	
Water Level	NA			Start	Finish
Time				1200	1330
Date					
Reference					

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA	ML		0	0.0-5.0' yellowish brown (10YR5/6) silt with trace fine sand and subrounded gravel up to
					0	30mm, stiff, low plasticity, moist
					0	
3					0	
					0	
					0	
	5.0/5.0		ML		0	5.0-9.5' yellowish brown (10YR5/6) silt with trace fine sand and subrounded gravel up to
6					0	30mm, grades to a very fine sandy silt with depth, stiff, low plasticity, moist
					0	
					0	
					0	
9					0	
					0	
	5.0/3.5		SP		0	10.0-13.5' brownish yellow (10YR6/6) fine sand with trace silt, medium dense, moist
					0	
12					0	
					0	
					0	
					0	
15	5.0/5.0		SP		0	15.0-20.0' yellow (10YR7/6) fine sand, medium dense, moist; gray staining and LPH
					0	odor noted 19.5-20.0'
					0	
					0	
18					0	
					2.6	
					90.4	
	5.0/5.0		SP		15.0	20.0-21.1' yellow (10YR7/6) fine sand, medium dense, moist
21					0	
			SW		0	21.1-24.4' pale brown (10YR6/3) well-graded gravelly sand, subrounded gravel up to
					128	18mm, medium dense, saturated, LPH odor noted
					176	
24			SM		33.9	24.4-25.0' brownish yellow (10YR6/6) very fine sandy silt, trace mica, stiff, low plasticity
	5.0/5.0		SW		25.2	25.0-30.0' pale brown (10YR6/3) well-graded sand with some gravel grading to a
					116	gravel/sand mix with depth, subrounded gravel up to 35mm, dense, saturated;
					1.3	LPH odor and sheen noted approximately 26.0'
27					0	
					0	
					0	
					0	
30					0	EOB 30' bgs

Logged by: M Phillips Date: 2/26/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

LOG OF SOIL/ROCK BORING

Job No. 1436916	Client: Exelon			Location: Perryman Generation Facility	
Drilling Method: hollow-stem auger				Boring No. **MW14-OW2-E**	
Sampling Method: 5 ft. Macrocore				Sheet 1 of 1	
				Drilling	
Water Level	NA			Start	Finish
Time				1400	1530
Date					
Reference					

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-0.1' topsoil
			ML		0	0.1-4.0' yellowish brown (10YR5/6) silt with trace fine sand, medium stiff, low plasticity,
					0	moist
3					0	
					0	
			SP		0	4.0-5.0' yellowish brown (10YR5/6) fine sand, medium dense, moist
	5.0/5.0		SP		0	5.0-7.8' yellowish brown (10YR5/6) fine sand, medium dense, moist
6					0	
					0	
			ML		0	7.8-10.0' yellowish brown (10YR5/6) and light gray (10YR7/2) mottled clayey silt, stiff,
					0	low plasticity, moist
9					0	
					0	
	5.0/5.0		SP		0	10.0-12.3' strong brown (7.5YR5/6) fine sand with some silt, medium dense, moist
					0	
12			ML		0	12.3-13.4' yellowish brown (10YR5/6) silt, stiff, low plasticity, moist
					0	
			SP		0	13.4-15.0' yellowish brown (10YR5/6) fine sand with some silt, medium dense, saturated
					0	
15	5.0/5.0		SP		0	15.0-16,5' yellowish brown (10YR5/6) fine sand with some silt, medium dense, saturated
					0	
			ML		0	16.5-17.2' yellowish brown (10YR5/6) clayey silt, medium stiff, low plasticity, moist
			SP		0	17.2-20.0' brownish yellow (10YR6/8) fine sand, medium dense, moist
18					0	
					0	
					4.9	
	5.0/5.0		SP		2.3	20.0-21.5' brownish yellow (10YR6/8) fine sand, medium dense, moist
21					7.2	
			SP		134	21.5-25.0' pale brown (10YR6/3) fine sand with little silt, medium dense, saturated;
					14.5	LPH staining and odor noted 22-23'
					2.2	
24					45.8	
	5.0/5.0		SP		12.9	25.0-30.0' pale brown (10YR6/3) fine to medium sand with little subrounded gravel up to
					2	25mm, medium dense, saturated
					0	
27					0	
					0	
					0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 2/26/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**MW14-OW1-N**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

					Drilling	
Water Level	NA				Start	Finish
Time					1100	1500
Date						
Reference						

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	Surface Conditions: grass
	5.0/4.2	NA	ML		0	0.0-4.2' yellowish brown (10YR5/4) silt with little clay, fine sand and subrounded gravel
					0	up to 20mm, soft, medium plasticity, moist
					0	
3					0	
					0	
					0	
	5.0/3.8		SP		0	5.0-7.2' pale brown (10YR6/3) grading to a strong brown (7.5YR5/6) fine sand with little
6					0	silt, medium dense, moist
					0	
			ML		0	7.2-8.8' brownish yellow (10YR6/6) clayey silt, medium stiff, low plasticity, moist
					0	
9					0	
					0	
	5.0/4.8		SP		0	10.0-12.0' pale brown (10YR6/3) medium sand, trace silt, medium dense, moist
					0	
12			ML		0	12.0-13.2' pale brown (10YR6/3) sandy silt, medium stiff, low plasticity, moist
					0	
			SP		0	13.2-15.0' brownish yellow (10YR6/8) medium sand, medium dense, moist
					0	
15	5.0/4.3		SP		0	15.0-16.8' brownish yellow (10YR6/8) medium sand, medium dense, moist to 16.4'
					0	then saturated
			ML		0	16.8-17.4' pale brown (10YR6/3) silt with little clay, stiff, low plasticity, moist
			SP		0	17.4-19.3' brownish yellow (10YR6/8) medium sand, medium dense, moist; LPH visible
18					0	at 19.1-19.3'
					0	
					68.3	
	5.0/5.0		SP		0	20.0-25.0' pale brown (10YR6/3) fine sand with little silt, trace mica, medium dense,
21					0	LPH visible 22.4-22.7', saturated
					97.7	
					2.9	
					0	
24					0	
	5.0/5.0		SP		0	25.0-30.0' pale brown (10YR6/3) medium sand, medium dense, some subrounded gravel
					0	29.0-29.9', saturated; LPH visible 26.2-26.6'
					55.5	
27					29.0	
					5.9	
					6.0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 2/27/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**RW&-OW2-W**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

					Drilling	
Water Level	NA				Start	Finish
Time					910	1050
Date						
Reference						

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	Surface Conditions: grass
	5.0/5.0	NA			0	0.0-0.5' grass/topsoil
			ML		0	0.5-5.0' yellowish brown (10YR5/6) silt with little fine sand, medium stiff, low plasticity,
					0	moist
3					0	
					0	
					0	
	5.0/5.0		ML		0	5.0-7.2' yellowish brown (10YR5/6) silt with little fine sand, medium stiff, low plasticity,
6					0	moist
					0	
			SM		0	7.2-10.0' yellowish brown (10YR5/8) silty fine sand, medium dense, moist
					0	
9					0	
					0	
	5.0/5.0		SM		0	10.0-12.8' yellowish brown (10YR5/8) silty fine sand, medium dense, moist
					0	
12					0	
			SP		0	12.8-15.0' yellowish brown (10YR5/8) fine sand with little silt, medium dense, moist
					0	
					0	
15	5.0/5.0		SP		0	15.0-20.0' yellowish brown (10YR5/8) fine sand with little silt, medium dense, moist;
					2.2	LPH odor noted
					2.3	
					2.8	
18					55.4	
					83	
					65.8	
	5.0/5.0		SP		23.2	20.0-20.5' yellowish brown (10YR5/8) fine sand with little silt, medium dense, moist
21			SP		14.8	20.5-25.0' grayish brown (10YR5/2) fine to medium sand, medium dense, saturated
					8.4	
					6.9	
					1.4	
24					0.7	
	5.0/5.0		SP		0	25.0-28.0' grayish brown (10YR5/2) fine to medium sand, medium dense, saturated,
					0	grades to a well-graded sand with some subrounded gravel up to 20mm with depth
					0	
27					0	
			ML		0	28.0-29.0' yellowish brown (10YR5/8) silt, medium stiff, low plasticity, saturated
					0	
			SW		0	29.0-30.0' brown (10YR5/3) well-graded sand with some subrounded gravel up to 25mm,
30					0	medium dense, saturated
						EOB 30.0' bgs

Logged by: M Phillips Date: 3/25/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**RW7-OW1-S**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

Water Level	NA			Drilling Start	Drilling Finish
Time				1100	1300
Date					
Reference					

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-0.5' grass/topsoil
			ML		0	0.5-5.0' yellowish brown (10YR5/4) silt, little fine sand, medium stiff, low palsticity,
					0	moist
3					0	
					0	
					0	
	5.0/5.0		ML		0	5.0-9.7' yellowish brown (10YR5/4) silt, little fine sand, medium stiff, low palsticity,
6					0	moist
					0	
					0	
					0	
9					0	
			SM		0	9.7-10.0' yelowish brown (10YR5/8) silty fine sand, medium dense, moist
	5.0/5.0		SM		0	10.0-13.6' yelowish brown (10YR5/8) silty fine sand, medium dense, moist
					0	
12					0	
					0	
			ML		0	13.6-15.0' brown (10YR5/3) silt, trace mica, medium stiff, low plasticity, moist
					0	
15	5.0/5.0		SP		0	15.0-20.0' yellowish brown (10YR5/8) fine to medium sand, medium dense, moist to
					0	18.0' then saturated
					0	
					0.1	
18					1.3	
					4.6	
					41	
	5.0/5.0		SP		56.5	20.0-25.0' grayish brown (10YR5/2) medium sand with little subrounded gravel up to
21					87.8	15mm 23-25', medium dense, saturated
					15.6	
					8.5	
					7.1	
24					0	
	5.0/5.0		SP		0	25.0-29.2' grayish brown (10YR5/2) medium sand with little subrounded gravel grading
					0	to a well-graded sand with little subrounded gravel up to 25mm, medium dense,
					0	saturated
27					0	
					0	
					0	
					0	
30			SM		0	29.2-30.0' yellowish brown (10YR5/8) silty fine sand, medium dense, saturated
						EOB 30.0' bgs

Logged by: M Phillips Date: 3/25/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**RW6-OW2-E**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

Water Level	NA			Drilling Start	Drilling Finish
Time				1315	1530
Date					
Reference					

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-0.3' grass/topsoil
			ML		0	0.3-5.0' brown (10YR5/3) silt with some very fine sand, medium stiff, low plasticity,
					0	moist
3					0	
					0	
					0	
	5.0/5.0		ML		0	5.0-8.0' brown (10YR5/3) silt with some very fine sand, medium stiff, low plasticity,
6					0	moist
					0	
					0	
			SM		0	8.0-10.0' brown (10YR5/3) silty very fine to fine sand, medium dense, moist
9					0	
					0	
	5.0/5.0		SM		0	10.0-12.5' brown (10YR5/3) silty very fine to fine sand, medium dense, moist
					0	
12					0	
			SP		0	12.5-15.0' yellowish brown (10YR5/4) fine sand with little silt and subrounded gravel up
					0	to 40mm, medium dense, moist
					0	
15	5.0/5.0		SP		0	15.0-20.0' yellowish brown (10YR5/6) medium sand, medium dense, saturated; LPH
					0	odor noted
					0	
					4.5	
18					3.9	
					27.4	
					19.7	
	5.0/5.0		SP		65.7	20.0-23.8' yellowish brown (10YR5/6) medium sand, medium dense, saturated; LPH
21					94.1	odor noted
					74.6	
					37	
			ML		18.1	23.8-25.0' pale brown (10YR6/3) silt with some sand and subrounded gravel up to 22mm,
24					6.6	medium stiff, low plasticity, saturated
	5.0/5.0		SP		0.4	25.0-30.0' grayish brown (10YR5/2) medium sand grading to a well-graded sand with
					0	depth, medium dense, saturated
					0	
27					0	
					0	
					0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 3/25/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**MW19-OW2-NE**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

Water Level	NA			Drilling Start	Drilling Finish
Time				815	1000
Date					
Reference					

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	Surface Conditions: gravel
	5.0/5.0	NA			0	0.0-1.2' gravel
			SM		0	1.2-5.0' yellowish brown (10YR5/6) silty fine to medium sand with little subrounded gravel
					0	up to 25mm, medium dense, moist
3					0	
					0	
					0	
	5.0/5.0		SM		0	5.0-8.4' yellowish brown (10YR5/6) silty fine to medium sand with little subrounded gravel
6					0	up to 25mm, medium dense, moist
					0	
					0	
			SP		0	8.4-10.0' brownish yellow (10YR6/6) fine sand, medium dense, moist
9					0	
					0	
	5.0/5.0		SP		0	10.0-14.2' brownish yellow (10YR6/6) fine sand, medium dense, moist
					0	
12					0	
					0	
			ML		0	14.2-15.0' yellowish brown (10YR5/8) silt with some clay, medium stiff, low plasticity,
					0	moist
15	5.0/5.0		ML		0	15.0-17.5' yellowish brown (10YR5/8) silt with some clay, medium stiff, low plasticity,
					0	moist
					0	
			SP		0	17.5-20.0' yellowish brown (10YR5/8) fine to medium sand, medium dense, moist
18					0	
					0	
					0	
	5.0/5.0		SP		0	20.0-25.0' yellowish brown (10YR5/4) fine to medium sand with some silt grading to a
21					12.8	clean medium sand with depth, medium dense, moist to 21.5' then saturated
					4	
					0.4	
					0	
24					0	
	5.0/5.0		SP		0	25.0-30.0' brown (10YR5/3) medium sand, trace silt, medium dense, saturated
					0	
					0	
27					0	
					0	
					0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 3/26/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method: hollow-stem auger		Boring No. **MW19-OW1-SW**
Sampling Method: 5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

Water Level	NA			
Time				
Date				
Reference				

Drilling	
Start	Finish
1025	1230

Surface Conditions: gravel

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-1.0' gravel
			ML		0	1.0-2.8' grayish brown (10YR5/2) silt/sand mix, medium dense, moist
					0	
3			SM		0	2.8-5.0' yellowish brown (10YR5/6) silty medium sand with little subrounded gravel up
					0	to 30mm, medium dense, moist
					0	
	5.0/5.0		SM		0	5.0-9.5' yellowish brown (10YR5/6) silty medium sand with little subrounded gravel up
6					0	to 25mm, medium dense, moist
					0	
					0	
					0	
9					0	
			SP		0	9.5-10.0' yellowish brown (10YR5/8) fine sand, medium dense, moist
	5.0/5.0		SP		0	10.0-15.0' yellowish brown (10YR5/8) fine sand, medium dense, moist
					0	
12					0	
					0	
					0	
					0	
15	5.0/5.0		SP		0	15.0-17.5' yellowish brown (10YR5/6) fine to medium sand with little subrounded gravel
					0	up to 15mm, medium dense, moist
					0	
			ML		0	17.5-20.0' gray (10YR5/1) silt with some very fine sand, medium stiff, low plasticity,
18					0	moist
					0	
					0	
	5.0/5.0		ML		0	20.0-20.8' gray (10YR5/1) silt with some very fine sand, medium stiff, low plasticity,
21					0	moist
			SP		0	20.8-25.0' yellowish brown (10YR5/6) fine sand, little silt, medium dense, saturated
					0	
					0	
24					0	
	5.0/5.0		SP		0	25.0-30.0' yellowish brown (10YR5/6) fine sand, little silt, grades to a well-graded
					0	sand with little subrounded gravel up to 20mm with depth, medium dense, saturated
					0	
27					0	
					0	
					0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 3/26/13

Drilling Contractor: DTCI Driller: B Atkinson

EA Engineering, Science, and Technology, Inc.

Job No.	Client:	Location:
1436916	Exelon	Perryman Generation Facility
Drilling Method:		Boring No.
hollow-stem auger		**RW6-OW1-N**
Sampling Method:		
5 ft. Macrocore		Sheet 1 of 1

LOG OF SOIL/ROCK BORING

Coordinates: NA
Surface Elevation:
Casing Below Surface:
Reference Elevation:
Reference Desc:

					Drilling	
Water Level	NA				Start	Finish
Time					1300	1500
Date						
Reference						

Surface Conditions: grass

Depth (ft bgs)	ft driven/ recovered	Blow Count	USCS Symbol	USCS Log	PID/ FID	
	5.0/5.0	NA			0	0.0-0.4' topsoil
			ML		0	0.4-5.0' yellowish brown (10YR5/4) silt with some fine sand, medium stiff, low plasticity,
					0	moist
3					0	
					0	
					0	
	5.0/5.0		ML		0	5.0-6.2' yellowish brown (10YR5/4) silt with some fine sand, medium stiff, low plasticity,
6					0	moist
			SP		0	6.2-10.0' yellowish brown (10YR5/6) fine sand, medium dense, moist
					0	
					0	
9					0	
					0	
	5.0/5.0		SP		0	10.0-15.0' yellowish brown (10YR5/6) fine sand with little subrounded gravel up to
					0	20mm, medium dense, moist
12					0	
					0	
					0	
					0.2	
15	5.0/5.0		SP		4.8	15.0-16.2' yellowish brown (10YR5/6) fine sand with little subrounded gravel up to
					4.5	20mm, medium dense, moist
			SM		5.7	16.2-17.4' yellowish brown (10YR5/4) silty very fine sand, medium dense, moist
			SP		2	17.4-20.0' light yellowish brown (10YR6/4) fine to medium sand, medium dense, moist;
18					6.6	LPH odor noted
	5.0/5.0		SP		4.3	20.0-22.0' light yellowish brown (10YR6/4) fine to medium sand, medium dense, moist;
21					60.2	LPH odor noted
			SW		63.8	22.0-22.6' dark grayish brown (10YR4/2) well-graded gravelly sand with some silt,
					106	medium dense, saturated
			SP		74.7	22.6-25.0' brown (10YR5/3) medium sand grading to a gravelly sand with depth, medium
24						dense, saturated
	5.0/5.0		SW		59.6	25.0-28.2' brown (10YR5/3) gravelly well-graded sand, subrounded gravel up to 25mm,
					60.2	medium dense, saturated
					29.3	
27					10.9	
			SM		6.6	28.2-30.0' brown (10YR5/3) silty fine to medium sand, medium dense, saturated
					0	
					0	
30					0	EOB 30.0' bgs

Logged by: M Phillips Date: 3/26/13

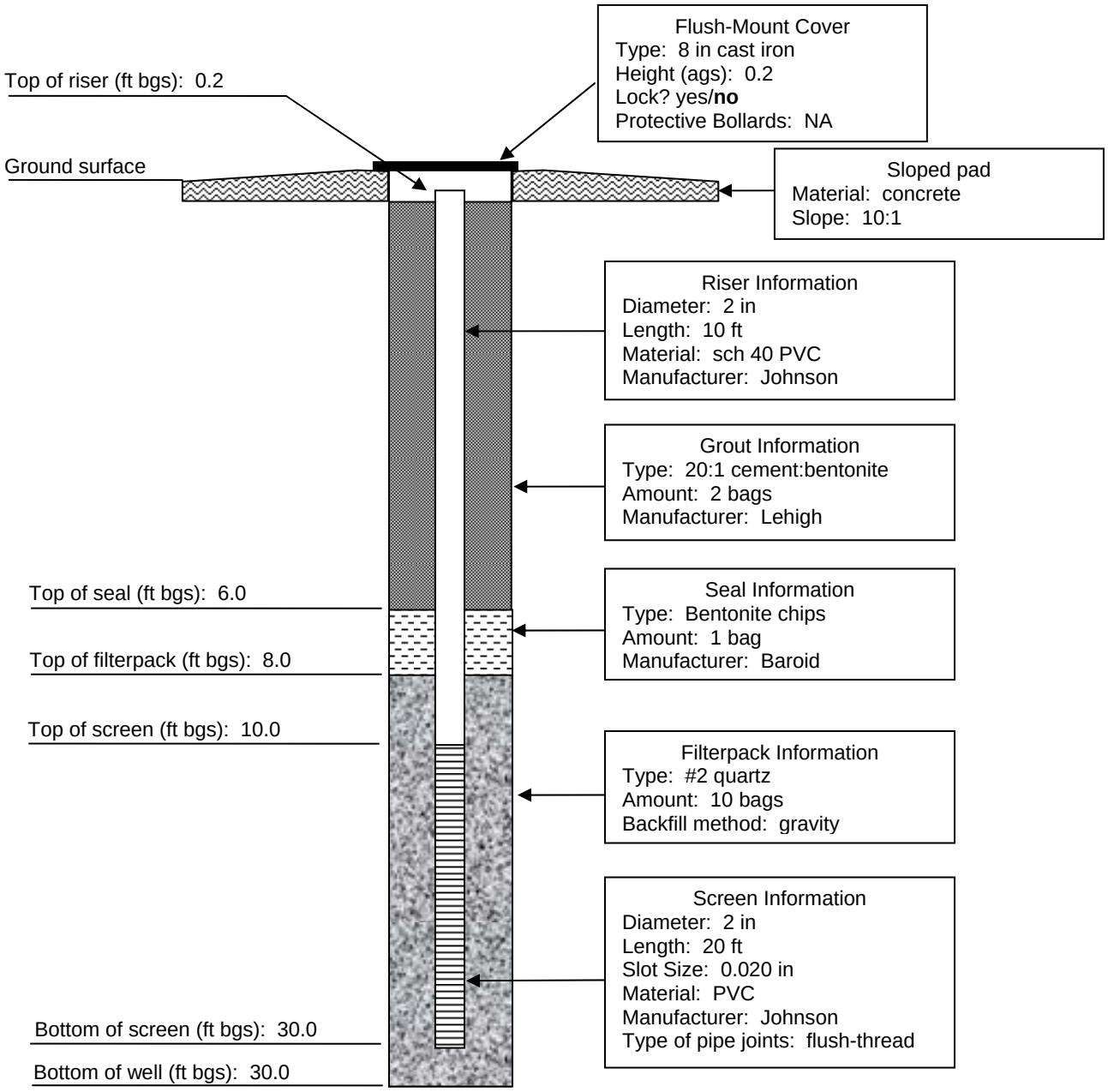
Drilling Contractor: DTCI Driller: B Atkinson

Attachment B

Well Completion Diagrams

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **MW14-OW1-N**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **27 February 2013** Time Finished: **1500**
Location: **Perryman Generation Facility**	Depth to Water: **20.89' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

