Addendum #5, Revision 1 to
Field Sampling Plan for Part 2 of the Supplemental Groundwater Remedial Investigation
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, Pennsylvania

Prepared for Harley-Davidson Motor Company Operations, Inc.
November 16, 2012

Prepared by:

Groundwater Sciences Corporation
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Vertical Extent in Suspected Source/DNAPL Areas – MW-136A

Section 4.2.1.2 of the Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation (GSC, April 2012) describes the program for investigating the vertical extent of CVOCs in six locations on the former York Naval Ordnance Plant (fYNOP). **Figure 1** (Figure 4.1-5 of the FSP) shows the locations of the proposed vertical extent investigations, with the subject well, MW-136A called out with a blue flag with the label "Determine Vertical Extent SW-WPL". During the drilling of vertical extent well MW-136A, concentrations of VOCs occurred in the breathing zone surrounding the well after encountering solution cavities and water bearing zones exceeding a blown yield of 50 gallons per minute (gpm). Laboratory analyses of water collected from the bottom of the water column in the well (at 202') indicated relatively high concentrations of VOCs in the range that would suggest the presence of DNAPL, although non-aqueous free phase liquid was not visible in the water collected from the well.

Well MW-136A Construction and Testing

Attachment 1 is the geologist's field log for well MW-136A. The well was constructed from June 20 to July 5, 2012 using 12' diameter continuous casing advancement to 202'. The boring penetrated a sediment-filled solution cavity at 172-180'. Weathered, fractured limestone continued below this solution cavity to the bottom of the hole. Advancement was stopped due to elevated readings of total volatile organic vapors detected using the photo ionization detector (PID) in the breathing zone. Blown yield (with continuous casing advancement) prior to cessation of drilling was estimated at 50 gpm.

Figure 2 is a cross section (H to H') constructed through the wells near MW-136A. A map inset on the figure shows the orientation of the section. The solution cavity in MW-136A is at a similar depth to solution cavities penetrated by adjacent wells MW-75S&D and CW-20, located 55' and 68', respectively, to the southeast.

A grab sample of water was collected from MW-136A using a Kemmerer sampler on July 10, 2012. The sampler was lowered into position at the bottom of the well bore (approximately 202'), then closed to obtain a sample of the water at the bottom of the bore. Photographs of the sampler and samples are included as **Attachment 2**. **Attachment 3** is a description of the sampling procedure from the field log book. Initial samples were placed in a mason jar and inspected. Samples were observed to be sediment-laden. DNAPL was not detected in the samples by visible inspection.

Table 1 presents laboratory data from the sample of groundwater grabbed from the bottom of the water column in MW-136A. Volatile organic compounds (VOCs) chemistry is dominated by 14,000 µg/l of tetrachloroethene (PCE), which is 6% of the aqueous solubility and 10,000 µg/l of trichloroethene (TCE), which is 0.7% of the aqueous solubility. These percentages of aqueous solubilities are generally indicative of DNAPL presence.

Considerations For Advancing The Vertical Extent Investigation

Numerous options have been discussed regarding the advancement of this boring versus moving to another location. While there are advantages and disadvantages to both options, this addendum proposes a plan to advance the existing borehole. The occurrence of stacked sediment-filled caverns in this location combined with the presence of likely DNAPL conditions make MW-136A an excellent location to further explore the potential for vertical migration in the karst features in a "worst case scenario". The concern that must be addressed is the potential for DNAPL or highly concentrated groundwater to be dragged down as the hole is advanced.

Well drilling in MW-136A was completed using a continuous casing advancement (CCA) system. There are a number of companies that provide a version of a CCA system, and the equipment is called by names such as ODEX (http://www.midnightsundrilling.com/ODEX_system.html), Stratex and Concentrix (http://www.keystonedrill.com/new_page_3.htm), to mention three. The CCA systems work by

under-reaming the bore hole slightly larger than the casing diameter, allowing the casing to follow the bit downward while the hole is advanced. The end of the casing is fitted with a "shoe", which is welded to the bottom of the casing. The drill bit engages with the "shoe", pulling the casing with it as the borehole advances. While more often used in unconsolidated formations, this method of drilling was selected because of the anticipation of stacked sediment-filled caverns penetrated in adjacent wells MW-75D and CW-20. Manufacturer's specifications indicate that the 12" Concentrix bit makes a hole diameter of 13-5/8". The outside diameter of the casing is 12.75" producing a 0.75" annulus.

