ENCLOSURE 1

TECHNOLOGY QUICK REFERENCE SHEETS

TECHNOLOGY QUICK REFERENCE SHEET #1
CONE PENETROMETER/RAPID OPTICAL SENSING TOOL (CPT/ROST$^{\text{TM}}$)
TECHNOLOGY QUICK REFERENCE SHEET

General Commercial Information (Information valid as of December 2008)

Vendor Contact:
Fugro, Inc.
1 (713) 369-5500
http://www.fugro.com/index.asp

Vendor Information:
Worldwide supplier of geotechnical, geologic, and environmental analytical services.

Limitations on Performance:
Variations in soil matrix require instrument calibration to optimize performance.

Principle of Analytical Operation:

The Rapid Optical Screen Tool (ROST™), also called Laser-Induced Fluorescence (LIF) sensor, is deployed by Cone Penetration Testing (CPT) equipment to characterize stratigraphy and petroleum hydrocarbons in soil. ROST™ employs a laser that pulses light down a fiber optic cable to a sapphire window on the side of the CPT probe. This pulsed light causes petroleum hydrocarbons to emit fluorescence, which is transmitted in real-time to a detection system within the CPT work area.

Speciation of products is possible by altering the wavelength of the laser light, thereby enabling identification of site-specific contaminants. The shape of the resulting waveform can be compared with those from common petroleum products to identify and differentiate encountered hydrocarbon products.

Relative concentration and a spectral product fingerprint are presented continuously in real-time. Four peaks are presented on each waveform and represent the fluorescence intensity measured at each of the four monitored wavelengths: 340 nm, 390 nm, 440 nm and 490 nm. As fluorescence intensity is proportional to petroleum hydrocarbon concentration, ROST™ can effectively delineate the extent of affected soils.

Availability/Rates:

Available for scheduling through sub-contractor procurement process. Rate for mobilization and demobilization vary based on site location. Daily operation cost totals approximately $5000.00.

Power Requirements:

CPT / ROST™ drilling setup is truck mounted and therefore mobile and self-driven.

Instrument Weight and/or Footprint:

CPT/ ROST™ is deployed on a truck mounted direct push system. The forward portion of the truck-mounted laboratory is the push room. It contains the rods, hydraulic rams, and associated system controllers. The weight of the CPT truck provides a 20-ton static reaction force for advancing the probe rod into the ground, which allows the hydraulics to advance threaded-end steel rod into the ground at about one meter per minute. The rods, sensing probes, and sampling tools can be advanced to 50 meters or more in soil.

GENERAL PERFORMANCE INFORMATION

Known or Potential Interferences:
Other fluorescent materials, such as calcite, give a false positive reading or amplified signal.

Applicable Media/Matrices:
Tight clay and silt to sand sized soil matrix

Wastes Generated Requiring Special Disposal:

NONE

Analytes Measurable with Expected Detection Limits:

Light Non-Aqueous Phase Liquids: gasoline, diesel fuel, jet fuels, fuel oil, grease, and coal tar.

Site specific detection limits can vary from 50 to 1,000 mg/kg; determined by site conditions and petroleum products being analyzed.

Other General Accuracy/Precision Information:
Being an in-situ tool, precision is determined thru evaluation of results from multiple measurements or their respective calibration check samples. Accuracy is assessed qualitatively by measuring the agreement between 'detect/nondetect' determinations made by the instrument and corresponding confirmatory laboratory samples.

Rate of Throughput:
Push rate is one meter per minute. Fluorescence data collected once per second.

TECHNOLOGY QUICK REFERENCE SHEET #2
BEACON EMFLUX PASSIVE SOIL GAS SAMPLING SYSTEM
ANALYSIS BY GAS CHROMATOGRAPHY/ MASS SPECTROMETRY (GC/MS)

General Commercial Information (Information valid as of December 2008)

Vendor Contact:
Beacon Environmental Services, Inc.
323 Williams Street,
Bel Air, MD 21014
POC: Harry O'Neill (410-838-8780)
www.beacon-usa.com

Vendor Information:
Providers of Passive Soil Gas Sampling and Analytical Services

Limitations on Performance:
Soil gas results reported in mass (nanograms); therefore, data cannot be compared directly to risk based corrective action values reported in concentrations (ppbv or ug/m3)

Principle of Analytical Operation:
Beacon Environmental's passive soil gas (PSG) technology employs small, hydrophobic adsorbent samplers that are emplaced subsurface to adsorb compounds in soil gas without forcing the flow rate of soil gas. This yields a more representative sample than active soil gas methods. PSG samplers, that contain an equal measured amount of adsorbent, are typically placed in a grid pattern to simultaneously sample trace levels of compounds in soil gas that originate from contamination in the soil or groundwater. By sampling all locations at the same time, the temporal variations in soil-gas concentrations that are known to occur daily and even hourly are normalized. In addition, the spatial variability of contamination is better defined with a PSG survey because the lower sampling and analytical costs of the method allow for more locations to be sampled than normally would be with a fixed budget. PSGs methods have been demonstrated to be more sensitive and reproducible than active soil gas methods and are able to target a broad range of organic compounds from vinyl chloride to polynuclear aromatic hydrocarbons (PAHs).
Beacon Environmental analyzes PSG samples for organic compounds following EPA Method 8260B, utilizing thermal desorption-gas chromatography/mass spectrometry (TD-GC/MS) instrumentation. Results are based on a 5-point initial calibration and internal standards and surrogates are included with each analysis to provide representative and reliable data.

Availability/Rates:
Technology is offered through test kits for self-conducted testing. Resulting samples are submitted to Beacon Environmental for analysis following EPA Method 8260B.
Typical analytical costs, that include a report with tabular results and color isopleth maps showing the distribution of measured compounds across the survey grid, range from $150-$200 per sample analysis.

Power Requirements:
No electrically or mechanically powered tools are required to collect PSG samples unless advancing a hole through asphalt and/or concrete, where a small hammer drill and generator are then required to create an approx. one-inch diameter hole.

Instrument Weight and/or Footprint:
PSG samplers are provided in BeSure Sample Collection Kits, which are 12” x 10” x 24” and weigh approximately 10 pounds. Each Kit is custom prepared and can be equipped to collect up to 60 samples.

GENERAL PERFORMANCE INFORMATION

Known or Potential Interferences:
Sampling should not be conducted when soil vapor extraction systems are in operation.

Wastes Generated Requiring Special Disposal:

NONE
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Analytes Measurable with Expected Detection Limits:
Broad range of VOCs and SVOCs with method detection limits ranging from 1 to 25 nanograms.

Other General Accuracy/Precision Information:
CLP data packages available upon request

Rate of Throughput:
A two-person team can install more than 100 PSG samplers per day.

TECHNOLOGY QUICK REFERENCE SHEET #3
GORE-SORBER PASSIVE SOIL GAS SAMPLING SYSTEM
ANALYSIS BY GAS CHROMATOGRAPHY/ MASS SPECTROMETRY (GC/MS)

General Commercial Information (Information valid as of December 2008)

Vendor Contact:
W. L. Gore & Associates, Inc.
100 Chesapeake Blvd.
P.O. Box 10
Elkton, MD 219220010
Tel. 14103927600
Fax. 14105064870

Vendor Information:
Providers of Passive Soil Gas Sampling and Analytical Services

Limitations on Performance:
Soil gas results reported in mass (nanograms); therefore, data cannot be compared directly to risk based corrective action values reported in concentrations (ppbv or ug/m3)

Principle of Analytical Operation:
The GORE^{TM} Module is a patented, passive, sorbent-based sampler, which collects volatile and semi-volatile compounds present in air, soil gas and water. The module is constructed of a GORE-TEX® membrane tube. The membrane is chemically-inert, vapor permeable and waterproof. The membrane has over 80% open area and pore sizes that are 1,000 times larger than the largest semivolatile organic vapor molecule. Engineered adsorbents are housed within the GORE-TEX® tube. The adsorbents were selected due to their affinity for a broad range of organic compounds while having minimal water vapor uptake. The adsorbents are located near the bottom of an approximately one foot length of the membrane tube which is fashioned with a loop. The loop is used as a means of tying the module to a string to facilitate installation and retrieval. The membrane is hydrophobic and excludes liquid water, and does not retard vapor transfer, thus allowing VOC and SVOC vapors to penetrate the module freely and collect on the adsorbent material. This ability to protect the sorbent media from contact with ground and soil pore water, without retarding soil vapor diffusion, facilitates the application of the GORE^{TM} Survey in virtually any geological site condition, while protecting sample integrity. For site assessment applications, the suggested exposure time for soil gas sampling is 7 to 10 days. For vapor concentration reporting, the exposure time may be less depending on the known or suspected chemical concentrations.

Availability/Rates:
Technology is offered through test kits for self-conducted testing. Resulting samples are submitted to Gore for analysis following EPA Method 8260B.
Typical analytical costs, that include a report with tabular results and color isopleth maps showing the distribution of measured compounds across the survey grid, range from approximately $150-$200 per sample analysis.

Power Requirements:
No electrically or mechanically powered tools are required to collect PSG samples unless advancing a hole through asphalt and/or concrete, where a small hammer drill and generator are then required to create an approx. one-inch diameter hole.

Instrument Weight and/or Footprint:
PSG samplers are provided in BeSure Sample Collection Kits, which are 12” x 10” x 24” and weigh approximately 10 pounds. Each Kit is custom prepared and can be equipped to collect up to 60 samples.

GENERAL PERFORMANCE INFORMATION

Known or Potential Interferences:
Sampling should not be conducted when soil vapor extraction systems are in operation.

Wastes Generated Requiring Special Disposal:

NONE
.

Analytes Measurable with Expected Detection Limits:
Broad range of VOCs and SVOCs with method detection limits ranging from 1 to 25 nanograms.

Other General Accuracy/Precision Information:
CLP data packages available upon request

Rate of Throughput:
A two-person team can install more than 100 PSG samplers per day.

ENCLOSURE 2

SAMPLING DECISION LOGIC FOR THE DISSOLVED PHASE INVESTIGATION GRAB GROUNDWATER SAMPLING EFFORT

TABLE 4-1
SUMMARY OF DIRECT PUSH GROUNDWATER SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	PROPOSED GROUNDWATER SAMPLE DEPTH (ft bgs)	BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	ACTUAL SAMPLE DEPTH (ft bgs)	SAMPLING RATIONALE	COMMENTS
HROST-81	**6/22/2005**						
		42	**72.77**	**08/23/05**	**42 No/insufficient water for Sampling**	Interpreted Rand Stratum (assuming 20 ft levy)	
		46.5		**08/23/05**	**46.5 No/insufficient water for Sampling**	EPA Stratum groundwater "surface" (assuming 20 ft levy)	
		56		**08/23/05**	**56**	Main Sand groundwater surface (assuming 20 ft levy)	
		63		**08/23/05**	**63**	ROST response (interpreted interference) / Interpreted as coarser (grinding)	
		73		**08/23/05**	**73**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-82	**6/21/2005**						
		19.5	**72.04**	**08/29/05**	**19.5 No/insufficient water for Sampling**	Interpreted Rand Stratum	Only inspected for product in the EPA and at the surface of the Main Sand saturated zone based on ROST response. Product not observed in EPA. Product observed in Main Sand.
		30 INSPECT FOR PRODUCT		**08/29/05**	**30**	EPA Stratum groundwater "surface"	
		39 INSPECT FOR PRODUCT		**08/29/05**	**39**	Main Sand groundwater surface / ROST response / Interpreted as coarser (grinding)	
HROST-83	**6/22/2005**						
		41	**71.06**	**08/23/05**	**41 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. Product observed in Main Sand.
		56 INSPECT FOR PRODUCT		**08/23/05**	**02/25/00**	Main Sand groundwater surface (assuming 20 ft levy) / ROST response / Interpreted as coarser (grinding)	
HROST-84	**6/17/2005**						
		24	**72.96**	**06/19/05**	**24 No/Insufficient water for Sampling**	Interpreted permeable lens	
		30		**06/19/05**	**30.5**	EPA Stratum groundwater "surface"	

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HROST-84	**6/17/2005**	**39**	**72.96**	**06/19/05**	**39.5**	Main Sand groundwater surface / ROST response / Interpreted as coarser (grinding)	
		56		**06/19/05**	**56**	Vertical distribution / Interpreted as coarser (grinding)	
		73		**06/19/05**	**69**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-85	**6/21/2005**						
		13.5	**71.98**	**08/29/05**	**13.5** **No/insufficient Water for Sampling**	Interpreted N. Olive Stratum	Only inspected for product in the EPA and at the surface of the Main Sand saturated zone based on ROST response. Product observed in Main Sand.
		30 **INSPECT FOR PRODUCT**		**08/29/05**	**30** **No/insufficient water for Sampling**	EPA Stratum groundwater "surface"	
		41 **INSPECT FOR PRODUCT**		**08/29/05**	**41**	Main Sand groundwater surface / ROST response / Interpreted as coarser (grinding)	
HROST-86	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-87	**5/25/2005**						
		15.5	**86.35**	**06/29/05**	**15.5** **No/insufficient water for Sampling**	Interpreted N. Olive Stratum	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. Product not observed.
		23		**06/29/05**	**23** **No/insufficient water for Sampling**	Interpreted permeable lens	
		35 **INSPECT FOR PRODUCT**		**06/29/05**	**35.5**	Main Sand groundwater surface	
HROST-88	**6/8/2005**						
		13.5	**70.86**	**08/22/05**	**13.5** **No/insufficient water for Sampling**	Interpreted N. Olive Stratum / ROST response	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. Product observed in Main Sand.
		27		**08/22/05**	**27** **No/insufficient water for Sampling**	Interpreted Rand Stratum / ROST response	

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HROST-88	**6/8/2005**	**32 INSPECT FOR PRODUCT**	**70.86**	**08/22/05**	**32**	EPA Stratum groundwater "surface"	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. Product observed in
		42.5 INSPECT FOR PRODUCT		**08/22/05**	**42.5**	Main Sand groundwater surface / ROST response / Interpreted as coarser (grinding)	
HROST-89	**6/2/2005**						
		19	**60.04**	**06/14/05**	**19 No/insufficient water for Sampling**	Interpreted Rand Stratum	
		28		**06/14/05**	**28.5**	Main Sand groundwater surface	
		43		**06/14/05**	**43**	Interpreted as coarser (grinding)	
		59		**06/14/05**	**61**	Max. achievable equipment depth	
HROST-90	**6/22/2005**						
		32 INSPECT FOR PRODUCT	**69.29**	**08/22/05**	**34.5**	Main Sand groundwater surface / ROST response	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. No product observed.
HROST-91	**6/21/2005**						
		12.5	**60.3**	**08/22/05**	**12.5 No/insufficient water for Sampling**	Interpreted N. Olive Stratum / ROST response	
		25		**08/22/05**	**25**	Interpreted Rand Stratum / ROST response	
		35		**08/22/05**	**35**	EPA Stratum groundwater "surface"	
		43 INSPECT FOR PRODUCT		**08/22/05**	**43**	Main Sand groundwater surface / ROST response / Interpreted as coarser (grinding)	
HROST-92	**6/5/2005**						
		22	**59.18**	**08/24/05**	**22 No/insufficient water for Sampling**	Interpreted Rand Stratum	
		30		**08/24/05**	**30 No/insufficient water for Sampling**	Main Sand groundwater surface	
		44		**08/24/05**	**44**	Vertical distribution/ Interpreted as coarser (grinding)	

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HROST-92	**6/5/2005**	**59**	**59.18**	**08/24/05**	**59**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-93	**6/17/2005**						
		22.5	**62.0**	**06/19/05**	**22.5 No/insufficient water for Sampling**	Interpreted permeable lens	
		30		**06/19/05**	**30**	Main Sand groundwater surface	
		46		**06/19/05**	**46**	Vertical distribution / Interpreted as coarser (grinding)	
		62		**06/19/05**	**60**	Max. achievable equipment depth / ROST response (Interpreted interference) / Interpreted as coarser (grinding)	
HROST-94	**6/2/2005**						
		12	**64.96**	**06/15/05**	**12 No/insufficient water for Sampling**	Interpreted N. Olive Stratum	
		19.5		**06/15/05**	**21**	Interpreted Rand Stratum	
		30		**06/15/05**	**32**	Main Sand groundwater surface	
		47		**06/15/05**	**47**	Vertical distribution	
		62.5		**06/15/05**	**61**	Max. achievable equipment depth / ROST response (Interpreted interference) / Interpreted as coarser (grinding)	
HROST-95	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-96	**6/2/2005**						
		19	**59.71**	**06/15/05**	**19 No/insufficient water for Sampling**	Interpreted Rand Stratum	
		29		**06/15/05**	**30.5**	Main Sand groundwater surface	
		44		**06/15/05**	**44**	Vertical distribution	
		59		**06/15/05**	**59**	Max. achievable equipment depth / ROST response (interpreted interference) / Interpreted as coarser (grinding)	

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HROST-97	**6/16/2005**						
		25	**63.78**	**06/18/05**	**See comments**	Main Sand groundwater surface	Attempts to collect a sample at 25 ft bgs, 28 ft bgs and 30 ft bgs were unsuccessful.
		43		**06/18/05**	**43**	Vertical distribution	
		60		**06/18/05**	**60**	Max. achievable equipment depth / ROST response (interpreted interference) / Interpreted as coarser (grinding)	Attempts to collect a sample at 25 ft bgs, 28 ft bgs and 30 ft bgs were unsuccessful.
HROST-98	**6/2/2005**						
		21	**50**	**06/16/05**	**21 No/insufficient water for Sampling**	Interpreted Rand Stratum	
		29		**06/16/05**	**29.5**	Main Sand groundwater surface	
		40		**06/16/05**	**40**	Vertical distribution	
		50		**06/16/05**	**50**	Max. achievable equipment depth	
HROST-99	**6/5/2005**						
		32	**64.04**	**08/20/05**	**32.5**	Main Sand groundwater surface / ROST response	
		45.5		**08/20/05**	**45.5**	Vertical distribution	
		58.5		**08/23/05**	**58.5**	ROST response (interpreted interference) / Interpreted as coarser (grinding)	
		64		**08/23/05**	**See comments**	Max. achievable equipment depth / Interpreted as coarser (grinding)	Equipment damaged-could not obtain sample at 64 ft bgs
HROST-100	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-101	**6/16/2005**						
		19	**71.58**	**06/17/05**	**19 No/insufficient water for Sampling**	Interpreted Rand Stratum	
		27		**06/17/05**	**27.5**	Main Sand groundwater surface	
		43		**06/17/05**	**43**	Vertical distribution	
		61		**06/17/05**	**61.5**	ROST response (interpreted interference) / Interpreted as coarser (grinding)	
		72		**06/17/05**	**72**	Max. achievable equipment depth	
HROST-102	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.

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HROST-103	**6/21/2005**						
		26	**58.46**	**08/21/05**	**26 No/insufficient water for Sampling**	Main Sand groundwater surface	
		43		**08/21/05**	**43**	Vertical distribution	
		59		**08/21/05**	**57.5**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-104	**6/5/2005**						
		31	**85.17**	**08/20/05**	**34**	Main Sand groundwater surface	Unable to readvance equipment to maximum depth to collect sample after completion of initial boring at this location
		47		**08/20/05**	**47**	Vertical distribution	
		62.5		**08/20/05**	**62.5**	ROST response (interpreted interference) / Interpreted as coarser (grinding)	
		85		**08/21/05**	**69**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-105	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-106	**6/21/2005**						
		31	**71.39**	**08/19/05**	**33.5**	Main Sand groundwater surface	
		47		**08/19/05**	**47**	Vertical distribution / Interpreted as coarser	
		64.5		**08/19/05**	**64.5**	ROST response (interpreted interference) / Interpreted as coarser (grinding)	
		71.5		**08/19/05**	**72**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-107	**6/5/2005**						
		32	**65.02**	**08/21/05**	**32**	Main Sand groundwater surface	
		36		**08/21/05**	**38**	ROST response (interpreted interference)	
		44		**08/21/05**	**46**	Vertical distribution	
		58.5		**08/21/05**	**59**	Interpreted as coarser (grinding)	
		65		**08/21/05**	**63.5**	Max. achievable equipment depth	
HROST-108	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-109	**6/5/2005**						
		20	**53.28**	**06/29/05**	**20 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	
		32		**06/29/05**	**33**	Main Sand groundwater surface	
		42.5		**06/29/05**	**42.5**	Vertical distribution	

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HROST-109	**6/5/2005**	**53**	**53.28**	**06/29/05**	**53.5**	Max. achievable equipment depth	
HROST-110	**6/4/2005**						
		16.5	**72.11**	**06/30/05**	**16.5 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	
		31		**06/30/05**	**31.5**	Main Sand groundwater surface	
		49		**06/30/05**	**49.5**	Vertical distribution	
		57		**06/30/05**	**57.5**	Interpreted as coarser / below silty clay lens	
		72		**06/30/05**	**71.5**	Max. achievable equipment depth / Interpreted as coarser	
HROST-111	**6/4/2005**						
		32	**68.76**	**06/30/05**	**32.5**	Main Sand groundwater surface	
		43		**06/30/05**	**43.5**	Vertical distribution	
		56		**06/30/05**	**56.5**	Below silty clay lens	
		67.5		**06/30/05**	**67.5**	Max. achievable equipment depth / ROST response (interpreted interference) / Interpreted as coarser (grinding)	
HROST-112	**6/4/2005**						
		19.5	**68.83**	**08/19/05**	**19.5 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	
		30		**08/19/05**	**30**	Main Sand groundwater surface	
		43		**08/19/05**	**43**	Vertical distribution	
		55		**08/19/05**	**55**	Beneath potential "edge" of silty clay lens in HROST-111	
		69		**08/19/05**	**69**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-113	**6/20/2005**						
		11.5	**73.49**	**06/28/05**	**11.5 No/insufficient water for Sampling**	Interpreted N.Olive Stratum / ROST response	Only inspected for product at the Main Sand groundwater surface per Work Plan and based on ROST response. Product observed.
		21		**06/28/05**	**21 No/insufficient water for Sampling**	Interpreted Rand Stratum / ROST response	

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The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	PROPOSED GROUNDWATER SAMPLE DEPTH (ft bgs)	BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	ACTUAL SAMPLE DEPTH (ft bgs)	SAMPLING RATIONALE	COMMENTS
HROST-113	6/20/2005	30 INSPECT FOR PRODUCT	73.49	06/28/05	34	Main Sand groundwater surface	
HROST-114	6/20/2005						
		21	74.08	06/28/05	21 No/insufficient water for Sampling	Interpreted Rand Stratum / ROST response	Only inspected for product at the Main Sand groundwater surface per Work Plan and based on ROST response. Product observed.
		31 INSPECT FOR PRODUCT		06/28/05	35	Main Sand groundwater surface / ROST response	
HROST-115	6/27/2005						
		20.5 INSPECT FOR PRODUCT	70.01	06/29/05	20.5 No/insufficient water for Sampling	ROST response / Interpreted Main Silt as being potentially water bearing	Only inspected for product at the Main Sand groundwater surface per Work Plan and based on ROST response. No product observed.
		32 INSPECT FOR PRODUCT		06/29/05	32.5	Main Sand groundwater surface	
HROST-116	6/20/2005						
		20	67.06	06/28/05	20 No/insufficient water for Sampling	ROST response / Interpreted Main Silt as being potentially water bearing	Only inspected for product at the Main Sand groundwater surface per Work Plan and based on ROST response. No product observed.
		31 INSPECT FOR PRODUCT		06/28/05	31	Main Sand groundwater surface / ROST response	
HROST-117	6/27/2005						
		31 INSPECT FOR PRODUCT	64.04	06/29/05	32	Main Sand groundwater surface / ROST response	Only inspected for product at the Main Sand groundwater surface per Work Plan and based on ROST response. No product observed.
HROST-118	6/21/2005						
		32.5	69.42	07/01/05	33	EPA groundwater "surface" / ROST response	
		41		07/01/05	41.5	Main Sand groundwater surface/ ROST response / Interpreted as coarser (grinding)	
		55		07/01/05	55.5	Vertical distribution / Interpreted as coarser (grinding)	
		69.5		07/01/05	69.5	Max. achievable equipment depth / Interpreted as coarser (grinding)	

TABLE 4-1
SUMMARY OF DIRECT PUSH GROUNDWATER SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	PROPOSED GROUNDWATER SAMPLE DEPTH (ft bgs)	BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	ACTUAL SAMPLE DEPTH (ft bgs)	SAMPLING RATIONALE	COMMENTS
HROST-119	**6/4/2005**						
		22.5	**66.73**	**08/17/05**	**22.5 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	
		31		**08/17/05**	**31**	Main Sand groundwater surface	
		41		**08/17/05**	**41**	Vertical distribution / ROST response (interpreted interference)	
		55		**08/17/05**	**55**	Interpreted as coarser / below silty clay lens	
		67		**08/17/05**	**70**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-120	**6/4/2005**						
		18.5	**65.29**	**08/18/05**	**18.5 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	
		31		**08/18/05**	**31**	Main Sand groundwater surface	
		45		**08/18/05**	**45**	Vertical distribution / below silty clay lens	
		57		**08/18/05**	**57**	ROST response (organic clay)	
		65		**08/18/05**	**65**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-121	**6/4/2005**						
		32	**71.98**	**08/18/05**	**32**	Main Sand groundwater surface	
		43		**08/18/05**	**43**	Vertical distribution	
		56		**08/18/05**	**56**	Interpreted as coarser	
		68		**08/18/05**	**68**	Near max. achievable equipment depth / Interpreted as coarser (grinding) / ROST response (interpreted interference)	
HROST-122	**8/15/2005**						
		22	**70.08**	**08/15/05**	**22 No/insufficient water for Sampling**	Main Silt interpreted to potentially be water bearing	Installed in area of known free product to obtain geologic data. Only inspected for product at the Main Sand groundwater surface based on ROST response. Product observed.
		36 INSPECT FOR PRODUCT		**08/15/05**	**36.0**	Main Sand groundwater surface	

TABLE 4-1
SUMMARY OF DIRECT PUSH GROUNDWATER SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	PROPOSED GROUNDWATER SAMPLE DEPTH (ft bgs)	BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	ACTUAL SAMPLE DEPTH (ft bgs)	SAMPLING RATIONALE	COMMENTS
HROST-123	**6/27/2005**						
		27	**76.9**	**06/29/05**	**27.5**	Main Silt interpreted to potentially be water bearing	Only inspected for product at the surface of the Main Sand saturated zone based on ROST response. Product observed in Main Sand.
		31 **INSPECT FOR PRODUCT**		**06/29/05**	**32.5**	Main Sand groundwater surface	
HROST-124	**6/27/2005**						
		31	**58.13**	**06/28/05**	**31.5**	Main Sand groundwater surface	
		41		**06/28/05**	**41.5**	ROST response (interpreted interference) / Vertical distribution	
		58		**06/28/05**	**58.5**	Max. achievable equipment depth / Interpreted as coarser (grinding)	
HROST-125	**9/16/2005**						
		NA	**69.09**	**NA**	**NA**	**NA**	Installed in area of known free product for LNAPL remedy selection
HROST-126	**8/29/2005**						
		NA	**70.08**	**NA**	**NA**	**NA**	Installed in area of known free product for LNAPL remedy selection
HROST-127	**NA**						
		NA	**NA**	**NA**	**NA**	**NA**	Awaiting railroad access.
HROST-128	**8/29/2005**						
		NA	**60.43**	**NA**	**NA**	**NA**	Installed in area of known free product for LNAPL remedy selection
HROST-129	**8/30/2005**						
		NA	**68.04**	**NA**	**NA**	**NA**	Installed in area of known free product for LNAPL remedy selection
HROST-130	**9/16/2005**						
		NA	**80.57**	**NA**	**NA**	**NA**	Installed in area of known free product for LNAPL remedy selection

NOTES: bgs = Below ground surface
NA = Not applicable - no water or LNAPL present
All samples collected for analysis of BETX and MTBE

TABLE 4-1
SUMMARY OF DIRECT PUSH GROUNDWATER SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	GROUNDWATER SAMPLE DEPTH (ft bgs)	CPT/ROST BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	SAMPLING RATIONALE
HP-01	**5/23/2005**				
		25		**05/26/05**	Main Sand groundwater surface
		50		**05/26/05**	"ROST peak" (interpreted interference)
		62	**65.22**	**05/26/05**	Maximum achievable equipment depth/"ROST peak'
HP-02	**5/24/2005**				
		31		**05/31/05**	Main Sand groundwater surface
		45		**05/31/05**	Interpreted as coarser (grinding)
		62	**62.73**	**05/31/05**	Maximum achievable equipment depth
HP-03	**5/24/2005**				
		31		**05/27/05**	Main Sand groundwater surface
		48		**05/27/05**	Vertical Distribution
		61	**61.55**	**05/27/05**	Maximum achievable equip. depth/Interpreted as coarser (grinding)
HP-04	**5/24/2005**				
		32		**05/26/05**	Main Sand groundwater surface
		46 (45)		**05/26/05**	Vertical distribution
		60	**60.76**	**05/26/05**	Maximum achievable equipment depth
HP-05	**5/23/2005**				
		24-24.5		**05/25/05**	Main Sand groundwater surface
		40		**05/25/05**	Interpreted as coarser (grinding)
		55		**05/25/05**	"ROST peak" (interpreted interference)
		80.5 (81)	**81.82**	**05/26/05**	Maximum achievable equipment depth/Interpreted as coarser (grinding)
HP-06	**5/23/2005**				
		26		**05/27/05**	Main Sand groundwater surface
		42		**05/27/05**	Interpreted as coarser (grinding)
		62		**05/27/05**	"ROST peak" (interpreted interference)
		74	**74.73**	**05/27/05**	Maximum achievable equipment depth
HP-07	**5/24/2005**				
		28		**05/31/05**	Main Sand groundwater surface
		42		**05/31/05**	Interpreted as coarser (grinding)
		58	**58.66**	**05/31/05**	Maximum achievable equipment depth

TABLE 4-1
SUMMARY OF DIRECT PUSH GROUNDWATER SAMPLING LOCATIONS

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

LOCATION	BORING COMPLETION DATE	GROUNDWATER SAMPLE DEPTH (ft bgs)	CPT/ROST BORING TERMINATION DEPTH (ft bgs)	GROUNDWATER SAMPLING DATE	SAMPLING RATIONALE
HP-08	**5/24/2005**				
		28		**06/01/05**	Main Sand groundwater surface
		47		**06/01/05**	Interpreted as coarser (grinding)
		63	**63.78**	**06/01/05**	Maximum achievable equipment depth
HP-09	**5/24/2005**				
		29		**06/01/05**	Main Sand groundwater surface
		46		**06/01/05**	Interpreted as coarser (grinding)
		63	**63.78**	**06/01/05**	Maximum achievable equipment depth

NOTES: bgs = Below ground surface
() around a sample depth identifies the original proposed sampling depth.

ENCLOSURE 3

U.S. EPA SUGGESTIONS FOR APPLICATION OF THE TRIAD AT THE HARTFORD PLUME SITE

Considerations for Applying the Triad Approach
Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

United States
Environmental Protection
Agency

Office of Solid Waste and
Emergency Response
(5102G)

EPA 542-R-06-008
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Considerations for Applying the Triad Approach
Hartford Area Hydrocarbon Plume Site
Hartford, Illinois

Prepared by
U.S. Environmental Protection Agency
Office of Superfund Remediation and Technology Innovation
Superfund Triad Support Team

In cooperation with:
U.S. Environmental Protection Agency Region V

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Foreword

This document is one in a series designed to provide information about innovative technologies and approaches that support less costly and more representative site characterization. These documents include reports about new technologies as well as novel applications of familiar tools or processes. They are prepared to offer operational experience and to communicate information about ways to improve the efficiency of data collection at hazardous waste sites.

Acknowledgments

Special acknowledgement is given to EPA Region 5, other federal and state staff and remediation professionals, and to the staff of Tetra Tech EM Inc. for their support in preparing this document.

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ACRONYMS AND ABBREVIATIONS

AOC	Administrative Order on Consent
bgs	Below ground surface
CCD	Charged-coupled device
Clayton	Clayton Group Services
CPT	Cone penetrometer test
CSM	Conceptual site model
DNAPL	Dense nonaqueous phase liquid
EPA	U.S. Environmental Protection Agency
Hartford site	Hartford Area Hydrocarbon Plume
HSA	Hollow stem auger (HSA)
HS	Heavy sheen
HWG	Hartford Working Group
IEPA	Illinois Environmental Protection Agency
ITRC	Interstate Technology Regulatory Council
LED	Light-emitting diode
LIF	Laser induced fluorescence
mg/m^3	Milligrams per cubic meter
MIP	Membrane interface probe
MS	Moderate sheen
NAPL	Nonaqueous phase liquid
NS	No sheen
OSC	On-scene coordinator
OSRTI	Office of Superfund Remediation and Technology Innovation
PAH	Polynuclear aromatic hydrocarbons
PID	Photoionization detector
Praxis	Praxis Environmental Technologies, Inc.
RCRA	Resource Conservation and Recovery Act
ROI	Radius of influence
ROST	Rapid Optical Screening Tool
scfm	Standard cubic feet per minute
SS	Slight sheen
START	Superfund Technical Assessment and Response Team
SVE	Soil vapor extraction
TCE	Trichloroethylene
Tetra Tech	Tetra Tech EM Inc.

UVF	Ultraviolet fluorescence
VMP	Vapor monitoring points
VOC	Volatile organic compound

1.0 INTRODUCTION

Tetra Tech EM Inc. (Tetra Tech) prepared the following work products and related suggestions on integration of the principles of the Triad approach at the Hartford Area Hydrocarbon Plume (the Hartford site) in Hartford, Illinois. Tetra Tech prepared this document through its support to the U.S. Environmental Protection Agency (EPA) Office of Superfund Remediation and Technology Innovation (OSRTI), and in cooperation with the Superfund Technical Assessment and Response Team (START) and EPA Region 5. Intermittent fires related to vapor intrusion and odor complaints at the Hartford site have affected residences throughout the Village of Hartford. Subsequent investigations by a group of potentially responsible parties, known as the Hartford Working Group (HWG), have detected extensive hydrocarbon contamination beneath the site. The suggestions provided in this report are intended to provide input to the HWG so characterization and remedial design can be optimized.

1.1 THE TRIAD APPROACH

The START project team submitted a request for OSRTI to evaluate the planned approach for field activities to be conducted at the Hartford site, and in particular, to review the results obtained using a cone penetrometer test (CPT) equipped with the Rapid Optical Screening Tool (ROST). OSRTI authorized Tetra Tech to provide a set of comprehensive suggestions about the project as a whole, keeping in mind the most urgent needs at the Hartford site and the principles of the Triad approach. This assignment was based on review of on-going project documents and subsequent discussions with the Region 5 on-scene coordinators (OSC) and State of Illinois Environmental Protection Agency (IEPA) representatives. The suggestions provided are intended as a starting point for refining the existing conceptual site model (CSM) for the Hartford site so that an effective remedy can be designed and implemented as quickly as possible.

The Triad approach emphasizes the need for an aggressive, up-front systematic planning process to integrate dynamic work strategies and real-time measurements during site characterization and remedial design to streamline the cleanup process. The Triad approach also stresses a continuously refined, interactive process that relies on innovative technologies and strategies to increase the weight of evidence generated to support decision-making at environmental cleanup sites.

OSRTI is promoting the Triad approach as a means for streamlining site characterizations and remediation to improve cleanup decisions at Superfund, Resource Conservation and Recovery Act

(RCRA), Brownfields, and other revitalization sites. The Triad approach is becoming more widely accepted and used by many EPA regions, states, and local governments. The principles and tools used with the Triad approach have been demonstrated to reduce schedules and budgets required to reach project milestones at many sites across the country. OSTRI has forged partnerships with the U.S. Department of Energy, the U.S. Army Corps of Engineers, and the Interstate Technology Regulatory Council (ITRC). These partnerships have been forged to document use of the Triad approach at small and large sites to expedite reaching project milestones more quickly and economically while increasing the level of confidence in project decisions.

1.2 BACKGROUND

The Hartford site is located in the northern portion of the Village of Hartford, Illinois, along the historical edges of the active Mississippi River channel (Figure 1). Activities are currently being carried out at the Hartford site to mitigate hazards from vapor intrusion identified within the limits of the Village of Hartford. From 1966 through 1990, intermittent house fires occurred along East Watkins Street, East Date Street, and several other streets. More recently, homeowners have registered complaints about petroleum hydrocarbon odors that triggered the need to temporarily relocate the occupants of several households. Because of the concern related to petroleum hydrocarbon odor, EPA identified project objectives that included implementing effective short- and long-term vapor mitigation measures and delineating free phase and vapor phase hydrocarbons to support final remediation objectives.

A series of documents were reviewed in preparing this report. The documents Tetra Tech reviewed primarily address the geology and hydrogeology of the site, characterization and delineation of hydrocarbon impacts at the site, and mitigation of vapor intrusion. The suggestions provided in this report were prepared based on information obtained from references listed in the bibliography provided as part of this report. Clayton Group Services (Clayton) also provided valuable support in terms of raw data and files required to prepare these suggestions.

Tetra Tech's OSRTI support staff became involved at the Hartford site in February 2004. The data provided in this revised report were updated to include results available as of February 2006. Overall conclusions presented in this report have also been updated based on more recent results and reports.

In support of the project team's objectives as stated in various work plans, Tetra Tech compiled the attached figures to support development of a refined CSM for the Hartford site. A Triad systematic planning process relies heavily on the CSM as the primary tool to focus activities where they can provide the greatest value to decision-making and be used to identify data gaps, which may need to be filled to achieve project milestones. The CSM is also used to identify an optimal sequence of activities.

Many practitioners are accustomed to using specific types of CSMs, such as a geological or hydrogeologic CSM or a pathway-receptor diagram as is often used by the risk assessment community. Triad practitioners use these forms of a CSM, along with others. A Triad-type CSM also identifies the decision logic: a systematic process to identify and refine project decisions. Factors such as source geochemistry, the nature of any possible remedies, and practical considerations are weighed in establishing the most efficient and logical sequence of activities needed to address project issues and reach project milestones.

1.3 PROJECT OBJECTIVES

Tetra Tech has identified the following project requirements based on a review of the Administrative Order on Consent (AOC) and on discussions with the project team:

- "Abate any imminent and substantial threat to the public health or welfare in the area. More specifically any threat to fish, shellfish and wildlife, public and private property, habitat, and other living and nonliving natural resources" (Article 3 of the order).
- "Specific attention is to be paid to the investigation of the source and extent of contamination, implementation of EPA approved interim measures, and design of an active recovery system designed to abate the on-going threat of discharge to the Mississippi River" (Article 38 of the order).
- "Conduct a vapor extraction pilot test and provide options for improving and extending the existing vapor control system" (Article 43 of the order).
- "Implement a sentinel well monitoring program" (Article 47 of the order).
- "Establish the extent of dissolved phase hydrocarbons" (Article 51 of the order).
- "Identify preferential pathways such as utilities and pipelines and establish the extent of vapor phase and free phase hydrocarbons which could be impacting human health and the environment at the Hartford site" (Article 52 of the order).

1.4 PRINCIPAL STUDY QUESTIONS

Tetra Tech developed the following principal study questions based on the stated objectives in the AOC and on review of historical data available for the Hartford site.

1. What are the key, geologic, hydrogeologic, source, and or preferred pathway related factors that might control:

    (a) The release of petroleum fuel related vapors that pose a potential threat to human health and the environment.
    (b) Migration of free product and dissolved phase contamination in and away from potential source areas?

2. How can these factors be used collaboratively along with design optimization tools to expedite installation of:

    (a) A vapor mitigation system?
    (b) A free product extraction system?
    (c) A release control and monitoring system for groundwater and surface water?

The following sections of this report examine elements of the preliminary CSM for the Hartford site and demonstrate how they relate to the principal study questions. The intent is to identify physical characteristics of the Hartford site that can facilitate planning additional investigations. As the preliminary CSM is refined, the scale of heterogeneity and variation in environmental conditions can be understood in sufficient detail as to support implementation of an effective remedy. In addition, a mature CSM will allow the project team to select appropriate sample locations and sample densities and apply innovative strategies in the most efficient way possible given the physical constraints of the project.

2.0 PRELIMINARY CONCEPTUAL SITE MODEL

Efforts to mitigate vapors and other adverse environmental conditions at the Hartford site will be guided by the project team's understanding of several key elements of the preliminary CSM. These elements of the preliminary CSM include, but may not be limited to, the following:

- Geology and hydrogeology beneath the Hartford site
- Thickness of free product and dissolved phase contamination and proximity to preferred pathways
- Chemistry and geochemistry of the free product and dissolved-phase contamination

Limited data are available on the chemistry and geochemistry of the contamination beneath the Hartford site; therefore, interpretive efforts focus on the relationships among the geology, hydrology, and contaminant distributions across and surrounding the Hartford site. Tetra Tech attempted to link potential preferred migration pathways with these factors to identify when and where additional investigation might be warranted. However, details on the configurations of underground utilities or sewer lines were not available when these suggestions were developed; therefore, this link was not fully developed. General suggestions are provided on the type and quantity of chemical and geochemical data needed to support implementation of an effective remedy at the site.

Tetra Tech has developed work products based on the data provided in the references associated with this report. The work products include a generalized regional cross section (Figure 2) to show the approximate relationship between the Cahokia Alluvium and the underlying Main Sand. The Cahokia Alluvium contains silty or clayey sand units of limited extent, such as the North Olive, Rand, and EPA Strata, as well as fine-grained silty clay layers. The position of the Hartford site on the cross section in Figure 2 shows the potential for hydrocarbon contamination to affect both surface water and potential drinking water aquifers adjacent to the site.

Figure 3 is an enlargement of the Hartford site area that shows the general relationships between specific sand units known to be present. The estimated groundwater flow direction is shown to be toward the Mississippi River and may vary significantly between individual sand units at the Hartford site.

Based on the limited piezometric surface data that are currently available, the direction of groundwater flow adjacent to the Mississippi River near the Hartford site can trend from directly toward the river to directly away from the river. The direction of groundwater flow may fluctuate in response to changes in the river's elevation and local groundwater pumping. Significant changes in direction of flow between aquifers over time is demonstrated by the potentiometric surface maps provided in *"Work Plan - Dissolved Phase Groundwater Investigation, The Hartford Area Hydrocarbon Plume Site"* (Clayton 2004d) Figures 2-5 through 2-10.

Figure 4 is a CSM prepared by compiling data from the *"FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois"* (Clayton 2004b) and results from the *"Site Wide Free Product Investigation"* (Clayton 2006b). Figure 4 shows site-specific geological relationships and the extent of hydrocarbon contamination identified along select cross sections indicated on the block layout shown in the upper left-hand corner. The blocks extend beyond the boundaries of the Hartford site to show expected geologic relationships; however, data were not available for the areas surrounding the Hartford site when this report was generated. Although CSMs of this type are useful, they also introduce an element of spatial bias in that only select cross-sections can be presented. This same bias is not as significant in the isopach and top of formation maps discussed later in this report and used for understanding key geologic, hydrogeologic, and contaminant relationships.

2.1 CURRENTLY IDENTIFIED REGIONAL DATA GAPS

Based on information provided by Clayton, free product does appear to be moving off-site to the northwest. Data available for the site have been improved over the last 18 months. Figure 5 shows the locations where ROST data have been collected. The extent of the free product plume and the associated dissolved-phase plume have been adequately delineated in terms of the nature and extent, but additional characterization may be necessary to finalize system design and optimization. Significant data gaps remain, particularly in the design of optimized soil vapor extraction and product removal systems.

2.2 GENERAL SUGGESTIONS FOR FILLING REGIONAL DATA GAPS

ROST data have been collected in upgradient source areas from beneath the Premcor refinery (Clayton 2006b), but similar investigations are needed for other surrounding properties to assure that any proposed remedies are reliable. Historical information on upgradient sources should also be compiled as available.

Data for soil and groundwater in down gradient areas have been used to delineate the extent of the dissolve phase associated with the product plume (Clayton 2006a). A higher density of data is needed around source areas where geologic conditions are favorable for vapor intrusion and product removal is possible to improve the efficiency of the soil vapor extraction (SVE) and product removal systems. The specific locations and types of data suggested for collection in and immediately surrounding the Hartford site are also discussed in more detail later in this report.

2.3 GEOLOGY, HYDROGEOLOGY, AND CONTAMINANT DISTRIBUTIONS

According to "*Sedimentary Environments: Processes, Facies and Stratigraphy,"* (Reading 1996), the depositional environment beneath the Hartford site can be thought of as a mixed load river avulsion zone. The Hartford site is located in an area where the Mississippi River has shifted its position in recent geologic time, in a process referred to as an "avulsion" of the river channel. An avulsion occurs when the river breaches its natural levee and cuts a new channel in the floodplain. The river bed load is called a mixed load because widely variable sediment grain size — ranging from finer-grained levee deposits to coarse sands — can be deposited across a broad avulsion band such as is shown in Figure 6. These fluvial processes create a highly heterogeneous sediment package.

The typical sedimentary sequence includes thick sequences of sheet-like channel sands, lenticular splay sands, fine-grained levee, and floodplain deposits. Figure 7 depicts the variety of deposits that are generally associated with fluvial deposits in a major river avulsion band. Figures 6 and 7 are schematic diagrams and are not site-specific, but near-surface fine-grained sediments generally grade with depth to massive sands units. Although the cross section shown in Figure 7 is theoretical, site-specific cross sections provided in the *"FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois"* (Clayton, 2004b) seem to concur with this generalized geologic sequence. Keeping in mind the two principal study questions, this geologic setting suggests that better delineation of fine-grained sediments will yield important information on locations where vapors might be expected to be present at the highest concentrations. Fine-grained sediments can be substantial barriers to vapor-phase, as well as free-phase and dissolved–phase, hydrocarbons. Finer-grained sediments can also act as long-term source locations and pose significant challenges to source mitigation.

Tetra Tech's experience with free-product sites suggests that addressing coarse-grained contaminated aquifers without also addressing contamination in fine-grained sediments will reduce the effectiveness of a remedy. For example, applying high vacuums to coarse-grained sands can remove substantial quantities of free product from the sand units. However, once the system is turned off, residual contamination bound to fine-grained sediment units can re-contaminate the aquifer.

Based on the schematic diagrams shown in Figure 6 and 7, sands tend to thicken and merge toward the present-day river and can be in direct hydraulic communication with the river. Therefore, dissolved phase contamination may be discharged to the river. Thick sections of more fine-grained materials or levee deposits are also expected around the edges of the former channel sand deposits. Currently, vertical and lateral piezometric, geologic, and contaminant distribution data are insufficient, both inside and outside of the Hartford site boundaries, to begin to construct a detailed regional CSM adequate to address the requirements stipulated in the AOC for the Hartford area.

2.3.1 ROST Results, Contaminant Transport, and Source Areas

The response of the ROST to petroleum hydrocarbon contamination can be roughly correlated with the presence or absence of product (Tetra Tech 2004). With this in mind, the ROST responses (as shown as red, yellow, green and blue color bands depending on the range of hydrocarbons) in Figure 4 can be examined to distinguish primary sources from areas where contaminant migration may have resulted from transport of free-phase hydrocarbon along the top of the water table. Product source areas are generally indicated by ROST responses at depths at the surface to 10 feet below ground surface (bgs), depending on whether the release is suspected to have occurred at the surface or below a buried pipeline. From a review of Figure 4, it is apparent that source material (above 20 feet bgs) is present primarily along the eastern, western, and northern edges of the Hartford site. One exception is the area beneath the river pipeline that runs along Elm Street. New ROST data in this area also indicate the presence of free product at depths starting at approximately 8 feet. Most of the other product contamination indicated in the ROST responses is present near the water table or the smear zone, which is defined as the region where the upward and downward fluctuations in the groundwater table spread hydrocarbon contamination across a greater vertical interval of the soil. It is anticipated that additional surface source areas will be identified as the density of data for the site increases.

2.3.1.1 ROST Results and Product Recovery Challenges

As discussed in many of the reports reviewed in preparing these suggestions, most of the recorded incidents of fire and odors occur during high stands in groundwater. A review of Tables 2-1 through 2-3 of the work plan (Clayton 2004a) suggests that free product thickness can increase dramatically as water levels rise. This relationship is particularly evident at well HMW-22, suggesting that product recovery may need to focus on wells screened across intervals that correspond to high stands in water levels. Water is sometimes used to enhance the secondary recovery of petroleum in an oil field, although, fluctuations in water levels may also act as a hydraulic pump to enhance product recovery.

The relationship of apparent hydrocarbon sources to minimum and maximum groundwater levels can be used to focus areas where different types of cleanup might be most effective. For example, vapor extraction technologies could be used with only a minimal need for direct free product recovery in areas where little or no source material is located at or below a low stand in groundwater if the product present is in the gasoline range. Conversely, the focus of cleanup efforts might be on collecting free product during high stands in the water table where source material is present in the smear zone or below the water table. However, it is important that current efforts focus on monitoring both changes in water levels and in observed free product thickness on a finer scale than in the past.

At present, the project team has installed nested piezometers or extraction wells in each of the primary sand units and screened them across the upper portion or across the entire sand unit where the thickness permits (Clayton 2004b). This strategy may be inefficient, however, based on the observation that much of the free product underlying the Hartford site is likely present in the smear zone below the upper sand units. Free product recovery should be directed at those areas where thick columns of product are observed and should focus on design of a recovery system that target zones for removal based on geologic conditions and the proximity of product and the water table.

It is apparent from the ROST response observed in potential near-surface source areas, such as are indicated near ROST locations HROST-6 and HROST-10, that near-surface source areas are limited in extent. However, the heterogeneity of these areas indicates variation on a finer scale than can be understood based on existing ROST results. Therefore, additional characterization is needed before near-surface source areas can be addressed adequately. Outside of near-surface source areas, it may be possible to define regional trends in geology, hydrology, and product thicknesses and then to design free product removal and vapor intrusion mitigation systems on a more regional scale.

2.3.2 Sand and Clay Isopach, Formation Top, and Free Product Thickness Maps

Tetra Tech has developed top of stratum and hydrocarbon product thickness maps and top of formation and product ROST response maps (Figures 8 through 16) for each of the four major strata (North Olive, Rand, EPA, and Main sands) and the silty clay units that separate them. In addition, Tetra Tech prepared maps that show the top of free product (heavy, mid-range, and light range) and total product thickness (Figure 17 and 18). These maps were developed to identify (1) areas where vapor intrusion issues might be greatest, (2) areas where design of a product extraction system may be warranted, and (3) areas where monitoring the dissolved-phase plume or where additional characterization is needed. An isopach map of the total silty clay (Figure 12) has been developed, along with a map to indicate where the sand units may intersect known potential preferred pathways such as sewer lines and other buried utilities (Figure 19), as a first attempt at a more sophisticated level of interpretation.

Figure 19 is an example of the type of work product that could be important, as the CSM is refined. The geologic, hydrogeologic, and contaminant characteristics provided in Figures 8 through 18 can be combined on composite maps to drive a dynamic work strategy and guide future investigations. However, any additional integration of the materials presented or discussed in this report is beyond the scope of the support available through OSRTI to the Hartford Working Group and EPA Region 5.

The potential for vapor intrusion is likely highest where the uppermost extents of permeable sand units are closest to the surface, the total thickness of fine-grained alluvial deposits is lowest, and the total thickness of sand and product is the greatest. The maps discussed in the following sections attempt to identify specific geologic, hydrogeologic, and free product relationships that could directly influence the fate and transport of free product, distributions of vapor-phase contaminants, and distributions of dissolved-phase hydrocarbons.

2.3.2.1 North Olive Sand Maps

It appears that the North Olive Stratum thins across the central portion of the Hartford site and terminates here (i.e pinches out). Figure 8 shows the isopach thickness of the North Olive Stratum. This pinching out suggests that the North Olive Stratum is not in direct hydraulic communication with either the Rand or Main Sands except in the southeastern portion of the site, where the North Olive merges with the Main Sand. Free product or vapors within the North Olive unit cease beyond a point, as suggested by the general relationship between reported fires and the extent of the North Olive stratum.

Product was also detected in ROST locations HROST 51 and HROST 52 (Figure 8), where the North Olive merges with the Main Sand. Therefore, the potential for direct communication of contaminants from the North Olive Stratum into the Main Sand, or vice versa, exists in this area. Multiple fire events have occurred in this area.

As mentioned previously and as shown in the isopach of the North Olive Stratum in Figure 9, areas where fires have been historically reported across the Hartford site seem to correspond with areas where a measurable thickness of the North Olive Stratum has been mapped. It has also been observed that the silty clay layers thin out above the Main and Rand strata in this area.

2.3.2.2 Rand Stratum Maps

The Rand Stratum merges into the Main Sand adjacent to the eastern boundary of the Village of Hartford, as shown in Figure 10. Figure 11 presents the thickness of the Rand Stratum in feet. Contamination within the Rand Stratum in the southeastern portion of the site could therefore easily migrate in the vapor or free phase from the Rand Stratum into the area enclosed by the 12-foot bgs contour in the Main Sand. A potential also exists for contamination within the Rand Stratum near ROST locations HROST 26 and 33 (Figure 5) to migrate up into the structural high in the Main Sand shown in the north-central portion of the village.

Evaluation of the isopach of the silty clay above the Rand and Main sands further supports why fires have not been recorded in and around ROST locations HROST 23 and 24 (Figure 4). The silty clay in this area thickens to nearly 20 feet (Figure 12). The thickness of the silty clay above the Rand or Main Sand is generally less than 12 feet and the North Olive Stratum is also present throughout the area where fires have been recorded.

The thickening of the clay in this area may indicate that the need to mitigate vapors may be less urgent. However, the hydrocarbons appear thickest in this area. Product recovery in this location may be warranted because of the potential for product to move from this area toward the northwest, where the silty clay unit thins dramatically and fires have been reported.

2.3.2.3 EPA Stratum Maps

The EPA Stratum is limited in extent, as shown in Figures 13 and 14. However, contamination in the EPA Stratum would migrate directly up into the Main Sand in the northwest portion of the Hartford site.

2.3.2.4 Main Sand Maps

An isopach of the Main Sand could not be created because it represents the basal glacial outwash sand unit, which extends down to the limestone bedrock in the area. Stratigraphic information on the bottom of the unit is not available. An isopach of silty clay between the EPA stratum of Main Sand and the Rand stratum or the North Olive stratum is presented in Figure 15. The contour map of the top of the Main Sand (Figure 16) shows a northwest-trending structural high along the approximate axis of fires reported in the southern portion of the affected region beneath the village. This structural high is crudely aligned along the expected flow direction in the Main Sand, as depicted in the work plan (Clayton 2004d). This northwest-trending feature in the Main Sand suggests that a principal area of concern for contaminant migration away from the site could exist northwest of the current site boundaries. Migration of dissolved- and free-phase constituents might be expected downgradient of this structural high along the regional northwest direction of flow within the Main Sand. As will be discussed later in this section, product appears to extend off site and downgradient along this northwesterly trend (Clayton 2006a). The impacts from the presence of product west and north of the village are not thought to immediately affect the current remedial design efforts and are therefore not discussed further in this report.

2.3.2.5 Light Range Petroleum Hydrocarbon Maps

A large high in the top of the ROST response for lighter hydrocarbons is present along Elm Street (pipelines run from the refinery to the river along Elm Street). Figure 17 shows the approximate extent of lighter range, lower boiling point fuels in combination with the top of the ROST response. The depth of the response appears to coincide with the approximate depth of the pipelines in this area. Numerous spills have been recorded in this area and historical records for the pipelines indicate that these lines could have leaked throughout the history if their use.

Heavier hydrocarbons have a greater peak height at higher wavelengths of absorbance, as indicated by greater peak heights on the right-hand side of the ROST output file (the dwell profile). When peak heights are greater on the left-hand side of these dwell profiles, the fuel at this spot in the contaminant plume is likely made up of hydrocarbons such as gasoline, which have lower boiling points, usually considered light range hydrocarbons. Diesel fuels might be considered a mid-range hydrocarbon product with greater peak heights in the center of the profile. Motor oil or weathered product, which has been in the ground for extended periods, is usually considered a heavy range hydrocarbon product. Based on the general results shown in Figure 17, it appears that the preponderance of hydrocarbons present across the site are in the gasoline range.

2.3.2.6 Mid-Range Petroleum Hydrocarbon Maps

The distribution of mid range hydrocarbons shown in Figure 17 seems to indicate the potential for the presence of two source areas for this type of petroleum product. One is located along the northeastern boundary of the site near ROST location HROST 6 and 10 and another is located near the northwestern boundary of the site near HROST 2. The nature and extent of mid-range hydrocarbons may influence their treatability and their tendency to cause vapor intrusion and will therefore need to be examined more closely. The specific chemistry and constituent makeup of each of the source types identified should be examined to determine: (1) site-specific action levels for vapor intrusion, and (2) site-specific action levels that can be used to assess the need for removal. These action levels will be driven by the chemistry and type of potential associated risk or hazard identified for the area of interest within the site.

2.3.2.7 Heavy Range Petroleum Hydrocarbon Maps

Figure 17 shows the limited extent of heavier range hydrocarbons at the Hartford site. As expected, the extent does not generally correspond to areas where fire hazards have been reported. Since heavy hydrocarbons products tend to sorb to the soil and are generally more viscous, they have less of a tendency to migrate away from primary source areas. Primary concerns in these areas should be focused on limiting the potential for direct contact. Chemicals of potential concern in surface soil in this area might include polynuclear aromatic hydrocarbons (PAH). A close inspection of the ROST profiles in this area does indicate the presence of light hydrocarbons beneath these apparent heavier hydrocarbon source areas.

2.3.2.8 Total Petroleum Hydrocarbon Map

Figure 18 shows the extent of the total ROST response to all three ranges of hydrocarbons. The largest thickness in ROST response is along Elm Street. This supports the large high in the ROST response of lighter range hydrocarbons in that same location.

2.3.3 Interaction of Shallow Stratums with Sewers and Utilities

Tetra Tech prepared Figure 19 to identify areas where preferred pathways (sewers) might intersect permeable stratum units, allowing hydrocarbons to accumulate at shallow depths. Figure 19 shows the location of product pipelines, municipal sewer mains, and shallow stratum units (with upper extents above 12 feet bgs). The map identifies the upper extents of shallow sand intervals (primarily the North Olive Stratum, but also the Main Sand in the southern portion of the Hartford site). The 12-foot bgs contour shown in this figure is significant because the depth of buried pipelines is approximately 12 feet bgs, as noted in the "*Utility and Pipeline Investigation Work Plan, the Hartford Area Hydrocarbon Plume Site"* (Clayton 2004f). This work plan did not indicate the depth of the municipal sewer mains, but it can be assumed that they are above the 10-foot bgs contour. Notably, a sewer main crosses the 8- to 10-foot bgs contour interval in the eastern portion of the village. Five buildings where fires have been reported are located within 100 feet of this sewer main. This map, like those previously discussed, should be considered when the working group prioritizes locations where sewer and utility investigations and design-related activities are planned. The HWG also may consider using the presence or absence of light or mid-range free product in the shallow sand units as a means of prioritizing when and where to focus remediation efforts for sewers and utilities.

2.4 HYDROCARBON CHEMISTRY AND GEOCHEMISTRY

The chemistry and geochemistry of hydrocarbon product, geologic formations, and groundwater beneath the Hartford site will have a strong influence on the effectiveness of any remedy. These and other physical factors such as moisture content, permeability, and effective porosity should be used in conjunction with one another to support the design of any potential remedy. The HWG has not focused on the chemistry of the product found beneath the Hartford site up to this point, as is indicated by responses to comments provided by Clayton to EPA Region 5 dated June 21, 2004, and titled *"Letter to USEPA Region 5. Response to Comments to ROST Investigation Report and Work Plan."*) The response to U.S. EPA comment 1 part A, second sentence states, *"It is Clayton's opinion, based on experience at other petroleum sites, that the design of the remediation system will be primarily based upon geology of the area and the amount of product present not the type of product"* (Clayton 2004e).

Ignoring product-specific chemistry during remedial design could limit the effectiveness of any cleanup strategy. The petroleum industry has long recognized that the nature of various petroleum products can pose different challenges to extraction of petroleum from an oil reservoir. Heavier products often require more aggressive techniques to extract. For example, methods such as steam-enhanced recovery have been developed to address removal of heavier hydrocarbons where simple flooding methods have proven ineffective.

Not only is further characterization of the nature of the product necessary; the physical properties of the petroleum hydrocarbons need to be understood so their fate and transport can be estimated and input to a model to support the evaluation of impacts to surface water in the area. Further characterization of the product is also suggested to support risk estimation and development of field-based action levels related to both vapor intrusion and dissolved-phase fate and transport issues.

For example, one of the questions at the Hartford site is the impact of removing the free product and dissolved-phase hydrocarbons will have on vapor intrusion. This issue is chemistry related. Petroleum hydrocarbons consist of complex mixtures of carbon, hydrogen, ammonia, sulfur compounds, and other constituents, such as lead and oxygenates, used to improve fuel performance. Each mixture has a susceptibility to treatment at a particular moisture level in soil that is related to its Henry's Law constant. Therefore, the composition and physical properties of the mixture can affect the removal rate and estimated risk. Liquid-phase removal may also be affected by the chemical and physical properties of the free product, such as its tendency to form a physical or chemical emulsion that will be difficult to treat. Detailed data on chemistry, geochemistry, and physical properties are needed to design a system and then predict whether it can be successful in mitigating vapor or dissolved phase-related hazards.

The HWG should consider implementing a robust chemical, geochemical, and physical properties characterization effort to begin to understand differences in product chemistry. The analytical suite should include, but not necessarily be limited to, the following:

- Volatile organic analyses (using method 8260)
- Semivolatile organic analysis (using method 8270)
- PAH analyses (using modified method 8270 operated in the selective ion monitoring mode)
- Viscosity and density analyses
- Porosity, permeability, grain size, total organic carbon
- Nonaqueous phase liquid (NAPL) saturation
- Cation exchange capacity

In addition to these chemical and physical property analyses, site-specific testing in the form of core column tests might be considered. These tests can also be performed in situ using innovative tools such as the Praxis Environmental Technologies, Inc. (Praxis) PneuLog, which allows for the design of the SVE removal system to be optimized once a system has been installed. Since there is an existing system on site, this technology might be immediately applicable.

Core column studies may be conducted when there are significant questions on the applicability of one of several alternatives for treatment, such as in the area near ROST location HROST 2. Pilot testing with PneuLog could be used to optimize and expand an existing system design in areas where SVE already appears to be the logical alternative, such as the area surrounding HROST 51. Chemical data, along with concentrations present, should be used to estimate any risk that requires treatment. Additional information on the use of core column and well product removal pilot testing can be made available from Tetra Tech on request.

3.0 SUGGESTIONS FOR OPTIMIZING CLEANUP SYSTEM DESIGN AND IMPLEMENTATION

In the review of the primary study questions and the information presented thus far in this report, the working group faces the following issues at the Hartford site that will eventually need to be addressed:

- Immediate physical hazards, such as fires that result from vapor intrusion
- Impacts to human health from vapors
- Impacts from contaminated soil in the vadose zone to groundwater
- Impacts to groundwater from free product in the smear and saturated zone
- Impacts from dissolved- and free-phase hydrocarbons to surface water

A robust set of suggestions for each of these issues is beyond the scope of the support that Tetra Tech can provide under its current assignment for OSRTI. Therefore, the focus in this section is on providing general observational data and suggestions for most of the key elements that should be evaluated. HWG can then more fully evaluate the types of specific activities and decisions that will need to be made.

Installing and sampling vapor monitoring probes (VMP) is under way at the Hartford site to evaluate the potential hazards and risks to human health from vapors. The maps and suggestions provided by Tetra Tech in this document are intended to identify areas where the interaction among the sewer and utility system, geologic features, and free product should be further evaluated through VMPs. In addition, the maps and suggestions provided indicate where free product may be collecting in stratigraphic traps, such as the area near ROST location HROST 51. Tetra Tech believes this area might be more amenable to SVE than other areas where the presence of more fine-grained materials might pose a challenge to the use of SVE. Suggestions are also provided that identify areas where free product extraction should be the focus of the HWG efforts. Free product extraction may be warranted where free product is found at the greatest thicknesses (Figure 18) and has the greatest potential to continue to contribute to migration of dissolved-phase contamination away from source areas.

The current data set lacks sufficient information on hydrology and the chemistry and spatial distribution of contaminants to support the design of a free product extraction or dissolved-phase monitoring and treatment system. Therefore, this section discusses use of collaborative data sets and similar approaches to optimize the design of the vapor extraction system, investigate the dissolved-phase contamination, evaluate methods to remove free product from the smear and saturated zones, and implement an integrated monitoring system to track the progress of the remedial action.

3.1 SOIL VAPOR EXTRACTION SYSTEM DESIGN AND OPTIMIZATION

As mentioned previously, SVE may be an effective alternative in source areas at the Hartford site, particularly where free product is present above the water table and geologic conditions are favorable. PneuLog is a technology designed to reduce long-term operational costs and accelerate cleanup by optimizing SVE systems in unsaturated zones. The PneuLog technology uses in-well instrumentation to measure air permeability and contamination production continuously throughout an extraction well within the screened interval during SVE. This technology is intended to improve the assessment of geologic heterogeneity within the screened intervals of individual wells and identify mass transfer constraints in the vadose zone. Data from several wells can be used to optimize a cleanup strategy and estimate operation times needed to meet closure requirements.

Tetra Tech proposes using PneuLog technology to support the evaluation and optimization of any SVE systems planned for the Hartford site. Tetra Tech suggests that a dynamic work strategy may be used as an alternative to the traditional phased approach to limit the need for mobilizations and thus streamline product removal and vapor mitigation. The PneuLog technology can be used not only to target zones with the highest concentration in vapors; it can also be used to size pumps where contamination in concentrated in fine-grained soils. In contrast, conventional SVE design and optimization procedures rely on empirical data that do not adequately evaluate mass transfer constraints, limiting the effectiveness of the remedy. As a result, conventional systems may be overbuilt, inefficient, and expensive to operate.

The PneuLog approach incorporates short-term SVE testing with pneumatic well logging to delineate the horizontal and vertical extent of contaminants and quantify the permeability of soils throughout the screened interval. The PneuLog test is repeatable, and multiple deployments can track the progress of cleanup when combined with technologies such as passive or active soil gas surveys and vapor probe analysis in a collaborative data set. When used in a number of wells, this approach provides a more complete and accurate baseline evaluation for design and optimization of SVE systems. In addition, data on soil permeability and airflow rate data provided by PneuLog can be used in models to estimate removal action timeframes.

3.1.1 Traditional Vadose Zone Profiling and Monitoring Techniques

Traditional methods of delineating vadose zone contamination to implement SVE involve soil gas surveys and multipoint vapor probe sampling. Traditional methods of developing vertical contaminant profiles involve installing discrete VMPs at multiple depths at a single location. Similarly, traditional methods of developing lithology profiles require continuous split spoon sampling. SVE pilot testing is used to develop soil vapor production rates, contaminant concentrations, and radius of influence (ROI) information on a site-wide scale.

Before an SVE system can be constructed, the following types of data should be collected at specific targeted locations within the Hartford site at a density sufficient to characterize the heterogeneity of the hydrogeologic setting:

- Contaminant type and associated volatility
- Permeability of the soil
- Soil structure and stratification
- Soil moisture content
- Depth to groundwater and changes in product thickness and water level over time

The following sections briefly summarize methods Tetra Tech suggests for horizontal and vertical profiling of the vadose zone.

3.1.2 Soil Sampling

Vertical profiling is an important component of site characterization and CSM development. Before cleanup technologies for soil treatment can be evaluated, a site is usually investigated to characterize the geology and vertical distribution of contaminants on a site-specific scale. Lithologic and geotechnical parameters are usually collected at various depth intervals. New tools such as the membrane interface probe (MIP) and other real-time sensors, or near-continuously reading instruments such as PneuLog, are changing existing ideas about how contaminants are distributed in the environment. Small-scale heterogeneity seems to be the rule, rather than the exception, and can severely impair the effectiveness of a remedy.

Soil structure and stratification are important to the effectiveness of SVE because they affect vapor flow within the soil matrix under SVE conditions. For instance, it is widely accepted that SVE is generally less effective in moist, silty, or clayey soils. Structural characteristics (such as layering and fractures) can create preferential flow pathways that can short-circuit SVE systems, resulting in extended remedial timeframes if the extraction points are positioned such that the induced airflow bypasses the area of contamination.

Soil borings are typically completed using a hollow stem auger (HSA) or direct-push probe such as a Geoprobe. These borings are drilled to collect a continuous soil sample and characterize the subsurface. Instruments can be deployed with direct-push drilling equipment that can record nearly continuous measurements of the soil's physical and chemical characteristics, resulting in development of a continuous vertical profile. The MIP technology provides a continuous log of soil conductivity and the volatile organic compound (VOC) concentration as it is driven into the soil. The Simulprober technology is a modified split spoon sampler that can also be used with conventional direct-push drilling techniques and is intended to collect continuous soil and soil gas samples and conduct in situ single-point slug tests. These tools have significant limitations; an investigation must proceed with these limitations in mind and should not be conducted without consulting with an expert who has significant experience with these instruments.

3.1.3 Soil Permeability Testing

Permeability affects the rate of air and vapor movement through the soil: the higher the permeability of the soil, the faster the movement and (ideally) the greater the quantity of vapors that can be extracted. High moisture content in soils can reduce permeability and, consequently, the effectiveness of SVE by restricting the flow of air through soil pores. Fine-grained soils produce a thicker capillary fringe than coarse-grained soils. SVE is generally not effective in treating soils below the top of the capillary fringe. Pumps can be used to depress the water table; however, pumping to lower the water table is not feasible because of the volume of water in the aquifers beneath the Hartford site. Site-specific data on water levels and soil permeability will be integral in optimizing the effectiveness of SVE or when SVE is selected as the preferred remedial alternative. Combining this information with characterization data on a finer scale can help engineers understand the limitations of a proposed system. For example, a site where the CSM indicates contamination in the finer-grained portions of the soil profile may not be effectively remediated using SVE alone. This level of understanding on the potential for SVE as a remedy at specific locations within the Hartford site (such as near HROST-2) can be developed only by collecting data on soil permeability and contaminant concentration on a finer scale using pneumatic tests.

3.1.4 Vapor Monitoring Points

VMPs are the traditional method for developing initial vertical contaminant profiles at SVE sites and may also be used as a tool for optimizing existing systems. VMPs are constructed by installing several relatively short-screened interval wells separated by bentonite seals within a single borehole. VMPs are used to measure vertical variations of vapor-phase contaminant concentrations and pressure and vacuum response (and, indirectly, permeability) along the soil profile when they are placed at varying depth intervals. Soil vapor chemistry is assessed at each discrete depth interval by withdrawing and analyzing soil vapor samples. The vacuum pressure required to extract the soil vapor from each individually screened depth interval indirectly indicates permeability. Soil permeability dictates the amount of airflow. Relatively high airflow indicates higher permeability, and relatively low airflow indicates low permeability.

Continuous soil borings are typically used to install VMPs. This method can be labor intensive and does not yield a continuous soil profile. Optimal locations for these points are best identified using high-quality geologic, contaminant distribution, and pneumatic test data. Conducting MIP profiles or a headspace soil gas survey before the VMPs are installed can improve efficiency when vapor probes are designed and installed. Installing VMPs without these data can result in poor system design and ineffectiveness of the remedy.

3.1.5 SVE Pilot Testing

A pilot test is recommended for evaluating SVE effectiveness and design parameters at any site, particularly where SVE is expected to be only marginally to moderately effective. Data provided by pilot testing are necessary to properly design the full-scale SVE system. Pilot tests also provide information on the concentration of VOCs that are likely to be extracted during the early stages of operation of the SVE system.