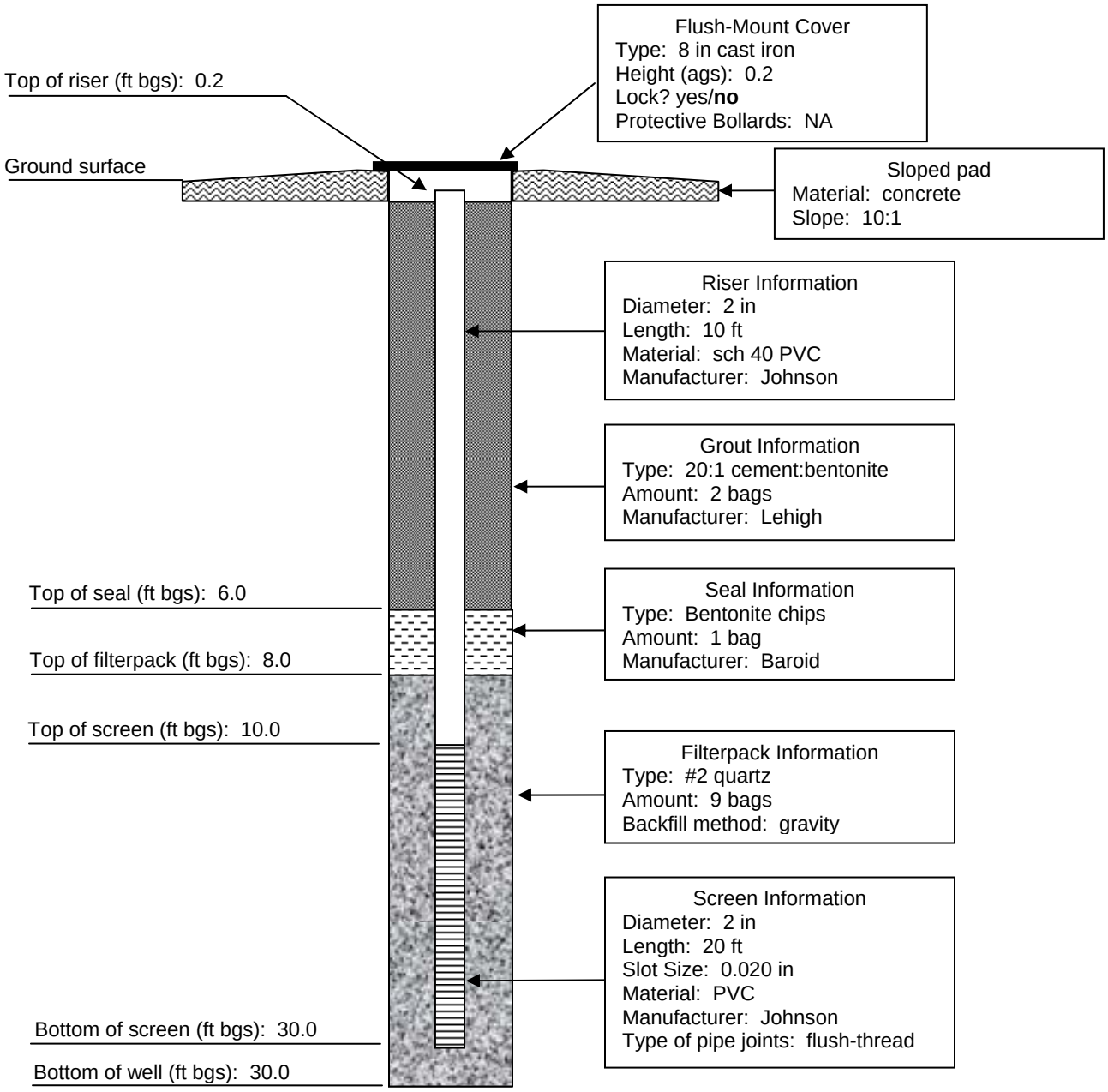


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **MW14-OW2-E**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **26 February 2013** Time Finished: **1530**
Location: **Perryman Generation Facility**	Depth to Water: **20.97' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

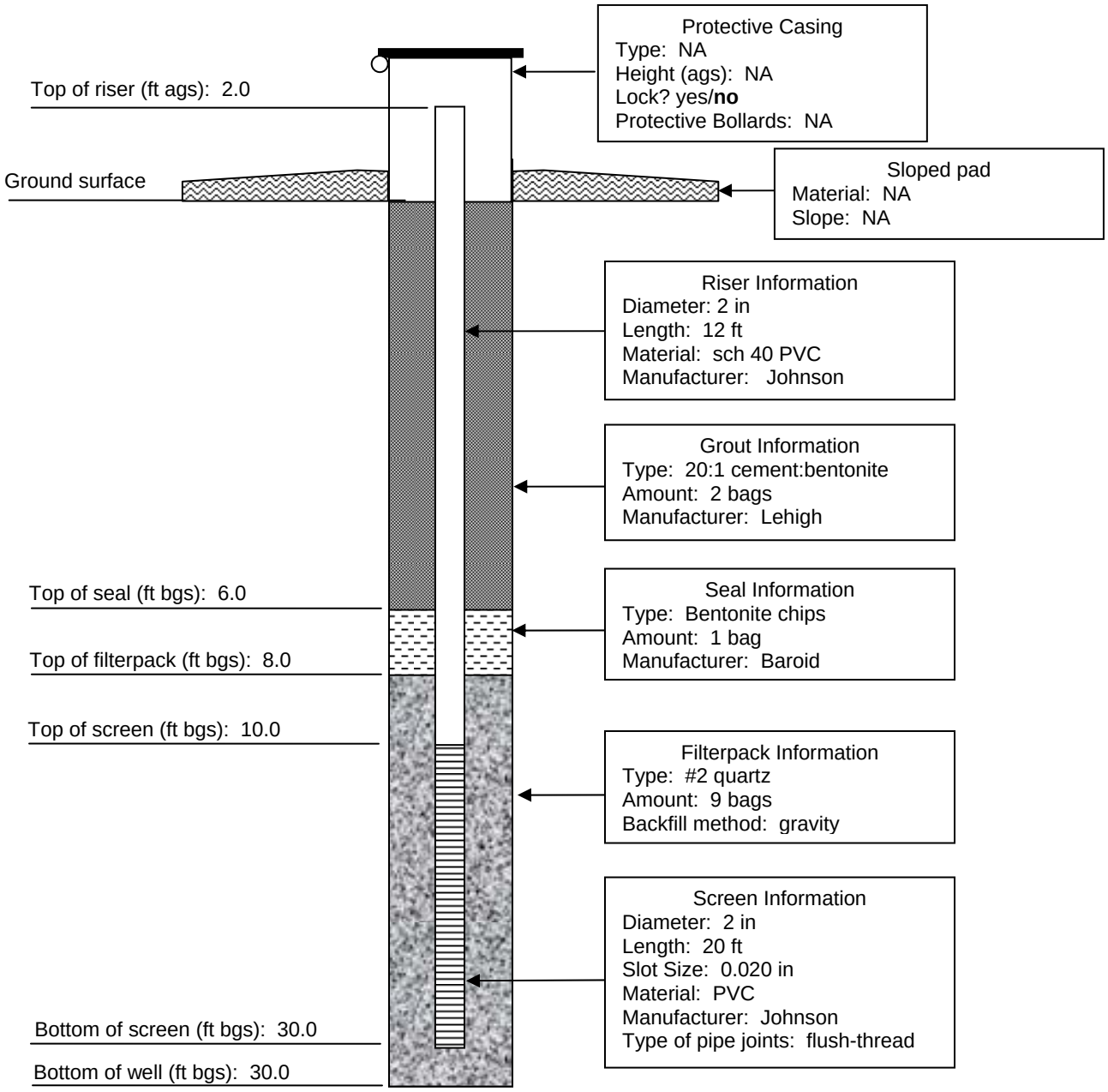


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(STICK-UP)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **MW19-OW1-SW**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **26 March 2013** Time Finished: **1220**
Location: **Perryman Generation Facility**	Depth to Water: **23.14' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

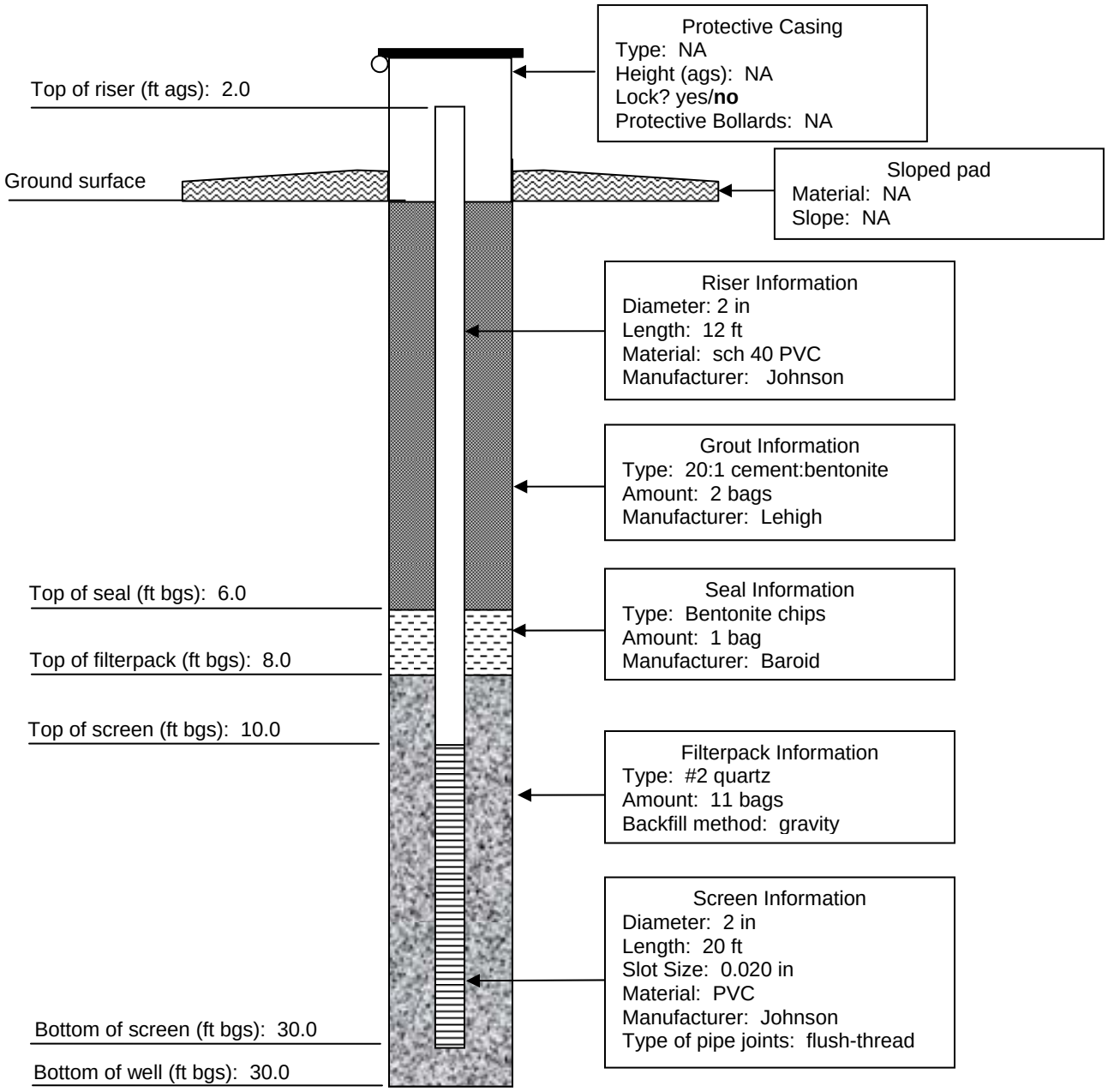


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(STICK-UP)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **MW19-OW2-NE**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **26 March 2013** Time Finished: **1015**
Location: **Perryman Generation Facility**	Depth to Water: **23.29' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

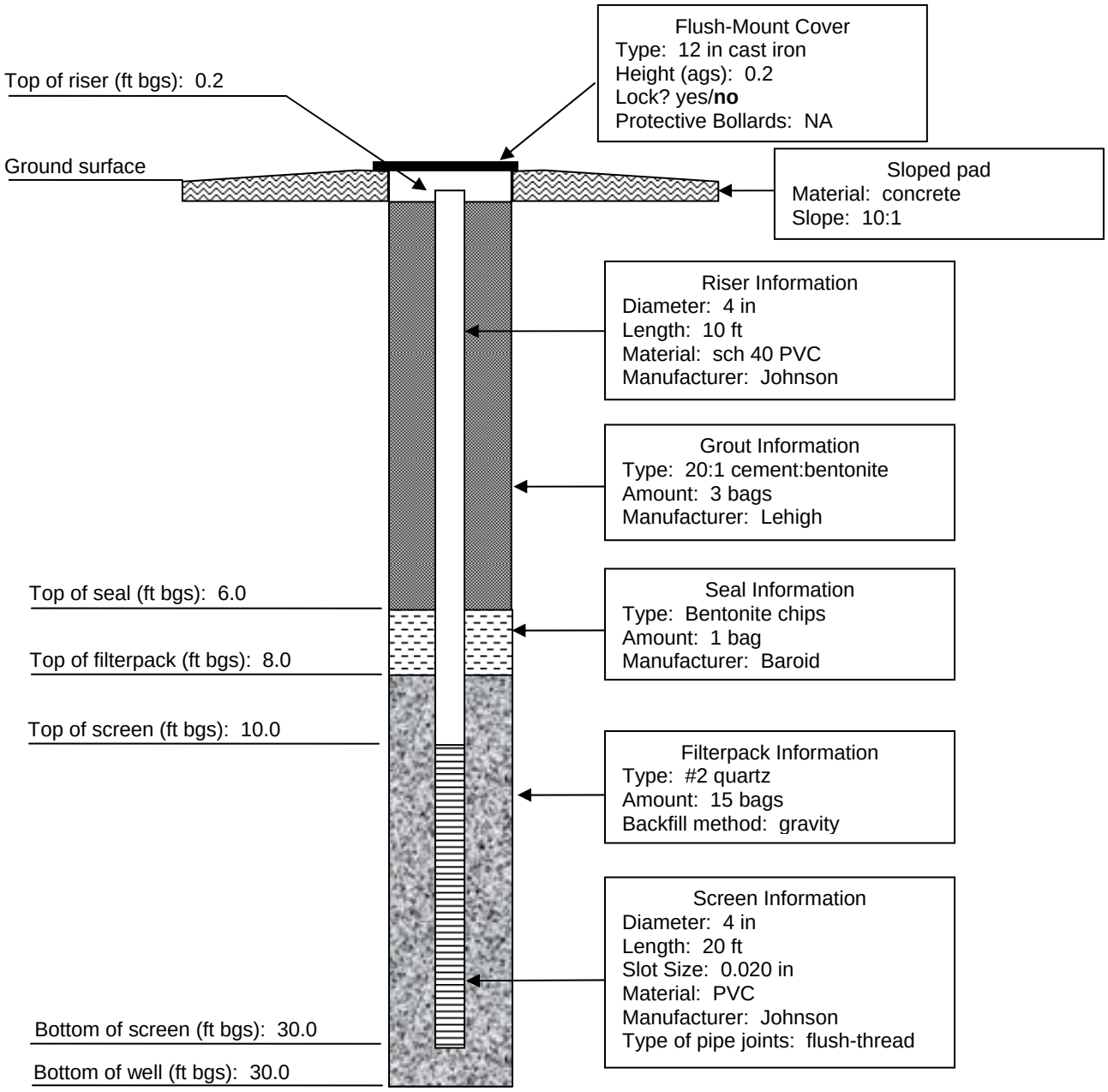


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW-6**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **27 February 2013** Time Finished: **1045**
Location: **Perryman Generation Facility**	Depth to Water: **21.53' TOC**
Site Geologist: **M Phillips**	Drilling Method: **8 ¼" HSA**

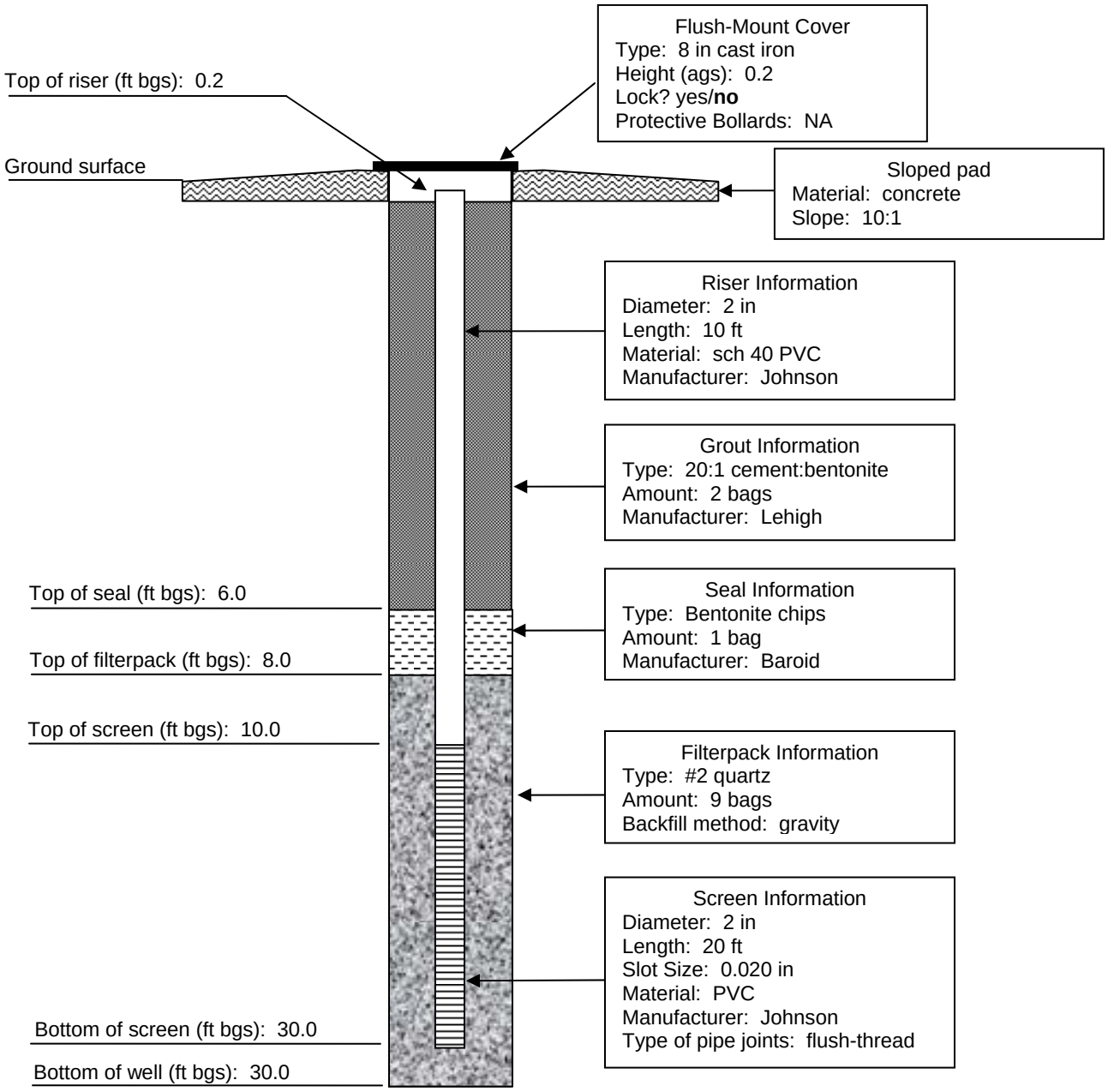


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW6-OW1-N**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **27 March 2013** Time Finished: **0900**
Location: **Perryman Generation Facility**	Depth to Water: **20.04' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

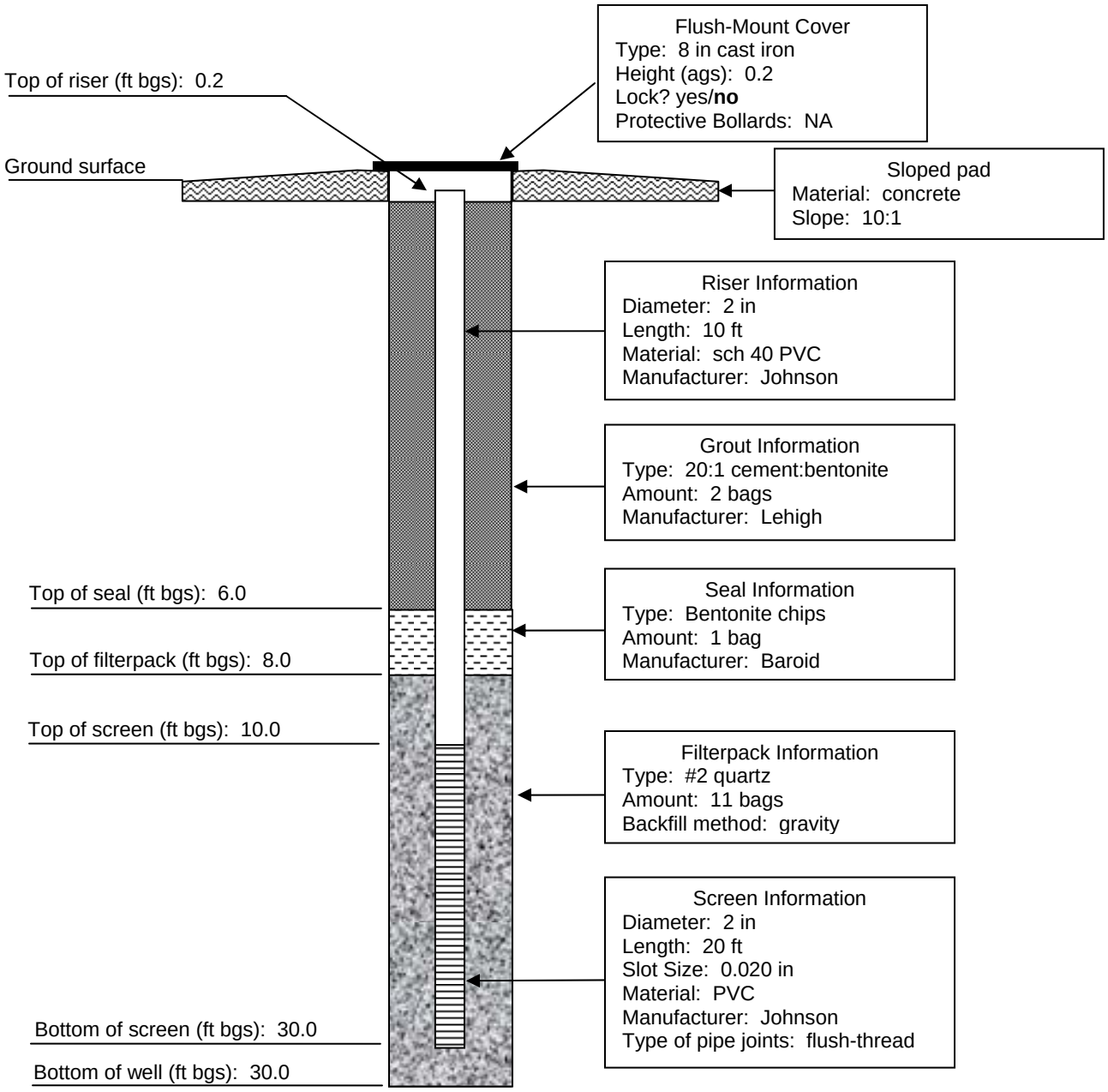


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW6-OW2-E**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **27 March 2013** Time Finished: **1000**
Location: **Perryman Generation Facility**	Depth to Water: **20.08' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