A 12" Concentrix system was used to advance the hole to 202'. A sediment-filled cavern was penetrated from 172' to 180', followed by fractured carbonate rock through to the current bottom of the hole at 202'. PID readings were elevated in the borehole and in the containment vessel, but spiked significantly as the fractured zones from 182'-202' were penetrated, suggesting the fractures below the cavern are the source of the highest concentration of contaminants. While the hole was penetrating the sediment-filled void, the drilling process was producing 250 gpm. Once past the void, just prior to stopping the drilling, the drilling process was producing 50 gpm.

Two grouting engineers were consulted by KCF Groundwater, Inc. (KCF). They were asked their approach to sealing the permeable pathways to DNAPL migration around the casing. They both recommended a program of drilling a number of small diameter boreholes in a radial pattern closely surrounding the well to inject grout at depth. They recommended that grouting from within the borehole itself be left up to the well driller that drilled the borehole.

This addendum recommends grouting from within the borehole. The following plan was developed in consultation with Eichelberger Well Drilling and KCF.

When the drilling was stopped, the formation appeared to be fractured, there is concern that grout of the pipe at the current depth will be ineffective because of fractured condition of the bottom of the boring and the potential that the fractured conditions continue below 202'. The inside diameter (ID) of the casing shoe is 11", restricting the number of additional strings of telescoping casing. To preserve one telescoping casing size that may be needed to case off deeper voids, the following plan is proposed:

1. When the well was sampled on July 10, 2012, the bottom of the hole was sounded at 202', with a soft bottom. The well was sounded on November 13, 2012 to a depth of 194.8', and found to have a very soft bottom, suggesting silt and clay has oozed into the well bore through the annulus or the bottom of the bore hole below the casing. The PID reading at the top of the casing was 0 ppm.

2. The casing pipe will be cleaned out using a cable tool drilling rig or other necessary means to expose the casing shoe. Level B personnel protection may be required for this and subsequent operations.

3. An attempt will be made to re-engage the Concentrix drill bit. The driller suggests the chances of successfully re-engaging at 75%. The option is available for using a video camera to examine the casing shoe before attempting to engage the bit if it is felt there would be useful information gained.

4. If engagement is successful, the 12" borehole would be advanced until the formation is stable and unfractured for a minimum of 5'. Level B personnel protection may be required for this operation. If engagement is not successful, consideration will be given to grouting the casing in the current position, as described below if the inflowing sediment issue can be resolved.

5. The 12" casing would then be pressure grouted in place to seal the annulus. The process would involve raising the 12" casing approximately 5', installing a Baski packer (http://www.baski.com/packer.htm) in the bottom of the casing, and pressure grouting through the packer into the borehole below the packer. The borehole below the casing would be filled with grout, and presumably the annulus above the bottom of the casing would be grouted as well. Target grouting pressures and grout mobility will be determined in consultation with packer manufacturers and KCF. The casing would then be lowered back down in the borehole and seated on the solid rock bottom of the borehole.

6. There is concern that the material that has apparently filled the bottom 7' of the hole will continue to fill the annulus or bottom of the hole, either before or after the casing is lifted for grouting. To overcome this concern, the drill bit will be disengaged from the casing

and the well bore will be sounded. If free of soft material, the casing would be raised, and subsequently re-sounded to determine if the hole is free of caved material. If not, the material would be cleared from the hole, and additional attempts would be made to obtain a clear hole prior to pressure grouting. One possibility would be to fill the bottom of the borehole with bentonite slurry prior to raising the 12" casing pipe.

7. After completion of installation of the 12" casing pipe and grout, the well bore would be advanced using 10" diameter drilling. After drilling a few feet past the bottom of the casing, the water level in the borehole would be pumped down and recovery measured to test the effectiveness of the seal. A sample would be collected and analyzed for VOCS.