Various extraction rates and wellhead vacuums must be evaluated to estimate optimal operating conditions. Pilot studies typically involve extraction of soil vapors for a short period (1 to 30 days) from a single extraction well, which may be an existing monitoring well at the Hartford site. However, longer pilot studies (up to 6 months) using more than one extraction well may be appropriate for larger sites. More information on methods for system operation can be found in *"Innovative Site Remediation Technology, Design and Application, Volume 7, Vacuum Extraction and Air Sparging"* (EPA 1998).

Vapor concentrations should be measured at two or more intervals during the pilot study to estimate initial vapor concentrations that may be expected during operation of a full-scale system. The vapor concentration, vapor extraction rate, and vacuum data should also be used in the design process to select extraction and treatment equipment.

Estimating the ROI of each extraction point is important for proper design of an SVE system. The ROI is defined as the greatest distance from an extraction well where a sufficient vacuum and vapor flow can be induced to adequately enhance volatilization and extraction of contaminants in the soil. Practitioners can increase their confidence that the pilot test design accommodates site conditions with better characterization methods and pneumatic logging techniques.

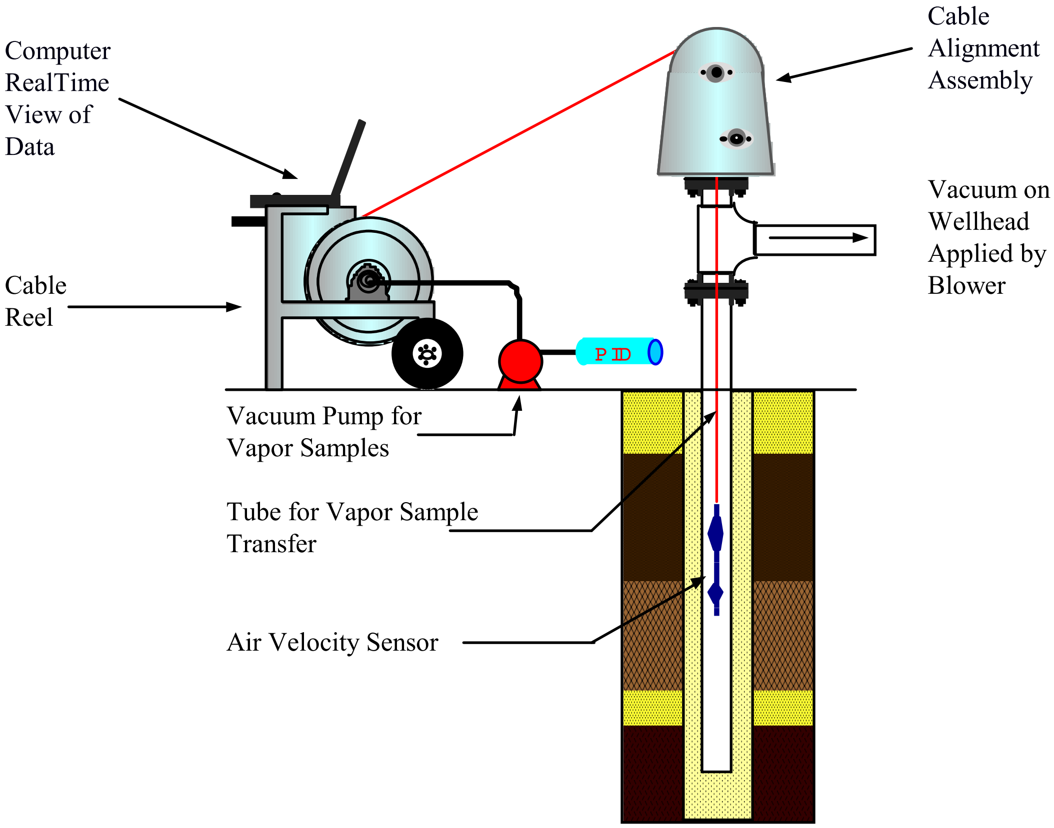
3.2 PNEUMATIC WELL LOGGING TECHNOLOGY

Pneumatic well logging is a technology developed by Praxis, which is designed to optimize SVE design and operation. Pneumatic well logging is performed by simultaneously measuring cumulative airflow and contaminant vapor concentrations vertically along the depth of an extraction well screen during active SVE. To record these measurements, a flow sensor is moved up through the well while vapor extraction and soil gas samples are continuously collected and analyzed. Collecting these measurements at a representative number of wells can yield a three-dimensional picture of the extent of soil contamination at a site as well as the distribution of soil permeability. These measurements, in conjunction with traditional sampling methods, can yield a more thorough understanding of a site and how an SVE system can be optimized. This more thorough understanding is possible because PneuLog technology provides information that other technologies cannot, such as soil permeability and mass loading of the vadose zone.

3.2.1 Equipment

The equipment used for PneuLog pneumatic well logging is illustrated in Exhibit 1. The PneuLog instrument is attached to a cable, which passes through alignment pulleys and a vacuum-tight fitting at the wellhead. The instrumentation is raised or lowered by a cable wound around a motorized reel. The logging proceeds at a rate of 8 feet per minute along the screen in the SVE extraction well. Sensors in the pulley assembly indicate the depth of the measurement. Electrical leads connect the flow sensor to a data acquisition system located on the motorized reel. A vapor sampling tube connects the sample port on the instrument to a vacuum pump, also located on the reel. The sampling pump draws a continuous stream of air through the sampling tube to the surface, where it is analyzed for VOCs and other compounds of interest (such as oxygen and carbon dioxide). A photoionization detector (PID) is used to provide a continuous reading of total VOC concentrations. Summa canister samples can be collected for off-site analysis by gas chromatography and mass spectrometry to estimate compound-specific concentrations at discrete depths and to calibrate the PID readings. Supplemental vapor samples can be collected in Tedlar bags and analyzed on-site with a field gas chromatograph.

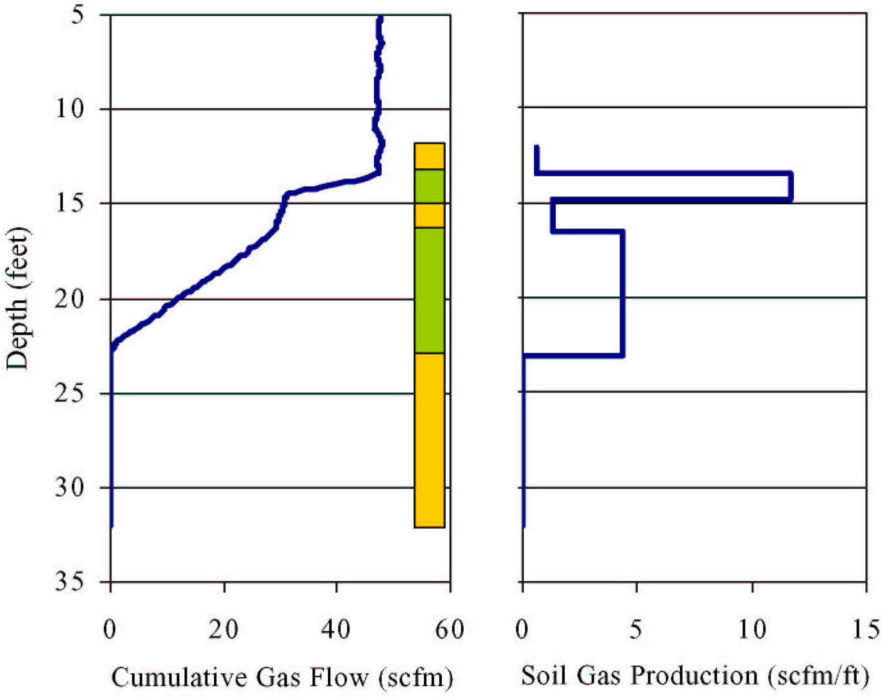
Exhibit 1: Schematic of Pneumatic Well Logging Equipment



3.2.2 Permeability Profiles

The airflow from each soil layer is related to the cumulative airflow by a simple mass balance. The cumulative airflow measured below the soil layer is subtracted from the cumulative airflow measured above the soil layer to calculate the airflow from a soil layer. The soil permeability of the interval is then determined from Darcy's law. The data and the analyses appear similar to output from borehole flowmeter testing in water wells. A typical cumulative gas flow measurement from PneuLog is provided in Part (a) of Exhibit 2, below. In this example, the well is screened from 12 to 32 feet bgs. As shown, the airflow from the bottom half of the well is essentially zero. The airflow increases steadily from 0 to 28 standard cubic feet per minute (scfm) between 23 and 16.5 feet bgs as the instrument is raised through the screen. The steady flow increase indicates this soil interval has a relatively uniform permeability to air. Only 2.5 scfm of soil gas are added from 16.5 to 15 feet. The volumetric flow increases by 15 scfm in the next 1.5-foot interval up to 13.5 feet. The top 1.5 feet of the screen adds only 1 scfm to the total.

Exhibit 2: Example Pneumatic Well Logging Results for Soil Permeability to Air



Part (a)

Part (b)

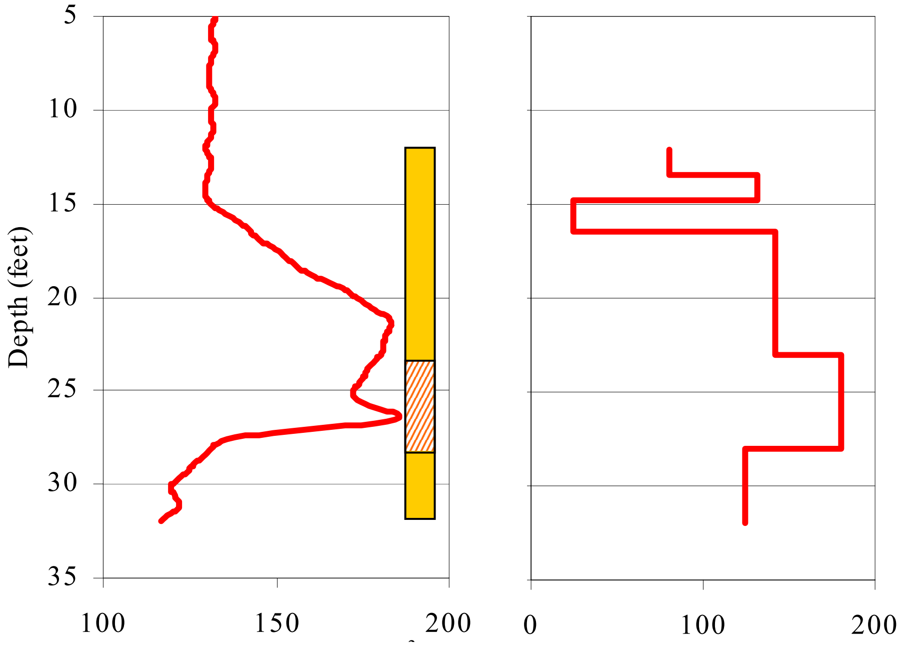
The diagrams present an interpretation of the cumulative flow measurements as soil gas production proceeded. An effective air permeability profile can be generated using the soil gas production profile with multi-dimensional analytical or numerical airflow models. The permeability of an interval is proportional to the change in flow across the interval, its thickness, its depth below the surface, and the well vacuum according to Darcy's law. Part (b) of Exhibit 2 reveals five soil strata along the screen. The permeability of the stratum intersected by the bottom half of the screen (yellow or light blocks) is relatively low since no measurable soil gas was produced. The geologist characterized the soil of this interval as silt. The air production rates for the soil intervals from 16.5 to 23 feet and 13.5 to 15 feet indicate coarse sand. These two sand intervals are separated by a 1.5-foot-thick silt interval. The soil at the top of the screen was also characterized as silt. This characterization of the physical properties is superior to a geological log and a typical air permeability test. The PneuLog results are usually consistent with the geologic observations; however, geologic logs provide little or no indication of potential air permeability. Without the pneumatic logging data, the permeability measured by typical testing is averaged over the screen interval and of the subsurface flow profile. It therefore cannot be quantified and well screens subsequently optimized.

3.2.3 Concentration Profiles

The measurement of VOC concentrations along the well screen indicates the distribution of VOCs in the screened interval. An example concentration log, which was collected simultaneously with the airflow log previously discussed, is presented in Part (a) of Exhibit 3, below. This concentration profile was obtained from a continuously reading PID that was calibrated to trichloroethylene (TCE) concentrations with on-site and off-site gas chromatographic analysis of vapor samples from discrete depths and the wellhead. The vapor concentration measured is lowest near the bottom of the screen and increases slightly up to a depth of about 28 feet. As the tool is raised higher in the well, the concentration increases sharply to a maximum at 26 feet and remains relatively high to a depth of 21 feet. The concentration then decreases steadily from 21 to 15 feet bgs. The concentration increases very slightly between 15 feet and the top of the screen.

The increases and decreases in concentration observed can be combined with the depth-specific air production in a mass balance to estimate depth-specific soil gas concentrations. The PneuLog device simultaneously measures the flow rate and concentration versus depth. The change in the product of these two variables over a specified depth interval divided by the flow change is equal to the contaminant vapor concentration in the soils of the depth interval. Application of this relationship to the data shown in Exhibit 3 Part (a) yields the contaminant vapor concentration profile presented in Exhibit 3, Part (b). The highest concentration occurs in the low-permeability material that underlies the deeper sand interval. This high concentration indicates that the low-permeability interval creates a mass transfer constraint to SVE.

Exhibit 3: Sample of Pneumatic Well Logging Results for Contaminant Product



Cum. TCE Conc. (mg/m^3)
Part (a)

TCE Soil Gas Conc. (mg/m^3)
Part (b)

Note: mg/m^3 = Milligrams per cubic meter

3.3 OPTIMIZING AN SVE SYSTEM AND IDENTIFYING SVE AS A VIABLE REMEDIAL ALTERNATIVE

As illustrated by this example, pneumatic well logging provides a more thorough and appropriate site characterization than will traditional methods alone. Repeating the process in a representative number of wells can generate a three-dimensional description of the physical and chemical subsurface by correlating between locations. The technique also provides higher-quality data that can be used to more effectively design and optimize an SVE system. Soil strata near or below cleanup goals are quickly identified, and the extraction flow rate can be reduced or terminated from these layers. The operation can then be focused on strata where contaminants remain at concentrations above cleanup goals. This optimization could lead to cost savings by accelerating cleanup and lowering operation and maintenance costs.

PneuLog can be used in conjunction with other new and improved methods of site characterization to build comprehensive data sets that can be used to evaluate when and if SVE is a viable alternative and even to decide when SVE is no longer needed. Real-time measurement technologies such as a MIP or laser induced fluorescence (LIF) provide contaminant distribution data that are independent of the permeability of the contaminated stratum. PneuLog, on the other hand, is biased by the permeability of the soil. Combining these two different types of data in a collaborative data set can provide practitioners with a better idea of whether SVE will be effective and the design specifications that are most appropriate.

3.3.1 Technology Assessment

Praxis developed the PneuLog technology to aid both site characterization and optimization of SVE systems. Tetra Tech's evaluation of this technology revealed several advantages and disadvantages. The primary advantages of this technology are as follows:

- A continuous vertical profile of contaminant concentration and soil permeability can be quickly developed for each SVE well on site. This profile represents average values for each major soil interval intersected by the vent well.
- The use of progressive extraction, vapor sampling, and pneumatic logging of the wells as they are installed will provide guidance for locating additional wells to more adequately characterize the Hartford site.
- The actual VOC concentrations in milligrams per cubic meter (mg/m^3) produced at specific intervals are measured.
- The permeability, flow rate, and total VOC production for a section of screened interval can be estimated. This information is useful in optimizing or modifying vent wells and for sizing blowers and vapor treatment equipment for new or modified SVE systems.
- The data are presented in a manner that is easy to interpret and highlights significant variations between intervals. When combined with other, more detailed, methods that can measure contaminant distribution regardless of permeability, the data can be used to decide when and if SVE will be effective or whether to modify the system.

The primary disadvantages are as follows:

- An SVE extraction well must be installed if one does not already exist. If SVE does not turn out to be appropriate for the Hartford site, then this site characterization method may be more expensive because installation of a well will generate soil cuttings and is labor intensive.
- Pneumatic logging provides limited data from soil intervals that are not within the screened interval of the well. The ideal screened depths cannot be identified before the vent well is installed. However, PneuLog testing in a single-well pilot test could be used to more effectively locate well screens in a full-scale, multi-well SVE system.
- Contamination from an overlying low-permeability layer may be detected at dilute concentrations in an underlying high-permeability layer. High levels of VOC contamination may be entering the vent well from one direction and be diluted by clean soil gas from other directions. The vent well tends to average VOC concentrations, and the PneuLog tool can measure only the average VOC concentration inside the well and the average permeability of the soil interval.

Overall, a technology such as PneuLog is warranted because of the size of the Hartford site and the need for efficiency in implementing a cleanup strategy. Additional information and design considerations should be evaluated in conjunction with Praxis or an equivalent vendor of a similar technology.

3.3.2 Monitoring the Effectiveness of a Cleanup Strategy

A direct measurement approach should be used to monitor the impact of any cleanup strategy for the Hartford site. Passive soil gas probes placed at regular intervals in and around treatment zones to measure relative changes in concentration can be an economical way to accomplish this task. Alternately, VMP samples can be collected over time using a focused analytical program. Any analytical program for monitoring the effectiveness of the remedy needs to include not only contaminant-specific analysis, but should also monitor for explosive levels of less toxic petroleum fuel-related constituents. Action levels in the vapor phase will need to be agreed upon by all stakeholders before a cleanup strategy can be implemented.

Real-time measurement tools such as a mobile gas chromatograph should be considered initially as a method to economically increase the density of vapor sampling. More sensitive vapor probe measurements such as Summa canisters may be required as concentrations decrease and vapors are mitigated. The PneuLog itself can also be used to evaluate yields and the benefit of continued operation of an SVE system.

3.4 GEOVIS VIDEO MICROPSCOPE ESTIMATES OF IN SITU NAPL SATURATIONS USING CPT TECHNOLOGY

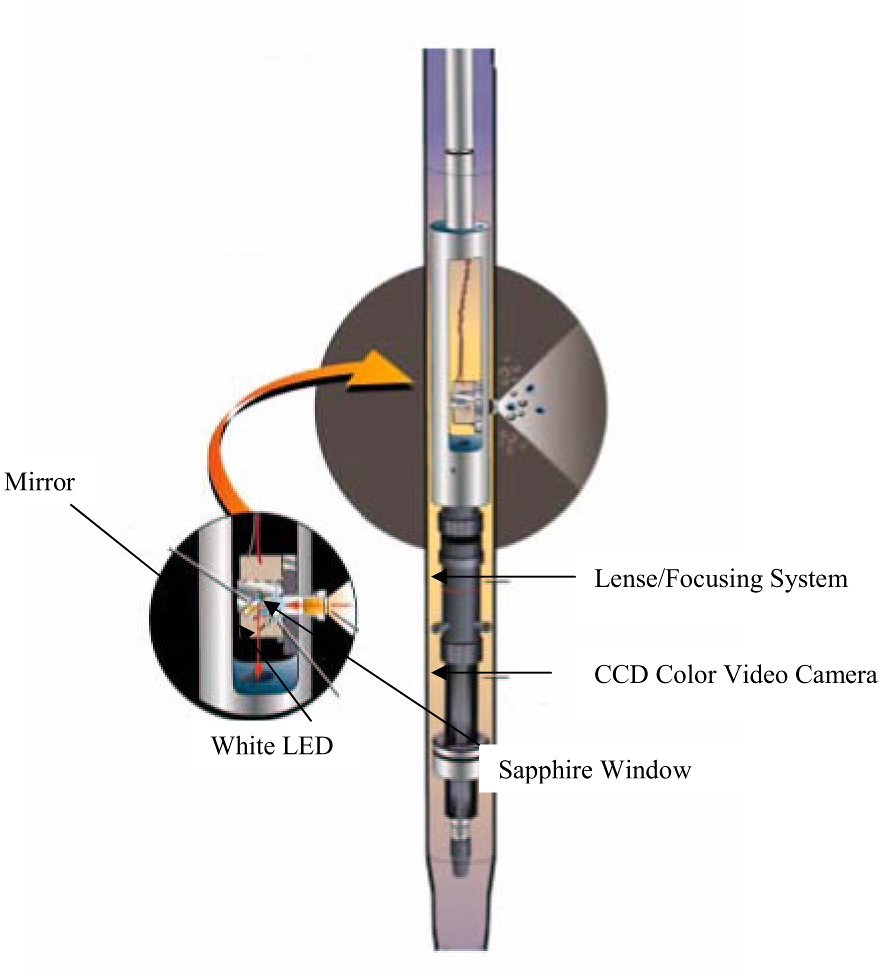
In addition to traditional methods for evaluating the potential for product removal at the site, Tetra Tech suggests that HWG consider GeoVIS as a method to increase the project team's understanding of hydrocarbon saturations. Hydrocarbon saturations can be used to estimate where additional permeability and productivity testing using high-vacuum extraction may be warranted. Currently, the HWG proposes to base its product removal system design on one or two key locations where core data were collected and conditions were favorable for further testing (Clayton 2006c). Use of a limited set of results in the manner proposed could result in an ineffective remedial design and wasted project funds.

The GeoVIS video microscope has the capability for collecting real-time in situ images of the subsurface soil environment for use in estimating soil porosity and light NAPL saturations. The GeoVIS system uses a miniature digital video camera coupled with magnification and focusing lens systems integrated into a cone penetrometer probe. The soil environment is imaged through a window in the probe and the video signal from the camera is returned to the surface where it can be viewed in real-time on a video monitor, recorded on a video recorder, or digitized (or any combination). When combined with lithology information obtained from CPT probe data and soil contamination estimations from LIF data, GeoVIS provides the small-scale tools necessary to identify thin layers of highly permeable material that provide a potential pathway for contaminant transport and removal, which could be overlooked easily through conventional means. It also provides a direct means for locating contamination source zones that have been difficult to localize using traditional sampling approaches.

3.4.1 Equipment

The equipment used for GeoVIS is a direct push penetrometer mounted on a CPT platform. It is equipped with a vertically mounted charged-coupled device (CCD), a mirror to reflect a side view of the soil into the camera, and a sapphire viewing window (Exhibit 4). The GeoVIS uses light from four light-emitting diode (LED) light sources (Xenon lamps) to distribute diffused light evenly across a sapphire viewing window, resulting in even reflected light from the soil. The standard GeoVIS optics system provides a viewing field of approximately 2 by 3 millimeters and a magnification of 100 when viewed on a standard 13-inch monitor. Approximately eight unique (non-overlapping) photomicrographs can be collected per inch of soil or 96 unique images per foot of video push. All soil photomicrographs are collected using a frame capture device and can be saved as bitmap files. The pores between sand and gravel grains and contents of the pores (such as dense NAPL, or dense nonaqueous phase liquid [DNAPL]) are generally readily observable and easily definable from these soil microphotographs.

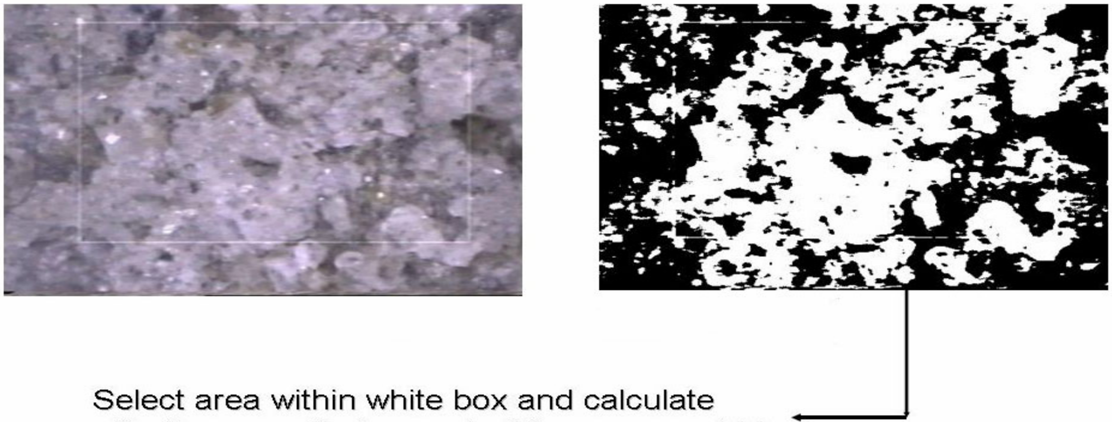
Exhibit 4: Schematic of GeoVIS Direct-Push Probe



3.4.2 Effective Porosity

Porosity between fine-grained materials is part of total porosity that cannot be observed within the photomicrographs; therefore, total porosity cannot be rendered. However, effective porosity as it relates to the specific yield of the soil is extracted and quantified since the large pores between granular materials can be observed. Pixels of grain and matrix materials are converted to pure white and pixels of pore space are converted to pure black. The number of white versus black pixels is used to estimate the percent pore space in the photomicrograph. Area percentages calculated from two-dimensional photomicrographs can be used to estimate porosity, saturation, and void volumes by the consecutive volume slice method. If a sufficient number of compositional determinations of two-dimensional slices are conducted on a three-dimensional volume, then the composition of the volume can be reliably estimated (Exhibit 5).

Exhibit 5: Estimated Soil Porosity (Vadose Zone) from GeoVIS Images



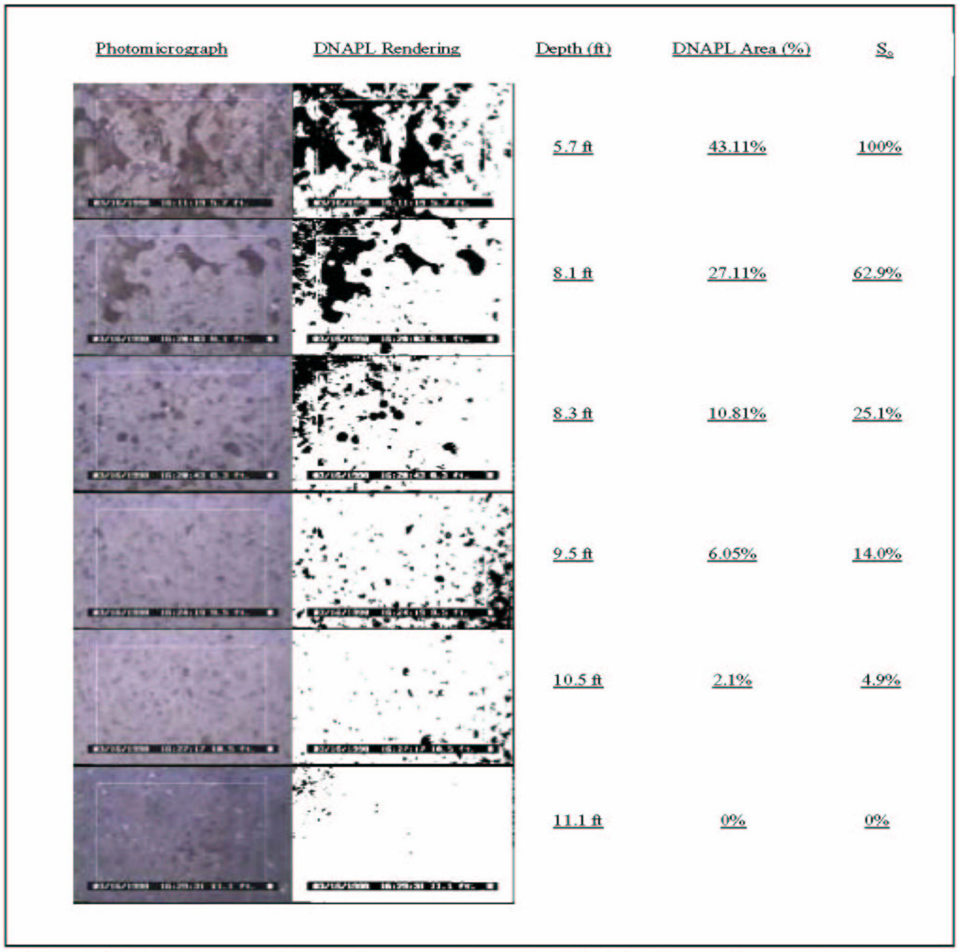
Select area within white box and calculate effective porosity (percent white vs percent black area = pores). Area to volume assuming consecutive slices.

Navy PWC San Diego SCAPS Project

3.4.3 NAPL Saturation

Obtaining NAPL saturations is more problematic than processing GeoVIS outputs for porosity. NAPL color varies based on the thickness of the NAPL in the pores, the NAPL type, background reflectance, pore size, and soil type. Dark, globular DNAPLs are easily rendered, whereas lightly colored fuels and diesel are not rendered well. Another problem that may arise is that dark mica or other dark minerals can also be misinterpreted as free product; therefore, the percentage of dark minerals must be known before images can be processed for free product. It is recommended that images of fluorescing NAPL induced by LIF be collected to overcome the highly variable nature of NAPL colors and reflectance under most field conditions. After the NAPL areas are obtained from each photomicrograph, the areas can be converted to NAPL saturation by dividing the area by the effective porosity average for the push. Exhibit 6 shows the results of the DNAPL image processing for a soil video profile. Photomicrographs of DNAPL droplets are shown on the left. Results of the DNAPL image processing, presented in black and white, are shown adjacent to each photograph. Pixel counts as total image area and DNAPL saturation results are presented on the right. Saturation results are a percent within the pore space, assuming a consistent porosity of 43.1 percent. The photomicrographs and image processing results both show a large drop in DNAPL droplet numbers and sized and in DNAPL saturation with depth.

Exhibit 6: Vertical Profile of Soil Photomicrographs with DNAPL Droplets



Photomicrograph	DNAPL Rendering	Depth (ft)	DNAPL Area (%)	S_o
		5.7 ft	43.11%	100%
		8.1 ft	27.11%	62.9%
		8.3 ft	10.81%	25.1%
		9.5 ft	6.05%	14.0%
		10.5 ft	2.1%	4.9%
		11.1 ft	0%	0%

The information on this technology was adapted from *"Confirmation of CPT Video Microscope Estimates of In Situ Soil Porosity and NAPL Saturations"* (Sinfield, 2004).

3.5 ADDITIONAL SITE CHARACTERIZATION ACTIVITIES

In addition to the continued refinement of a CSM to support the evaluation of vapor intrusion issues at the Hartford site, information should also be gathered to support the evaluation of the nature and extent of dissolved- and free-phase contamination at depth and in off-site areas. The data available from the investigations conducted thus far have focused on the presence or absence of free product immediately beneath the Hartford site. Future investigations should also consider the engineering and characterization data needed to optimize the proposed remedies for the site.

As a first step in this process, the preliminary CSM should be expanded to include potential source areas north, east, and west of the Hartford site. Without any information on these potential source areas, it is difficult to provide detailed suggestions on delineation of dissolved-phase hydrocarbons at this time. The project team should consider the following activities:

- Compiling existing data from areas surrounding the Hartford site.
- Continued piezometer installation and monitoring real-time flow directions and water levels using pressure transducers in and around source areas where product recovery and SVE will likely be applied.
- Additional water sampling from small-gauge, multi-level wells both on and off site. Small-gauge wells should be installed with screened intervals within, and below, the identified boundaries of the free-phase and dissolved-phase plume to monitor product thicknesses and water levels.
- Additional source term characterization should be conducted such that mass loading can be estimated and the fate and transport of petroleum contaminants can be predicted.
- Fate and transport parameters such as groundwater flow velocities and directions should be mapped and calibrated using intrinsic tracers, or existing plume extents and characteristics, where possible.
- Natural attenuation parameters should be added to the set of monitoring parameters for wells in the distal fringe and surrounding the contaminant plumes.

Nested wells are needed throughout these areas for product removal, and monitoring wells should also extend to some depth below the plumes for monitoring.

The well network currently proposed should be augmented with small-gauge wells or temporary monitoring points whose locations are optimized based on the work products provided in this report. A dynamic approach is suggested to limit project cost and improve performance. As mentioned in the CSM portion of this report, there are obvious pathways for contaminant transport that will need to be refined and targeted.

4.0 INCORPORATING TRIAD-DRIVEN DYNAMIC WORK STRATEGIES

The general approach presented by Clayton and in the *"Technical Memorandum, Vapor Control System Upgrade Design"* (Clayton 2004c) and the utility and pipeline investigation is a traditional static or phased approach. Tetra Tech suggests that the project team instead consider adopting a dynamic work strategy to guide future activities. A dynamic work strategy explains how the decisions will be guided by field measurement results and how spatial uncertainties will be identified and addressed as the field activities proceed. Ideally, stakeholders build consensus on project objectives and key decisions that are based on agreed-on action levels before the new field activities are undertaken.

For example, if a sampling location is found to contain free product, the dynamic work strategy might discuss how its extent will be delineated and what type of data will be used to support delineation. Another example might include evaluating how headspace soil gas surveys, VMPs, PneuLog, or GeoVIS will be used to optimize treatment system design. Data from these types of evaluations then might be used to select specific VMP locations and locations where additional design data should be collected. These types of strategies should be laid out using a series of flow charts and diagrams before field crews mobilize.

Tetra Tech understands some of the basic reasons behind the phased approach Clayton proposed. However, Tetra Tech believes it is imperative for the project team to clearly state the specific rationale that will be used to select when and where various activities will be considered. The rationale should be based on a well established CSM and address every aspect of the project design, including installation of piezometers, direct-push soil borings, VMPs, soil and ambient air gas samples, full-size wells and vacuum monitoring probes. Establishing clear guidelines for decision-making should be the first step in the systematic planning process.

The revised CSM should be developed and used to select the most appropriate set of innovative technologies for use at the site. A data management and communication platform that operates in real time should be considered. Many three-dimensional data presentation tools are available. A web portal with a relational database should also be considered to expedite communication of results. This portal will facilitate project decision-making on a real-time basis and swift communication of results to all regulators and affected stakeholders.

4.1 SUMMARY OF SUGGESTIONS

The following summarizes the proposed dynamic work strategy to support the implementation of a vapor mitigation program and product removal design effort at the Hartford site. The activities are designed in a logical sequence such that the quality and utility of data that are collected is maximized. Maximizing the utility of data will also require that the CSM for the Hartford site be continually revised as new data are received. The CSM can communicate results to stakeholders as new data are received and can guide subsequent actions. The CSM should be used as the basis to scope additional work and establish contingencies and options that might need to be built into the removal strategy.

Suggested activities include, but are not necessarily limited to, the following:

- Hydrocarbon concentrations in near-surface preferential pathways such as sewers and utility corridors should be analyzed using ambient air methods. These data are particularly important because of the difficulty in using intrusive sampling methods near utility corridors, such as Rand Avenue. Real-time ambient air monitoring technologies for sampling from sewer manholes are the most promising method. A portable gas chromatograph or the equivalent with a mass selective detection system are suggested.
- The well network should be expanded north, east, and west to answer not only vapor-related issues, but also more long-range concerns related to impacts from the Hartford site to the surrounding environment. Downhole transducers should be placed in wells as practicable so that rapid fluctuations and changes in direction of flow can be monitored on a real-time basis. Upgradient sources will likely need to be addressed to assure the long-term effectiveness of the remedy. Technologies should be used that can increase well and screened interval density. Small gauge multiport wells, such as can be obtained from Precision Sampling Inc., should be used to reduce costs and improve the project team’s ability to monitor vertical and horizontal off-site migration of contaminants.
- In addition to lithologic descriptions, any contaminant-related features such as odor, staining, or unusual solid constituents should be noted on the logs. The visual observation of hydrocarbon contamination should be documented using the following standardized descriptions:
    - No Visible Evidence – No visible evidence of oil on soil sample;
    - Sheen – Any visible sheen in the water on soil particles as described by the sheen testing method presented later in this section;
    - Staining – Visible brown or black staining in soil. Can be visible as mottling or in bands. Typically associated with fine-grained soils;
    - Coating – Visible brown or black oil coating soil particles. Typically associated with coarse-grained soils such as coarse sand, gravels, and cobbles;

  - Oil Wetted – Visible brown or black oil wetting the soil sample. Oil appears as a liquid and is not held by soil grains. Soils oozing petroleum typically contain 2 to 3 percent petroleum.

- These descriptions are general and may need to be modified to more accurately reflect actual site conditions and product characteristics.
- In addition to PID headspace and visual observations, the presence of free product in soil cores should also be evaluated periodically through direct application of a technology similar to ROST on the open core at ground surface. This evaluation is particularly important across the smear zone within the top of the Main Sand, where free product is most likely to be present. As the visual evidence of free product decreases, a water sheen test or SiteLAB total petroleum hydrocarbon ultraviolet fluorescence (UVF) field test kits or the equivalent might be considered to further understand the relationship between the measured concentration in soil, the presence of free product, and the ROST response.
- The water sheen test can be performed by placing soil in a small plastic bag or glass jar, adding distilled water, shaking the bag or jar, and observing the water's surface for signs of sheen. Sheen should be classified as follows:
  - No Sheen (NS) – No visible sheen on water surface;
  - Slight Sheen (SS) – Light colorless film; spotty to globular; spread is irregular, not rapid; areas of no sheen on water surface remain; film dissipates rapidly;
  - Moderate Sheen (MS) – Light to heavy film; may have some color or iridescence; globular to stringy; spread is irregular to flowing; few remaining areas of no sheen on water surface;
  - Heavy Sheen (HS) – Heavy colorful film with iridescence; stringy in appearance; spread is rapid; sheen flows of the sample; most of water surface may be covered with sheen.
  - Additional multiport VMP and well designs should be optimized using PneuLog. Petroleum vapors invading sewer lines should be collected before the final SVE system is designed and tested. Specific areas for testing should be identified through the use of the CSM as it is revised based on the products developed during this effort and subsequent data collection efforts.
- A near-surface monitoring network that might rely on VMP data and or headspace soil gas should be used to evaluate the impact of free product removal and vadose zone SVE or other methods for reducing vapors during remedy testing and before full-scale implementation. The performance of the system should be checked against well-defined decision criteria before full-scale implementation is considered.
- GeoVIS should be used along with other types of physical and empirical testing to evaluate and map zones beneath the village where product removal should be considered. This type of evaluation will improve the potential for the effective removal of product beneath the village.

4.2 SUMMARY

The work products generated in support of the refinement of a CSM for the Hartford site are encouraging. Tetra Tech hopes that the additional work products provided in this report will continue to expand the project team's understanding of the Hartford site. Tetra Tech also hopes that the project team will continue to refine and clearly state the decision logic that guides the activities in future work plans. The project schedule should be sequenced to assure that field activities and remedial efforts are optimized. Once optimized, locations where actions will be considered should be further tested using empirical methods. As systems come on line, the HWG should continue to refine operating conditions and parameters.

The Hartford site is complex, and implementation of an efficient remedy can be supported by all elements of the Triad approach. Real-time measurement techniques can be used to make maximum use of data as it is collected. The aggressive use of a systematic plan designed around the refinement of the CSM and efficient communication of results is needed. Well-documented dynamic work strategies, which clearly define how data will be used to support decision-making, will limit project delays. The collaborative use of differing sources of information is needed to improve project efficiency.

Current data are not sufficient to address many of the principal study questions for the project. As the project progresses, Tetra Tech suggests that the project team begin to consider ways to address as many of the objectives as efficiently as possible through a dynamic approach designed around innovative technologies and strategies.

Tetra Tech would be pleased to provide related available data sources on the products presented in this report to the Hartford Working Group. If you have any questions or comments on this document, please contact Mr. Robert A. Howe at (303) 441-7911 or via e-mail at Robert.Howe@ttemi.com.

5.0 REFERENCES

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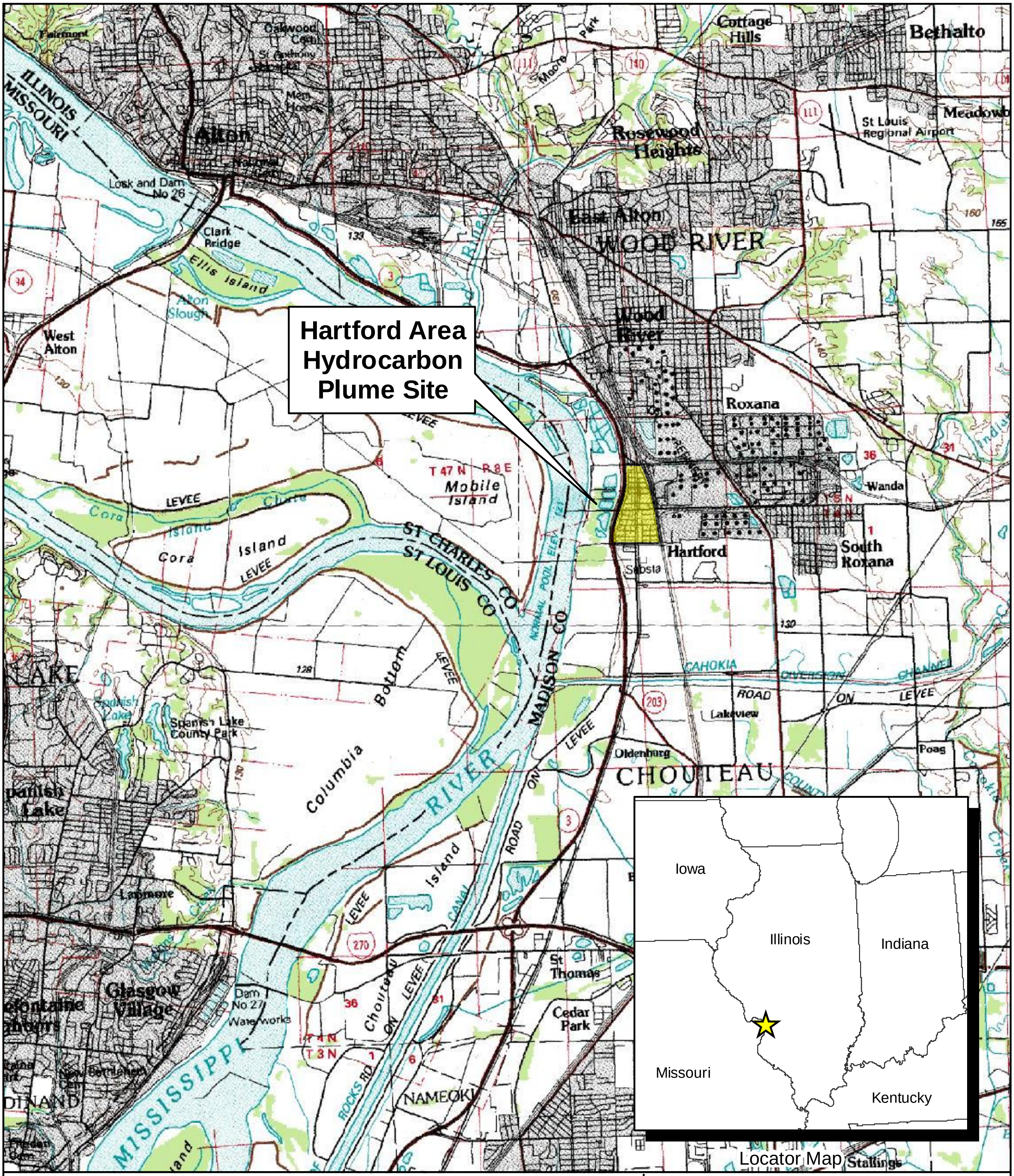
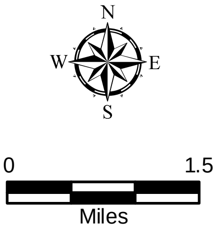
FIGURES


Hartford Area Hydrocarbon Plume Site

Legend

🟨 Site Boundary



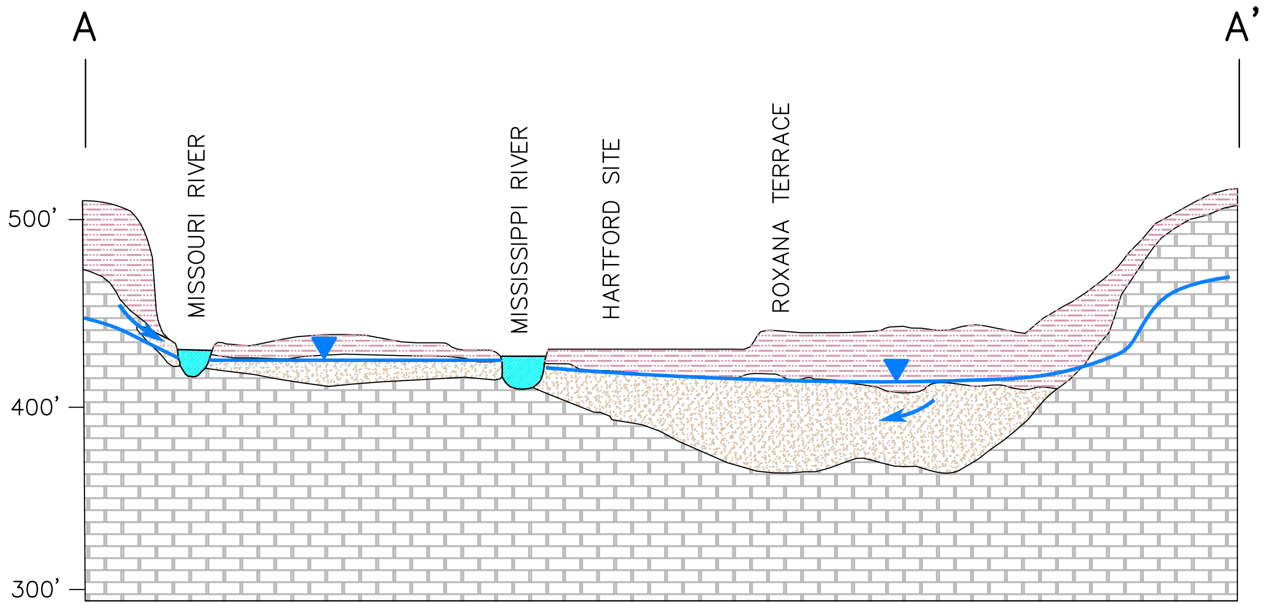
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 1
LOCATION MAP

TETRA TECH EM INC.

2007/07/23 O:\DOJ\Fig1_Location_Map1.mxd TtEMI-DN Kurt.Cholak

R:\Clients\Prem Cor\Clayton\ Fig2_PREMCOR-GEO_X-SECTION.dwg 07/23/2007 deborah.ford DN



LEGEND

▤	CAHOKIA ALLUVIUM
▒	MAIN SAND
▦	RENAULT LIMESTONE – MISSISSIPPIAN BEDROCK
▨	WATER
▼	WATER TABLE SURFACE
→	GROUNDWATER FLOW DIRECTION

100'
50'
0

VERTICAL SCALE:
1" = 100'
APPROX.

1 0 1 2

SCALE: 1" = 2 MILES
HORIZONTAL

HARTFORD AREA
HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 2

REGIONAL GEOLOGIC CROSS SECTION

TETRA TECH EM INC.

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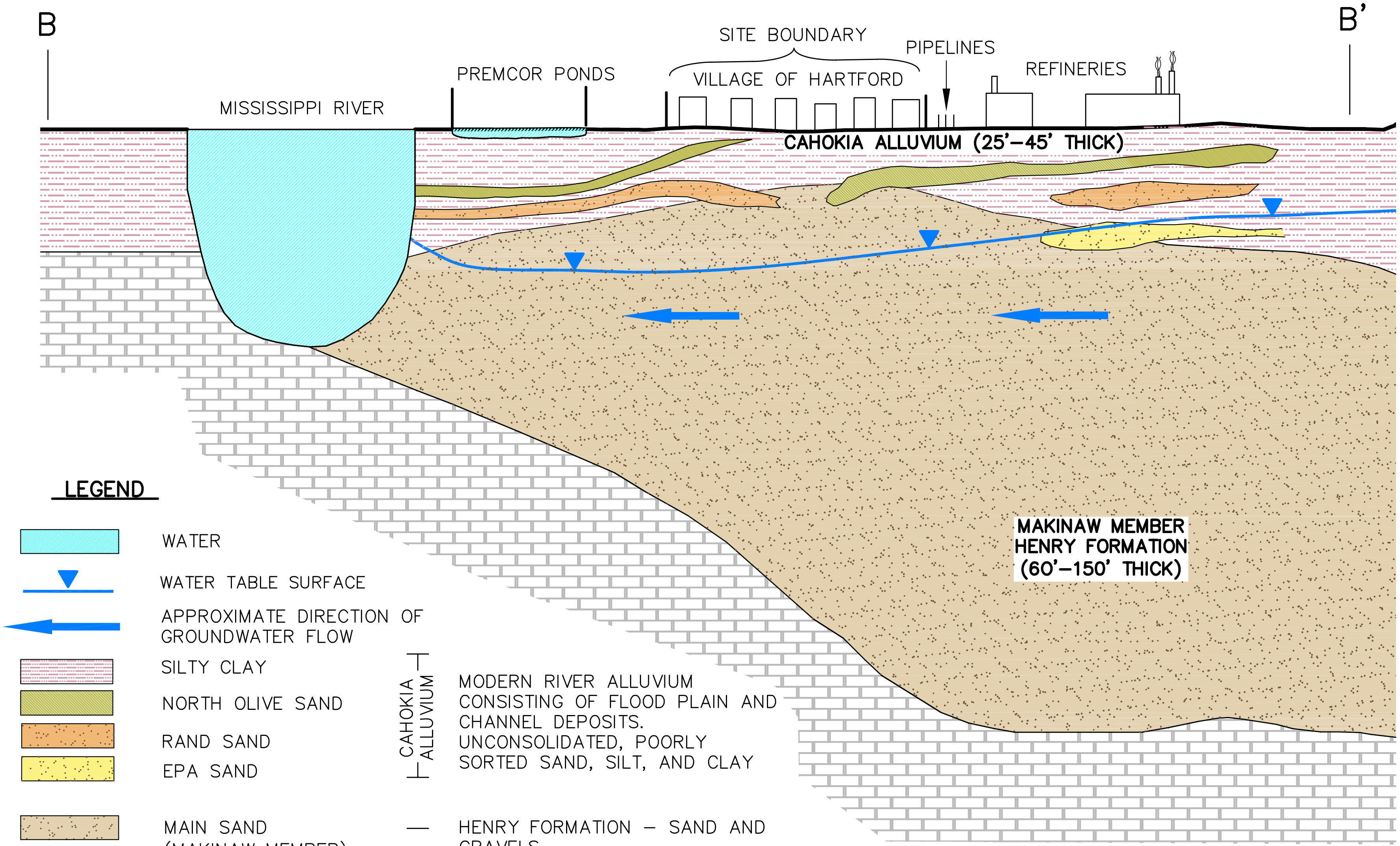


LEGEND

▨	WATER		
▼	WATER TABLE SURFACE		
←	APPROXIMATE DIRECTION OF GROUNDWATER FLOW		
▨	SILTY CLAY	CAHOKIA ALLUVIUM	MODERN RIVER ALLUVIUM CONSISTING OF FLOOD PLAIN AND CHANNEL DEPOSITS. UNCONSOLIDATED, POORLY SORTED SAND, SILT, AND CLAY
▨	NORTH OLIVE SAND		
▨	RAND SAND		
▨	EPA SAND		
▨	MAIN SAND (MAKINAW MEMBER)	—	HENRY FORMATION – SAND AND GRAVELS
▨	RENAULT LIMESTONE (MISSISSIPPIAN BEDROCK)	—	MISSISSIPIAN AGE BEDROCK SANDY TO CLEAN LIMESTONE

GEOLOGY REFERENCED FROM CLAYTON GROUP SERVICES APRIL 8, 2004 "FPH CPT/ROST SUBSURFACE INVESTIGATION REPORT AND FPH MONITORING WELL AND SOIL SAMPLING PLAN FOR THE VILLAGE OF HARTFORD, ILLINOIS"

0.5 0 0.5 1

SCALE: 1" = 1 MILE
HORIZONTAL

40'
20'
0

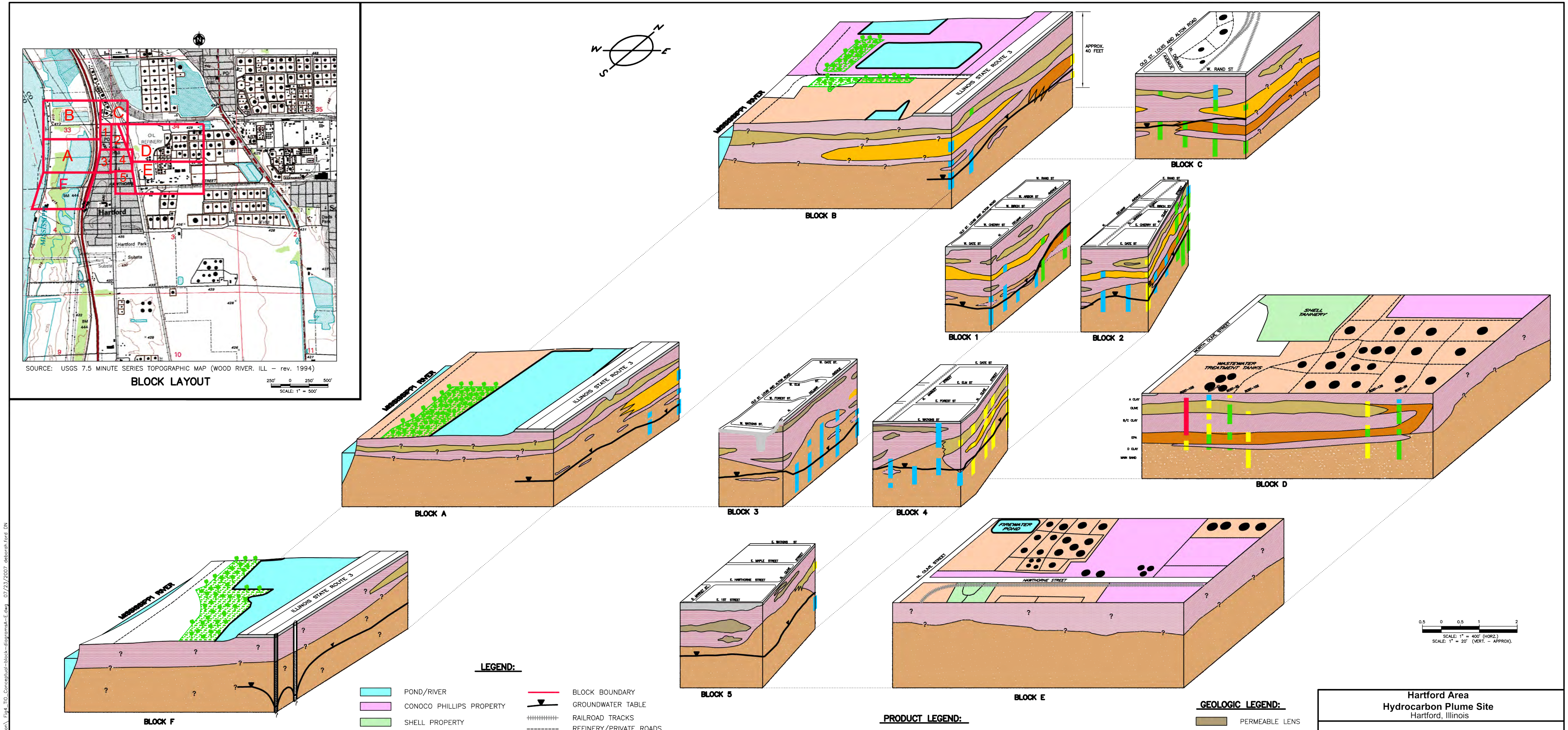
VERTICAL SCALE:
1" = 40'
APPROX.

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 3

GEOLOGIC CROSS SECTION SHOWING FORMATION DISTRIBUTION IN AND SURROUNDING THE HARTFORD AREA HYDROCARBON PLUME SITE

TETRA TECH EM INC.



SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP (WOOD RIVER. ILL – rev. 1994)

BLOCK LAYOUT

250' 0 250' 500'
SCALE: 1" = 500'

0.5 0 0.5 1 2
SCALE: 1" = 400' (HORZ.)
SCALE: 1" = 20' (VERT. – APPROX).

LEGEND:

🟦	POND/RIVER
🟪	CONOCO PHILLIPS PROPERTY
🟩	SHELL PROPERTY
🟧	PREMCOR PROPERTY
⬜	FILL
—	BLOCK BOUNDARY
▼	GROUNDWATER TABLE
++++++++++	RAILROAD TRACKS
---------	REFINERY/PRIVATE ROADS
—?—?—	UNKNOWN BOUNDARY
🟩	VEGETATED AREA
◆	HARTFORD PUBLIC WATER WELLS
●	ABOVEGROUND STORAGE TANK

PRODUCT LEGEND:

🟥	HEAVY RANGE PETROLEUM HYDROCARBON
🟨	MID–HEAVY RANGE PETROLEUM HYDROCARBON
🟩	MID RANGE PETROLEUM HYDROCARBON
🟦	LIGHT RANGE PETROLEUM HYDROCARBON

GEOLOGIC LEGEND:

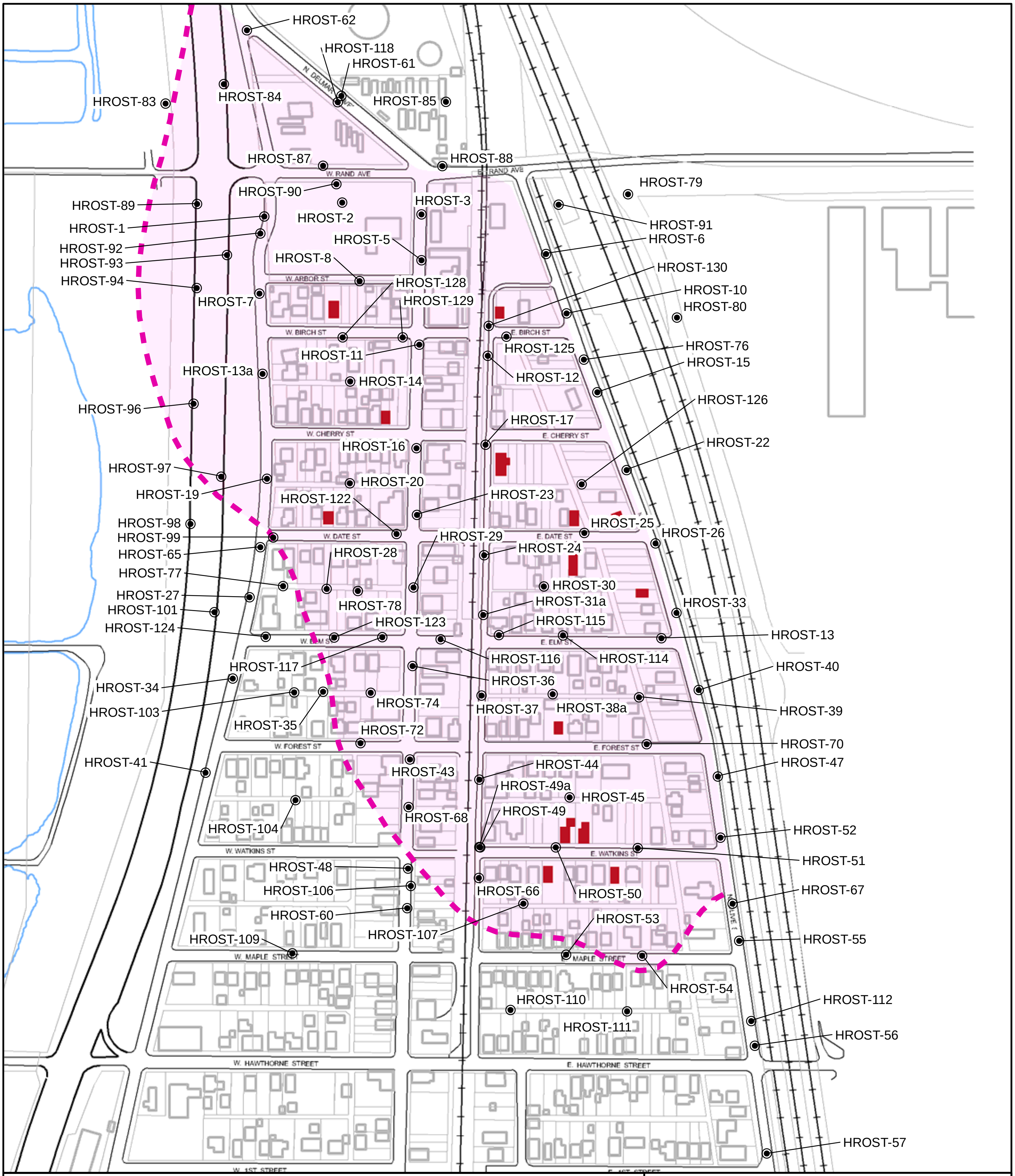
🟫	PERMEABLE LENS
▤	SILTY CLAY
🟫	NORTH OLIVE SAND
🟨	RAND SAND
🟧	EPA SAND
🟫	MAIN SAND

Hartford Area
Hydrocarbon Plume Site
Hartford, Illinois

FIGURE 4
PRELIMINARY GEOLOGICAL CONCEPTUAL SITE MODEL

TETRA TECH EM INC

R:\Clients\Prem Cor\Clayton\ Fig4_TIO_Conceptual-block-diagramsA-E.dwg 07/23/2007 deborah.ford DN



07/24/07 O:\DOJ\FigA5_Plume.mxd TtEMI-DN Kurt.Cholak

Legend

- ● ROST Sample Location
- ROST Response Boundary
- Pond
- Railroad
- Parcel
- Extent of Free Product Plume
- Building
- 🟥 Building with Reported Fire

N
W E
S

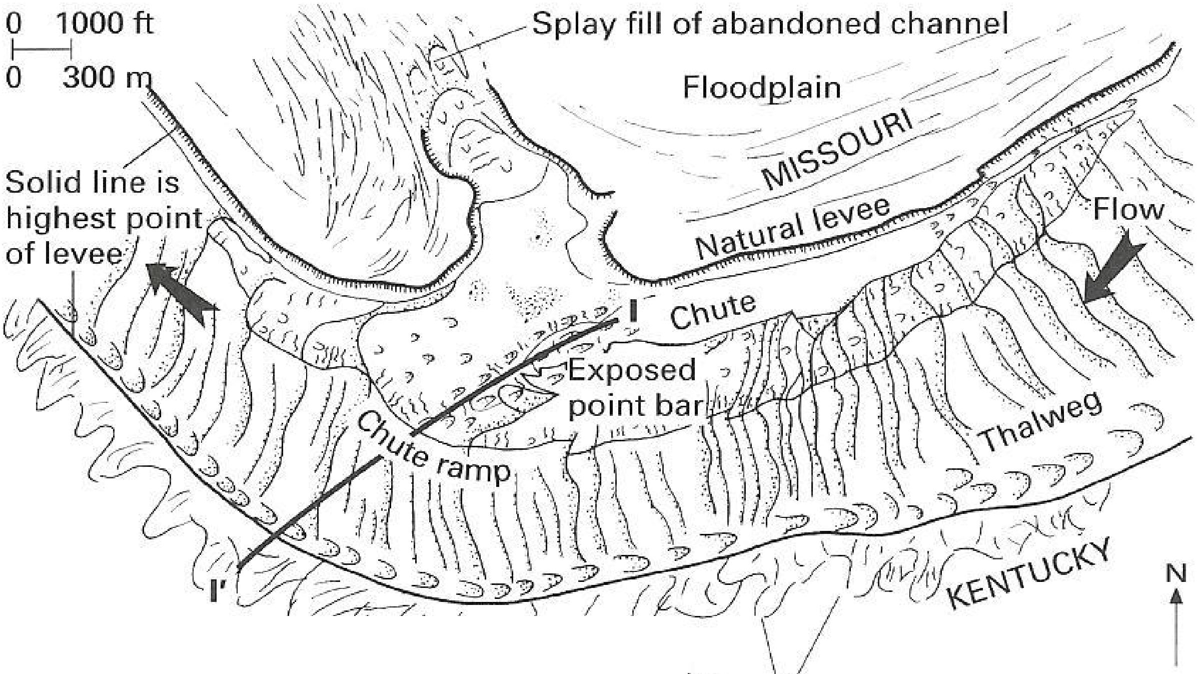
0 400
Feet

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 5

ROST APPROXIMATE
EXTENT OF HYDROCARBON MAP

TETRA TECH EM INC.



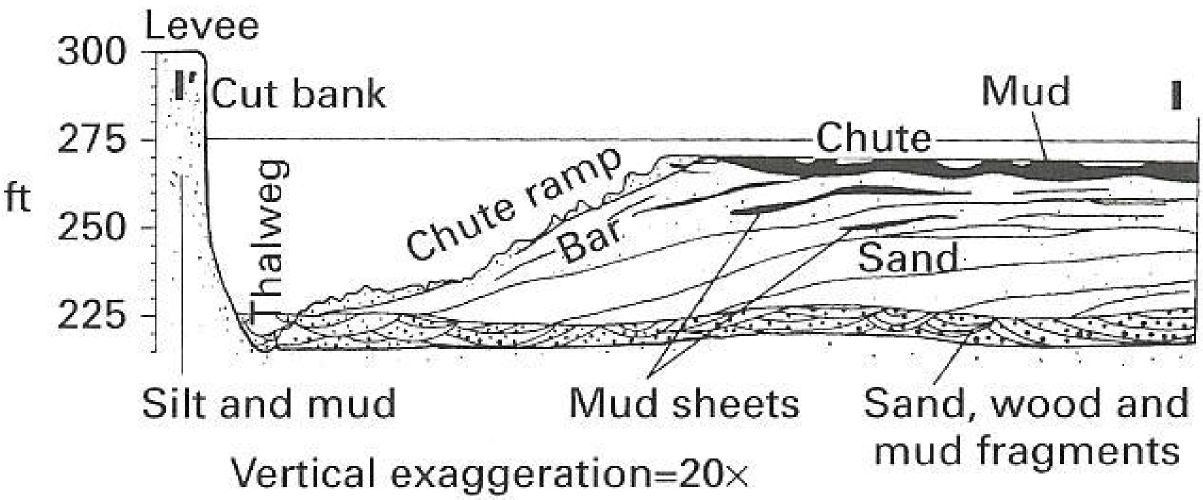
(From Reading, 1998, "Sedimentary Environments)

HARTFORD AREA
HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 6

AVULSION OF A SEDIMENTARY SEQUENCE

TETRA TECH EM INC.



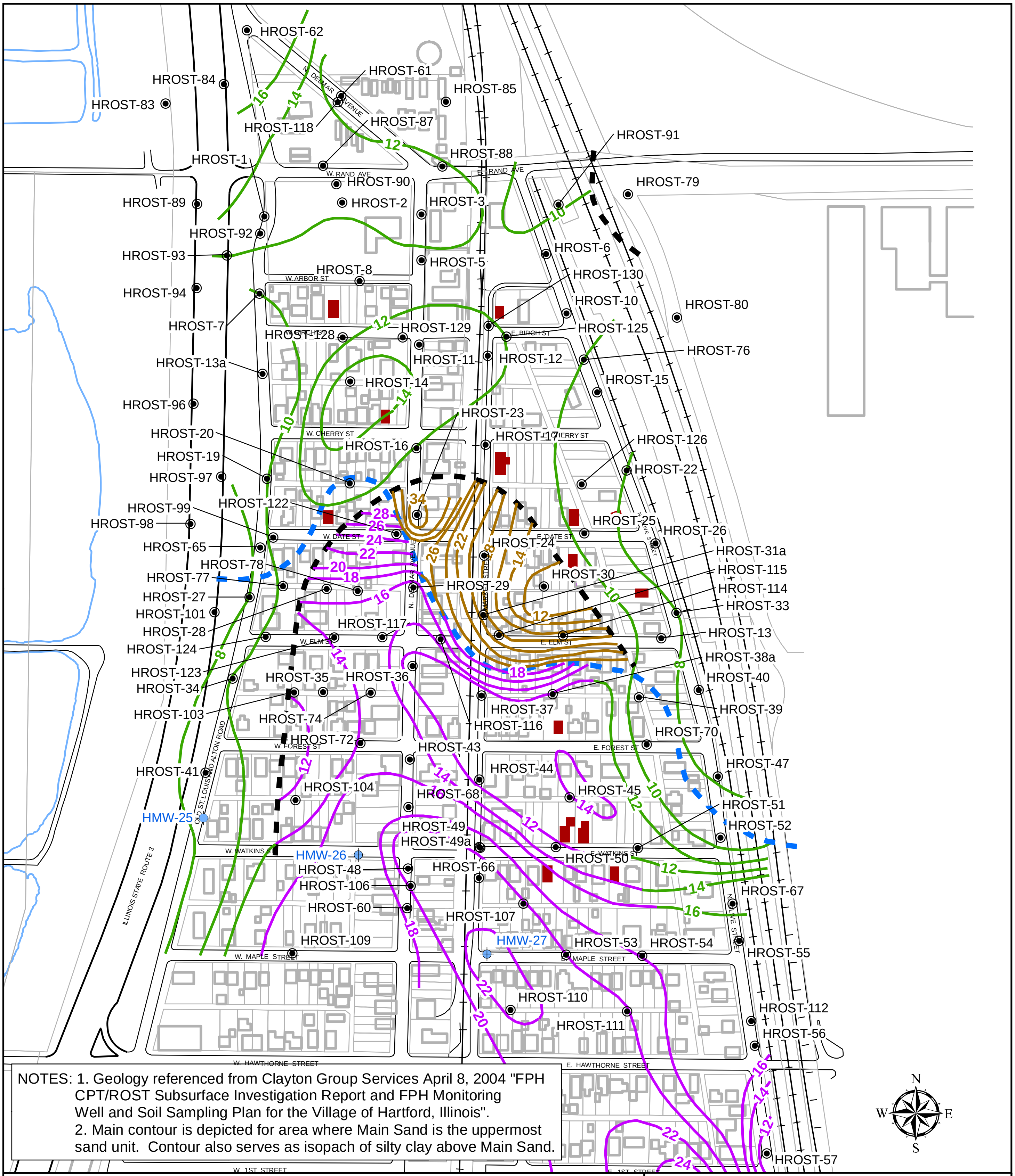
(From Reading, 1998, "Sedimentary Environments)

HARTFORD AREA
HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 7

CROSS SECTION OF A MIXED LOAD RIVER

TETRA TECH EM INC.



NOTES: 1. Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".
2. Main contour is depicted for area where Main Sand is the uppermost sand unit. Contour also serves as isopach of silty clay above Main Sand.