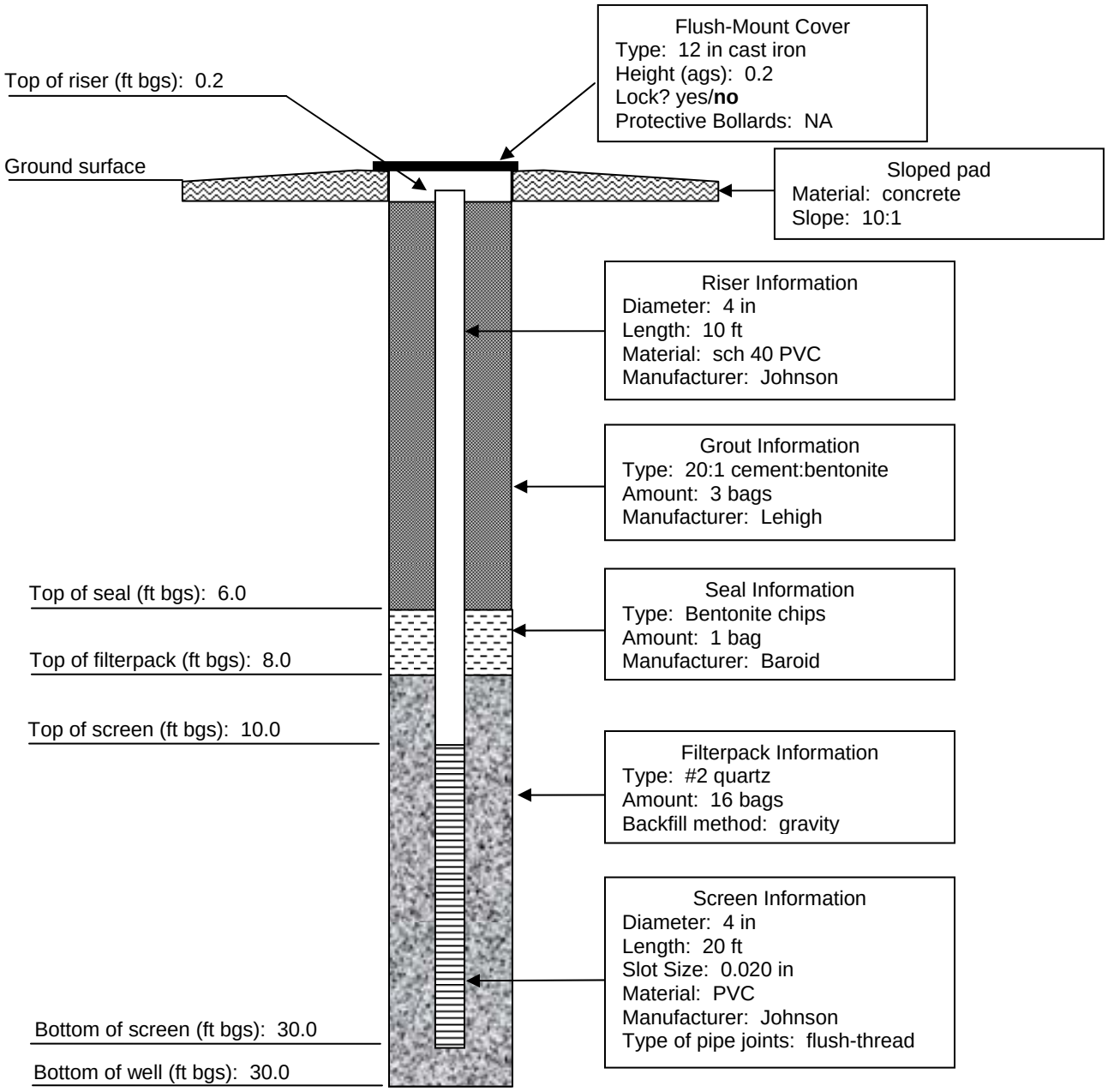


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW-7**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **26 February 2013** Time Finished: **1350**
Location: **Perryman Generation Facility**	Depth to Water: **19.88' TOC**
Site Geologist: **M Phillips**	Drilling Method: **8 ¼" HSA**

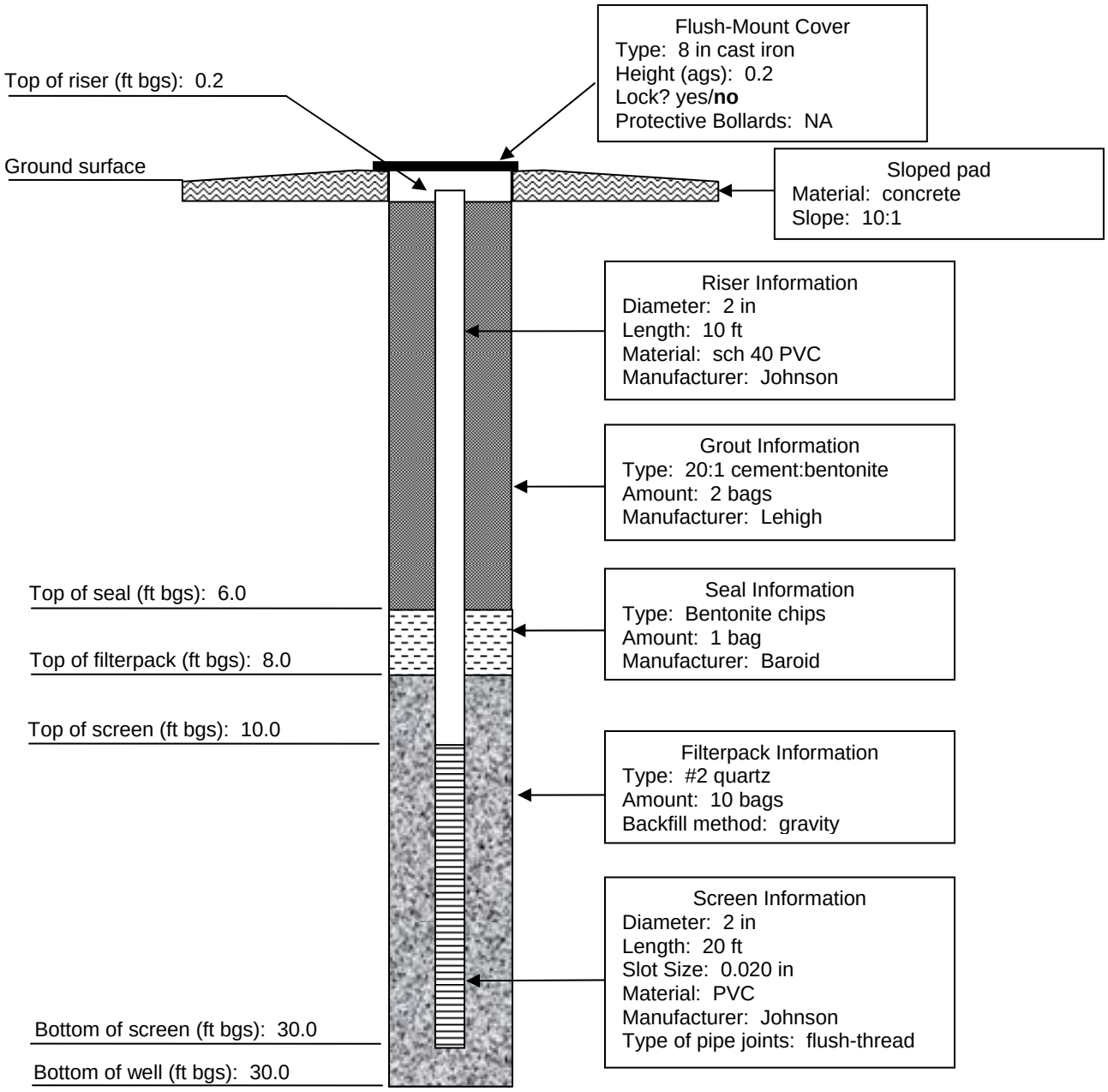


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW7-OW1-S**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **25 March 2013** Time Finished: **1305**
Location: **Perryman Generation Facility**	Depth to Water: **20.39' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**

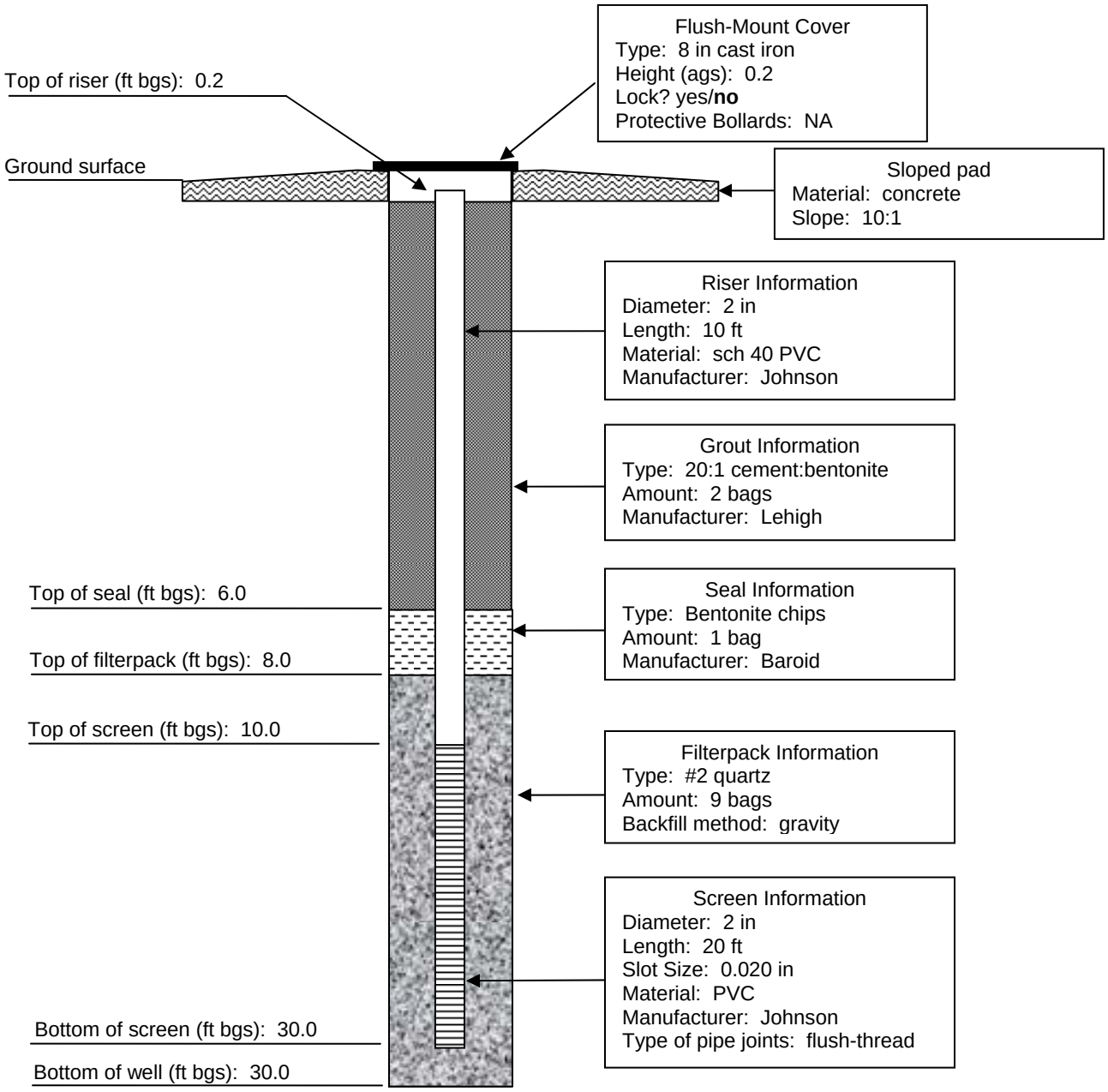


Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

RECORD OF MONITORING WELL CONSTRUCTION
(FLUSH-MOUNT)

EA Engineering, Science, and Technology, Inc.	Monitoring Well/Soil Boring ID No.: **RW7-OW2-W**
Project Title/ Project No.: **Perryman/1436916**	Date Installed: **25 March 2013** Time Finished: **1050**
Location: **Perryman Generation Facility**	Depth to Water: **21.49' TOC**
Site Geologist: **M Phillips**	Drilling Method: **4 ¼" HSA**



Note: All features not to scale

ags – Above Ground Surface
bgs – Below Ground Surface

Attachment C

IDW Analytical Results

New Jersey
ACCUTEST LABORATORIES

Reissue #1
05/22/13

Technical Report for

EA Engineering

Perryman

Accutest Job Number: JB33079

Sampling Date: 03/29/13

Report to:

EA Engineering

shd@eaest.com

ATTN: Scott Dobson

Total number of pages in report: **13**

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs as applicable.

Nancy Cole
Laboratory Director

Client Service contact: Marie Meidhof 732-329-0200

Certifications: NJ(12129), NY(10983), CA, CT, DE, FL, IL, IN, KS, KY, LA, MA, MD, MI, MT, NC, OH VAP (CL0056), PA, RI, SC, TN, VA, WV

This report shall not be reproduced, except in its entirety, without the written approval of Accutest Laboratories. Test results relate only to samples analyzed.

Accutest Laboratories is the sole authority for authorizing edits or modifications to this document. Unauthorized modification of this report is strictly prohibited.

ACCUTEST LABORATORIES

May 9, 2013

Mr. Mike Hertz
EA Engineering
1311 Continental Drive
Suite K
Abingdon, MD 21009

Re: Accutest Job# JB33079

Dear Mr. Hertz,

The final report for Accutest job number JB33079 has been edited to reflect corrections to the final report.

The DRO results for sample JB33079-1 has been revised due to a calculation error in the initial batch G2Z1200.

Sample#	Field ID	Original result:	Revised result:
JB33079-1	032913-COMP	1240	1120

The revised report incorporates this revision.

Our apologies for any inconvenience the above issue may have caused you. Please contact me at 732-355-4552 if I may be of further assistance in this matter, or if you have any further questions regarding this data report.

Sincerely,

Accutest Laboratories

Marie Meidhof
Project Manager

Table of Contents

-1-

Section 1: Sample Summary **4**
Section 2: Case Narrative/Conformance Summary **5**
Section 3: Summary of Hits **6**
Section 4: Sample Results **7**
4.1: JB33079-1: 032913-COMP 8
Section 5: Misc. Forms **11**
5.1: Chain of Custody 12

Accutest LabLink@732691 09:26 22-May-2013

Sample Summary

EA Engineering

Perryman

Job No: JB33079

Sample Number	Collected Date	Time	By	Received	Matrix Code	Type	Client Sample ID
JB33079-1	03/29/13	10:50	MP	04/02/13	SO	Soil	032913-COMP

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

CASE NARRATIVE / CONFORMANCE SUMMARY

Client:	EA Engineering	**Job No**	JB33079
Site:	Perryman	**Report Date**	4/25/2013 4:52:01 PM

On 04/02/2013, 1 Sample(s), 0 Trip Blank(s) and 0 Field Blank(s) were received at Accutest Laboratories at a temperature of 4.8 C. Samples were intact and chemically preserved, unless noted below. An Accutest Job Number of JB33079 was assigned to the project. Laboratory sample ID, client sample ID and dates of sample collection are detailed in the report's Results Summary Section.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GCMS By Method SW846 8260B

Matrix: SO **Batch ID:** VX5833

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) JB33079-1MS, JB33079-1MSD were used as the QC samples indicated.

Volatiles by GC By Method SW846 8015C

Matrix: SO **Batch ID:** GPF3078

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) JB33087-11MS, JB33087-11MSD were used as the QC samples indicated.

Extractables by GC By Method SW846 8015C

Matrix: SO **Batch ID:** OP65086

- All samples were extracted within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) JB33001-4MS, JB33001-4MSD were used as the QC samples indicated.

Wet Chemistry By Method SM2540 G-97

Matrix: SO **Batch ID:** GN82994

- The data for SM2540 G-97 meets quality control requirements.

Accutest certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting Accutest's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

Accutest Laboratories is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. Data release is authorized by Accutest Laboratories indicated via signature on the report cover

Summary of Hits

Job Number: JB33079
Account: EA Engineering
Project: Perryman
Collected: 03/29/13

3

Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
JB33079-1	**032913-COMP**					
TPH-GRO (C6-C10)		53.7	12	1.2	mg/kg	SW846 8015C
TPH-DRO (C10-C28)		1120	10	3.9	mg/kg	SW846 8015C

New Jersey

ACCUTEST LABORATORIES

Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	032913-COMP		
Lab Sample ID:	JB33079-1	**Date Sampled:**	03/29/13
Matrix:	SO - Soil	**Date Received:**	04/02/13
Method:	SW846 8260B	**Percent Solids:**	91.4
Project:	Perryman		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	X134643.D	1	04/06/13	MS	n/a	n/a	VX5833
Run #2							

	Initial Weight
Run #1	5.0 g
Run #2	

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.1	0.13	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
1868-53-7	Dibromofluoromethane	100%		70-130%
17060-07-0	1,2-Dichloroethane-D4	87%		70-122%
2037-26-5	Toluene-D8	103%		81-127%
460-00-4	4-Bromofluorobenzene	110%		66-132%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	032913-COMP		
Lab Sample ID:	JB33079-1	**Date Sampled:**	03/29/13
Matrix:	SO - Soil	**Date Received:**	04/02/13
Method:	SW846 8015C	**Percent Solids:**	91.4
Project:	Perryman		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	PF06409.D	1	04/12/13	HT	n/a	n/a	GPF3078
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	9.6 g	10.0 ml	100 ul
Run #2			

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-GRO (C6-C10)	53.7	12	1.2	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
98-08-8	aaa-Trifluorotoluene	92%		66-119%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	032913-COMP		
Lab Sample ID:	JB33079-1	**Date Sampled:**	03/29/13
Matrix:	SO - Soil	**Date Received:**	04/02/13
Method:	SW846 8015C SW846 3546	**Percent Solids:**	91.4
Project:	Perryman		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	2Z30379.D	1	04/16/13	HP	04/08/13	OP65086	G2Z1207
Run #2							

	Initial Weight	Final Volume
Run #1	10.7 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	1120	10	3.9	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	100%		13-142%
16416-32-3	Tetracosane-d50	89%		12-141%
438-22-2	5a-Androstane	97%		13-142%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

New Jersey

ACCUTEST LABORATORIES

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

ACCUTEST LABORATORIES

SO

CHAIN OF CUSTODY

2235 Route 130, Dayton, NJ 08810
Tel: 732-329-0200 FAX: 732-329-3499/3480
www.accutest.com

PAGE 1 OF 1

FED-EX Tracking #:
Bottle Order Control #:
Accutest Quote #: 161-12004-SO Rev 2
Accutest Job #: JB33079

Client / Reporting Information

Company Name: EA Engineering
Street Address: 1311 Continental Dr Ste K
City / State / Zip: Abingdon MD 21009
Project Contact / E-mail: Mike Hertz mhertz@eaest.com
Phone # / Fax #: 410.671.6051
Sampler(s) Name(s) / Phone #: M Phillips

Project Information

Project Name: Perryman
Street:
City / State:
Project #:
Client Purchase Order #:
Project Manager:

Billing Information (if different from Report to)

Company Name:
Street Address:
City / State / Zip:
Attention:

Requested Analysis (see TEST CODE sheet)

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB-Equipment Blank
RB- Rinse Blank
TB-Trip Blank

Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE	Benzene (8260B)	TPH-GRO (8015)	TPH-DRO (8015)	LAB USE ONLY
-1	032913-COMP		3/29/13	1050	MP	SO	3									X	X	X	D34T3
																			19A

Turnaround Time (Business days)

- [X] Std. 15 Business Days
- [ ] Std. 10 Business Days (by Contract only)
- [ ] 10 Day *RUSH*
- [ ] 5 Day *RUSH*
- [ ] 3 Day *EMERGENCY*
- [ ] 2 Day *EMERGENCY*
- [ ] 1 Day *EMERGENCY*

Emergency & Rush T/A data available VIA Lablink

Approved By (Accutest PM): / Date:

Data Deliverable Information

- [ ] Commercial "A" (Level 1)
- [ ] Commercial "B" (Level 2)
- [ ] FULLT1 (Level 3+4)
- [ ] NJ Reduced
- [ ] Commercial "C"
- [ ] NYASP Category A
- [ ] NYASP Category B
- [ ] State Forms
- [ ] EDD Format
- [ ] Other

Commercial "A" = Results Only
Commercial "B" = Results + QC Summary
NJ Reduced = Results + QC Summary + Partial Raw data

Comments / Special Instructions

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1	4/2/13 1510	1 Sally Temp 1510	2 Sally Temp 4/2/13	1810	2
Relinquished by Sampler: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal #	Intact / Not Intact	Preserved where applicable / On Ice / Cooler Temp. 4.8C

IB Cooled MB G.G

JB33079: Chain of Custody
Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: JB33079 **Client:** **Project:**

Date / Time Received: 4/2/2013 **Delivery Method:** **Airbill #'s:**

Cooler Temps (Initial/Adjusted): #1: (4.8/4.8); 0

Cooler Security	Y	or	N
1. Custody Seals Present:	☑		☐
2. Custody Seals Intact:	☑		☐
3. COC Present:	☑		☐
4. Smpl Dates/Time OK	☑		☐

Cooler Temperature	Y	or	N
1. Temp criteria achieved:	☑		☐
2. Cooler temp verification:	IR Gun		
3. Cooler media:	Ice (Bag)		
4. No. Coolers:	1		

Quality Control Preservation	Y	or	N	N/A
1. Trip Blank present / cooler:	☐		☑	☐
2. Trip Blank listed on COC:	☐		☑	☐
3. Samples preserved properly:	☑		☐	
4. VOCs headspace free:	☐		☐	☑

Sample Integrity - Documentation	Y	or	N
1. Sample labels present on bottles:	☑		☐
2. Container labeling complete:	☑		☐
3. Sample container label / COC agree:	☑		☐

Sample Integrity - Condition	Y	or	N
1. Sample recvd within HT:	☑		☐
2. All containers accounted for:	☑		☐
3. Condition of sample:	Intact		

Sample Integrity - Instructions	Y	or	N	N/A
1. Analysis requested is clear:	☑		☐	
2. Bottles received for unspecified tests	☐		☑	
3. Sufficient volume recvd for analysis:	☑		☐	
4. Compositing instructions clear:	☐		☐	☑
5. Filtering instructions clear:	☐		☐	☑

Comments

Accutest Laboratories
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2235 US Highway 130
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Dayton, New Jersey
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5.1

5

JB33079: Chain of Custody
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Attachment D

VER Field Observations

VER Field Data Form

Location:	Perryman	Initial DTP:	19.79
Date:	4/19/13	Initial DTW:	19.86
Start Time:	0740	Final DTP:	19.69
Technician:	MP	Final DTW:	19.69 (sheen)
Field Conditions:	60 cloudy	Total Fluids Recovered:	1404
Recovery Well:	RW-7	Total LPH Recovered:	7.1 gal

	Recovery Well	Observation Wells						
	RW-7	RW7-OW1-S			RW7-OW2-W			
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	
0 (initial)	—	—	19.70	20.29	—	19.80	21.30	
30	-5.0							
60	-6.0	-3.9	20.36	21.15	-3.7	20.32	22.35	
90	-6.3							
120	-7.2	-2.8	19.94	20.67	-3.0	19.98	21.50	
150	-8.4							
180	-13.2	-11.3	20.20	20.21	-10.9	20.17	20.25	
210	-13.0							
240	-14.0	-7.7	20.01	20.02	-8.2	19.95	19.95	SHEEN
270	-16.5							
300	-18.0	-7.5	19.95	19.95 (sheen)	-8.0	20.01	20.02	
330	-21.5							
360	-17.5	-7.3	19.90	19.90 (sheen)	-7.8	20.02	20.02 (sheen)	
390	-18.0							
420	-17.5	-7.6	19.92	19.92 (sheen)	-8.0	20.00	20.00 (sheen)	
450	-17.0							
480	-17.5	-7.5	19.90	19.90 (sheen)	-7.8	19.99	19.99 (sheen)	

Notes: 0740 stinger set to 20'. 0850 raise stinger to 19'
32" in tank = 1404 gal
0.01' LPH = 7.1 gal
32-33" = 59 gal ([59×12]/100) 1 = 7.1

VER Field Data Form

Location:	Ferryman	Initial DTP:	23.46
Date:	4/22/13	Initial DTW:	23.65
Start Time:	0800	Final DTP:	NA
Technician:	MA	Final DTW:	23.59
Field Conditions:	40 sun	Total Fluids Recovered:	1581 gal
Recovery Well:	MW-19	Total LPH Recovered:	<0.01' = <7.1 gal

	Recovery Well	Observation Wells					
	MW-19	MW19-OW1-SW			MW19-OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	–	23.11	–	–	23.28
30	-24	~~0.0~~	–	~~23.23~~	~~0.0~~		
60	-24	0.0	–	23.23	0.0	–	23.42
90	-24						
120	-24	0.0	–	23.24	0.0	–	23.42
150	-23						
180	-23	-0.3	–	23.63	-0.4	–	23.81
210	-23						
240	-23	-0.1	–	23.59	-0.1	–	23.75
270	-23						
300	-23	-0.2	–	23.55	-0.1	–	23.62
330	-23						
360	-23	-0.1	–	23.57	-0.1	–	23.66
390	-22						
420	-22	-0.1	–	23.55	-0.2	–	23.61
450							
480							