8. If advancement of the 12" casing is not possible (Steps 3 and 4), if pressure grouting was not successful (Step 5), or if the results of Step 8 are not satisfactory, the contingency plan is to attempt to drill a rock socket below the 12" pipe into solid rock, and install an eight-inch diameter casing pipe, using conventional telescoping methods.

9. After successful installation of the 12" casing (Step 8) or installation of the 8" casing (Step 9), conventional telescoping casing methods would be used to advance the borehole. A steel casing would be grouted into place at a depth of 270'. Prior to casing installation, testing of karst features encountered would be conducted, if formation conditions allow. The borehole would then be advanced below the 270' depth to 320', the design depth of this well.

References

GSC, 2011. Supplemental Remedial Investigation Groundwater Report (Part 1) Former York Naval Ordnance Plant, September.

GSC, 2012. Field Sampling Plan (FSP) for Part 2 of the Supplemental Groundwater Remedial Investigation, April.

USEPA, 1992. Directive No. 9283.1-06 Considerations in Ground-water Remediation at Superfund Sites and RCRA Facilities – Update, p. 6.

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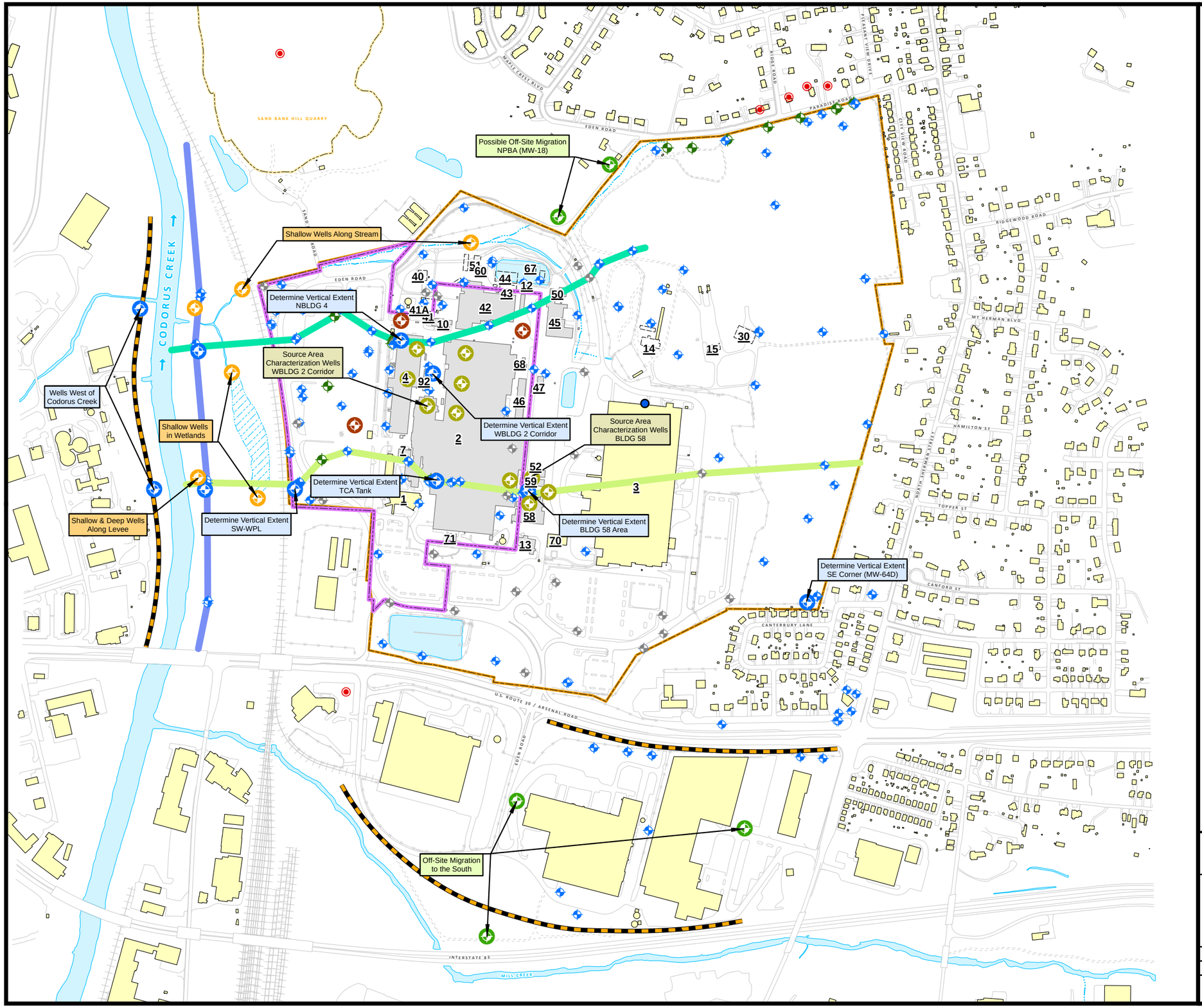