Legend

- ⊙ ROST Sample Location
- ⊕ HMW Well
- Contour of Thickness of A-Clay above North Olive (feet - depth from surface)
- Contour of Thickness of A-Clay above Main (feet - depth from surface)
- Contour of Thickness of A-Clay above Rand (feet - depth from surface)
- Extent of Rand Sand
- Pinched-out Boundary for North Olive
- Pond
- Railroad
- Parcel
- ☐ Building
- 🟥 Building with Reported Fire

0 400
Feet

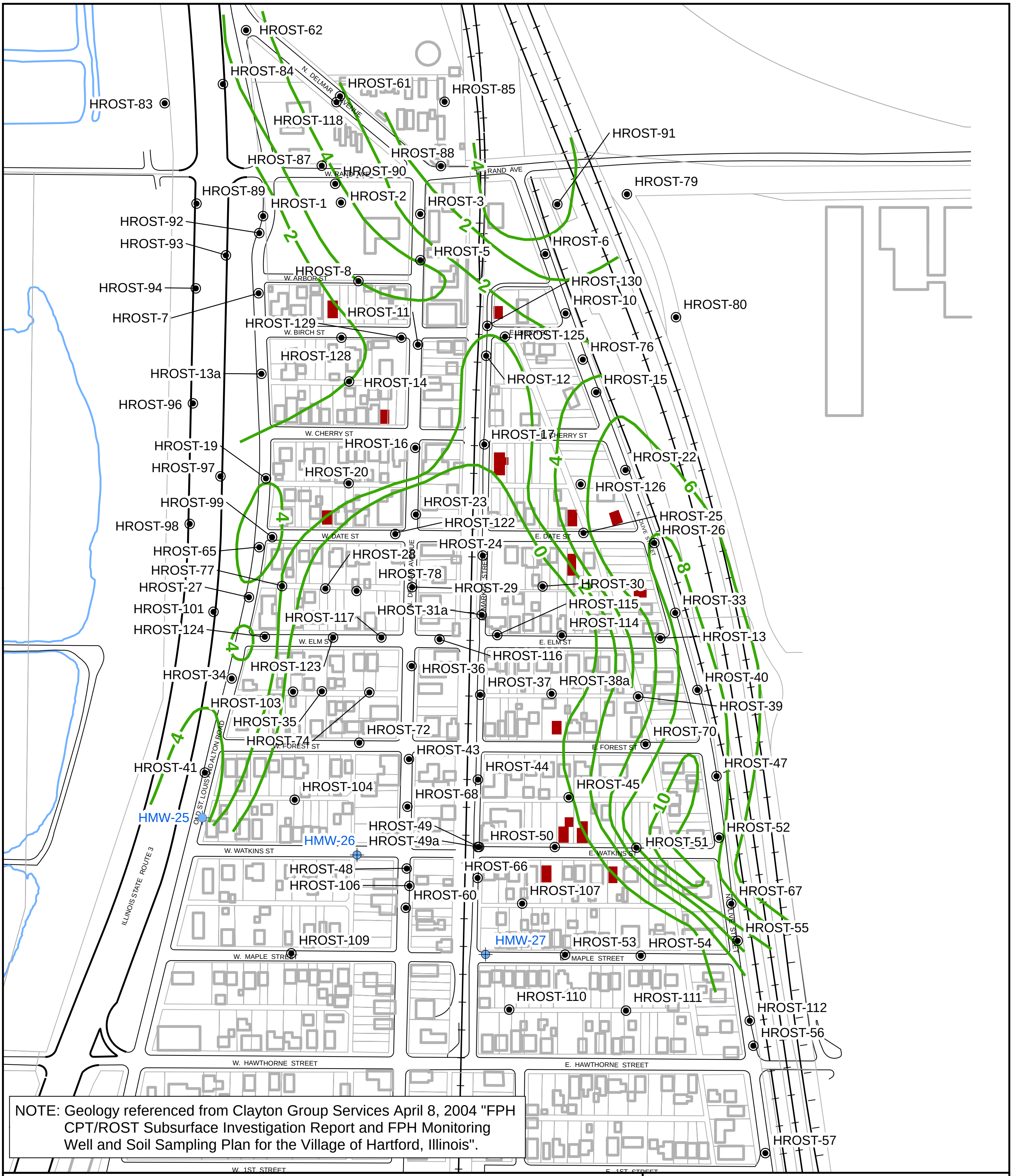
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 8

ISOPACH OF A-CLAY ABOVE
STRATUMS INDICATED

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA8_TopA_Clay.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

◉ ROST Sample Location
⊕ HMW Well
— North Olive Thickness (feet)
— Pond
┼ Railroad
— Parcel
▢ Building
🟥 Building with Reported Fire

N
W E
S

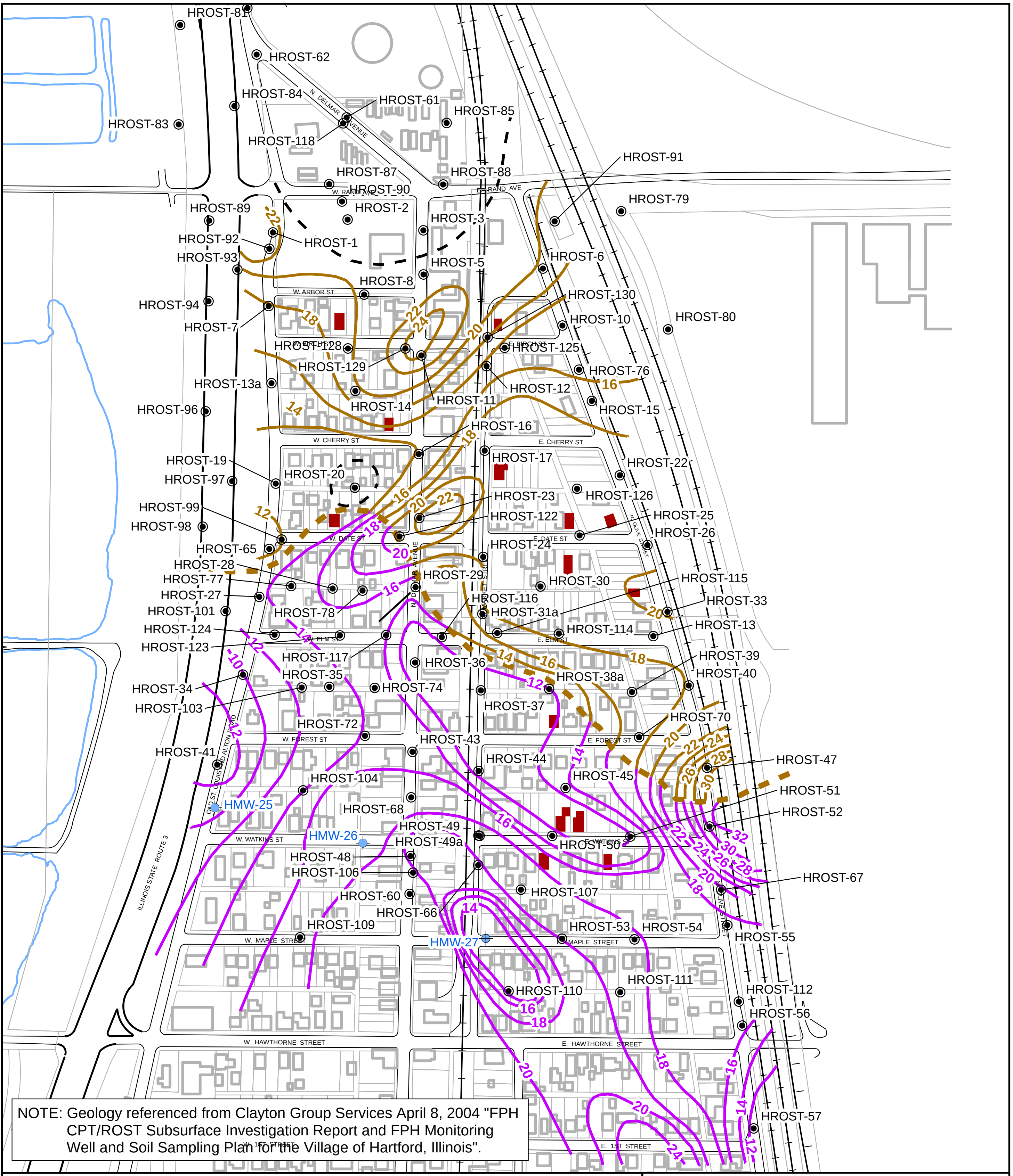
0 400
Feet

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 9
NORTH OLIVE STRATUM ISOPACH

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA9_N_Olive_Sand_Isopach.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

⊙ ROST Sample Location

⊕ HMW Well

Rand Contour (feet - depth from surface)

Main Contour (feet - depth from surface)

Pinched-out Boundary for Rand

Boundary of Rand Conjoining Main

Pond

Railroad

Parcel

▢ Building

■ Building with Reported Fire

N
W E
S

0 400
Feet

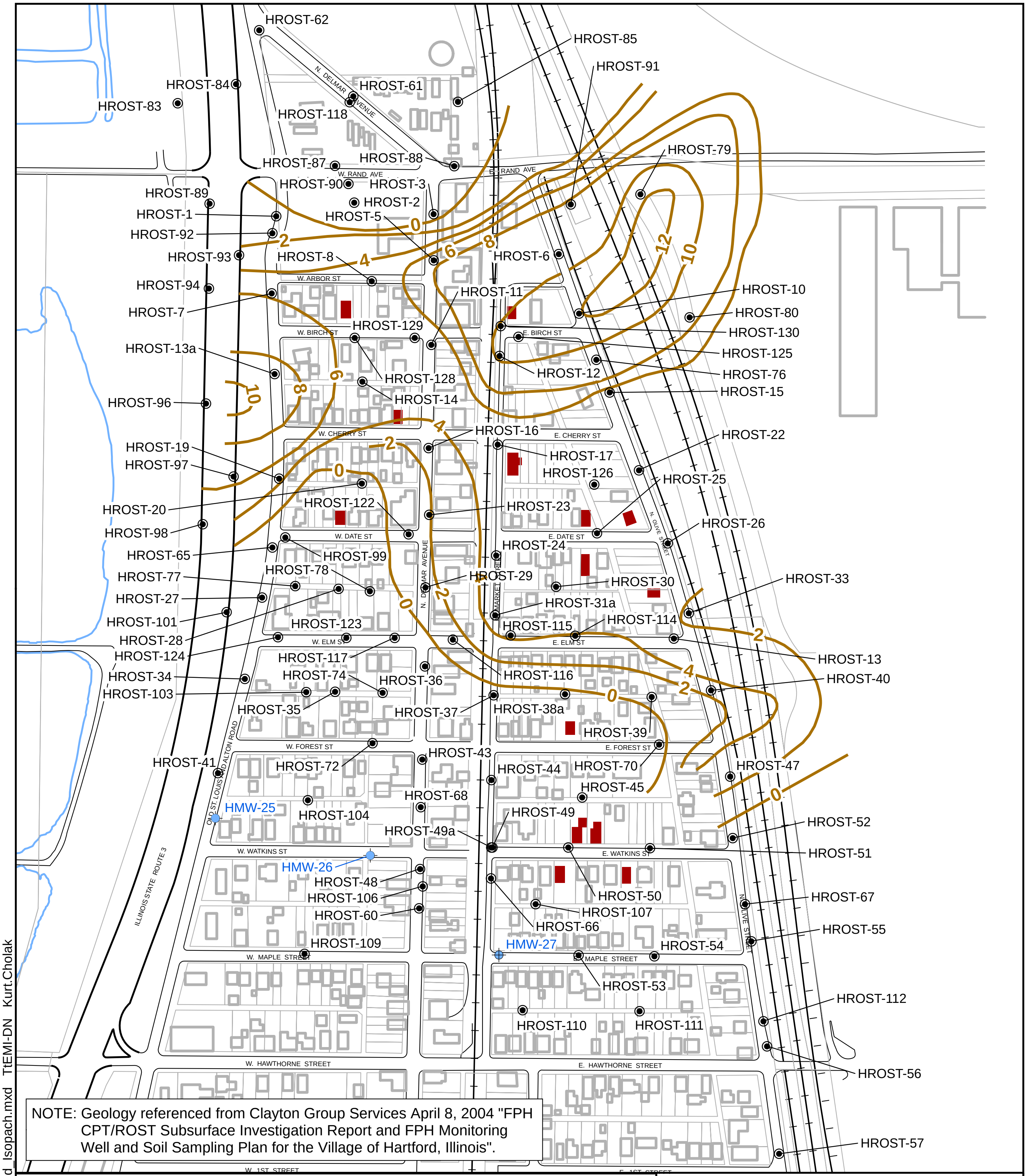
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 10

TOP OF RAND AND
MAIN STRATUM

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA10_Rand_Sand_Top.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

- ⊙ ROST Sample Location
- ⊕ HMW Well
- — Thickness of Rand in feet
- — Pond
- ┼ Railroad
- — Parcel
- ▭ Building
- ■ Building with Reported Fire

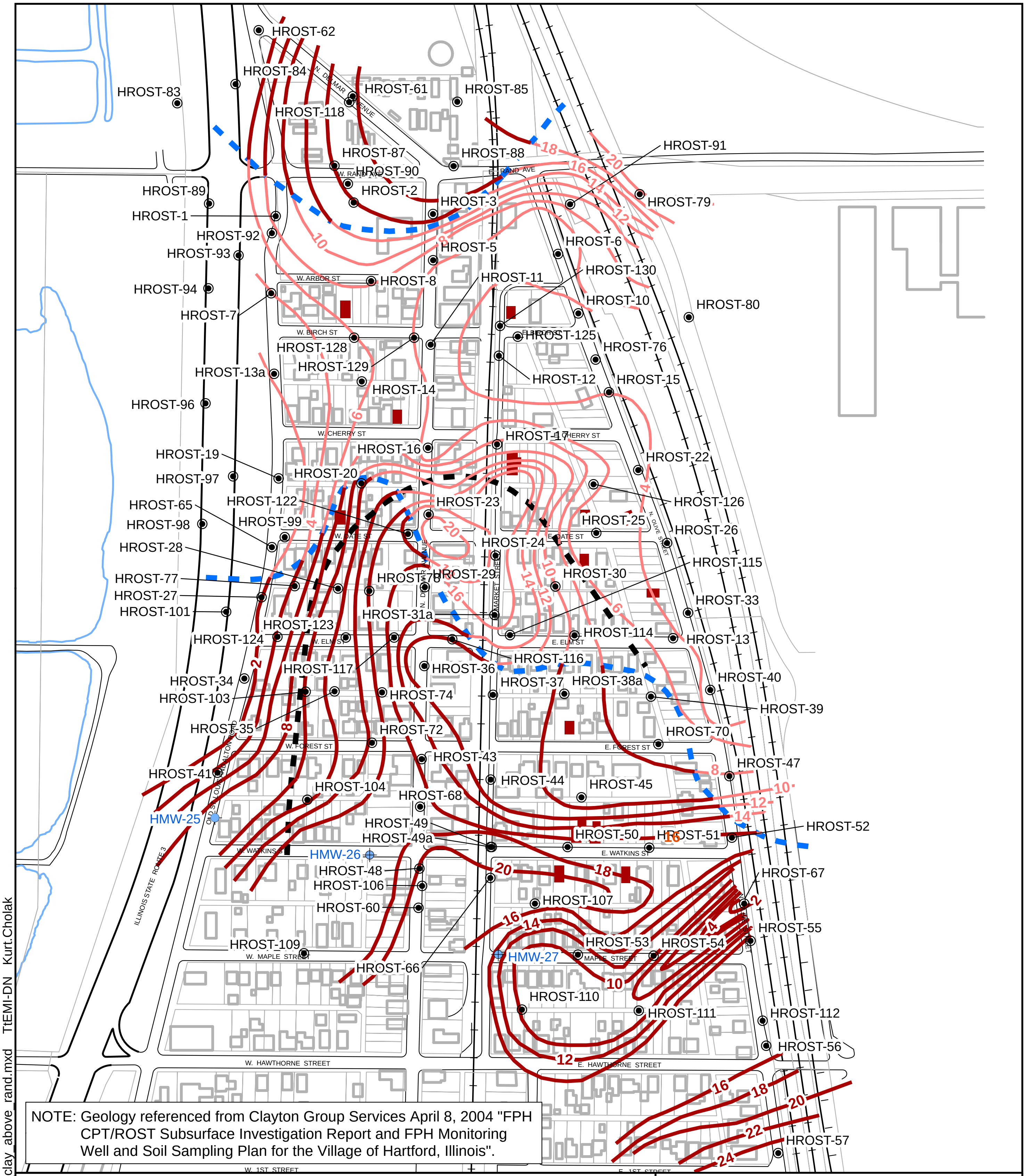
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 11

THICKNESS OF RAND
STRATUM IN FEET

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA11_Rand_Sand_Isopach.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

- ⊙ ROST Sample Location
- ⊕ HMW Well
- — Isopach Silty Clay Contour in feet
- — Isopach Silty Clay Contour above Main in feet
- - - Extent of Rand Sand
- - - Pinched-out Boundary for North Olive
- — Pond
- +— Railroad
- — Parcel
- ☐ Building
- ■ Building with Reported Fire

N
W E
S

0 400
Feet

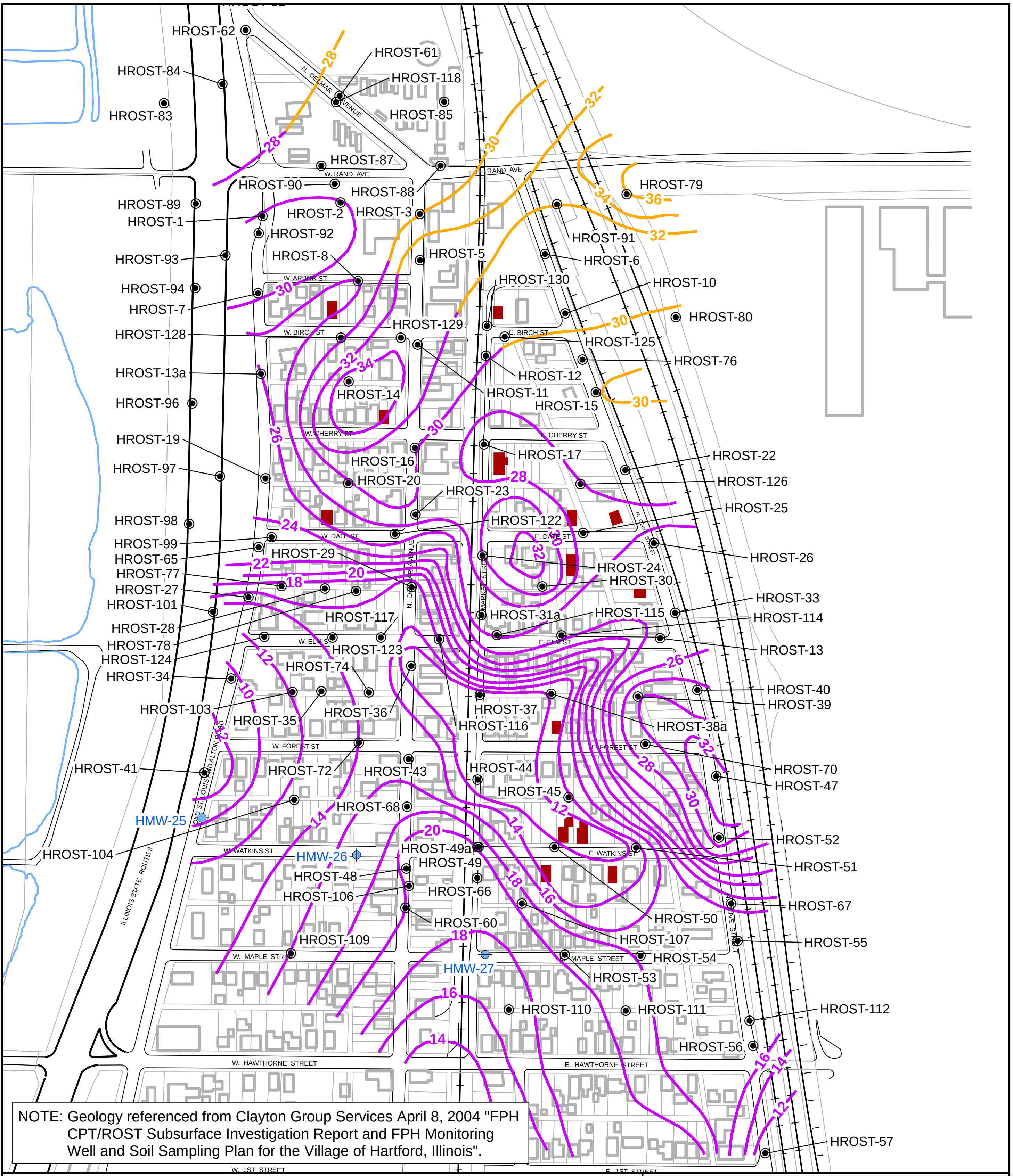
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 12

ISOPACH OF SILTY CLAY BETWEEN RAND STRATUM OR MAIN SAND AND THE NORTH OLIVE STRATUM OR GROUND SURFACE

TETRA TECH EM INC.

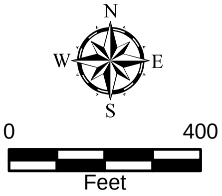
2007-07-24 O:\DOJ\FigA12 isopach clay above rand.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

- ⊙ ROST Sample Location
- ⊕ HMW Well
- — EPA Contour (feet - depth from surface)
- — Main Contour (feet - depth from surface)
- — Pond
- —+— Railroad
- — Parcel
- ☐ Building
- ■ Building with Reported Fire

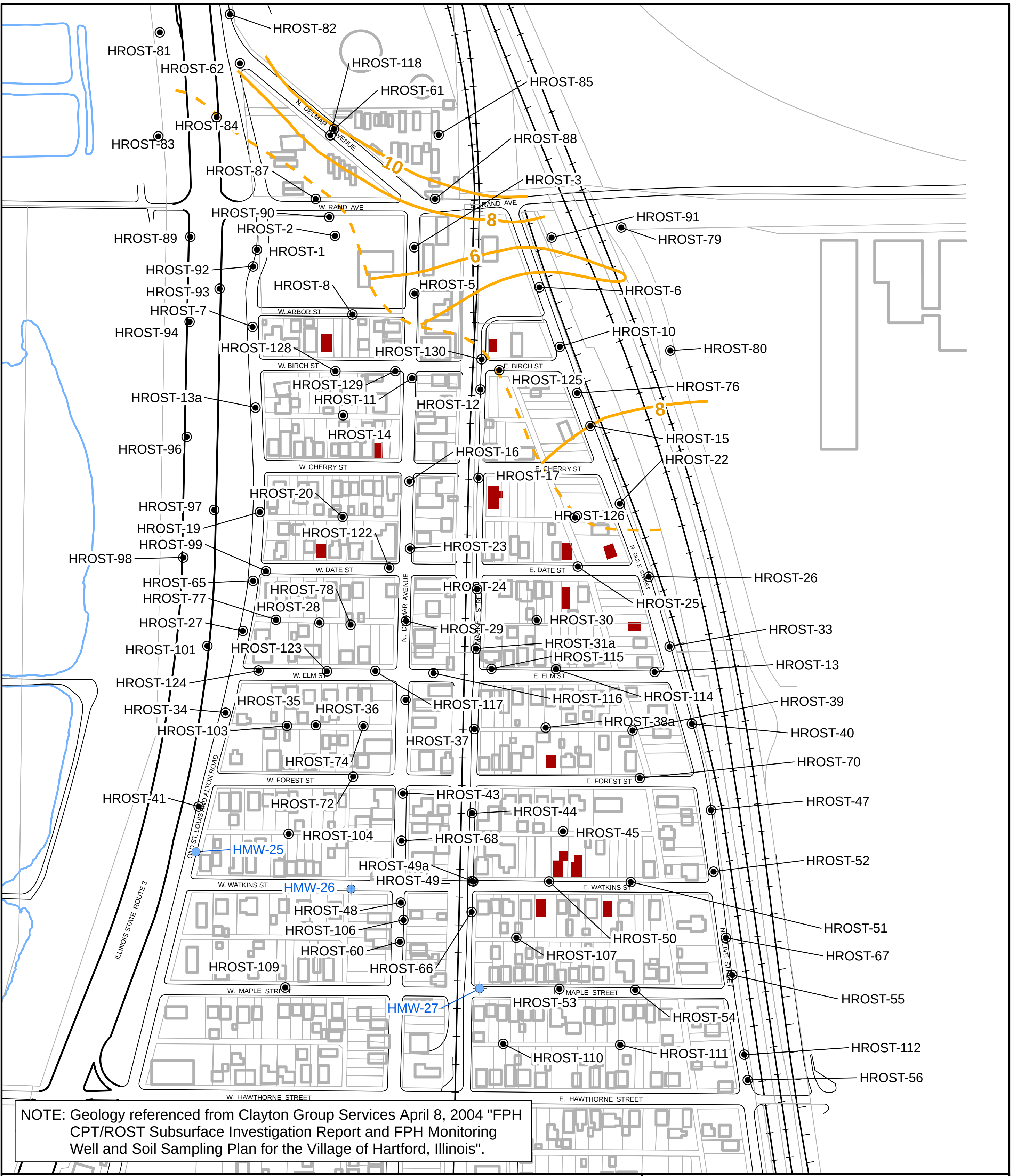


HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 13
TOP OF EPA STRATUM

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA13_Epa_Sand_Top.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

- ⊙ ROST Sample Location
- – – EPA Merges with Main Boundary
- — EPA Thickness (Feet)
- — Pond
- ┼ Railroad
- — Parcel
- ☐ Building
- 🟥 Building with Reported Fire

N
W E
S

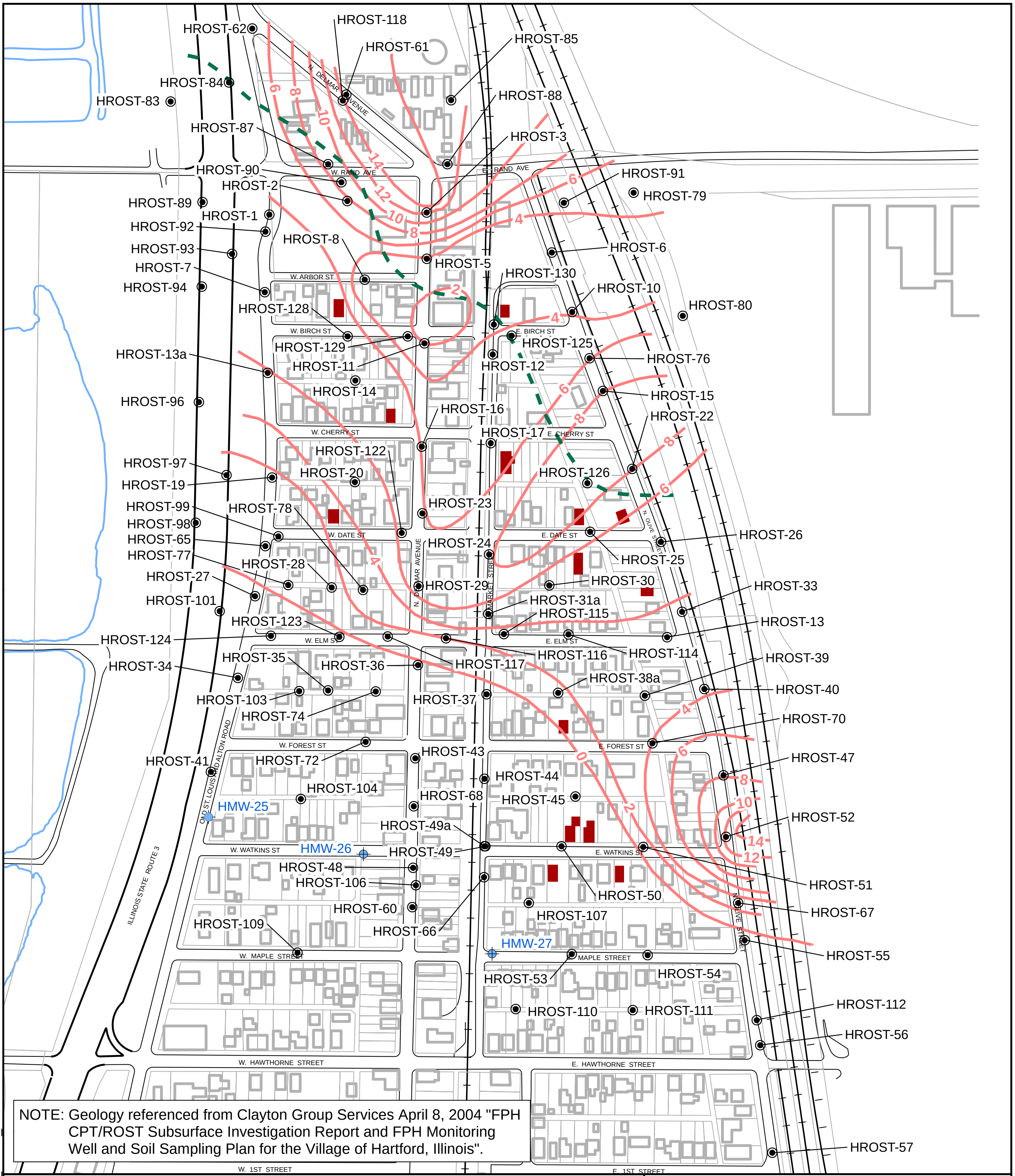
0 400
Feet

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 14
EPA STRATUM ISOPACH

TETRA TECH EM INC.

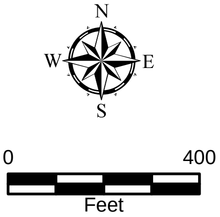
2007-07-24 O:\DOJ\FigA14_Epa_Sand_Isopach.mxd TtEMI-DN Kurt.Cholak



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

⊙	ROST Sample Location
⊕	HMW Well
—	Silty Clay Thickness (feet)
- -	Extent of EPA Sand
—	Pond
+—	Railroad
—	Parcel
☐	Building
■	Building with Reported Fire

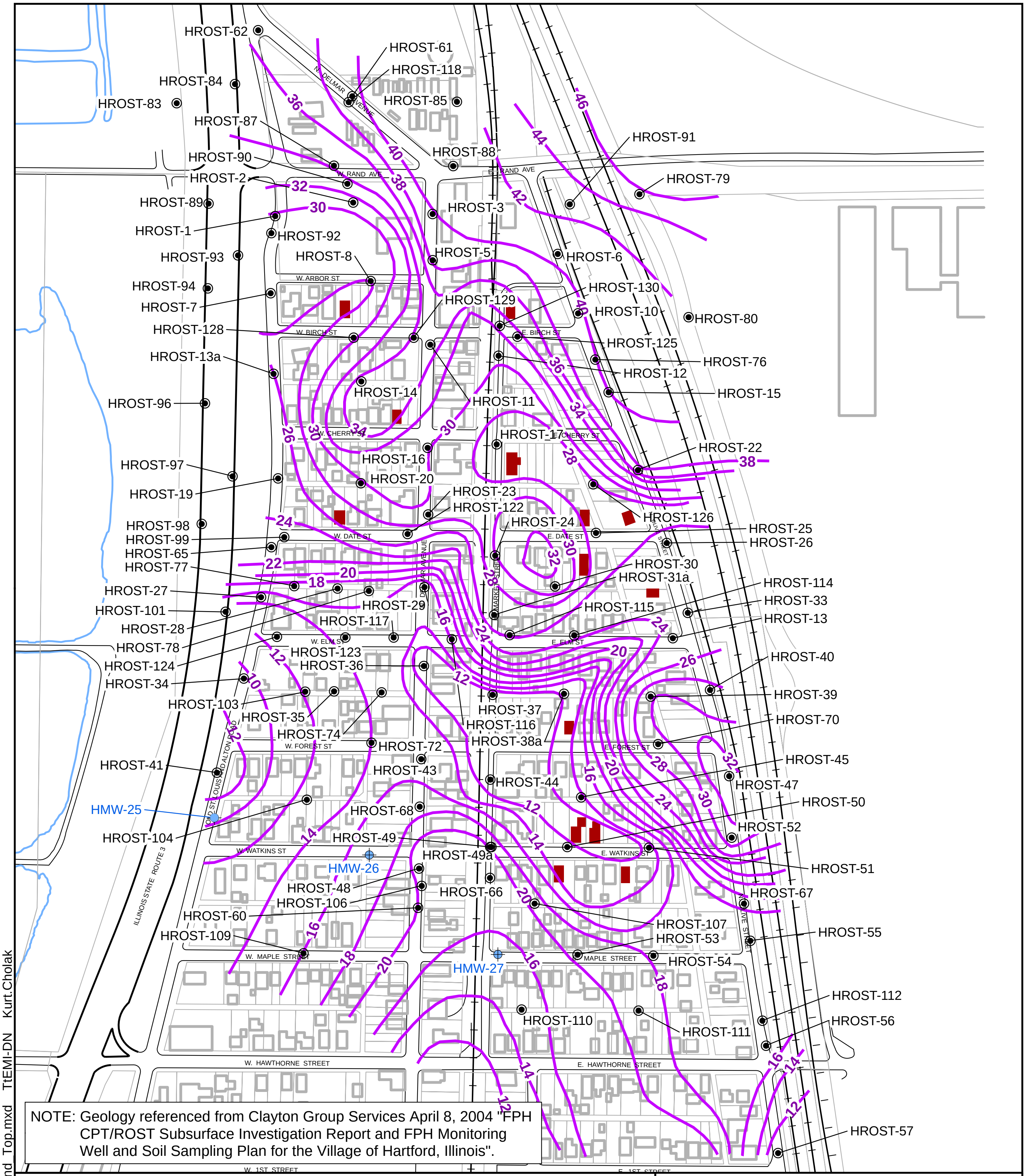


HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 15
ISOPACH OF SILTY CLAY BETWEEN EPA STRATUM OR MAIN SAND AND THE RAND STRATUM OR NORTH OLIVE STRATUM

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA15_Silty_Clay_above_EPA.mxd TtEMI-DN Kurt.Cholak

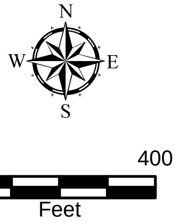


NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

2007-07-24 O:\DOJ\FigA16 Main Sand Top.mxd TtEMI-DN Kurt.Cholak

Legend

- ⊙ ROST Sample Location
- ⊕ HMW Well
- Main Contour in feet
- Pond
- Railroad
- Parcel
- ▭ Building
- 🟥 Building with Reported Fire

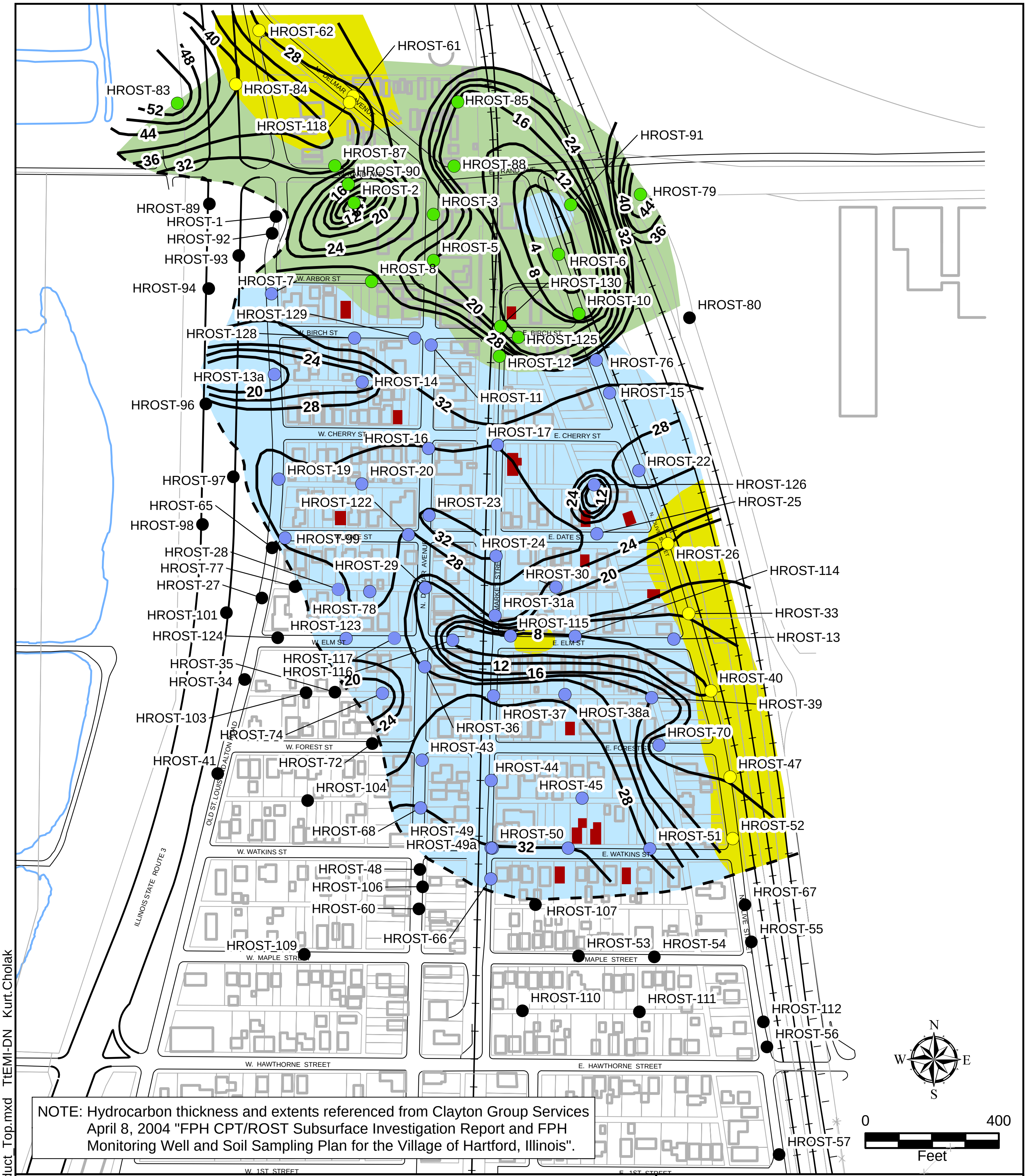


HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 16
TOP OF MAIN SAND

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA17_Total_Product_Top.mxd TtEMI-DN Kurt.Cholak



NOTE: Hydrocarbon thickness and extents referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

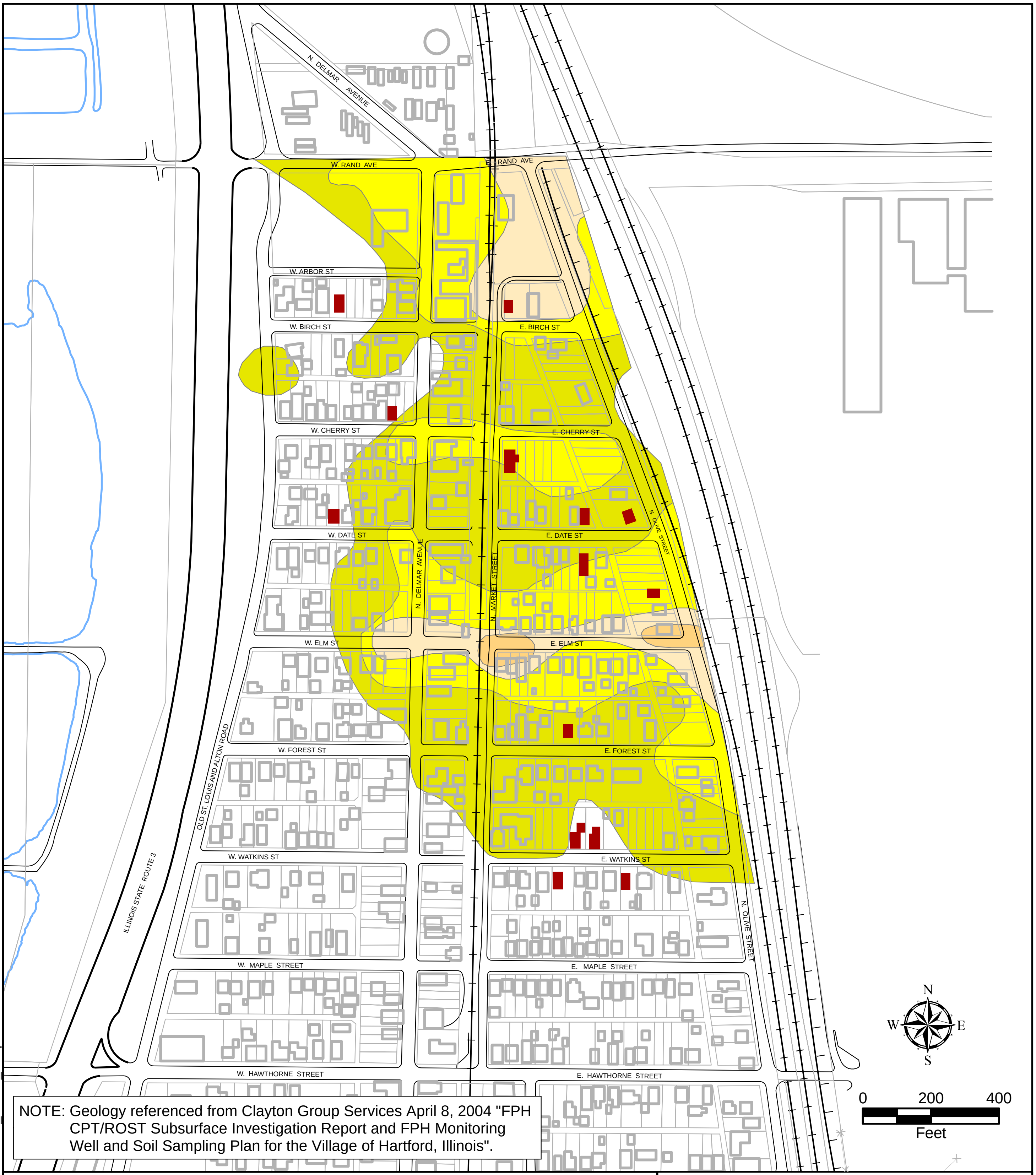
Legend

●	ROST Sample Location - no apparent product
🔵	ROST Sample Location - Light Range Product
🟢	ROST Sample Location - Mid Range Product
🟡	ROST Sample Location - Heavy Range Product
- -	Product Boundary
—	Product Contour in feet, depth below surface
▭	Building
🟥	Building with Reported Fire
🟦	Light Range Product Boundary
🟩	Mid Range Product Boundary
🟨	Heavy Range Product Boundary
—	Pond
+—+	Railroad
—	Parcel

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 17
TOP OF TOTAL PETROLEUM HYDROCARBON ROST RESPONSE

TETRA TECH EM INC.



NOTE: Geology referenced from Clayton Group Services April 8, 2004 "FPH CPT/ROST Subsurface Investigation Report and FPH Monitoring Well and Soil Sampling Plan for the Village of Hartford, Illinois".

Legend

🟨	5 to < 10 Feet of total ROST Response
🟨	10 to < 20 Feet of total ROST Response
🟧	20 to < 30 Feet of total ROST Response
🟧	30 to < 40 Feet of total ROST Response
▭	Building
🟥	Building with Reported Fire
—	Pond
┼	Railroad
—	Parcel

Note: < Less Than

Sources:
Clayton Group Services, Inc. 2006a.,
Clayton Group Services, Inc. 2004b.,
Clayton Group Services, Inc. 2006c.

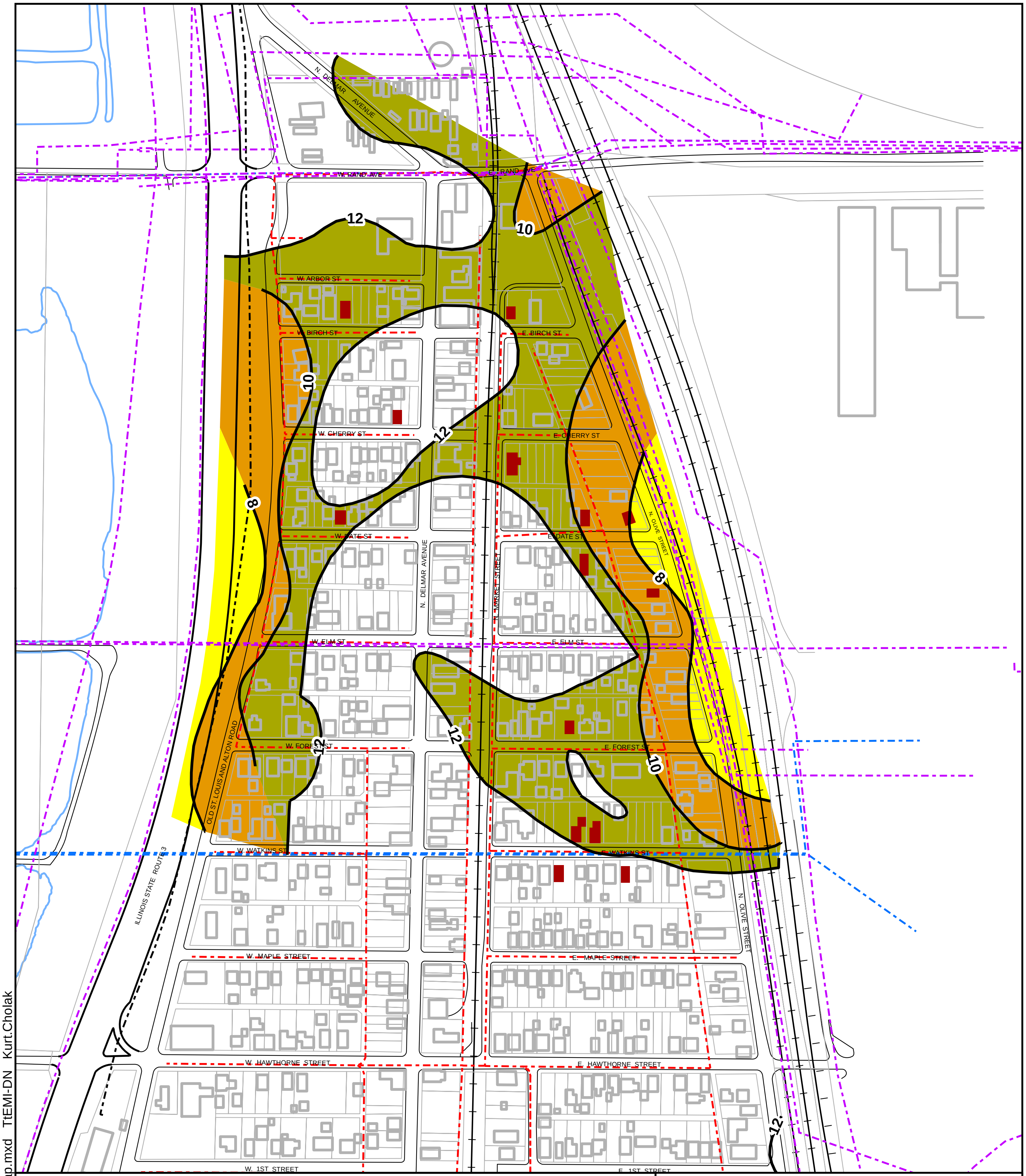
HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 18

TOTAL PETROLEUM HYDROCARBON ROST RESPONSE THICKNESS

TETRA TECH EM INC.

2007-07-24 O:\DOJ\FigA18_Product_Thickness_ROST_Responses.mxd TtEMI-DN Kurt.Cholak



2007-07-24 O:\DOJ\FigA19_Sewer_Map.mxd TtEMI-DN Kurt.Cholak

Legend

— Top of Sand (feet - depth from surface)
- - Product Pipeline
- - Municipal Sewer
- - Industrial Sewer
- - Forced Main
— Pond
+ Railroad
— Parcel

🟨 Less than 8 Feet Below Ground Surface
🟧 8-10 Feet Below Ground Surface
🟩 10-12 Feet Below Ground Surface
☐ Building
🟥 Building with Reported Fire

N
W E
S

0 400
Feet

HARTFORD AREA HYDROCARBON PLUME SITE
HARTFORD, ILLINOIS

FIGURE 19

LOCATIONS WHERE POROUS STRATUM (SAND UNITS) ARE POTENTIALLY IN CONTACT WITH PRODUCT PIPELINES AND MUNICIPAL SEWERS

TETRA TECH EM INC.

Considerations for Applying
the Triad Approach
Hartford Area Hydrocarbon Plume Site

Office of Solid Waste and
Emergency Response

EPA-542-R-06-008
August 2007
www.epa.gov/tio
http://clu-in.org

United States
Environmental Protection Agency
(5102G)
Washington, DC 20460

Official Business
Penalty for Private Use $300

ENCLOSURE 4

TARGET ANALYTE LISTS AND REPORTING LIMITS FOR ACTIVITIES CONDUCTED AT THE HARTFORD PLUME SITE

CLAYTON. 2004. FREE-PASE HYDROCARBON INVESTIGATION REPORT. OCTOBER 29TH.

VILLAGE OF HARTFORD, ILLINOIS

TABLE 3-3
Probe/Well Development Indicator Parameters Summary
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

Probe/Well Number	Date	Time	Total Volume of Water Purged (gals)	Temperature (°F)	pH (std. units)	Conductivity (uS/cm)	Total Dissolved Solids (ppm)	Visual Clarity/Observations
MP-29C	08/06/04	0813	8	65.3	6.22	872	456	Very Cloudy
		---	Purged Dry	---	---	---	---	---
	08/11/04	---	Dry	---	---	---	---	---
MP-29 D	07/26/04	1003	2.5	71.7	6.34	1050	545	Dark Brown, Cloudy, Oil Droplets
		---	10	65.6	5.74	1112	576	Dark Brown, Cloudy, Oil Droplets
		---	25	64.8	5.54	497	265	Light Brown, Cloudy, Oil Droplets
		---	35	63.8	5.45	299	586	Light Brown, Cloudy, Oil Droplets
		---	50	63.4	5.41	334	174	Clear/Light Brown, Oil Droplets
		---	100	65.1	5.30	956	495	Clear/Semi-Cloudy, Oil Droplets
		---	110	64.4	5.29	1064	548	Clear/Semi-Cloudy, Oil Droplets
		---	125	65.0	5.25	986	514	Clear/Semi-Cloudy, Oil Droplets
		---	150	64.9	5.28	1007	527	Clear/Semi-Cloudy, Oil Droplets
		1054	160	64.7	5.28	988	520	Clear/Semi-Cloudy, Oil Droplets
MP-30 C	08/10/04	0903	12	66.9	6.27	1085	552	Very Cloudy
		0907	28	66.6	6.53	1025	523	Slightly Cloudy
		0913	64	63.8	6.52	1022	521	Very Cloudy
		0915	76	64.9	6.48	1022	522	Slightly Cloudy
		0918	94	65.7	6.50	1030	523	Slightly Cloudy
		0921	112	67.9	6.48	1020	515	Slightly Cloudy
		0926	142	64.9	6.50	1013	516	Slightly Cloudy
		0928	154	64.9	6.53	1003	512	Slightly Cloudy
		0930	166	65.1	6.53	1020	519	Slightly Cloudy
		0932	178	65.1	6.51	1023	524	Slightly Cloudy
		0934	190	65.0	6.53	1039	517	Slightly Cloudy
		0936	202	64.6	6.54	1011	514	Slightly Cloudy
MP-31C	08/05/04	0900	5	64.4	5.97	739	384	Very Cloudy
		0904	10.2	64.3	6.13	834	431	Very Cloudy
		0909	16.7	63.8	6.01	1050	546	Cloudy
		0914	23.2	64.4	5.89	1218	633	Cloudy
		0919	29.7	64.1	5.87	1274	662	Cloudy
		0924	36.2	64.2	6.01	1306	678	Slightly Cloudy
		0929	42.7	63.5	5.97	1288	669	Cloudy
		0933	47.9	63.8	6.02	1364	709	Cloudy
		0937	53.1	64.0	6.03	1401	728	Cloudy
		0940	57	64.1	6.05	1358	705	Slightly Cloudy

TABLE 4-1
Soil Chemical Analysis Results - BETX/MTBE and LEAD
Main Sand
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

SAMPLE			COMPOUNDS							COMMENTS	PIPELINE CORRIDOR
ID	Date Collected	Sample Depth ft bgs	Benzene ug/kg	Ethylbenzene ug/kg	Toluene ug/kg	Total Xylenes ug/kg	MTBE ug/kg	Lead mg/kg	Total BETX ug/kg		
MP-31	07/20/04	24.0	3.2	2.3 J	6.4	5.8	< 2.3	14.8	17.7	Shallow outside of FPH plume	NA
MP-48	07/20/04	24.0	37,300	89,300	195,000	389,000	< 2,170	8.44	710,600	Shallow within FPH plume	NA
Dup-03	07/20/04	24.0	38,100	84,900	192,000	372,000	< 2,200	7.29	687,000		
MP-65	08/19/04	10.0-12.0	1.1 J	3.2 J	5.6	10.1	< 2.9	7.77	20	Shallow outside of FPH plume	NA
Dup-01	08/19/04	10.0-12.0	< 1.5	< 7.6	< 7.6	2.1	< 3.0	9.16	2.1		
MP-65	08/18/04	20.0-22.0	3.4	3.8 J	8.1	10.2	< 2.7	6.95	25.5	Deep outside of FPH plume	NA
MP-66	08/20/04	10.0-12.0	2.2	4.5 J	13	13.8	< 2.4	14.8	33.5	Shallow outside of FPH plume	NA
MP-66	08/20/04	20.0-22.0	1.1	1.4 J	3.2	4.6	< 2.2	3.1 J	10.3	Deep outside of FPH plume	NA
MP-67	08/19/04	20.0-22.0	1 J	1.9 J	2.8	7.1	< 3.3	6.82	12.8	Deep outside of FPH plume	NA
HMW-40	08/03/04	22.0-24.0	3.9	2.2 J	6.6	6.4	< 2.5	4.86	19.1	Outside of FPH plume	NA
HMW-42	08/04/04	23.0-24.0	5.8	3.5 J	8.7	34.5	< 2.7	6.84	52.5	Outside of FPH plume	NA
HMW-51	08/03/04	18.0-20.0	4.6	2.8 J	10.6	8.1	< 2.8	4.78	26.1	Outside of FPH plume	NA
Dup-02	08/03/04	18.0-20.0	3.6	3.8 J	9.2	8.9	< 2.7	4.6	25.5		
HMW-52	08/25/04	14.0-16.0	3.1	1.9 J	7.0	7.5	< 2.7	10.1	19.5	Outside of FPH plume	NA
VMP-21	07/23/04	29.0-30.0	408	10,300	6,980	43,900	< 184	---	61,588	Within FPH plume	Rand
										(sample collected in wet/saturated conditions)	
VMP-36	09/01/04	34.0	23,000	121,000	291,000	562,000	< 1,340	---	997,000	Within FPH plume	N. of E. Elm
										(sample collected in wet/saturated conditions)	
VMP-44	09/01/04	27.0	128	117	36.7	267	< 2.3	---	548.7	Outside of FPH plume	NA
										(sample collected in wet/saturated conditions)	

NOTES:

ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
ft bgs = feet below ground surface
J = Analyte detected below reporting limits.
NA = Not Applicable
--- = compound not analyzed

TABLE 4-1
Soil Chemical Analysis Results - Metals and Inorganics
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

SAMPLE			METAL COMPOUNDS														INORGANICS		
ID	Date Collected	Sample Depth ft bgs	Antimony mg/kg	Arsenic mg/kg	Barium mg/kg	Beryllium mg/kg	Cadmium mg/kg	Total Chromium mg/kg	Cobalt mg/kg	Lead mg/kg	Mercury mg/kg	Nickel mg/kg	Selenium mg/kg	Silver mg/kg	Vanadium mg/kg	Zinc mg/kg	Cyanide mg/kg	COMMENTS	PIPELINE CORRIDOR
MP-29	07/12/04	13.0	0.45 J	16.7	217	1.04	1.37	30.8	14.5	23.0	0.04	37.4	< 0.566	< 0.89	78.2	102	< 0.64	Clay above Rand below N.Olive within FPH plume	NA
MP-31	07/20/04	19.0	0.64	8.99	243	0.78	0.66	19.5	9.54	14.8	0.04	24.8	0.45 J	< 0.94	35.9	83.4	< 0.66	Clay above Main below N.Olive outside FPH plume	NA
MP-34	07/19/04	27.5	0.43 J	14.0	171	0.76	0.35	24.5	12.7	16.3	0.04	29.3	< 0.588	< 0.98	48.5	89.4	< 0.66	Clay above Main below Rand within FPH plume	NA
MP-47	07/13/04	10.0	0.24 J	8.69	124	< 0.09	0.47	13.4	6.27	13.3	0.02	19	< 0.588	< 0.94	29.6	51	< 0.64	N.Olive within FPH plume	N. Olive
MP-47	07/13/04	20.0	0.28 J	4.39	216	0.63	0.62	17.4	6.72	17.3	0.03	19.7	< 0.600	< 0.89	32.9	77.9	< 0.70	Rand within FPH plume	N. Olive
MP-47	07/13/04	27.0	0.43 J	8.2	198	1.15	1.23	27.5	12.0	24.4	0.05	35.8	< 0.545	< 0.93	59.6	88.0	< 0.67	Clay above Main below Rand within FPH plume	N. Olive
MP-55	07/16/04	12.0	0.43 J	6.51	199	< 0.10	0.32	13.6	7.94	13.9	0.03	22.8	< 0.600	< 0.96	33.0	59.2	< 0.62	N.Olive within FPH plume	Elm/N. Olive
MP-55	07/16/04	20.0	0.20 J	< 2.45	183	0.50	0.27	12.8	6.61	13.2	0.03	16.2	< 0.577	< 0.98	24.5	77.9	< 0.64	Rand within FPH plume	Elm/N. Olive
HMW-38	08/03/04	26.0-28.0	0.58	8.75	314	0.79	0.36	25.0	11.5	15.0	0.05	29.6	< 0.600	< 0.98	50.7	86.4	0.2 J	Clay above Main below N.Olive outside FPH plume	Rand
HMW-44	08/05/04	16.0-18.0	0.9	21.8	240	1.22	1.33	27.2	12.9	22.1	0.07	38.4	< 0.588	< 0.98	69.8	108	< 0.68	Clay above Rand below N.Olive within FPH plume	N. Olive
HMW-44	08/05/04	20.0-22.0	0.18 J	3.92	132	< 0.10	0.45	13.0	6.09	23.7	0.06	17.2	< 0.556	< 1.00	23.7	41.6	< 0.63	Rand within FPH plume	N. Olive
HMW-44	08/05/04	26.0-28.0	0.67	1.6 J	212	1.11	0.55	27.5	11.1	21.7	0.06	31.1	< 0.588	< 0.93	42.6	101	< 0.70	Clay above Main below Rand within FPH plume	N. Olive
HMW-45	08/04/04	22.0-24.0	0.45 J	9.5	196	0.56	0.43	20.8	10.6	18.8	0.05	20.6	< 0.600	< 1.00	42.1	70.2	< 0.63	Clay above Rand below N.Olive within FPH plume	NA
HMW-45	08/04/04	28.0-30.0	0.21 J	4.19	184	0.95	0.92	26.6	9.1	19.2	0.02	25.5	< 0.577	< 0.98	37.9	89.7	< 0.70	Clay above Main below Rand within FPH plume	NA
HMW-46	08/02/04	12.0-14.0	0.68	6.89	208	0.61	0.36	19	8.99	13.6	0.02	25.3	< 0.600	< 1.00	38.8	62.7	< 0.63	N.Olive within FPH plume	Rand
HMW-47	08/02/04	14.0-16.0	0.92	11.3	245	0.92	0.41	24	11.8	20.2	0.05	30.3	< 0.566	< 1.00	48.3	89.6	0.22 J	N.Olive within FPH plume	Rand
HMW-48	08/02/04	14.0-16.0	1.17	9.46	259	0.97	0.39	23.2	9.51	17.9	0.05	29.4	< 0.566	< 0.94	45.7	88.6	0.30 J	Clay above Rand below N.Olive within FPH plume	N. Olive
HMW-48	08/02/04	22.0-24.0	0.27 J	3.94	82.2	0.47	0.22	13.4	8.55	12.4	0.02	19.7	< 0.588	< 1.00	26.0	38.0	0.23 J	Rand within FPH plume	N. Olive
HMW-51	08/03/04	10.0-12.0	0.44 J	5.85	296	0.41	0.22	11.5	9.46	11.2	0.01	18.5	< 0.556	< 0.94	26.0	51.2	< 0.59	N.Olive outside FPH plume	NA
HSVE-12	07/29/04	20.0-22.0	0.91	6.14	196	< 0.10	0.42	13.9	9.03	25.8	0.03	22	0.951	< 0.98	21.3	57.1	< 0.61	Clay within FPH plume	NA

NOTES:
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
ft bgs = feet below ground surface
J = Analyte detected below reporting limits.
NA = Not Applicable

TABLE 4-2
Soil Geotechnical Analysis Results - North Olive Stratum
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

SAMPLE			SAMPLE ANALYSIS								DESCRIPTION
							PERCENT COMPOSITION				
Boring ID	Date Collected	Sample Depth (ft bgs)	Natural Moisture Content (%)	Fraction Of Organic Carbon (mg/kg)	Porosity (%)	Permeability (K) (cm/sec)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	
MP-29	07/28/04	10.0-12.0	29.1	0.022	--	--	0	40	46	14	Gray Sandy Lean SILT, ML
MP-31	07/29/04	14.0-16.0	26.4	0.025	--	--	0	64	25	11	Brown Sandy Lean SILT, ML
MP-34	07/28/04	14.0-16.0	32.2	0.036	--	--	0	3	66	32	Gray-Brown Lean CLAY, Trace SAND, CL
MP-47	07/16/04	8.0-10.0	30.5	0.022	--	--	0	3	76	22	Brown Lean SILT, Trace SAND, ML
		10.0-12.0	34.5	0.022	--	--	0	2	77	20	Brown Lean SILT, Trace SAND, ML
MP-48	08/02/04	16.0-18.0	27.6	0.042	--	--	0	14	72	15	Gray-Brown Lean SILT, Trace SAND, ML
MP-55	07/20/04	10.0-12.0	28.8	0.017	--	--	0	5	83	12	Gray Lean SILT, Trace SAND, ML
HMW-35	06/15/04	12.0-14.0	36.2	--	--	--	0	7	71	22	Lean SILT, Trace SAND, ML
HMW-38	08/17/04	14.0-16.0	29.1	0.047	--	--	0	5	64	31	Gray-Brown Lean CLAY, Trace SAND, CL
HMW-41	08/19/04	15.0-17.0	24.8	0.034	--	--	0	4	82	15	Gray-Brown Lean SILT, Trace SAND, ML
HMW-43	08/23/04	12.0-14.0	31.1	0.038	--	--	0	6	81	14	Gray-Brown Lean SILT, Trace SAND, ML
HMW-44	08/25/04	10.0-12.0	22.3	0.027	--	--	0	10	72	18	Gray-Brown Lean SILT, Trace SAND, ML
HMW-45	08/20/04	14.0-15.0	24.2	0.031	49.4	1.60E-05	0	7	83	10	Gray-Brown Lean SILT, With SAND, ML
HMW-46	08/19/04	12.5-13.0	24.3	0.019	48.3	2.90E-04	0	11	72	17	Gray Lean SILT, Trace SAND, ML
	08/18/04	14.0-16.0	33.1	0.036	--	--	0	14	66	20	Gray-Brown Lean SILT, Trace SAND, ML
HMW-47	08/19/04	17.0-17.5	36.8	0.050	50.0	1.40E-06	0	2	77	21	Gray Lean SILT, Trace SAND, ML
HMW-48	08/17/04	12.0-14.0	35.2	0.069	--	--	0	3	44	53	Gray-Brown Fat CLAY, Trace SAND, CH
HMW-49	08/24/04	11.0-13.0	32.2	0.023	--	--	0	9	71	20	Gray Lean SILT, Trace SAND, ML
HMW-51	08/23/04	10.0-12.0	15.4	0.013	--	--	0	10	80	10	Brown Lean SILT, Trace SAND, ML
PMP-18	07/23/04	13.5	31.5	--	48.4	--	0	6	77	17	Dark gray-brown Clayey SILT, ML-CL
VMP-24M	07/20/04	16.0-18.0	36.5	--	50.5	--	0	3	31	66	Dark gray SILT, with sand, ML
Average			29.6	0.032	49.3	1.02E-04	0	11	67	22	

NOTES:

-- = Not Analyzed

ft bgs = feet below ground surface

Grain size results that were <0.5% are reported as 0% and may be classified as "trace" amounts in the soil description.

ENSR. 2005. SOIL VAPOR INVESTIGATION REPORT. MAY.

VILLAGE OF HARTFORD, ILLINOIS

TABLE 3-1
VMP SOIL SAMPLE ANALYTICAL RESULTS

Hartford Working Group
Hartford, Illinois

Sample ID and Depth interval (ft. bgs) Date PID/FID	VMP-27D (25-27.5) 12-Jan-05 67.3 / 5,614	VMP-54 (2.5-5) 11-Jan-05 53.1 / 2,341	VMP-54 (22.5-25) 11-Jan-05 63.7 / 4,310	VMP-55 (2.5-5) 10-Jan-05 2.1/175	VMP-55 (12.5-15) 10-Jan-05 0.5 /300	VMP-56 (10 12.5) 10-Jan-05 71 / 3200	VMP-56 (17.5-20) 10-Jan-05 688 /6.01%	VMP-57 (11.5-14) 02-Feb-05 10.51 / 1,138	VMP-58 (2.5-5) 11-Jan-05 27 / 460	VMP-58 (10-12.5) 11-Jan-05 10.7 / 820	VMP-59 (10-12.5) 12-Jan-05 810 / 6.94%	VMP-59 (20-22.5) 12-Jan-05 16.66 / 146	VMP-60 (2-4) 11-Jan-05 -0.43 / 143
ASTM D2974	%	%	%	%	%	%	%	%	%	%	%	%	%
Percent Moisture	21.3	18.3	16.7	19.9	23.5	24.9	27.9	25.1	19.7	20	27.9	27.4	20.5
Standard Method 18th Ed 2540G	%	%	%	%	%	%	%	%	%	%	%	%	%
Total Solids	78.7	81.7	83.3	80.1	76.5	75.1	72.1	74.9	80.3	80	72.1	72.6	79.5
SW-846 5035, 8260B	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
BENZENE	46.5	1.2 J	35	1.1 J	1.4 J	1.6	271	38.9	5	4	2,660	10,900	1.3 U
ETHYL BENZENE	6.2 J	6.2 U	5.5 J	5.5 J	6.8 J	6.2 J	210	6.2 J	5.9 U	131	1,760	65,400	6.7 U
METHYL TERT-BUTYL ETHER	2.5 U	2.5 U	2.2 J	2.2 U	2.7 U	2.5 U	64 U	2.5 U	2.4 U	1.9 U	201 U	399 U	2.7 U
TOLUENE	6.2 J	6.2 J	7.9	6	6.8 J	8.1	160 J	6.2 U	5.9 J	4.8 J	502 J	1,700	6.7 U
XYLENES (total)	20.1	6.2 J	9.6	10.2	6.8 J	13.3	183	6.2 J	5.9 J	409	3,160	71,400	6.7 J
SW-846 5035, 8260B	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH - GRO	5.86	1.6	2.78	1.11 J	1.36 J	6.24	1,020	2.75	1.18 U	8.98	1,340	3,320	1.35 U
SW-846 3550B, 8270C	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH-DRO	15.1 J	14.4 J	14.2 J	14.7 U	15.5 U	112	517	16 J	14.6 J	14.7 J	959	1,180	15 J

ft. bgs - Feet below ground surface.
VMP - Vapor Monitoring Point
TPH - Total Petroleum Hydrocarbon
GRO - Gasoline Range Organics
DRO - Diesel Range Organics
PID/FID Readings - obtained with TVA 1000
PID/FID Readings - in parts per million (ppm)
ug/kg - Micrograms per kilogram.
mg/kg - Milligrams per kilogram.
FO - Flame-out of FID
J - Analyte detected below reporting limits
U - Not detected at the reporting limit.

TABLE 3-2
GEOTECHNICAL SOIL SAMPLE ANALYTICAL RESULTS

Hartford Working Group
Hartford, Illinois

Sample Label (depth interval ft bgs)	Water Content (%)	Dry Bulk Density (g/cc)	Specific Gravity	Total Porosity (%)	Water Filled Porosity (%)	Air Filled Porosity (%)	Gravel Content (%)	Sand Content (%)	Silt Content (%)	Clay Content (%)	Lithology Description*
Vapor Monitoring Point (VMP) Borings											
VMP-57 (13-13.5)	NT	NT	NT	NT	NT	NT	0	16	66	18	Gray-Brown Silty **CLAY**, with Sand, CL
VMP-66 (12.5-15)	NT	NT	NT	NT	NT	NT	0	11	77	12	Gray-Brown **SILT**, ML
VMP-67 (27.5-30)	NT	NT	NT	NT	NT	NT	0	37	50	13	Gray Sandy **SILT**, ML
VMP-70 (35-37)	NT	NT	NT	NT	NT	NT	0	97	3	0	Brown Fine **SAND**, SP
VMP-75 (4-6)	24.1	1.547	2.70	42.7	37.2	5.5	0	22	37	41	Gray-Brown Silty **CLAY**, with Sand, CL
VMP-75 (10-12)	17.3	1.370	2.69	49.1	23.7	25.4	0	32	59	9	Brown Sandy **SILT**, ML
VMP-88 (13-14)	NT	NT	NT	NT	NT	NT	0	3	75	22	Gray-Brown **SILT**, ML
VMP-89 (10-10.5)	NT	NT	NT	NT	NT	NT	0	2	27	71	Gray-Brown **CLAY**, CH
VMP-89 (14-15)	NT	NT	NT	NT	NT	NT	0	1	75	24	Gray-Brown Silty **CLAY**, ML/CL
VMP-90 (9-10)	NT	NT	NT	NT	NT	NT	0	14	69	17	Dark Gray **SILT**, ML
VMP-92 (12.5-13.5)	NT	NT	NT	NT	NT	NT	0	1	69	30	Gray-Brown Silty **CLAY**, ML/CL
VMP-93 (9-10)	NT	NT	NT	NT	NT	NT	0	8	75	17	Brown **SILT**, ML
VMP-94 (12-13)	NT	NT	NT	NT	NT	NT	0	6	70	24	Dark Gray **SILT**, ML
VMP-94 (14-14.5)	NT	NT	NT	NT	NT	NT	0	45	43	12	Dark Gray-Brown Sandy **SILT**, ML
GeoProbe (GP) Borings											
GP-4 (5-6)	27.2	1.511	2.59	41.7	41.2	0.5	0	2	50	48	Dark Gray-Brown **CLAY**, CH
GP-6 (5-6)	28.3	1.452	2.62	44.6	41.0	3.6	0	4	50	46	Dark Gray-Brown **CLAY**, CH
GP-27 (3-6)	28.7	1.423	NT	NT	NT	NT	0	11	68	21	Very Dark Gray Clayey **SILT**, ML/CL

Key:
* - Based on physical characteristics (ASTM-D2488) observed by Shively Geotechnical Inc.
bgs - below ground surface.
g/cc - grams per cubic centimeter.
Silt Content - grain-size range (0.074-0.005 mm); mm = millimeter.
Clay Content - grain-size scale range (<0.005 mm).
NT - Not Tested.