Notes: 0800 stinger set @ 24.0'
1515 stop VER (BGE impactor, offsite)
35-36" = 59 gal ([59×12]/100)1 = 7.1; <7.1 gal rec

VER Field Data Form

Location:	Ferryman	Initial DTP:	21.99
Date:	4/23/13	Initial DTW:	22.90
Start Time:	0730	Final DTP:	NA
Technician:	MP	Final DTW:	24.76
Field Conditions:	50 cloudy	Total Fluids Recovered:	579
Recovery Well:	MW-14	Total LPH Recovered:	0.01" = 6.0 gal

	Recovery Well	Observation Wells					
	MW-14	MW14-OW1-N			MW14-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	-16.0	—	20.07	20.72	—	19.96	20.83
30	-17.0						
60	-17.0	-4.0	20.24	20.28	-2.8	20.16	20.33
90	-17.5			(sheen)			
120	-16.5	-6.6	20.30	20.30	-9.1	20.21	20.30
150	-17.5			(sheen)			
180	-17.5	-6.4	20.33	20.33	-9.0	20.27	20.29
210	-16.0			(sheen)			
240	-16.0	-6.6	20.24	20.24	-9.2	20.28	20.29
270	-17.5			(sheen)			(sheen)
300	-17.5	-6.6	20.21	20.21	-9.2	20.26	20.26
330	-18.0			(sheen)			(sheen)
360	-17.5	-6.5	20.20	20.20	-9.0	20.25	20.25
390	-16.0			(sheen)			(sheen)
420	-18.0	-6.4	20.25	20.25	-9.1	20.27	20.27
450	-17.5			(sheen)			(sheen)
480	-16.0	-6.5	20.28	20.28	-9.0	20.24	20.24

Notes: 0730 begin VER w/ drop tube @ 23'; 0810 lower drop tube to 26'; 0840 drop tube set @ bottom of well
17-18" = 50 gal ([50×12]/100) = 6.0 gal

VER Field Data Form

Location:	Pennyman	Initial DTP:	19.94
Date:	4/24/13	Initial DTW:	21.33
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	21.83
Field Conditions:	60 cloudy	Total Fluids Recovered:	76 gal
Recovery Well:	RW-6	Total LPH Recovered:	2.01' = 6.4 gal

	Recovery Well	Observation Wells					
	RW-6	RW6-OW1-N			RW6-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	19.98	19.98 (sheen)	—	20.03	20.03 (sheen)
30	-15.0						
60	-14.0	-4.4	20.01	20.01 (sheen)	-3.9	20.32	20.32 (sheen)
90	-14.0						
120	-13.5	-9.5	—	20.04	-2.2	20.41	20.41 (sheen)
150	-14.0						
180	-15.0	-9.4	—	20.08	-1.5	20.42	20.42 (sheen)
210	-15.0						
240	-16.0	-9.4	—	20.10	-1.4	20.39	20.39 (sheen)
270	-15.0						
300	-15.5	-9.5	—	20.12	-1.5	—	20.41
330	-16.0						
360	-15.5	-9.3	—	20.15	-1.5	—	20.44
390	-15.5						
420	-16.0	-9.4	—	20.15	-1.6	—	20.46
450	-16.0						
480	-15.5	-9.4	—	20.16	-1.6	—	20.46

Notes: 0730 begin VER w/ drop tube @ 22'; 0750 lower drop tube to 24'
0840 lower drop tube to 27'
([53×12]/100)1 = 6.4 gal

VER Field Data Form

Location:	Perryman	Initial DTP:	19.96
Date:	5/13/13	Initial DTW:	21.35
Start Time:	0730	Final DTP:	21.87
Technician:	MP	Final DTW:	21.88
Field Conditions:	50 sun	Total Fluids Recovered:	403 gal
Recovery Well:	RW-6	Total LPH Recovered:	<11.5 gal

	Recovery Well	Observation Wells					
	RW-6	RW6-OW1-N			RW6-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	-	-	19.98	19.98 (sheen)	-	20.04	20.04 (sheen)
30	-15.0						
60	-16.5	-	-	-	-	-	-
90	-17.0						
120	-16.0	-6.4	-	20.18	-2.1	-	20.34
150	-16.0						
180	-16.0	-9.0	-	20.20	-2.3	-	20.40
210	-16.5						
(1130 5/13) 240	-16.0	-8.9	-	20.20	-2.1	-	20.42
(0730 5/15) 270	-13.0						
300	-13.0	-1.9	-	20.08	0.0	-	20.29
330	-14.5						
360	-15.0	-6.9	-	20.09	-0.4	-	20.33
390	-16.0						
420	-16.0	-8.0	-	20.11	-0.9	-	20.31
450	-16.5						
480	-15.5	-8.4	-	20.11	-0.9	-	20.35

Notes: 0730 begin VER w/drop tube @ 24'; 0900 lower drop tube to 26'

12" = 349 gal on 5/13; <0.01' LPH = <5.0 gal

5/15 0730 resume VER 23" = 891 - 437 (from MW-14) = 454 gal

<0.01' LPH = <6.5

VER Field Data Form

Location:	Ferryman	Initial DTP:	19.91
Date:	5/13/13	Initial DTW:	20.15
Start Time:	1130	Final DTP:	20.74 (sheen)
Technician:	MP	Final DTW:	20.74
Field Conditions:	60 sun	Total Fluids Recovered:	2686
Recovery Well:	RW-7	Total LPH Recovered:	<14.1

	Recovery Well	Observation Wells					
	RW-7	RW7-OW1-S			RW7-OW2-W		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	19.80	20.49	–	19.90	21.82
30	-10.5						
60	-14.0	-5.5	19.99	20.30	-6.8	20.04	21.90
90	-15.0						
120	-15.0	-7.3	20.01	20.10	-7.1	20.09	20.93
150	-16.0			(sheen)			
180	-16.5	-7.5	20.03	20.03	-7.1	20.15	20.29
210	-15.5			(sheen)			
240	-16.0	-7.7	20.03	20.03	-6.0	20.10	20.12
270	-16.0			~~(sheen)~~			(sheen)
300	-17.0	-8.9	~~20.37~~ 20.12	~~20.37~~ 20.14	~~-9.6~~ -9.6	20.37	20.37
330	-16.5			(sheen)			(sheen)
360	-16.0	-8.8	20.16	20.16	-9.4	20.39	20.39
390	-16.5						
420	-16.0	-5.6	–	20.21	-6.0	–	20.15
450	-16.5						
480	-16.5	-6.4	–	20.11	-6.7	–	20.22

1530 5/13 → 1130 5/15

Notes: 1130 begin VER, stinger @ 20'
39" = 1817 gal − 349 (from RW-6) = 1468 gal on 5/13; <0.01' LPH = <7.1 gal
5/15 1130 resume VER
41" = 2109 gal − 891 (RW-6 + MW-14) = 1218 gal on 5/15
<0.01' LPH = <7.0 gal

VER Field Data Form

Location:	Perryman	Initial DTP:	22.02
Date:	5/14/13	Initial DTW:	22.90
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	23.13
Field Conditions:	45 sun	Total Fluids Recovered:	437 gal
Recovery Well:	MW-14	Total LPH Recovered:	10.8 gal

	Recovery Well	Observation Wells					
	MW-14	MW14-OW1-N			MW14-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	20.09	20.76	—	19.96	20.83
30	-8.0						
60	-15.0	-3.0	20.26	20.30	-6.8	20.19	20.22
90	-16.0						
120	-16.5	-6.8	20.34	20.35	-9.3	20.23	20.23 (sheen)
150	-16.0			(sheen)			
180	-16.0	-6.4	20.29	20.29	-9.4	20.24	20.24 (sheen)
210	-17.0			(sheen)			
240	-16.5	-6.5	20.25	20.25	-9.1	20.21	20.21 (sheen)
270	-16.5						
300	-17.0	-6.5	—	20.32	-9.1	20.26	20.26 (sheen)
330	-16.5						
360	-16.5	-6.4	~~20.34~~	20.31	-9.2	20.24	20.24 (sheen)
390	-16.5						
420	-17.0	-6.6	—	20.35	-8.8	—	20.27
450	-16.0						
480	-16.5	-6.4	—	20.33	-8.9	—	20.26

Notes: 0730 begin VER; stinger set 1' off bottom of well
14" = 437 gal; 0.02' LPH = 10.8 gal

VER Field Data Form

Location:	Perryman	Initial DTP:	23.36
Date:	5/16/13	Initial DTW:	23.51
Start Time:	0815	Final DTP:	23.51 (sheen)
Technician:	EL	Final DTW:	23.51
Field Conditions:	70, cloudy	Total Fluids Recovered:	2051 gals
Recovery Well:	MW-19	Total LPH Recovered:	~0.01 ≈ 8 gals

	Recovery Well	Observation Wells					
	MW-19	MW19-OW1-SW			MW-19-OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	–	23.10	–	–	23.22
30	~23						
60	~22	0.00	–	23.53	0.0.3	–	23.66
90	~21.5						
120	~21	-00.1	–	23.33	0.0.3	–	23.69
150	~21.5						
180	~21	-01.0	–	23.42	-00.3	–	23.44
210	~21						
240	~21	-0.7	23.28	(sheen) 23.28	-0.9	–	23.41
270	~21						
300	~21	-0.8	–	23.38	-1.3	–	23.51
330	~21						
360	~21	-1.2	–	23.35	-1.5	–	23.50
390	~21						
420	~21	-1.5	–	23.37	-1.4	–	23.51
450	~21				–		
480	~21	-0.7	–	23.30	-1.4	–	23.46

Notes: 0815 stinger set @ 25'
1015 raised stinger to ~24'
1025 raised stinger to ~19' (water rising due to capillary action)

VER Field Data Form

Location:	Parryman	Initial DTP:	19.84
Date:	6/17/13	Initial DTW:	20.81
Start Time:	0730	Final DTP:	NA
Technician:	MP	Final DTW:	20.44
Field Conditions:	75 sun	Total Fluids Recovered:	614
Recovery Well:	RW-6	Total LPH Recovered:	<6.0

	Recovery Well	Observation Wells					
	RW-6	RW6-OW1-N			RW6-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	—	19.84	—	—	19.89
30	-11						
60	-16	-8.1	—	19.93	-4.0	—	20.06
90	-20						
120	-22	-10.5	—	19.99	-7.7	—	20.08
150	-23						
180	-25	-9.3	—	20.02	-7.0	—	20.16
210	-25						
240	-26	-6.2	—	20.04	-5.6	—	20.21
270	-8						
300	-7	-7.6	—	19.93	-5.0	—	20.14
330	-10						
360	-15	-9.8	—	19.98	-5.8	—	20.18
390	-14						
420	-15	-9.6	—	20.00	-6.9	—	20.21
450	-16						
480	-15	-10.5	—	19.99	-7.3	—	20.20

6/17 1130 → 6/19 0730

Notes: 6/17 0730 drop tube set @ 26'. 1130 11" = 307 gal, <0.01' LPH
6/19 0730 stinger @ 29'; 1130 22" = 437 gal - 437 from MW-14 = 307 gal
<0.01' LPH
total: 614 gal, <0.02' LPH

VER Field Data Form

Location:	Perryman	Initial DTP:	19.69
Date:	6/17/13	Initial DTW:	20.05
Start Time:	1130	Final DTP:	20.20
Technician:	MP	Final DTW:	20.20
Field Conditions:	60 sun	Total Fluids Recovered:	1097+680=1777
Recovery Well:	RW-7	Total LPH Recovered:	<7.1

	Recovery Well	Observation Wells					
	RW-7	RW7-OW1-S			RW7-OW2-W		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	19.69	19.90	–	19.79	20.95
30	-4						
60	-3	0	19.70	19.88	0	19.74	20.80
90	-5						
120	-4	0	19.70	19.84	0	19.81	20.14
150	-5						
180	-7	0	–	19.76	0	–	19.86
210	-6						
240	-6	0	–	19.78	-0.6	–	19.84
270	-4						
300	-6	-6.4	19.70	19.74	-8.9	19.82	20.33
330	-5						
360	-5	-10.9	–	19.75	-11.7	19.85	19.91
390	-7						
420	-6	-12.0	–	19.77	-12.3	–	19.87
450	-6						
480	-5	-12.2	–	19.75	-12.8	–	19.87

6/17 1533 → 6/19 1130

Notes: 6/17 1130 drop tube set 21'; 1530 32" = 1424 - 327 from RW-6 = 1097 gal, <0.01' LPH
6/19 1130 stinger set @ 21'; 1530 680 g <0.01' LPH

VER Field Data Form

Location:	Ferguson	Initial DTP:	21.89
Date:	6/18/13	Initial DTW:	22.40
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	24.07
Field Conditions:	70 cloudy	Total Fluids Recovered:	437
Recovery Well:	MW-14	Total LPH Recovered:	25.4

	Recovery Well	Observation Wells					
	MW-14	MW14-OW1-N			MW14-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	19.93	20.31	—	19.82	20.39
30	-1						
60	-3	-4.3	20.01	20.27	-8.6	19.98	20.11
90	-3						
120	-5	-6.2	sheen	20.26	-10.5	20.10	20.18
150	-7						
180	-7	-6.5	—	20.28	-10.7	sheen	20.12
210	-9						
240	-8	-7.8	—	20.25	-10.4	sheen	20.10
270	-7						
300	-8	-7.9	—	20.21	-11.0	—	20.09
330	-7						
360	-8	-6.1	—	20.24	-10.7	—	20.10
390	-9						
420	-8	-8.0	—	20.25	-10.6	—	20.13
450	-8						
480	-8	-7.9	—	20.23	-10.9	—	20.12

Notes: 0730 stinger set @ 26'
1530 14" = 437 gal, 0.01' LPH

VER Field Data Form

Location: Perryman

Date: 6/21/13

Start Time: 0730

Technician: MP

Field Conditions: 85 sun

Recovery Well: MW-19

Initial DTP: 23.23

Initial DTW: 23.37

Final DTP: 24.07

Final DTW: 24.08

Total Fluids Recovered: 1229

Total LPH Recovered: <6.8

	Recovery Well	Observation Wells					
		MW19-OW1-SW			MW19-OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	–	22.49	–	–	23.05
30	20						
60	22	0	–	22.90	-0.1	–	23.04
90	21						
120	20	-0.1	–	22.91	-0.3	–	23.04
150	22						
180	23	-0.1	–	22.93	-0.2	–	23.05
210	22						
240	20	-0.4	–	22.96	-0.6	–	23.11
270	21						
300	21	-0.3	–	23.02	-0.8	–	23.18
330	21						
360	22	-0.6	–	23.09	-1.0	–	23.26
390	23						
420	21	-0.8	–	23.13	-1.2	–	23.23
450	21						
480	22	-0.8	–	23.12	-1.1	–	23.24

Notes: 0730 stinger set @ 25'; 1000 raise stinger to 22'
1530 1229 gal, <0.01' LPH

VER Field Data Form

Location:	Pennman	Initial DTP:	19.79
Date:	7/15/13	Initial DTW:	20.74
Start Time:	0730	Final DTP:	sheen
Technician:	MP	Final DTW:	23.36
Field Conditions:	95 sun	Total Fluids Recovered:	349 + 307 = 656
Recovery Well:	RW-6	Total LPH Recovered:	<5 + <4.8 = <9.8

	Recovery Well	Observation Wells					
	RW-6	RW6-OW1-N			RW6-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	–	19.75	–	–	19.80
30	-15						
60	-17	-7.8	–	-19.83	-1.1	–	-19.91
90	-18						
120	-18	-7.5	–	-19.84	-0.8	–	-19.89
150	-17						
180	-19	-6.9	–	19.82	-2.0	–	19.93
210	-19						
240	-20	-7.0	–	19.90	-1.5	–	19.93
270	-18						
300	-21	-6.0	–	19.84	-1.3	–	19.90
330	-22						
360	-21	-8.3	–	19.88	-2.1	–	19.94
390	-20						
420	-21	-6.7	–	19.86	-1.8	–	19.94
450	-21						
480	-22	-9.0	–	19.91	-2.2	–	19.97

7/15 1130 → 7/18 0730

Notes: 7/15 0730 sheen not @ 23'; 1130 12" = 349 gal, <0.01' LPH
7/18 11" = 307 gal, <0.01' LPH

VER Field Data Form

Location:	Perryman	Initial DTP:	19.61
Date:	7/15/13	Initial DTW:	20.17
Start Time:	1130	Final DTP:	sheen
Technician:	MP	Final DTW:	19.73
Field Conditions:	95 sun	Total Fluids Recovered:	2403+1165=3268
Recovery Well:	RW-7	Total LPH Recovered:	46.5

	Recovery Well	Observation Wells					
	RW-7	RW7-OW1-S			RW7-OW2-W		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	19.58	20.06	–	19.68	21.09
30	-6						
60	-7	-4.3	19.58	19.78	-6.4	19.74	20.50
90	-7						
120	-6	-4.8	19.59	19.62	-10.7	–	19.76
150	-8						
180	-6	-4.2	–	19.61	-11.3	–	19.76
210	-9						
240	-8	-4.5	–	19.61	-12.0	–	19.80
270	-6						
300	-9	-2.3	19.60	19.68	-6.6	19.71	20.04
330	-9						
360	-8	-4.0	–	19.62	-8.7	–	19.75
390	-9						
420	-12	-4.1	–	19.64	-9.0	–	19.82
450	-13						
480	-12	-3.8	–	19.62	-9.4	–	19.79

7/15 1530
7/18 1130

Notes: 1130 stinger set @ 22'; 1530 56" = 2752 gal − 349 = 2403
7/18 stinger @ 22'

VER Field Data Form

Location:	Perryman	Initial DTP:	21.84
Date:	7/16/13	Initial DTW:	22.33
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	22.47
Field Conditions:	95 sun	Total Fluids Recovered:	228
Recovery Well:	MW-14	Total LPH Recovered:	20.01' = 24.3

	Recovery Well	Observation Wells					
	MW-14	MW14-OW1-N			MW14-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	-	—	19.90	20.40	—	19.79	20.41
30	-4						
60	-4	-3.8	19.95	20.10	-3.0	19.85	20.03
90	-5						
120	-4	-4.0	19.98	19.99	-4.9	sheen	19.92
150	-6						
180	-7	-6.9	19.99	20.00	-8.6	-	19.98
210	-7						
240	-6	-7.2	-	20.04	-8.4	-	19.95
270	-8						
300	-8	-7.9	-	20.11	-9.1	-	19.97
330	-7						
360	-8	-7.4	-	20.15	-9.1	-	19.98
390	-9						
420	-6	-7.7	-	20.13	-9.8	-	20.00
450	-10						
480	-9	-8.0	-	20.16	-9.4	-	20.05

Notes: 0730 stinger set @ 30'; 1000 raise stinger to 26'

VER Field Data Form

Location:	Ferryman	Initial DTP:	23.18
Date:	7/17/13	Initial DTW:	23.25
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	23.24
Field Conditions:	95 sun	Total Fluids Recovered:	1640
Recovery Well:	MW-19	Total LPH Recovered:	<0.01' = <5

	Recovery Well	Observation Wells					
	MW19	MW19-OW-1-SW			MW19-OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	—	22.85	—	—	23.02
30	18						
60	17	0	—	22.92	-1.3	—	23.03
90	20						
120	19	0	—	23.01	-1.4	—	23.10
150	20						
180	21	-0.3	—	23.04	-2.0	—	23.14
210	22						
240	21	-0.4	—	23.02	-1.9	—	23.21
270	20						
300	22	-0.3	—	23.06	-2.3	—	23.18
330	22						
360	22	-0.4	—	23.11	-2.7	—	23.25
390	21						
420	22	-0.7	—	23.13	-2.4	—	23.28
450	23						
480	22	-0.7	—	23.13	-2.8	—	23.31

Notes: 0730 stinger set @ 24'; 1030 raise to 23'

VER Field Data Form

Location:	Perryman	Initial DTP:	23.12
Date:	8/12/13	Initial DTW:	23.18
Start Time:	0730	Final DTP:	—
Technician:	MP	Final DTW:	23.28
Field Conditions:	60 clouds	Total Fluids Recovered:	244
Recovery Well:	MW-19	Total LPH Recovered:	<0.01' <6.5 gal

	Recovery Well	Observation Wells					
	MW-19	OW1-SW			OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	-	-	-	22.80	-	-	22.98
30	20						
60	19	0	-	22.89	0	-	23.01
90	22						
120	21	0	-	22.92	0	-	23.06
150	22						
180	22	-0.4	-	22.93	-0.6	-	23.06
210	22						
240	22	-0.6	-	22.93	-0.6	-	23.10
270	21						
300	21	-0.6	-	22.97	-0.8	-	23.11
330	22						
360	22	-0.7	-	22.96	-0.6	-	23.11
390	21						
420	22	-0.6	-	23.04	-0.3	-	23.15
450	21						
480	20	-0.6	-	23.01	-0.5	-	23.18

Notes: 0730 stinger set 24' TOC; 0930 raise stinger to 23.5'

VER Field Data Form

Location:	Perry Mount	Initial DTP:	19.48'
Date:	8/13/13	Initial DTW:	21.06'
Start Time:	0735	Final DTP:	19.49
Technician:	CC/TM	Final DTW:	19.62
Field Conditions:	77° / cloudy	Total Fluids Recovered:	219 + 1404 = 1623
Recovery Well:	RW-7	Total LPH Recovered:	22 + 12 = 34

Time (minutes)	Recovery Well RW-7 Vacuum (in. Hg)	Observation Wells OW1-S Vacuum (in. H2O)	OW1-S DTP (ft. TOC)	OW1-S DTW (ft. TOC)	OW2-W Vacuum (in. H2O)	OW2-W DTP (ft. TOC)	OW2-W DTW (ft. TOC)
0800 0 (initial)			19.45	~~20.26~~ 19.58		20.26	20.60
30	-20		~~19.58~~	~~20.60~~			
60	-22	0.0	19.44	19.82	0.0	19.52	20.57
90	-22						
120	-22	0.1	19.45	19.73	0.1	19.52	20.59
150	-22						
180	-21	0.0	19.44	19.77	0.0	19.53	20.58
210	-22						
240	-22	0.0	19.42	19.70	0.0	19.52	20.53
270							
300							
330							
360							
390							
420							
450							
480							

Notes: Stingers set 22' TOC @

8/14 RW-7 19.52 DTP 19.85' DTW

" OW-1S 19.49 DTP 19.96 DTW

" OW-2W 19.57 DTP 20.70 DTW

VER Field Data Form

Location:	Perrymeen	Initial DTP:	19.68'
Date:	8/13/13	Initial DTW:	20.58'
Start Time:	1215	Final DTP:	20.03
Technician:	TM	Final DTW:	20.13
Field Conditions:	PC cloudy 80	Total Fluids Recovered:	177+219 = 396
Recovery Well:	RW-6	Total LPH Recovered:	14+24.2 = ≤16.2

	Recovery Well	Observation Wells					
	RW-6	OW1-N			OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
1215 0 (initial)			—	19.67		—	19.76
30	-10						
60	-10	-8.5	—	19.90	-1.7	—	20.02
90	-10						
120	-10	-8.5	—	19.86	-1.5	—	20.04
150	-10						
180	-10	-8.6	—	19.89	-3.9	—	20.02
210	-10						
240	-10	-8.5	—	19.85	-3.6	—	20.01
1315 270	-8						
300	-7	-9.7	—	19.83	-3.2	—	19.99
330	-7						
360	-7	-9.9	—	19.79	-3.5	—	19.92
390	-7						
420	-7	-9.4	—	19.75	-2.9	—	19.97
450	-8						
480	-8	-9.1	—	19.80	-2.9	—	19.99

Notes: @ 1210 Stinger set to 28' TOC @ 1220 Reset Stinger to 22' TOC

8/14/13	RW-6	19.78	DTP	20.13	DTW
"	OW-1N	19.75	DTP	20.00	DTW
"	OW-2E	—	DTP	19.68	DTW

VER Field Data Form

Location:	MLS - 14 / Perry Mc	Initial DTP:	21.78
Date:	8/14/13	Initial DTW:	22.56
Start Time:	1745	Final DTP:	22.69
Technician:	TM	Final DTW:	22.80
Field Conditions:	Sunny 70°	Total Fluids Recovered:	621
Recovery Well:	MW-14	Total LPH Recovered:	14