N

W E

S

LEGEND

- Proposed Vertical Extent Wells
- Proposed Shallow & Deep Pairs
- Proposed Shallow Air Rotary
- Proposed Shallow Boring in Overburden
- Proposed Stratigraphic Boring
- Collection Well
- Monitoring Well
- Abandoned Monitoring Well
- Residential Well
- Lift Station
- Proposed Electrical Imaging Survey
- Cross Section A-A'
- Cross Section B-B'
- Cross Section C-C'
- West Campus Property Line
- Existing Building to Remain
- Demolished
- Demolished/Slab Removed
- Site Property Boundary
- Railroad
- Road (Paved)
- Road Curb
- Road (Unpaved)
- Walkway
- Fenceline
- Wetland Boundary (2006)

Scale (feet)

0 150 300 600

Figure 1

Former York Naval Ordnance Plant

1425 Eden Road, York, PA 17402

Proposed Drilling Program
Supplemental Remedial Investigation
Part 2

DRAWN BY: JPB	CHECKED AND APPROVED BY: SMS	DATE: 4/30/2012

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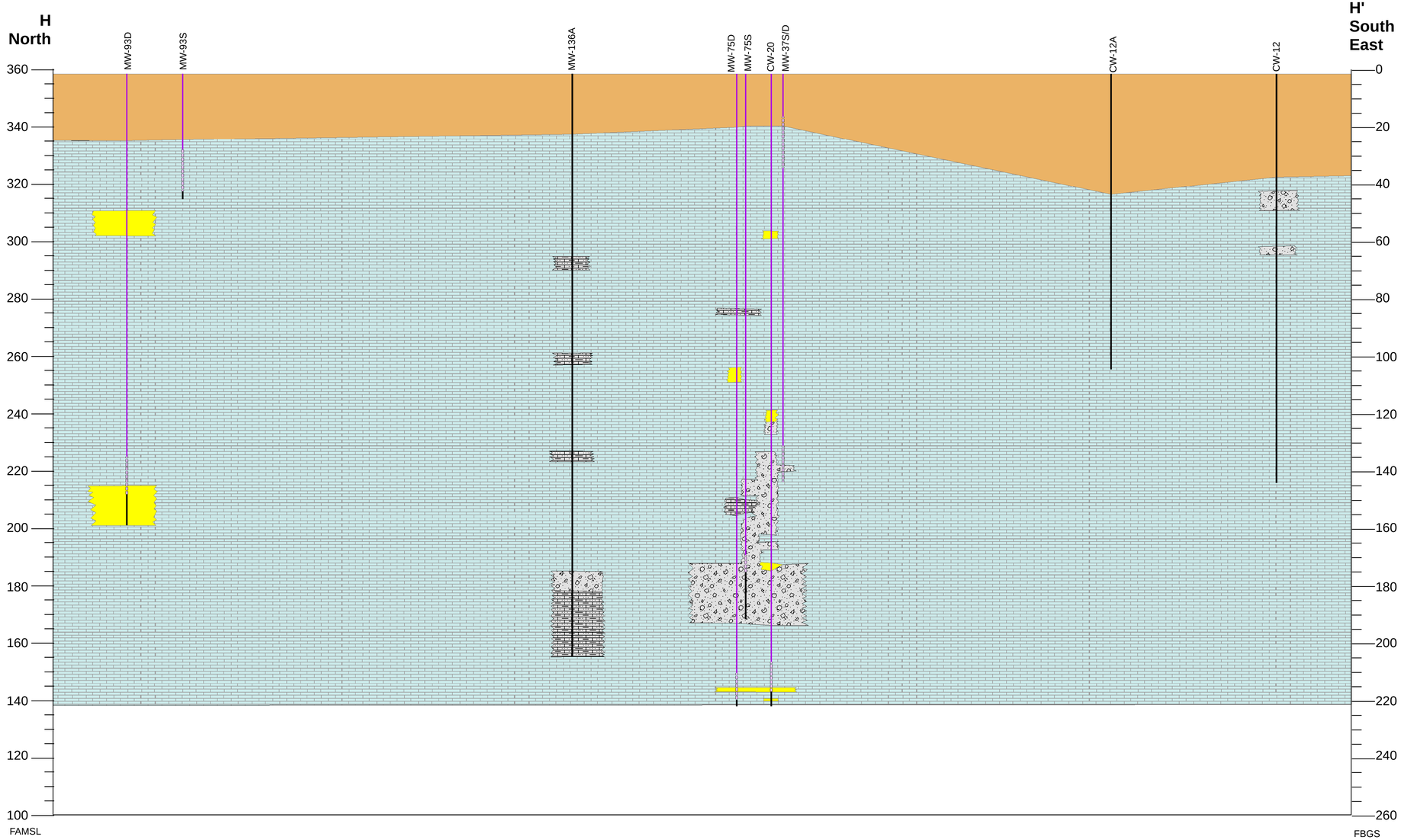
GROUNDWATER SCIENCES CORPORATION