TABLE 3-3A
ACTIVE SOIL VAPOR ANALYTICAL RESULTS (ppbv)
VMP1 Through VMP-54
January 2005-March 2005

Hartford Working Group
Hartford, Illinois

Location ID	VMP-1	VMP-1	VMP-2	VMP-3	VMP-6	VMP-6	VMP-6	VMP-7	VMP-9	VMP-10	VMP-12	VMP-12	VMP-15	VMP-15	VMP-15	VMP-15	VMP-17	VMP-17
Port ID	VMP-1D	VMP-1S	VMP-2D	VMP-3	VMP-6M	VMP-6S	VMP-6S	VMP-7	VMP-9	VMP-10	VMP-12M	VMP-12VS	VMP-15D	VMP-15M	VMP-15S	VMP-15S	VMP-17D	VMP-17M
Sample Date	1/13/2005	1/13/2005	1/13/2005	1/13/2005	2/21/2005	2/21/2005	2/21/2005	1/18/2005	2/21/2005	1/18/2005	1/14/2005	1/14/2005	1/10/2005	1/10/2005	1/6/2005	1/10/2005	1/12/2005	1/12/2005
Sample ID	011305-VMP-1D	011305-VMP-1S	011305-VMP-2D	011305-VMP-3	022105-VMP-6M	022105-VMP-6S	022105-VMP-6S DUP	011805-VMP-7	022105-VMP-9	011805-VMP-10	011405-VMP-12M	011405-VMP-12VS	011005-VMP-15D	011005-VMP-15M	010605-VMP15-S	011005-VMP-15S	011205-VMP-17D	011205-VMP-17M
Sample Matrix	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS
Sample Class	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
Analytical Method D1946	%	%	%	%	%	%	%	%	%	%	%	%	%	%	ppmv	%	%	%
CARBON DIOXIDE	15	0.29	16	17	14	14	14	21	8.6	2	2.6	1.2	8.2	14		15	14	12
METHANE	65	0.5	32	10	37	53	54	37	21	0.89	28	1.4	54	46		48	0.28	0.00016 U
METHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	490,000	-	-	-
OXYGEN	0.64	20	1.1	4.5	0.63	0.47	0.42	1.6	6.1	17	5	11	0.48	0.62		0.96	1.6	4.2
Analytical Method TO14	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1-BUTENE	1,100 U	4.4 U	760 U	1,300 U	6,400	2,900 U	3,000 U	1,600 U	560 U	12,000	44 U	11	2,800,000	2,300,000	-	1,100,000	3.3 U	3.3 U
ACETYLENE	2,800 U	11 U	1,900 U	3,300 U	4,700 U	7,300 U	7,400 U	4,100 U	1,400 U	360 U	110 U	16 U	52,000 U	51,000 U	-	36,000 U	8.2 U	8.2 U
BUTANE	4,200,000	1,100	63,000	4,700,000	8,000,000	11,000,000	10,000,000	7,200,000	2,100,000	640,000	6,300	570	100,000,000	96,000,000	-	71,000,000	8.2 U	8.2 U
CIS-2-BUTENE	1,100 U	4.4 U	760 U	3,400	20,000	13,000	12,000	1,600 U	560 U	41,000	44 U	7.1	5,400,000	4,600,000	-	2,300,000	3.3 U	3.3 U
ETHANE	120,000	300	150,000	54,000	76,000	100,000	97,000	77,000	38,000	520	2,300	190	970,000	680,000	-	760,000	17	8.2 U
ETHENE	2,800 U	11 U	1,900 U	3,300 U	4,700 U	7,300 U	7,400 U	4,100 U	1,400 U	1,200	260	43	620,000	330,000	-	190,000	8.2 U	8.2 U
ISOBUTANE	2,900,000	680	2,900,000	1,600,000	2,300,000	3,400,000	3,200,000	2,100,000	1,600,000	110,000	190,000	27,000	42,000,000	38,000,000	-	29,000,000	3.3 U	3.3 U
PROPANE	58,000	26	180,000	120,000	54,000	75,000	73,000	130,000	31,000	3,900	980	200	5,500,000	4,700,000	-	3,900,000	8.2 U	8.2 U
PROPYLENE	2,800 U	11 U	1,900 U	3,300 U	4,700 U	7,300 U	7,400 U	4,100 U	1,400 U	360 U	130	44	140,000	100,000	-	54,000	8.2 U	8.2 U
TRANS-2-BUTENE	1,100 U	5.8	760 U	12,000	51,000	41,000	39,000	2,500	1,100	46,000	44 U	6.2 U	6,700,000	5,700,000	-	3,000,000	3.3 U	3.3 U
Analytical Method TO15	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1,2,4-TRIMETHYLBENZENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	88,000	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
1,3,5-TRIMETHYLBENZENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	37,000	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
1,3-BUTADIENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	4,800 U	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
BENZENE	43,000 U	8.8 U	33,000 U	38,000 U	140,000	230,000	260,000	57,000 U	28,000 U	310,000	1,600 U	420 U	700,000	630,000	820,000	570,000	0.82 U	0.82 U
ETHYL BENZENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	180,000	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
HEXANE	43,000 U	8.8 U	33,000 U	270,000	950,000	1,200,000	1,200,000	220,000	28,000 U	740,000	3,700	420 U	2,000,000	1,800,000	1,900,000	1,800,000	0.82 U	0.82 U
ISOPENTANE	12,000,000	2,100	9,600,000	6,100,000	14,000,000	18,000,000 J	19,000,000	18,000,000	4,800,000 J	1,500,000	560,000	100,000	44,000,000	42,000,000	43,000,000	30,000,000	0.82 U	0.82 U
M,P-XYLENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	600,000	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
O-XYLENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	190,000	1,600 U	420 U	140,000 U	220,000 U	190,000 U	120,000 U	0.82 U	0.82 U
TOLUENE	43,000 U	8.8 U	33,000 U	38,000 U	62,000 U	49,000 U	50,000 U	57,000 U	28,000 U	1,100,000	1,600 U	420 U	160,000	220,000 U	190,000 U	120,000	0.82 U	0.82 U
Analytical Method TO15 (rerun)	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
BENZENE	3,500	-	840	410	-	-	-	-	1,600	-	3,300	5.9	-	-	-	-	-	-
ETHYL BENZENE	210 U	-	110 U	110 U	-	-	-	-	11 U	-	160 U	5.0 U	-	-	-	-	-	-
M,P-XYLENE	210 U	-	110 U	110 U	-	-	-	-	290	-	1,200	5.0 U	-	-	-	-	-	-
O-XYLENE	210 U	-	110 U	110 U	-	-	-	-	11 U	-	700	5.0 U	-	-	-	-	-	-
TOLUENE	360	-	590	160	-	-	-	-	11 U	-	2,300	5.0 U	-	-	-	-	-	-

Notes:

%-result is reported as a percent

U-compound was analyzed for but not detected above reporting limit

J-Estimated value, analyte detected below reporting limit

UJ-Non detected compound associated with low bias in the CCV

ppbv-parts per billion volume

ppmv-part per million volume

S-Shallow depth vapor monitoring port

M-Medium depth vapor monitoring port

D-Deep depth vapor monitoring port

TABLE 3-3B
ACTIVE SOIL VAPOR ANALYTICAL RESULTS (ug/m3)
VMP-1 Through VMP-54
January 2005-March 2005

Hartford Working Group
Hartford, Illinois

Location ID	VMP-1	VMP-1	VMP-2	VMP-3	VMP-6	VMP-6	VMP-6	VMP-7	VMP-9	VMP-10	VMP-12	VMP-12	VMP-15	VMP-15	VMP-15	VMP-15	VMP-17	VMP-17
Port ID	VMP-1D	VMP-1S	VMP-2D	VMP-3	VMP-6M	VMP-6S	VMP-6S	VMP-7		VMP-10	VMP-12M	VMP-12VS	VMP-15D	VMP-15M	VMP-15S	VMP-15S	VMP-17D	VMP-17M
Sample Date	1/13/2005	1/13/2005	1/13/2005	1/13/2005	2/21/2005	2/21/2005	2/21/2005	1/18/2005	2/21/2005	1/18/2005	1/14/2005	1/14/2005	1/10/2005	1/10/2005	1/6/2005	1/10/2005	1/12/2005	1/12/2005
Sample ID	011305-VMP-1D	011305-VMP-1S	011305-VMP-2D	011305-VMP-3	022105-VMP-6M	022105-VMP-6S	022105-VMP-6S DUP	011805-VMP-7	022105-VMP-9	011805-VMP-10	011405-VMP-12M	011405-VMP-12VS	011005-VMP-15D	011005-VMP-15M	010605-VMP15-S	011005-VMP-15S	011205-VMP-17D	011205-VMP-17M
Sample Matrix	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS
Sample Class	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
Analytical Method TO14	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
1-BUTENE	2,600 U	10 U	1,800 U	3,000 U	15,000	6,700 U	6,800 U	3,800 U	1,300 U	27,000	100 U	25	6,400,000	5,200,000	-	2,500,000	7.5 U	7.5 U
ACETYLENE	3,000 U	12 U	2,000 U	3,500 U	5,000 U	7,800 U	7,900 U	4,400 U	1,500 U	380 U	120 U	17 U	55,000 U	54,000 U	-	39,000 U	8.7 U	8.7 U
BUTANE	9,900,000	2,700	150,000	11,000,000	19,000,000	26,000,000	25,000,000	17,000,000	5,000,000	1,500,000	15,000	1,400	240,000,000	23,000 0000	-	170,000,000	19 U	19 U
CIS-2-BUTENE	2,600 U	10 U	1,800 U	7,800	45,000	30,000	28,000	3,800 U	1,300 U	93,000	100 U	16	12,000,000	10,000,000	-	5,200,000	7.5 U	7.5 U
ETHANE	150,000	370	180,000	67,000	93,000	120,000	120,000	94,000	47,000	640	2,800	230	1,200,000	840,000	-	930,000	20	10 U
ETHENE	3,200 U	13 U	2,200 U	3,800 U	5,400 U	8,400 U	8,500 U	4,700 U	1,600 U	1,400	300	50	710,000	380,000	-	220,000	9.4 U	9.4 U
ISOBUTANE	6,900,000	1,600	6,800,000	3,700,000	5,500,000	8,100,000	7,500,000	5,100,000	3,800,000	260,000	450,000	64,000	100,000,000	91,000,000	-	70,000,000	7.8 U	7.8 U
PROPANE	100,000	47	320,000	210,000	98,000	140,000	130,000	240,000	56,000	7,000	1,800	350	10,000,000	8,400,000	-	7,100,000	15 U	15 U
PROPYLENE	4,900 U	19 U	3,300 U	5,600 U	8,000 U	12,000 U	13,000 U	7,000 U	2,400 U	620 U	220	75	240,000	170,000	-	93,000	14 U	14 U
TRANS-2-BUTENE	2,600 U	13	1,800 U	29,000	120,000	93,000	90,000	5,700	2,500	110,000	100 U	14 U	15,000,000	13,000,000	-	7,000,000	7.5 U	7.5 U
Analytical Method TO15	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
1,2,4-TRIMETHYLBENZENE	210,000 U	43 U	160,000 U	190,000 U	310,000 U	240,000 U	240,000 U	280,000 U	140,000 U	430,000	7,600 U	2,000 U	690,000 U	1,100,000 U	950,000 U	570,000 U	4.0 U	4.0 U
1,3,5-TRIMETHYLBENZENE	210,000 U	43 U	160,000 U	190,000 U	310,000 U	240,000 U	240,000 U	280,000 U	140,000 U	180,000	7,600 U	2,000 U	690,000 U	1,100,000 U	950,000 U	570,000 U	4.0 U	4.0 U
1,3-BUTADIENE	94,000 U	19 U	72,000 U	84,000 U	140,000 U	110,000 U	110,000 U	130,000 U	62,000 U	11,000 U	3,400 U	920 U	310,000 U	500,000 U	430,000 U	260,000 U	1.8 U	1.8 U
BENZENE	140,000 U	28 U	100,000 U	120,000 U	430,000	740,000	820,000	180,000 U	89,000 U	1,000,000	5,000 U	1,300 U	2,200,000	2,000,000	2,600,000	1,800,000	2.6 U	2.6 U
ETHYL BENZENE	180,000 U	38 U	140,000 U	160,000 U	270,000 U	210,000 U	220,000 U	250,000 U	120,000 U	810,000	6,700 U	1,800 U	610,000 U	970,000 U	840,000 U	500,000 U	3.6 U	3.6 U
HEXANE	150,000 U	31 U	120,000 U	940,000	3,300,000	4,000,000	4,300,000	790,000	98,000 U	2,600,000	13,000	1,500 U	6,900,000	6,400,000	6,700,000	6,400,000	2.9 U	2.9 U
ISOPENTANE	36,000,000	6,300	28,000,000	18,000,000	41,000,000	53,000,000 J	56,000,000	52,000,000	14,000,000 J	4,500,000	1,700,000	300,000	130,000,000	120,000,000	120,000,000	90,000,000	2.4 U	2.4 U
M,P-XYLENE	180,000 U	38 U	140,000 U	160,000 U	270,000 U	210,000 U	220,000 U	250,000 U	120,000 U	2,600,000	6,700 U	1,800 U	610,000 U	970,000 U	840,000 U	500,000 U	3.6 U	3.6 U
O-XYLENE	180,000 U	38 U	140,000 U	160,000 U	270,000 U	210,000 U	220,000 U	250,000 U	120,000 U	840,000	6,700 U	1,800 U	610,000 U	970,000 U	840,000 U	500,000 U	3.6 U	3.6 U
TOLUENE	160,000 U	33 U	120,000 U	140,000 U	240,000 U	180,000 U	190,000 U	210,000 U	100,000 U	4,000,000	5,800 U	1,600 U	600,000	840,000 U	730,000 U	450,000	3.1 U	3.1 U
Analytical Method TO15 (rerun)	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
BENZENE	11,000	-	2,700	1,300	-	-	-	-	5,100	-	10,000	19	-	-	-	-	-	-
ETHYL BENZENE	920 U	-	500 U	500 U	-	-	-	-	48 U	-	670 U	22 U	-	-	-	-	-	-
M,P-XYLENE	920 U	-	500 U	500 U	-	-	-	-	1,200	-	5,300	22 U	-	-	-	-	-	-
O-XYLENE	920 U	-	500 U	500 U	-	-	-	-	48 U	-	3,000	22 U	-	-	-	-	-	-
TOLUENE	1,400	-	2,200	620	-	-	-	-	42 U	-	8600	19 U	-	-	-	-	-	-

Notes:

%-result is reported as a percent

U-compound was analyzed for but not detected above reporting limit

J-Estimated value, analyte detected below reporting limit

UJ-Non detected compound associated with low bias in the CCV

ppbv-parts per billion volume

ppmv-part per million volume

S-Shallow depth vapor monitoring port

M-Medium depth vapor monitoring port

D-Deep depth vapor monitoring port

TABLE 3-5A
Active Soil Vapor Analytical Results - MP (ppbv)
January-March 2005

Hartford Working Group
Hartford, Illinois

Location ID	MP-5	MP-5	MP-6	MP-7	MP-7	MP-8	MP-8	MP-9	MP-9	MP-10	MP-11	MP-11	MP-12	MP-12	MP-13	MP-13	MP-14	MP-14	MP-15	MP-15	MP-16
Point ID	MP-5D	MP-5S	MP-6S	MP-7D	MP-7S	MP-8D	MP-8S	MP-9D	MP-9S	MP-10S	MP-11D	MP-11S	MP-12D	MP-12S	MP-13D	MP-13S	MP-14D	MP-14S	MP-15D	MP-15S	MP-16D
Sample Date	1/26/2005	1/26/2005	1/20/2005	1/26/2005	1/26/2005	1/20/2005	1/20/2005	1/26/2005	2/22/2005	1/26/2005	1/11/2005	1/11/2005	1/11/2005	1/11/2005	1/26/2005	1/26/2005	1/26/2005	1/26/2005	1/10/2005	1/10/2005	1/10/2005
Sample ID	012605-MP-5D	012605-MP-5S	012005-MP-6S	012605-MP-7D	012605-MP-7S	012005-MP-8D	012005-MP-8S	012605-MP-9D	022205-MP-9S	012605-MP-10S	011105-MP11D	011105-MP11S	011105-MP12D	011105-MP12S	012605-MP-13D	012605-MP-13S	012605-MP-14D	012605-MP-14S	011005-MP-15D	011005-MP-15S	011005-MP-16D
Sample Matrix	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS
Sample Class	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
Analytical Method D1946	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
CARBON DIOXIDE	0.081	5.2	15	1.3	8.3	0.05	4.6	16	0.8	0.039	0.085	0.16	0.27	0.66	1.4	0.14	5.8	0.14	16	0.54	15
METHANE	0.053	7.6	45	5.1	36	0.0003	30	54	2.3	0.0001900	0.0064	0.00016 U	0.00025	0.00016 U	0.00014 U	0.00028	0.0014	0.00033	0.28	0.00036	0.49
METHANE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OXYGEN	22	15	0.84	20	9.2	24	12	1.6	20	22	20	21	20	20	20	20	13	21	1.5	20	1.40
Analytical Method TO14	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1-BUTENE	120	4,800	4,200	5,000	35,000	3.4 U	48,000	37,000	230	3.1 U	3.4 U	3.1 U	3.2 U	3.2 U	2.9 U	3.1 U	5.10	3.0 U	9,800	4.6 U	23,000
ACETYLENE	25 U	580 U	3,200 U	660 U	2,300 U	8.6 U	2,300 U	3,500 U	330 U	7.8 U	8.4 U	7.8 U	8.0 U	7.9 U	7.2 U	7.8 U	11 U	7.6 U	220 U	11 U	640 U
BUTANE	56,000	1,100,000	4,800,000	1,300,000	4,800,000	46	3,700,000	6,500,000	510,000	7.8 U	620	15	23	7.9 U	14	39	330	7.6 U	460,000	11 U	1,400,000
CIS-2-BUTENE	540	27,000	11,000	30,000	130,000	3.4 U	200,000	130,000	1,700	3.1 U	5.4	3.1 U	3.2 U	3.2 U	2.9 U	3.1 U	16	3.0 U	25,000	4.6 U	67,000
ETHANE	700	29,000	140,000	28,000	150,000	9	98,000	200,000	6,000	7.8 U	46	7.8 U	16	7.9 U	7.2 U	9.6	33	7.6 U	13,000	14	29,000
ETHENE	29	580 U	3,200 U	660 U	2,300 U	8.6 U	2,300 U	3,500 U	330 U	7.8 U	23	7.8 U	13	7.9 U	7.2 U	7.8 U	14	7.6 U	5,500	11 U	11,000
ISOBUTANE	18,000	360,000	1,900,000	390,000	1,500,000	16	1,100,000	2,200,000	140,000	8.60	190	4.4	6.4	3.2 U	2.9 U	17	74	11	110,000	5.2	300,000
PROPANE	710	17,000	90,000	20,000	90,000	8.6 U	67,000	120,000	3,600	7.8 U	26	7.8 U	11	8.6	7.2 U	7.8 U	11 U	7.6 U	12,000	11 U	23,000
PROPYLENE	25 U	580 U	3,200 U	660 U	2,300 U	8.6 U	2,300 U	3,500 U	330 U	7.8 U	8.4 U	7.8 U	8.0 U	7.9 U	7.2 U	7.8 U	11 U	7.6 U	220 U	11 U	640 U
TRANS-2-BUTENE	1,200	44,000	40,000	58,000	210,000	3.4 U	250,000	230,000	5,300	3.1 U	8	3.1 U	3.2 U	3.2 U	2.9 U	3.1 U	17	3.0 U	30,000	4.6 U	83,000
Analytical Method TO15	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
1,2,4-TRIMETHYLBENZENE	700 U	9,100 U	73,000 U	19,000 U	35,000 U	13	27,000 U	74,000 U	4,100 U	0.78 U	2.8 U	2.1 U	2.20	0.79 U	490	1.5	1,400	0.92	4,700	1.1 U	9,300 U
1,3,5-TRIMETHYLBENZENE	700 U	9,100 U	73,000 U	19,000 U	35,000 U	3.6	27,000 U	74,000 U	4,100 U	0.78 U	2.8 U	2.1 U	0.82	0.79 U	160	1.8	920	0.76 U	3,400	1.1 U	9,300 U
1,3-BUTADIENE	700 U	9,100 U	73,000 U	19,000 U	35,000 U	0.86 U	27,000 U	74,000 U	4,100 U	0.78 U	2.8 U	2.1 U	0.80 U	0.79 U	3.6 U	0.78 U	28 U	0.76 U	2,300 U	1.1 U	9,300 U
BENZENE	700 U	28,000	73,000 U	96,000	35,000 U	21	92,000	74,000 U	6,700	0.78 U	2.8 U	2.1 U	2.4	0.79 U	32	0.78 U	2,700	0.84	98,000	1.1 U	310,000
ETHYL BENZENE	700 U	9,100 U	73,000 U	19,000 U	35,000 U	6.8	27,000 U	74,000 U	4,100 U	0.78 U	3.9	2.1 U	0.80 U	0.79 U	32	0.78 U	83	1.7	18,000	1.1 U	36,000
HEXANE	18,000	220,000	620,000	480,000	1,100,000	40	990,000	1,500,000	52,000	0.79	13	5.6	2.2	0.79 U	94	1.4	7,200	0.76 U	160,000	1.1 U	710,000
ISOPENTANE	160,000	2,400,000	12,000,000	3,000,000	10,000,000	84	8,600,000	14,000,000	1,100,000	1.4	690	7.4	15	8.6	68	10	3,100	0.81	530,000	1.1 U	2,400,000
M,P-XYLENE	700 U	9,100 U	73,000 U	68,000	35,000 U	14	27,000 U	74,000 U	4,100 U	0.78 U	7.6	2.1 U	2.4	0.79 U	250	0.78 U	7,700	7.9	93,000	1.1 U	84,000
O-XYLENE	700 U	9,100 U	73,000 U	19,000 U	35,000 U	3	27,000 U	74,000 U	4,100 U	0.78 U	3.6	2.1 U	0.80 U	0.79 U	110	1	3,500	1.2	31,000	1.1 U	25,000
TOLUENE	1,000	9,100 U	73,000 U	47,000	35,000 U	8.3	27,000 U	74,000 U	4,100 U	0.78 U	13	2.1 U	1.2	0.79 U	14	0.78 U	6,300	2.2	190,000	1.1 U	400,000
Analytical Method TO15 (rerun)	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv	ppbv
BENZENE	35 U	-	7,200	-	32,000	-	-	3,700 U	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYL BENZENE	35 U	-	240 U	-	23,000 U	-	-	3,700 U	-	-	-	-	-	-	-	-	-	-	-	-	-
M,P-XYLENE	35 U	-	240 U	-	23,000 U	-	-	3,700 U	-	-	-	-	-	-	-	-	-	-	-	-	-
O-XYLENE	35 U	-	240 U	-	23,000 U	-	-	3,700 U	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	35 U	-	240 U	-	23,000 U	-	-	3,700 U	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
%-Result is reported as a percent
U-compound was analyzed for but not
detected above the reporting limit
J-Estimated value, analyte detected below
reporting limit
UJ-Non detected compound associated
with low bias in the CCV
ppbv-parts per billion volume
ppmv-part per million volume
S-Shallow depth vapor monitoring port
M-Medium depth vapor monitoring port
D-Deep depth vapor monitoring port

TABLE 3-5B
Active Soil Vapor Analytical Results - MP (ug/m3)
January-March 2005

Hartford Working Group
Hartford, Illinois

Location ID	MP-5	MP-5	MP-6	MP-7	MP-7	MP-8	MP-8	MP-9	MP-9	MP-10	MP-11	MP-11	MP-12	MP-12	MP-13	MP-13	MP-14	MP-14	MP-15	MP-15	MP-16
Point ID	MP-5D	MP-5S	MP-6S	MP-7D	MP-7S	MP-8D	MP-8S	MP-9D	MP-9S	MP-10S	MP-11D	MP-11S	MP-12D	MP-12S	MP-13D	MP-13S	MP-14D	MP-14S	MP-15D	MP-15S	MP-16D
Sample Date	1/26/2005	1/26/2005	1/20/2005	1/26/2005	1/26/2005	1/20/2005	1/20/2005	1/26/2005	2/22/2005	1/26/2005	1/11/2005	1/11/2005	1/11/2005	1/11/2005	1/26/2005	1/26/2005	1/26/2005	1/26/2005	1/10/2005	1/10/2005	1/10/2005
Sample ID	012605-MP-5D	012605-MP-5S	012005-MP-6S	012605-MP-7D	012605-MP-7S	012005-MP-8D	012005-MP-8S	012605-MP-9D	022205-MP-9S	012605-MP-10S	011105-MP11D	011105-MP11S	011105-MP12D	011105-MP12S	012605-MP-13D	012605-MP-13S	012605-MP-14D	012605-MP-14S	011005-MP-15D	011005-MP-15S	011005-MP-16D
Sample Matrix	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS	GS
Sample Class	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
Analytical Method TO14	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
1-BUTENE	260	11,000	9,700	12,000	81,000	7.8 U	110,000	84,000	540	7.1 U	7.7 U	7.1 U	7.4 U	7.2 U	6.6 U	7.1 U	12	7.0 U	22,000	10 U	53,000
ACETYLENE	27 U	620 U	3,400 U	700 U	2,500 U	9.1 U	2,500 U	3,700 U	350 U	8.2 U	8.9 U	8.2 U	8.6 U	8.4 U	7.7 U	8.2 U	12 U	8.1 U	230 U	12 U	690 U
BUTANE	130,000	2,500,000	11,000,000	3,100,000	11,000,000	110	8,900,000	15,000,000	1,200,000	18 U	1,500	36	55	19 U	32	92	780	18 U	1,100,000	27 U	3,200,000
CIS-2-BUTENE	1,200	61,000	25,000	68,000	290,000	7.8 U	450,000	310,000	3,800	7.1 U	12	7.1 U	7.4 U	7.2 U	6.6 U	7.1 U	36	7.0 U	57,000	10 U	150,000
ETHANE	860	36,000	170,000	34,000	180,000	11	120,000	250,000	7,400	9.5 U	56	9.5 U	19	9.7 U	8.8 U	12	40	9.3 U	15,000	17	35,000
ETHENE	33	670 U	3,700 U	760 U	2,600 U	9.8 U	2,700 U	4,000 U	380 U	8.9 U	27	8.9 U	14	9.1 U	8.3 U	8.9 U	16	8.7 U	6,300	13 U	13,000
ISOBUTANE	42,000	850,000	4,400,000	930,000	3,700,000	37	2,600,000	5,200,000	320,000	20	450	10	15	7.5 U	6.8 U	41	180	26	270,000	12	700,000
PROPANE	1,300	30,000	160,000	36,000	160,000	15 U	120,000	220,000	6,500	14 U	46	14 U	20	16	13 U	14 U	20 U	14 U	21,000	21 U	42,000
PROPYLENE	43 U	1,000 U	5,600 U	1,100 U	4,000 U	15 U	4,000 U	6,000 U	560 U	13 U	14 U	13 U	14 U	14 U	12 U	13 U	19 U	13 U	380 U	20 U	1,100 U
TRANS-2-BUTENE	2,800	100,000	91,000	130,000	470,000	7.8 U	580,000	530,000	12,000	7.1 U	18	7.1 U	7.4 U	7.2 U	6.6 U	7.1 U	39	7.0 U	69,000	10 U	190,000
Analytical Method TO15	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
1,2,4-TRIMETHYLBENZENE	3,400 U	45,000 U	360,000 U	91,000 U	170,000 U	64	130,000 U	370,000 U	20,000 U	3.8 U	14 U	10 U	11	3.9 U	2,400	7.3	6,700	4.5	23,000	5.6 U	46,000 U
1,3,5-TRIMETHYLBENZENE	3,400 U	45,000 U	360,000 U	91,000 U	170,000 U	18	130,000 U	370,000 U	20,000 U	3.8 U	14 U	10 U	4	3.9 U	780	8.8	4,500	3.7 U	16,000	5.6 U	46,000 U
1,3-BUTADIENE	1,500 U	20,000 U	160,000 U	41,000 U	77,000 U	1.9 U	60,000 U	160,000 U	9,100 U	1.7 U	6.2 U	4.6 U	1.8 U	1.7 U	8.0 U	1.7 U	61 U	1.7 U	5,100 U	2.5 U	20,000 U
BENZENE	2,200 U	90,000	230,000 U	310,000	110,000 U	67	290,000	240,000 U	21,000	2.5 U	8.9 U	6.6 U	7.7	2.5 U	100	2.5 U	8,700	2.7	310,000	3.6 U	1,000,000
ETHYL BENZENE	3,000 U	40,000 U	320,000 U	81,000 U	150,000 U	29	120,000 U	320,000 U	18,000 U	3.4 U	17	9.0 U	3.5 U	3.4 U	140	3.4 U	360	7.4	76,000	5.0 U	160,000
HEXANE	64,000	770,000	2,200,000	1,700,000	3,800,000	140	3,500,000	5,100,000	180,000	2.8	45	20	7.7	2.8 U	330	4.8	25,000	2.7 U	560,000	4.0 U	2,500,000
ISOPENTANE	490,000	7,100,000	36,000,000	8,800,000	30,000,000	250	26,000,000	43,000,000	3,400,000	4.1	2,000	22	44	25	200	31	9,000	2.4	1,600,000	3.4 U	7,200,000
M,P-XYLENE	3,000 U	40,000 U	320,000 U	300,000	150,000 U	59	120,000 U	320,000 U	18,000 U	3.4 U	33	9.0 U	10	3.4 U	1,100	3.4 U	33,000	34	400,000	5.0 U	360,000
O-XYLENE	3,000 U	40,000 U	320,000 U	81,000 U	150,000 U	13	120,000 U	320,000 U	18,000 U	3.4 U	15	9.0 U	3.5 U	3.4 U	490	4.6	15,000	5.5	130,000	5.0 U	110,000
TOLUENE	3,900	34,000 U	280,000 U	180,000	130,000 U	31	100,000 U	280,000 U	15,000 U	2.9 U	48	7.8 U	4.3	3.0 U	51	2.9 U	24,000	8.2	730,000	4.3 U	1,500,000
Analytical Method TO15 (rerun)	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3	ug/m3
BENZENE	110 U	-	23,000	-	100,000	-	-	12,000 U	-	-	-	-	-	-	-	-	-	-	-	-	-
ETHYL BENZENE	150 U	-	1,000 U	-	100,000 U	-	-	16,000 U	-	-	-	-	-	-	-	-	-	-	-	-	-
M,P-XYLENE	150 U	-	1,000 U	-	100,000 U	-	-	16,000 U	-	-	-	-	-	-	-	-	-	-	-	-	-
O-XYLENE	150 U	-	1,000 U	-	100,000 U	-	-	16,000 U	-	-	-	-	-	-	-	-	-	-	-	-	-
TOLUENE	130 U	-	920 U	-	87,000 U	-	-	14,000 U	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
%-Result is reported as a percent
U-compound was analyzed for but not detected above the reporting limit
J-Estimated value, analyte detected below reporting limit
UJ-Non detected compound associated with low bias in the CCV
ppbv-parts per billion volume
ppmv-part per million volume
S-Shallow depth vapor monitoring port
M-Medium depth vapor monitoring port
D-Deep depth vapor monitoring port

TABLE 3-7
PRAXAIR POINT SOIL VAPOR ANALYTICAL RESULTS

Hartford Working Group
Hartford, Illinois

Location ID	PA-40		PA-46		PA-50		PA-53		PA-60		PA-61		PA-67		PA-69		PA-69	
Sample ID	082604PA-40		022205-PA-46		082604PA50		022205-PA-53		082604PA-60		022205-PA-61		022205-PA-67		082604PA-69		082604PA-69-DUPE	
Sample Date	26-Aug-04		22-Feb-05		26-Aug-04		22-Feb-05		26-Aug-04		22-Feb-05		22-Feb-05		26-Aug-04		26-Aug-04	
Sample Matrix	GS		GS		GS		GS		GS		GS		GS		GS		GS	
Sample Class	Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor	
Analytical Method - D1946	%		%		%		%		%		%		%		%		%	
CARBON DIOXIDE	9.5		4.8		0.28		2.9		4.7		0.039		0.2		1.8		1.7	
METHANE	0.00073		0.021		0.00021		0.0015		0.00015 U		0.0002		0.00019		0.00021		0.00018	
OXYGEN	8.6		13		20		15		16		21		21		18		18	
Method - TO14	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3
1-BUTENE	-	-	18,000	41,000	3.4 U	8 U	3 U	6.8 U	-	-	2.5 U	5.7 U	2.6 U	5.9 U	12	27	2.7 U	6.3 U
ACETYLENE	-	-	580 U	610 U	-	-	7.4 U	7.9 U	-	-	6.2 U	6.6 U	6.4 U	6.9 U	-	-	-	-
BUTANE	-	-	1,100,000	2,700,000	98	240	410	970	-	-	39	94	69	160	200	490	7.3	18
CIS-2-BUTENE	-	-	20,000	46,000	3.4 U	8 U	3 U	6.8 U	-	-	2.5 U	5.7 U	2.8	6.4	27	64	2.7 U	6.3 U
ETHANE	-	-	2,300	2,800	-	-	32	40	-	-	6.2 U	7.7 U	9.2	11	-	-	-	-
ETHENE	-	-	580 U	660 U	-	-	7.4 U	8.5 U	-	-	6.2 U	7.2 U	6.4 U	7.4 U	-	-	-	-
ISOBUTANE	-	-	570,000	1,400,000	28	68	1,900	4,500	-	-	20	48	32	76	24	57	3.8	9.2
PROPANE	-	-	41,000	73,000	-	-	78	140	-	-	7.9	14	7.4	13	48	110	2.7 U	6.3 U
PROPYLENE	-	-	580 U	990 U	-	-	7.4 U	13 U	-	-	6.2 U	11 U	6.4 U	11 U	-	-	-	-
TRANS-2-BUTENE	-	-	37,000	86,000	3.5	8.2	3 U	6.8 U	-	-	2.5 U	5.7 U	3.8	8.7	-	-	-	-
Method - TO15 (short list)	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3
ISOPENTANE	77	230	770,000	2,300,000	190	580	920	2,700	3 U	9.1 U	0.62 U	1.8 U	20	59	110	340	13	38
1,2,4-TRIMETHYLBENZENE	5	25	2,600 U	13,000 U	5	25	3 U	15 U	0.76 U	3.8 U	0.62 U	3.1 U	0.7	3.4	22	110	5	25
1,3,5-TRIMETHYLBENZENE	1.7	8.7	2,600 U	13,000 U	3.1	15	3 U	15 U	0.76 U	3.8 U	0.62 U	3.1 U	0.64 U	3.2 U	9.7	48	3.5	17
1,3-BUTADIENE	0.96 U	2.1 U	2,600 U	5,700 U	1.1 U	2.6 U	3 U	6.6 U	0.76 U	1.7 U	0.62 U	1.4 U	0.64 U	1.4 U	1.4 U	3.1 U	0.68 U	1.5 U
BENZENE	0.96 U	3.1 U	2,600 U	8,200 U	5.8 U	19	3 U	9.5 U	0.76 U	2.5 U	0.62 U	2 U	2.8	9	28	93	6.9	22
ETHYL BENZENE	0.96 U	4.2 U	2,600 U	11,000 U	1.4 U	6.1	3 U	13 U	0.76 U	3.4 U	0.62 U	2.7 U	0.82	3.5	9.8	43	5.3	24
HEXANE	17	60	9,500	33,000	130	470	4.8	17	0.76 U	2.7 U	0.62 U	2.2 U	8	28	33	120	20	70
M,P-XYLENE	1.2	5.1	2,600 U	11,000 U	20 U	88	3 U	13 U	0.76 U	3.4 U	0.62 U	2.7 U	3.4	15	59	260	20	88
O-XYLENE	0.96 U	4.2 U	2,600 U	11,000 U	5.5	24	3 U	13 U	0.76 U	3.4 U	0.62 U	2.7 U	1	4.6	14	64	7.9	35
TOLUENE	1.2	4.4	2,600 U	9,700 U	9.4 U	36	3	11	0.76 U	2.9 U	0.62 U	2.4 U	6.2	23	60	230	23	90
Method - TO-15	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3	ppbv	ug/m3
1,2,3-TRIMETHYLBENZENE	-	-	-	-	4.6 U	23 U	-	-	-	-	-	-	-	-	5.6 U	28 U	2.7 U	14 U
1,3-DIETHYLBENZENE	-	-	-	-	4.6 U	25 U	-	-	-	-	-	-	-	-	5.6 U	31 U	2.7 U	15 U
1,4-DIETHYLBENZENE	-	-	-	-	4.6 U	25 U	-	-	-	-	-	-	-	-	5.5 J	31 J	2.7 U	15 U
1-DECENE	-	-	-	-	11 U	66 U	-	-	-	-	-	-	-	-	14 U	81 U	6.8 U	40 U
1-HEPTENE	-	-	-	-	4.6 U	19 U	-	-	-	-	-	-	-	-	5.6 U	23 U	2.7 U	11 U
1-HEXENE	-	-	-	-	4.6 U	16 U	-	-	-	-	-	-	-	-	5.6 U	19 U	2.7 U	9.5 U
1-NONENE	-	-	-	-	4.6 U	24 U	-	-	-	-	-	-	-	-	5.6 U	29 U	2.7 U	14 U
1-OCTENE	-	-	-	-	4.6 U	21 U	-	-	-	-	-	-	-	-	5.6 U	26 U	2.7 U	13 U
1-PENTENE	-	-	-	-	4.6 U	13 U	-	-	-	-	-	-	-	-	10	30	2.7 U	7.9 U
1-UNDECENE	-	-	-	-	11 U	73 U	-	-	-	-	-	-	-	-	14 U	89 U	6.8 U	44 U
2,2,4-TRIMETHYLPENTANE	-	-	-	-	69 U	330	-	-	-	-	-	-	-	-	10	50	6.1	29
2,2-DIMETHYLBUTANE	-	-	-	-	10	36	-	-	-	-	-	-	-	-	5.6 U	20 U	2.7 U	9.7 U
2,3,4-TRIMETHYLPENTANE	-	-	-	-	50	240	-	-	-	-	-	-	-	-	5.6 U	26 U	2.7 U	13 U
2,3-DIMETHYLBUTANE	-	-	-	-	44	160	-	-	-	-	-	-	-	-	8.5	30	4	14
2,3-DIMETHYLPENTANE	-	-	-	-	81	340	-	-	-	-	-	-	-	-	17	71	10	43
2,4-DIMETHYLPENTANE	-	-	-	-	34	140	-	-	-	-	-	-	-	-	9.7	40	5.3	22
2-ETHYLTOLUENE	-	-	-	-	4.6	23 U	-	-	-	-	-	-	-	-	5.8	29	2.7 U	14 U
2-METHYLHEPTANE	-	-	-	-	52 U	240	-	-	-	-	-	-	-	-	5.6 U	26 U	2.7 U	13 U
2-METHYLHEXANE	-	-	-	-	120	500	-	-	-	-	-	-	-	-	12	49	8.2	34
2-METHYLPENTANE	-	-	-	-	180	650	-	-	-	-	-	-	-	-	32	120	16	58
3-ETHYLTOLUENE	-	-	-	-	6.4	32	-	-	-	-	-	-	-	-	17	86	4.9	24
3-METHYLHEPTANE	-	-	-	-	94	440	-	-	-	-	-	-	-	-	6.1	29	2.8	13
3-METHYLHEXANE	-	-	-	-	170	700	-	-	-	-	-	-	-	-	12	48	8.5	35
3-METHYLPENTANE	-	-	-	-	150	530	-	-	-	-	-	-	-	-	20	71	11	41
4-ETHYLTOLUENE	-	-	-	-	4.6	23 U	-	-	-	-	-	-	-	-	10	52	3.4	17
ALPHA-PINENE	-	-	-	-	11 U	64 U	-	-	-	-	-	-	-	-	14 U	79 U	6.8 U	38 U
BETA-PINENE	-	-	-	-	11	64 U	-	-	-	-	-	-	-	-	14 U	79 U	6.8 U	38 U
CIS-2-HEXENE	-	-	-	-	11 U	40 U	-	-	-	-	-	-	-	-	14 U	48 U	6.8 U	24 U
CIS-2-PENTENE	-	-	-	-	4.6 U	13 U	-	-	-	-	-	-	-	-	13	37	2.7 U	7.9 U
CUMENE	-	-	-	-	4.6 U	23 U	-	-	-	-	-	-	-	-	5.6 U	28 U	2.7 U	14 U

TABLE 3-8A
SUBSLAB SOIL VAPOR ANALYTICAL RESULTS
(ppbv units)

Hartford Working Group
Hartford, Illinois

Location ID	Sample ID	Sample Date	1,2,4-TRIMETHYLBENZENE	1,3,5-TRIMETHYLBENZENE	1,3-BUTADIENE	BENZENE	ETHYL BENZENE	HEXANE	ISOPENTANE	M,P-XYLENE	METHANE	METHANE	METHYL TERT-BUTYL ETHER	METHYLCYCLOHEXANE	O-XYLENE	PROPYLBENZENE	STYRENE	TOLUENE
Subslab Comparison Value (ppbv)			**13**	**13**	**10**	**40**	**2,300**	**550**	**390**	**1,000**	**NA**	**NA**	**7,000**	**7,500**	**1,000**	**300**	**600**	**800**
		Units	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppmv**	**%**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**	**ppbv**
100NOldStLouis	013105 100NOldStLouis SS-1	1/31/2005	< 0.73	< 0.73	< 2.9	< 0.73	< 0.73	< 0.73	44	0.75	34	-	< 2.9	< 0.73	< 0.73	< 0.73	< 0.73	4.8
	013105 100NOldStLouis SS-2	1/31/2005	2.3	2.3	< 3.0	< 0.74	< 0.74	1.7	44	1.1	230	-	< 3.0	1.1	< 0.74	< 0.74	0.98	24
	013105 100NOldStLouis SS-3	1/31/2005	< 0.80	< 0.80	< 3.2	< 0.80	< 0.80	< 0.80	33	< 0.80	3.1	-	< 3.2	< 0.80	< 0.80	< 0.80	< 0.80	4.8
110EMaple	012405 110 E Maple SS1	1/24/2005	0.93	< 0.72	< 0.72	2.5	0.87	< 2.9	33	2.9	-	0.00037	-	< 2.9	0.76	< 2.9	< 0.72	5.5
	012405 110 E Maple SS2	1/24/2005	< 0.79	< 0.79	< 0.79	2.3	< 0.79	< 3.2	14	2.1	-	< 0.00016	-	< 3.2	< 0.79	< 3.2	< 0.79	5.5
	012405 110 E Maple SS3	1/24/2005	< 0.72	< 0.72	< 0.72	1.7	< 0.72	< 2.9	5.3	2	-	< 0.00014	-	< 2.9	< 0.72	< 2.9	< 0.72	4.6
111WDate	022305 111 W Date SS1	2/23/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	< 0.72	-	< 0.00014	< 2.9	< 0.72	< 0.72	< 0.72	< 0.72	< 0.72
	022305 111 W Date SS2	2/23/2005	< 0.73	< 0.73	< 2.9	< 0.73	< 0.73	< 0.73	< 2.9	< 0.73	-	< 0.00015	< 2.9	< 0.73	< 0.73	< 0.73	< 0.73	< 0.73
	022305 111 W Date SS3	2/23/2005	< 0.70	< 0.70	< 2.8	< 0.70	< 0.70	< 0.70	3.4	< 0.70	-	< 0.00014	< 2.8	< 0.70	< 0.70	< 0.70	< 0.70	0.73
112WBirch	021005 112 W Birch SS1	2/10/2005	< 240	< 240	< 480J	**91**	< 5.8	480	**89,000**	< 5.8	13,000	-	< 960	< 240	< 5.8	< 240	< 240	< 5.8
	021005 112 W Birch SS2	2/10/2005	< 9,300	< 9,300	< 9,300J	**3,600**	< 60	**54,000**	**3,400,000**	< 60	69,000	-	< 43,000	< 11,000	< 60	< 11,000	< 11,000	< 60
	021005 112 W Birch SS3	2/10/2005	< 13,000	< 13,000	< 13,000J	**2,900**	< 63	**88,000**	**3,800,000**	< 63	110,000	-	< 90,000	< 22,000	< 63	< 22,000	< 22,000	< 63
	021005 112 W Birch SS4	2/10/2005	< 15,000	< 21,000	< 15,000J	**4,600**	< 58	**120,000**	**5,500,000**	< 58	110,000	-	< 83,000	< 21,000	< 58	< 21,000	< 21,000	< 58
114NDelmar	021505 114 N Delmar SS1	2/15/2005	< 0.84	< 0.84	< 3.4	< 0.84	< 0.84	< 0.84	< 3.4	< 0.84	-	< 0.00017	< 3.4	< 0.84	< 0.84	< 0.84	< 0.84	< 0.84
	021505 114 N Delmar SS1 Dup	2/15/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	< 0.72	-	< 0.00014	< 2.9	< 0.72	< 0.72	< 0.72	< 0.72	< 0.72
	021505 114 N Delmar SS2	2/15/2005	< 0.88	< 0.88	< 3.5	< 0.88	< 0.88	< 0.88	12	< 0.88	-	< 0.00018	< 3.5	< 0.88	< 0.88	< 0.88	< 0.88	< 0.88
116EWatkins	020705116EWATKINS SS1	2/7/2005	< 0.66	< 0.66	< 2.6	< 0.66	< 0.66	< 0.66	2.7	< 0.66	-	0.00027	< 2.6	< 0.66	< 0.66	< 0.66	< 0.66	1.4
	020705116EWATKINS SS2	2/7/2005	< 0.80	< 0.80	< 3.2	30	< 0.80	< 0.80	< 3.2	2.1	-	< 0.00016	< 3.2	< 0.80	< 0.80	< 0.80	< 0.80	5.7
	020705116EWATKINS SS3	2/7/2005	< 0.76	< 0.76	< 3.0	< 0.76	< 0.76	< 0.76	18	< 0.76	-	< 0.00015	< 3.0	< 0.76	< 0.76	< 0.76	< 0.76	< 0.76
117WDate	032205 117 W Date SS1	3/22/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	< 0.74	< 1.5	-	< 3.0	< 0.74	< 0.74	< 0.74	< 0.74	< 0.74
	032205 117 W Date SS2	3/22/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	< 0.72	< 1.4	-	< 2.9	< 0.72	< 0.72	< 0.72	< 0.72	0.98
	032205 117 W Date SS2 Dupe	3/22/2005	< 0.76	< 0.76	< 3.0	< 0.76	< 0.76	< 0.76	< 3.0	0.92	< 1.5	-	< 3.0	< 0.76	< 0.76	< 0.76	< 0.76	1.5
	032205 117 W Date SS3	3/22/2005	< 0.70	< 0.70	< 2.8	< 0.70	< 0.70	< 0.70	< 2.8	< 0.70	< 1.4	-	< 2.8	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70
118WBirch	031705 118 W Birch SS1	3/17/2005	< 0.82	< 0.82	< 3.3	< 0.82	< 0.82	< 0.82	< 3.3	2.2	-	< 0.00016	< 3.3	< 0.82	0.97	< 0.82	< 0.82	1.8
	031705 118 W Birch SS2	3/17/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	1.9	-	< 0.00015	< 3.0	< 0.74	0.95	< 0.74	< 0.74	1.4
	031705 118 W Birch SS3	3/17/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	2.1	-	< 0.00014	< 2.9	< 0.72	1	< 0.72	< 0.72	1.6
118WCherry	040405 118 W Cherry SS1	4/4/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	< 0.74	-	< 0.00015	< 3.0	< 0.74	< 0.74	< 0.74	< 0.74	0.97
	040405 118 W Cherry SS2	4/4/2005	< 0.73	< 0.73	< 2.9	< 0.73	< 0.73	< 0.73	< 2.9	1.2	-	< 0.00015	< 2.9	< 0.73	< 0.73	< 0.73	< 0.73	1.3
	040405 118 W Cherry SS3	4/4/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	6.5	12	0.98	-	< 0.00014	< 2.9	< 0.72	< 0.72	< 0.72	< 0.72	5.5
119WCherry	031005 119 W Cherry SS1	3/10/2005	< 0.70	< 0.70	< 2.8	< 0.70	< 0.70	< 0.70	< 2.8	< 0.70	-	< 0.00014	< 2.8	< 0.70	< 0.70	< 0.70	< 0.70	< 0.70
	031005 119 W Cherry SS2	3/10/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	< 0.74	-	< 0.00015	< 3.0	< 0.74	< 0.74	< 0.74	< 0.74	< 0.74
	031005 119 W Cherry SS3	3/10/2005	< 0.76	< 0.76	< 3.0	< 0.76	< 0.76	< 0.76	< 3.0	0.81	-	< 0.00015	< 3.0	< 0.76	< 0.76	< 0.76	< 0.76	1
120WCherry	030805 120 W Cherry SS1	3/8/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	2.2	-	< 0.00015	< 3.0	< 0.74	0.78	< 0.74	< 0.74	2.4
	030805 120 W Cherry SS1 DUP	3/8/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	2.1	-	< 0.00014	< 2.9	< 0.72	0.75	< 0.72	< 0.72	2.3
	030805 120 W Cherry SS2	3/8/2005	< 0.66	< 0.66	< 2.6	< 0.66	< 0.66	< 0.66	4.3	1.1	-	< 0.00013	< 2.6	< 0.66	< 0.66	< 0.66	< 0.66	1.9
	030805 120 W Cherry SS3	3/8/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	< 3.0	0.93	-	< 0.00015	< 3.0	< 0.74	< 0.74	< 0.74	< 0.74	1.6
122EForest	021505 122 E Forest SS1	2/15/2005	< 0.70	< 0.70	< 2.8	2	< 0.70	34	160	1.6	-	0.00028	< 2.8	5.8	< 0.70	< 0.70	< 0.70	1.2
	021505 122 E Forest SS2	2/15/2005	< 0.72	< 0.72	< 2.9	< 0.72	< 0.72	< 0.72	< 2.9	< 0.72	-	< 0.00014	< 2.9	< 0.72	< 0.72	< 0.72	< 0.72	< 0.72
	021505 122 E Forest SS3	2/15/2005	< 0.80	< 0.80	< 3.2	1.6	< 0.80	37	150	1.1	-	0.0002	< 3.2	4.4	< 0.80	< 0.80	< 0.80	1.1
123EWatkins	020705123EWATKINS SS1	2/7/2005	< 0.76	< 0.76	< 3.0	1.4	< 0.76	1.2	9.5	2.3	-	< 0.00015	< 3.0	< 0.76	0.82	< 0.76	< 0.76	4.4
	020705123EWATKINS SS2	2/7/2005	< 0.84	< 0.84	< 3.4	1.1	< 0.84	< 0.84	< 3.4	1.5	-	< 0.00017	< 3.4	< 0.84	< 0.84	< 0.84	< 0.84	3.7
	020705123EWATKINS SS3	2/7/2005	< 0.78	< 0.78	< 3.1	0.87	< 0.78	1.1	< 3.1	1.2	-	0.00023	< 3.1	< 0.78	< 0.78	< 0.78	< 0.78	2.9
123WCherry	030205 123 W Cherry SS1	3/2/2005	< 0.70	< 0.70	< 2.8	< 0.70	< 0.70	< 0.70	3.9	0.94	-	< 0.00014	< 2.8	< 0.70	< 0.70	< 0.70	< 0.70	4.2
	030205 123 W Cherry SS2	3/2/2005	< 0.74	< 0.74	< 3.0	< 0.74	< 0.74	< 0.74	13	1.2	-	0.00026	< 3.0	< 0.74	< 0.74	< 0.74	< 0.74	7.9
	030205 123 W Cherry SS3	3/2/2005	< 0.80	< 0.80	< 3.2	< 0.80	< 0.80	< 0.80	< 3.2	0.84	-	< 0.00016	< 3.2	< 0.80	< 0.80	< 0.80	< 0.80	3.8
124WForest	022305 124 W Forest SS1	2/23/2005	< 0.73	< 0.73	< 2.9	< 0.73	< 0.73	< 0.73	5.2	< 0.73	-	< 0.00015	< 2.9	< 0.73	< 0.73	< 0.73	< 0.73	1.6
	022305 124 W Forest SS2	2/23/2005	< 0.70	< 0.70	< 2.8	< 0.70	< 0.70	< 0.70	< 2.8	< 0.70	-	< 0.00014	< 2.8	< 0.70	< 0.70	< 0.70	< 0.70	2
	022305 124 W Forest SS3	2/23/2005	2.5	< 0.73	< 2.9	2	2	< 0.73	3.3	12	-	< 0.00015	< 2.9	< 0.73	4.9	< 0.73	< 0.73	16
126WElm	021105 126 W Elm SS1	2/11/2005	9.4	10	< 4.8J	25	6	210	**1,900**	15	-	0.0004	< 19	450	< 4.8	< 4.8	< 4.8	19
	021105 126 W Elm SS2	2/11/2005	< 2.1	< 2.1	< 2.1J	3.4	< 2.1	2.7	64	< 2.1	-	< 0.00016	< 8.3	11	< 2.1	< 2.1	< 2.1	< 2.1

TABLE 3-10
AREA 1-SOIL SAMPLE ANALYTICAL RESULTS

Hartford Working Group
Hartford, Illinois

Sample ID	HA-8 (5-6)	HA-8D (5-6)	HA-10 (5-6)	HA-13 (5-6)	HA-16 (5-6)	HA-19 (5-6)	HA-21 (5-6)	HA-24 (5-6)	HA-27 (5-6)	HA-29 (5-6)	HA-31 (5-6)	HA-34 (5-6)	HA-36 (5-6)	HA-37 (5-6)
Depth Interval (ft. bgs)	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6	5-6
Date	17-Feb-05	17-Feb-05	17-Feb-05	17-Feb-05	17-Feb-05	17-Feb-05	16-Feb-05	16-Feb-05	16-Feb-05	16-Feb-05	15-Feb-05	16-Feb-05	16-Feb-05	15-Feb-05
PID/FID	14 / 2,410	14 / 2,410	52 / 935	19 / 2,650	24 / 450	72 / 1,890	2/8	2 / 956	62 / 2,010	8 / 515	0 / 515	25 / 850	6 / 576	0 / 20
ASTM D2974	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Percent Moisture	21.2	24.4	26.3	20.8	24.2	22.9	27.2	26.3	20.9	20.9	22.4	19.9	20.8	15.5
Standard Method 18th Ed 2540G	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Total Solids	78.8	75.6	73.7	79.2	75.8	77.1	72.8	73.7	79.1	79.1	77.6	80.1	79.2	84.5
SW-846 5035, 8260B	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg	ug/kg
BENZENE	12.1	7.3	1,450	95.5	55.4	2,480	1.2	0.8 J	994	96.7	0.8 J	2	125	1 J
ETHYL BENZENE	3.3 U	3.6 U	333	3.5 J	3.6 J	485	4.0 U	4.0 U	7.6	5.5	4.0 U	3.6 U	3.3 U	2.9 U
TOLUENE	3.3 U	3.6 J	5.9	3.5 J	3.6 U	15	4.0 U	4.0 U	3.3 J	3.6 J	4.0 J	3.6 U	3.3 U	2.9 U
XYLENES (total)	3.3 J	3.6 U	246	16.2	3.6 J	1,060	4.0 J	4.0 U	14.3	13.6	4.0 J	3.6 U	4.0	2.9 J
METHYL TERT-BUTYL ETHER	1.3 U	1.4 U	1.6 U	1.4 U	1.4 U	1.4 U	1.6 U	1.6 U	1.3 U	1.5 U	1.6 U	1.4 U	1.3 U	1.2 U
SW-846 5035, 8260B	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH - GRO	1.47	0.883	5.49	1.5	1.48	6.35	0.810 U	0.794 J	3.05	1.07	0.796 U	1.94	0.857	0.589 U
SW-846 3550B, 8270C	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
TPH-DRO	14.8 U	15.8 U	16.4 U	14.8 J	15.9 U	16 U	16.1 U	16.6 U	15.3 U	15.2 U	15.7 U	14.7 J	15.2 U	13.9 U

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ft. bgs - Feet below ground surface.

HA - Hand Augered boring

TPH - Total Petroleum Hydrocarbon

GRO - Gasoline Range Organics

DRO - Diesel Range Organics

PID/FID Readings - obtained with TVA 1000

PID/FID Readings - in parts per million (ppm)

ug/kg - Micrograms per kilogram.

mg/kg - Milligrams per kilogram.

FO - Flame-out of FID

J - Analyte detected below reporting limits

U - Not detected at the reporting limit.

CLAYTON. 2005. LNAPL ACTIVE RECOVERY SYSTEM CONCEPTUAL SITE MODEL. DECEMBER 15TH.

VILLAGE OF HARTFORD, ILLINOIS

TABLE 2-1

HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS - North Olive Stratum

The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS							
Boring/Well ID	**Date of Collection/ Test**	**Sample/ Screen Depth (ft bgs)**	**Tested By**	**Analytical Method**	**Falling Head Test Hydraulic Conductivity (cm/sec)**	**Rising Head Test Hydraulic Conductivity (cm/sec)**	**Permeability (K) (cm/sec)**	**Average Hydraulic Conductivity (cm/sec)**	**Average Hydraulic Conductivity (ft/sec)**	**Average Hydraulic Conductivity (ft/day)**
MP-69	12/07/04	12.0-12.5	PSC	ASTM-D 5084	- -	- -	2.0E-04	- -	6.56E-06	5.67E-01
MP-72	11/30/04	14.5-15.0	PSC	ASTM-D 5084	- -	- -	8.7E-06	- -	2.85E-07	2.47E-02
HMW-45	12/14/04	13.5-14.0	PSC	ASTM-D 5084	- -	- -	1.5E-05	- -	4.92E-07	4.25E-02
HMW-45	08/20/04	14.5-15.0	PSC	ASTM-D 5084	- -	- -	1.60E-05	- -	5.25E-07	4.54E-02
HMW-46	08/19/04	12.5-13.0	PSC	ASTM-D 5084	- -	- -	2.90E-04	- -	9.51E-06	8.22E-01
HMW-47	08/19/04	17.0-17.5	PSC	ASTM-D 5084	- -	- -	1.40E-06	- -	4.59E-08	3.97E-03
Overall Average							8.85E-05	- -	2.90E-06	2.51E-01
Overall Geomean							2.35E-05	- -	7.72E-07	6.67E-02

NOTES:
ft bgs = feet below ground surface
S = Slug test hydraulic conductivity testing method
Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers
with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.
-- = Not conducted

TABLE 2-2
AVERAGE HYDRAULIC CONDUCTIVITY VALUES

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

Study Area Hydrostratigraphic Unit	Boring/Well ID in Hydrostratigraphic Unit	Average Hydraulic Conductivity		
		(cm/sec)	(ft/sec)	(ft/day)
North Olive Stratum	MP-69, MP-72, HMW-45, HMW-46, and HMW-47	8.85E-05	2.90E-06	2.51E-01
Rand Stratum	HMW-04, HMW-45 and HMW-50A	2.82E-03	9.24E-05	7.98E+00
EPA Stratum	HMW-49C and HMW-50B	1.97E-04	6.45E-06	5.57E-01
Main Sand	HMW-25, HMW-27, HMW-28, and HMW-29	2.17E-02	7.11E-04	6.14E+01

Geometric Mean Hydraulic Conductivity

Study Area Hydrostratigraphic Unit	Boring/Well ID in Hydrostratigraphic Unit	Geometric Mean Hydraulic Conductivity		
		(cm/sec)	(ft/sec)	(ft/day)
North Olive Stratum	MP-69, MP-72, HMW-45, HMW-46, and HMW-47	2.35E-05	7.72E-07	6.67E-02
Rand Stratum	HMW-04, HMW-45 and HMW-50A	5.83E-04	1.91E-05	1.65E+00
EPA Stratum	HMW-49C and HMW-50B	7.61E-05	2.50E-06	2.16E-01
Main Sand	HMW-25, HMW-27, HMW-28 and HMW-29	2.10E-02	6.89E-04	5.95E+01

TABLE 3-3
BAILDOWN TEST AND HVR EVENT LNAPL T AND K VALUE SUMMARY
Hartford Area Hydrocarbon Plume Site

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

Well ID	Type	Date	DTP	Density	Avg Tn	Avg Kn	Cooper et al		L (ft)
							T_n (cm^2/s)(C et al)	K_n (cm/s)(C et al)	
HMW-18	BD	3/2/2004	34.94	0.7649	2.86E-02	5.31E-04	3.86E-02	6.55E-04	1.94
HMW-18	BD	3/4/2004	34.83	0.7649			4.93E-03	9.19E-05	1.76
HMW-18	BD	8/24/2005	33.76	0.7649			4.23E-02	8.46E-04	1.64
HMW-19	BD	3/2/2004	34.85	0.7415	9.38E-02	3.22E-03	1.18E-02	2.74E-04	1.41
HMW-19	BD	3/4/2004	34.64	0.7415			1.34E-02	3.35E-04	1.31
HMW-19	HVR	5/23/2005	31.33	0.7415			3.49E-01	1.37E-02	0.83
HMW-19	HVR	6/7/2005	31.84	0.7415			4.53E-03	1.68E-04	0.88
HMW-19	HVR	6/21/2005	30.50	0.7415			1.39E-01	3.46E-03	1.31
HMW-19	HVR	7/8/2005	31.45	0.7415			4.14E-01	2.34E-02	0.57
HMW-19	HVR	7/22/2005	32.39	0.7415			3.41E-03	1.03E-04	1.08
HMW-19	HVR	8/9/2005	33.25	0.7415			2.13E-02	3.87E-04	1.79
HMW-19	HVR	8/10/2005	33.31	0.7415			2.59E-02	4.64E-04	1.82
HMW-19	HVR	8/11/2005	33.38	0.7415			2.53E-02	4.56E-04	1.81
HMW-19	HVR	8/12/2005	33.42	0.7415			1.74E-01	3.32E-03	1.71
HMW-19	HVR	8/16/2005	33.54	0.7415			2.81E-02	5.30E-04	1.73
HMW-19	HVR	8/17/2005	33.58	0.7415			6.31E-02	1.23E-03	1.67
HMW-19	HVR	8/18/2005	33.61	0.7415			3.12E-02	6.19E-04	1.64
HMW-19	HVR	8/19/2005	33.69	0.7415			2.25E-02	4.53E-04	1.62
HMW-19	HVR	8/22/2005	33.71	0.7415			2.38E-01	5.22E-03	1.48
HMW-19	HVR	8/23/2005	33.74	0.7415			3.08E-02	7.16E-04	1.40
HMW-20	BD	3/3/2004	32.75	0.7428	2.61E-02	5.06E-04	1.04E-01	2.02E-03	1.69
HMW-20	HVR	5/16/2005	30.09	0.7428			3.09E-04	4.00E-06	2.53
HMW-20	HVR	6/14/2005	29.28	0.7428			2.04E-04	2.25E-06	2.97
HMW-20	HVR	7/15/2005	30.29	0.7428			1.91E-05	6.26E-07	0.99
HMW-44C	HVR	5/13/2005	28.50	0.7641	8.74E-02	1.12E-03	2.41E-02	2.67E-04	2.95
HMW-44C	HVR	6/27/2005	27.75	0.7641			1.39E-01	1.31E-03	3.47
HMW-44C	HVR	7/14/2005	28.46	0.7641			2.39E-02	2.61E-04	2.99
HMW-44C	HVR	7/25/2005	29.28	0.7641			4.66E-02	6.32E-04	2.41
HMW-44C	HVR	7/26/2005	29.32	0.7641			5.00E-02	6.95E-04	2.35
HMW-44C	HVR	7/27/2005	29.48	0.7641			1.56E-02	2.24E-04	2.27
HMW-44C	HVR	7/28/2005	29.53	0.7641			4.00E-02	6.06E-04	2.16
HMW-44C	HVR	7/29/2005	29.57	0.7641			1.56E-02	2.37E-04	2.15
HMW-44C	HVR	8/1/2005	29.65	0.7641			3.62E-03	5.51E-05	2.14
HMW-44C	HVR	8/2/2005	29.71	0.7641			1.56E-02	2.42E-04	2.10
HMW-44C	HVR	8/3/2005	29.76	0.7641			9.03E-03	1.40E-04	2.10
HMW-44C	HVR	8/4/2005	29.83	0.7641			6.27E-03	1.02E-04	2.00
HMW-44C	HVR	8/5/2005	29.92	0.7641			4.37E-03	7.12E-05	2.00
HMW-44C	HVR	8/8/2005	30.01	0.7641			1.45E-03	2.39E-05	1.99
HMW-44C	BD	9/23/2004	29.14	0.7641			9.16E-01	1.20E-02	2.50
MP-35D	BD	8/30/2005	32.40	0.7763	1.32E-01	2.57E-03	1.32E-01	2.57E-03	1.69
MP-39C	BD	9/23/2004	32.94	0.7481	1.48E-03	3.08E-05	1.20E-03	2.38E-05	1.66
MP-39C	BD	8/31/2005	34.21	0.7481			1.75E-03	3.78E-05	1.52
MP-45C	BD	9/24/2004	30.26	0.7616	1.81E-02	2.46E-04	6.00E-04	9.94E-06	1.98
MP-45C	BD	8/30/2005	33.64	0.7616			3.57E-02	4.82E-04	2.43
MP-47C	BD	9/24/2004	31.58	0.7569	3.25E-03	4.88E-05	1.64E-04	2.22E-06	2.43
MP-47C	HVR	5/10/2005	28.35	0.7569			1.00E-03	1.33E-05	2.46
MP-47C	HVR	5/25/2005	28.36	0.7569			2.72E-03	4.28E-05	2.07
MP-47C	HVR	6/9/2005	28.46	0.7569			8.93E-03	1.35E-04	2.15
MP-47C	HVR	7/12/2005	28.29	0.7569			3.43E-03	5.02E-05	2.24
MP-49C	BD	8/31/2005	32.72	0.7335	7.20E-05	1.25E-06	7.20E-05	1.25E-06	1.88
MP-50C	HVR	5/26/2005	29.77	0.7410	1.71E-01	4.49E-03	1.01E+00	2.64E-02	1.24
MP-50C	HVR	7/13/2005	29.98	0.7410			1.82E-02	4.90E-04	1.21
MP-50C	HVR	8/24/2005	31.96	0.7410			5.52E-05	1.07E-06	1.68
MP-50C	HVR	8/25/2005	32.24	0.7410			3.41E-04	2.33E-05	0.47
MP-50C	HVR	8/26/2005	32.14	0.7410			9.54E-05	5.60E-06	0.55
MP-50C	HVR	8/29/2005	31.94	0.7410			1.37E-04	2.85E-06	1.57
MP-52C	BD	8/23/2005	33.08	0.7360	1.05E-05	2.29E-07	1.05E-05	2.29E-07	1.50
MP-53C	BD	9/23/2004	32.46	0.7480	1.81E-03	3.58E-05	2.80E-05	5.36E-07	1.71
MP-53C	HVR	7/19/2005	30.50	0.7480			3.59E-03	7.10E-05	1.65
MP-55C	BD	9/23/2004	29.20	0.7705	2.04E-02	4.16E-04	9.54E-04	8.50E-06	3.69
MP-55C	HVR	6/17/2005	28.53	0.7705			4.27E-02	1.30E-03	1.07
MP-55C	HVR	7/6/2005	28.43	0.7705			1.72E-02	1.83E-04	3.07
MP-55C	HVR	7/20/2005	28.95	0.7705			2.06E-02	1.73E-04	3.89
MP-56C	HVR	7/18/2005	29.98	0.7456	3.52E-04	1.10E-05	3.52E-04	1.10E-05	1.04
RW-4A	HVR	8/30/2005	31.80	0.7649	3.21E-03	9.00E-05	4.81E-03	1.28E-04	1.22
RW-4A	HVR	8/31/2005	31.94	0.7649			1.61E-03	5.15E-05	1.02
RW-5	HVR	9/1/2005	31.97	0.7649	1.94E-03	6.47E-05	1.94E-03	6.47E-05	0.97

NOTES: T_n and K_n calculated according to Huntley (2000)

CLAYTON. 2006. DISSOLVED PHASE GROUNDWATER INVESTIGATION REPORT. JANUARY 4TH.

VILLAGE OF HARTFORD, ILLINOIS

TABLE 4-2
2004-2005 COMPOUND/ANALYTE LIST FOR WATER SAMPLES - VOCs
Village of Hartford

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

PARAMETER	PREPARATION METHOD		ANALYTICAL METHOD		COMPOUND	METHOD DETECTION LIMIT * (µg/L)	PRACTICAL QUANTITATION LIMIT * (µg/L)	ACCEPTABLE DETECTION LIMIT ** (µg/L)
	Source	Method No.	Source	Method No.				
VOCs								
	SW-846	5030	SW-846	8260	Benzene	0.5	2	5
	SW-846	5030	SW-846	8260	Carbon disulfide	1	5	700
	SW-846	5030	SW-846	8260	Chlorobenzene	1	5	100
	SW-846	5030	SW-846	8260	Chloroform	1	5	0.2
	SW-846	5030	SW-846	8260	1,2-Dibromoethane or Ethylene dibromide (EDB)	1	5	0.05
	SW-846	5030	SW-846	8260	1,2-Dichlorobenzene	1	5	600
	SW-846	5030	SW-846	8260	1,3-Dichlorobenzene	1	5	NA
	SW-846	5030	SW-846	8260	1,4-Dichlorobenzene	1	5	75
	SW-846	5030	SW-846	8260	1,1-Dichloroethane	1	5	700
	SW-846	5030	SW-846	8260	1,2-Dichloroethane	1	5	5
	SW-846	5030	SW-846	8260	Ethylbenzene	1	5	700
	SW-846	5030	SW-846	8260	Methyl ethyl ketone (MEK) or 2-Butanone	5	50	NA
	SW-846	5030	SW-846	8260	Methyl tertiary butyl ether (MTBE)	0.5	2	70
	SW-846	5030	SW-846	8260	Styrene	1	5	100
	SW-846	5030	SW-846	8260	1,1,1-Trichloroethane	1	5	200
	SW-846	5030	SW-846	8260	Tetrachloroethene	1	5	5
	SW-846	5030	SW-846	8260	Toluene	1	5	1,000
	SW-846	5030	SW-846	8260	Trichloroethene	1	5	5
	SW-846	5030	SW-846	8260	o, m, p-Xylenes (total)	1	5	10,000
	SW-846	3510	SW-846	8015	1,4-Dioxane	250	500	NA

NOTES:

µg/L = Micrograms per liter

NA = Not available

* Method detection limit and practical quantitation limit as identified by Teklab, Inc. (Ottensmeier, 2004).