	Recovery Well	Observation Wells					
	MW 14	MW 14 - OW 1-N			MW 14 - OW 2E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	20.01	20.19	—	19.95	20.59
30	-15						
60	-15	-6.5	20.10	20.25	-9.7	20.01	20.35
90	-15						
120	-14	-6.7	20.12	20.20	-9.3	sheen	19.97
150	-13						
180	-13	-7.0	—	20.07	-9.7	—	20.00
210	-13						
240	-13	-7.1	—	20.03	-10.0	—	19.96
270	-13						
300	-13	-7.0	—	20.05	-9.5	—	19.93
330	-13						
360	-13	-7.0	—	20.04	-9.5	—	19.96
390	-13						
420	-13	-6.8	—	20.02	-9.6	—	19.93
450	-13						
480		-6.8	—	20.04	-10.1	—	19.95

Notes: 0740 - Stinger set to 27' TOC (inner)

8/15/13	MW 14	21.78	DTP	22.41	DTW
	OW 1-N	Sheen ~~19.89~~	DTP	19.90	DTW
	OW 2-E	19.79	DTP	20.03	DTW

VER Field Data Form

Location:	Hartman	Initial DTP:	19.49
Date:	8/15/13	Initial DTW:	19.80
Start Time:	0745	Final DTP:	19.40
Technician:	TM	Final DTW:	19.45
Field Conditions:	Sunny 62°	Total Fluids Recovered:	14 gal
Recovery Well:	RW-7	Total LPH Recovered:	20 gal

	Recovery Well	Observation Wells					
		OW1-S			OW2-W		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0745 0 (initial)	—	—	19.50	19.93	—	19.93	20.50
30	-19						
60	-19	-8.2	20.05	20.60	-8.6	20.23	20.62
90	-19						
120	-12	-15.2	19.91	20.25	-15.4	20.03	20.10
150	-12						
180	-12	-14.4	19.82	19.85	-14.9	sheen	20.03
210	-12						
240	-12	-13.9	19.42	19.50	-14.2	sheen	19.65
270							
300							
330							
360							
390							
420							
450							
480							

Notes: 0740 Stinger set to 22' TOC 0945 Raise stinger to 18' TOC

VER Field Data Form

Location:	Perryman	Initial DTP:	19.95
Date:	9/16/13	Initial DTW:	21.42
Start Time:	0730	Final DTP:	21.24
Technician:	MP	Final DTW:	21.2-
Field Conditions:	65 cloudy	Total Fluids Recovered:	307 + 392 = 699
Recovery Well:	RW-6	Total LPH Recovered:	<5.0

	Recovery Well	Observation Wells					
	RW-6	RW-6-OW1-N			RW-6-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	—	—	—	20.00	—	—	20.04
30	-16						
60	-18	-6.0	—	20.06	-0.7	—	20.11
90	-16						
120	-16	-7.2	—	20.13	-1.2	—	20.15
150	17						
180	-19	-7.4	—	20.15	-1.4	—	20.17
210	-19						
240	-20	-7.0	-	~~20.17~~	-1.2	—	20.20
270	-18						
300	-19	-5.6	—	20.10	-1.0	-	20.19
330	-18						
360	-20	-6.6	—	20.15	-0.8	—	20.22
390	-22						
420	-20	-7.0	—	20.18	-1.1	—	20.20
450	-21						
480	-20	-6.6	—	20.18	-1.3	—	20.24

9/16 1130 → 9/19 0730

Notes: 9/16 0730 set stinger 26'; 1130 11" = 307 gal <0.01' LPH
9/19 0730 set stinger 26'; 1130 392 gal <0.01' LPH

VER Field Data Form

Location:	Perryman	Initial DTP:	19.73
Date:	9/16/13	Initial DTW:	20.84
Start Time:	1130	Final DTP:	–
Technician:	MP	Final DTW:	21.11
Field Conditions:	70 cloudy	Total Fluids Recovered:	807+1370 = 2177
Recovery Well:	RW-7	Total LPH Recovered:	<14.2

	Recovery Well	Observation Wells					
	RW-7	RW7-OW1-S			RW7-OW2-W		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	19.69	20.80	–	19.80	21.84
30	-7						
60	-7	-5.3	19.71	19.84	-9.9	19.85	20.70
90	-9						
120	-9	-5.1	19.72	19.74	-10.8	–	19.90
150	-12						
180	-11	-6.0	–	19.73	-12.7	–	19.88
210	-12						
240	-12	-5.8	–	19.73	-11.3	–	19.89
270	-11						
300	-10	-5.0	19.85	19.98	-6.8	19.90	20.43
330	-12						
360	-14	-6.1	19.86	19.87	-11.6	–	19.96
390	-16						
420	-15	-6.8	–	19.87	-11.4	–	19.94
450	-17						
480	-16	-6.5	–	19.85		–	19.95

9/16 1330 →
9/19 1130

Notes: 9/16 807 gal <0.01' LPH
9/19 1370 gal, <0.01' LPH

VER Field Data Form

Location:	Pennsauken	Initial DTP:	22.04
Date:	9/17/13	Initial DTW:	22.78
Start Time:	0730	Final DTP:	23.01
Technician:	MP	Final DTW:	23.07
Field Conditions:	65 cloudy	Total Fluids Recovered:	3.49
Recovery Well:	MW-14	Total LPH Recovered:	<5.6

	Recovery Well	Observation Wells					
	MW-14	MW14-OW1-N			MW14-OW2-E		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	~~[illegible]~~ (19.19)	19.92	–	19.00	19.79
30	-6						
60	-7	-4.4	19.25	19.38	-2.7	19.18	19.20
90	-6						
120	-6	-4.4	19.26	19.27	-3.9	–	19.27
150	-8						
180	-9	-5.1	–	19.29	-4.6	–	19.29
210	-9						
240	-8	-6.2	–	19.28	-6.7	–	19.29
270	-10						
300	-9	-6.8	–	19.30	-7.5	–	19.25
330	-10						
360	-11	-7.4	–	19.33	-9.2	–	19.28
390	-10						
420	-9	-7.9	–	19.32	-9.1	–	19.31
450	-10						
480	-10	-8.3	–	19.34	-9.6	–	19.30

Notes: 0730 set stinger @ 28'; 3.49 gal, <0.01' LPH

VER Field Data Form

Location:	Perryman	Initial DTP:	23.37
Date:	9/18/13	Initial DTW:	23.64
Start Time:	0730	Final DTP:	23.59 (sheen)
Technician:	MP	Final DTW:	23.59
Field Conditions:	65 sun	Total Fluids Recovered:	4.91
Recovery Well:	MW-19	Total LPH Recovered:	<6.0

	Recovery Well	Observation Wells					
	MW-19	MW19-OW1-SW			MW19-OW2-NE		
Time (minutes)	Vacuum (in. Hg)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)	Vacuum (in. H2O)	DTP (ft. TOC)	DTW (ft. TOC)
0 (initial)	–	–	–	23.06	–	–	23.23
30	16						
60	18	0	–	23.18	-0.7	–	23.29
90	17						
120	16	0	–	23.20	-0.9	–	23.33
150	19						
180	18	0	–	23.21	-1.1	–	23.33
210	18						
240	18	-0.5	–	23.21	-1.6	–	23.35
270	19						
300	18	-0.4	–	23.25	-1.4	–	23.40
330	20						
360	21	-0.5	–	23.24	-1.8	–	23.41
390	20						
420	20	-0.6	–	23.25	-1.7	–	23.40
450	21						
480	20	-0.6	–	23.25	-1.9	–	23.41

Notes: 0730 stinger set 25' TOC; 0930 raise stinger to 23'
<0.01' LPH

Attachment E

Baildown Test Forms

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: MW-19
Technician: MP
Date: 3/18/13
Field Conditions: 35 rain/snow

Initial DTW: 24.14 Bailing Start Time: 1040
Initial DTP: 23.55 Bailing End Time: 1042
Product Thickness: 0.59 Amount Bailed (gal): 0.2

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	23.62	23.68	@ 1043
1.25			
1.5			
1.75			
2	23.61	23.75	
2.25			
2.5			
2.75			
3	23.60	23.78	
3.25			
3.5			
3.75			
4	23.60	23.78	
4.25			
4.5			
4.75			
5	23.60	23.78	
6	23.59	23.79	
7	23.59	23.81	
8	23.59	23.83	
9	23.59	23.85	
10	23.59	23.86	
12	23.59	23.87	
14	23.59	23.88	
16	23.59	23.88	
18	23.59	23.88	
20	23.59	23.88	
25	23.59	23.89	
30	23.59	23.89	

Time (min)	DTP	DTW	Comments
35	23.59	23.89	
40	23.59	23.89	
50	23.58	23.88	
60	23.57	23.87	
	23.56	23.86	@1314
	23.53	23.81	@1555
	23.53	23.87	@0940 3/19

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: MW-14
Technician: MP
Date: 3/18/13
Field Conditions: 40 cloudy. DTP/DTW readings collected from top of protective casing (not PVC). Emulsion of LPH/GW caused by bailing may be cause of greater measured LPH near beginning of test.

Initial DTW: 24.40 Bailing Start Time: 1205
Initial DTP: 23.25 Bailing End Time: 1206
Product Thickness: 1.15 Amount Bailed (gal): 0.8

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	24.04	24.10	@ 1207
1.25			
1.5			
1.75			
2	23.68	23.86	
2.25			
2.5			
2.75			
3	23.65	23.50	
3.25			
3.5			
3.75			
4	23.53	23.73	
4.25			
4.5			
4.75			
5	23.55	23.69	
6	23.51	23.62	
7	23.49	23.59	
8	23.47	23.58	
9	23.46	23.57	
10	23.44	23.55	
12	23.42	23.54	
14	23.40	23.53	
16	23.39	23.54	
18	23.38	23.55	
20	23.37	23.56	
22	23.37	23.58	
24	23.36	23.60	

Time (min)	DTP	DTW	Comments
26	23.36	23.62	
~~30~~ 28	23.35	23.64	
~~35~~ 30	23.35	23.66	
35	23.34	23.68	
40	23.33	23.70	
45	23.33	23.71	
50	23.32	23.72	
55	23.32	23.74	
60	23.32	23.75	
80	23.33	23.80	@ 1327
	23.32	23.84	@ 1413
	23.30	23.90	@ 1527
	23.30	23.95	@ 1622
	23.24	24.13	3/19 @ 8:57

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: RW-6
Technician: MF
Date: 3/13/13
Field Conditions: 40 cloudy

Initial DTW: 21.91 Bailing Start Time: 1337
Initial DTP: 20.10 Bailing End Time: 1339
Product Thickness: 1.81 Amount Bailed (gal): 1.1

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	20.63	20.74	@1340
1.25			
1.5			
1.75			
2	20.42	20.59	
2.25			
2.5			
2.75			
3	20.38	20.60	
3.25			
3.5			
3.75			
4	20.34	20.60	
4.25			
4.5			
4.75			
5	20.32	20.60	
6	20.30	20.60	
7	20.29	20.62	
8	20.29	20.65	
9	20.28	20.65	
10	20.28	20.67	
12	20.27	20.69	
14	20.26	20.73	
16	20.24	20.74	
18	20.24	20.76	
20	20.25	20.79	
22	20.25	20.80	
24	20.24	20.81	

Time (min)	DTP	DTW	Comments
26	20.24	20.83	
28	20.24	20.85	
30	20.24	20.86	
35	20.23	20.87	
40	20.22	20.88	
45	20.22	20.90	
50	20.21	20.93	
55	20.20	20.93	
60	20.20	20.96	
	20.19	21.13	@1524
	20.16	21.24	@1626
	20.09	21.66	3/19@08:55

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: RW-7
Technician: MF
Date: 3/18/13
Field Conditions: 40 min

Initial DTW: 20.79 Bailing Start Time: 1441
Initial DTP: 19.89 Bailing End Time: 1443
Product Thickness: 0.90 Amount Bailed (gal): 0.7

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	20.03	20.04	@ 1444
1.25			
1.5			
1.75			
2	20.03	20.08	
2.25			
2.5			
2.75			
3	20.02	20.10	
3.25			
3.5			
3.75			
4	20.01	20.13	
4.25			
4.5			
4.75			
5	20.01	20.13	
6	20.00	20.13	
7	20.00	20.14	
8	20.00	20.15	
9	20.00	20.16	
10	20.00	20.16	
12	20.99	20.16	
14	20.99	20.17	
16	20.98	20.17	
18	20.98	20.18	
20	20.98	20.18	
25	20.98	20.19	
30	20.97	20.19	

Time (min)	DTP	DTW	Comments
35	20.97	20.20	
40	20.97	20.20	
50	20.97	20.20	
60	20.96	20.22	
81	20.97	20.23	@1604
101	20.95	20.21	@1624
	19.94	20.26	3/19 @08:52

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: MW-14
Technician: MP
Date: 6/25/13
Field Conditions: 90 sun

Initial DTW: 22.29 Bailing Start Time: 1309
Initial DTP: 21.77 Bailing End Time: 1313
Product Thickness: 0.52 Amount Bailed (gal): 0.45

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	22.49	22.52	1314
1.25			
1.5			
1.75			
2	22.26	22.33	1315
2.25			
2.5			
2.75			
3	22.20	22.24	1316
3.25			
3.5			
3.75			
4	22.12	22.16	1317
4.25			
4.5			
4.75			
5	22.06	22.10	1318
6	22.03	22.06	1319
7	22.00	22.03	1320
8	19.98	22.01	1321
9	19.95	19.98	1322
10	19.93	19.96	1323
12	19.92	19.95	1325
14	19.90	19.96	1327
16	19.89	19.96	1329
18	19.86	19.96	1331
20	19.85	19.97	1333
22	19.84	19.97	1335
24	19.85	19.98	1337

Time (min)	DTP	DTW	Comments
26	19.84	19.98	1339
28	19.84	19.99	1341
30	19.84	19.99	1343
35	19.84	19.99	1348
40	19.83	22.00	1353
45	19.83	22.00	1358
55	19.82	22.02	1408
65	19.82	22.02	1418
75	19.82	22.02	1428

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: RW-6
Technician: MP
Date: 6/27/13
Field Conditions: 90 sun

Initial DTW: 20.45 Bailing Start Time: 0942
Initial DTP: 19.78 Bailing End Time: 0945
Product Thickness: 0.67' Amount Bailed (gal): 1.0 gal

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	19.96	20.00	@ 0946
1.25			
1.5			
1.75			
2	19.89	19.97	
2.25			
2.5			
2.75			
3	19.87	19.97	
3.25			
3.5			
3.75			
4	19.86	19.97	
4.25			
4.5			
4.75			
5	19.86	19.98	
6	19.86	19.99	
7	19.85	19.99	
8	19.85	20.00	
9	19.85	20.00	
10	19.85	20.01	
12	19.85	20.02	
14	19.84	20.02	
16	19.84	20.02	
18	19.84	20.03	
20	19.83	20.02	
25	19.83	20.04	
30	19.83	20.06	

Time (min)	DTP	DTW	Comments
35	19.83	20.08	
40	19.83	20.10	
50	19.82	20.12	
60	19.82	20.14	@1045
90	19.81	20.20	
120	19.81	20.22	
180	19.80	20.24	@1245

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: RW-6
Technician: MA
Date: 6/23/13
Field Conditions: 100 sun

Initial DTW: 21.41 Bailing Start Time: 0926
Initial DTP: 20.02 Bailing End Time: 0931
Product Thickness: 1.39 Amount Bailed (gal): 1.4

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	20.40	20.41	@ 0932
1.25			
1.5			
1.75			
2	20.30	20.33	
2.25			
2.5			
2.75			
3	20.26	20.29	
3.25			
3.5			
3.75			
4	20.22	20.29	
4.25			
4.5			
4.75			
5	20.21	20.30	0936
6	20.20	20.30	
7	20.19	20.31	
8	20.19	20.32	
9	20.19	20.33	
10	20.19	20.33	0941
12	20.18	20.35	
14	20.18	20.35	
16	20.18	20.35	
18	20.18	20.36	
20	20.18	20.36	
25	20.18	20.36	
30	20.18	20.38	

Time (min)	DTP	DTW	Comments
35	20.18	20.39	
40	20.18	20.39	
50	20.17	20.39	
60	20.17	20.40	1032
90	20.16	20.42	1102
130	20.16	20.48	1142
170	20.15	20.47	1222
210	20.14	20.46	1302
300	20.13	20.51	1432
320	20.13	20.56	1452

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: MW-14
Technician: MT
Date: 5/23/13
Field Conditions: 70 Sun

Initial DTW: 22.81 Bailing Start Time: 1313
Initial DTP: 22.04 Bailing End Time: 1317
Product Thickness: 0.77 Amount Bailed (gal): 0.8

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	24.46	24.49	@1318
1.25			
1.5			
1.75			
2	24.01	24.13	
2.25			
2.5			
2.75			
3	23.76	23.92	
3.25			
3.5			
3.75			
4	23.64	23.78	
4.25			
4.5			
4.75			
5	23.56	23.69	
6	23.51	23.62	
7	23.48	23.58	
8	23.44	23.53	
9	23.41	23.49	
10	23.40	23.46	
11	23.36	23.44	
12	23.35	23.41	
13	23.35	23.42	
14	23.33	23.41	
15	23.32	23.40	
17	23.30	23.40	
20	23.29	23.39	1337

Time (min)	DTP	DTW	Comments
25	23.24	23.39	
30	23.26	23.40	
35	23.25	23.40	
40	23.25	23.41	
50	23.24	23.41	
60	23.24	23.42	
70	23.24	23.43	1427
130	23.24	23.45	1527
150	23.24	23.45	1547

* initial DTW/DTP referenced to PVC
recovery DTW/DTP referenced to steel casing

EA Engineering, Science, and Technology, Inc.

LNAPL BAIL DOWN TEST FORM

Location ID: RW-7
Technician: MP
Date: 9/26/13
Field Conditions: 65 sun

Initial DTW: 21.14 Bailing Start Time: 1035
Initial DTP: 19.70 Bailing End Time: 1039
Product Thickness: 1.44 Amount Bailed (gal): 1.5

Time (min)	DTP	DTW	Comments
0.25			
0.50			
0.75			
1	19.87	19.96	@ 1040
1.25			
1.5			
1.75			
2	19.66	20.00	
2.25			
2.5			
2.75			
3	19.65	20.02	
3.25			
3.5			
3.75			
4	19.65	20.05	
4.25			
4.5			
4.75			
5	19.65	20.06	
6	19.65	20.06	
7	19.64	20.07	
8	19.64	20.09	
9	19.64	20.10	
10	19.64	20.12	
12	19.63	20.12	
14	19.63	20.12	
16	19.63	20.13	
18	19.63	20.15	
20	19.62	20.15	
25	19.62	20.20	
30	19.62	20.21	

Time (min)	DTP	DTW	Comments
35	19.61	20.22	
40	19.61	20.22	
45	19.61	20.24	
50	19.61	20.24	
60	19.61	20.24	@ 1140
100	19.80	20.34	1220
150	19.78	20.38	1310
230	19.76	20.46	1430
250	19.76	20.58	1450

Attachment F

Manual Skimming Test Field Forms

Well RW-6

Site Ferryman

Manual Skimming Test Field Form

Project #:	14360915	Site Name:	Ferryman
Well:	RW-6	Samplers:	MP/CN
Evacuation Method:	bailer	Weather:	45 cloudy

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:	4"	Fluid Type:	#2 fuel oil
Total Depth :	30'	Volume Removed:	
Depth to Top of Screen:	10'	Evacuation Method:	
Screen Length:	20'	LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
Static	3/19/13	9	15	–			20.09	21.66	
Pump On		9	20	–			–	–	Test Start
Pump Off		9	22	0	3780	320	–	–	
		9	27	5		~~320~~	20.28	20.59	
start bailing		9	32	10			20.24	20.64	
stop bailing		9	34	12	590	240	–	–	
		9	39	17			20.27	20.46	
		9	44	22			20.24	20.57	
start bailing		9	48	26			–	–	
stop bailing		9	49	27	320	180	–	–	
		9	54	32	20.28	20.42			
		9	59	37	20.25	20.49			

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Well RW-6 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
	3/19/13	10	04	42			20.24	20.55	
		10	09	47			20.24	20.59	
start bailing		10	14	52			20.24	20.61	
		10	16	54	465	235	–	–	14.60 mL/min
		10	23	61			20.26	20.45	
		10	26	64			20.24	20.49	
		10	31	69			20.24	20.56	
		10	36	74			20.24	20.60	
start bailing		10	41	79			20.23	20.61	
stop bailing		10	44	82	480	175	–	–	17.14 mL/min
		10	49	87			20.27	20.45	
		10	54	92			20.25	20.50	
		10	59	97			20.24	20.54	
		11	04	102			20.24	20.60	
		11	09	107			20.24	20.61	
start bailing		11	11	109			–	–	
stop bailing		11	13	111	540	560	–	–	14.60 mL/min
		11	18	116			20.27	20.39	

Well RW-6 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
	3/19/13	11	23	121			20.26	20.48	
		~~11~~	~~28~~	~~126~~					end test; LPH recharge stable @ avg 18.1 mL/min
		~~11~~	~~33~~	~~131~~					
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						

Well MW-14

Site Perryman

Manual Skimming Test Field Form

Project #:	14369115	Site Name:	Perryman
Well:	MW-14	Samplers:	MAGN
Evacuation Method:	bailer	Weather:	50 sun

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:	4"	Fluid Type:	#2 fuel oil
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
Static	3/19/13	11	40	—			23.24	24.13	0.22' = 25% static
Pump On		11	45	—					Test Start
Pump Off		11	48	0			—	—	
		11	53	5	3360 + 140	530 + 640	23.45	23.54	
		11	58	10			23.39	23.49	
		~~11~~ 12	~~05~~ 11	23			23.33	23.51	
		12	16	28			23.32	23.53	
bail start		12	18	30	140 + 750 = 890	530 + 250	—	—	
bail stop		12	20	32			—	—	
		12	25	37			23.41	23.47	
		12	30	42			23.37	23.43	
		12	40	52			23.32	23.44	

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Well MW-14 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
	3/19/13	12	45	57			23.31	23.48	
Start bailing		12	55	67			23.30	23.51	
Stop bailing		12	57	69	520	400	—	—	14.1 mL/min
		1	07	79			23.34	23.42	
		1	22	94			23.31	23.47	
		1	28	100			23.31	23.50	
Start bailing		1	40	~~110~~ 112			23.32	23.54	
Stop bailing		1	42	114	490	430	—	—	10.9 mL/min
		1	52	124			23.36	23.44	
		2	04	136			23.32	23.47	
		2	12	144			23.31	23.49	
Start bailing		2	20	152			23.30	23.52	
Stop bailing		2	22	154	450	280	—	—	
		2	32	164	~~450~~	~~280~~	23.34	23.52	9.4 mL/min
		2	47	179			23.32	23.45	
		2	57	189			23.31	21.49	
Start bailing		3	08	200			23.30	23.51	
Stop bailing		3	10	202	420	410	—	—	8.75

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Well MW-14 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
	3/19/13	3	:28	220			23.32	23.40	end test; LPH recharge stable @ 9.7 mL/min
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						

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Well MW-19

Site Perryman

Manual Skimming Test Field Form

Project #:	1436915	Site Name:	Perryman
Well:	MW-19	Samplers:	MP
Evacuation Method:	bailer	Weather:	35 cloudy