LEGEND

- Boring
- Casing
- Screen Interval
- Void with Silt
- Weathered Limestone
- Silt / Clay
- Open Solution Cavity
- Solution Cavity with Alluvial Gravels
- Solution Cavity with Unknown Material
- Alluvial Gravels
- Limestone / Dolostone
- Sandstone / Quartzite

Vertical Scale (feet)

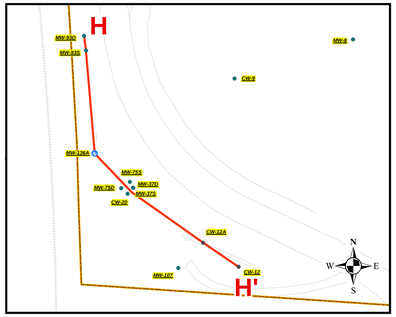
0 10 20 40

Horizontal Scale (feet)

0 10 20 40

Vertical Exaggeration 1X

LOCATION MAP



NOTES:
- Colors not representative of geologic age.
- Static water levels measured October 20, 2008.
- CW-20, MW-37S, MW-37D, MW-75S, and MW-75D are a well cluster.
-CW-12 and CW-12A have been abandoned.
-FAMSL- Feet Above Mean Sea Level
-FBGS- Feet Below Ground Surface.

Figure 2

Former York Naval Ordnance Plant

1425 Eden Road, York, PA 17402

Cross Section H-H'

DRAWN BY: AGM	CHECKED AND APPROVED BY:	DATE: 7/12/2012

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fYNOP FSP Addendum 5 Table 1
Preliminary Groundwater Data Summary - MW-136A