** Acceptable detection limit is the IPCB TACO Tier 1 Groundwater Remediation Objective for Class I Groundwater.

TABLE 4-2
2004-2005 COMPOUND/ANALYTE LIST FOR WATER SAMPLES - SVOCs
Village of Hartford

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

PARAMETER	PREPARATION METHOD		ANALYTICAL METHOD		COMPOUND	METHOD DETECTION LIMIT * (mg/L)	PRACTICAL QUANTITATION LIMIT * (mg/L)	ACCEPTABLE DETECTION LIMIT ** (mg/L)
	Source	Method No.	Source	Method No.				
SVOCs								
	SW-846	3510	SW-846	8310	Acenaphthene	0.002	0.005	0.42
	SW-846	3510	SW-846	8310	Anthracene	0.0001	0.005	2.1
	SW-846	3510	SW-846	8310	Benzo(a)anthracene	0.00005	0.0001	0.00013
	SW-846	3510	SW-846	8310	Benzo(b)fluoranthene	0.0001	0.00018	0.00018
	SW-846	3510	SW-846	8310	Benzo(k)fluoranthene	0.0001	0.00017	0.00017
	SW-846	3510	SW-846	8310	Benzo(a)pyrene	0.0001	0.0002	0.0002
	SW-846	3510	SW-846	8270	Bis(2-ethylhexyl)phthalate	0.004	0.006	0.006
	SW-846	3510	SW-846	8310	Chrysene	0.0003	0.0008	0.0015
	SW-846	3510	SW-846	8270	o-Cresol	0.001	0.01	0.35
	SW-846	3510	SW-846	8270	m-Cresol	0.001	0.01	NA
	SW-846	3510	SW-846	8270	p-Cresol	0.001	0.01	NA
	SW-846	3510	SW-846	8270	Di-n-butyl phthalate	0.003	0.01	0.7
	SW-846	3510	SW-846	8310	Dibenzo(a,h)anthracene	0.0002	0.0003	0.0003
	SW-846	3510	SW-846	8270	Diethyl phthalate	0.002	0.01	5.6
	SW-846	3510	SW-846	8270	2,4-Dimethylphenol	0.001	0.01	0.14
	SW-846	3510	SW-846	8270	Dimethyl phthalate	0.001	0.01	NA
	SW-846	3510	SW-846	8270	2,4-Dinitrophenol	0.001	0.02	0.014
	SW-846	3510	SW-846	8310	Fluoranthene	0.0005	0.002	0.28
	SW-846	3510	SW-846	8310	Fluorene	0.0004	0.001	0.28
	SW-846	3510	SW-846	8310	Indeno(1,2,3-cd)pyrene	0.0001	0.0004	0.00043
	SW-846	3510	SW-846	8310	Napthalene	0.002	0.005	0.14
	SW-846	3510	SW-846	8270	4-Nitrophenol	0.001	0.02	NA
	SW-846	3510	SW-846	8310	Phenanthrene	0.0005	0.005	NA
	SW-846	3510	SW-846	8270	Phenol	0.001	0.005	0.1
	SW-846	3510	SW-846	8310	Pyrene	0.0001	0.002	0.21
	SW-846	3510	SW-846	8270	Pyridine	0.005	0.02	NA
	SW-846	3510	SW-846	8270	Quinoline	0.001	0.005	NA

NOTES:
mg/L = Milligrams per liter
NA = Not available
* Method detection limit and practical quantitation limit as identified by Teklab, Inc. (Ottensmeier, 2004).
** Acceptable detection limit is the IPCB TACO Tier 1 Groundwater Remediation Objective for Class I Groundwater.
2,4-Dinitrophenol and 4-Nitrophenol PQL revised per Teklab (Klostermann, 2005)

TABLE 4-2
2004-2005 COMPOUND/ANALYTE LIST FOR WATER SAMPLES - Inorganics
Village of Hartford

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

PARAMETER	PREPARATION METHOD		ANALYTICAL METHOD		COMPOUND	METHOD DETECTION LIMIT * (mg/L)	PRACTICAL QUANTITATION LIMIT * (mg/L)	ACCEPTABLE DETECTION LIMIT ** (mg/L)
	Source	Method No.	Source	Method No.				
Metals								
	SW-846	3020A	SW-846	7041	Antimony	0.0017	0.005	0.006
	SW-846	3020A	SW-846	7060A	Arsenic	0.0007	0.003	0.05
	SW-846	3005A	SW-846	6010	Barium	0.0024	0.005	2
	SW-846	3005A	SW-846	6010	Beryllium	0.003	0.001	0.004
	SW-846	3005A	SW-846	6010	Cadmium	0.0003	0.002	0.005
	SW-846	3005A	SW-846	6010	Chromium-Total	0.004	0.01	0.1
	SW-846	3005A	SW-846	6010	Cobalt	0.0022	0.01	1
	SW-846	3020A	SW-846	7421	Lead	0.0004	0.002	0.0075
	--	--	SW-846	7470	Mercury	0.00005	0.0002	0.002
	SW-846	3005A	SW-846	6010	Nickel	0.0033	0.01	0.1
	SW-846	3020A	SW-846	7740	Selenium	0.0035	0.006	0.05
	SW-846	3005A	SW-846	6010	Silver	0.0032	0.01	0.05
	SW-846	3005A	SW-846	6010	Vanadium	0.0032	0.01	0.049
	SW-846	3005A	SW-846	6010	Zinc	0.0021	0.01	5
General								
	--	--	SW-846	9040-B	pH	0	1	NA
	--	--	Standard Method	M2320B	Alkalinity, Total (as, Ca, CO_3)	0	0	NA
	--	--	SW-846	9251.0	Chloride	0.5	1	200
	--	--	Standard Method	M5220D	COD	7.3	20	NA
	--	--	SW-846	9012A	Cyanide Total	0.0026	0.007	0.2
	--	--	Standard Method	M2340C	Hardness (as, Ca, CO_3)	3	5	NA
	--	--	SW-846	9036.0	Sulfate	1.5	5	400
	--	--	Standard Method	M4500SD	Sulfide	0.013	0.50	NA
	--	--	Standard Method	M2540C	Total Dissolved Solids	10	20	NA
	--	--	Standard Method	M2540D	Total Suspended Solids	5	6	NA

NOTES:
mg/L = Milligrams per liter [except for pH (unitless)].
NA = Not available
-- = Not applicable
* Method detection limit and practical quantitation limit as identified by Teklab, Inc. (Ottensmeier, 2004).
** Acceptable detection limit is the IPCB TACO Tier 1 Groundwater Remediation Objective for Class I Groundwater.

TABLE 5-3
Summary of Groundwater Analytical Results
Skinner List - VOCs

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

PERIOD: From 12/16/2003 thru 10/14/2005 - Inclusive
SAMPLE TYPE: Water

CONSTITUENT	SITE SAMPLE ID DATE RESULT TYPE	Comparison Value	HB-31 HB-31/050201 02/01/2005 Primary	HB-31 HB-31/050720 07/20/2005 Primary	HB-31 HB-31/051014 10/14/2005 Primary	HB-32 HB-32/050201 02/01/2005 Primary	HB-32 HB-32/050414 04/14/2005 Primary
1,1,1-Trichloroethane	(ug/l)	200	**<250**	<125	**<1000**	<5.0	<5.0
1,1-Dichloroethane	(ug/l)	700	<250	<125	**<1000**	<5.0	<5.0
1,2-Dibromoethane	(ug/l)	0.05	**<250**	**<125**	**<1000**	**<5.0**	**<5.0**
1,2-Dichlorobenzene	(ug/l)	600	<250	<125	**<1000**	<5.0	<5.0
1,2-Dichloroethane	(ug/l)	5	**<250**	**<125**	**<1000**	<5.0	<5.0
1,3-Dichlorobenzene	(ug/l)		<250	<125	<1000	<5.0	<5.0
1,4-Dichlorobenzene	(ug/l)	75	**<250**	**<125**	**<1000**	<5.0	<5.0
2-Butanone	(ug/l)		<1250	<625	<5000	<25.0	<25.0
Benzene	(ug/l)	5	**23700**	**23800**	**25400**	**312**	**636**
Carbon disulfide	(ug/l)	700	<250	<125	**<1000**	<5.0	<5.0
Chlorobenzene	(ug/l)	100	**<250**	**<125**	**<1000**	<5.0	<5.0
Chloroform	(ug/l)	0.2	**<250**	**<125**	**<1000**	**<5.0**	**<5.0**
Ethylbenzene	(ug/l)	700	**2000**	**2000**	**1690**	2.6J	4.4J
Methyl tert-butyl ether	(ug/l)	70	**<100**	<50.0	**<400**	<2.0	<2.0
Styrene	(ug/l)	100	**<250**	**<125**	**<1000**	<5.0	<5.0
Tetrachloroethene	(ug/l)	5	**<250**	**<125**	**<1000**	<5.0	<5.0
Toluene	(ug/l)	1000	**16600**	**16700**	**22000**	5.2	7.4
Trichloroethene	(ug/l)	5	**<250**	**<125**	**<1000**	<5.0	<5.0
Xylene (total)	(ug/l)	10000	8780	**10100**	8480	5.8	4.9J
1,4-Dioxane	(ug/l)		<500	<500	<500	<500	<500

See Notes at Beginning of Table

TABLE 5-4
Summary of Groundwater Analytical Results
Skinner List - SVOCs

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

PERIOD: From 12/16/2003 thru 10/14/2005 - Inclusive
SAMPLE TYPE: Water

CONSTITUENT	SITE SAMPLE ID DATE RESULT TYPE	Comparison Value	HB-31 HB-31/050201 02/01/2005 Primary	HB-31 HB-31/050720 07/20/2005 Primary	HB-31 HB-31/051014 10/14/2005 Primary	HB-32 HB-32/050201 02/01/2005 Primary	HB-32 HB-32/050414 04/14/2005 Primary
2,4-Dimethylphenol	(mg/l)	0.14	0.026	0.044J	0.040	<0.010	<0.010
2,4-Dinitrophenol	(mg/l)	0.014	**<0.020**	**<0.100**	**<0.020**	**<0.021**	**<0.020**
4-Nitrophenol	(mg/l)		<0.020	<0.100	<0.020	<0.021	<0.020
Bis(2-ethylhexyl)phthalate	(mg/l)	0.006	**0.096**	**<0.030**	**0.015**	<0.006	<0.006
Di-n-butyl phthalate	(mg/l)	0.7	<0.010	<0.050	<0.010	<0.010	<0.010
Diethyl phthalate	(mg/l)	5.6	<0.010	<0.050	<0.010	<0.010	<0.010
Dimethyl phthalate	(mg/l)		<0.010	<0.050	<0.010	<0.010	<0.010
m,p-Cresol	(mg/l)		<0.010	0.053	0.047	<0.010	<0.010
o-Cresol	(mg/l)	0.35	<0.010	0.029J	0.029	<0.010	<0.010
Phenol	(mg/l)	0.1	<0.005	0.026	0.041	<0.005	0.003J
Pyridine	(mg/l)		<0.020	<0.100	<0.020	<0.021	<0.020
Quinoline	(mg/l)		<0.005	<0.025	<0.005	<0.005	<0.005
Acenaphthene	(mg/l)	0.42	<0.00300	<0.00300	<0.00300	<0.00300	<0.00300
Anthracene	(mg/l)	2.1	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo(a)anthracene	(mg/l)	0.00013	<0.00009	<0.00009	<0.00009	<0.00009	<0.00009
Benzo(a)pyrene	(mg/l)	0.0002	<0.00012	<0.00012	<0.00012	<0.00012	<0.00012
Benzo(b)fluoranthene	(mg/l)	0.00018	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Benzo(k)fluoranthene	(mg/l)	0.00017	<0.00015	<0.00015	<0.00015	<0.00015	<0.00015
Chrysene	(mg/l)	0.0015	<0.00045	<0.00045	<0.00045	<0.00045	<0.00045
Dibenzo(a,h)anthracene	(mg/l)	0.0003	<0.00018	<0.00018	<0.00018	<0.00018	<0.00018
Fluoranthene	(mg/l)	0.28	0.00177	0.00109	0.00099	<0.00090	0.00122

See Notes at Beginning of Table

TABLE 5-4
Summary of Groundwater Analytical Results
Skinner List - SVOCs

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

PERIOD: From 12/16/2003 thru 10/14/2005 - Inclusive
SAMPLE TYPE: Water

CONSTITUENT	SITE SAMPLE ID DATE RESULT TYPE	Comparison Value	HB-31 HB-31/050201 02/01/2005 Primary	HB-31 HB-31/050720 07/20/2005 Primary	HB-31 HB-31/051014 10/14/2005 Primary	HB-32 HB-32/050201 02/01/2005 Primary	HB-32 HB-32/050414 04/14/2005 Primary
Fluorene	(mg/l)	0.28	<0.00030	<0.00030	<0.00030	<0.00030	0.00059
Indeno(1,2,3-cd)pyrene	(mg/l)	0.00043	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Naphthalene	(mg/l)	0.14	**0.542**	**0.483**	**0.427**	<0.00300	<0.00300
Phenanthrene	(mg/l)		0.00296	0.00165	0.00189	<0.00060	0.00073
Pyrene	(mg/l)	0.21	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

See Notes at Beginning of Table

TABLE 5-5
Summary of Groundwater Analytical Results
Skinner List - Metals (Total and Dissolved)

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

PERIOD: From 12/16/2003 thru 10/14/2005 - Inclusive
SAMPLE TYPE: Water

CONSTITUENT	SITE SAMPLE ID DATE RESULT TYPE	Comparison Value	HB-31 HB-31/050201 02/01/2005 Primary	HB-31 HB-31/050720 07/20/2005 Primary	HB-31 HB-31/051014 10/14/2005 Primary	HB-32 HB-32/050201 02/01/2005 Primary	HB-32 HB-32/050414 04/14/2005 Primary
Antimony	(mg/l)	0.006	<0.0050	<0.0050	0.0024J	<0.0050	<0.0050
Antimony (Dissolved)	(mg/l)	0.006	<0.0050	<0.0050	<0.0050	NA	<0.0050
Arsenic	(mg/l)	0.05	0.0284	0.0206	0.0234	<0.0030	<0.0030
Arsenic (Dissolved)	(mg/l)	0.05	0.0232	0.0224	0.0206	NA	<0.0030
Barium	(mg/l)	2	1.57	0.847	0.954	0.499	0.471
Barium (Dissolved)	(mg/l)	2	0.676	0.464	0.501	NA	0.458
Beryllium	(mg/l)	0.004	**0.0061**	0.0028	0.0016	<0.0010	<0.0010
Beryllium (Dissolved)	(mg/l)	0.004	<0.0010	0.0006J	<0.0010	NA	<0.0010
Cadmium	(mg/l)	0.005	<0.0020	0.0015J	<0.0020	0.0004J	0.0003J
Cadmium (Dissolved)	(mg/l)	0.005	<0.0020	<0.0020	<0.0020	NA	<0.0020
Chromium	(mg/l)	0.1	**0.198**	0.0587	<0.0100	<0.0100	<0.0100
Chromium (Dissolved)	(mg/l)	0.1	<0.0100	<0.0100	<0.0100	NA	<0.0100
Cobalt	(mg/l)	1	0.0928	0.0313	0.0076J	<0.0100	<0.0100
Cobalt (Dissolved)	(mg/l)	1	0.0022J	0.0040J	<0.0100	NA	<0.0100
Iron	(mg/l)	5	NA	**111**	**64.2**	NA	NA
Iron (Dissolved)	(mg/l)	5	NA	**30.6**	**31.6**	NA	NA
Lead	(mg/l)	0.0075	**0.175**	**0.0836**	**0.204**	0.0022	0.0010J
Lead (Dissolved)	(mg/l)	0.0075	0.0050	**0.0163**	**0.0102**	NA	0.0017J
Mercury	(mg/l)	0.002	0.00019J	0.00011J	0.00021	<0.00020	<0.00020
Mercury (Dissolved)	(mg/l)	0.002	<0.00020	<0.00020	<0.00020	NA	<0.00020

See Notes at Beginning of Table

TABLE 5-5
Summary of Groundwater Analytical Results
Skinner List - Metals (Total and Dissolved)

The Hartford Working Group / Hartford, Illinois
1190505040 -- Madison County -- ILR000128249

PERIOD: From 12/16/2003 thru 10/14/2005 - Inclusive
SAMPLE TYPE: Water

CONSTITUENT	SITE SAMPLE ID DATE RESULT TYPE	Comparison Value	HB-31 HB-31/050201 02/01/2005 Primary	HB-31 HB-31/050720 07/20/2005 Primary	HB-31 HB-31/051014 10/14/2005 Primary	HB-32 HB-32/050201 02/01/2005 Primary	HB-32 HB-32/050414 04/14/2005 Primary
Nickel	(mg/l)	0.1	**0.211**	0.0866	0.0186	<0.0100	<0.0100
Nickel (Dissolved)	(mg/l)	0.1	<0.0100	<0.0100	<0.0100	NA	<0.0100
Selenium	(mg/l)	0.05	<0.0060	<0.0060	<0.0060	<0.0060	<0.0060
Selenium (Dissolved)	(mg/l)	0.05	<0.0060	<0.0060	<0.0060	NA	<0.0060
Silver	(mg/l)	0.05	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Silver (Dissolved)	(mg/l)	0.05	<0.0100	<0.0100	<0.0100	NA	<0.0100
Vanadium	(mg/l)	0.049	**0.303**	**0.131**	<0.0100	<0.0100	<0.0100
Vanadium (Dissolved)	(mg/l)	0.049	<0.0100	<0.0100	<0.0100	NA	<0.0100
Zinc	(mg/l)	5	0.630	0.336	0.0604	<0.0100	0.712
Zinc (Dissolved)	(mg/l)	5	0.0024J	0.0942	0.0072J	NA	0.682

See Notes at Beginning of Table

TABLE 5-8
HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS SUMMARY - North Olive Stratum
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS							
Boring/Well ID	**Date of Collection/ Test**	**Sample/ Screen Depth (ft bgs)**	**Tested By**	**Analytical Method**	**Falling Head Test Hydraulic Conductivity (cm/sec)**	**Rising Head Test Hydraulic Conductivity (cm/sec)**	**Permeability (K) (cm/sec)**	**Average Hydraulic Conductivity (cm/sec)**	**Average Hydraulic Conductivity (ft/sec)**	**Average Hydraulic Conductivity (ft/day)**
MP-69	12/07/04	12.0-12.5	PSC	ASTM-D 5084	- -	- -	2.0E-04	- -	6.56E-06	5.67E-01
MP-72	11/30/04	14.5-15.0	PSC	ASTM-D 5084	- -	- -	8.7E-06	- -	2.85E-07	2.47E-02
HMW-45	12/14/04	13.5-14.0	PSC	ASTM-D 5084	- -	- -	1.5E-05	- -	4.92E-07	4.25E-02
HMW-45	08/20/04	14.5-15.0	PSC	ASTM-D 5084	- -	- -	1.60E-05	- -	5.25E-07	4.54E-02
HMW-46	08/19/04	12.5-13.0	PSC	ASTM-D 5084	- -	- -	2.90E-04	- -	9.51E-06	8.22E-01
HMW-47	08/19/04	17.0-17.5	PSC	ASTM-D 5084	- -	- -	1.40E-06	- -	4.59E-08	3.97E-03
Overall Average							8.85E-05	- -	2.90E-06	2.51E-01
Overall Geomean							2.35E-05	- -	7.72E-07	6.67E-02

NOTES:

ft bgs = feet below ground surface

S = Slug test hydraulic conductivity testing method

Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.

-- = Not conducted

TABLE 5-8

HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS SUMMARY - Rand Stratum

The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS							
Boring / Well ID	**Date of Collection/ Test**	**Sample/ Screen Depth (ft bgs)**	**Tested By**	**Analytical Method**	**Falling Head Test Hydraulic Conductivity (cm/sec)**	**Rising Head Test Hydraulic Conductivity (cm/sec)**	**Permeability (K) (cm/sec)**	**Average Hydraulic Conductivity (cm/sec)**	**Average Hydraulic Conductivity (ft/sec)**	**Average Hydraulic Conductivity (ft/day)**
HMW-45	12/14/04	26.0-26.5	PSC	ASTM-D 5084	- -	- -	5.5E-05	5.5E-05	1.80E-06	1.56E-01
HMW-04	07/28/05	20.02-25.75	Clayton	Bouwer & Rice	S 2.73E-04	S 6.35E-04	- -	4.54E-04	1.49E-05	1.29E+00
HMW-50A	07/27/05	17.30-27.0	Clayton	Cooper et al	S 4.08E-03	S 1.18E-02	- -	7.94E-03	2.60E-04	2.25E+01
Overall Average								2.82E-03	9.24E-05	7.98E+00
Overall Geomean								5.83E-04	1.91E-05	1.65E+00

NOTES:

ft bgs = feet below ground surface

S = Slug test hydraulic conductivity testing method

Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.

Cooper, H. H., J.D. Bredehoeft, and S.S. Papadopulos. 1967**.** Response of a Finite-Diameter Well to an Instantaneous Charge of Water. Water Resources Research, Vol. 3, no. 1, pp. 263-269.

-- = Not conducted

TABLE 5-8
HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS SUMMARY - Clay Strata
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS								
Boring/Well ID	Date of Collection/ Test	Sample/ Screen Depth (ft bgs)	Tested By	Analytical Method	Falling Head Test Hydraulic Conductivity (cm/sec)	Rising Head Test Hydraulic Conductivity (cm/sec)	Permeability (K) (cm/sec)	Average Hydraulic Conductivity (cm/sec)	Average Hydraulic Conductivity (ft/sec)	Average Hydraulic Conductivity (ft/day)
MP-76	12/09/04	5.5-6.0	PSC	ASTM-D 5084	- -	- -	6.0E-09	- -	1.97E-10	1.70E-05
MP-76	12/09/04	13.5-14.0	PSC	ASTM-D 5084	- -	- -	4.9E-05	- -	1.61E-06	1.39E-01
HMW-45	12/14/04	9.0-9.5	PSC	ASTM-D 5084	- -	- -	1.7E-04	- -	5.58E-06	4.82E-01
HMW-45	12/14/04	20.0-20.5	PSC	ASTM-D 5084	- -	- -	4.9E-08	- -	1.61E-09	1.39E-04
HMW-46	12/14/04	6.0-6.5	PSC	ASTM-D 5084	- -	- -	6.6E-05	- -	2.17E-06	1.87E-01
Overall Average							5.70E-05	- -	1.87E-06	1.62E-01
Overall Geomean							2.77E-06	- -	9.07E-08	7.84E-03

NOTES:

ft bgs = feet below ground surface

S = Slug test hydraulic conductivity testing method

Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.

-- = Not conducted

TABLE 5-8

HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS SUMMARY - EPA Stratum

The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS										
Boring / Well ID	Date of Collection/ Test	Sample/ Screen Depth (ft bgs)	Tested By	Analytical Method	Falling Head Test Hydraulic Conductivity (cm/sec)		Rising Head Test Hydraulic Conductivity (cm/sec)		Permeability (K) (cm/sec)	Average Hydraulic Conductivity (cm/sec)	Average Hydraulic Conductivity (ft/sec)	Average Hydraulic Conductivity (ft/day)
HMW-49C	07/28/05	29.9'-39.0'	Clayton	Bouwer & Rice	S	2.21E-05	S	8.51E-06	- -	1.53E-05	5.02E-07	4.34E-02
HMW-50B	07/27/05	35.0'-39.6'	Clayton	Bouwer & Rice	S	3.96E-04	S	3.60E-04	- -	3.78E-04	1.24E-05	1.07E+00
Overall Average										1.97E-04	6.45E-06	5.57E-01
Overall Geomean										7.61E-05	2.50E-06	2.16E-01

NOTES:

ft bgs = feet below ground surface

S = Slug test hydraulic conductivity testing method

Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.

-- = Not conducted

TABLE 5-8
HYDRAULIC CONDUCTIVITY/PERMEABILITY ANALYSIS RESULTS SUMMARY - Main Sand Stratum
The Hartford Area Hydrocarbon Plume Site, Hartford, Illinois

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

SAMPLE			SAMPLE ANALYSIS							
Boring/Well ID	**Date of Collection/ Test**	**Sample/ Screen Depth (ft bgs)**	**Tested By**	**Analytical Method**	**Falling Head Test Hydraulic Conductivity (cm/sec)**	**Rising Head Test Hydraulic Conductivity (cm/sec)**	**Permeability (K) (cm/sec)**	**Average Hydraulic Conductivity (cm/sec)**	**Average Hydraulic Conductivity (ft/sec)**	**Average Hydraulic Conductivity (ft/day)**
HMW-25	12/19/03	24.0-38.7	Clayton	Bouwer & Rice	S 1.39E-02	S 1.78E-02	- -	1.59E-02	5.20E-04	4.49E+01
HMW-27	12/19/03	25.0-39.7	Clayton	Bouwer & Rice	S 1.48E-02	S 2.92E-02	- -	2.20E-02	7.22E-04	6.24E+01
HMW-28	12/19/03	25.0-39.7	Clayton	Bouwer & Rice	S 3.31E-02	S 2.81E-02	- -	3.06E-02	1.00E-03	8.67E+01
HMW-29	12/19/03	25.0-39.7	Clayton	Bouwer & Rice	S 2.25E-02	S 1.40E-02	- -	1.83E-02	5.99E-04	5.17E+01
Overall Average								2.17E-02	7.11E-04	6.14E+01
Overall Geomean								2.10E-02	6.89E-04	5.95E+01

NOTES:

ft bgs = feet below ground surface

S = Slug test hydraulic conductivity testing method

Bouwer, H. and R.C. Rice. 1976. A Slug Test Method for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrated Wells. Water Resources Research, Vol. 12, no.3, pp. 423-428.

-- = Not conducted

TABLE 6-2
2006 COMPOUND/ANALYTE LIST FOR WATER SAMPLES - VOCs
Village of Hartford

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

PARAMETER	PREPARATION METHOD		ANALYTICAL METHOD		COMPOUND	METHOD DETECTION LIMIT * (ug/L)	PRACTICAL QUANTITATION LIMIT * (ug/L)	ACCEPTABLE DETECTION LIMIT ** (ug/L)
	Source	Method No.	Source	Method No.				
VOCs								
	SW-846	5030	SW-846	8260	Benzene	0.5	2	5
	SW-846	5030	SW-846	8260	Ethylbenzene	1	5	700
	SW-846	5030	SW-846	8260	Methyl tertiary butyl ether (MTBE)	0.5	2	70
	SW-846	5030	SW-846	8260	Toluene	1	5	1,000
	SW-846	5030	SW-846	8260	o, m, p-Xylenes (total)	1	5	10,000

NOTES:

µg/L = Micrograms per liter

* Method detection limit and practical quantitation limit as identified by Teklab, Inc. (Ottensmeier, 2004).

** Acceptable detection limit is the IPCB TACO Tier 1 Groundwater Remediation Objective for Class I Groundwater.

TABLE 6-2
2006 COMPOUND/ANALYTE LIST FOR WATER SAMPLES - Inorganics
Village of Hartford

1190505040 -- Madison County -- ILR 000128249
The Hartford Working Group / Hartford, Illinois

PARAMETER	PREPARATION METHOD		ANALYTICAL METHOD		COMPOUND	METHOD DETECTION LIMIT * (mg/L)	PRACTICAL QUANTITATION LIMIT * (mg/L)	ACCEPTABLE DETECTION LIMIT ** (mg/L)
	Source	Method No.	Source	Method No.				
Metals								
	SW-846	3020A	SW-846	7041	Antimony	0.0017	0.005	0.006
	SW-846	3020A	SW-846	7060A	Arsenic	0.0007	0.003	0.05
	SW-846	3005A	SW-846	6010	Barium	0.0024	0.005	2
	SW-846	3005A	SW-846	6010	Beryllium	0.003	0.001	0.004
	SW-846	3005A	SW-846	6010	Cadmium	0.0003	0.002	0.005
	SW-846	3005A	SW-846	6010	Chromium-Total	0.004	0.01	0.1
	SW-846	3005A	SW-846	6010	Cobalt	0.0022	0.01	1
	SW-846	3005A	SW-846	6010	Iron	0.007	0.02	5
	SW-846	3020A	SW-846	7421	Lead	0.0004	0.002	0.0075
	--	--	SW-846	7470	Mercury	0.00005	0.0002	0.002
	SW-846	3005A	SW-846	6010	Nickel	0.0033	0.01	0.1
	SW-846	3020A	SW-846	7740	Selenium	0.0035	0.006	0.05
	SW-846	3005A	SW-846	6010	Silver	0.0032	0.01	0.05
	SW-846	3005A	SW-846	6010	Vanadium	0.0032	0.01	0.049
	SW-846	3005A	SW-846	6010	Zinc	0.0021	0.01	5
General								
	--	--	Standard Method	M2320B	Alkalinity, Total (as, Ca, CO_3)	0	0	NA
	--	--	EPA Method	E350.1	Ammonia as N	0.04	0.1	NA
	--	--	SW-846	9251.0	Chloride	0.5	1	200
	--	--	Standard Method	M5220D	COD	7.3	20	NA
	--	--	SW-846	9012A	Cyanide Total	0.0026	0.007	0.2
	--	--	Standard Method	M2340C	Hardness (as, Ca, CO_3)	3	5	NA
	--	--	EPA Method	E353.2	Nitrate as N	0.004	0.01	10.0
	--	--	EPA Method	E353.2	Nitrate-Nitrite	0.004	0.01	NA
	--	--	EPA Method	E353.2	Nitrite as N	0.004	0.01	NA
	--	--	EPA Method	E365.2	Phosphorus as P	0.01	0.02	NA
	--	--	EPA Method	E365.2 (D)	Phosphorus, Dissolved as P	0.01	0.02	NA
	--	--	SW-846	9036.0	Sulfate	1.5	5	400
	--	--	Standard Method	M4500SD	Sulfide	0.013	0.50	NA
	--	--	Standard Method	M2540C	Total Dissolved Solids	10	20	NA
	--	--	EPA Method	E415.1	Total Organic Carbon	0.5	1	NA
	--	--	Standard Method	M2540D	Total Suspended Solids	5	6	NA

NOTES:

mg/L = Milligrams per liter

NA = Not available

* Method detection limit and practical quantitation limit as identified by Teklab, Inc. (Ottensmeier, 2004).

** Acceptable detection limit is the IPCB TACO Tier 1 Groundwater Remediation Objective for Class I Groundwater.

-- = Not applicable

CLAYTON. 2006. PROPOSAL FOR AN ACTIVE LNAPL RECOVERY SYSTEM. FEBRUARY 2ND.

VILLAGE OF HARTFORD, ILLINOIS

TABLE 3-7
LNAPL MOBILITY

1190505040 -- Madison County -- ILR000128249
The Hartford Working Group / Hartford, Illinois

		PORE FLUID SATURATIONS, % Pv			
		Initial Fluid Saturations		After Centrifuge at 1000xG	
SAMPLE ID.	DEPTH, ft.	WATER (Swi) SATURATION	NAPL (Soi) SATURATION	WATER (Srw) SATURATION	NAPL (Sor) SATURATION
HMW-44C	9.6	82.6	3.6	60.4	3.6
HMW-44C	10.3	68.9	3.5	29.7	3.2
HMW-44C	10.8	55.6	1.1	31.7	0.9
HMW-44C	17.0	87.2	1.7	67.7	1.5
HMW-44C	17.4	90.8	0.4	83.7	0.4
HMW-44C	20.05	78.4	2.5	43.5	2.1
HMW-44C	30.0	76.2	4.8	44.9	4.8
HMW-44C	32.4	32.2	30.4	10.7	6.0
HMW-44C	40.3	50.3	9.1	7.8	5.1
MP-29D	24.0	76.1	5.9	46.9	4.9
MP-29D	35.35	57.5	6.8	5.7	6.0
MP-29D	39.35	60.1	4.0	7.8	2.8

NOTES:

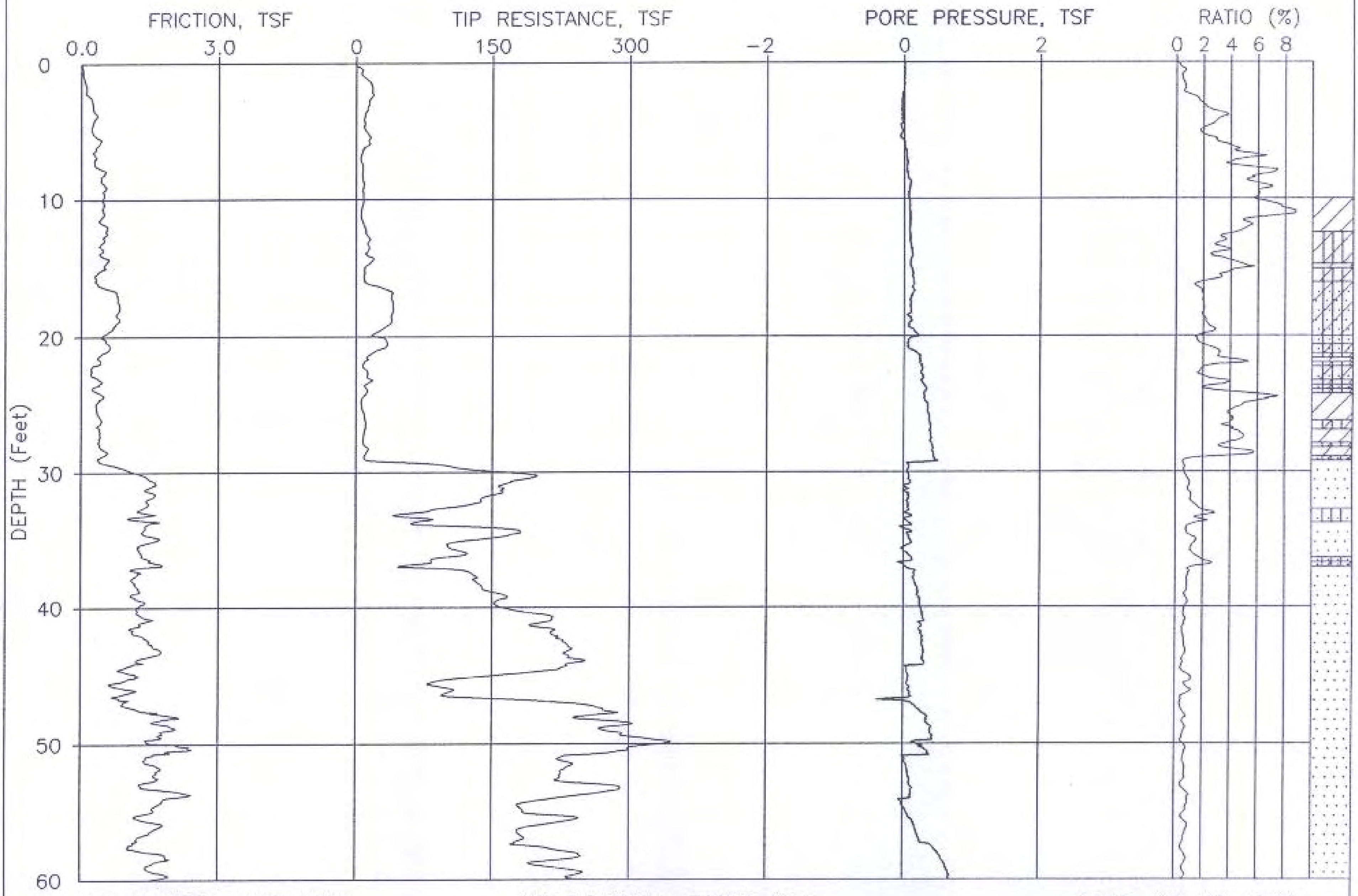
Soi = Initial NAPL Saturation as received prior to centrifuging at 1000xG, Swi = Initial Water Saturation

Sor = Residual NAPL Saturation after centrifuging at 1000xG, Srw = Residual Water Saturation after ce

Fluid Densities for pore fluid saturation calculations: Water =0.9996 g/cc, LNAPL = 0.7500 g/cc.

ENCLOSURE 5

SELECT ROST PROFILES AND CONE PENETROMETER LOGS ADJACENT TO THE RIVER PIPELINE CORRIDOR, ELM STREET, VILLAGE OF HARTFORD, ILLINOIS



JOB NUMBER: 0305-1583

ELEVATION: 0.00

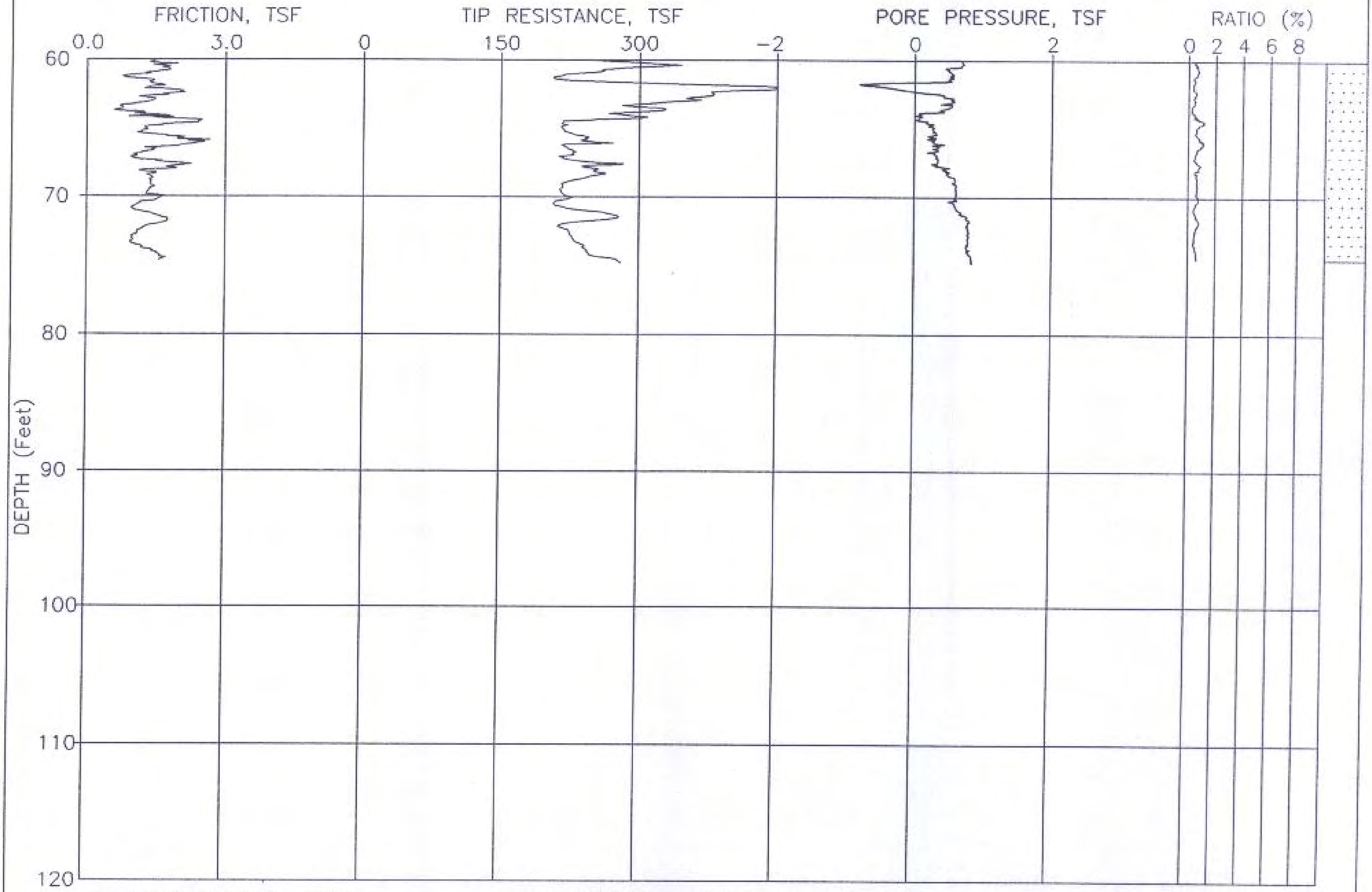
CPT NUMBER: HROST-114

CONE NUMBER: F7.5CKEW1346

DATE: 06-20-2005

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0305-1583

ELEVATION: 0.00

CPT NUMBER: HROST-114

CONE NUMBER: F7.5CKEW1346

DATE: 06-20-2005

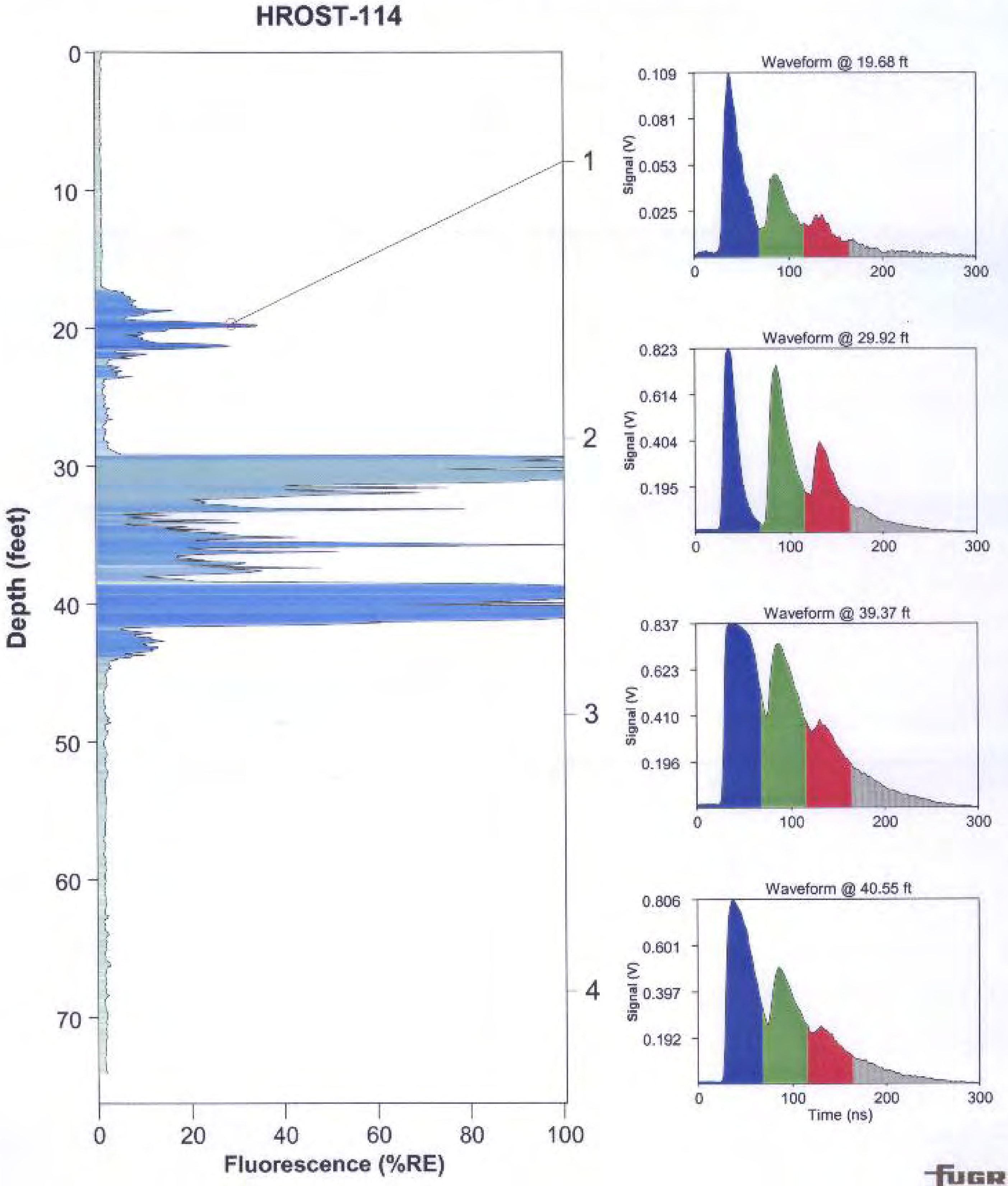
PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

ROST Fluorescence Response Data

Site: HARTFORD WORKING GROUP
Client: CLAYTON
Date/Time: 6/20/2005 @ 3:32:14 PM
ROST Unit: III

Operator: Robert Biehle
Fugro Job #: 0305-1583
Max fluorescence: 486.02% @ 39.37 ft
Final depth BGS: 74.08 ft

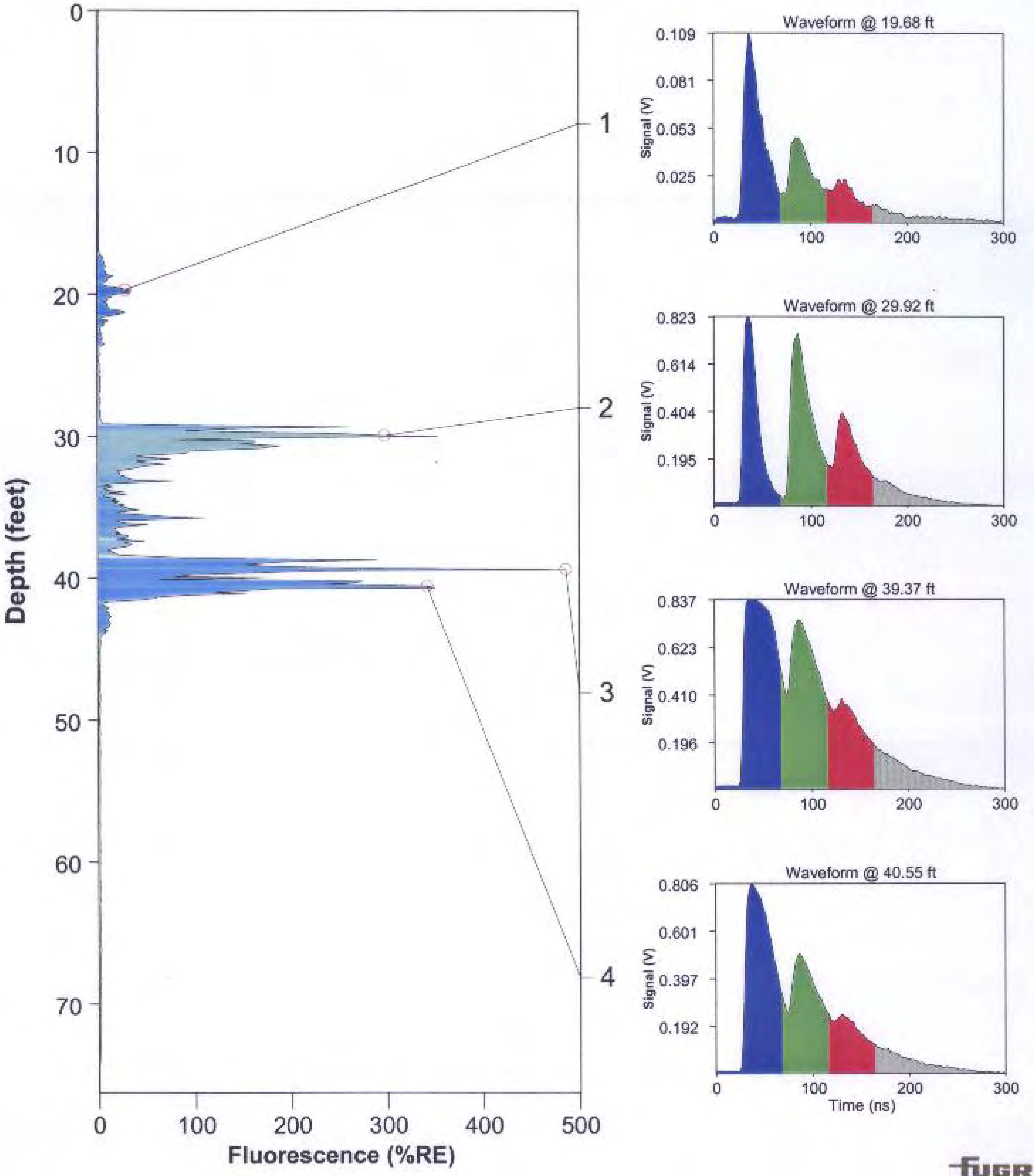


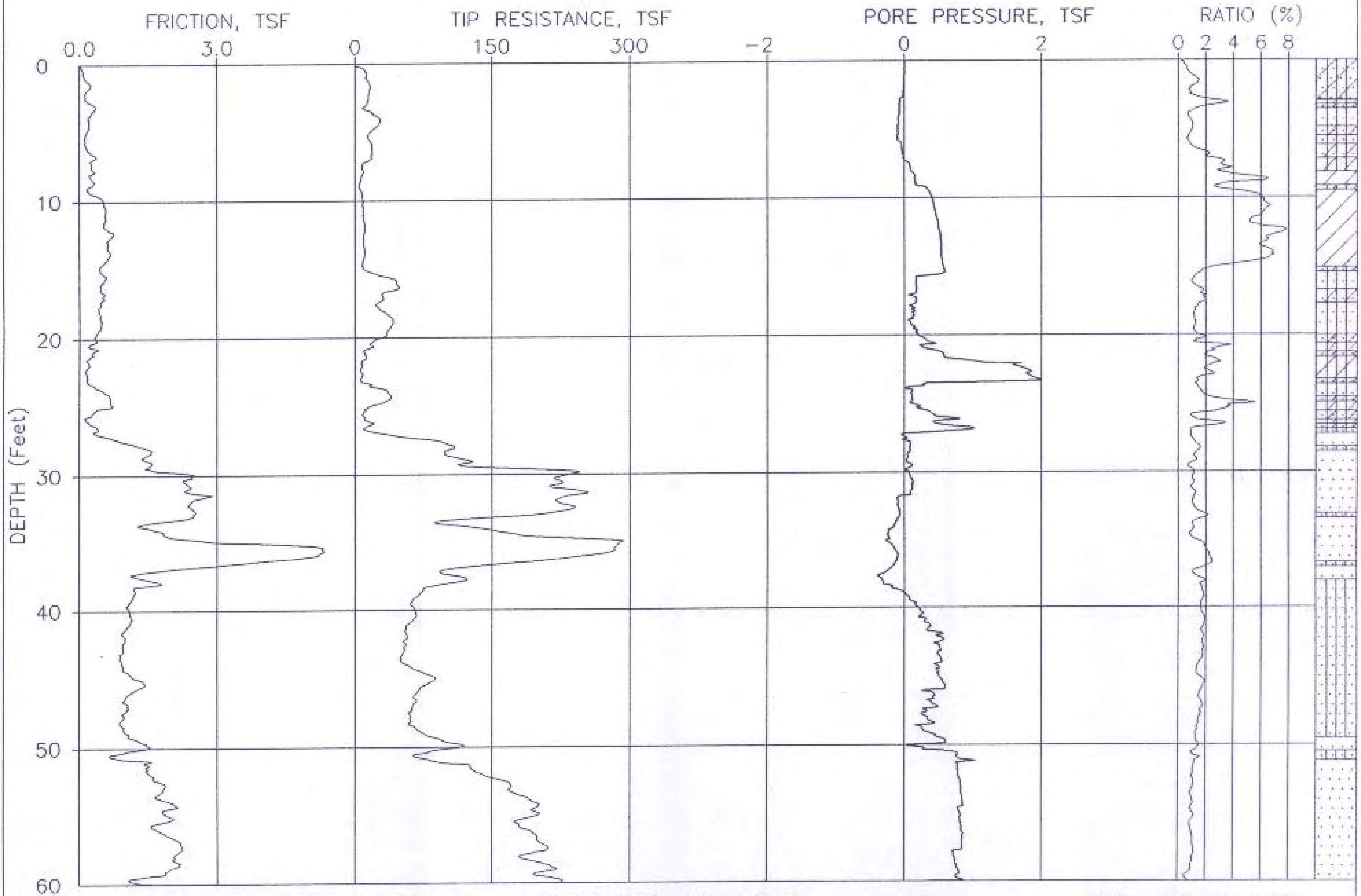
ROST Fluorescence Response Data

Site: HARTFORD WORKING GROUP
Client: CLAYTON
Date/Time: 6/20/2005 @ 3:32:14 PM
ROST Unit: III

Operator: Robert Biehle
Fugro Job #: 0305-1583
Max fluorescence: 486.02% @ 39.37 ft
Final depth BGS: 74.08 ft

HROST-114





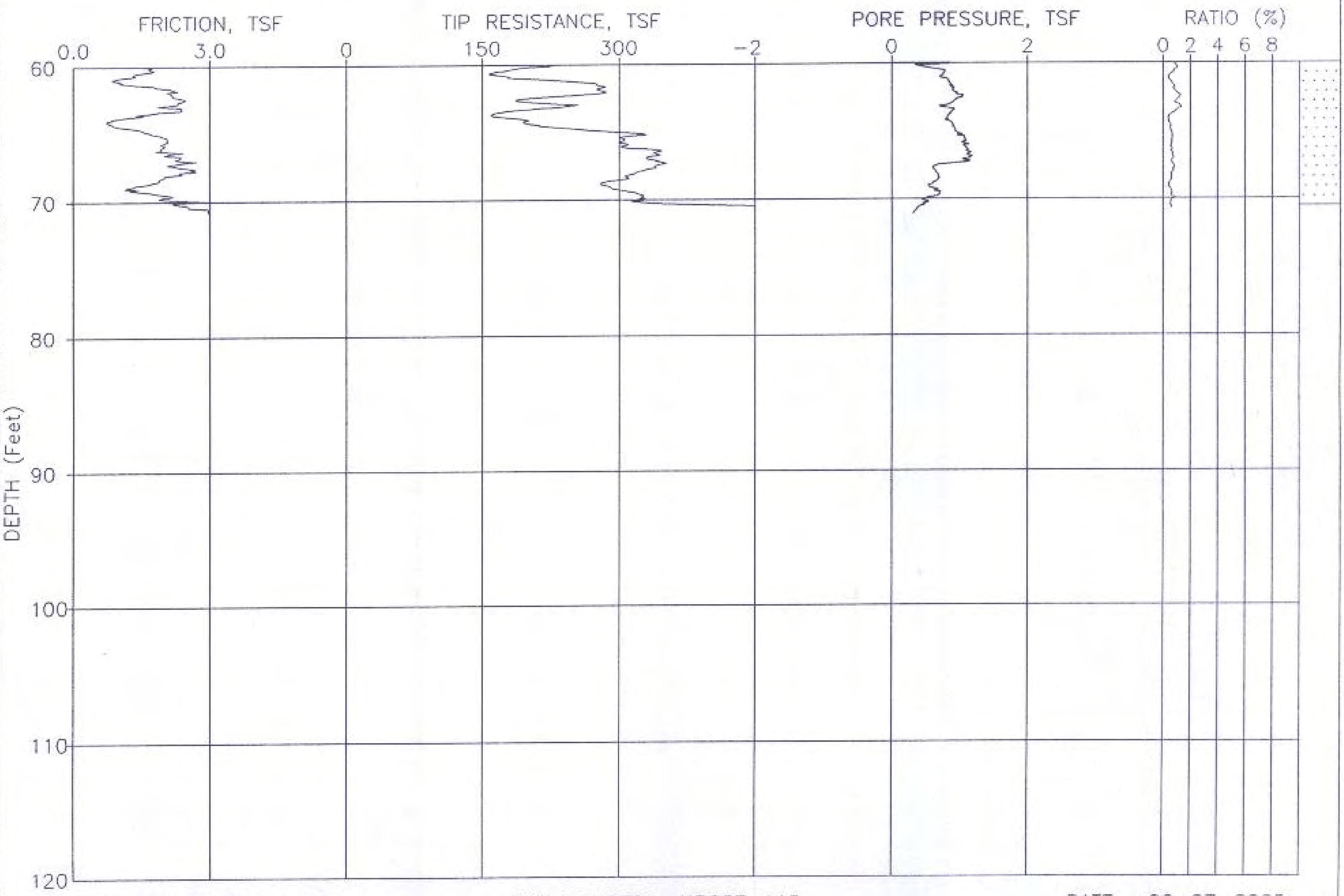
JOB NUMBER: 0305-1583
ELEVATION: 0.00

CPT NUMBER: HROST-115
CONE NUMBER: F7.5CKEW1346

DATE: 06-27-2005

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0305-1583
ELEVATION: 0.00

CPT NUMBER: HROST-115
CONE NUMBER: F7.5CKEW1346

DATE: 06-27-2005

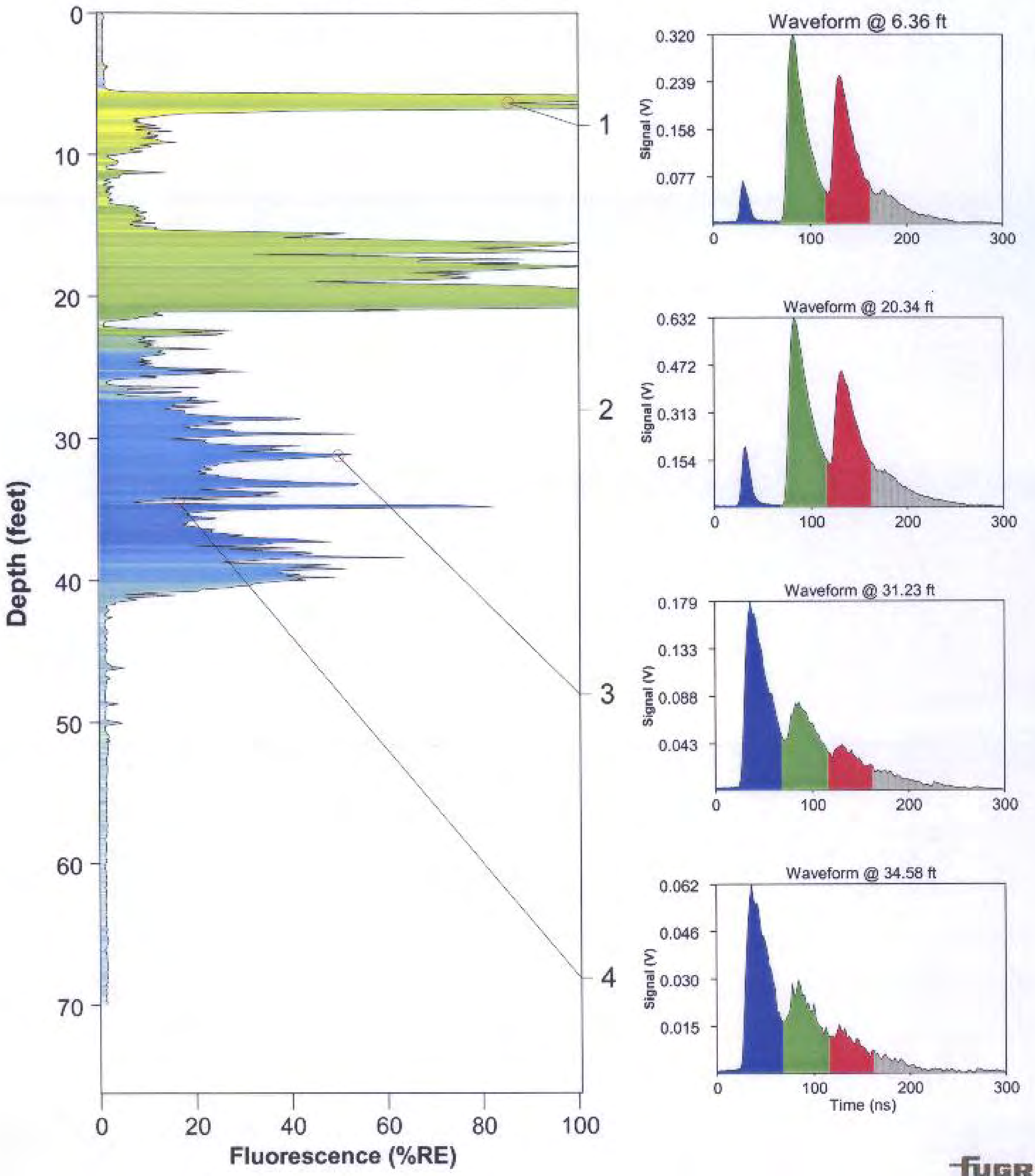
PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

ROST Fluorescence Response Data

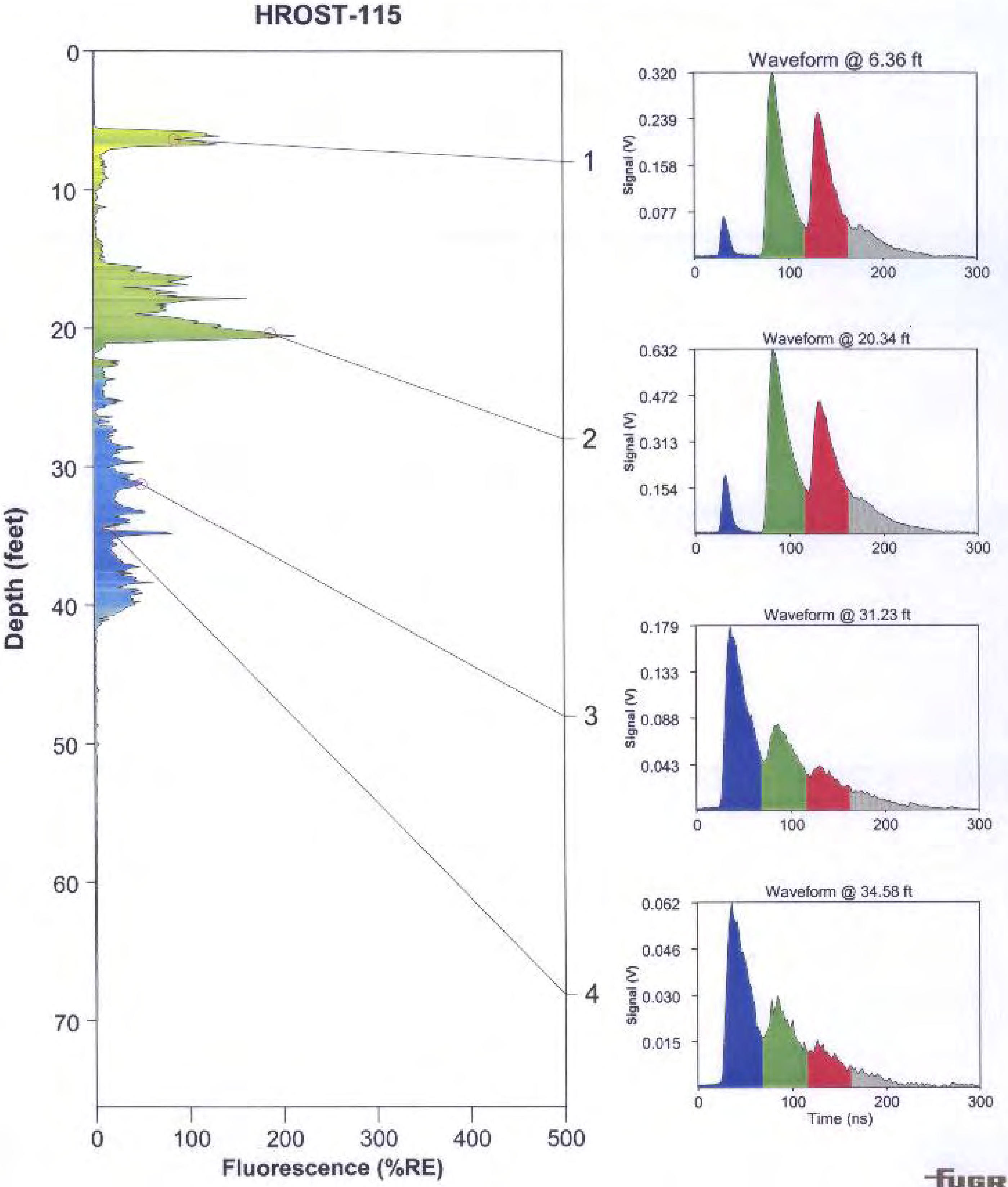
Site: HARTFORD WORKING GROUP	Operator: Robert Biehle
Client: CLAYTON	Fugro Job #: 0305-1583
Date/Time: 6/27/2005 @ 4:32:48 PM	Max fluorescence: 214.11% @ 20.53 ft
ROST Unit: III	Final depth BGS: 70.01 ft

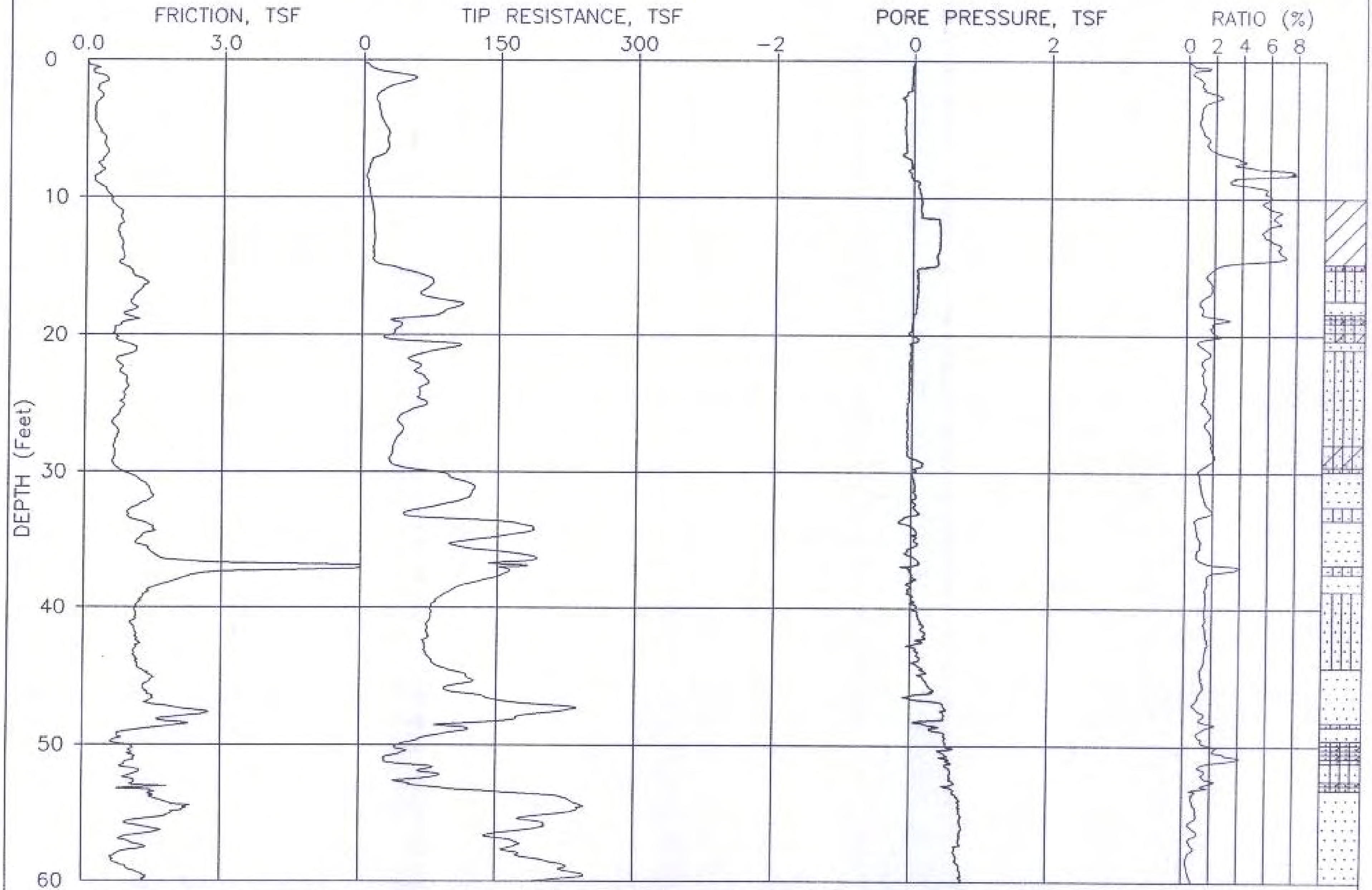
HROST-115



ROST Fluorescence Response Data

Site: HARTFORD WORKING GROUP	Operator: Robert Biehle
Client: CLAYTON	Fugro Job #: 0305-1583
Date/Time: 6/27/2005 @ 4:32:48 PM	Max fluorescence: 214.11% @ 20.53 ft
ROST Unit: III	Final depth BGS: 70.01 ft





JOB NUMBER: 0305-1583

ELEVATION: 0.00

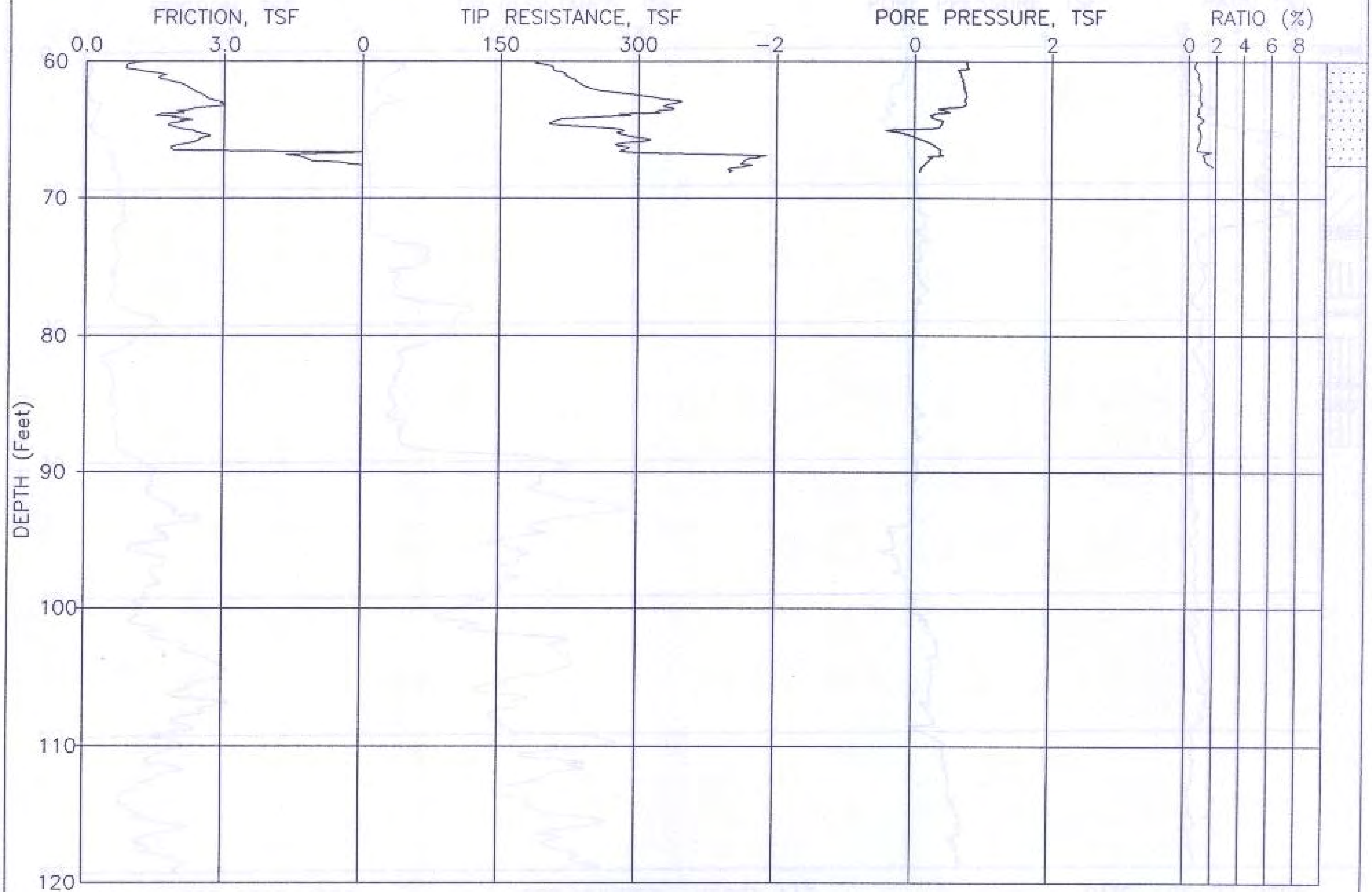
CPT NUMBER: HROST-116

CONE NUMBER: F7.5CKEW1346

DATE: 06-20-2005

PLATE: 1 OF 2

FUGRO GEOSCIENCES,INC



JOB NUMBER: 0305-1583

ELEVATION: 0.00

CPT NUMBER: HROST-116

CONE NUMBER: F7.5CKEW1346

DATE: 06-20-2005

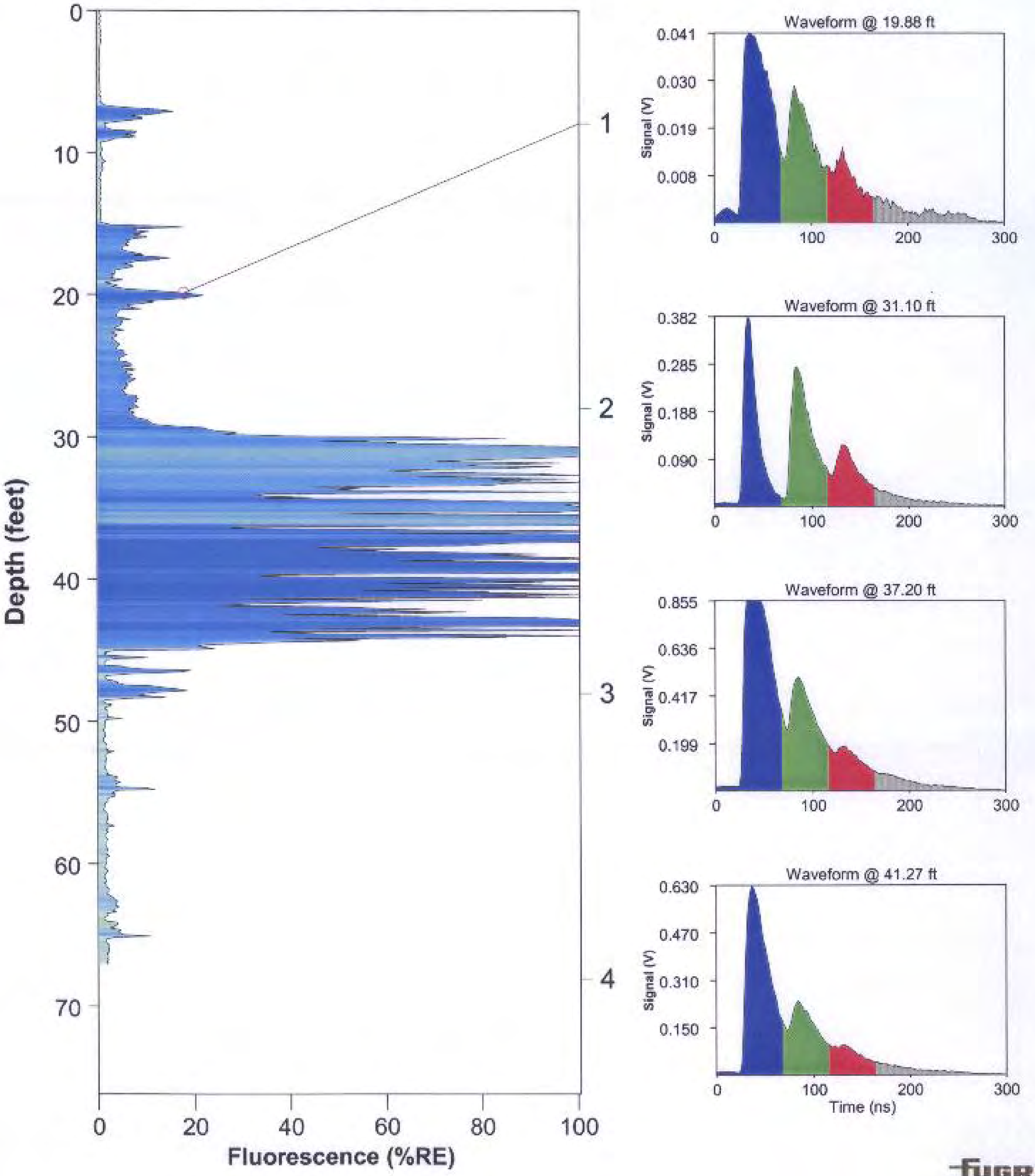
PLATE: 2 OF 2

FUGRO GEOSCIENCES,INC

ROST Fluorescence Response Data

Site: HARTFORD WORKING GROUP	Operator: Robert Biehle
Client: CLAYTON	Fugro Job #: 0305-1583
Date/Time: 6/20/2005 @ 4:45:34 PM	Max fluorescence: 367.59% @ 37.20 ft
ROST Unit: III	Final depth BGS: 67.06 ft

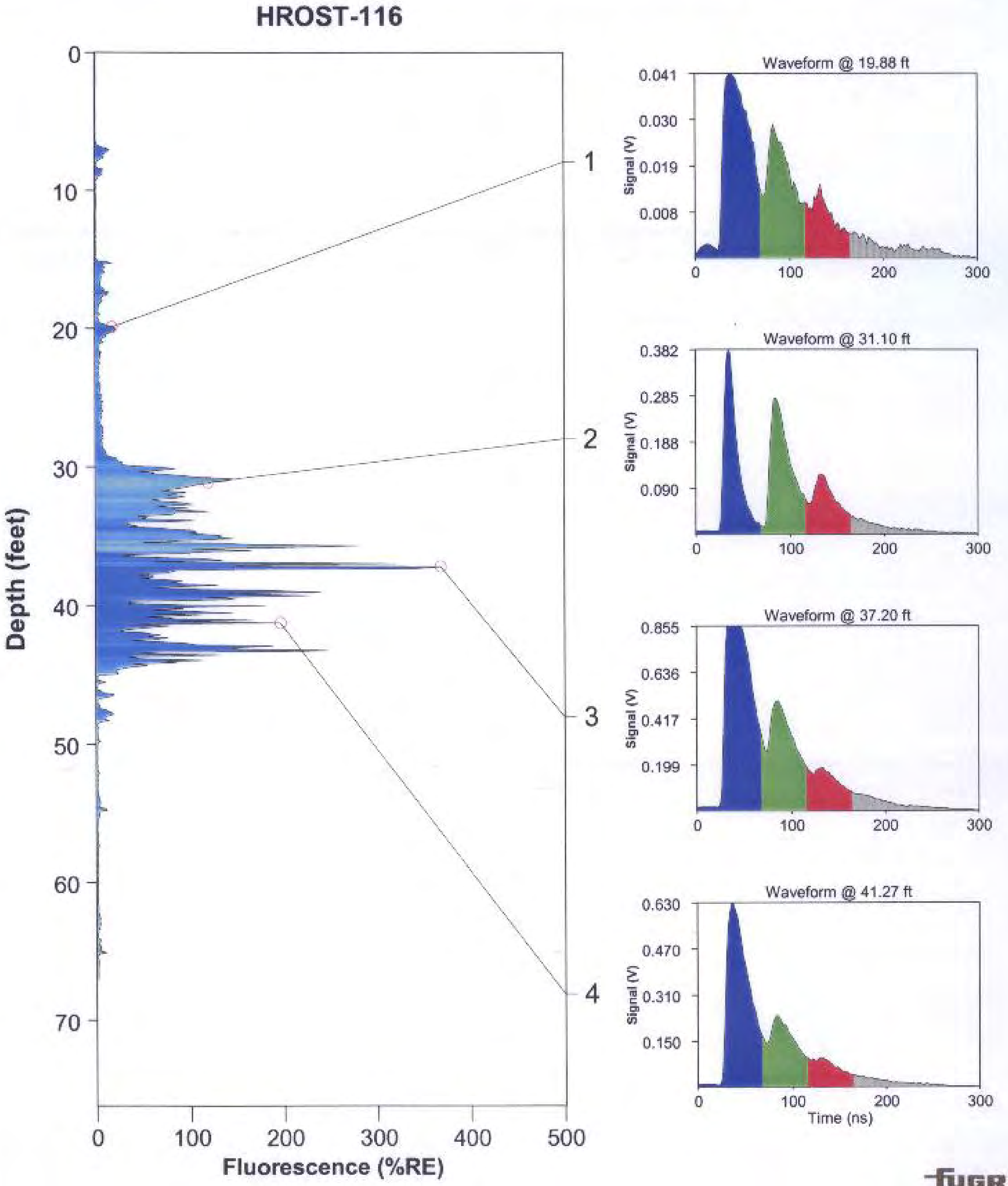
HROST-116



ROST Fluorescence Response Data

Site: HARTFORD WORKING GROUP
Client: CLAYTON
Date/Time: 6/20/2005 @ 4:45:34 PM
ROST Unit: III

Operator: Robert Biehle
Fugro Job #: 0305-1583
Max fluorescence: 367.59% @ 37.20 ft
Final depth BGS: 67.06 ft



ENCLOSURE 6

PASSIVE SOIL GAS EVALUATION TECHNICAL MEMORANDUMS

AREA 1 PASSIVE SAMPLER TECHNICAL MEMORANDUM

Technical Memorandum

To:	The Hartford Working Group	**Date:**	April 27, 2005
From:	Patrick Haskell Daniel Groher	**File:**	01005-093-351
RE:	Hartford Area Hydrocarbon Plume Site - Area 1 - HCC Passive Soil Vapor Sample Results	**CC:**	D. Schumacher/ENSR R. Feeney/ENSR J. Petruccione/ENSR R. Schilling/ENSR

ENSR has reviewed the passive soil gas data collected in Area 1 in the vicinity of the Hartford Community Center (HCC). The data in this review includes the results from paired Emflux® and Gore-Sorber® samplers installed in Area 1 in February 2005 and the soil vapor samples collected from vapor monitoring points in January 2005. These data were reviewed with the following objectives:

1. to evaluate the effectiveness of the passive samplers as a screening tool to identify locations that would be appropriate for the installation of permanent vapor monitoring points (e.g., where vapor plumes are present at shallow depths);
2. to evaluate the results from co-located passive samplers to compare the performance of the two types of samplers; and
3. to compare the passive sampler data with samples collected from nearby active soil gas sampling stations.