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:	2"	Fluid Type:	#2 fuel oil
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	3/20/13	10	30				24.29	24.78	0.49' (25% = 0.12')
Pump On		10	35						Test Start
Pump Off		10	39	0	130	340			
		10	44	5			24.32	24.44	0.12'
start		10	45	6					
stop		10	46	8	50	140			6.25 ml/min
		10	53	14			24.31	24.45	0.14'
start		10	55	15					
stop		10	58	18	60	330			6.0 ml/min
		11	00	21			24.32	24.36	
		11	05	26			24.31	24.40	
		11	10	31			24.30	24.43	

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Well MW-19 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	3/20/13	11	:11	32					
stop		11	:13	34	40	230			2.5 mL/min
		11	:13	39			24.31	24.35	
		11	:23	44			24.31	24.39	
		11	:26	49			24.31	24.41	
		11	:34	55			24.30	24.43	
start		11	:37	57					
stop		11	:39	59	40	330			1.6 mL/min
		11	:44	64			24.30	24.36	
		11	:54	74			24.31	24.42	
start		11	:57	77					
stop		12	:00	80	50	440	~~24.31~~	~~24.32~~	2.4 mL/min
		12	:05	85			24.31	24.32	
		12	:09	90			24.31	24.32	
		12	:20	100			24.30	24.34	
		12	:30	110			24.30	24.36	
		12	:40	120			24.29	24.39	
start		12	:41	121					

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Well MW-19 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
stop	3/20/13	12	45	125	40	370			0.89 mL/min
		13	52				24.26	24.36	
start		13	54						
stop		13	58	198	30	370			0.41 mL/min
		14	04				24.26	24.28	(sheen)
		15	47				24.26	24.37	
start		15	50						
stop		15	54	314	25	270			0.22 mL/min
	3/21/13	9	07				24.23	24.45	
start		9	10						
stop		9	14	1038	45	250	~~24.42~~	~~24.32~~	0.06 mL/min
		9	30				24.30	24.32	
		11	05				24.29	24.41	
start		11	07						
stop		11	10	1154	30	210			0.26 mL/min
		11	30				24.29	24.31	
		12	50				24.27	24.38	
start		12	52						

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Well MW-19 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
stop	3/21/13	12	: 54	1262	30	250			0.23 mL/min
		13	: 20				24.28	24.29	
		14	: 40				24.25	24.35	
start		14	: 41		~~30~~				
stop		14	: 44	1368	30	190			0.26 mL/min
			:						and test; LPH, recharge stable @ 0.27 mL/min
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						

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Well RW-7

Site Perryman

Manual Skimming Test Field Form

Project #:	14360915	Site Name:	Perryman
Well:	RW-7	Samplers:	MA
Evacuation Method:	bailer	Weather:	40 cloudy

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:	4"	Fluid Type:	≈ 2 fuel oil
Total Depth :	30'	Volume Removed:	
Depth to Top of Screen:	10'	Evacuation Method:	bailer
Screen Length:	20'	LNAPL Well Volume:	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	3/20/13	13	04				19.44	20.62	.74(.25) = 0.19'
Pump On		13	06						Test Start
Pump Off		13	09	0	790	650			
		13	14	5			19.95	19.99	
		13	19	10			19.94	20.00	
		13	29	20			19.94	20.00	
		13	39	30			19.94	20.01	
		14	17	67			19.91	20.02	
		14	39	90			19.91	20.03	
		15	09	120			19.91	20.03	
		15	39	150			19.90	20.03	
		16	12	182			19.90	20.03	

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Well RW-7 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	3/20/13	16	:15						
stop		16	:18	188	200	220			1.1 mL/min
	3/21/13	9	:42				19.91	19.98	
start		9	:44						
stop		9	:47	1049	115	485			0.13 mL/min
		10	:00				19.94	19.94	(sheen)
		10	:30				19.93	19.95	
		11	:40				19.92	19.95	
		13	:25				19.91	19.94	
		14	:00				19.91	19.95	
		15	:05				19.91	19.95	
		16	:00				19.91	19.96	
start		16	:02						
stop		16	:05	1427	45	435			0.12 mL/min
		16	:10				19.94	19.94	(sheen)
	3/22/13	08	:35				19.93	20.00	
start		08	:40						
stop		08	:44	2426	130	520			0.13 mL/min

stop test; LNAPL recharge rate stable @ 0.13 mL/min avg.

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Well RW-7

Site

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:	RW-7	Samplers:	
Evacuation Method:	bailer	Weather:	Sunny, 85-90°

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
Static	6/24/13		:				19.51	19.84	.33'(.25) = .08'
Pump On		8	:42	0			–	–	Test Start
Pump Off		8	:43	1	475+165 =640	535+740	–	–	
		8	:54	12			19.55	19.59	
		9	:05	23			19.54	19.60	
		9	:15	33			19.56	19.60	
		9	:25	43			19.54	19.62	
		9	:26	44	120+80 =200	910+500	–	–	200 ml/43 min = 4.65 ml/min
		9	:38	56			19.55	19.56	
		9	:48	66			19.55	19.57	
		9	:58	76			19.55	19.58	
		10	:25	103			19.54	19.59	

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Well RW-7 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
	6/24/13	10	:55	133			19.54	19.59	
		11	:25	163			19.55	19.63	
		11	:38	176	180	420	—	—	180 mL / 82 min = 2.2 mL/min
		12	:08	196			19.54	19.59	
		12	:58	226			19.55	19.62	
		13	:08	256			19.54	19.58	
		13	:38	286			19.54	19.59	
		14	:08	296			19.53	19.60	
		14	:12	300	150	200	—	—	150/124 = 1.2 mL/min
		14	:42	330			19.54	19.58	
		15	:12	400			19.52	19.59	
		15	:42	430			19.53	19.57	
		15	:48	436	95	240	—	—	95 mL / 136 min = 0.70
	6/25/13	08	:10	1407			19.50	19.76	
start		08	:30	1427			—	—	
stop		08	:32	1429	415	540	—	—	415/993 = 0.42 mL/min
		09	:02	1459			19.53	19.56	
		09	:32	1489			19.53	19.61	

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Well RW-7

Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	6/25/13	09	33	1490			–	–	
stop		09	35	1492	100	510	–	–	100/63 = 1.59 mL/min
		10	40	1557			19.53	19.59	
		11	10	1587			19.52	19.60	
start		11	11	1588			–	–	
stop		11	13	1590	110	340	–	–	110/98 = 1.12 mL/min
		12	23	1660			19.52	19.57	
		12	53	1690			19.52	19.59	
start		12	55	1692			–	–	
stop		12	57	1694	90	390	–	–	90/104 = 0.87 mL/min
		13	47	1744			19.53	19.56	
		14	37	1794			19.52	19.56	
		15	07	1824			19.52	19.59	
start		15	09	1826			–	–	
stop		15	12	1829	110	540	–	–	110/135 = 0.81 mL/min
	10/26/13	08	30	2467			19.51	19.79	
start		08	32	2469			–	–	
stop		08	35	2472	590	330	–	–	590/1043 = 0.57 mL/min

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Well RW-7 Site Parrymore

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
	6/26/13	10	:00	2957			19.52	19.60	
start		10	:02	2959			–	–	
stop		10	:05	2962	150	620	–	–	150/90 = 1.67 mL/min
		10	:40	2997			19.53	19.56	
		11	:15	3032			19.52	19.58	
		11	:55	3072			19.55	19.62	
start		11	:57	3074			–	–	
stop		12	:00	3077	130	560	–	–	130/115 = 1.13 mL/min
		12	:40	3117			19.55	19.57	
		13	:35	3172			19.54	19.59	
		14	:20	3217			19.55	19.62	
start		14	:24	3221			–	–	
stop		14	:27	3224	135	480	–	–	135/147 = 0.91 mL/min
		15	:15	3262			19.54	19.59	
		15	:55	3302			19.54	19.60	
		16	:20	3327			19.54	19.61	
start		16	:22	3329			–	–	
stop		16	:25	3332	110	520	–	–	110/108 = 1.02 mL/min

stable @ 1.02 mL/min avg / 3 readings

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Well RW-6

Site

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:	RW-6	Samplers:	
Evacuation Method:		Weather:	Sunny, 85°-90°

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
Static	6/24/13	10	10				19.78	20.44	$0.66^2 \times 0.25 = 0.165'$
Pump On		10	13	0					Test Start
Pump Off		10	16	3	1000+890 +410+200	75+560 +820+910			
		10	19	6	+80+15 =2595	1010	19.94	19.99	
		10	29	16			19.87	19.95	
		10	39	26			19.85	19.98	
		10	49	36			19.85	19.20	
		10	52	39	450+190 +90=730	570+900 +570	—	—	730 mL ÷ 36 min = 20.3 mL/min
		11	07	54			19.87	19.91	
		11	17	64			19.85	19.91	
		11	33	80			19.85	19.95	
		11	53	100			19.84	20.03	

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Well RW-6 Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
	6/24/12	11	:58	105	510	460	–	–	510 ml / 66 min = 7.7 ml/min
		12	:19	126			19.85	19.93	
		12	:29	136			19.85	19.98	
		12	:39	146			19.84	19.21	
		12	:43	150	405	465	–		405 ml / 45 min = 9 ml/min
		12	:53	160			19.85	19.92	
		13	:03	170			19.85	19.91	
		13	:13	180			19.85	19.96	
		13	:23	190			19.84	19.95	
		13	:33	200			19.84	19.98	
		13	:43	210			19.84	19.97	
		13	:53	220			19.83	20.02	
		13	:55	222	500	450	–	–	500 ml / 72 min = 6.94 ml/min
		14	:05	232			19.85	19.89	
		15	05	242			19.84	1989	
		14	:25	252			19.83	19.93	
		14	:35	262			19.83	19.95	
		14	:45	272			19.83	19.99	

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Well RW-6

Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
		14	50	277	~~340~~	300	—	—	340/55 min = 6.18 mL/min
		15	00	287			19.83	19.94	
		15	10	297			19.83	19.97	
		15	20	307			19.83	19.97	
		15	30	317			19.83	19.98	
		15	40	327			19.83	19.99	
		15	45	332	350	310	—	—	350 mL / 55 min = 6.36
			:						recovery rate stable @
			:						6.49 mL/min avg
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						
			:						

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Well MW-19

Site Ferryman

Manual Skimming Test Field Form

Project #:		Site Name:	
Well:		Samplers:	
Evacuation Method:		Weather:	

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	6/25/13	09	45				23.15	23.25	0.10(.25) = ~0.03
Pump On		09	49	0			–	–	Test Start
Pump Off		09	52	3	20	310	–	–	
		10	02	13			23.18	23.18	(sheen)
		10	12	23			23.16	23.16	(sheen)
		10	19	30			23.16	23.16	"
		10	29	40			23.16	23.16	"
		11	29	100			23.16	23.16	"
		12	29	160			23.15	23.15	"
		13	30	221			23.15	23.15	"
		14	55	306			23.15	23.15	"
	6/26/13	09	05	1436			23.15	23.22	

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Well MW-19

Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	6/26/13	09	12	1443			–	–	
stop		09	15	1446	15	700	–	–	15/1443 = 0.01 mL/min
		09	45	1476			23.15	23.15	sheen
		11	35	1586			23.15	23.15	"
		13	45	1916			23.18	23.18	"
	6/27/13	08	45	~~3376~~ 2356		~~540~~	23.17	23.17	sheen
		08	50	~~3344~~ 2361			–	–	
		08	53	~~3344~~ 2364	<1	540	–	–	1/1418 = 0.0007 mL/min
		14	15				23.17	23.17	sheen
	6/28	09	25				23.15	23.15	sheen
		09	30				–	–	
		09	32	4343	<1	400	–	–	1/1479 = 0.0007 mL/min
		:							
		:							
		:							
		:							
		:							
		:							

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Well MW-14

Site Perryman

Manual Skimming Test Field Form

Project #:	MW-14	Site Name:	Perryman
Well:		Samplers:	
Evacuation Method:		Weather:	

Borehole Diameter (INCHES):

Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	6/26/13	10	00				21.76	22.28	0.50(.25) ≈ 0.13
Pump On		10	12	0			—	—	Test Start
Pump Off		10	15	3	1340	6600	—	—	
		10	25	13			21.91	21.95	
		10	35	23			21.84	21.92	
		10	45	33			21.83	21.95	
start		10	47	35			—	—	
stop		10	50	38	210	360	—	—	210/35 = 6.0 mL/min
		11	00	48			21.84	21.86	
		11	10	58			21.83	21.89	
		11	25	73			21.85	21.94	
		11	40	88			21.86	21.99	

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Well MW-14 Site

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	6/26/13	11	42	90			-	-	
stop		11	45	93	210	450	-	-	240/55 = 4.36 ml/min
		12	15	123			21.86	21.90	
		12	45	153			21.86	21.97	
		13	15	183			21.85	21.98	
start		13	16	184			—	—	
stop		13	20	188	265	430	—	—	265/95 = 2.79 ml/min
		14	15	223			21.86	21.96	
		14	50	268			21.85	21.97	
start		14	53	271			—	—	
stop		14	57	275	245	450	-	-	245/87 = 2.82 ml/min
		15	35	313			21.86	21.95	
		16	05	333			21.85	21.97	
start		16	06	334			—	-	
stop		16	09	337	160	480	-	-	160/62 = 2.58 ml/min
									stable @ 2.73 ml/min avg
		:							
		:							
		:							

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Well RW-7

Site Perryman

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:		Samplers:	Phillips/Newcombe
Evacuation Method:		Weather:	Sunny 70°

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Depth to LNAPL	Depth to Water	Comments
Static	9/24/13		:				19.73	21.00	25% = 0.32 ft
Pump On		8	: 40				–	–	Test Start
Pump Off		8	: 43	0	960 + 950 + 630 + 300 + 90 = 2930	300 + 700 + 290	~~19.90~~	~~20.01~~	
		8	: 44	1			19.90	20.01	
		8	: 48	5			19.88	20.10	
		8	: 53	10			19.86	20.14	
		~~8~~	~~: 55~~	~~12~~			–	–	
start bail		8	: 55	12	520	360	–	–	520 mL / 12 min = 43.3 mL/min
stop bail		8	: 56	13			–	–	
		9	: 01	18			19.89	20.03	
		9	: 13	~~33~~ 30			19.88	20.09	
		9	: 27	~~47~~ 44			19.86	20.13	

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Well RW-7 Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start bail	9/24/13	9	29	~~49~~ 46	440	320	–	–	440/~~33~~ = ~~13.2~~ 13.3 mL/min
stop bail		9	31	~~51~~ 48			–	–	
		9	57	~~77~~ 74			19.87	20.04	
		10	10	~~90~~ 87			19.85	20.08	
		10	34	~~114~~ 111			19.85	20.12	
start bail		10	35	~~115~~ 112	370	310	–	–	370/64 = 5.78 mL/min
stop bail		10	37	~~117~~ 114			–	–	
		11	18	155			19.84	20.05	
start bail		11	39	176			–	–	
stop bail		11	40	177	330	350	–	–	330/62 = 5.32 mL/min
		12	41	238			19.85	20.06	
start bail		12	45	242	325	380	–	–	325/65 = 5.0 mL/min
stop bail		12	47	244			–	–	
		13	43	300			19.84	20.02	
start bail		13	57	314	330	370	–	–	330/72 = 4.58 mL/min
stop bail		13	59	316			–	–	
		14	48	365			19.83	19.99	
start bail		15	06	383	280	320	–	–	280/67 = 4.17 mL/min
stop bail		15	08	385			–	–	avg 4.58 mL/min

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Well RW-6

Site Perryman

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:		Samplers:	Phillips / Newcombe
Evacuation Method:		Weather:	Sunny 70°

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)	
	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	9/24/13	10	49				20.08	20.92	25% = 0.21 ft
Pump On		10	51				–	–	Test Start
Pump Off		10	53	0	960+860 +230 = 2,050	130+200	–	–	
		11	00	7			20.19	20.24	
		11	17	24			20.16	20.34	
start bail		11	20	27			–	–	
stop bail		11	21	28	290	250	–	–	290/28 = 10.36 mL/min
		11	51	58			20.15	20.25	
		12	39	106			21.16	21.34	
start bail		12	42	109	240	320	–	–	240/81 = 2.96 mL/min
stop bail		12	43	110			–	–	
		13	44	171			20.15	20.29	

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Well RW-6 Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start bail		14	01	188	200 ~~230~~	370	—	—	~~200~~ 200/78 = ~~4.25~~ 2.56 mL/min
stop bail		14	03	190			—	—	
		14	46	233			20.14	20.24	
start bail		15	03	250			—	—	
stop bail		15	05	252	190	340	—	—	190/60 = 3.16
		:							
		:							avg 2.89 mL/min
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							

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Well MW-19

Site Perryman

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:	MW-19	Samplers:	MS
Evacuation Method:	bailer	Weather:	65 sun

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	9/25/13	8	28	–	–	–	23.43	23.56	25% = 0.03 ft
Pump On		8	34	–	–	–	–	–	Test Start
Pump Off		8	38	0	15	330	–	–	
		8	51	13	–	–	23.46	23.46	sheen
		9	08	30	–	–	23.46	23.47	
		9	37	59	–	–	23.46	23.49	
start bail		9	38	60	–	–	–	–	
stop bail		9	42	64	8	390	–	–	8 mL/64 min = 0.125 mL/min
		9	53	75	–	–	–	23.47	
		12	37	239	–	–	23.42	23.45	
start		12	39	241	–	–	–	–	
stop		12	41	243	30	240	–	–	30 mL/179 min = 0.168 mL/min

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Well MW-19 Site Ferguson

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
	9/25/13	14	23	345	–	–	23.40	23.43	
start		14	25	347	–	–	–	–	
stop		14	27	349	20	350	–	–	20 ml/106 min = 0.189 ml/min
		15	52	434	–	–	23.42	23.44	
start		15	55	437	–	–	–	–	
stop		15	57	439	15	190	–	–	15 ml/90 min = 0.167 ml/min
		:							
		:							~~avg 174.67 ml~~
		:							avg 0.175 ml/min
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							
		:							

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Well MW-14

Site Perryman

Manual Skimming Test Field Form

Project #:		Site Name:	Perryman
Well:	MW-14	Samplers:	MD
Evacuation Method:	bailer	Weather:	65 sun

Borehole Diameter (INCHES):
Filter Pack Specific Yield (LNAPL)
0.175

Well Information		LNAPL Information	
Casing Diameter:		Fluid Type:	
Total Depth :		Volume Removed:	
Depth to Top of Screen:		Evacuation Method:	
Screen Length:		LNAPL Well Volume:	

Length and volumetric units need to be specified

Length Units: **Volume Units:**

Effective Well Radius (FT)

	LNAPL Well Volume
ft^3	
gal	
ml	

* initial gauging referenced to PVC, recovery gauging referenced to steel protective casing

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
Static	9/25/13	10	05	–	–	–	22.11	22.55	25% = 0.11 ft
Pump On		10	07	–	–	–	–	–	Test Start
Pump Off		10	11	0	1100	700	–	–	
		10	18	7	–	–	23.34	23.39	
		10	26	17	–	–	23.28	23.35	
		10	37	26	–	–	23.26	23.36	
start bail		10	38	27	–	–	–	–	
stop bail		10	40	29	160	400	–	–	160 ml/29 min = 5.52 ml/min
		10	59	48	–	–	23.26	23.30	
		11	15	64	–	–	23.26	23.33	
		11	24	73	–	–	23.26	23.34	
		11	40	89	–	–	23.26	23.35	

w
140/400
560/300

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Well MW-14 Site Perryman

Pump	Date	Time Hour	Time Minute	Elapsed Time (min)	LNAPL Volume Removed	Water Volume Removed	Depth to LNAPL	Depth to Water	Comments
start	9/25/13	11	48	97	–	–	–	–	
stop		11	51	100	150	480	–	–	150mL/71min = 2.11 mL/min
		12	17	126	–	–	23.26	23.30	
		13	48	~~94~~ 217	–	–	23.26	23.35	
start		13	50	~~93~~ 219	–	–	–	–	
stop		13	52	~~95~~ 221	110	450	–	–	110mL/95min = 1.16 mL/min
		15	01	290	–	–	23.26	23.31	
		15	32	321	–	–	23.25	23.33	
start		15	34	~~93~~ 323	–	–	–	–	
stop		15	36	325	110	330	–	–	110mL/104min = 1.06 mL/min
		16	26	~~399~~ 377	–	–	23.25	23.31	
		16	45	~~410~~ 394	–	–	23.25	23.33	
		16	47	~~413~~ 396	–	–	–	–	
		16	49	~~415~~ 398	100	310	–	–	100mL/90min = 1.11 mL/min
		:							
		:							avg 1.11 mL/min
		:							
		:							

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Attachment G

LPH Transmissivity and Recoverability Calculations

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
3/19/2013	11:40	0	23.24	24.13			static	--		0.00	23.37		
3/19/2013	11:45	--	--	--	3500	1170	start bailing	1	--		--		
3/19/2013	11:48	0	--	--			stop bailing	1	0	--	--		
3/19/2013	11:53	5	23.45	23.54				1	5	0.21	23.46		
3/19/2013	11:58	10	23.39	23.49				1	10	0.15	23.41		
3/19/2013	12:11	23	23.33	23.51				1	23	0.09	23.36		
3/19/2013	12:16	28	23.32	23.53				1	28	0.08	23.35		
3/19/2013	12:18	30	--	--	940	800	start bailing	1	30	--	--	31.33	no
3/19/2013	12:20	32	--	--			stop bailing	2	0	--	--		
3/19/2013	12:25	37	23.41	23.47				2	5	0.17	23.42		
3/19/2013	12:30	42	23.37	23.43				2	10	0.13	23.38		
3/19/2013	12:40	52	23.32	23.44				2	20	0.08	23.34		
3/19/2013	12:45	57	23.31	23.48				2	25	0.07	23.34		
3/19/2013	12:55	67	23.30	23.51	520	400	start bailing	2	35	0.06	23.33	14.86	no
3/19/2013	12:57	69	--	--			stop bailing	2	37	--	--		
3/19/2013	13:07	79	23.34	23.42				3	10	0.10	23.35		
3/19/2013	13:22	94	23.31	23.47				3	25	0.07	23.33		
3/19/2013	13:28	100	23.31	23.50				3	31	0.07	23.34		
3/19/2013	13:40	112	23.32	23.54	490	430	start bailing	3	43	0.08	23.35	11.40	yes
3/19/2013	13:42	114	--	--			stop bailing	4	0	--	--		
3/19/2013	13:52	124	23.36	23.44				4	10	0.12	23.37		
3/19/2013	14:04	136	23.32	23.47				4	22	0.08	23.34		
3/19/2013	14:12	144	23.31	23.49				4	30	0.07	23.34		
3/19/2013	14:20	152	23.30	23.52	450	280		4	38	0.06	23.33	11.84	yes
3/19/2013	14:22	154	--	--				5	0	--	--		
3/19/2013	14:32	164	23.34	23.37				5	10	0.10	23.34		
3/19/2013	14:37	179	23.32	23.45				5	25	0.08	23.34		
3/19/2013	14:57	189	23.31	23.49				5	35	0.07	23.34		
3/19/2013	15:08	200	23.30	23.51	420	410	start bailing	5	46	0.06	23.33	9.13	yes
3/19/2013	15:10	202	--	--			stop bailing	5	0	--	--		
3/19/2013	15:28	220	23.32	23.40				6	18	0.08	23.33		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 3 through 5: Q_n = 10.79 mL/min
Convert to cubic feet per day: Q_n = 0.55 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.08 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 4.80 ft^2/day