Location/ID Sample Date Parameter	MSC Used Aquifer R (ug/L)	MSC Used Aquifer NR (ug/L)	Federal MCL (ug/L)	EPA RSL Tap Water (ug/L)	MW-136A 7/10/2012
TOTAL VOC					
					25170
Volatile Organic Compound					
1,1,1,2-Tetrachloroethane	70	70		0.52	1000 U
1,1,1-Trichloroethane	200	200	200	9100	570 J
1,1,2,2-Tetrachloroethane	0.84	4.3		0.067	1000 U
1,1,2-Trichloroethane	5	5	5	0.24	1000 U
1,1-Dichloroethane	31	160		2.4	1000 U
1,1-Dichloroethene	7	7	7	340	1000 U
1,2-Dibromoethane	0.05	0.05	0.05	0.0065	1000 U
1,2-Dichloroethane	5	5	5	0.15	1000 U
1,2-Dichloropropane	5	5	5	0.39	1000 U
1,4-Dioxane	6.4	32		0.67	200000 U
2-Butanone	4000	4000		7100	5000 U
2-Hexanone	11	44		47	5000 U
4-Methyl-2-Pentanone	2900	8200		2000	5000 U
Acetone	33000	92000		22000	5000 U
Acrylonitrile	0.72	3.7		0.045	20000 U
Benzene	5	5	5	0.41	1000 U
Bromochloromethane	90	90			1000 U
Bromodichloromethane	80	80		0.12	1000 U
Bromoform	80	80		8.5	1000 U
Bromomethane	10	10		8.7	1000 U
Carbon Disulfide	1500	6200		1000	1000 U
Carbon Tetrachloride	5	5	5	0.44	1000 U
Chlorobenzene	100	100	100	91	1000 U
Chlorodibromomethane	80	80		0.15	1000 U
Chloroethane	230	900		21000	1000 U
Chloroform	80	80		0.19	1000 U
Chloromethane	30	30		190	1000 U
cis-1,2-Dichloroethene	70	70	70	73	270 J
cis-1,3-Dichloropropene	6.6	26		0.43	1000 U
Ethylbenzene	700	700	700	1.5	1000 U
Methyl tert-butyl ether	20	20		12	1000 U
Methylene chloride	5	5		4.8	330 J B
Styrene	100	100	100	1600	1000 U
Tetrachloroethene	5	5	5	0.11	14000
Toluene	1000	1000	1000	2300	1000 U
trans-1,2-Dichloroethene	100	100	100	110	1000 U
trans-1,3-Dichloropropene	6.6	26		0.43	1000 U
Trichloroethene	5	5	5	2	10000
Vinyl Chloride	2	2	2	0.016	1000 U
Xylenes (Total)	10000	10000	10000	200	3000 U

Blank results = analyte not analyzed. U = Not detected. J = Organics; estimated. Inorganics; blank contamination. B = Organics; blank contamination. Inorganics; estimated. E = Inorganics: matrix interference.

Attachment 1

To

Addendum 5
Field Sampling Plan For Part 2 of the
Supplemental Groundwater Investigation
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, PA

Geologist's Field Log for MW-136A

Groundwater Sciences Corporation

Rock Classification Sheet

Project Harley Davidson Job. No. 10012.07 Sheet 1 of 4

Site Area MW136A / Rail Road Drill Hole No. MW136A

Contractor E. Chellbergers Driller Chris Classified By WBF Date 6/20/12 - 7/5/12 Coordinates N/S E/W

Depth	Drilling History: Run No.	Core Rec.	Remarks	Well Constr	Graphic Log	Geologic Characteristics: Description	Engineering Characteristics: Description (BS = Breathing Space)	Discont.	Groundwater: Static Water Level Time & Date
0						0'-6' Airknife cuttings/topsoil/ moderate Brown/Dry	BS @ 0' = 0.0 ppm		
							Diverter ~10' = 0.0 ppm		
10						6'-16' moderate Brown soil, Dry			
						16'-19' Same as above	Diverter ~20' = 0.0 ppm / BS = 0.0 ppm		
20						19'-21' same as above, little Rounded quartz			
						21'-22' Beginning of competent Bedrock/ weathered Bedrock	Diverter ~30' = 0.0 ppm / BS = 0.0 ppm		
30						31' competent Blue-grey limestone Dry			
						31'-40' Blue grey limestone Some Rounded quartz Dry	Diverter ~40' 0.0 ppm / BS = 0.0 ppm		
40						40'-50' Blue grey limestone Dry	Diverter ~50' 0.0 ppm / BS = 0.0 ppm		
50						50'-60' same as above	~60' 0.0 ppm / BS = 0.0 ppm		
60									

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Groundwater Sciences Corporation