Figure 1 shows selected passive soil gas sample locations, along with nearby shallow vapor monitoring point (VMP) sample locations. Observations and recommendations regarding these data as they relate to the above-listed objectives follow.

Discussion of Passive Soil Vapor Sampling Methodology

Both Gore-Sorber® and Emflux® samplers rely on passive sorption of hydrocarbons from soil vapor into the sampler medium to assess the relative presence of hydrocarbon vapors in the subsurface. This sampling mechanism requires that the soil vapor be in direct contact with the sampler. Such soil vapors can come into contact with the sampler via either diffusion or advective transport.

The passive samplers have been used at the site to assess the relative presence of hydrocarbon vapors in the very shallow overburden, which consists of a low-permeability silty clay. The primary transport mechanism through this silty clay is understood to be advective vapor transport through secondary porosity (i.e., higher-permeability seams, fractures and utility conduits). While diffusion of vapors occurs at the site, the mass of hydrocarbon vapors transported by vapor diffusion is orders of magnitude less than that which can be moved by advective transport. For example, it is not conceivable that flammable concentrations of hydrocarbon vapors could be transported through the subsurface from a distant source via diffusion.

Because vapor transport in the silty clay is controlled by secondary porosity features, passive samplers are at a disadvantage relative to active samplers, which have the potential to pull vapors from nearby secondary features, whereas passive samplers merely respond to the relatively immobile mass of vapors that have slowly diffused through the impermeable soil immediately surrounding the sampler. Despite this limitation, passive samplers have the potential to serve as a screening method for investigating hydrocarbon vapors, and it is this potential which is being evaluated herein.

Comparison of Emflux® and Gore-Sorber® Samples

The results of the Area 1 passive vapor sampler study indicate that the Emflux® sampler exhibited higher sensitivity to subsurface hydrocarbons than did the Gore-Sorber® sampler (i.e., the Emflux® results indicated a greater frequency of analyte detection and typically had higher numerical results). This contrasts with the findings in the Area 2 study. However, the Emflux® samplers used in the Area 1 study used a different sorbent from the prior study. The absorbent material (i.e., carbon molecular sieve) was modified in Area 1 to include both the 75 meter squared/gram (used in Area 2) and the addition of 485 meter squared/gram in order to increase the trapping properties of the sampler for lighter end petroleum hydrocarbons (e.g., benzene). This adjustment to the Emflux samplers resulted in an increased dynamic range for mass values of the contaminants of concern versus those mass values obtained in Area 2. The Area 2 results, however limited due to less "sensitive" adsorbent media used, do indicate that heavier end petroleum hydrocarbons do not appear to be present versus the lighter end constituents where the passive Emflux sampling was performed.

Figures 2 and 3 depict interpreted contours of the Emflux® and Gore-Sorber® results, respectively, for benzene; Figures 4 and 5 depict the same respective results for isopentane; and Figures 6 and 7 depict the same respective results for petroleum hydrocarbons. The contours depicted in these figures were generated by kriging the passive sampler data using the spatial data analysis program Surfer®. Each of these datasets indicates an area of elevated impacts that lies less than 100 ft. from the northwest corner of the HCC.

While the extents of the benzene and isopentane plumes inferred from the two types of samplers are somewhat similar, the numerical results of the two samplers do not appear to correlate well. Figures 8, 9 and 10 are graphs depicting the correlation of the isopentane, petroleum hydrocarbon (total petroleum hydrocarbon [Gore-Sorber®] and total aliphatic hydrocarbon [Emflux®]) and benzene values from the two types of passive samplers[1]. The figures present correlation coefficients for linear, logarithmic and exponential fits of the data. The graphs and calculated correlation coefficients indicate that data are generally not well correlated between the two passive samplers, although the correlation for benzene is somewhat better than those for isopentane and TPH.

Comparison of Passive Sample Data and Soil Field Screening Data

Figures 11 and 12 depict the results of flame ionization detector (FID) and photoionization detector (PID) field screening for soil samples collected from the passive sampler soil borings at the depth at which the samplers were installed. The contours depicted in these figures were generated by kriging the soil headspace screening data for the passive sampler boring locations using the spatial data analysis program Surfer®. While the general areas of impacts are similar, there are differences in the patterns of impacts indicated by the soil screening results and the passive sampler results. In particular, there are elevated FID responses at locations where petroleum hydrocarbons and isopentane are not indicated by the passive vapor sampler results (e.g., north of Rand Avenue). The discrepancy could be due to the presence of methane or other hydrocarbon not quantitated by passive sampler analysis, but to which the FID responds.

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[1] The correlations were performed only for results that indicated a detection of an analyte. Non-detect results are not depicted on the figures.

Figures 13 through 16 compare FID and PID screening results with passive sampler petroleum hydrocarbon and benzene results, respectively. While FID soil screening and passive sampler petroleum hydrocarbon results do not correlate well, PID soil screening and passive sampler benzene results do correlate moderately well ($r^2 = 0.72$). This suggests that while analytical differences may exist that cause soil screening and passive soil vapor data to differ, the basic technique of screening soil samples with FID and PID for indications of soil vapor impacts provides a similar level of characterization of soil gas impacts as the passive samplers. In addition, soil screening can be performed more effectively by using a carbon filter in conjunction with the FID to determine how much methane or other light-end non-sorbing hydrocarbons (e.g., ethene) are present that could affect FID screening results.

Comparison of Passive Sample Data and Active Soil Vapor Sample Data

Because none of the passive soil gas sample locations were selected to correlate with specific active soil gas sample locations and because no active soil gas sampling was performed during the passive soil gas sampling period, a strict comparison between passive and active soil gas samples is not possible. However, the interpreted soil vapor concentration contours derived from the results of the various sampling methods can be compared to qualitatively evaluate whether the two sampling methods provide the same characterization of soil gas impacts.

Figures 17 through 19 depict the benzene, isopentane and total petroleum hydrocarbon data from the shallow overburden vapor monitoring points in Area 1 that were sampled in January 2005. The contours depicted in these figures were generated by kriging the soil vapor sampling data for HCC - Area 1 only, using the spatial data analysis program Surfer®. Data from beyond Area 1 were not used in the derivation of these contours, and therefore, extrapolation beyond the sampling locations depicted in the figures may not be representative.

While the results cannot be directly correlated due to differences in sampling times and locations, it is notable that in the area east of the HCC, active soil vapor sampling results indicate an area of elevated benzene vapor concentrations in the shallow overburden at VMP-10. This area of elevated benzene concentrations was not observed in passive sampler results from the nearby sampling location HA-37. This difference between active and passive sampler results suggests that either there is a high degree of temporal variability in vapor concentrations in the shallow subsurface or that the sampling methodology of passive samplers has limitation with respect to accurately representing soil vapor concentrations. Given previous instances of false negative results and the absence of false positive results for passive samplers co-located next to vapor monitoring points in previous the study (Area 2 Passive Soil Vapor Sample Results. Technical Memorandum, ENSR, 2005) this supports the conceptual model that passive samplers at the site are unable to accurately characterize soil vapors in low permeability soils, except those immediately adjacent to the sampler.

Conclusions

1. The results of the passive soil gas samples from Area 1 indicate that the Emflux® samplers are more sensitive for benzene and may potentially be more accurate than the Gore-Sorber® samplers used in the study. This is in contrast to passive sampling in Area 2 and likely indicates that the Emflux® sampler media used in the Area 1 study are more appropriate than those used in the Area 2 study.

2. PID screening results from soil samples collected from the passive sampler locations provide conclusions similar to the passive sampler benzene results, indicating that field headspace screening measurements may be as useful as the passive samplers for selecting locations with elevated vapor concentrations.

3. FID screening results from soil samples collected from the passive sampler locations do not correlate well with passive sampler analytical data. Because methane is a significant component of the soil vapor near

the HCC it is, therefore important to perform carbon filtering of soil screening samples in conjunction with FID screening to evaluate to what extent FID screening data are indicative of methane in the subsurface.

4. The rate of non-detection results was greater for the passive samplers than for soil headspace screening, indicating that FID and PID are more sensitive to lower concentrations of vapors than passive samplers.
5. Passive samplers sometimes indicated an absence of significant hydrocarbon vapors at locations where active vapor sampling detected elevated concentrations, suggesting that the passive sampling techniques are limited in their ability to accurately characterize soil vapor concentrations in the heterogeneous, low-permeability subsurface at the site, due to their reliance on diffusion to transport mass to the sampler location or due to temporal variability in the soil vapor distribution.
6. The characterizations of the extent of soil vapors in the shallow overburden by the two types of passive samplers differ from one another and from the results of vapor monitoring point sampling. Because vapor monitoring point sampling provides a better indication of soil vapor concentrations, the passive samplers should be considered solely as a screening tool similar to soil headspace screening.

Recommendations:

1. Rely on the active sample locations to characterize soil vapor concentrations in the village both spatially and temporally.
2. If indications of potential soil gas impacts are desired in areas not characterized by vapor monitoring points, soil screening via FID (and possibly PID) is sufficient. If such screening indicates the potential for soil gas impacts, a vapor monitoring point can be installed.
3. Only use passive soil gas sampler in locations where the conceptual site model indicates that
    a. the active sampling network is insufficient to understand the vapor concentrations,
    b. soil headspace screening reveals impacts,
    c. soil vapors need to be characterized with respect to specific analytes; AND
    d. installation of vapor monitoring points is impractical.

Even in these cases where passive samplers are utilized, it is important to consider in the evaluation of results that the passive samplers will typically only represent vapors transported by diffusion (in the absence of a local vapor migration pathway) and will not represent temporal fluctuations in soil gas concentrations.

References:

ENSR International, 2005. Hartford Area Hydrocarbon Plume Site - Area 2 Passive Soil Vapor Sample Results. Technical Memorandum to USEPA, dated February 24, 2005.

Table 1
Summary of Gore-Sorber Data
Area 1 - Hartford Community Center
Hartford, Illinois

Location		HA2	HA-4	HA-6	HA-8	HA-10	HA-13	HA-16	HA-19	HA-24	HA-27	HA-29	HA-31	HA-34	HA-37
Approximate depth below grade (ft)		**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Gore-Sorber® Module Installation Date		**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**
Gore-Sorber® Module Retrieval Date		**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**	**2/25/05**
Compound	**MDL**														
Total Petroleum Hydrocarbons	NA	0.79	0.19	2.60	1.57	18.41	0.54	0.87	117.73	1.51	110.33	28.52	0.25	142.17	0.53
BTEX	NA	ND	ND	ND	0.00	5.42	0.00	0.06	6.91	ND	5.06	5.08	0.00	0.20	ND
Benzene	**0.03**	ND	ND	ND	ND	2.82	BDL	0.03	5.92	ND	4.59	4.17	ND	0.10	ND
Toluene	**0.02**	ND	ND	ND	BDL	BDL	ND	ND	0.09	ND	BDL	0.03	BDL	0.05	ND
Ethylbenzene	**0.01**	ND	ND	ND	BDL	1.14	ND	BDL	0.12	ND	0.15	0.20	ND	BDL	ND
m,p-Xylene	**0.01**	ND	ND	ND	BDL	1.23	BDL	0.02	0.74	ND	0.30	0.50	ND	0.02	ND
o-Xylene	**0.01**	ND	ND	ND	ND	0.24	ND	ND	0.05	ND	0.03	0.20	ND	0.02	ND
Undecane, tridecane & pentadecane	NA	0.00	ND	ND	ND	ND	ND	ND	ND	ND	0.04	0.05	ND	0.03	0.00
Undecane	**0.02**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.04	0.05	ND	0.03	ND
Tridecane	**0.01**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND
Pentadecane	**0.02**	BDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	BDL	ND	BDL	BDL
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	ND	ND	ND	0.00	0.67	ND	0.00	0.40	ND	1.64	1.31	ND	0.02	ND
1,2,4-Trimethylbenzene	**0.02**	ND	ND	ND	ND	0.38	ND	ND	0.23	ND	0.45	0.91	ND	BDL	ND
1,3,5-Trimethylbenzene	**0.03**	ND	ND	ND	BDL	0.30	ND	BDL	0.17	ND	1.19	0.40	ND	0.02	ND
Naphthalene and 2-Methylnaphthalene	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	**0.01**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**0.02**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl tertiary-butyl ether	**0.04**	ND	ND	BDL	ND	ND	ND	ND	BDL	ND	0.04	ND	ND	BDL	ND
Octane	**0.02**	ND	ND	ND	ND	BDL	ND	ND	0.08	BDL	0.03	0.03	ND	0.11	ND
Isopentane	**0.02**	ND	ND	1.39	0.56	6.71	0.16	0.17	29.80	0.02	16.64	1.31	ND	5.58	ND

NOTES:
Compound results reported in micrograms (µg) per sorber
MDL - Method Detection Limit
BDL-below detection limit (compound detected below the MDL - cannot quantify with confidence)
ND-non detect
NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

Table 2
Summary of Emflux Data
Hartford Community Center
Area 1 - Hartford, Illinois

Location	**HA-1**	**HA-2**	**HA-3**	**HA-5**	**HA-6**	**HA-7**	**HA-8**	**HA-10**	**HA-13**	**HA-13 D**	**HA-15**	**HA-16**	**HA-19**
Approximate depth below grade (ft)	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**
Emflux Module Installation Date	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**
Emflux Module Retrieval Date	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**
Compound													
Isopentane	**116**	**311**	**165**	**963**	**17,798**	**770**	**678**	**337**	**727**	**1,029**	**179**	**42,678**	**5,748**
Methyl-t-butyl Ether	<20	<20	<20	<20	<20	<20	<20	**21**	<20	<20	<20	<20	<20
Hexane	<20	<20	<20	**41**	**347**	<20	<20	<20	<20	**21**	<20	**678**	<20
Benzene	**57**	**53**	**71**	**22**	**31**	**57**	**118**	**963**	**281**	**289**	**80**	**141**	**5,656**
Toluene	**20**	**24**	**24**	**22**	**28**	**30**	**29**	**41**	**31**	**30**	**32**	**47**	**99**
Octane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Ethylbenzene	<20	<20	<20	<20	<20	<20	<20	**66**	<20	<20	<20	<20	**429**
p & m-Xylene	<20	<20	<20	<20	<20	<20	<20	**58**	<20	**21**	<20	**20**	**641**
o-Xylene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	**28**
1,3,5-Trimethylbenzene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	**29**
1,2,4-Trimethylbenzene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	**53**
Undecane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Naphthalene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Tridecane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-Methylnaphthalene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Pentadecane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Total Aliphatic Hydrocarbons	<1,000	<1,000	<1,000	**8,932**	**19,462**	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	**33,253**	**4,944**

NOTES:

Compound results reported in nanograms (ng) per trap

Table 2
Summary of Emflux Data
Hartford Community Center
Area 1 - Hartford, Illinois

Location	**HA-24**	**HA-27**	**HA-29**	**HA-31**	**HA-31 D**	**HA-34**	**HA-36**	**HA-37**	**Meth Blk**	**Trip-3**	**Trip-4**	**Meth_Blk**
Approximate depth below grade (ft)	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**5**	**NA**	**NA**	**NA**	**NA**
Emflux Module Installation Date	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**2/18/05**	**NA**	**NA**	**NA**	**NA**
Emflux Module Retrieval Date	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**2/21/05**	**NA**	**NA**	**NA**	**NA**
Compound												
Isopentane	**390**	**26,612**	**4,319**	**474**	**373**	**99,732**	**66,732**	**404**	<20	**69**	**39**	<20
Methyl-t-butyl Ether	**28**	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Hexane	<20	**103,335**	**260**	**52**	**28**	**3,387**	**60,270**	**82**	<20	<20	**28**	<20
Benzene	**79**	**58,436**	**651**	**86**	**30**	**80**	**26,016**	**111**	<20	<20	**35**	<20
Toluene	**30**	**2,042**	**67**	**31**	**32**	**196**	**1,058**	**29**	<20	<20	**20**	<20
Octane	<20	**18,801**	<20	**31**	<20	<20	<20	<20	<20	<20	<20	<20
Ethylbenzene	<20	**1,865**	**24**	<20	<20	**21**	<20	<20	<20	<20	<20	<20
p & m-Xylene	<20	**1,616**	**87**	**24**	**25**	**59**	**473**	<20	<20	<20	<20	<20
o-Xylene	<20	**230**	**214**	<20	**20**	**30**	**206**	<20	<20	<20	<20	<20
1,3,5-Trimethylbenzene	<20	**3,320**	**31**	<20	**20**	<20	**3,381**	<20	<20	<20	<20	<20
1,2,4-Trimethylbenzene	<20	**793**	**356**	**26**	**30**	<20	**1,546**	<20	<20	<20	<20	<20
Undecane	<20	**89**	**29**	<20	<20	<20	<20	<20	<20	<20	<20	<20
Naphthalene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Tridecane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
2-Methylnaphthalene	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Pentadecane	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
Total Aliphatic Hydrocarbons	**3,711**	**534,264**	**18,214**	<1,000	<1,000	**141,750**	**310,071**	**1,604**	<1,000	<1,000	<1,000	<1,000

NOTES:

Compound results reported in nanograms (ng) per trap

Table 3
Summary of Soil Headspace Screening Results
Hartford Community Center
Hartford, Illinois

Sample Location	PID (ppmv)	FID (ppmv)
HA-1	1	7
HA-2	2	10
HA-3	1	8
HA-4	1	1000
HA-5	1	4
HA-6	1	14
HA-07	0	0
HA-08	14	2410
HA-10	52	935
HA-13	19	2650
HA-15	0	10
HA-16	24	450
HA-19	72	1890
HA-21	2	8
HA-23	0	1
HA-24	2	956
HA-27	62	2010
HA-29	8	515
HA-31	0	50
HA-34	25	850
HA-36	6	576
HA-37	0	20

NOTES:

All samples collected from 5 to 6 feet below grade, where passive samplers were installed.

ppmv = parts per million by volume

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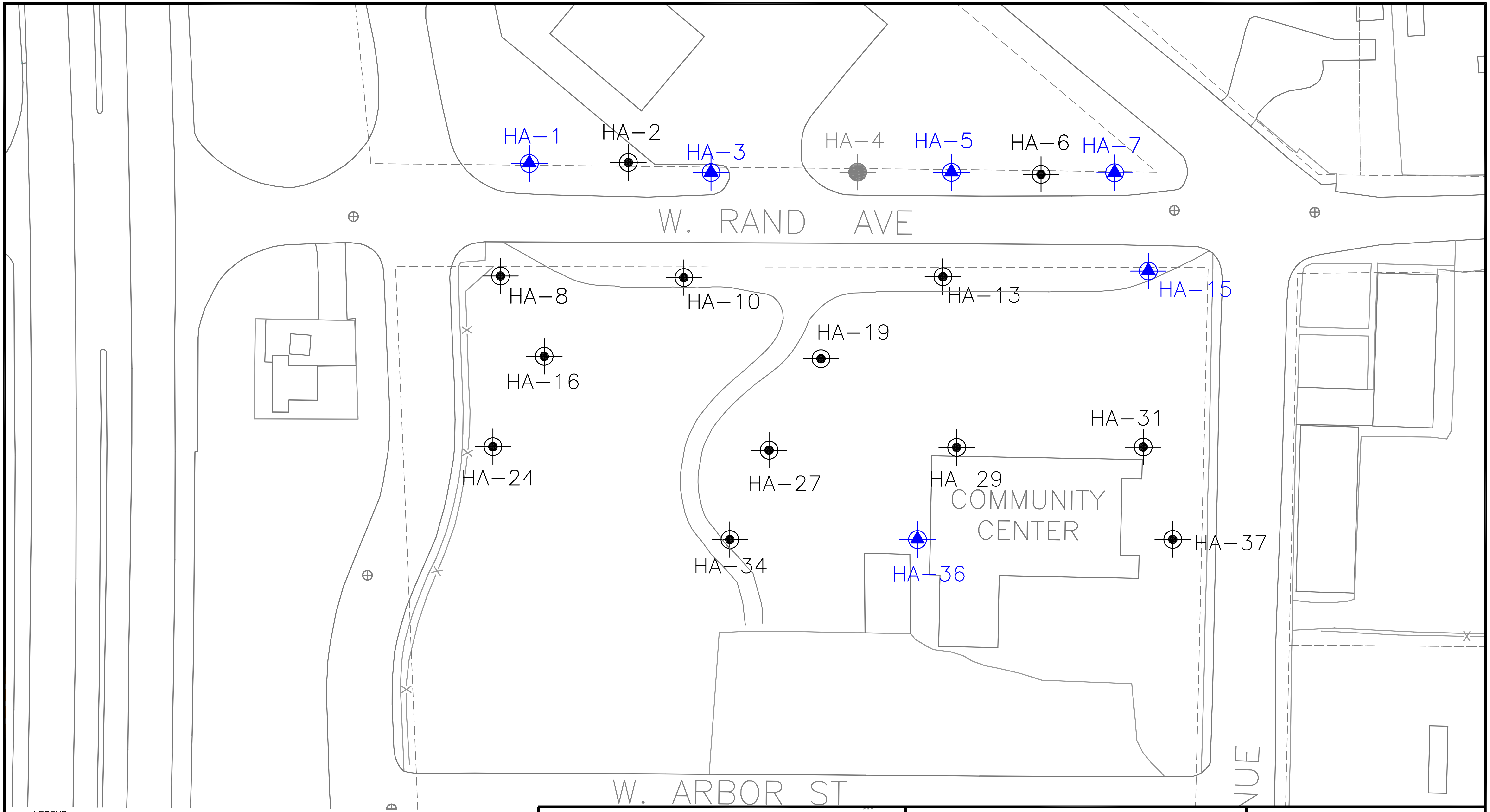


LEGEND:

- HAND AUGER LOCATION (GORE SORBER)
- HAND AUGER LOCATION (EMFLUX)
- HAND AUGER LOCATION (GORE SORBER & EMFLUX)

DRAFT WORK IN PROGRESS

SCALE IN FEET
0 50 100
1" = 50'

N

DRAWN: JG
DATE: 12/13/04
PROJECT
APPROVED: JLP
REVISED: 5/03/05
01005-093

AREA 1 - PASSIVE SOIL VAPOR SAMPLE AND VAPOR MONITORING POINT LOCATIONS HARTFORD, IL

FIGURE 1

ENSR® INTERNATIONAL
CONSULTING • ENGINEERING • REMEDIATION

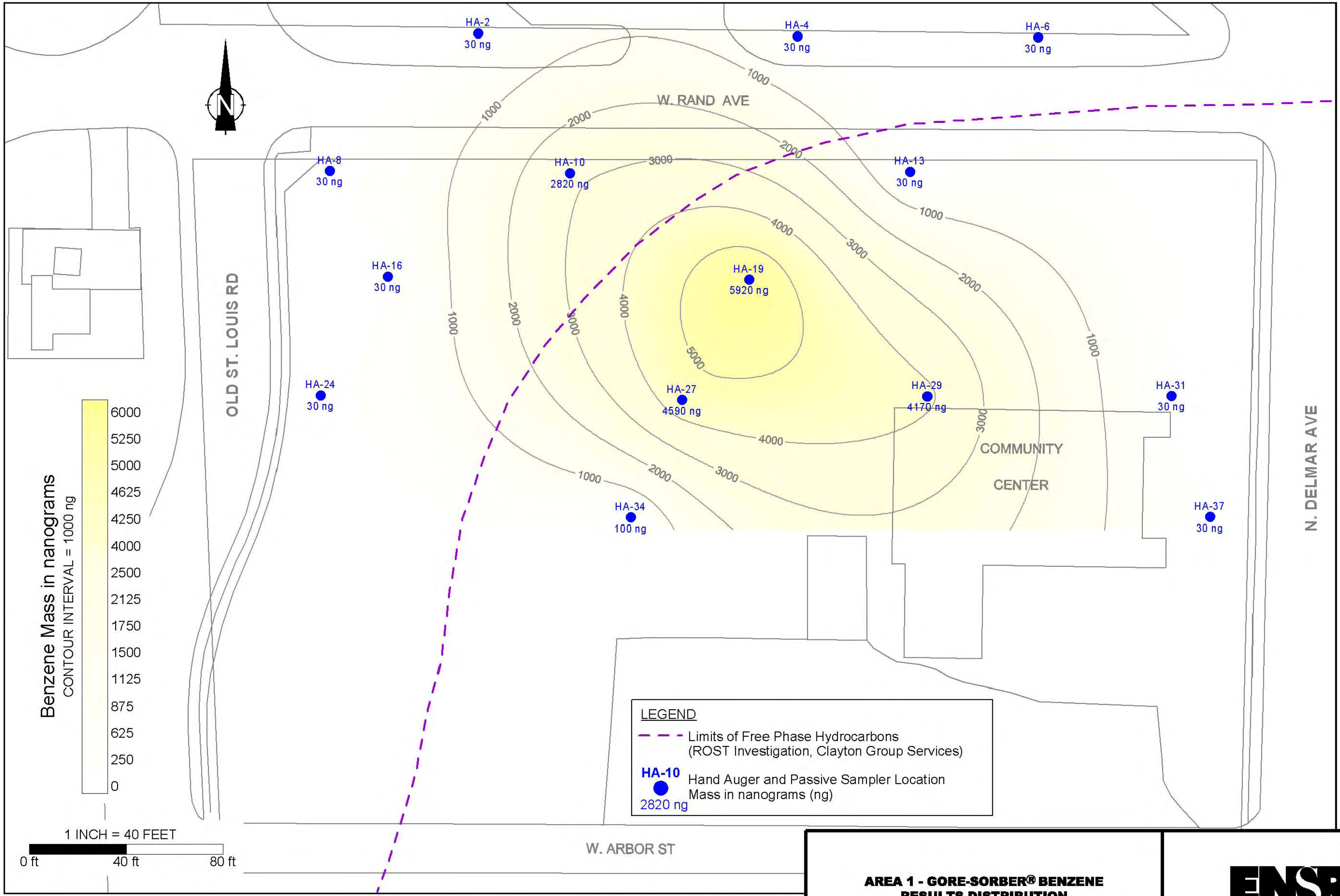


FIGURE 2

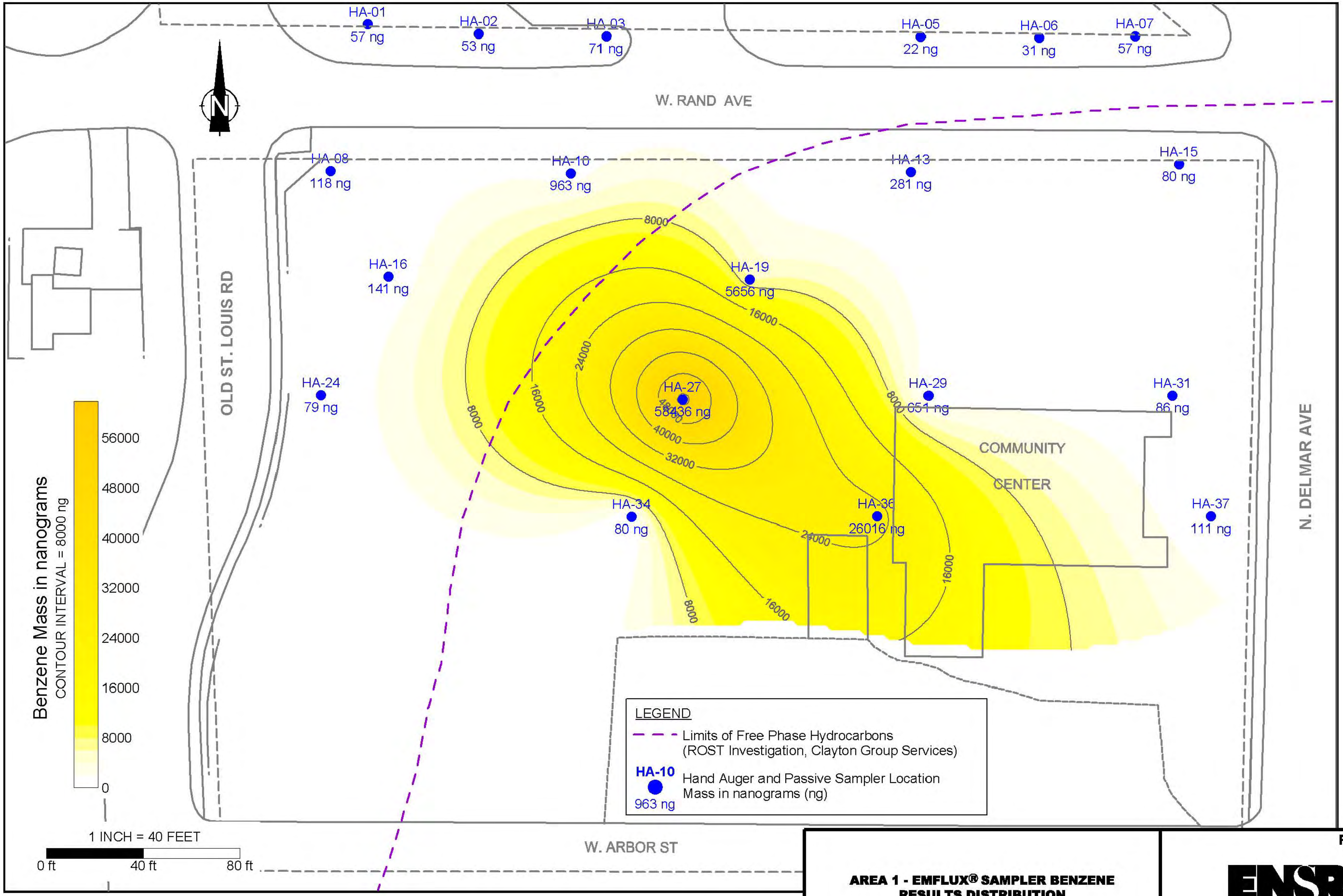
AREA 1 - GORE-SORBER® BENZENE
RESULTS DISTRIBUTION
HARTFORD, ILLINOIS

ENSR® INTERNATIONAL
CONSULTING • ENGINEERING • REMEDIATION

DRAWN: JG	DATE: 5/03/05	PROJECT
APPROVED: JLP	REVISED:	01005-093

U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 2_Gore-Sorber Benzene Results.dwg

U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 3_Emflux Sampler Benzene Results.dwg



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AREA 1 - EMFLUX® SAMPLER BENZENE RESULTS DISTRIBUTION HARTFORD, ILLINOIS

FIGURE 3

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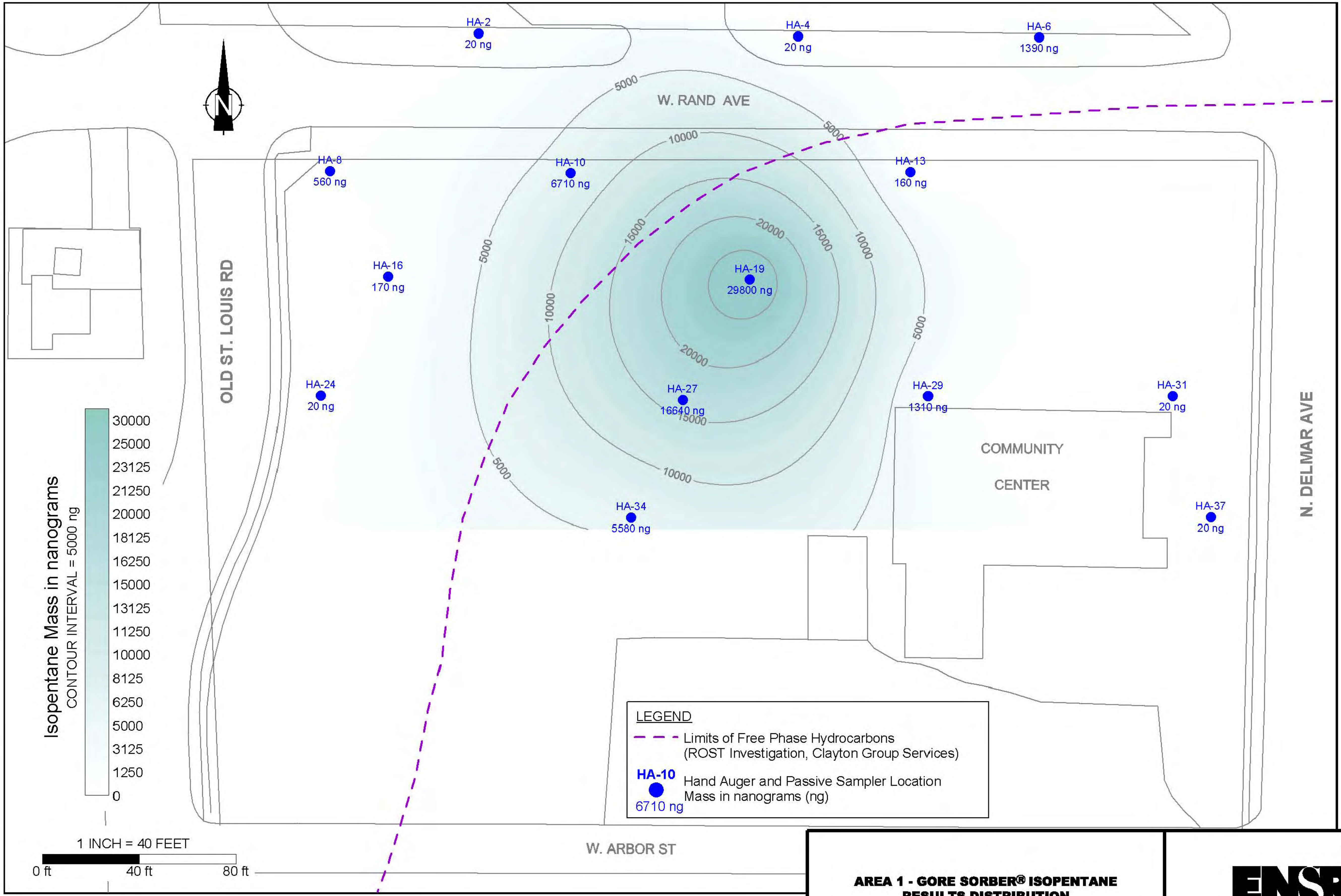

FIGURE 4

AREA 1 - GORE SORBER® ISOPENTANE RESULTS DISTRIBUTION HARTFORD, ILLINOIS

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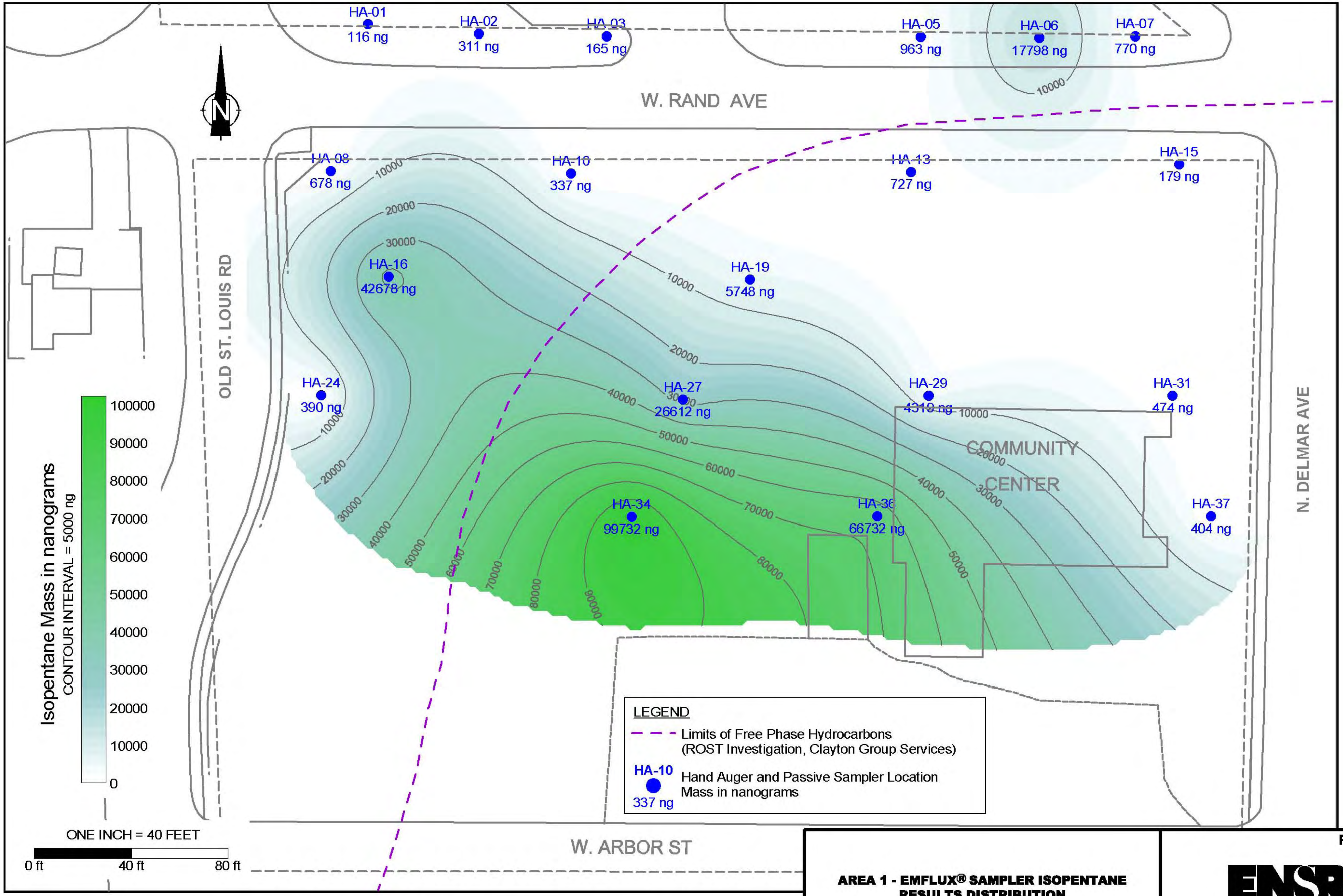

FIGURE 5

AREA 1 - EMFLUX® SAMPLER ISOPENTANE RESULTS DISTRIBUTION
HARTFORD, ILLINOIS

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U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 5_Emflux Sampler Isopentane Results.dwg

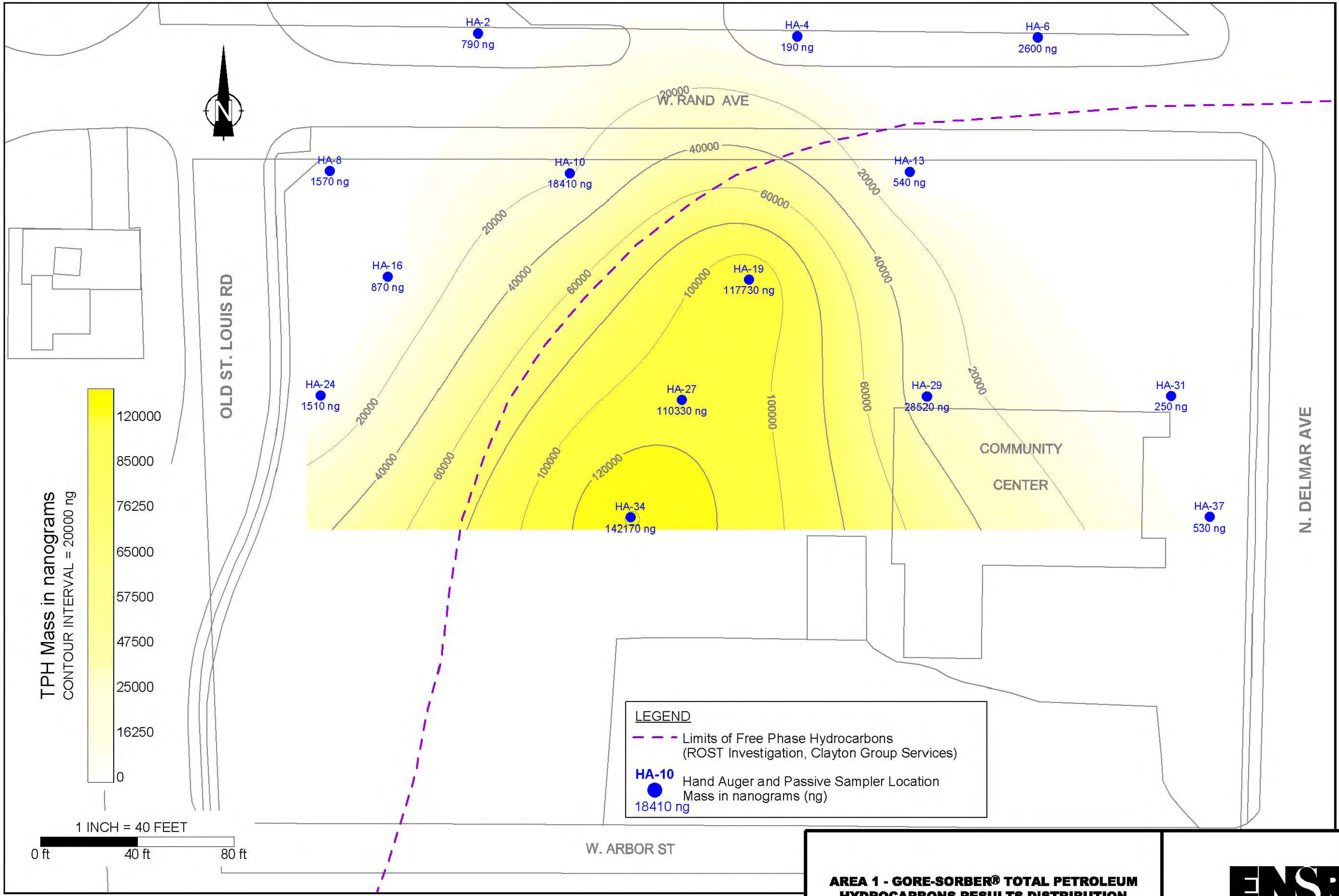

FIGURE 6

AREA 1 - GORE-SORBER® TOTAL PETROLEUM HYDROCARBONS RESULTS DISTRIBUTION
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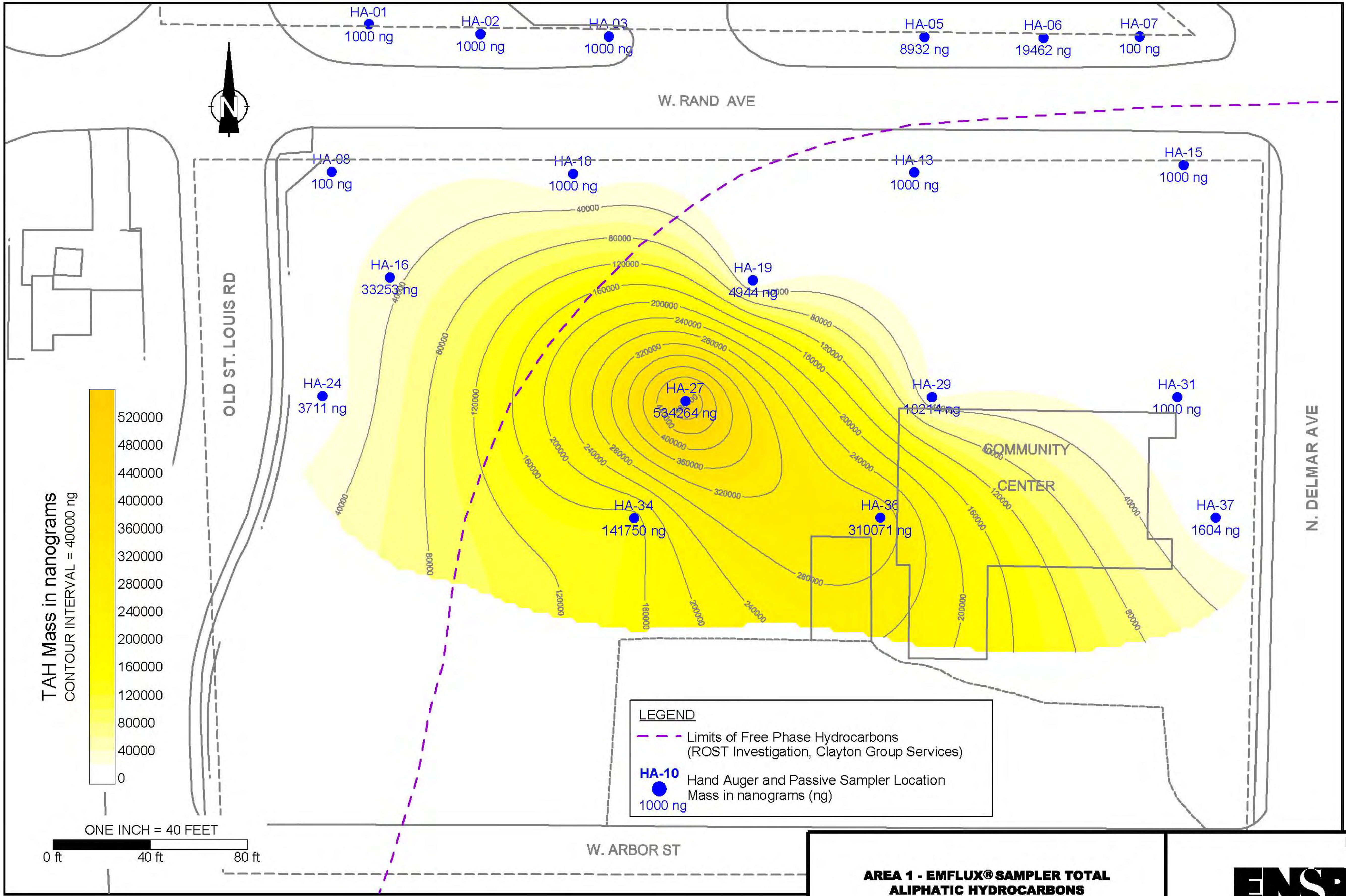
U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 6_Gore-Sorber Total Petroleum Hydrocarbons Results.dwg

U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 7_Emflux Sampler Aliphatic Results.dwg



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AREA 1 - EMFLUX® SAMPLER TOTAL ALIPHATIC HYDROCARBONS RESULTS DISTRIBUTION HARTFORD, ILLINOIS

FIGURE 7

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Figure 8
Comparison of Gore and Emflux Benzene Data
Area 1 - Hartford Community Center
Hartford, IL

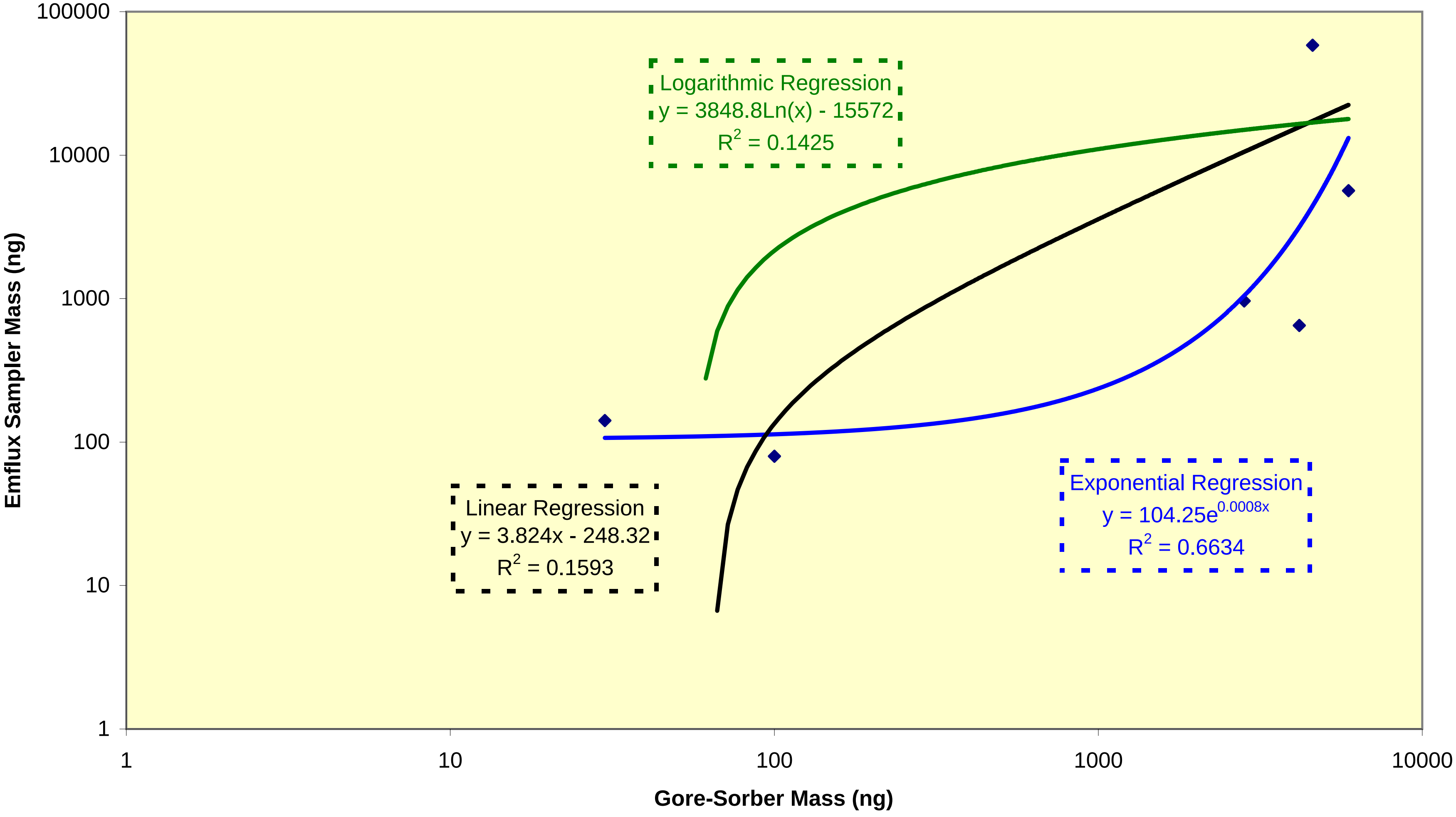


Figure 9
Comparison of Gore and Emflux Isopentane Data
Area 1 - Hartford Community Center
Hartford, IL

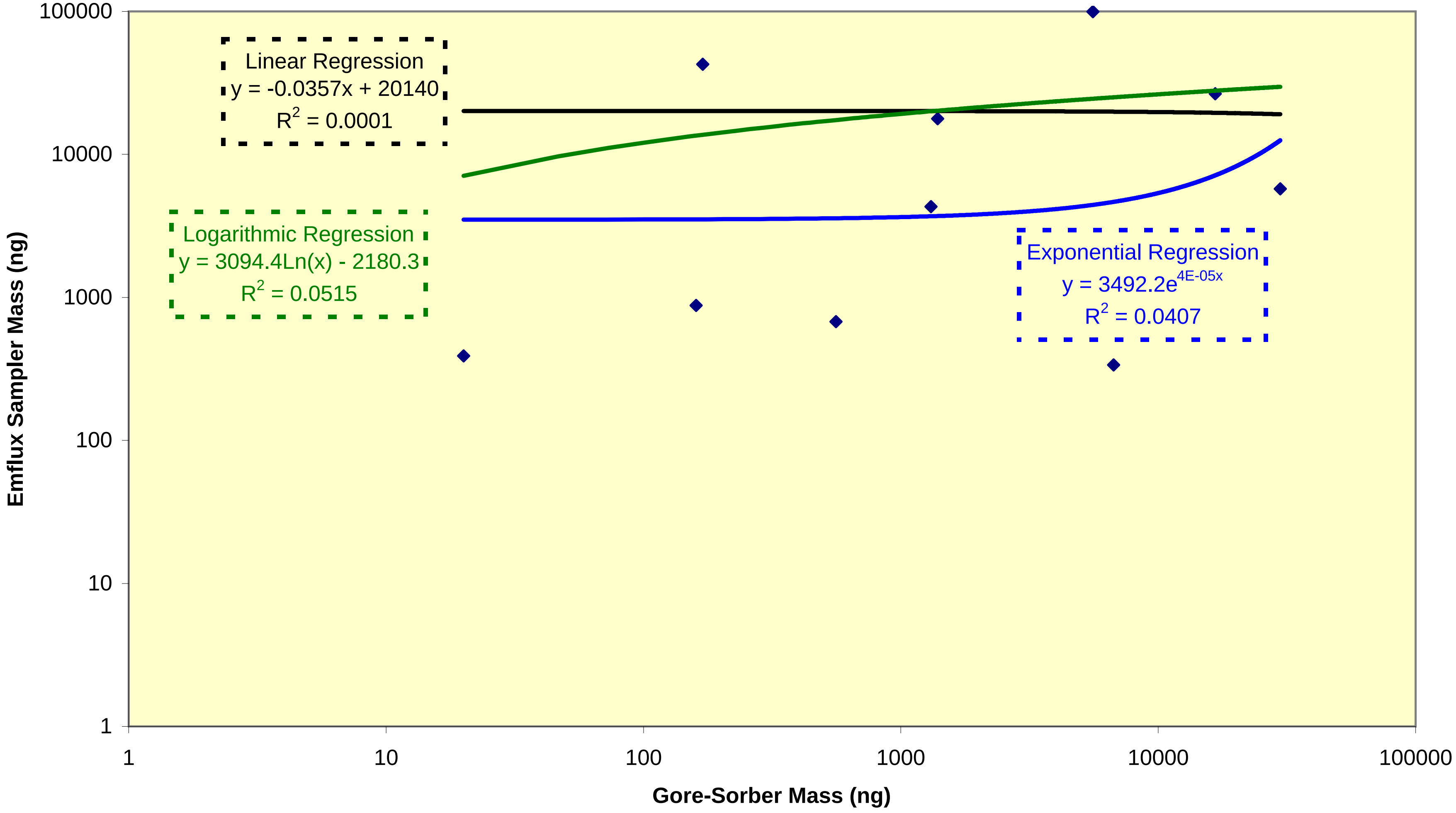
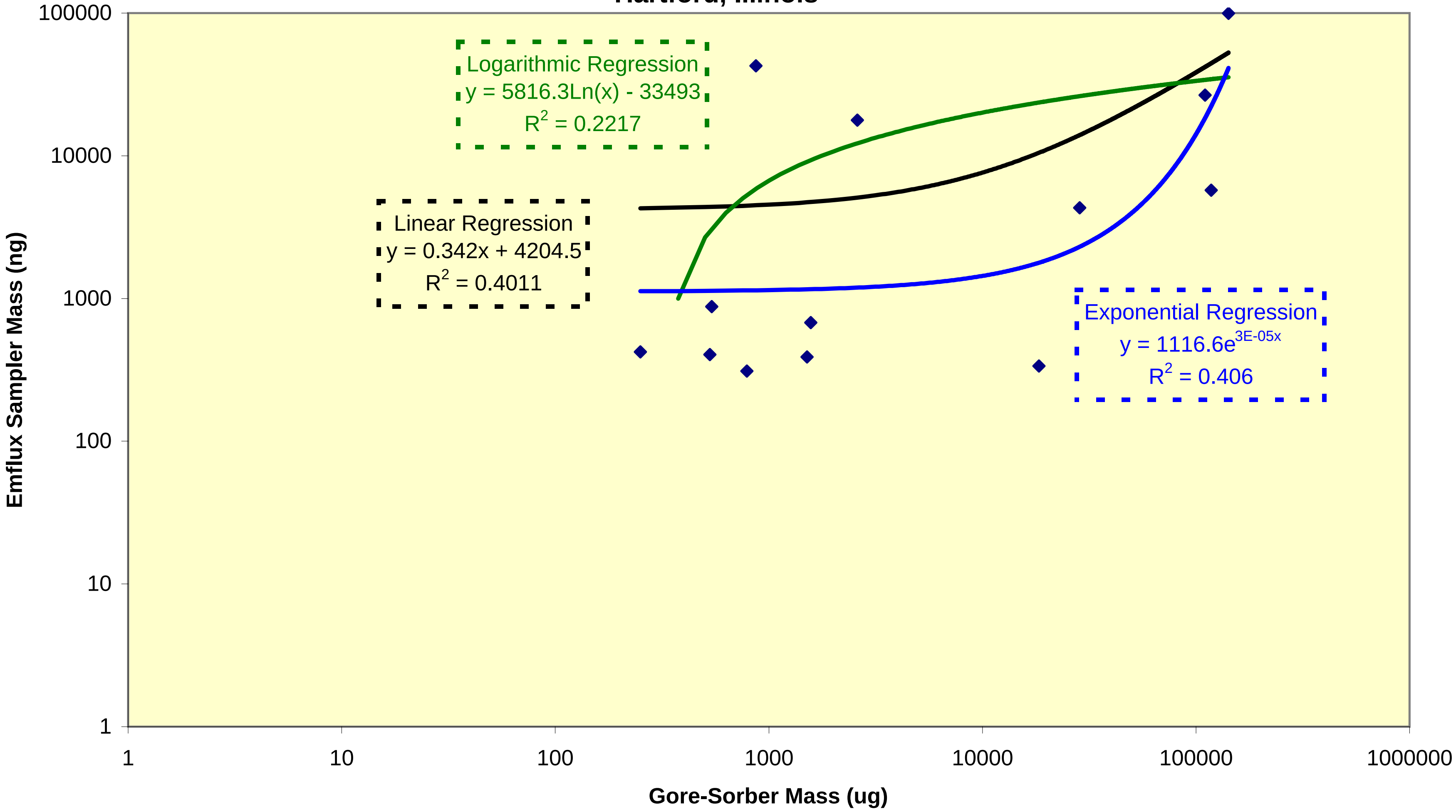
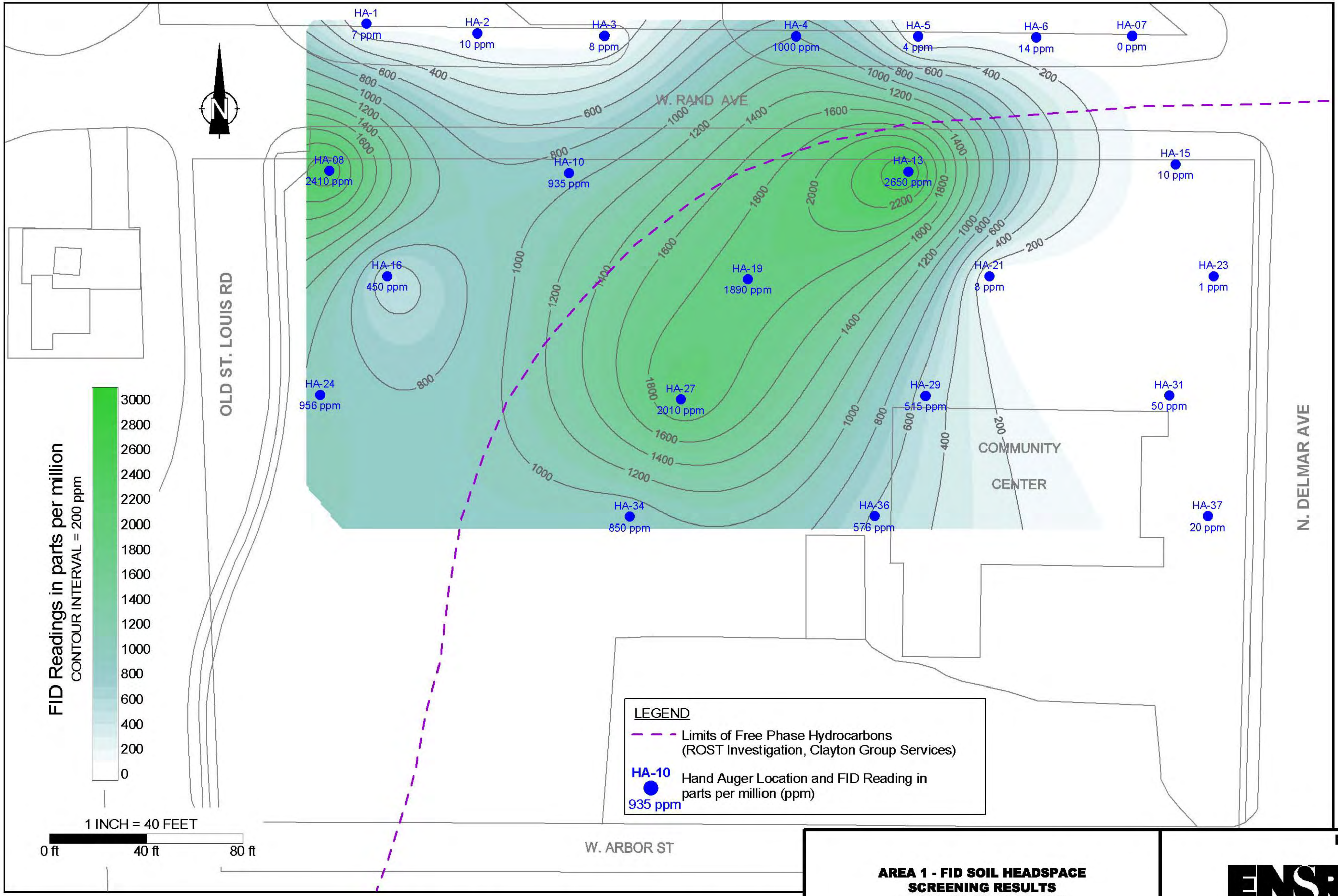


Figure 10
Comparison of Gore and Emflux Petroleum Hydrocarbon Results
Area 1- Hartford Community Center
Hartford, Illinois



U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 11_FID Soil Headspace Screening Results.dwg



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AREA 1 - FID SOIL HEADSPACE SCREENING RESULTS RESULTS DISTRIBUTION HARTFORD, ILLINOIS

FIGURE 11

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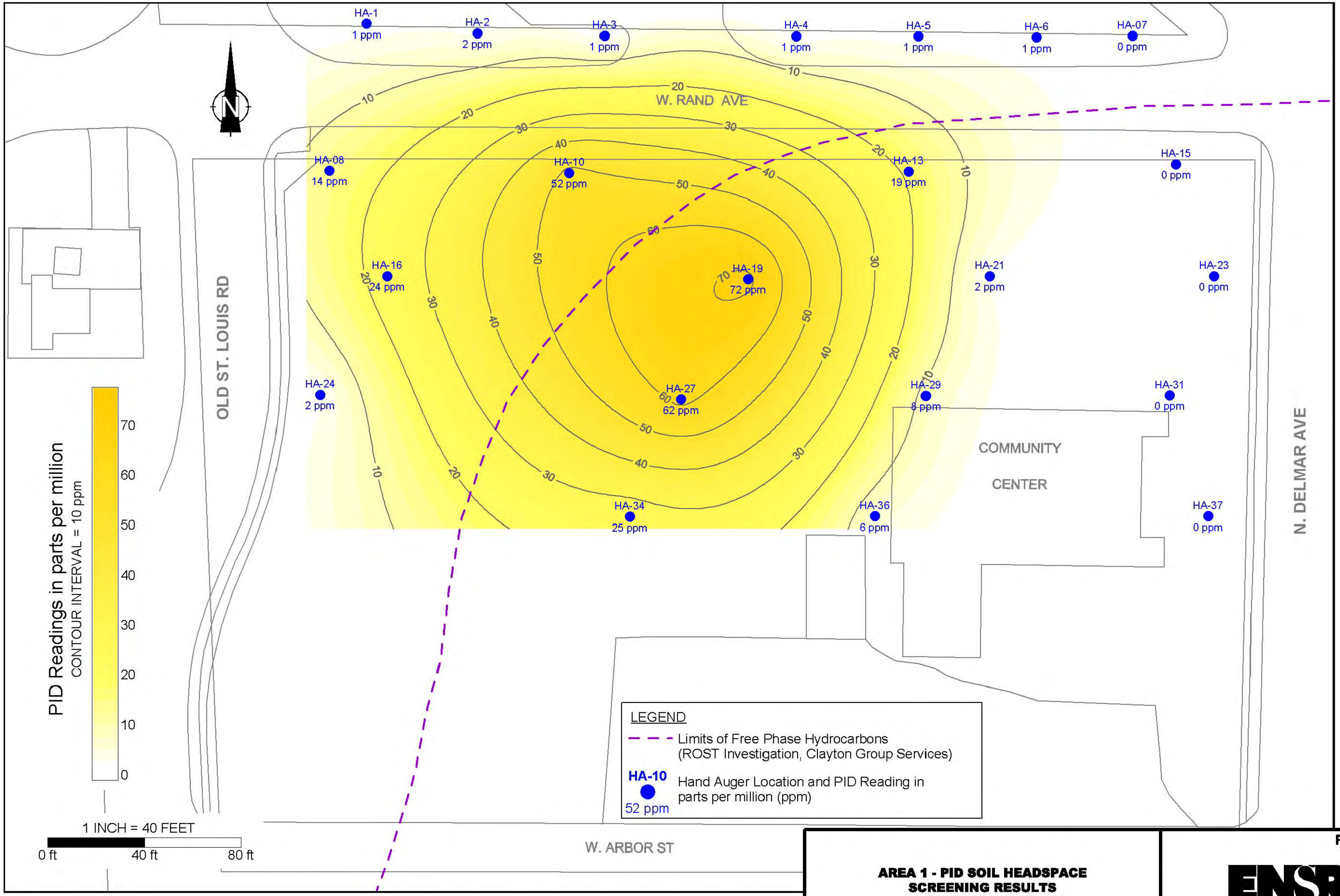
U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 12_PID Soil Headspace Screening Results.dwg