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
3/20/2013	10:30	0	24.29	24.78			static	--		0.04	24.36		
3/20/2013	10:35	--	--	--	130	380	start bailing	1	--	--	--		
3/20/2013	10:39	0	--	--			stop bailing	1	0	--	--		
3/20/2013	10:44	5	24.32	24.44				1	5	0.07	24.34		
3/20/2013	10:45	6	--	--	50	180	start bailing	1	6	--	--	8.33	no
3/20/2013	10:48	9	--	--			stop bailing	2	0	--	--		
3/20/2013	10:53	14	24.31	24.45				2	5	0.06	24.33		
3/20/2013	10:55	16	--	--	60	330	start bailing	2	7	--	--	8.57	no
3/20/2013	10:58	19	--	--			stop bailing	3	0	--	--		
3/20/2013	11:00	21	24.32	24.36				3	2	0.07	24.33		
3/20/2013	11:05	26	24.31	24.40				3	7	0.06	24.32		
3/20/2013	11:10	31	24.30	24.43				3	12	0.05	24.32		
3/20/2013	11:11	32	--	--	40	280	start bailing	3	13	--	--	3.08	no
3/20/2013	11:13	34	--	--			stop bailing	4	0	--	--		
3/20/2013	11:18	39	24.31	24.35				4	5	0.06	24.32		
3/20/2013	11:23	44	24.31	24.39				4	10	0.06	24.32		
3/20/2013	11:28	49	24.31	24.41				4	15	0.06	24.33		
3/20/2013	11:34	55	24.30	24.43				4	21	0.05	24.32		
3/20/2013	11:37	58	--	--	40	330	start bailing	4	24	--	--	1.67	no
3/20/2013	11:39	60	--	--			stop bailing	5	0	--	--		
3/20/2013	11:44	65	24.30	24.36				5	5	0.05	24.31		
3/20/2013	11:54	75	24.31	24.42				5	15	0.06	24.33		
3/20/2013	11:57	78	--	--	50	440	start bailing	5	18	--	--	2.78	no
3/20/2013	12:00	81	--	--			stop bailing	6	0	--	--		
3/20/2013	12:05	86	24.31	24.32				6	5	0.06	24.31		
3/20/2013	12:09	90	24.31	24.32				6	9	0.06	24.31		
3/20/2013	12:20	101	24.30	24.34				6	20	0.05	24.31		
3/20/2013	12:30	111	24.30	24.36				6	30	0.05	24.31		
3/20/2013	12:40	121	24.29	24.39				6	40	0.04	24.31		
3/20/2013	12:41	122	--	--	40	370	start bailing	6	41	--	--	0.98	no
3/20/2013	12:45	126	--	--			stop bailing	7	0	--	--		
3/20/2013	13:52	193	24.26	24.36				7	67	0.01	24.28		
3/20/2013	13:54	195	--	--	30	370	start bailing	7	69	--	--	0.43	no
3/20/2013	13:58	199	--	--			stop bailing	8	0	--	--		
3/20/2013	14:04	205	24.28	24.28				8	6	0.03	24.28		
3/20/2013	15:47	308	24.26	24.37				8	109	0.01	24.28		
3/20/2013	15:50	311	--	--	25	270	start bailing	8	112	--	--	0.22	no
3/20/2013	15:54	315	--	--			stop bailing	9	0	--	--		
3/21/2013	9:07	1348	24.28	24.45				9	1033	0.03	24.31		
3/21/2013	9:10	1351	--	--	45	250	start bailing	9	1036	--	--	0.04	no
3/21/2013	9:14	1355	--	--			stop bailing	10	0	--	--		
3/21/2013	9:30	1371	24.30	24.32				10	16	0.05	24.30		
3/21/2013	11:05	1466	24.29	24.41				10	111	0.04	24.31		
3/21/2013	11:07	1468	--	--	30	210	start bailing	10	113	--	--	0.27	yes
3/21/2013	11:10	1471	--	--			stop bailing	11	0	--	--		
3/21/2013	11:30	1491	24.29	24.31				11	20	0.04	24.29		
3/21/2013	12:50	1571	24.27	24.38				11	100	0.02	24.29		
3/21/2013	12:54	1575	--	--	30	250	start bailing	11	104	--	--	0.29	yes
3/21/2013	12:58	1579	--	--			stop bailing	12	0	--	--		
3/21/2013	13:20	1601	24.28	24.29				12	22	0.03	24.28		
3/21/2013	14:40	1681	24.25	24.35				12	102	0.00	24.27		
3/21/2013	14:41	1682	--	--	30	190	start bailing	12	103	--	--	0.29	yes
3/21/2013	14:44	1685	--	--			stop bailing	12	--	--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 10 through 12: Q_n = 0.28 mL/min
Convert to cubic feet per day: Q_n = 0.01 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.03 ft

Transmissivity Calculation:

$$T_n = \frac{0.01 \times 4.6}{2\pi \times 0.03}$$

T_n = 0.31 ft^2/day

			Field Data						Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
3/19/2013	9:15	0	20.09	21.66			static	--	--	0.00	20.33		
3/19/2013	9:20	--	--	--	3780	320	start bailing	1	--	--	--		
3/19/2013	9:22	0	--	--			stop bailing	1	0	--	--		
3/19/2013	9:27	5	20.28	20.59				1	5	0.19	20.33		
3/19/2013	9:32	10	20.24	20.64	590	240	start bailing	1	10	0.15	20.30	59.00	
3/19/2013	9:34	12	--	--			stop bailing	2	0	--	--		
3/19/2013	9:39	17	20.27	20.46				2	5	0.18	20.30		
3/19/2013	9:44	22	20.24	20.57				2	10	0.15	20.29		
3/19/2013	9:48	26	--	--	320	180	start bailing	2	14	--	--	22.86	yes
3/19/2013	9:49	27	--	--			stop bailing	3	0	--	--		
3/19/2013	9:54	32	20.28	20.42				3	5	0.19	20.30		
3/19/2013	9:59	37	20.25	20.49				3	10	0.16	20.29		
3/19/2013	10:04	42	20.24	20.55				3	15	0.15	20.29		
3/19/2013	10:09	47	20.24	20.59				3	20	0.15	20.29		
3/19/2013	10:14	52	20.24	20.61	465	235	start bailing	3	25	0.15	20.30	18.60	yes
3/19/2013	10:16	54	--	--			stop bailing	4	0	--	--		
3/19/2013	10:23	61	20.26	20.45				4	7	0.17	20.29		
3/19/2013	10:26	64	20.24	20.49				4	10	0.15	20.28		
3/19/2013	10:31	69	20.24	20.56				4	15	0.15	20.29		
3/19/2013	10:36	74	20.24	20.60				4	20	0.15	20.29		
3/19/2013	10:41	79	20.23	20.61	480	175	start bailing	4	25	0.14	20.29	19.20	yes
3/19/2013	10:44	82	--	--			stop bailing	5	0	--	--		
3/19/2013	10:49	87	20.27	20.45				5	5	0.18	20.30		
3/19/2013	10:54	92	20.25	20.50				5	10	0.16	20.29		
3/19/2013	10:59	97	20.24	20.54				5	15	0.15	20.29		
3/19/2013	11:04	102	20.24	20.60				5	20	0.15	20.29		
3/19/2013	11:09	107	20.24	20.61				5	25	0.15	20.30		
3/19/2013	11:11	109	--	--	540	560	start bailing	5	27	--	--	20.00	yes
3/19/2013	11:13	111	--	--			stop bailing	--	0	--	--		
3/19/2013	11:18	116	20.27	20.39				--	5	0.18	20.29		
3/19/2013	11:23	121	20.26	20.48				--	10	0.17	20.29		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 2 through 5: Q_n = 20.16 mL/min
Convert to cubic feet per day: Q_n = 1.03 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.16 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 4.61 ft^2/day

			Field Data						Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
3/20/2013	13:04	0	19.88	20.62			static	--	--	0.00	19.99		
3/20/2013	13:06	--	--	--	790	650	start bailing	1	--	--	--		
3/20/2013	13:09	0	--	--			stop bailing	1	0	--	--		
3/20/2013	13:14	5	19.95	19.99				1	5	0.07	19.96		
3/20/2013	13:19	10	19.94	20.00				1	10	0.06	19.95		
3/20/2013	13:29	20	19.94	20.00				1	20	0.06	19.95		
3/20/2013	13:39	30	19.94	20.01				1	30	0.06	19.95		
3/20/2013	14:17	68	19.91	20.02				1	68	0.03	19.93		
3/20/2013	14:39	90	19.91	20.03				1	90	0.03	19.93		
3/20/2013	15:09	120	19.91	20.03				1	120	0.03	19.93		
3/20/2013	15:39	150	19.90	20.03				1	150	0.02	19.92		
3/20/2013	16:12	183	19.90	20.03				1	183	0.02	19.92		
3/20/2013	16:15	186	--	--	200	220	start bailing	1	186	--	--	1.08	
3/20/2013	16:18	189	--	--			stop bailing	2	0	--	--		
3/21/2013	9:42	1233	19.91	19.98				2	1044	0.03	19.92		
3/21/2013	9:47	1238	--	--	115	485	start bailing	2	1049	--	--	0.11	
3/21/2013	10:00	1251	--	--			stop bailing	3	0	--	--		
3/21/2013	10:30	1281	19.94	19.94				3	30	0.06	19.94		
3/21/2013	11:40	1351	19.93	19.95				3	100	0.05	19.93		
3/21/2013	13:25	1456	19.92	19.95				3	205	0.04	19.92		
3/21/2013	14:00	1491	19.91	19.95				3	240	0.03	19.92		
3/21/2013	15:05	1556	19.91	19.95				3	305	0.03	19.92		
3/21/2013	16:00	1611	19.91	19.96				3	360	0.03	19.92		
3/21/2013	16:02	1613	--	--	45	435	start bailing	3	362	--	--	0.12	
3/21/2013	16:05	1616	--	--			stop bailing	4	0	--	--		
3/21/2013	16:10	1621	19.94	19.94				4	5	0.06	19.94		
3/22/2013	8:35	2606	19.93	20.00				4	990	0.05	19.94		
3/22/2013	8:40	2611	--	--	130	520	start bailing	4	995	--	--	0.13	
3/22/2013	8:44	2615	--	--			stop bailing	--		--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 2 through 5: Q_n = 0.12 mL/min
Convert to cubic feet per day: Q_n = 0.01 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.04 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 0.10 ft^2/day

			Field Data						Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
6/26/2013	10:00	0	21.78	22.28			static	--		0.00	21.86		
6/26/2013	10:12	--	--	--			start bailing	1		--	--		
6/26/2013	10:15	0	--	--	1340	660	stop bailing	1	0	--	--		
6/26/2013	10:25	10	21.91	21.95				1	10	0.13	21.92		
6/26/2013	10:35	20	21.84	21.92				1	20	0.06	21.85		
6/26/2013	10:45	30	21.83	21.95				1	30	0.05	21.85		
6/26/2013	10:47	32	--	--	210	360	start bailing	1	32	--	--	6.56	no
6/26/2013	10:50	35	--	--			stop bailing	2	0	--	--		
6/26/2013	11:00	45	21.84	21.86				2	10	0.06	21.84		
6/26/2013	11:10	55	21.83	21.89				2	20	0.05	21.84		
6/26/2013	11:25	70	21.85	21.94				2	35	0.07	21.86		
6/26/2013	11:40	85	21.86	21.99				2	50	0.08	21.88		
6/26/2013	11:42	87	--	--	240	450	start bailing	2	52	--	--	4.62	no
6/26/2013	11:45	90	--	--			stop bailing	3	0	--	--		
6/26/2013	12:15	120	21.86	21.90				3	30	0.08	21.87		
6/26/2013	12:45	150	21.86	21.97				3	60	0.08	21.88		
6/26/2013	13:15	180	21.85	21.98				3	90	0.07	21.87		
6/26/2013	13:16	181	--	--	265	430	start bailing	3	91	--	--	2.91	yes
6/26/2013	13:20	185	--	--			stop bailing	4	0	--	--		
6/26/2013	14:15	240	21.86	21.96				4	55	0.08	21.88		
6/26/2013	14:50	275	21.85	21.97				4	90	0.07	21.87		
6/26/2013	14:53	278	--	--	245	450	start bailing	4	93	--	--	2.63	yes
6/26/2013	14:57	282	--	--			stop bailing	5	0	--	--		
6/26/2013	15:35	320	21.86	21.95				5	38	0.08	21.87		
6/26/2013	16:05	350	21.85	21.97				5	68	0.07	21.87		
6/26/2013	16:06	351	--	--	160	480	start bailing	5	69	--	--	2.32	yes
6/26/2013	16:09	354	--	--			stop bailing	--	--	--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 3 through 5: Q_n = 2.62 mL/min
Convert to cubic feet per day: Q_n = 0.13 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.07 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 1.30 ft^2/day

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
6/25/2013	6/25/2013 9:45	0	23.15	23.25			static	--		0.00	23.17		
6/25/2013	6/25/2013 9:49	--	--	--		20	310 start bailing	1	--	--	--		
6/25/2013	6/25/2013 9:52	0	--	--			stop bailing	1	0	--	--		
6/25/2013	6/25/2013 10:02	10	23.18	23.18				1	10	0.03	23.18		
6/25/2013	6/25/2013 10:12	20	23.16	23.16				1	20	0.01	23.16		
6/25/2013	6/25/2013 10:19	27	23.16	23.16				1	26.99999999	0.01	23.16		
6/25/2013	6/25/2013 10:29	37	23.16	23.16				1	36.99999999	0.01	23.16		
6/25/2013	6/25/2013 11:29	97	23.16	23.16				1	97	0.01	23.16		
6/25/2013	6/25/2013 12:29	157	23.15	23.15				1	157	0.00	23.15		
6/25/2013	6/25/2013 13:30	218	23.15	23.15				1	218	0.00	23.15		
6/25/2013	6/25/2013 14:55	303	23.15	23.15				1	303	0.00	23.15		
6/26/2013	6/26/2013 9:05	1393	23.15	23.22				1	1393	0.00	23.16		
6/26/2013	6/26/2013 9:12	1400	--	--		15	700 start bailing	1	1400	--	--	0.01	no
6/26/2013	6/26/2013 9:15	1403	--	--			stop bailing	2	2.999999999	--	--		
6/26/2013	6/26/2013 9:45	1433	23.15	23.15				2	33	0.00	23.15		
6/26/2013	6/26/2013 11:35	1543	23.15	23.15				2	143	0.00	23.15		
6/26/2013	6/26/2013 13:45	1673	23.18	23.18				2	273	0.03	23.18		
6/27/2013	6/27/2013 8:45	2813	23.17	23.17				2	1413	0.02	23.17		
6/27/2013	6/27/2013 8:50	2818	--	--	<1		540 start bailing	2	1418	--	--	0.0007	yes
6/27/2013	6/27/2013 8:53	2821	--	--			stop bailing	3	0	--	--		
6/27/2013	6/27/2013 14:15	3143	23.17	23.17				3	322	0.02	23.17		
6/28/2013	6/28/2013 9:25	4293	23.15	23.15				3	1472	0.00	23.15		
6/28/2013	6/28/2013 9:30	4298	--	--	<1		400 start bailing	3	1477	--	--	0.0007	yes
6/28/2013	6/28/2013 9:32	4300	--	--			stop bailing						

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 2 through 3: Q_n = 0.0007 mL/min
Convert to cubic feet per day: Q_n = 0.0000 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.004 ft

Transmissivity Calculation:

$$T_n = \frac{0.01 \times 4.6}{2\pi \times 0.03}$$

T_n = 0.006 ft^2/day

			Field Data						Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
6/24/2013	10:10	0	19.78	20.44			static	--	--	0.00	19.88		
6/24/2013	10:13	--	--	--			start bailing	1	--	--	--		
6/24/2013	10:16	0	--	--	2595	3375	stop bailing	1	0	--	--		
6/24/2013	10:19	3	19.94	19.99				1	3	0.16	19.95		
6/24/2013	10:29	13	19.87	19.95				1	13	0.09	19.88		
6/24/2013	10:39	23	19.85	19.98				1	23	0.07	19.87		
6/24/2013	10:49	33	19.85	19.20	730	2040	start bailing	1	33	0.07	19.75	22.12	no
6/24/2013	10:52	36	--	--			stop bailing	2	0	--	--		
6/24/2013	11:07	51	19.87	19.91				2	15	0.09	19.88		
6/24/2013	11:17	61	19.85	19.91				2	25	0.07	19.86		
6/24/2013	11:33	77	19.85	19.95				2	41	0.07	19.87		
6/24/2013	11:53	97	19.84	20.03	510	880	start bailing	2	61	0.06	19.87	8.36	no
6/24/2013	11:58	102	--	--			stop bailing	2	0	--	--		
6/24/2013	12:19	123	19.85	19.93				3	21	0.07	19.86		
6/24/2013	12:29	133	19.85	19.98				3	31	0.07	19.87		
6/24/2013	12:39	143	19.84	19.21	405	465	start bailing	3	41	0.06	19.75	9.88	no
6/24/2013	12:43	147	--	--			stop bailing	4	0	--	--		
6/24/2013	12:53	157	19.85	19.92				4	10	0.07	19.86		
6/24/2013	13:03	167	19.85	19.91				4	20	0.07	19.86		
6/24/2013	13:13	177	19.85	19.96				4	30	0.07	19.87		
6/24/2013	13:23	187	19.84	19.95				4	40	0.06	19.86		
6/24/2013	13:33	197	19.84	19.98				4	50	0.06	19.86		
6/24/2013	13:43	207	19.84	19.97				4	60	0.06	19.86		
6/24/2013	13:53	217	19.83	20.02	500	450	start bailing	4	70	0.05	19.86	7.14	yes
6/24/2013	13:55	219	--	--			stop bailing	5	0	--	--		
6/24/2013	14:05	229	19.85	19.89				5	10	0.07	19.86		
6/24/2013	15:05	289	19.84	19.89				5	70	0.06	19.85		
6/24/2013	14:25	249	19.83	19.93				5	30	0.05	19.85		
6/24/2013	14:35	259	19.83	19.95				5	40	0.05	19.85		
6/24/2013	14:45	269	19.83	19.99	340	300	start bailing	5	50	0.05	19.85	6.80	yes
6/24/2013	14:50	274	--	--			stop bailing	6	0	--	--		
6/24/2013	15:00	284	19.83	19.94				6	10	0.05	19.85		
6/24/2013	15:10	294	19.83	19.97				6	20	0.05	19.85		
6/24/2013	15:20	304	19.83	19.97				6	30	0.05	19.85		
6/24/2013	15:30	314	19.83	19.98				6	40	0.05	19.85		
6/24/2013	15:40	324	19.83	19.99	350	310	start bailing	6	50	0.05	19.85	7.00	yes
6/24/2013	15:45	329	--	--			stop bailing	--					

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 4 through 6: Q_n = 6.98 mL/min
Convert to cubic feet per day: Q_n = 0.36 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 4 through 6: 0.06 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 4.65 ft^2/day

Field Data								Calculated Data						
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
6/24/2013	6/24/2013 8:40	0	19.51	19.84			static	--	--	0.00	19.56		
6/24/2013	6/24/2013 8:42	--	--	--	640	1275	start bailing	1	--	--	--		
6/24/2013	6/24/2013 8:43	0	--	--			stop bailing	1	0	--	--		
6/24/2013	6/24/2013 8:54	11	19.55	19.59				1	11	0.04	19.56		
6/24/2013	6/24/2013 9:05	22	19.54	19.60				1	22	0.03	19.55		
6/24/2013	6/24/2013 9:15	32	19.56	19.60				1	32	0.05	19.57		
6/24/2013	6/24/2013 9:25	42	19.54	19.62	200	1410	start bailing	1	42	0.03	19.55	4.76	no
6/24/2013	6/24/2013 9:26	43	--	--			stop bailing	2	0	--	--		
6/24/2013	6/24/2013 9:38	55	19.55	19.56				2	12	0.04	19.55		
6/24/2013	6/24/2013 9:48	65	19.55	19.57				2	22	0.04	19.55		
6/24/2013	6/24/2013 9:58	75	19.55	19.58				2	32	0.04	19.55		
6/24/2013	6/24/2013 10:25	102	19.54	19.59				2	59	0.03	19.55		
6/24/2013	6/24/2013 10:55	132	19.54	19.59				2	89	0.03	19.55		
6/24/2013	6/24/2013 11:25	162	19.55	19.63				2	119	0.04	19.56		
6/24/2013	6/24/2013 11:38	175	--	--	180	420	start/stop bailing	3	132	--	--	1.36	no
6/24/2013	6/24/2013 12:08	205	19.54	19.59				3	30	0.03	19.55		
6/24/2013	6/24/2013 12:38	235	19.55	19.62				3	60	0.04	19.56		
6/24/2013	6/24/2013 13:08	265	19.54	19.58				3	90	0.03	19.55		
6/24/2013	6/24/2013 13:38	295	19.54	19.59				3	120	0.03	19.55		
6/24/2013	6/24/2013 14:08	325	19.53	19.60	150	200	start bailing	3	150	0.02	19.54	1.00	no
6/24/2013	6/24/2013 14:12	329	--	--			stop bailing	4	0	--	--		
6/24/2013	6/24/2013 14:42	359	19.54	19.58				4	30	0.03	19.55		
6/24/2013	6/24/2013 15:12	389	19.52	19.59				4	60	0.01	19.53		
6/24/2013	6/24/2013 15:42	419	19.53	19.57	95	240	start bailing	4	90	0.02	19.54	1.06	no
6/24/2013	6/24/2013 15:48	425	--	--			stop bailing	5	0	--	--		
6/25/2013	6/25/2013 8:10	1407	19.50	19.76				5	982	-0.01	19.54		
6/25/2013	6/25/2013 8:30	1427	--	--	415	540	start bailing	5	1002	--	--	0.41	no
6/25/2013	6/25/2013 8:32	1429	--	--			stop bailing	6	0	--	--		
6/25/2013	6/25/2013 9:02	1459	19.53	19.58				6	29.99999999	0.02	19.54		
6/25/2013	6/25/2013 9:32	1489	19.53	19.61				6	60	0.02	19.54		
6/25/2013	6/25/2013 9:33	1490	--	--	100	510	start bailing	6	61	--	--	1.64	no
6/25/2013	6/25/2013 9:35	1492	--	--			stop bailing	7	0	--	--		
6/25/2013	6/25/2013 10:40	1557	19.53	19.59				7	65	0.02	19.54		
6/25/2013	6/25/2013 11:10	1587	19.52	19.60				7	95.00000001	0.01	19.53		
6/25/2013	6/25/2013 11:11	1588	--	--	110	340	start bailing	7	96	--	--	1.15	no
6/25/2013	6/25/2013 11:13	1590	--	--			stop bailing	8	0	--	--		
6/25/2013	6/25/2013 12:23	1660	19.52	19.57				8	70	0.01	19.53		
6/25/2013	6/25/2013 12:53	1690	19.52	19.59				8	100	0.01	19.53		
6/25/2013	6/25/2013 12:55	1692	--	--	90	390	start bailing	8	102	--	--	0.88	no
6/25/2013	6/25/2013 12:57	1694	--	--			stop bailing	9	0	--	--		
6/25/2013	6/25/2013 13:47	1744	19.53	19.56				9	50.00000001	0.02	19.53		
6/25/2013	6/25/2013 14:37	1794	19.52	19.56				9	100	0.01	19.53		
6/25/2013	6/25/2013 15:07	1824	19.52	19.59				9	130	0.01	19.53		
6/25/2013	6/25/2013 15:09	1826	--	--	110	580	start bailing	9	132	--	--	0.83	no
6/25/2013	6/25/2013 15:12	1829	--	--			stop bailing	10	0	--	--		
6/26/2013	6/26/2013 8:30	2867	19.51	19.79				10	1038	0.00	19.55		
6/26/2013	6/26/2013 8:32	2869	--	--	590	330		10	1040	--	--	0.57	no
6/26/2013	6/26/2013 8:35	2872	--	--				10	1043	--	--		
6/26/2013	6/26/2013 10:00	2957	19.52	19.60				10	1128	0.01	19.53		
6/26/2013	6/26/2013 10:02	2959	--	--	150	620	start bailing	10	1130	--	--	0.13	no
6/26/2013	6/26/2013 10:05	2962	--	--			stop bailing	11	0	--	--		
6/26/2013	6/26/2013 10:40	2997	19.53	19.56				11	35	0.02	19.53		
6/26/2013	6/26/2013 11:15	3032	19.52	19.58				11	70	0.01	19.53		
6/26/2013	6/26/2013 11:55	3072	19.55	19.62				11	110	0.04	19.56		
6/26/2013	6/26/2013 11:57	3074	--	--	130	580	start bailing	11	112	--	--	1.16	yes
6/26/2013	6/26/2013 12:00	3077	--	--			stop bailing	12	0	--	--		
6/26/2013	6/26/2013 12:40	3117	19.55	19.57				12	40	0.04	19.55		
6/26/2013	6/26/2013 13:35	3172	19.54	19.59				12	95	0.03	19.55		
6/26/2013	6/26/2013 14:20	3217	19.55	19.62				12	140	0.04	19.56		
6/26/2013	6/26/2013 14:24	3221	--	--	135	480	start bailing	12	144	--	--	0.94	yes
6/26/2013	6/26/2013 14:27	3224	--	--			stop bailing	13	0	--	--		
6/26/2013	6/26/2013 15:15	3272	19.54	19.59				13	48	0.03	19.55		
6/26/2013	6/26/2013 15:55	3312	19.54	19.60				13	88	0.03	19.55		
6/26/2013	6/26/2013 16:20	3337	19.54	19.61				13	113	0.03	19.55		
6/26/2013	6/26/2013 16:22	3339	--	--	110	520	start bailing	13	115	--	--	0.96	yes
6/26/2013	6/26/2013 16:25	3342	--	--			stop bailing						