Rock Classification Sheet

Project Harley Davidson Job. No. 10012.07 Sheet 2 of 4

Site Area MW136A / Rail Road Drill Hole No. MW136A

Contractor Eickelbergers Driller Chris Classified By VBF Date 6/20/12 - 7/5/12 Coordinates N/S E/W

Depth	Drilling History: Run No.	Core Rec.	Remarks	Well Constr	Graphic Log	Geologic Characteristics: Description	Engineering Characteristics: Description	Discont.	Groundwater: Static Water Level Time & Date
60						60'-66' same as above			
70						66'-68' weathered/ Broken Rock - no loss of circulation/ possible Fracture, Dry	~70' = 0.0 ppm / BS = 0.0 ppm		
						68'-70' blue grey limestone, trace quartz, Dry			
80						70'-80' Same as above	~80' 0.0 ppm / BS = 0.0 ppm		
						80'-90' same as above	~90' 0.0 ppm / BS = 0.0 ppm		
90						90'-97' same as above			
						97'-99' Broken Rock/ possible large fracture First water ~150 gpm	97' 0.0 ppm / BS = 0.0 ppm		
100						99'-110' blue grey/ Dark grey limestone, some quartz	100' = 0.0 ppm / BS = 0.0 ppm		
110							~110' = 0.0 ppm / BS = 0.0 ppm		
						110'-119' same as above water @ ~250 gpm			
120									

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Rock Classification Sheet

Project Harley Davidson Job. No. 10012.07 Sheet 3 of _____

Site Area mw136A / Mail Road Drill Hole No. mw136A

Contractor Ficklbergers Driller Chris Classified By VKBF Date 6/20/12 - 7/5/12 Coordinates N/S _____ E/W _____

Depth	Run No.	Core Rec.	Remarks	Well Constr.	Graphic Log	Description	Description	Discont.	Static Water Level Time & Date
			Drilling History			**Geologic Characteristics**	**Engineering Characteristics**		**Groundwater**
120			@120' lose drive shoe 6/28/12 - 7/2/12 spent pulling augers Back Borehole			120' limestone/blue grey water @ ~120 300 gpm	~120' water is 1.5ppm		
						120'-130' Same as above	~125' hole water is 79.2ppm BS = 0.5ppm Diverter = 15.5ppm		
130						130'-132' same as above	~136' BS = 0.0ppm Diverter = 1.7ppm		
						132'-136' Fracture increase in water volume ~300gpm			
140						136'-142' Blue grey limestone/ moderate Brown silt	~142' BS = 0.0ppm Diverter = 1.5 ppm		
						142'-144' same as above			
150						144'-147' Dark grey limestone w/ calcite veining trace rounded quartz			
						147'-148' same but Faster Drilling Rate	~152' = 0.0ppm @ diverter hose		
160						152'-152.5' possible Fracture			
						160' as above, less Calcite veining @ 162' ~300gpm	~161' 0.5ppm @ diverter		
170						160'-172' Dark grey limestone, little calcite veining, little quartz	~166' 1.2ppm @ diverter		
						172'-180' void - mustard Brown to white subrounded quartz gravel	~180' 1.5ppm @ diverter		
180									

Groundwater Sciences Corporation

Rock Classification Sheet

Project Harley Davidson Job. No. 10012.07 Sheet 4 of 4

Site Area MW136A / Rail Road Drill Hole No. MW136A

Contractor Eichelbergers Driller Chris Classified By UBF Date 6/20/12 - 7/5/12 Coordinates N/S E/W