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AREA 1 - PID SOIL HEADSPACE
SCREENING RESULTS
RESULTS DISTRIBUTION
HARTFORD, ILLINOIS

FIGURE 12

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Figure 13
Comparison of FID Soil Screening and Gore-Sorber Petroleum Hydrocarbon Results
Hartford Community Center
Hartford, IL

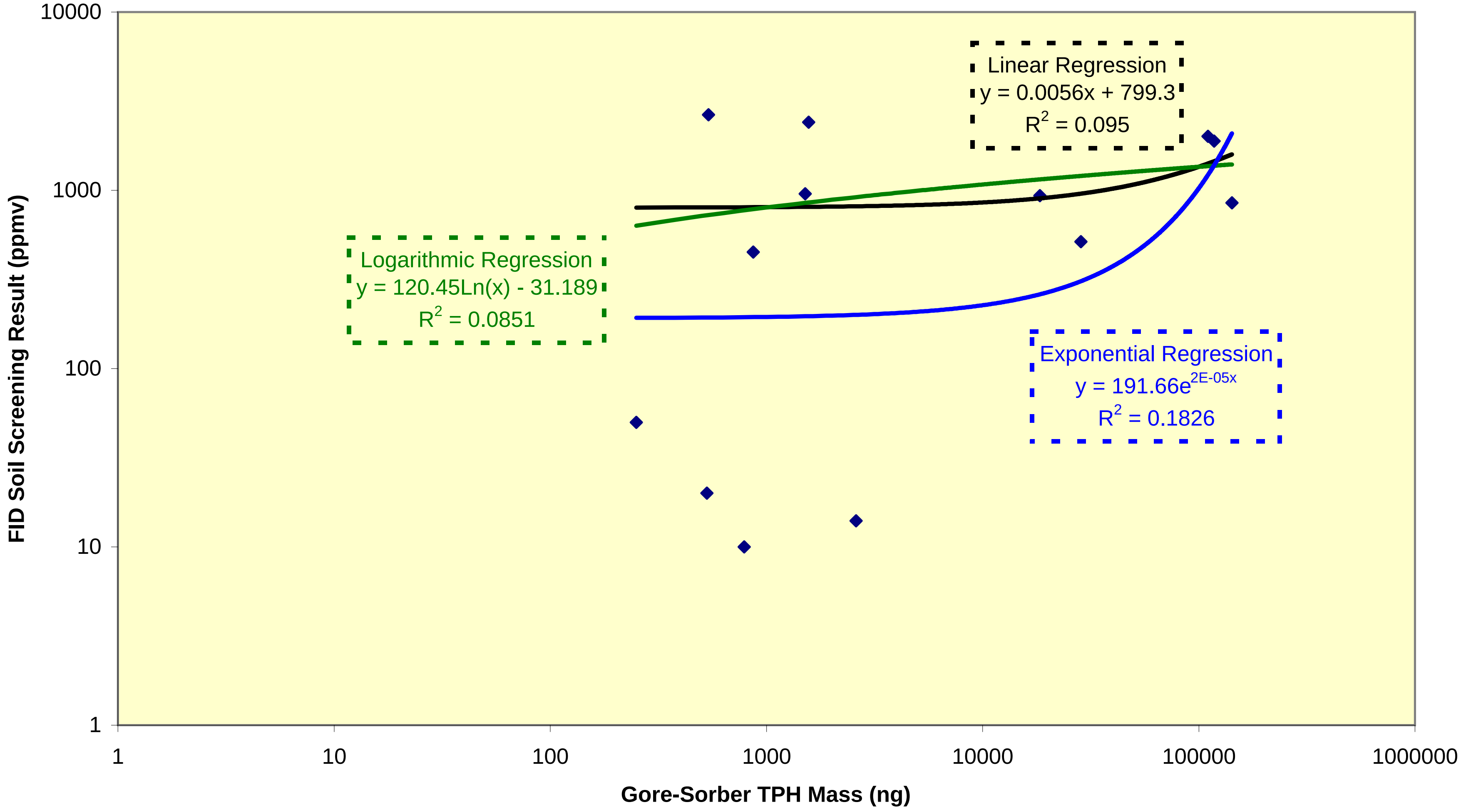


Figure 14
Comparison of FID Soil Screening and Emflux Hydrocarbon Results
Hartford Community Center
Hartford, Illinois

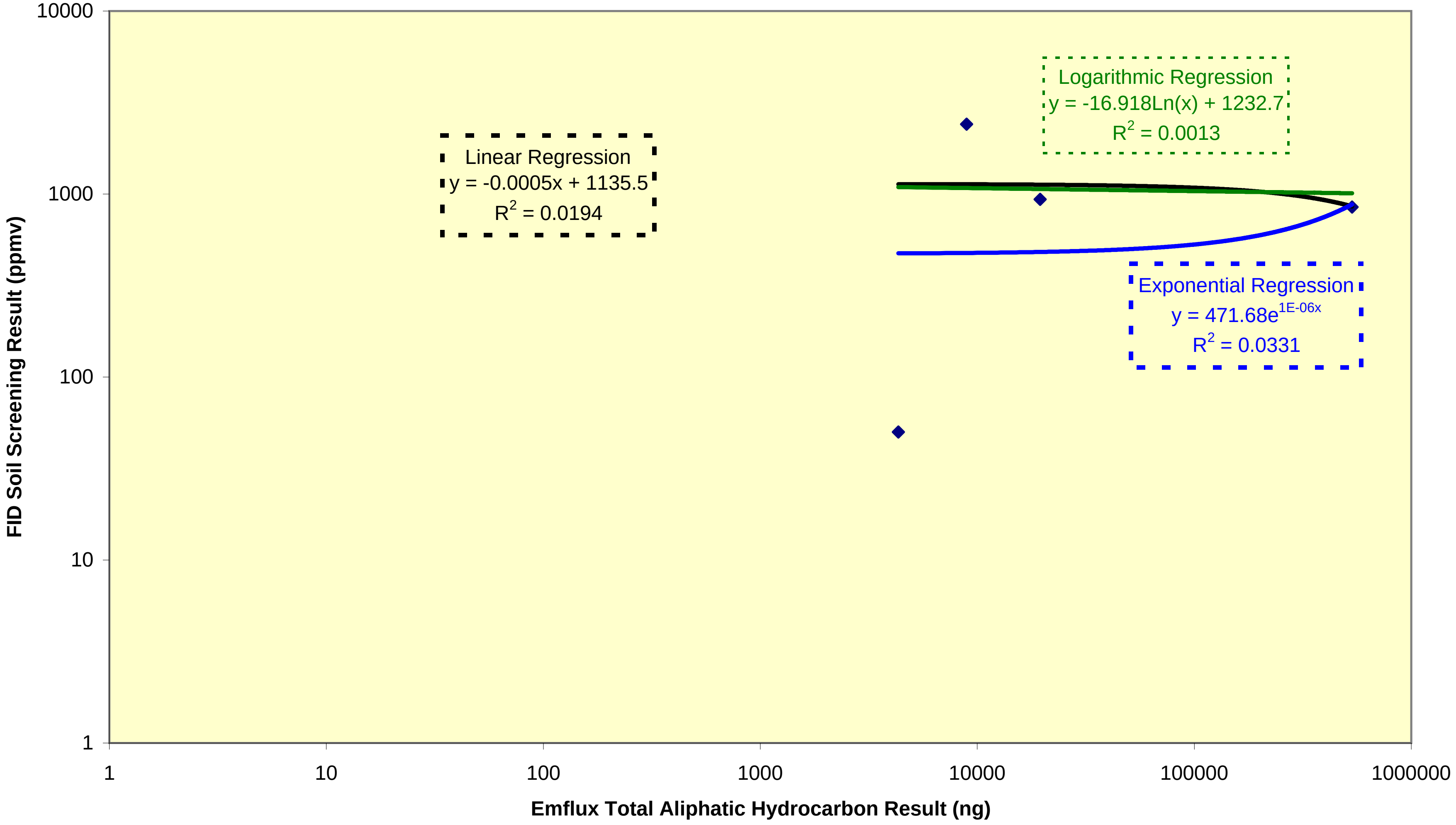


Figure 15
Comparison of Gore-Sorber Benzene and PID Soil Screening Data
Hartford Community Center
Hartford, Illinois

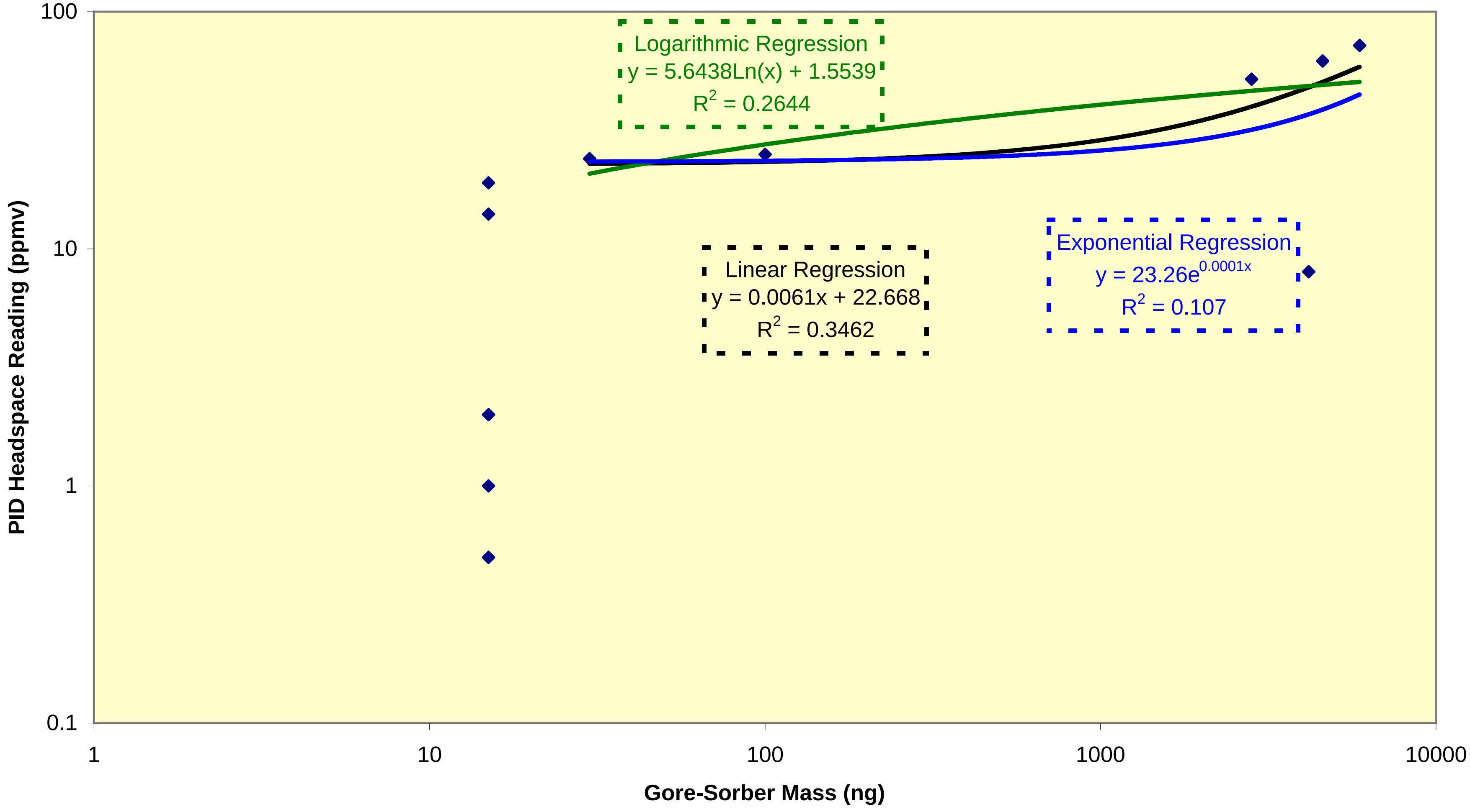
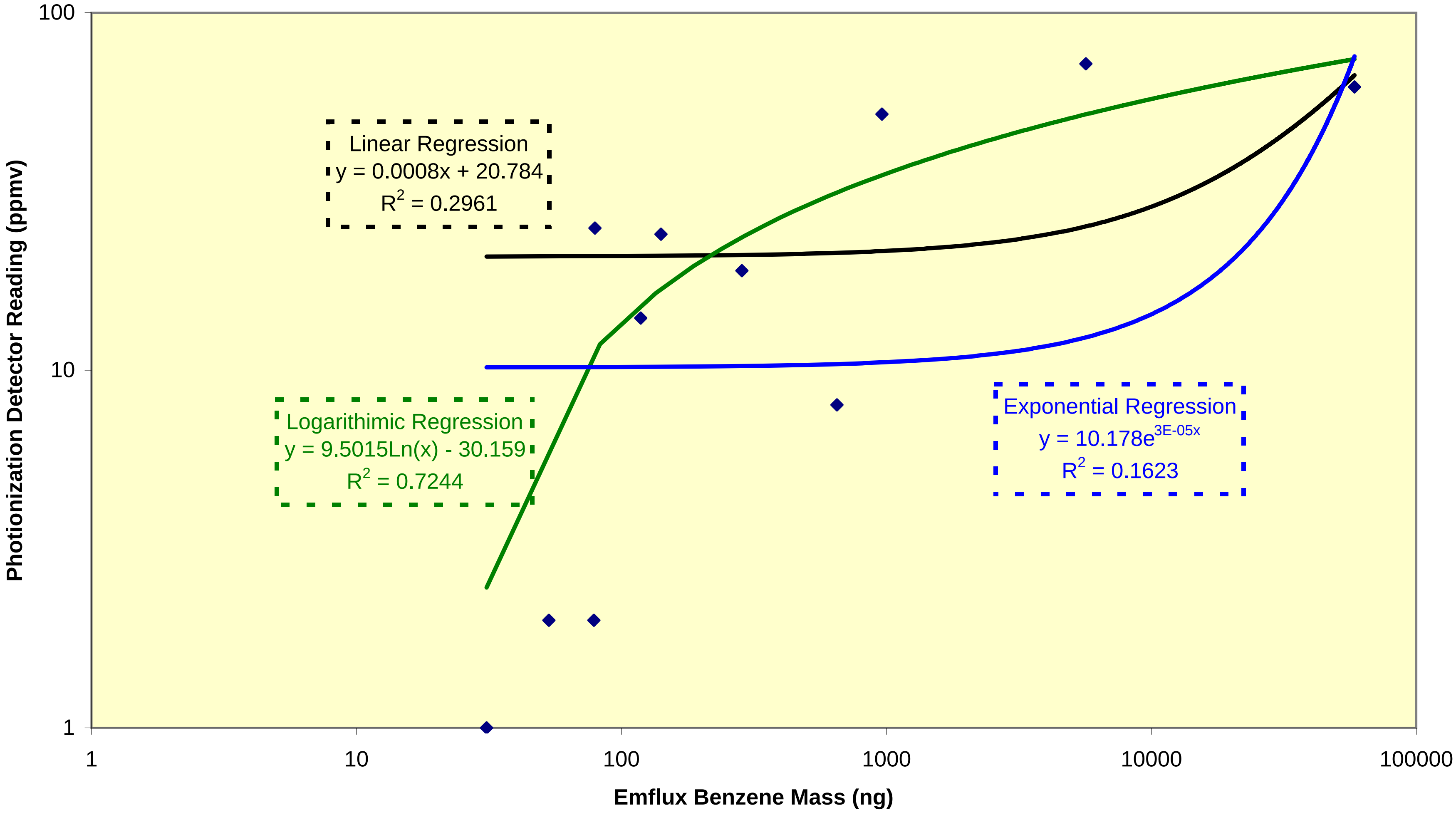


Figure 16
Comparison of Emflux Benzene Data and PID Soil Screening Data
Hartford Community Center
Hartford, IL



U:\Cad_Drive\01000-01999\1005\093\CSM Report\Appendix Figures\01005-093_Fig 17_Shallow Soil Vapor Benzene Results.dwg

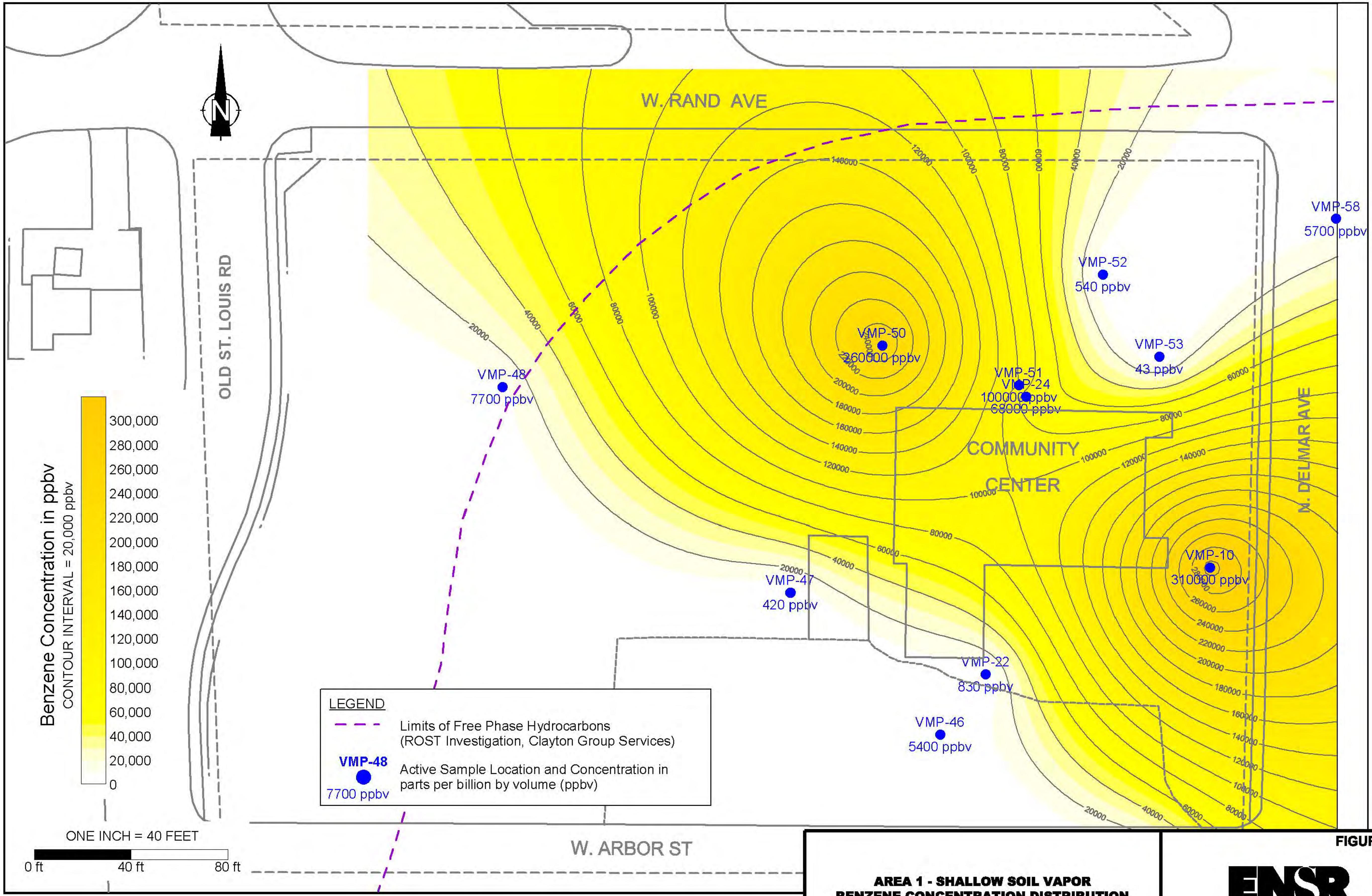


FIGURE 17

AREA 1 - SHALLOW SOIL VAPOR
BENZENE CONCENTRATION DISTRIBUTION
HARTFORD, ILLINOIS

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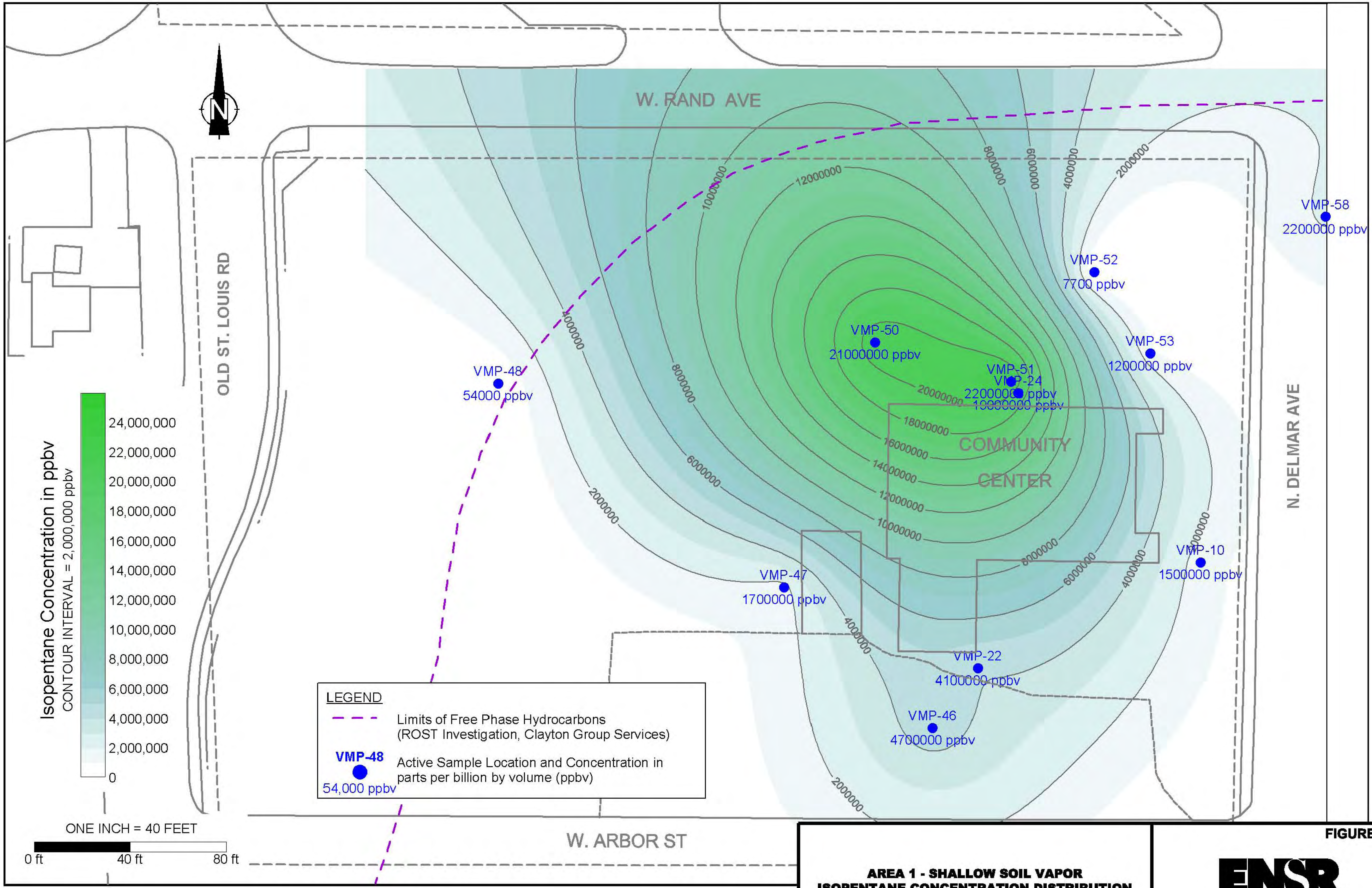

FIGURE 18

AREA 1 - SHALLOW SOIL VAPOR
ISOPENTANE CONCENTRATION DISTRIBUTION
HARTFORD, ILLINOIS

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AREA 2 PASSIVE SAMPLER TECHNICAL MEMORANDUM

ENSR INTERNATIONAL

March 7, 2005

Technical Memorandum

To:	Steve Faryan/USEPA Kevin Turner/USEPA	**Date:**	March 7, 2005
From:	Ralph Feeney/ENSR Dan Groher/ENSR Dave Schumacher/ENSR	**File:**	01005-093-351
RE:	Hartford Area Hydrocarbon Plume Site - Area 2 Passive Soil Vapor Sample Results	**CC:**	Chris Cahnovsky/IEPA Jim Moore/IEPA Tom Binz/TTEMI Robert Howe/TTEMI J. Wigger/Atlantic Richfield T. Mroz/Premcor H. Hand/Shell M. Lahvis/Shell K. Jurish/ERM R. Veenstra/URS J. Petruccione/ENSR R. Schilling/ENSR

ENSR has reviewed the passive soil gas data collected in January 2005. These data included results from paired Emflux® and Gore-Sorber® samplers installed in Area 2, which is as described in ENSR's CSM Investigation Work Plan (December, 2004) and later expanded, at the request of USEPA, to include transects along East Forest Street and a portion of North Market Street. Both samplers collect soil vapors passively but use different sorbents and subsequent analyses. These data were reviewed with the following objectives:

1. Effectiveness of the passive samplers as a screening tool to identify locations (e.g., where vapor plumes are present at shallow depths) that would be appropriate for the installation of permanent vapor monitoring points.
2. Correlation of the paired samples to compare the two samplers.
3. Evaluation and comparison of results along two transects that transition across areas of the site with varying subsurface conditions.
4. Comparison of the passive sampler data with samples collected from nearby active soil gas sampling stations.

Figure 1 shows selected passive soil gas data and their sample locations, along with nearby shallow vapor monitoring point (VMP) sample results from January 2005. Observations and recommendations regarding these data as they relate to the above-listed objectives follow.

Comparison of Emflux® and Gore-Sorber® Samples

Figures 2 and 3 show the correlation of the TPH and benzene values, respectively, from the two samplers. The figures present correlation coefficients for both linear and logarithmic fits of the data. Visually, the two methods do not appear to correlate well, and the correlation coefficients also indicate that the data are not well correlated. Similar correlations of these data, using only detected values (i.e., removing non-detects) show similar lack of correlation (correlation not shown). Inspection of the data indicates that the samplers tend to agree when the concentrations are very low or non-detect.

Comparison of results along two transects along North Market Street and East Forest Street

Figure 4 presents the Gore-Sorber® and Emflux® benzene data, plotted as a transect along North Market Street. As shown in this figure, the Gore-Sorber® results indicate that more benzene was detected at the transect's north end, near East Elm Street. South of East Forest Street, the concentrations are either low or non-detect. The Emflux® results show a similar trend, with the highest detected concentrations in the most northern samples. However, the range of the Emflux® data varies far less than the Gore-Sorber® data. The largest result for the Emflux® data is less than four times the detection limit (77 ng compared to a detection limit of 20 ng); while the Gore-Sorber® sorbers have results in the northern-most samples over three orders-of-magnitude greater than the detection limit. These data indicate that the Gore-Sorber® samples are more sensitive to benzene than the Emflux® samplers used in this study.

Figure 4 also plots five shallow VMP sample results. These data confirm that the highest benzene vapor concentrations along the transect were detected near the North Market and East Elm Streets intersection. The VMP data show a similar trend as the passive data, in that the benzene concentrations decrease toward the transect's southern end. However, the passive samplers did not detect elevated benzene levels near vapor monitoring points VMP-74 and VMP-80, where benzene was detected at 32,000 and 14,000 ug/m^3, respectively. Figure 4 also presents photoionization detector (PID) data from headspace screening of soil samples collected from the screened interval of each Emflux® vapor sampling point. PID headspace screening data obtained during installation of GP-20 and GP-16, similarly underrepresented concentrations detected at nearby vapor monitoring points VMP-74 and VMP-80.

Figure 5 presents the TPH data for the same passive sampler results along the North Market Street transect. These data show a similar, though less consistent, trend as the benzene data, with the lowest concentrations near the southern end of the transect. Figure 5 also depicts VMP isopentane data as a surrogate for TPH,because TPH was not measured for the VMP samples. Figure 5 shows that there is not strong agreement between the passive sample TPH results and the VMP sample isopentane results. The Gore-Sorber® TPH results visually correlate better to the VMP isopentane data (see especially VMP-80/GP-16) than the Emflux® results and are elevated near the two VMP locations where isopentane concentrations are highest, but otherwise, the passive data do not correlate well with the VMP data.. PID soil screening data obtained during installation were similar to Emflux® results, in that they underpredicted concentrations near VMP-80 and VMP-74.

Figures 6 and 7 present the passive benzene and TPH data respectively for the samplers installed along East Forest Street. These data show a fairly consistent trend of the relatively high benzene levels on the eastern end of the transect near North Olive Street, the location of shallow source material, and relatively high concentrations at GP-12, near the intersection with North Market Street, where the Main Sand is relatively shallow. The data for the middle of the transect, where there is no known shallow source material, are less consistent The benzene measurements within the middle of the transect are relatively low for both the Gore-Sorber® and Emflux® samplers, indicating that there may not be any sources there. The Emflux® TPH data demonstrate a similar pattern of low mass values in the center of the transect, whereas the Gore-Sorber® results are not as consistently low in the center compared to the eastern and western ends. PID data are consistent with the passive sampler benzene results and are likewise generally similar to the Emflux® TPH results. Since there are few active samples along this transect for comparison, it is difficult to assess which method, Gore-Sorber® or Emflux® , provides more accurate data regarding soil vapor concentrations in the area.

To further evaluate the relative utility of using the passive samplers and PID soil screening results, the Gore-Sorber® TPH results and PID screening results for the North Market and East Forest Street transects are plotted on linear scales in Figures 8 and 9, respectively. The trends indicated by the PID results are generally the same as the trends indicated by the Gore-Sorber® TPH results for both transects. These data indicate that PID soil screening may be as useful as the passive samplers to survey areas where there is otherwise little or no soil vapor data.

Comparison of Passive Samples with Active Soil Gas Samples

Eight of the passive soil gas samples were installed near active soil gas samples (the shallowest sample depths for each multi-level VMP). The results of these samples were compared to assess how well the passive sampler results reflect the concentrations observed in the more representative active samplers. (Active samplers are more representative of subsurface conditions due to much greater control over size and duration of sample collection.) Figure 10 shows a correlation of the Gore-Sorber® benzene data and the associated VMP sample locations, and Figure 11 shows a correlation of the Gore-Sorber® TPH data and the associated VMP isopentane data at nearby sample locations. The two methods do appear to correlate somewhat on a logarithmic scale (R-squared correlation coefficients between 0.69 and 0.74). Figure 12 shows the benzene graphically, with the associated Emflux® data as well. This figure shows that while the three datasets sometimes co-vary, there are false negatives in the passive sampler dataset, and the passive sampler data do not provide a better indication of subsurface conditions than PID soil screening data.

Conclusions/Recommendations

1. The results of the passive soil gas samples indicate that the Gore-Sorber® are more sensitive for benzene and may potentially be more accurate than the Emflux® samplers used in the study, based on comparisons to nearby VMP data.

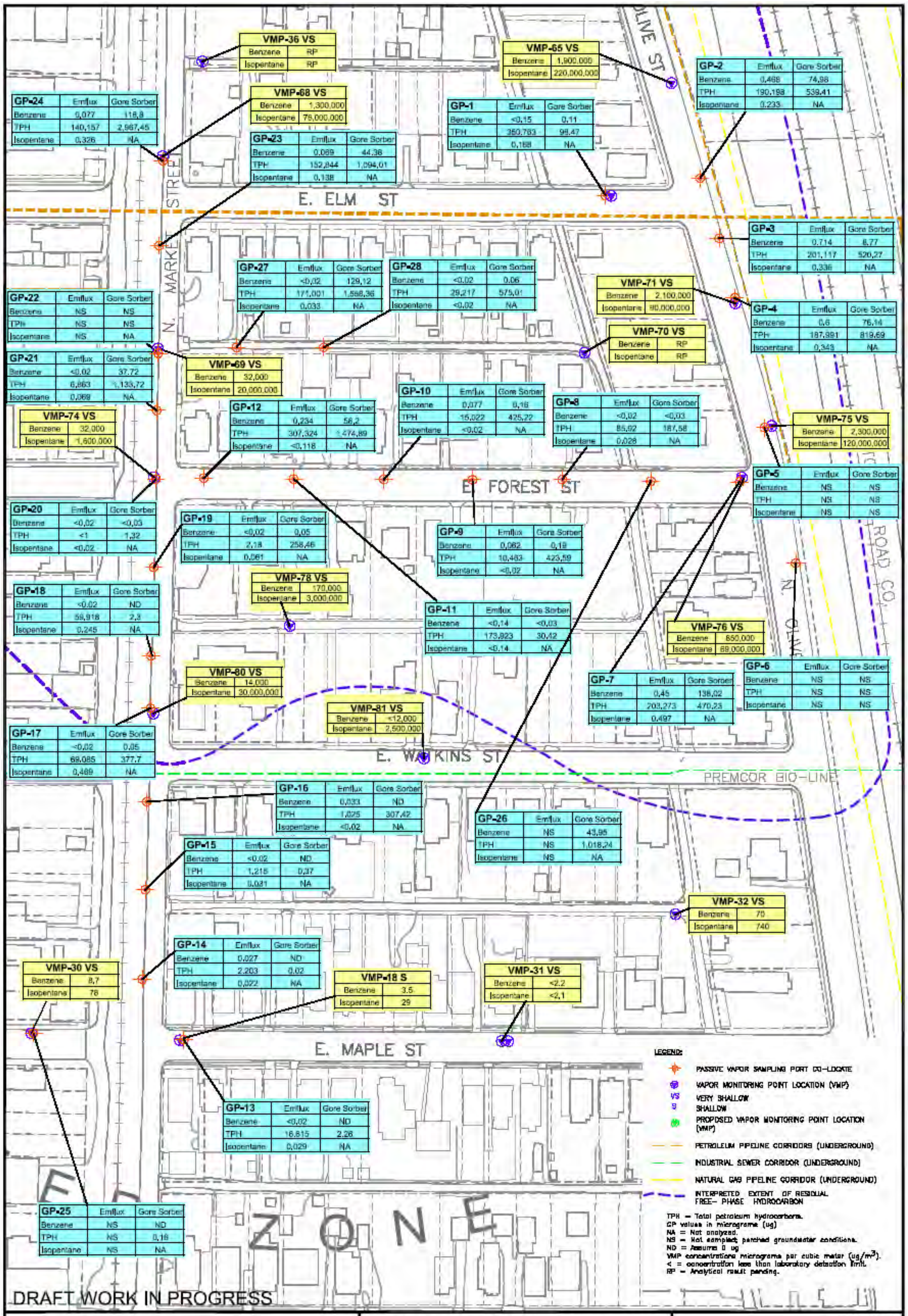
2. The north-south transect of passive soil gas samples (both Gore-Sorber® and Emflux®) along North Market Street appear to accurately indicate when a sample is outside of the plume (i.e., non-detect for benzene and low TPH values in buffer zone areas). However, passive samples along the transect were also non-detect for benzene where an active sample indicated that significant benzene was present. Thus, the passive samples may provide false negative results for benzene.

3. PID screening values of soil samples collected from the passive sampler locations provide similar results as the passive sampler results, indicating that field headspace screening measurements may be as useful as the passive samplers for selecting locations with elevated TPH and benzene concentrations. In addition, PID headspace screening has the advantage of providing more immediate data that can be used to direct active sampler installation.

4. While the passive soil sampler results do somewhat correlate with VMP data, the passive samplers do not consistently reflect the soil gas concentrations detected at VMP locations using discrete active sampling methods. While passive sampler results (particularly the Gore Sorber results) in areas where concentrations are greatest are generally correlated to VMP data, other areas with elevated concentrations were not reflected by the passive sampler data. PID screening results were similarly

correlated. These correlations in the zones of highest concentrations coupled with the lack of correlation in slightly less-impacted areas suggest two possible shortcomings of the passive samplers. Either the passive samplers are insufficiently sensitive to benzene to detect concentrations between 10,000 and 30,000 ug/m^3, or the passive sampler results in zones of highest concentrations are merely indicative of localized soil impacts but the passive sampling techniques are unable to accurately characterize soil vapor concentrations in the heterogeneous, low-permeability subsurface at the site.

5. Before proceeding further with these samplers, it would be better to understand whether the active sampler network within the study area is sufficient to monitor vapor concentrations. Statistical and graphical analyses of VMP sampling data using EVS software is being performed to understand the sufficiency of the sampling network and to evaluate locations where additional sampling data may be necessary.



VMP-36 VS	
Benzene	RP
Isopentane	RP

VMP-65 VS	
Benzene	1,900,000
Isopentane	220,000,000

GP-24	Emflux	Gore Sorber
Benzene	0,077	118,8
TPH	140,157	2,967,45
Isopentane	0,326	NA

VMP-68 VS	
Benzene	1,300,000
Isopentane	75,000,000

GP-1	Emflux	Gore Sorber
Benzene	<0,15	0,11
TPH	350,763	98,47
Isopentane	0,168	NA

GP-2	Emflux	Gore Sorber
Benzene	0,468	74,98
TPH	190,198	539,41
Isopentane	0,233	NA

GP-23	Emflux	Gore Sorber
Benzene	0,069	44,36
TPH	152,844	1,094,01
Isopentane	0,138	NA

GP-3	Emflux	Gore Sorber
Benzene	0,714	8,77
TPH	201,117	520,27
Isopentane	0,336	NA

GP-27	Emflux	Gore Sorber
Benzene	<0,02	129,12
TPH	171,001	1,568,36
Isopentane	0,033	NA

GP-28	Emflux	Gore Sorber
Benzene	<0,02	0,06
TPH	29,217	575,01
Isopentane	<0,02	NA

VMP-71 VS	
Benzene	2,100,000
Isopentane	90,000,000

GP-22	Emflux	Gore Sorber
Benzene	NS	NS
TPH	NS	NS
Isopentane	NS	NA

GP-4	Emflux	Gore Sorber
Benzene	0,6	76,14
TPH	187,991	819,69
Isopentane	0,343	NA

VMP-70 VS	
Benzene	RP
Isopentane	RP

GP-21	Emflux	Gore Sorber
Benzene	<0,02	37,72
TPH	6,863	1,133,72
Isopentane	0,069	NA

VMP-69 VS	
Benzene	32,000
Isopentane	20,000,000

GP-10	Emflux	Gore Sorber
Benzene	0,077	0,16
TPH	15,022	425,22
Isopentane	<0,02	NA

GP-8	Emflux	Gore Sorber
Benzene	<0,02	<0,03
TPH	85,02	187,58
Isopentane	0,028	NA

VMP-74 VS	
Benzene	32,000
Isopentane	1,600,000

GP-12	Emflux	Gore Sorber
Benzene	0,234	56,2
TPH	307,324	1,474,89
Isopentane	<0,118	NA

VMP-75 VS	
Benzene	2,300,000
Isopentane	120,000,000

GP-5	Emflux	Gore Sorber
Benzene	NS	NS
TPH	NS	NS
Isopentane	NS	NS

GP-20	Emflux	Gore Sorber
Benzene	<0,02	<0,03
TPH	<1	1,32
Isopentane	<0,02	NA

GP-19	Emflux	Gore Sorber
Benzene	<0,02	0,05
TPH	2,18	258,46
Isopentane	0,061	NA

GP-9	Emflux	Gore Sorber
Benzene	0,062	0,19
TPH	10,463	423,59
Isopentane	<0,02	NA

VMP-78 VS	
Benzene	170,000
Isopentane	3,000,000

GP-18	Emflux	Gore Sorber
Benzene	<0,02	ND
TPH	59,918	2,3
Isopentane	0,245	NA

GP-11	Emflux	Gore Sorber
Benzene	<0,14	<0,03
TPH	173,823	30,42
Isopentane	<0,14	NA

VMP-76 VS	
Benzene	850,000
Isopentane	69,000,000

GP-6	Emflux	Gore Sorber
Benzene	NS	NS
TPH	NS	NS
Isopentane	NS	NS

VMP-80 VS	
Benzene	14,000
Isopentane	30,000,000

GP-7	Emflux	Gore Sorber
Benzene	0,45	138,02
TPH	203,273	470,23
Isopentane	0,497	NA

VMP-81 VS	
Benzene	<12,000
Isopentane	2,500,000

GP-17	Emflux	Gore Sorber
Benzene	<0,02	0,05
TPH	69,085	377,7
Isopentane	0,489	NA

GP-16	Emflux	Gore Sorber
Benzene	0,033	ND
TPH	1,025	307,42
Isopentane	<0,02	NA

GP-26	Emflux	Gore Sorber
Benzene	NS	43,95
TPH	NS	1,018,24
Isopentane	NS	NA

GP-15	Emflux	Gore Sorber
Benzene	<0,02	ND
TPH	1,216	0,37
Isopentane	0,031	NA

VMP-32 VS	
Benzene	70
Isopentane	740

GP-14	Emflux	Gore Sorber
Benzene	0,027	ND
TPH	2,203	0,02
Isopentane	0,022	NA

VMP-30 VS	
Benzene	8,7
Isopentane	78

VMP-18 S	
Benzene	3.5
Isopentane	29

VMP-31 VS	
Benzene	<2,2
Isopentane	<2,1

GP-13	Emflux	Gore Sorber
Benzene	<0,02	ND
TPH	16,815	2,26
Isopentane	0,029	NA

GP-25	Emflux	Gore Sorber
Benzene	NS	ND
TPH	NS	0,16
Isopentane	NS	NA

TPH = Total petroleum hydrocarbons.
GP values in micrograms (ug)
NA = Not analyzed.
NS = Not sampled; perched groundwater conditions.
ND = Assume 0 ug
VMP concentrations micrograms per cubic meter (ug/m^3).
< = concentration less than laboratory detection limit.
RP = Analytical result pending.

SCALE IN FEET
0 50 100 200
1" = 100'
N

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AREA 2 - VERY SHALLOW (~ 5 ft SUBSURFACE)
PASSIVE AND ACTIVE SOIL VAPOR RESULTS
JANUARY 2005
THE HARTFORD AREA HYDROCARBON
PLUME SITE
THE HARTFORD WORKING GROUP
HARTFORD, IL

FIGURE 1

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Figure 2. Passive TPH Soil Vapor Values
Comparison of Paired EMFLUX and GORE Samples
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

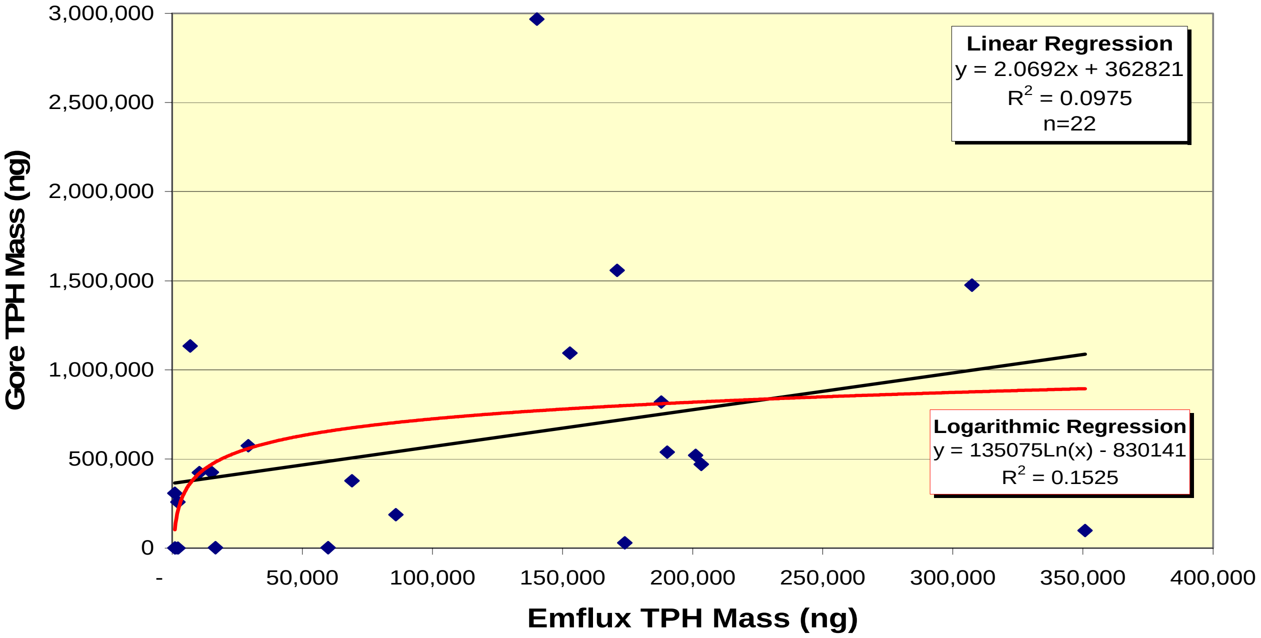


Figure 3. Passive Benzene Soil Vapor Values
Comparison of Paired EMFLUX and GORE Samples
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

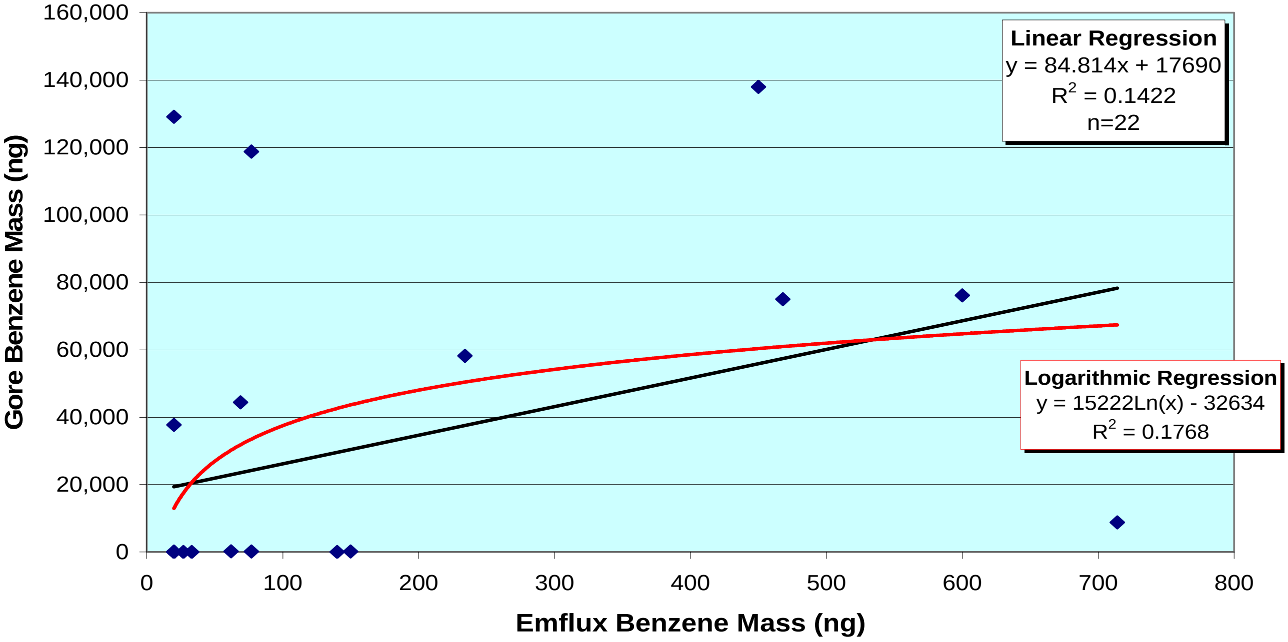


Figure 4. Passive and Active Benzene Soil Vapor Values - N. Market St.
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

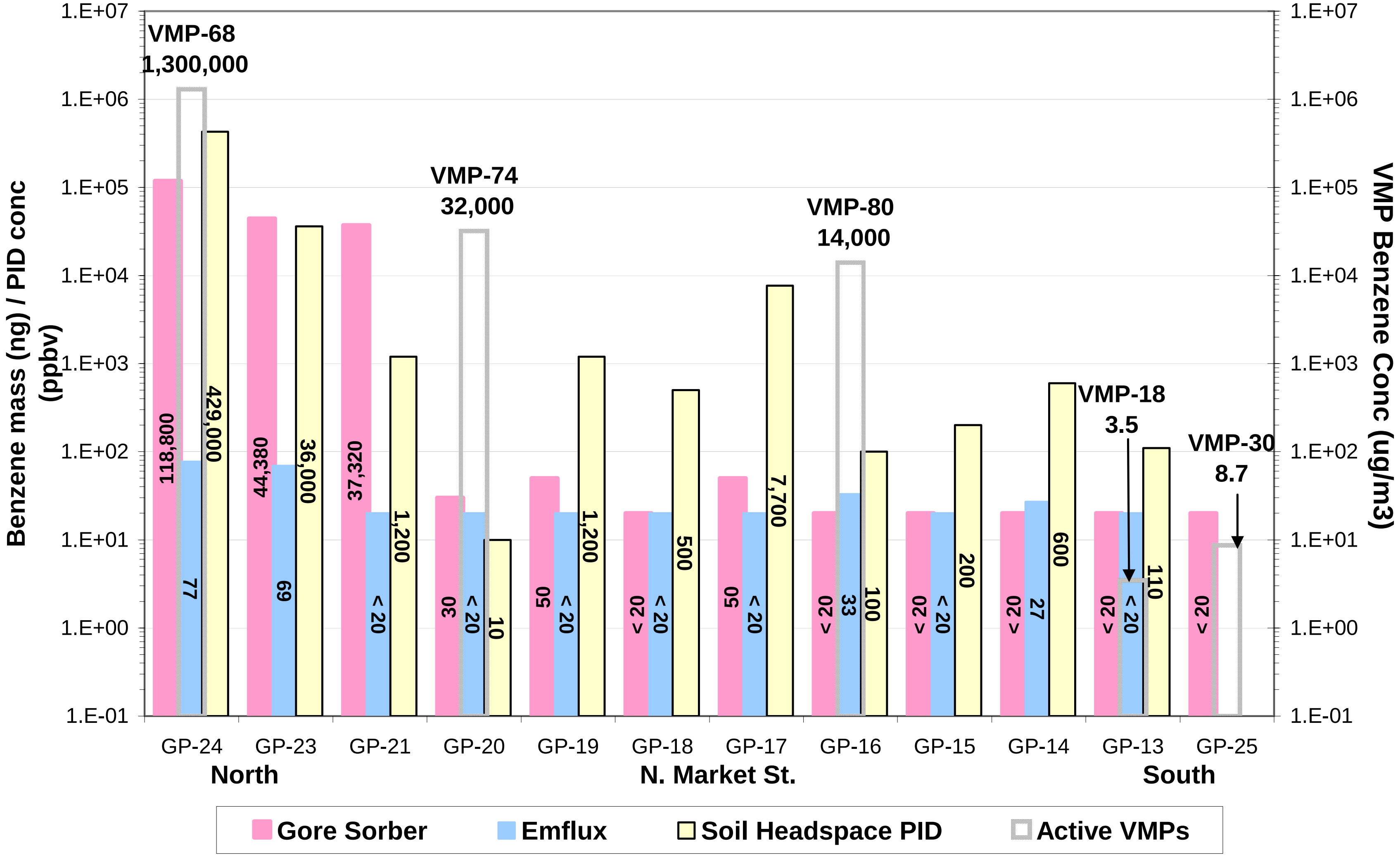


Figure 5. Passive and Active TPH Soil Vapor Values - N. Market St.
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

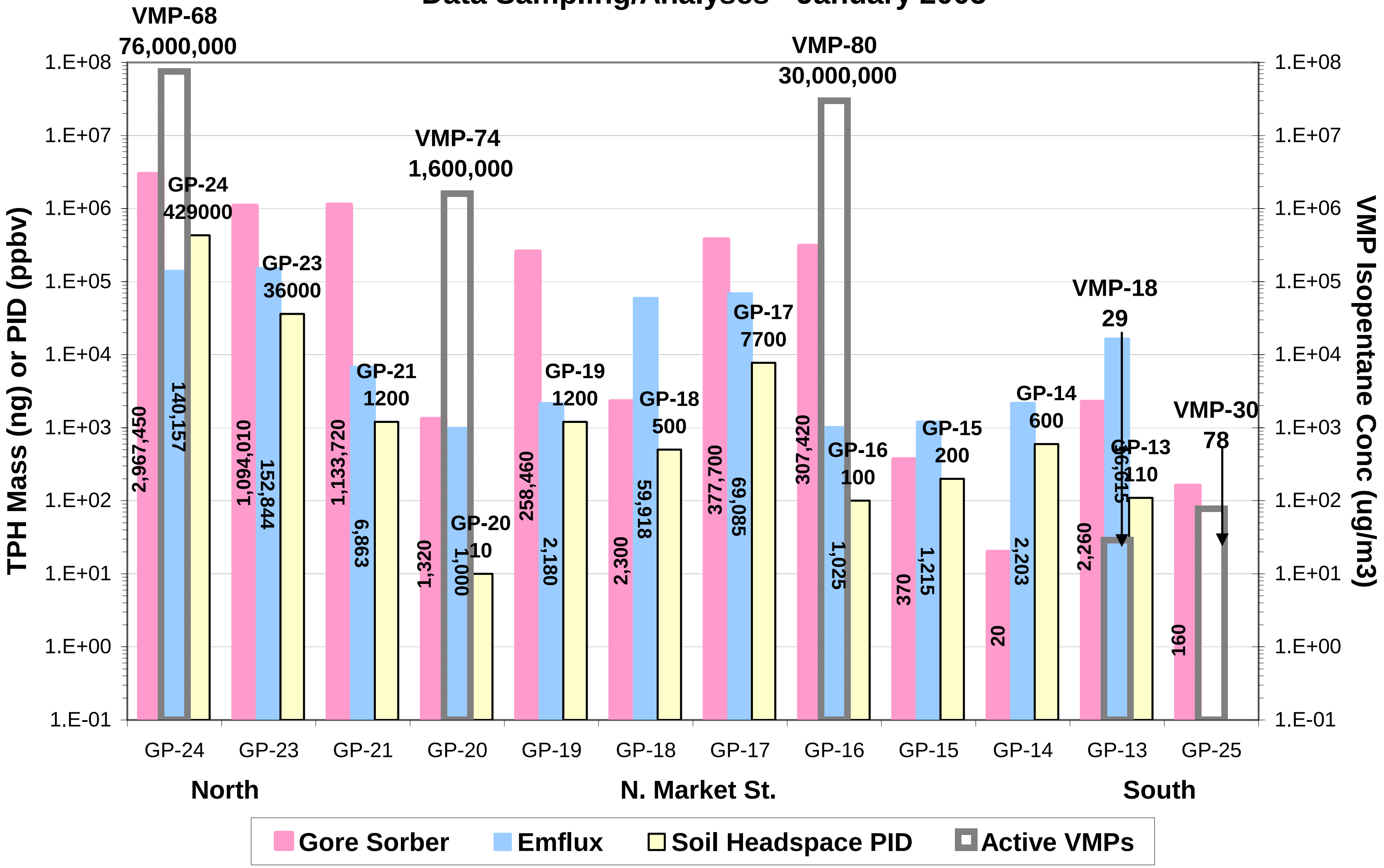


Figure 6. Passive Benzene Soil Vapor Values - E. Forest St.
The Hartford Area Hydrocarbon Plume Site
Data Sampling/Analyses - January 2005

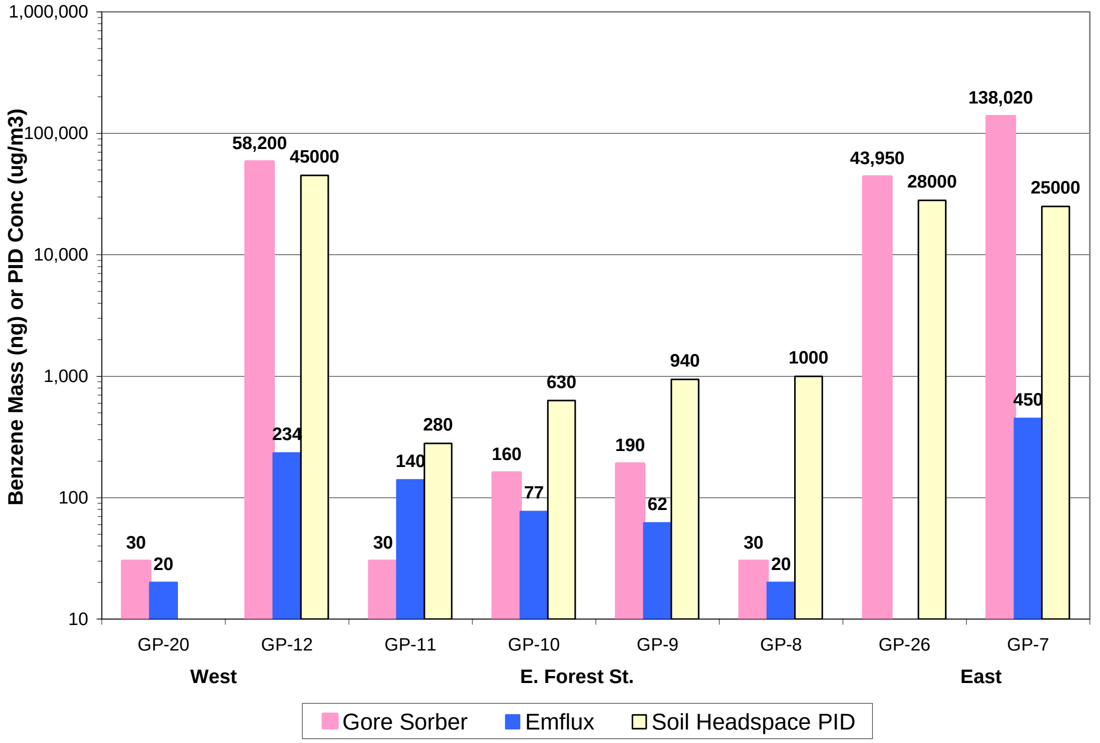


Figure 7. Passive Total Petroleum Hydrocarbon Soil Vapor Values - E. Forest St.
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

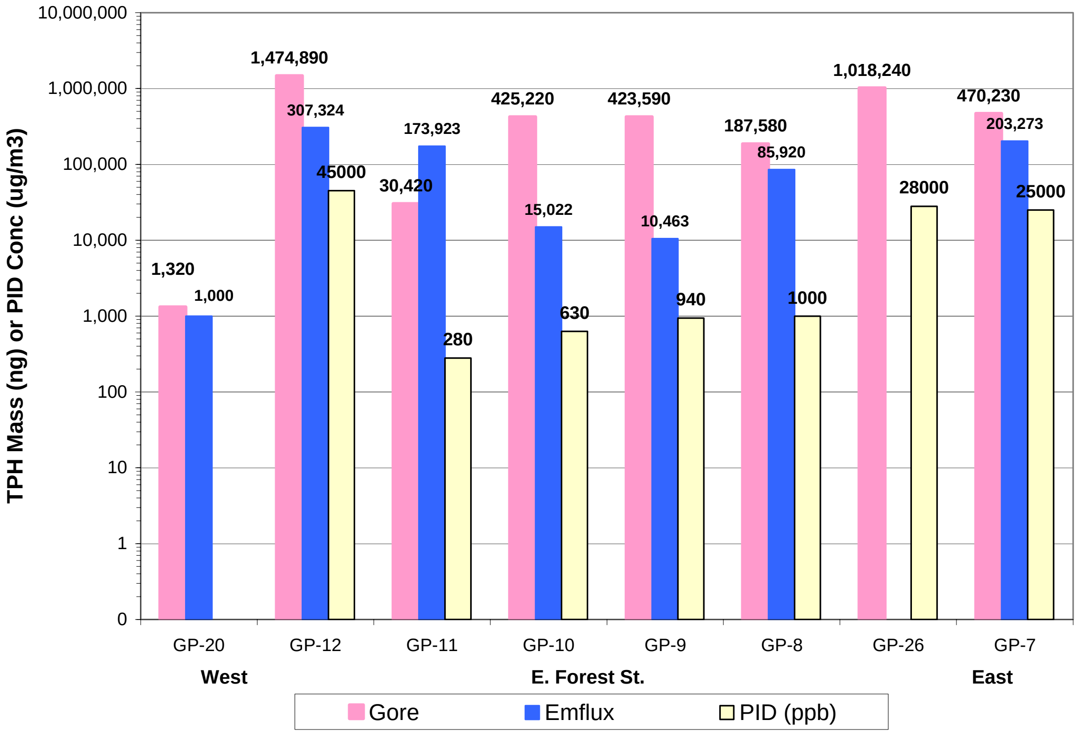


Figure 8. Gore Soil Vapor TPH Values vs. Soil Headspace PID - N. Market St.
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

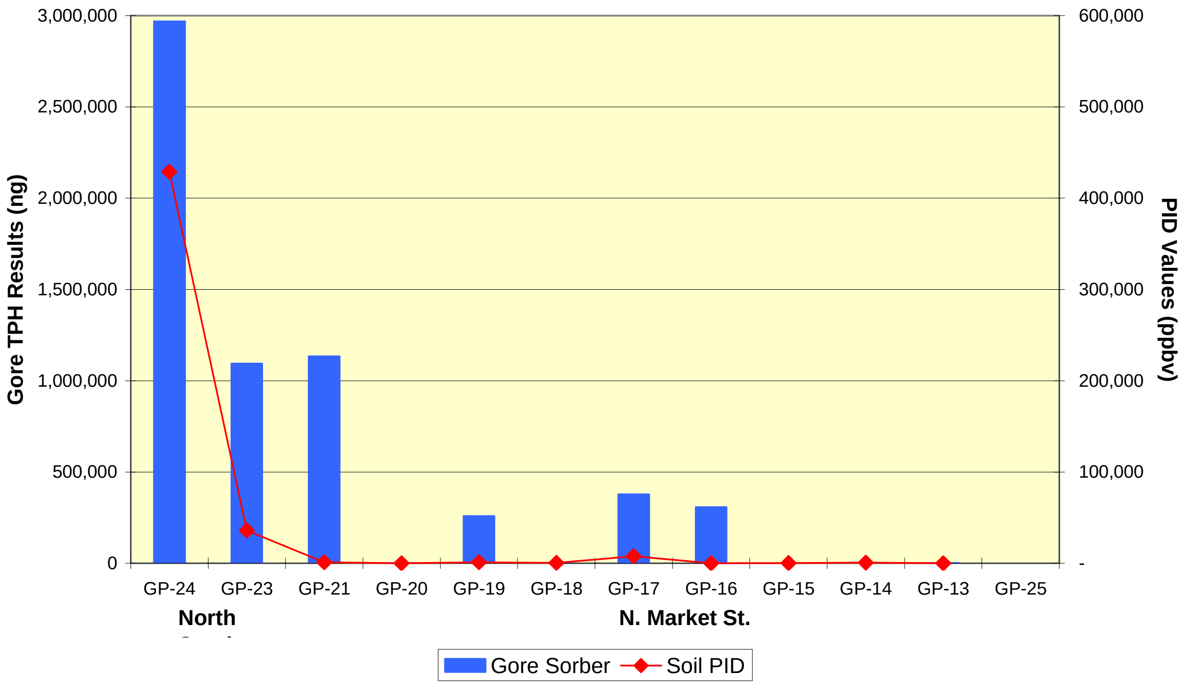


Figure 9. Gore TPH Soil Vapor Values and PID Readings - E. Forest St.
The Hartford Working Group, Hartford, IL
Data Sampling/Analyses - January 2005

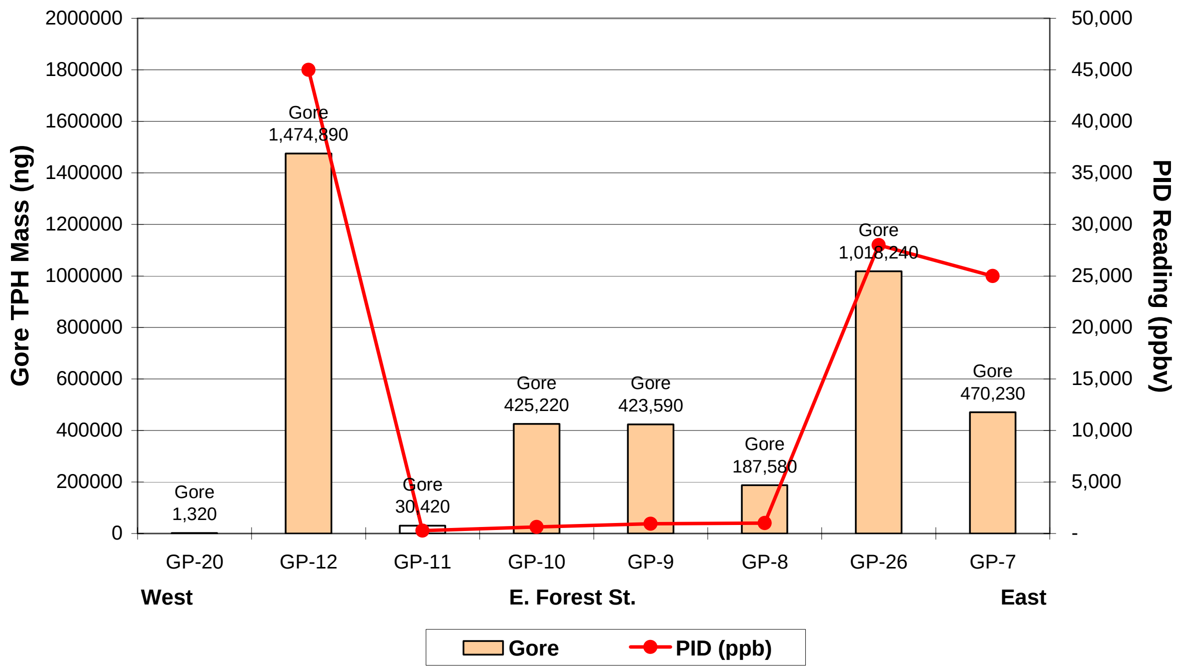


Figure 10. Passive vs. Active Benzene Soil Vapor Values
The Hartford Working Group, Hartford, IL
Sampling/Analyses - January 2005

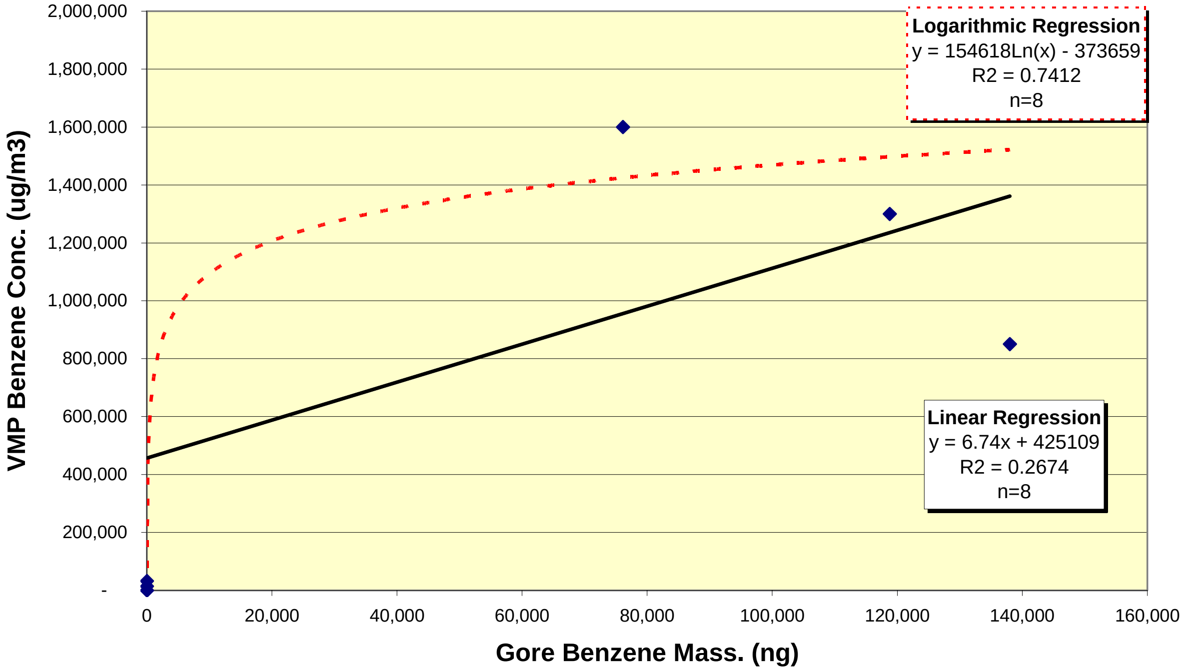


Figure 11. Gore TPH vs. Active Isopentane Soil Vapor Values
The Hartford Working Group, Hartford, IL
Sampling/Analyses - January 2005