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 11 through 13: Q_n = 1.02 mL/min
Convert to cubic feet per day: Q_n = 0.05 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.03 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 1.17 ft^2/day

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
9/25/2013	10:05	--	22.11	22.55			static	--		0.00	22.18		
9/25/2013	10:07	--	--	--	1100	700	start bailing	--		--	--		
9/25/2013	10:11	0	--	--			stop bailing	1	0	--	--		
9/25/2013	10:18	7	23.34	23.39				1	7	1.23	23.35		
9/25/2013	10:28	17	23.28	23.35				1	17	1.17	23.29		
9/25/2013	10:37	26	23.26	23.36				1	26	1.15	23.28		
9/25/2013	10:38	27	--	--	160	400	start bailing	1	27	--	--	5.93	no
9/25/2013	10:40	29	--	--			stop bailing	2	0	--	--		
9/25/2013	10:59	48	23.26	23.30				2	19	1.15	23.27		
9/25/2013	11:15	64	23.26	23.33				2	35	1.15	23.27		
9/25/2013	11:24	73	23.26	23.34				2	44	1.15	23.27		
9/25/2013	11:40	89	23.26	23.35				2	60	1.15	23.27		
9/25/2013	11:48	97	--	--	150	480	start bailing	2	68	--	--	2.21	no
9/25/2013	11:51	100	--	--			stop bailing	3	0	--	--		
9/25/2013	12:17	126	23.26	23.30				3	26	1.15	23.27		
9/25/2013	13:48	217	23.26	23.35				3	117	1.15	23.27		
9/25/2013	13:50	219	--	--	110	450	start bailing	3	119	--	--	0.92	yes
9/25/2013	13:52	221	--	--			stop bailing	4	0	--	--		
9/25/2013	15:01	290	23.26	23.31				4	69	1.15	23.27		
9/25/2013	15:32	321	23.25	23.33				4	100	1.14	23.26		
9/25/2013	15:34	323	--	--	110	330	start bailing	4	102	--	--	1.08	yes
9/25/2013	15:36	325	--	--			stop bailing	5	0	--	--		
9/25/2013	16:28	377	23.25	23.31				5	52	1.14	23.26		
9/25/2013	16:45	394	23.25	23.33				5	69	1.14	23.26		
9/25/2013	16:47	396	--	--	100	310	start bailing	5	71	--	--	1.41	yes
9/25/2013	16:49	398	--	--			stop bailing	5	--	--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 3 through 5: Q_n = 1.14 mL/min
Convert to cubic feet per day: Q_n = 0.06 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 1.14 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 0.04 ft^2/day

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
9/25/2013	8:28	--	23.43	23.56			static	--		0.00	23.45		
9/25/2013	8:34	--	--	--	15	330	start bailing	1	--	--	--		
9/25/2013	8:38	0	--	--			stop bailing	1	0	--	--		
9/25/2013	8:51	13	23.46	23.46				1	13	0.03	23.46		
9/25/2013	9:08	30	23.46	23.47				1	30	0.03	23.46		
9/25/2013	9:37	59	23.46	23.49				1	59	0.03	23.46		
9/25/2013	9:38	60	--	--	8	390	start bailing	1	60	--	--	0.133	no
9/25/2013	9:42	64	--	--			stop bailing	2	0	--	--		
9/25/2013	9:53	75	23.47	23.47				2	11	0.04	23.47		
9/25/2013	12:37	239	23.42	23.45				2	175	0.13	23.42		
9/25/2013	12:39	241	--	--	30	280	start bailing	2	177	--	--	0.169	yes
9/25/2013	12:41	243	--	--			stop bailing	3	0	--	--		
9/25/2013	14:23	345	23.40	23.44				3	102	0.12	23.41		
9/25/2013	14:25	347	--	--	20	350	start bailing	3	104	--	--	0.192	yes
9/25/2013	14:27	349	--	--			stop bailing	4	0	--	--		
9/25/2013	15:52	434	23.42	23.44				4	85	0.13	23.42		
9/25/2013	15:55	437	--	--	15	190	start bailing	4	88	--	--	0.170	yes
9/25/2013	15:57	439	--	--			stop bailing	4	--		--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 2 through 4: Q_n = 0.177 mL/min
Convert to cubic feet per day: Q_n = 0.01 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 2 through 4: 0.09 ft

Transmissivity Calculation:

$$T_n = \frac{0.01 \times 4.6}{2\pi \times 0.03}$$

T_n = 0.07 ft^2/day

Field Data								Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
9/24/2013	10:49	--	20.08	20.92			static	--	--	0.00	20.21		
9/24/2013	10:51	--	--	--	2050	330	start bailing	1	--	--	--		
9/24/2013	10:53	0	--	--			stop bailing	1	0	--	--		
9/24/2013	11:00	7	20.19	20.24				1	7	0.11	20.20		
9/24/2013	11:17	24	20.16	20.34				2	24	0.08	20.19		
9/24/2013	11:20	27	--	--	290	250	start bailing	2	27	--	--	10.74	no
9/24/2013	11:21	28	--	--			stop bailing	3	0	--	--		
9/24/2013	11:51	58	20.15	20.25				3	30	0.07	20.17		
9/24/2013	12:39	106	20.16	20.34				3	78	0.08	20.19		
9/24/2013	12:42	109	--	--	240	320	start bailing	3	81	--	--	2.96	yes
9/24/2013	12:43	110	--	--			stop bailing	4	0	--	--		
9/24/2013	13:44	171	20.15	20.29				4	61	0.07	20.17		
9/24/2013	14:01	188	--	--	200	370	start bailing	4	78	--	--	2.56	yes
9/24/2013	14:03	190	--	--			stop bailing	5	0	--	--		
9/24/2013	14:46	233	20.14	20.24				5	43	0.06	20.16		
9/24/2013	15:03	250	--	--	190	340	start bailing	5	60	--	--	3.17	yes
9/24/2013	15:05	252	--	--			stop bailing	5	--	--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 3 through 5: Q_n = 2.90 mL/min
Convert to cubic feet per day: Q_n = 0.15 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 3 through 5: 0.07 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 1.55 ft^2/day

			Field Data						Calculated Data					
Date	Time	Elapsed Time (minutes)	Depth to LNAPL (ft)	Depth to Water (ft)	LNAPL Volume Removed (mL)	Water Volume Removed (mL)	Comments	Skimming Period	Time Since Bailing (min)	LNAPL Drawdown (ft)	Corrected DTW (ft)	Average Recovery Rate (mL/min)	Rate Used for Calulations?
9/24/2013	8:35	0	19.73	21.00			static	--	--	0.00	19.92		
	8:40	--	--	--	2960	1290	start bailing	1	--	--	--		
	8:43	0	--	--			stop bailing	1	0	--	--		
	8:44	1	19.90	20.01				1	1	0.17	19.92		
	8:48	5	19.88	20.10				1	5	0.15	19.91		
	8:53	10	19.86	20.14				1	10	0.13	19.90		
	8:55	12	--	--	520	360	start bailing	1	12	--	--	43.33	no
	8:56	13	--	--			stop bailing	2	0	--	--		
	9:01	18	19.89	20.03				2	5	0.16	19.91		
	9:13	30	19.88	20.09				2	17	0.15	19.91		
	9:27	44	19.86	20.13				2	31	0.13	19.90		
	9:29	46	--	--	440	320	start bailing	2	33	--	--	13.33	no
	9:31	48	--	--			stop bailing	3	0	--	--		
	9:57	74	19.87	20.04				3	26	0.14	19.90		
	10:10	87	19.85	20.08				3	39	0.12	19.88		
	10:34	111	19.85	20.12				3	63	0.12	19.89		
	10:35	112	--	--	370	310	start bailing	3	64	--	--	5.78	no
	10:37	114	--	--			stop bailing	4	0	--	--		
	11:18	155	19.84	20.05				4	41	0.11	19.87		
	11:39	176	--	--	330	350	start bailing	4	62	--	--	5.32	no
	11:40	177	--	--			stop bailing	5	0	--	--		
	12:41	238	19.85	20.06				5	61	0.12	19.88		
	12:45	242	--	--	325	380	start bailing	5	65	--	--	5.00	yes
	12:47	244	--	--			stop bailing	6	0	--	--		
	13:43	300	19.84	20.02				6	56	0.11	19.87		
	13:57	314	--	--	330	370	start bailing	6	70	--	--	4.71	yes
	13:59	316	--	--			stop bailing	7	0	--	--		
	14:48	365	19.83	19.99				7	49	0.10	19.85		
	15:06	383	--	--	280	320	start bailing	7	67	--	--	4.18	yes
	15:08	385	--	--			stop bailing	--	--	--	--		

LNAPL Transmissivity Equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

LNAPL Recovery Rate:

Use average of skimming period 5 through 7: Q_n = 4.63 mL/min
Convert to cubic feet per day: Q_n = 0.24 ft^3/day

Radius of Influence:

A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$
Source: ASTM 2012

Drawdown:

Calculate the geometric mean of the starting and ending drawdown values for skimming periods 5 through 7: 0.11 ft

Transmissivity Calculation:

$$T_n = \frac{0.55 \times 4.6}{2\pi \times 0.08}$$

T_n = 1.57 ft^2/day

Monitoring Well	Date	Baildown Test Data									Skimming Test Transmissivity Results (ft^2/d)
		Bouwer & Rice		Cooper & Jacob		Cooper, Bredehoeft, & Papdopulos		Summary			
		Result (ft^2/d)	Error (+/-)	Result (ft^2/d)	Root Mean Square Error	Result (ft^2/d)	Root Mean Square Error	Mean Transmissivity (ft^2/d)	Std. Deviation	Coeff. of Variation	
MW-14	3/18/2013	1.70	0.21	9.72	0.235	8.72	0.289	6.74	4.33	0.64	4.80
	6/25/2013	1.21	0.14	7.35	0.032	4.11	0.351	4.23	3.07	0.73	1.30
	9/23/2013	0.03	0.03	1.25	0.021	0.74	0.319	0.67	0.61	0.91	0.04
MW-19	3/18/2013	1.00	0.23	0.69	0.009	1.36	0.256	1.01	0.34	0.33	0.31
	6/25/2013	--	--	--	--	--	--	--	--	--	0.006
	9/23/2013	--	--	--	--	--	--	--	--	--	0.07
RW-6	3/18/2012	2.18	0.14	4.99	0.069	2.89	0.182	3.35	1.46	0.44	4.61
	6/27/2013	3.16	0.69	19.56	0.036	26.32	0.100	16.35	11.91	0.73	4.65
	9/23/2013	1.20	0.06	2.39	0.110	2.62	0.162	2.07	0.76	0.37	1.55
RW-7	3/18/2013	2.02	0.61	6.26	0.024	7.00	0.274	5.06	2.69	0.53	0.10
	6/25/2013	--	--	--	--	--	--	--	--	--	1.17
	9/26/2013	46.62	7.37	7.36	0.226	4.87	0.405	19.61	23.42	1.19	1.57

Attachment H

Corrective Action Plan

1.0 INTRODUCTION

EA Engineering, Science, and Technology, Inc. (EA) has prepared this Corrective Action Plan (CAP) as an attachment to the Vacuum-Enhanced Recovery (VER) Feasibility Study (FS) Report of Results conducted by EA in December 2013 (EA 2013). This CAP has been prepared in response to the findings of the VER FS, which indicate additional remediation is warranted at RW-6 and RW-7 at the Perryman Generating Station Site (referred to as the "Site" herein).

Based on the results of the VER FS, performed from 25 February to 26 September 2013, VER has proven to be an effective remedial option for the Site. VER events were conducted on a monthly basis for 6 months at MW-14, MW-19, RW-6, and RW-7. During the course of the VER program a total of 29,656 gallons (gal) of total liquids were recovered, including approximately 135.5 gal of LPH.

LPH transmissivity and recoverability were assessed using data from LPH baildown and manual skimming tests performed prior to beginning the VER events, after the third VER event, and after all six VER events were completed. Generally, both transmissivity and recoverability of LPH were found to have been reduced by VER. At the conclusion of the FS, LPH transmissivity at MW-14 and MW-19 had been reduced to within the lower limit of hydraulic recoverability of 0.1 to 0.8 ft^2/day, as defined by ITRC (2009). Additional active LPH recovery is not warranted at MW-14 and MW-19 as LPH has been removed to the maximum extent practical.

LPH transmissivity results for RW-6 and RW-7 indicate further remediation will be required to recover LPH to the greatest extent practicable at these isolated areas. The LPH transmissivity data were utilized to assess LPH recoverability and provide the basis for recommendations in this CAP for the Site.

2.0 RISK EVALUATION AND CLOSURE GOALS

Site-specific closure goals have been developed based on a December 2013 overall evaluation of the Maryland Department of the Environment (MDE) Oil Control Program (OCP) Seven Risk Factors. This evaluation was performed at the conclusion of the VER program. A brief discussion and site-specific evaluation of the risk factors is presented below:

1. ***LPH***—In general, LPH at the site has been successfully removed over the period from 1992 to 2000. LPH volume removal was significant initially; however, by 2000 the recovery system had become less effective due to limited LPH availability. Passive recovery was initiated and has further reduced the occurrence of LPH to residual amounts in isolated areas of the Site. Based on the LIF investigation, four areas of free-phase LPH were identified. The LPH occurrence at MW-14 and MW-19 demonstrated minimal recoverability and active remediation is not warranted. Recoverable LPH has been identified at RW-6 and RW-7; this CAP details the methods to achieve LPH removal to the maximum extent practicable. The observed LPH will be addressed by corrective action, as discussed in the following sections of this report.

2. ***Current and Future Use of Groundwater***—An existing production well at the Site has been designated for fire suppression and non-potable purposes only. This well reportedly has a total depth of 207-ft and is screened across three intervals from 96 to 100, 160 to 180, and 194 to 207-ft below ground surface (bgs). Based on local lithology and the well completion record, the screened intervals are below a confining unit (Confining Unit 1) which separates the water table aquifer (Aquifer 1, where LPH impact has been observed) from the deeper confined aquifer. Based on a query of the MDE Water Management Administration well databases and a visual survey, several residential wells are located within 0.5 miles of the property boundary. However, none of these residential wells are located within 0.5 mile of the LPH occurrence.

3. ***Migration of Contamination***—The contaminants (No. 2 fuel in the liquid phase and dissolved phase) have remained isolated and stable over the project history (over 20 years). LPH mass has been reduced through recovery efforts, and the dissolved phase plume concentrations have remained stable. Natural attenuation of the petroleum compounds in groundwater continues to limit the transport of the dissolved phase constituents, and the dissolved phase impacts to groundwater are generally limited to the same area as the observed residual LPH.

4. ***Human Exposure***—Site access is currently restricted to employees and contractors only. Groundwater is located approximately 15 to 20-ft bgs at the site. Based on the depth to groundwater, exposure through inhalation, ingestion, and dermal contact pathways are not likely a concern. Construction activities, including installation of subsurface utilities, would not likely be performed to the depths of observed LPH.

5. ***Ecological Exposure***—No LPH has been observed on the ground surface or in surface water; therefore, it is unlikely that exposure of plant or animal life, or the degradation of a natural resource has occurred or will occur in the future. Potential environmental ecological receptors were not observed in the vicinity of LPH occurrence.

6. ***Impacts to Utilities/Buried Services***—Known onsite private and public utilities are located either aboveground or buried at a significantly shallower depth than the LPH occurrence. Based on the steady-state nature of the LPH plume, no future impacts are expected.

7. ***Other Sensitive Receptors***—No other sensitive receptors have been identified in the immediate vicinity. Based on the extent of groundwater contamination as identified in Section 4.0, it is unlikely that surface water has been affected. No other sensitive receptors, such as residential housing or schools, are located in the vicinity of the site.

3.0 PROPOSED CORRECTIVE ACTION

Based on the December 2013 evaluation of the Seven Risk Factors and the current and projected land use of the site, there is no apparent migration of contamination or potential unacceptable risk to human health or the environment. However, LPH has not been removed to the maximum extent practicable at two isolated and discontinuous locations, RW-6 and RW-7. The proposed

remediation activities discussed below are intended to address this final risk factor. The recommended remedial goal for this site is to remove free-phase LPH to the maximum extent practicable by hydraulic means. The ITRC (2009) has defined the lower limit for practical recoverable LPH as 0.1-0.8 ft^2/day transmissivity. These values will be used for corrective action performance monitoring.

The overall scope of work will consist of deploying active skimmer pump systems at wells RW-6 and RW-7. The skimmer pump systems will be enhanced with bimonthly VER events, which have been proven effective at the site during the FS. Manual skimming tests will be performed after a period of 6 months to reassess LPH transmissivity. The following sections detail the proposed corrective action activities.

3.1 Active Skimmer Pumps

As previously stated, the results of the VER FS indicate that two wells, RW-6 and RW-7, contain recoverable LPH. EA will deploy a trailer-mounted active skimmer pump system at each of these wells to continuously recover LPH as it flows into the casing.

Skimmer pumps with floating intake heads will be used to account for groundwater table fluctuations at the site. The skimmer heads will be equipped with either hydrophobic membranes or specific-gravity selective intakes to minimize recovery of groundwater. As LPH enters the skimmer head, it will drain into an integral holding reservoir. This reservoir is emptied pneumatically at intervals to be determined based on LPH recovery rate at each well. A programmable pneumatic pump controller will be utilized to fine-tune discharge frequency and make adjustments to account for reduced LPH recovery rates as remediation progresses. LPH will be discharged into an over packed 55-gal drum. LPH collected in the drums will be transported to a permitted, offsite facility for disposal. Copies of the disposal certificates will be provided in a summary report, in the form of either a remedial action completion report or a site closure package report.

Following the skimmer pump system installation, an approximate 3-week startup period will be required to assess long-term recovery rate and adjust the pump controller accordingly. After the startup, operation and maintenance (O&M) visits will be conducted twice a month to monitor system performance. The O&M schedule may be modified based on long-term LPH recovery rates.

3.2 Vacuum-Enhanced Recovery Events

To maximize LPH recovery at the wells with active skimmer pumps (i.e., RW-6 and RW-7), VER will be implemented on a bimonthly to quarterly basis. Aside from the LPH volume removal provided by this technology, VER provides an aggressive “redevelopment” effect on the wells which ensures connectivity with the formation for enhanced LPH recovery. The VER events may ramp-down based on the LPH recovery results.

A vacuum will be induced using a vacuum truck equipped with a high-vacuum pump capable of producing up to 28-in. of mercury vacuum and will simultaneously induce LPH, groundwater,

and vapor removal. VER will be performed on each well for a period of up to 4 hours. It is anticipated that up to 3,000-gal of groundwater/LPH emulsions will be extracted from both wells during each VER event. The extraction volume may be modified depending on the groundwater/LPH recharge rates during the event.

The total fluids (groundwater and LPH) recovered from each well will be transported to a permitted, off-site disposal facility for separation and treatment. Copies of the disposal certificates will be provided in a summary report, in the form of either a remedial action completion report or a site closure package report.

3.4 Corrective Action Performance Monitoring

The recommended remedial goal for this site is to remove free-phase LPH to the maximum extent practicable by hydraulic means. The ITRC (2009) has defined the lower limit for recoverable LPH as 0.1-0.8 ft^2/day transmissivity. These values will be used for corrective action performance monitoring.

Manual skimming tests will be performed 6 months after implementation of the corrective action to reassess LPH transmissivity in RW-6 and RW-7. Any active or passive LPH recovery will be terminated for a minimum of 48 hours before conducting the tests to allow LPH in the vicinity of each well to return to static conditions.

Manual skimming tests will be conducted in accordance to ASTM E2856: *Standard Guide for Estimation of LNAPL Transmissivity* (ASTM 2012). In manual skimming test, LPH is bailed out initially and then repeatedly extracted before approximately 25 percent of the initial LPH thickness has recovered into the well. LPH volume and elapsed time is carefully recorded for each bailing cycle. Bailing is repeated until the volume/time ratio has stabilized to within 25 percent over three consecutive readings. For this method, transmissivity is calculated by the following analytical equation where the recovery rate is used as an input to the equation:

$$T_n = \frac{Q_n \ln \frac{R_{oi}}{r_w}}{2\pi s_n}$$

where:

T_n = LNAPL transmissivity (ft^2/day)
Q_n = measured LNAPL recovery rate (ft^3/day)
R_{oi} = radius of influence (ft)*
r_w = well radius (ft)*
s_n = geometric mean of starting and ending drawdown value (ft)

*A value of 4.6 is assumed for the term $\ln(R_{oi}/r_w)$

Manual skimming tests will be performed every 6 months for the duration of the corrective action to track performance. When transmissivity results indicate that the remedial goal has been met, the corrective action will be terminated. Monthly groundwater/LPH gauging and quarterly

groundwater sampling will continue during the implementation of the corrective action.

3.5 Performance Standard

The recommended remedial goal for this Site is to reduce LPH transmissivity in RW-6 and RW-7 to within the range of 0.1-0.8 ft^2/day, defined by the ITRC as the lower limit for LPH recoverability (ITRC 2009). If LPH transmissivities are met at these wells, a site closure document will be prepared and submitted to MDE OCP; and will include the LPH transmissivity assessment results, gauging results, and the quarterly groundwater sampling results.

The closure goal of reducing LPH transmissivity to within the range of 0.1 to 0.8 ft^2/day at wells RW-6 and RW-7 is reasonable and attainable for this Site based on the following:

- Approximately 69,992-gal of LPH has been recovered since 1992 with a variety of technologies including dual-phase extraction, passive LPH skimmer pumps, hand-bailing, and VER.

- LPH recovery was robust until year 2000 (LPH recovery of approximately 67,200-gal 1992 to 2000), but has greatly diminished (LPH recovery of approximately 175-gal 2007-present by hand bailing).

- The operation of the power plant will continue for the foreseeable future and potential human or ecological risks are minimal.

- The free-phase LPH occurrence has been greatly reduced in extent by remedial activities and now exists only in isolated pockets. The historical LPH occurrences at MW-14 and MW-19 have been greatly reduced as a result of VER activities and will continue to be addressed by passive methods during monthly O&M activities. The recoverable LPH identified at locations RW-6 and RW-7 will be removed to the maximum extent practicable as described in this CAP.

- Residual LPH has not moved laterally, and no dissolved phase contamination migration has been observed.

4.0 REFERENCES

ASTM International. 2012. *Standard Guide for Estimation of LNAPL Transmissivity*. Designation E2856-11.

EA Engineering, Science, and Technology, Inc. (EA). 2013. *Vacuum-Enhanced Recovery (VER) Feasibility Study Report of Results, Perryman Generation Facility*. December.

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