Depth	Drilling History: Run No.	Core Rec.	Remarks	Well Constr	Graphic Log	Geologic Characteristics: Description	Engineering Characteristics: Description	Discont.	Groundwater: Static Water Level Time & Date
180						180' Broken limestone quartz gravel and clay	~182' = 0.0 ppm BS = 0.0 ppm		
						182' less water			
190						182'-190' Scattered Dark grey limestone and quartz gravel water @ ~50 gpm	~185' Driller exclaims odor BS = 2.0 ppm 24.3 ppm @ diverter ~190' 7.1 ppm @ diverter		
200						190'-195' same as above	~195' 0.1 ppm BS 1.7 ppm diverter		
						198' same as above	~198' Diverter head = 220 ppm BS = 23.6 ppm ↳ move drillers away upwind BS = 2.6 ppm		
210			water level @ 1300 gpm = 29.5' 7/5/12 attached hose to PID @ 25' water is 89.3 ppm 10 ppm bar TOC			200' same as above Limestone w/ some quartz			
						202' same as above			
220						Attempt last piece of 12" casing	200' Diverter head = 1050 ppm move drillers upwind		
			Attempt to drill w/ fans to direct odor			- 89.5 ppm immediate BS - 31.2" in 10' upwind BS	200' BS = 89.9 ppm shut down, call SMS Diverter head = 856 ppm		
			1530 7/5/12 after rig shut off still 50 ppm on drillers platform 5 minutes after shutdown			- 27.5 ppm in 20' upwind BS - 35.2 ppm 10' from Rolloff			
						100+ ppm near Rolloff shutdown as driller cannot safely get near rig to operate			

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Attachment 2

To

Addendum 5
Field Sampling Plan For Part 2 of the
Supplemental Groundwater Investigation
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, PA

Photographs of Sampling of MW-136A

Attachment 2

MW-136A Well Head

First water recovered from well.

First water recovered from well.

First water recovered from well after sitting for a half hour.

Attachment 2

Filled Sample Containers.

Kemmerer sampler.

Kemmerer sampler close up.

Kemmerer sampler close up.

Attachment 3

To

Addendum 5
Field Sampling Plan For Part 2 of the
Supplemental Groundwater Investigation
Former York Naval Ordnance Plant
1425 Eden Road, Springettsbury Township
York, PA

Description of Sampling Procedure in Field Log Book
For
MW-136A


Rite in the Rain®
ALL-WEATHER
ENVIRONMENTAL
FIELD BOOK
№ 550
Harley - Davidson
Log Book
#2

Location Harley - Bldg 58 Area Date 7/6/12 JBZ

Project / Client

0720 - LBG, KBF, JSR Arrive on-site. Begin at well MW-129. Collect WLs.
0950 Begin Purge of MW-127
1000 Sample MW-129
1042 - Collect Field Blank Sample
1100 - Collect Equip Rinsate Blank using DI water from SAIC for all but VOC analysis - Used lab supplied DI for VOC samples.
1125 Sample MW-127

1225 - Sample MW-126
1430 - Sample MW-128
Collect duplicate @ MW-128

1520 - Kait & JSR off site

Location HD MW-136A Date

Project / Client HD - MW-136A Sampling
Sunny Mid 80's

1115 - Arrive on Site AGM collocate Sample objective collect an unpurged sample from MW-136A
1118 - talk with KBF and Get key to gate at MW-136A.

1125 - Arrive at MW-136A

Stick up Length = 2.20'

Depth to H2O Below stick up = 26.98'

1130 - First tried a 1.25" plastic bailer. Sent to bottom really hard to tell if on bottom pulled bailer and very sediment / clay amount in bailer placed recovered water into a Mason jar and took pictures

10

Location HO MW-1364 Date 7/10/12

Project / Client

Sunny Mid to upper 80's

1145 - Tried the Kramer bailer and worked ok

1235 - Collect Sample HO-MW-1364-0101

1245 - Clean up remove bailers and rope put in garbage bag

1320 - Heading over to KBF for PID

1327 - Headspace of water from Mason Jar.

PID: 43 ppm - non shaken

580 ppm - Shaken

- took picture of jar
- took picture of vials

additional notes - had some issues w/ bailer closing had to send bailer down 3-times

1403 - off site

Location HO MW-1364 Date 7/10/12

Project / Client

Sunny mid to upper 80s

- Additional notes: well had a distinct odor, and all equipment that went down well had a slippery film on it.
- when bailer was lowered into well bailer rope became discolored and turn a brownish color.
- samples were put into pre-iced coolers.
- once returned to office placed preserved cooled samples in Lab Refridgerator.

Alan G. Miller Jr.
Alan G. Miller Jr.
7/10/12