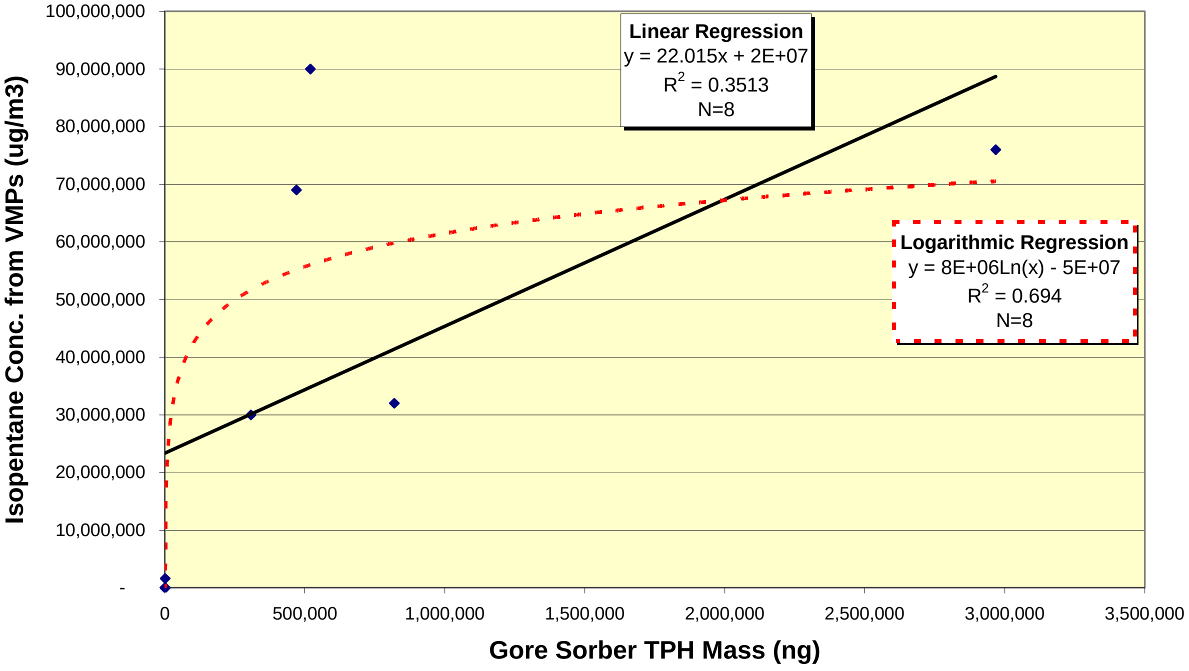
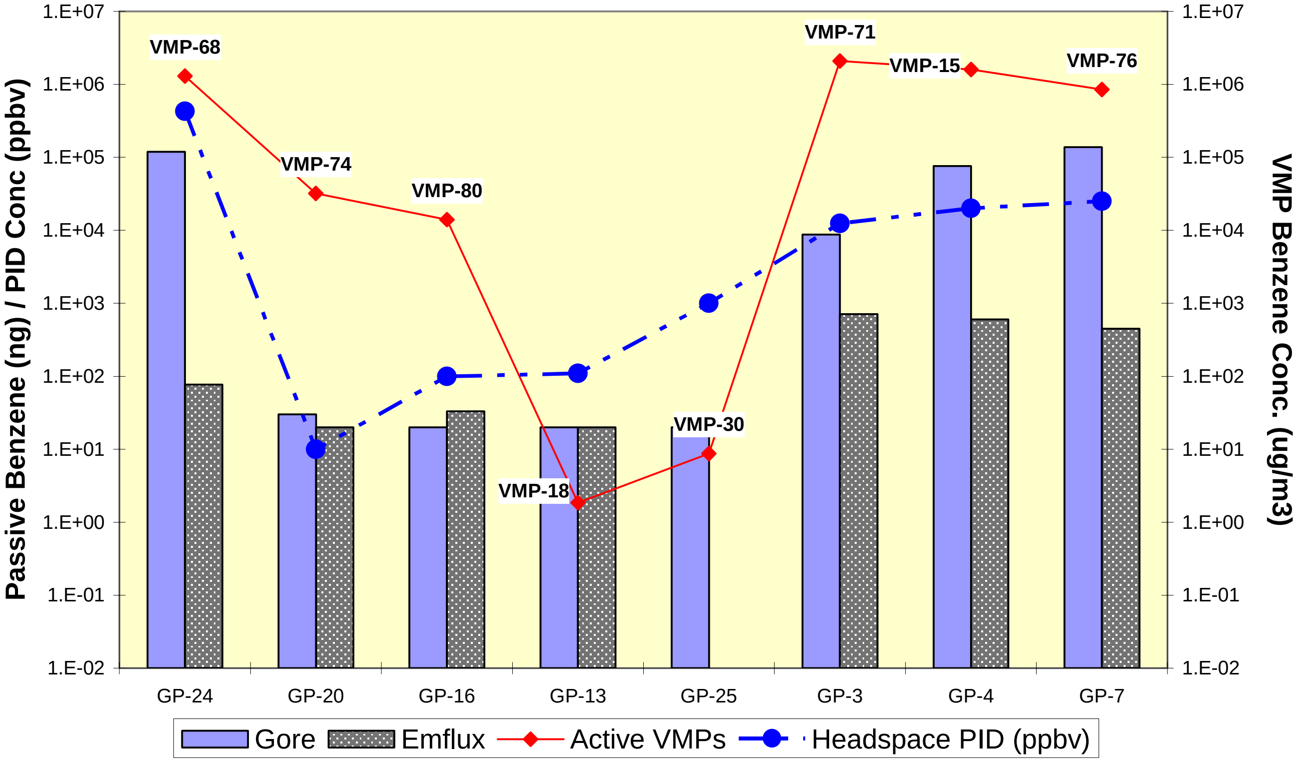


Figure 12. Passive and Active Benzene Soil Vapor Values
The Hartford Working Group, Hartford, IL
Sampling/Analyses - January 2005



PASSIVE SEWER VAPOR RESULTS

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A7	A7	A7	A7	A7	A7	A7	A7A	A7A	A7A	A7A	A7A	A7A	A7A	A8	A8
Approximate depth below sewer manhole rim (ft)		3	4	4	4	4	3	3	4	3	3	3	4	3	3	5	5
Gore-Sorber® Module Installation Date		1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05
Gore-Sorber® Module Retrieval Date		1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	105.71	29.31	44.74	23.46	44.91	35.69	50.95	17.22	8.70	18.92	8.91	48.64	8.42	45.75	111.09	25.34
BTEX	NA	0.69	0.30	0.34	0.26	1.19	0.83	0.52	0.36	0.86	4.03	0.69	1.24	0.29	2.76	0.39	0.30
Benzene	0.03	0.10	0.04	0.04	0.04	0.26	BDL	BDL	0.03	BDL	0.04	0.04	0.38	BDL	0.27	0.07	0.03
Toluene	0.02	0.04	0.02	BDL	0.04	0.61	0.04	0.06	0.03	0.05	0.02	0.06	0.25	0.03	0.21	0.03	0.03
Ethylbenzene	0.01	0.20	0.06	0.06	0.03	0.05	0.11	0.06	0.05	0.15	0.60	0.11	0.11	0.04	0.39	0.11	0.06
m,p-Xylene	0.01	0.28	0.12	0.18	0.10	0.16	0.49	0.30	0.16	0.46	2.92	0.35	0.35	0.15	1.58	0.13	0.12
o-Xylene	0.01	0.08	0.06	0.07	0.06	0.11	0.19	0.10	0.08	0.20	0.45	0.14	0.15	0.07	0.32	0.04	0.06
Undecane, tridecane & pentadecane	NA	0.69	0.85	0.84	0.73	0.70	0.56	7.18	0.29	0.32	1.41	0.21	0.50	0.18	0.71	0.69	0.41
Undecane	0.02	0.28	0.07	0.28	0.33	0.35	0.21	0.98	0.12	0.15	1.13	0.08	0.10	0.07	0.11	0.18	0.13
Tridecane	0.01	0.19	0.66	0.44	0.31	0.31	0.22	5.75	0.11	0.09	0.19	0.07	0.22	0.05	0.51	0.21	0.12
Pentadecane	0.02	0.23	0.13	0.12	0.10	0.04	0.14	0.44	0.07	0.08	0.10	0.06	0.19	0.06	0.09	0.29	0.16
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	2.20	0.86	0.46	0.28	0.39	1.01	0.38	0.48	0.59	0.58	0.33	0.46	0.27	0.39	1.34	0.75
1,2,4-Trimethylbenzene	0.02	1.81	0.59	0.16	0.19	0.27	0.78	0.27	0.36	0.48	0.47	0.25	0.32	0.18	0.30	1.11	0.50
1,3,5-Trimethylbenzene	0.03	0.40	0.27	0.29	0.09	0.12	0.23	0.11	0.12	0.12	0.12	0.08	0.14	0.09	0.09	0.23	0.25
Naphthalene and 2-Methylnaphthalene	NA	0.53	0.33	0.28	0.11	0.16	0.55	0.45	0.30	0.31	0.71	0.22	0.24	0.13	0.22	0.42	0.33
Naphthalene	0.01	0.38	0.25	0.18	0.07	0.09	0.29	0.14	0.20	0.20	0.29	0.16	0.16	0.09	0.13	0.30	0.24
2-Methylnaphthalene	0.02	0.15	0.08	0.10	0.04	0.06	0.26	0.32	0.10	0.11	0.42	0.06	0.07	0.04	0.09	0.11	0.09
Methyl tertiary-butyl ether	0.04	ND	ND	ND	BDL	ND	ND	ND	ND	ND	BDL	ND	ND	BDL	ND	ND	ND
Octane	0.02	0.23	0.05	0.08	0.07	0.07	0.02	0.02	0.03	0.11	0.04	0.08	0.15	0.02	0.07	0.24	0.04
Isopentane	0.02	-	0.55	0.76	0.22	0.33	0.46	0.17	-	0.21	0.09	0.07	0.61	0.10	0.57	-	0.38

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A8	A8	A8	A8	A8	A8A	A8A	A8A	A8A	A8A	A8A	A8A	A8.5A	A8.5A	A8.5A	A8.5A
Approximate depth below sewer manhole rim (ft)		4.5	4.5	4.5	5	5	5.5	5	5	5	5	5	5	6	5.5	5	5
Gore-Sorber® Module Installation Date		2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	12/1/04	12/30/04	1/13/05	1/26/05
Gore-Sorber® Module Retrieval Date		2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	12/30/04	1/13/05	1/26/05	2/10/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	46.13	29.11	25.76	50.15	66.16	35.15	9.99	19.11	12.05	15.87	41.91	196.12	105.14	77.94	17.74	9.75
BTEX	NA	0.39	0.31	0.31	0.72	0.20	0.65	0.81	0.51	0.55	0.60	0.41	1.14	1.04	1.04	0.96	0.59
Benzene	0.03	0.07	0.05	BDL	0.05	0.04	0.04	0.04	0.05	0.04	BDL	0.05	0.54	0.43	0.61	0.04	0.04
Toluene	0.02	0.02	0.05	0.08	0.04	0.06	0.03	0.04	0.03	0.04	0.05	0.03	0.25	0.07	0.02	0.04	BDL
Ethylbenzene	0.01	0.06	0.03	0.04	0.10	BDL	0.10	0.14	0.08	0.08	0.10	0.06	0.06	0.11	0.09	0.15	0.09
m,p-Xylene	0.01	0.17	0.11	0.12	0.41	0.05	0.34	0.41	0.25	0.27	0.32	0.19	0.20	0.29	0.24	0.52	0.31
o-Xylene	0.01	0.07	0.06	0.07	0.13	0.05	0.15	0.18	0.10	0.12	0.13	0.08	0.10	0.13	0.08	0.21	0.15
Undecane, tridecane & pentadecane	NA	0.30	0.67	0.44	0.33	3.63	0.21	0.29	0.20	0.31	0.65	0.57	0.53	0.70	0.25	0.28	0.30
Undecane	0.02	0.08	0.43	0.22	0.16	3.22	0.11	0.10	0.07	0.15	0.28	0.13	0.11	0.37	0.15	0.14	0.15
Tridecane	0.01	0.10	0.10	0.10	0.08	0.28	0.06	0.09	0.07	0.11	0.29	0.18	0.10	0.17	0.06	0.09	0.09
Pentadecane	0.02	0.12	0.13	0.12	0.08	0.14	0.05	0.11	0.07	0.06	0.09	0.26	0.33	0.15	0.04	0.05	0.06
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.33	0.27	0.25	0.24	0.44	0.58	0.54	0.34	0.43	0.48	0.36	0.33	0.68	0.37	0.65	0.54
1,2,4-Trimethylbenzene	0.02	0.22	0.19	0.18	0.16	0.29	0.42	0.44	0.28	0.26	0.30	0.21	0.19	0.45	0.26	0.47	0.44
1,3,5-Trimethylbenzene	0.03	0.12	0.09	0.07	0.08	0.15	0.17	0.10	0.06	0.17	0.18	0.14	0.13	0.23	0.11	0.18	0.11
Naphthalene and 2-Methylnaphthalene	NA	0.18	0.10	0.12	0.10	0.14	0.21	0.25	0.19	0.19	0.18	0.18	0.21	0.49	0.18	0.23	0.23
Naphthalene	0.01	0.12	0.06	0.06	0.05	0.07	0.14	0.16	0.13	0.14	0.12	0.11	0.13	0.33	0.12	0.16	0.14
2-Methylnaphthalene	0.02	0.05	0.04	0.05	0.05	0.07	0.07	0.09	0.06	0.06	0.06	0.06	0.08	0.16	0.07	0.07	0.08
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	BDL	ND	ND	ND
Octane	0.02	0.07	0.08	0.05	0.03	0.03	0.10	0.10	0.06	0.07	0.10	0.05	0.08	0.21	0.38	0.24	0.10
Isopentane	0.02	0.68	0.28	0.22	0.94	0.79	-	0.10	0.12	0.12	0.33	0.36	3.29	-	-	-	0.24

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A8.5A	A8.5A	A8.5A	A8.5A	A8.5A	A8.5B	A8.5B	A8.5B	A8.5B	A8.5B	A8.5B	A8.5B	A8.5C	A8.5C	A8.5C	A8.5C
Approximate depth below sewer manhole rim (ft)		5.5	5	5	5	5	5.5	5.5	5	5.5	5	5	5	5.5	5.5	5	6
Gore-Sorber® Module Installation Date		2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	12/1/04	12/30/04	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	12/1/04	12/30/04	1/13/05	1/26/05
Gore-Sorber® Module Retrieval Date		2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	12/30/04	1/13/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	12/30/04	1/13/05	1/26/05	2/10/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	12.89	32.30	171.74	33.14	174.85	132.88	140.93	14.13	24.77	27.00	31.32	45.69	95.04	237.45	47.08	13.45
BTEX	NA	0.58	0.53	1.65	0.29	0.86	0.24	0.92	0.09	0.10	0.13	0.16	0.06	0.29	1.36	0.62	0.47
Benzene	0.03	ND	0.08	0.82	0.04	0.69	0.15	0.76	BDL	0.40	0.04	0.05	0.06	0.03	0.68	0.04	0.05
Toluene	0.02	0.05	0.03	0.24	BDL	0.05	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	0.31	0.02	0.04
Ethylbenzene	0.01	0.09	0.07	0.10	0.04	0.04	0.03	0.05	BDL	BDL	BDL	BDL	BDL	0.04	0.10	0.15	0.08
m,p-Xylene	0.01	0.31	0.25	0.35	0.14	0.05	0.03	0.07	0.05	0.03	0.06	0.07	BDL	0.12	0.19	0.31	0.22
o-Xylene	0.01	0.13	0.11	0.15	0.07	0.03	0.03	0.04	0.04	0.02	0.04	0.04	BDL	0.06	0.08	0.10	0.09
Undecane, tridecane & pentadecane	NA	0.21	0.23	0.21	0.16	0.09	13.61	0.96	0.06	0.03	0.11	0.09	0.00	10.80	1.56	0.45	0.18
Undecane	0.02	0.10	0.13	0.11	0.09	0.07	0.15	0.20	0.03	0.03	0.05	0.04	BDL	10.18	0.39	0.14	0.06
Tridecane	0.01	0.06	0.06	0.07	0.05	BDL	1.58	0.10	BDL	BDL	0.02	0.03	BDL	0.26	0.33	0.15	0.06
Pentadecane	0.02	0.05	0.03	0.04	0.03	0.02	11.88	0.66	0.04	BDL	0.03	0.02	BDL	0.36	0.84	0.17	0.06
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.39	0.40	0.46	0.27	0.13	0.16	0.36	0.18	0.10	0.14	0.16	0.08	0.56	0.67	1.08	0.37
1,2,4-Trimethylbenzene	0.02	0.30	0.27	0.31	0.18	0.08	0.09	0.16	0.12	0.06	0.08	0.10	0.04	0.39	0.50	0.82	0.27
1,3,5-Trimethylbenzene	0.03	0.09	0.13	0.15	0.09	0.04	0.07	0.20	0.06	0.04	0.06	0.06	0.04	0.17	0.17	0.25	0.10
Naphthalene and 2-Methylnaphthalene	NA	0.20	0.23	0.18	0.13	0.08	0.17	0.09	0.06	0.00	0.06	0.05	0.00	0.48	0.28	0.29	0.19
Naphthalene	0.01	0.13	0.16	0.12	0.08	0.05	0.08	0.06	0.04	BDL	0.03	0.03	BDL	0.31	0.14	0.20	0.13
2-Methylnaphthalene	0.02	0.07	0.07	0.06	0.05	0.03	0.09	0.04	0.02	BDL	0.02	0.02	BDL	0.17	0.14	0.08	0.06
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	ND	ND	BDL	BDL	ND	ND	BDL	ND	ND	ND
Octane	0.02	0.16	0.22	0.16	0.15	0.10	0.02	0.19	ND	ND	0.04	0.04	0.03	0.08	1.33	0.14	0.05
Isopentane	0.02	0.29	0.61	4.55	0.95	5.69	-	-	0.44	0.58	0.89	1.55	1.55	-	-	-	0.15

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)
ND-non detect

NA - No MDL is available for combinations of analytes as they
are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A8.5C	A8.5C	A8.5C	A8.5C	A8.5C	A9	A9	A9	A9	A9	A9	A9	A9	A9	A10	A10
Approximate depth below sewer manhole rim (ft)		5.5	5	5	5	5	6	6	5	6	6	6	6	5	5	5.5	5
Gore-Sorber® Module Installation Date		2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	12/1/04	12/30/04	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	12/30/04	1/13/05
Gore-Sorber® Module Retrieval Date		2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	12/30/04	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/13/05	1/26/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	30.37	25.37	37.26	21.89	48.30	84.34	137.09	20.85	10.10	21.84	17.07	39.23	25.21	37.25	189.92	61.95
BTEX	NA	0.48	0.60	1.30	0.31	0.21	0.45	0.40	1.04	0.65	0.56	0.57	0.99	0.34	0.20	5.48	0.69
Benzene	0.03	0.05	0.08	0.35	BDL	0.03	0.16	0.19	0.04	0.04	0.05	0.06	0.28	BDL	BDL	4.14	0.29
Toluene	0.02	0.03	0.06	0.28	0.03	0.04	0.06	0.02	0.03	0.03	0.03	0.08	0.21	0.04	0.03	0.07	0.03
Ethylbenzene	0.01	0.08	0.08	0.12	0.05	0.02	0.04	0.06	0.24	0.13	0.12	0.08	0.09	0.05	0.03	0.87	0.15
m,p-Xylene	0.01	0.22	0.26	0.39	0.17	0.08	0.11	0.09	0.55	0.31	0.26	0.25	0.28	0.17	0.09	0.36	0.17
o-Xylene	0.01	0.09	0.11	0.17	0.08	0.04	0.06	0.04	0.18	0.14	0.10	0.11	0.13	0.08	0.05	0.05	0.05
Undecane, tridecane & pentadecane	NA	0.26	0.29	0.38	0.31	0.44	2.15	1.75	0.43	0.29	0.24	0.26	0.31	0.33	0.50	8.70	0.27
Undecane	0.02	0.09	0.11	0.20	0.13	0.13	0.80	0.67	0.18	0.12	0.09	0.10	0.13	0.13	0.15	4.09	0.08
Tridecane	0.01	0.08	0.10	0.10	0.08	0.15	0.58	0.55	0.16	0.10	0.09	0.08	0.10	0.10	0.19	2.63	0.07
Pentadecane	0.02	0.09	0.09	0.08	0.09	0.16	0.76	0.53	0.09	0.08	0.07	0.08	0.08	0.10	0.16	1.98	0.12
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.39	0.42	0.50	0.35	0.24	0.67	0.49	1.04	0.62	0.48	0.29	0.39	0.36	0.29	1.63	1.84
1,2,4-Trimethylbenzene	0.02	0.27	0.26	0.32	0.21	0.15	0.43	0.37	0.77	0.44	0.33	0.21	0.26	0.22	0.20	1.14	1.50
1,3,5-Trimethylbenzene	0.03	0.11	0.16	0.18	0.14	0.08	0.24	0.12	0.27	0.18	0.15	0.08	0.13	0.14	0.09	0.49	0.34
Naphthalene and 2-Methylnaphthalene	NA	0.19	0.19	0.18	0.15	0.12	0.45	0.31	0.29	0.23	0.19	0.15	0.14	0.17	0.16	0.85	0.35
Naphthalene	0.01	0.13	0.14	0.13	0.10	0.07	0.29	0.15	0.20	0.16	0.14	0.10	0.09	0.10	0.09	0.21	0.23
2-Methylnaphthalene	0.02	0.06	0.05	0.06	0.05	0.05	0.16	0.16	0.09	0.07	0.05	0.05	0.05	0.07	0.07	0.65	0.12
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	0.12	0.14	0.23	0.06	0.06	0.10	0.08	0.17	0.08	0.01	0.10	0.11	0.05	0.03	1.86	0.13
Isopentane	0.02	0.18	0.14	0.51	0.18	0.54	-	-	-	0.13	0.11	0.16	0.49	0.32	0.43	-	-

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A10	A10	A10	A10	A10	A10	A10A	A10A	A10A	A10A	A10A	A10A	A10A	A10B	A10B	A10B
Approximate depth below sewer manhole rim (ft)		5	5	5	5	6	6	4	3	5	5	5	4	4	3	6	4
Gore-Sorber® Module Installation Date		1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05
Gore-Sorber® Module Retrieval Date		2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/23/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	15.51	64.06	32.36	160.21	65.77	113.00	18.77	11.77	13.40	8.43	40.62	12.97	15.96	31.06	12.38	14.47
BTEX	NA	0.28	1.33	0.31	1.81	0.27	0.80	1.15	0.96	0.81	0.78	1.79	0.40	0.25	0.61	0.17	0.18
Benzene	0.03	0.03	0.88	0.08	0.93	0.14	0.63	0.04	0.04	0.04	0.04	0.49	BDL	0.04	0.30	BDL	BDL
Toluene	0.02	0.02	0.03	0.04	0.41	BDL	0.05	0.05	0.05	0.06	0.08	0.40	0.02	0.03	0.10	0.02	0.02
Ethylbenzene	0.01	0.06	0.18	0.04	0.09	0.03	0.04	0.19	0.16	0.13	0.13	0.16	0.06	0.03	0.05	0.03	0.03
m,p-Xylene	0.01	0.11	0.18	0.10	0.25	0.06	0.06	0.62	0.49	0.42	0.38	0.52	0.22	0.10	0.10	0.08	0.08
o-Xylene	0.01	0.06	0.05	0.05	0.13	0.03	0.02	0.26	0.22	0.17	0.16	0.22	0.10	0.05	0.06	0.05	0.04
Undecane, tridecane & pentadecane	NA	0.19	0.15	0.22	0.20	0.23	0.22	0.68	0.78	0.46	0.36	0.46	0.44	0.49	0.44	0.25	0.09
Undecane	0.02	0.05	0.06	0.07	0.09	0.08	0.09	0.23	0.26	0.13	0.13	0.15	0.14	0.18	0.17	0.14	BDL
Tridecane	0.01	0.05	0.03	0.04	0.05	0.05	0.05	0.23	0.27	0.16	0.10	0.14	0.12	0.13	0.09	0.04	0.03
Pentadecane	0.02	0.08	0.06	0.11	0.05	0.11	0.08	0.21	0.25	0.18	0.13	0.17	0.18	0.17	0.18	0.07	0.05
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.73	0.52	0.25	0.40	0.23	0.18	0.95	0.81	0.53	0.54	0.67	0.50	0.60	0.82	0.56	0.26
1,2,4-Trimethylbenzene	0.02	0.51	0.33	0.18	0.29	0.17	0.13	0.70	0.66	0.43	0.37	0.46	0.32	0.22	0.55	0.40	0.18
1,3,5-Trimethylbenzene	0.03	0.22	0.18	0.07	0.10	0.06	0.05	0.26	0.15	0.10	0.18	0.21	0.18	0.38	0.27	0.17	0.08
Naphthalene and 2-Methylnaphthalene	NA	0.45	0.19	0.13	0.16	0.19	0.14	0.73	1.04	0.51	0.38	0.41	0.44	0.44	0.10	0.11	0.02
Naphthalene	0.01	0.23	0.11	0.08	0.09	0.10	0.07	0.31	0.32	0.20	0.21	0.20	0.19	0.16	0.05	0.06	BDL
2-Methylnaphthalene	0.02	0.22	0.07	0.05	0.07	0.09	0.07	0.41	0.72	0.31	0.18	0.20	0.25	0.29	0.05	0.05	0.02
Methyl tertiary-butyl ether	0.04	ND	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	0.05	0.25	0.12	0.23	0.10	0.14	0.15	0.09	0.14	0.09	0.20	0.07	0.05	BDL	ND	ND
Isopentane	0.02	0.33	0.88	0.36	2.44	1.32	2.34	-	0.08	0.09	0.14	1.23	0.14	0.21	-	0.12	0.42

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		A10B	A10B	A10B	A10B	A10C	A10C	A10C	A10C	A10C	A10C	A10C	B6	B6	B6	B6	B6
Approximate depth below sewer manhole rim (ft)		4	4	4	4	3	5	4.5	4	4	4	4	2	2	2	2	2
Gore-Sorber® Module Installation Date		2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05
Gore-Sorber® Module Retrieval Date		3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	8.21	6.61	56.82	43.94	113.62	48.46	52.05	31.37	22.58	37.16	42.92	15.59	8.26	11.50	11.24	9.91
BTEX	NA	0.18	0.28	0.33	0.00	0.07	0.20	0.00	0.02	0.41	0.00	0.00	0.80	0.52	0.26	0.42	0.55
Benzene	0.03	BDL	BDL	0.09	BDL	0.04	BDL	BDL	BDL	BDL	BDL	ND	0.04	0.06	0.03	0.03	BDL
Toluene	0.02	0.04	0.05	0.15	BDL	BDL	0.10	BDL	BDL	0.09	BDL	ND	0.06	0.11	0.03	0.07	0.11
Ethylbenzene	0.01	0.02	0.03	BDL	BDL	BDL	BDL	BDL	BDL	0.04	ND	ND	0.13	0.07	0.03	0.06	0.08
m,p-Xylene	0.01	0.07	0.13	0.06	BDL	BDL	0.07	BDL	0.02	0.19	BDL	BDL	0.40	0.20	0.11	0.18	0.25
o-Xylene	0.01	0.04	0.07	0.04	BDL	0.03	0.03	BDL	BDL	0.09	ND	BDL	0.17	0.09	0.06	0.09	0.11
Undecane, tridecane & pentadecane	NA	0.03	0.08	0.09	0.08	5.38	0.74	0.25	0.17	0.04	0.05	0.08	0.27	0.20	0.17	0.20	0.23
Undecane	0.02	0.03	0.04	0.06	0.05	3.18	0.37	0.16	0.09	0.04	0.05	0.06	0.16	0.09	0.10	0.12	0.14
Tridecane	0.01	BDL	0.02	BDL	BDL	1.09	0.10	0.05	0.03	BDL	BDL	BDL	0.06	0.06	0.03	0.04	0.06
Pentadecane	0.02	BDL	0.02	0.03	0.02	1.11	0.27	0.05	0.05	BDL	BDL	0.03	0.06	0.06	0.04	0.04	0.03
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.21	0.38	0.28	0.16	2.43	0.43	0.22	0.13	0.26	0.10	0.09	0.44	0.28	0.20	0.22	0.36
1,2,4-Trimethylbenzene	0.02	0.15	0.28	0.19	0.12	1.61	0.26	0.12	0.07	0.18	0.06	0.06	0.32	0.22	0.04	0.16	0.23
1,3,5-Trimethylbenzene	0.03	0.06	0.10	0.09	0.05	0.82	0.18	0.10	0.06	0.07	0.04	0.03	0.13	0.06	0.15	0.06	0.13
Naphthalene and 2-Methylnaphthalene	NA	0.02	0.10	0.06	0.02	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.16	0.14	0.13	0.15
Naphthalene	0.01	BDL	0.06	0.03	BDL	0.03	BDL	ND	ND	BDL	BDL	BDL	0.12	0.10	0.10	0.09	0.11
2-Methylnaphthalene	0.02	0.02	0.04	0.03	0.02	0.04	BDL	BDL	BDL	BDL	BDL	BDL	0.05	0.06	0.05	0.04	0.05
Methyl tertiary-butyl ether	0.04	BDL	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	ND	BDL	0.03	ND	ND	ND	BDL	BDL	BDL	ND	ND	0.17	0.06	0.06	0.09	0.12
Isopentane	0.02	0.26	0.15	1.67	1.16	-	0.70	1.35	0.92	0.49	1.27	1.46	-	0.07	0.09	0.06	0.07

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		B6	B6	B7	B7	B7	B7	B7	B7	B7	C1	C1	C1	C1	C1	C1	C1
Approximate depth below sewer manhole rim (ft)		3	4	3	3	3	3	3	2	2	4	6	5	5	5	5	5
Gore-Sorber® Module Installation Date		3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05
Gore-Sorber® Module Retrieval Date		4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	13.15	23.01	31.75	10.50	23.88	19.28	25.73	14.37	20.32	39.95	143.43	157.33	31.60	11.53	18.93	19.01
BTEX	NA	0.19	0.19	0.70	0.53	0.40	0.59	0.59	0.29	0.39	0.37	0.09	0.26	0.09	0.69	0.76	0.20
Benzene	0.03	BDL	BDL	0.04	0.03	0.04	0.03	BDL	BDL	BDL	0.17	BDL	0.11	BDL	0.20	0.11	BDL
Toluene	0.02	0.03	0.04	0.04	0.03	0.03	0.06	0.08	0.03	0.05	0.04	0.02	0.08	0.03	0.35	0.52	0.10
Ethylbenzene	0.01	0.02	0.02	0.10	0.08	0.05	0.09	0.09	0.04	0.06	0.02	BDL	BDL	BDL	BDL	0.02	BDL
m,p-Xylene	0.01	0.08	0.07	0.36	0.26	0.18	0.28	0.30	0.16	0.19	0.07	0.03	0.03	0.03	0.06	0.06	0.05
o-Xylene	0.01	0.05	0.05	0.16	0.13	0.09	0.13	0.13	0.07	0.09	0.06	0.03	0.04	0.03	0.07	0.05	0.05
Undecane, tridecane & pentadecane	NA	0.22	0.96	0.21	0.22	0.21	0.22	0.27	0.18	0.52	1.73	29.54	21.89	5.75	0.67	0.35	0.57
Undecane	0.02	0.12	0.69	0.12	0.12	0.15	0.19	0.23	0.11	0.41	1.39	28.32	21.08	5.61	0.31	0.22	0.41
Tridecane	0.01	0.06	0.19	0.05	0.06	0.03	0.04	0.04	0.05	0.07	1.20	1.10	0.69	0.10	0.32	0.09	0.11
Pentadecane	0.02	0.03	0.09	0.04	0.05	0.02	BDL	BDL	0.03	0.03	0.14	0.13	0.12	0.04	0.04	0.04	0.05
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.20	0.59	0.53	0.41	0.28	0.39	0.37	0.28	0.61	0.22	0.17	0.11	0.47	0.99	0.19	0.27
1,2,4-Trimethylbenzene	0.02	0.13	0.36	0.38	0.32	0.22	0.29	0.26	0.17	0.38	0.17	0.12	0.07	0.37	0.72	0.14	0.19
1,3,5-Trimethylbenzene	0.03	0.08	0.23	0.15	0.09	0.06	0.09	0.11	0.11	0.23	0.06	0.04	0.04	0.10	0.28	0.06	0.09
Naphthalene and 2-Methylnaphthalene	NA	0.12	0.17	0.16	0.15	0.12	0.18	0.15	0.13	0.20	0.17	0.20	0.21	0.13	0.11	0.11	0.13
Naphthalene	0.01	0.07	0.11	0.11	0.10	0.08	0.13	0.10	0.09	0.14	0.09	0.10	0.10	0.08	0.07	0.07	0.08
2-Methylnaphthalene	0.02	0.04	0.07	0.05	0.06	0.04	0.05	0.05	0.04	0.06	0.08	0.10	0.11	0.05	0.04	0.05	0.05
Methyl tertiary-butyl ether	0.04	BDL	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	ND	ND	BDL	ND
Octane	0.02	0.12	0.03	0.13	0.06	0.13	0.20	0.10	0.12	0.07	0.14	BDL	0.02	ND	BDL	0.02	BDL
Isopentane	0.02	0.11	0.07	-	0.10	0.23	0.20	0.21	0.27	0.65	-	0.04	0.08	ND	0.06	0.32	0.14

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C1A	C1A	C1A	C1A	C1A	C1A	C1A	C2	C2	C2	C2	C2	C2	C2	C2A	C2A
Approximate depth below sewer manhole rim (ft)		4.5	3	5	4	7	4	4	5	5	6	6	6	5	5	3.5	3
Gore-Sorber® Module Installation Date		1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05
Gore-Sorber® Module Retrieval Date		1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	21.22	15.69	11.60	5.26	10.68	6.72	8.46	60.85	62.87	114.13	23.49	17.07	15.74	50.84	87.47	49.59
BTEX	NA	0.81	0.64	0.37	0.55	0.93	0.30	0.34	0.66	0.23	0.02	0.21	0.81	0.23	1.49	1.48	0.48
Benzene	0.03	0.07	0.03	BDL	BDL	0.25	BDL	BDL	0.38	0.07	BDL	BDL	0.19	BDL	0.18	0.87	0.04
Toluene	0.02	0.04	0.04	BDL	0.04	0.17	0.02	0.03	0.05	0.05	0.02	0.06	0.44	0.06	1.12	0.10	0.03
Ethylbenzene	0.01	0.13	0.12	0.06	0.09	0.09	0.05	0.05	0.04	BDL	BDL	0.02	0.03	0.03	0.03	0.09	0.06
m,p-Xylene	0.01	0.40	0.31	0.21	0.29	0.29	0.05	0.17	0.12	0.06	BDL	0.08	0.08	0.09	0.09	0.27	0.24
o-Xylene	0.01	0.17	0.15	0.10	0.12	0.12	0.16	0.09	0.07	0.05	BDL	0.06	0.07	0.06	0.07	0.14	0.12
Undecane, tridecane & pentadecane	NA	0.26	1.30	0.20	0.11	0.19	0.07	0.06	1.50	11.99	16.56	2.55	1.18	0.36	0.37	1.39	7.03
Undecane	0.02	0.13	1.11	0.14	0.09	0.11	0.08	0.04	0.56	11.31	15.91	2.41	0.12	0.10	0.17	0.94	6.62
Tridecane	0.01	0.07	0.10	0.04	0.02	0.05	0.05	BDL	0.59	0.46	0.47	0.07	1.01	0.17	0.12	0.25	0.27
Pentadecane	0.02	0.06	0.08	0.03	BDL	0.03	BDL	0.02	0.35	0.22	0.18	0.06	0.04	0.09	0.08	0.20	0.14
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.66	0.42	0.33	0.45	0.52	0.33	0.35	0.43	0.17	0.09	0.41	0.63	0.30	0.29	1.09	0.63
1,2,4-Trimethylbenzene	0.02	0.43	0.34	0.27	0.26	0.28	0.17	0.20	0.30	0.13	0.06	0.11	0.40	0.19	0.19	0.76	0.43
1,3,5-Trimethylbenzene	0.03	0.23	0.08	0.06	0.18	0.24	0.16	0.14	0.13	0.04	0.03	0.30	0.22	0.11	0.10	0.33	0.20
Naphthalene and 2-Methylnaphthalene	NA	0.24	0.19	0.16	0.14	0.16	0.10	0.12	0.28	0.20	0.17	0.23	0.14	0.20	0.25	0.58	0.53
Naphthalene	0.01	0.16	0.13	0.11	0.10	0.12	0.07	0.08	0.14	0.11	0.09	0.13	0.08	0.12	0.13	0.30	0.26
2-Methylnaphthalene	0.02	0.08	0.07	0.05	0.04	0.05	0.03	0.03	0.14	0.09	0.08	0.10	0.06	0.09	0.12	0.28	0.27
Methyl tertiary-butyl ether	0.04	ND	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	0.27	0.06	0.09	0.07	0.10	0.10	0.03	0.40	BDL	0.04	ND	0.12	0.05	0.06	0.65	0.07
Isopentane	0.02	-	0.16	0.12	0.08	0.68	0.08	0.09	-	0.15	0.06	0.04	0.19	0.20	0.74	-	0.29

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C2A	C2A	C2A	C2A	C2A	C2B	C2B	C2B	C2B	C2B	C2B	C2B	C3	C3	C3	C3
Approximate depth below sewer manhole rim (ft)		3	3	3	2.5	2.5	6	6	5	5	5	5	5	6	5	7	7
Gore-Sorber® Module Installation Date		2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/24/05
Gore-Sorber® Module Retrieval Date		2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/24/05	3/9/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	117.96	70.49	21.47	33.78	50.53	88.92	49.00	118.09	34.44	12.08	19.87	25.18	63.00	22.87	44.51	13.08
BTEX	NA	0.17	0.27	0.49	0.62	0.23	2.13	0.22	0.15	0.16	0.29	0.71	0.31	0.44	0.29	0.15	0.29
Benzene	0.03	0.05	0.04	BDL	0.04	0.05	1.49	0.03	0.05	BDL	BDL	0.03	BDL	0.27	BDL	0.04	BDL
Toluene	0.02	0.03	0.04	0.08	0.06	0.06	0.17	0.03	0.04	0.07	0.12	0.17	0.17	0.03	0.02	BDL	0.06
Ethylbenzene	0.01	BDL	0.02	0.07	0.09	0.02	0.10	0.02	BDL	BDL	0.03	0.09	0.02	0.03	0.04	BDL	0.04
m,p-Xylene	0.01	0.06	0.09	0.24	0.29	0.07	0.23	0.09	0.03	0.05	0.09	0.29	0.07	0.07	0.14	0.06	0.12
o-Xylene	0.01	0.04	0.09	0.10	0.14	0.04	0.15	0.05	0.03	0.04	0.05	0.14	0.04	0.04	0.08	0.05	0.07
Undecane, tridecane & pentadecane	NA	15.71	12.87	0.40	0.38	0.36	1.34	8.28	15.95	5.15	0.39	0.30	0.34	0.63	1.03	2.55	0.32
Undecane	0.02	15.24	12.50	0.28	0.23	0.18	0.68	7.10	15.59	5.02	0.11	0.13	0.12	0.25	0.51	2.31	0.08
Tridecane	0.01	0.32	0.27	0.09	0.09	0.09	0.40	1.03	0.27	0.08	0.25	0.11	0.08	0.21	0.17	0.13	0.19
Pentadecane	0.02	0.15	0.10	0.03	0.06	0.08	0.26	0.16	0.09	0.05	0.03	0.07	0.14	0.17	0.35	0.11	0.05
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.33	4.66	0.50	0.65	0.47	1.17	0.28	0.14	1.67	0.31	0.50	0.34	0.24	0.28	0.18	0.24
1,2,4-Trimethylbenzene	0.02	0.20	3.78	0.29	0.39	0.24	0.85	0.21	0.10	0.33	0.22	0.38	0.25	0.15	0.21	0.14	0.14
1,3,5-Trimethylbenzene	0.03	0.13	0.89	0.21	0.26	0.23	0.32	0.07	0.04	1.35	0.09	0.12	0.09	0.09	0.06	0.05	0.09
Naphthalene and 2-Methylnaphthalene	NA	0.42	0.55	0.26	0.32	0.34	0.74	0.68	0.47	0.63	0.29	0.45	0.42	0.19	0.25	0.19	0.13
Naphthalene	0.01	0.19	0.29	0.14	0.16	0.15	0.32	0.27	0.20	0.28	0.13	0.20	0.18	0.14	0.16	0.13	0.10
2-Methylnaphthalene	0.02	0.23	0.26	0.12	0.17	0.19	0.42	0.41	0.28	0.34	0.16	0.26	0.24	0.06	0.09	0.06	0.03
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	BDL
Octane	0.02	0.07	ND	0.18	0.06	0.04	1.15	BDL	0.07	ND	0.02	0.03	BDL	0.22	0.05	0.08	0.14
Isopentane	0.02	0.44	0.33	0.72	1.08	1.76	-	0.14	0.15	0.08	0.10	0.33	0.33	-	0.09	0.15	0.04

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C3	C3	C3	C3A	C3A	C3A	C3A	C3A	C3A	C3A	C4	C4	C4	C4	C4	C4
Approximate depth below sewer manhole rim (ft)		7	6	6	5	2	2	2	2	2	2	4	4	4	4	4	4
Gore-Sorber® Module Installation Date		3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/04	2/23/05	3/9/05	3/21/05
Gore-Sorber® Module Retrieval Date		3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/04	3/9/05	3/21/05	4/4/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	36.84	16.52	18.29	48.88	16.41	40.60	19.62	18.79	23.76	18.72	86.58	27.35	47.61	22.92	27.49	66.66
BTEX	NA	0.63	0.19	0.27	0.56	0.30	0.24	0.18	0.23	0.21	0.22	0.60	0.13	0.32	0.13	0.47	1.01
Benzene	0.03	0.15	BDL	BDL	0.23	0.04	0.18	0.04	0.06	0.08	0.11	0.37	0.04	0.18	0.03	0.08	0.22
Toluene	0.02	0.28	0.05	0.07	0.03	0.03	BDL	BDL	0.03	0.04	0.02	0.04	0.02	0.04	0.04	0.28	0.62
Ethylbenzene	0.01	0.03	0.02	0.03	0.05	0.04	BDL	BDL	0.02	BDL	BDL	0.04	BDL	BDL	BDL	BDL	0.02
m,p-Xylene	0.01	0.09	0.07	0.10	16.00	0.12	0.04	0.07	0.07	0.06	0.05	0.09	0.03	0.06	0.03	0.05	0.07
o-Xylene	0.01	0.08	0.05	0.07	0.10	0.08	0.03	0.07	0.05	0.04	0.04	0.05	0.03	0.04	0.03	0.06	0.08
Undecane, tridecane & pentadecane	NA	7.76	0.86	0.38	0.21	0.10	0.16	0.17	0.09	0.13	0.14	0.38	0.86	0.17	0.20	2.45	0.21
Undecane	0.02	0.13	0.07	0.12	0.09	0.03	0.10	0.14	0.03	0.06	0.06	0.15	0.05	0.06	0.05	0.14	0.06
Tridecane	0.01	7.56	0.73	0.19	0.06	0.04	0.03	0.03	0.03	0.04	0.05	0.11	0.23	0.05	0.09	2.29	0.10
Pentadecane	0.02	0.07	0.06	0.07	0.06	0.03	0.03	BDL	0.02	0.03	0.03	0.12	0.58	0.06	0.06	0.02	0.05
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.60	0.23	0.19	0.37	0.17	0.09	0.37	0.12	0.12	0.13	0.24	0.13	0.11	0.09	0.40	0.26
1,2,4-Trimethylbenzene	0.02	0.36	0.14	0.14	0.24	0.12	0.04	0.15	0.08	0.08	0.08	0.16	0.09	0.04	0.04	0.24	0.17
1,3,5-Trimethylbenzene	0.03	0.24	0.09	0.06	0.14	0.06	0.06	0.23	0.04	0.04	0.04	0.08	0.04	0.07	0.06	0.16	0.09
Naphthalene and 2-Methylnaphthalene	NA	0.14	0.14	0.15	0.11	0.03	0.00	0.00	0.00	0.04	0.07	0.20	0.20	0.13	0.11	0.12	0.15
Naphthalene	0.01	0.10	0.10	0.11	0.07	0.03	BDL	BDL	BDL	0.04	0.04	0.15	0.11	0.08	0.11	0.12	0.12
2-Methylnaphthalene	0.02	0.03	0.04	0.04	0.04	BDL	BDL	BDL	BDL	BDL	0.02	0.05	0.09	0.04	BDL	BDL	0.03
Methyl tertiary-butyl ether	0.04	ND	BDL	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND	ND	BDL	ND	ND
Octane	0.02	0.09	0.06	0.07	0.13	0.06	0.09	0.05	0.06	0.04	0.05	0.51	0.06	0.41	0.12	0.07	0.15
Isopentane	0.02	0.16	0.12	0.14	-	0.69	1.94	0.64	0.67	0.70	0.39	-	0.63	0.53	0.35	0.29	0.64

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they
are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C4	C4A	C4A	C4A	C4A	C4A	C4A	C4A	C6	C6	C6	C6	C6	C6	C6	C6A
Approximate depth below sewer manhole rim (ft)		4	2	2	3	3	3	3	3	4	3	3	3	3	2	4	2
Gore-Sorber® Module Installation Date		4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05
Gore-Sorber® Module Retrieval Date		4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	29.23	95.14	56.26	47.73	18.68	40.86	13.96	11.97	74.43	96.92	53.70	22.50	15.75	23.46	19.56	89.52
BTEX	NA	0.17	0.40	0.42	0.26	0.46	1.21	0.36	0.21	1.11	0.14	0.52	0.15	0.28	0.17	0.07	0.47
Benzene	0.03	BDL	0.05	0.04	0.04	BDL	0.26	BDL	BDL	0.81	0.06	0.38	0.04	BDL	0.04	BDL	0.28
Toluene	0.02	0.10	0.05	0.04	0.02	0.06	0.32	0.05	0.03	0.03	BDL	BDL	BDL	0.03	BDL	BDL	0.03
Ethylbenzene	0.01	BDL	0.05	0.06	0.03	0.07	0.11	0.05	0.03	0.07	BDL	0.03	BDL	0.04	BDL	BDL	0.05
m,p-Xylene	0.01	0.03	0.18	0.19	0.11	0.23	0.36	0.17	0.10	0.12	0.04	0.07	0.06	0.14	0.07	0.03	0.07
o-Xylene	0.01	0.03	0.08	0.09	0.06	0.10	0.16	0.08	0.05	0.07	0.03	0.05	0.04	0.08	0.06	0.04	0.05
Undecane, tridecane & pentadecane	NA	0.42	0.71	0.84	0.24	0.21	0.54	0.23	0.91	0.28	15.06	0.15	0.10	0.16	0.31	0.05	0.31
Undecane	0.02	0.08	0.52	0.68	0.12	0.10	0.25	0.10	0.15	0.08	8.33	0.05	0.04	0.05	0.05	0.03	0.12
Tridecane	0.01	0.27	0.09	0.07	0.08	0.06	0.24	0.07	0.70	0.07	5.93	0.05	0.03	0.04	0.24	0.02	0.09
Pentadecane	0.02	0.07	0.10	0.09	0.04	0.05	0.05	0.06	0.06	0.13	0.80	0.05	0.04	0.07	0.03	BDL	0.11
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.12	0.47	0.34	0.28	0.37	0.47	0.40	0.24	0.48	0.80	0.19	0.14	0.23	0.35	0.10	0.39
1,2,4-Trimethylbenzene	0.02	0.08	0.36	0.28	0.22	0.26	0.31	0.26	0.17	0.30	0.61	0.08	0.09	0.16	0.23	0.06	0.26
1,3,5-Trimethylbenzene	0.03	0.04	0.11	0.07	0.06	0.11	0.16	0.15	0.08	0.18	0.20	0.12	0.04	0.07	0.13	0.04	0.12
Naphthalene and 2-Methylnaphthalene	NA	0.07	0.24	0.16	0.13	0.18	0.17	0.14	0.14	0.19	1.45	0.06	0.08	0.09	0.10	0.04	0.22
Naphthalene	0.01	0.07	0.16	0.10	0.09	0.12	0.11	0.09	0.09	0.10	0.47	0.04	0.05	0.06	0.07	0.04	0.14
2-Methylnaphthalene	0.02	BDL	0.08	0.06	0.04	0.05	0.05	0.05	0.05	0.09	0.99	0.02	0.03	0.02	0.03	BDL	0.07
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	0.03	0.21	0.13	0.12	0.13	0.17	0.24	0.12	0.40	0.05	0.30	0.10	0.07	0.08	0.03	0.35
Isopentane	0.02	0.43	-	1.08	0.77	0.19	0.49	0.13	0.07	-	1.22	1.44	0.57	0.39	0.41	0.31	-

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C6A	C6A	C6A	C6A	C6A	C6A	C6B	C6B	C6B	C6B	C6B	C6B	C6B	C7	C7	C7
Approximate depth below sewer manhole rim (ft)		2.5	2	2	2	2	2	2.5	2.5	4	1	1	2	2	3	2	3
Gore-Sorber® Module Installation Date		1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05
Gore-Sorber® Module Retrieval Date		2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05
Compound	MDL																
Total Petroleum Hydrocarbons	NA	31.78	88.99	28.51	82.31	30.41	36.03	31.43	5.80	31.84	10.54	3.52	21.63	10.17	92.06	80.53	69.47
BTEX	NA	0.16	0.31	0.26	0.92	0.18	0.16	0.48	0.29	0.29	0.70	0.48	0.53	0.83	0.87	0.38	0.53
Benzene	0.03	BDL	0.17	0.03	0.25	BDL	BDL	0.05	BDL	BDL	0.22	BDL	BDL	0.04	0.53	0.05	0.32
Toluene	0.02	0.03	0.03	0.10	0.39	0.03	0.03	0.03	0.03	0.03	0.13	0.04	0.04	0.05	0.04	0.03	0.03
Ethylbenzene	0.01	0.02	0.02	0.02	0.05	BDL	BDL	0.07	0.04	0.04	0.06	0.07	0.08	0.11	0.07	0.06	0.04
m,p-Xylene	0.01	0.07	0.04	0.06	0.15	0.08	0.06	0.21	0.14	0.14	0.02	0.25	0.28	0.42	0.15	0.15	0.10
o-Xylene	0.01	0.05	0.04	0.05	0.09	0.07	0.07	0.12	0.08	0.08	0.09	0.12	0.14	0.22	0.07	0.10	0.05
Undecane, tridecane & pentadecane	NA	0.26	0.22	0.21	0.19	0.23	0.19	0.10	0.03	0.06	0.11	0.08	0.11	0.10	1.27	16.11	1.88
Undecane	0.02	0.10	0.07	0.08	0.09	0.14	0.08	0.04	0.03	0.04	0.05	0.05	0.07	0.06	0.20	10.76	0.62
Tridecane	0.01	0.07	0.06	0.06	0.06	0.08	0.07	0.02	BDL	0.02	0.03	0.03	0.03	0.02	0.25	4.57	0.87
Pentadecane	0.02	0.09	0.09	0.07	0.04	0.04	0.04	0.03	BDL	BDL	0.03	BDL	BDL	0.02	0.83	0.78	0.40
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.26	0.29	0.13	0.23	0.55	0.20	0.37	0.16	0.19	0.19	0.34	0.41	0.65	0.63	2.36	0.36
1,2,4-Trimethylbenzene	0.02	0.18	0.20	0.04	0.16	0.33	0.11	0.25	0.12	0.06	0.13	0.20	0.26	0.46	0.44	1.89	0.27
1,3,5-Trimethylbenzene	0.03	0.08	0.10	0.09	0.07	0.22	0.09	0.12	0.04	0.14	0.06	0.14	0.15	0.19	0.19	0.47	0.09
Naphthalene and 2-Methylnaphthalene	NA	0.13	0.41	0.12	0.32	0.16	0.14	0.08	0.00	0.04	0.05	0.07	0.09	0.14	0.36	1.77	0.19
Naphthalene	0.01	0.09	0.37	0.10	0.28	0.12	0.10	0.05	BDL	0.04	0.05	0.05	0.06	0.09	0.17	0.80	0.11
2-Methylnaphthalene	0.02	0.03	0.04	0.02	0.04	0.04	0.04	0.03	BDL	BDL	BDL	0.02	0.03	0.04	0.19	0.97	0.08
Methyl tertiary-butyl ether	0.04	ND	ND	ND	ND	ND	ND	BDL	ND	ND	ND	ND	BDL	ND	BDL	ND	ND
Octane	0.02	0.07	0.31	0.06	0.08	0.04	0.06	0.19	0.04	0.30	0.07	0.07	0.11	0.08	0.32	0.08	0.32
Isopentane	0.02	0.70	0.80	0.35	0.82	0.25	0.42	-	0.09	0.24	0.21	0.03	0.14	0.07	-	0.59	1.29

NOTES:

Compound results reported in micrograms (µg) per sorber

MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds

TABLE J-1
LABORATORY ANALYTICAL RESULTS - PASSIVE SEWER VAPOR SAMPLES

Hartford Working Group
Hartford, Illinois

Sewer Manhole Label		C7	C7	C7	C7	C7A	C7A	C7A	C7A	C7A	C7A	C7A
Approximate depth below sewer manhole rim (ft)		3	3	3	3	2	2	2	2	2	2	2
Gore-Sorber® Module Installation Date		2/23/05	3/9/05	3/21/05	4/4/05	1/13/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05
Gore-Sorber® Module Retrieval Date		3/9/05	3/21/05	4/4/05	4/19/05	1/26/05	2/10/05	2/23/05	3/9/05	3/21/05	4/4/05	4/19/05
Compound	MDL											
Total Petroleum Hydrocarbons	NA	21.45	26.52	36.98	37.51	243.02	35.57	50.32	23.03	90.47	25.04	24.54
BTEX	NA	0.48	0.86	0.48	0.24	0.44	0.10	0.07	0.00	0.23	0.14	0.06
Benzene	0.03	0.05	0.06	0.05	0.04	0.19	BDL	0.04	BDL	0.13	0.06	BDL
Toluene	0.02	0.03	0.08	0.03	0.03	0.12	BDL	BDL	ND	0.05	BDL	BDL
Ethylbenzene	0.01	0.07	0.12	0.07	0.03	0.02	BDL	BDL	BDL	BDL	BDL	BDL
m,p-Xylene	0.01	0.24	0.42	0.22	0.09	0.06	0.06	0.03	BDL	0.02	0.05	0.04
o-Xylene	0.01	0.10	0.18	0.10	0.05	0.05	0.04	BDL	BDL	0.03	0.03	0.02
Undecane, tridecane & pentadecane	NA	0.30	0.35	0.32	0.26	0.34	0.12	0.02	0.00	0.02	0.02	0.00
Undecane	0.02	0.12	0.12	0.13	0.12	0.22	0.02	BDL	BDL	0.02	BDL	BDL
Tridecane	0.01	0.06	0.09	0.11	0.06	0.07	0.04	BDL	BDL	BDL	BDL	BDL
Pentadecane	0.02	0.12	0.14	0.08	0.08	0.04	0.06	0.02	BDL	BDL	0.02	BDL
1,3,5-Trimethylbenzene & 1,2,4-Trimethylbenzene	NA	0.40	0.56	0.63	0.25	0.17	0.23	0.09	0.00	0.02	0.17	0.17
1,2,4-Trimethylbenzene	0.02	0.26	0.36	0.44	0.18	0.10	0.14	0.03	BDL	0.02	0.13	0.12
1,3,5-Trimethylbenzene	0.03	0.13	0.19	0.19	0.07	0.07	0.09	0.06	BDL	BDL	0.05	0.05
Naphthalene and 2-Methylnaphthalene	NA	0.18	0.17	0.19	0.16	0.00	0.11	0.03	0.00	0.00	0.02	0.06
Naphthalene	0.01	0.13	0.11	0.13	0.11	BDL	0.05	BDL	ND	ND	BDL	0.04
2-Methylnaphthalene	0.02	0.06	0.05	0.06	0.05	BDL	0.06	0.03	BDL	BDL	0.02	0.02
Methyl tertiary-butyl ether	0.04	ND	ND	BDL	ND	ND	ND	ND	ND	ND	ND	ND
Octane	0.02	0.16	0.18	0.09	0.04	0.21	0.03	0.35	BDL	0.13	0.17	BDL
Isopentane	0.02	0.46	1.23	1.73	1.57	-	1.57	1.74	0.68	2.60	0.68	0.96

NOTES:

Compound results reported in micrograms (µg) per sorber

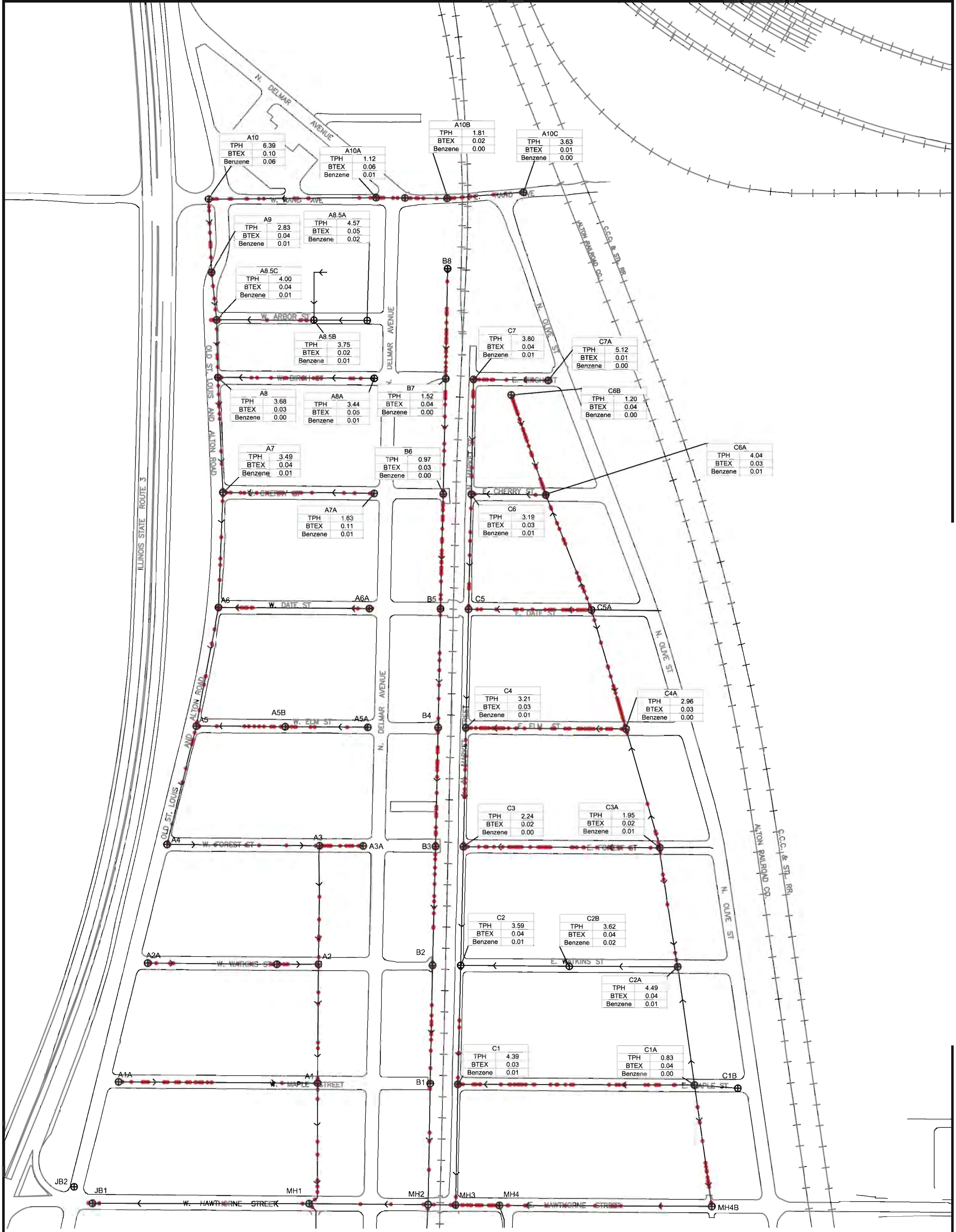
MDL - Method Detection Limit

BDL-below detection limit (Compound detected below the MDL

-cannot quantify with confidence)

ND-non detect

NA - No MDL is available for combinations of analytes as they are a summation of the individual compounds



LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

←— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)/DAY

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

FIGURE J-1

GORE-SORBER ANALYTICAL DATA
DAILY AVERAGE (12/01/04 - 4/19/05)
HARTFORD, ILLINOIS

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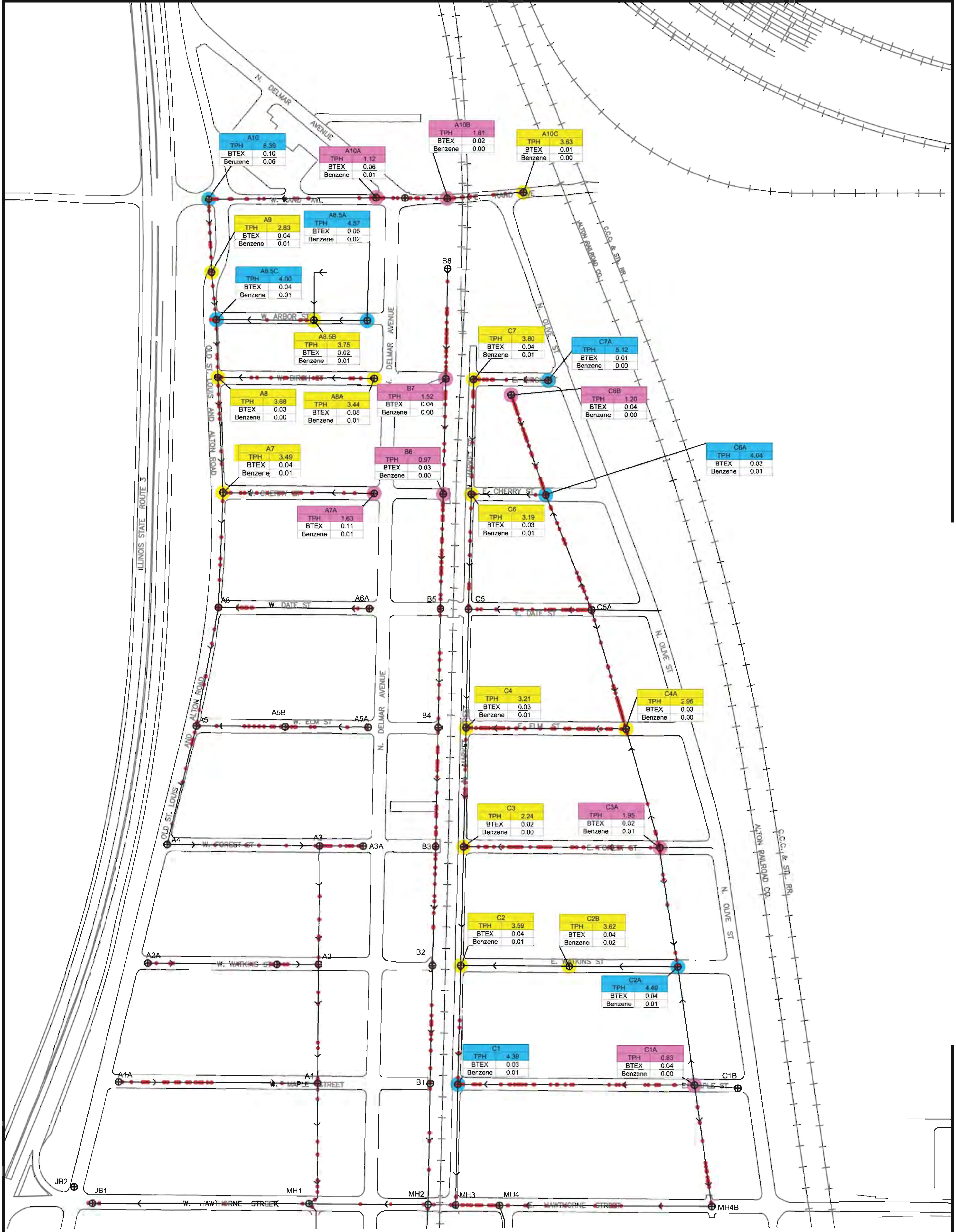

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

← SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)/DAY

🟦 TPH > 4 ug/day (Max. 6.39)

🟨 TPH > 2 and <4 ug/day

🟪 TPH <2 ug/day (Min. 0.83)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

FIGURE J-2

GORE-SORBER ANALYTICAL DATA
DAILY AVERAGE SORBED CONCENTRATIONS
(12/01/04 - 4/19/05)
HARTFORD, ILLINOIS

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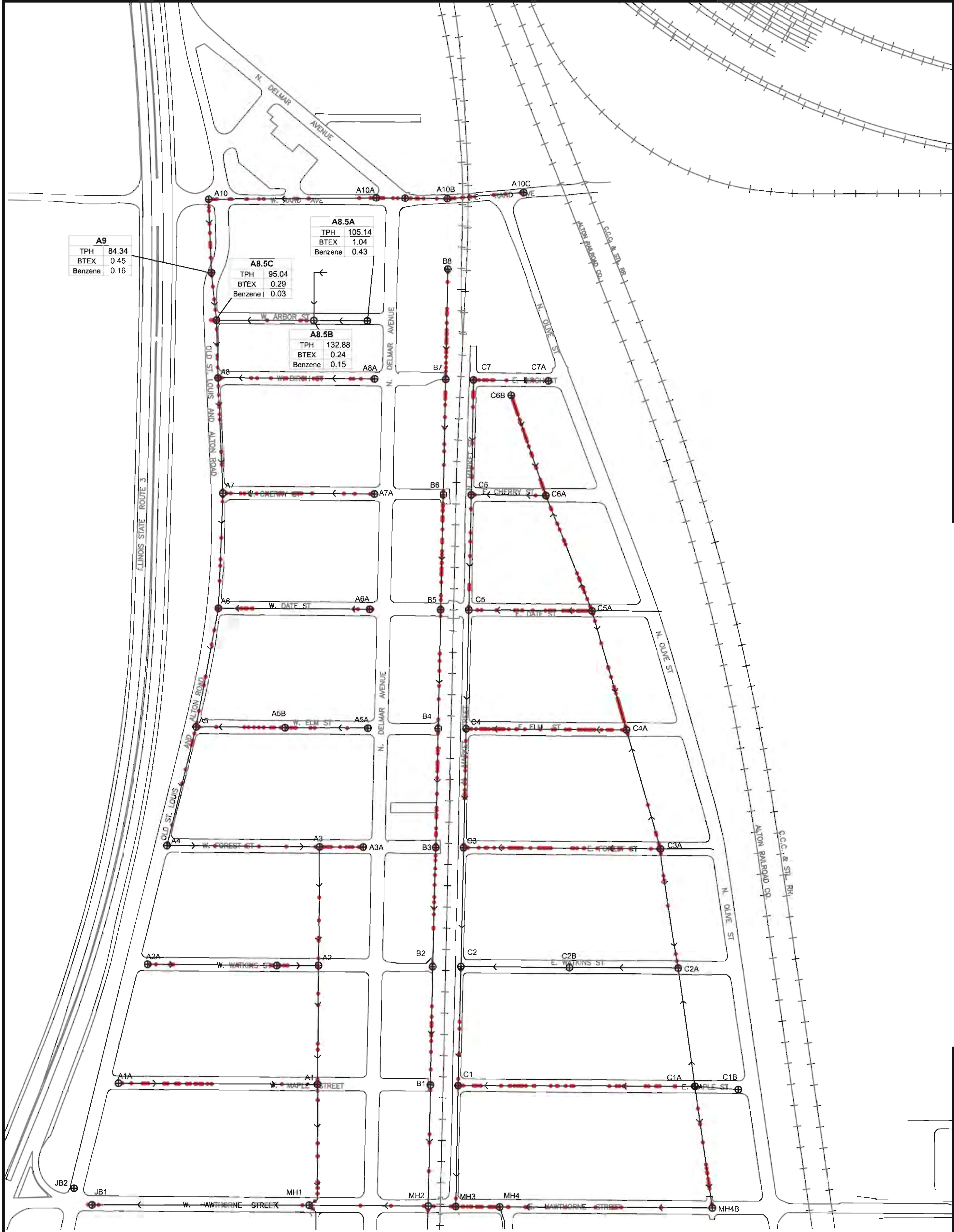

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

← SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH	TOTAL PETROLEUM HYDROCARBONS
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

FIGURE J-3

GORE-SORBER ANALYTICAL DATA
(12/1/04 - 12/30/2004)
HARTFORD, ILLINOIS

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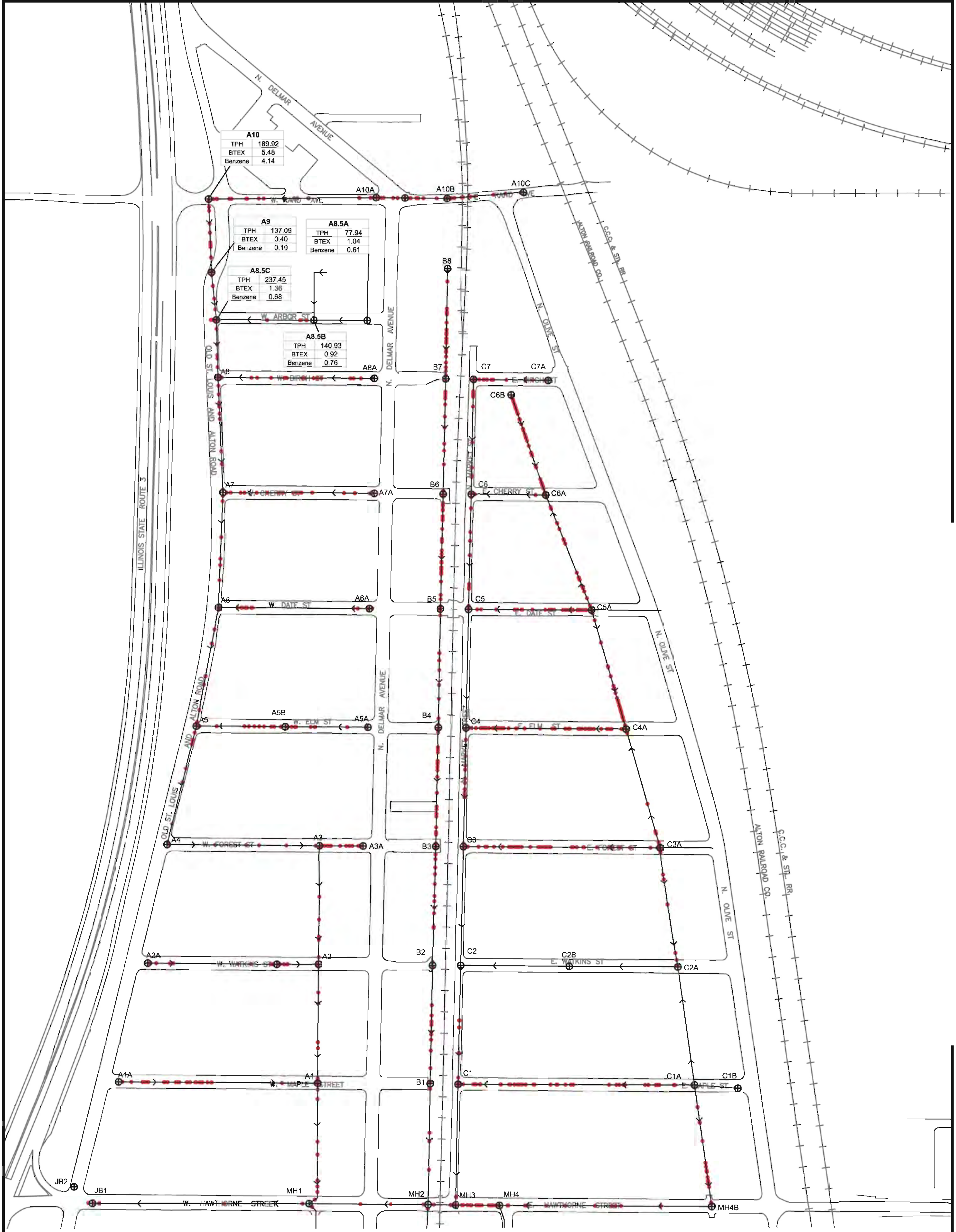

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

—<— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH	TOTAL PETROLEUM HYDROCARBONS
BTEX	BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

GORE-SORBER ANALYTICAL DATA
(12/30/04 - 1/13/2005)
HARTFORD, ILLINOIS

FIGURE J-4

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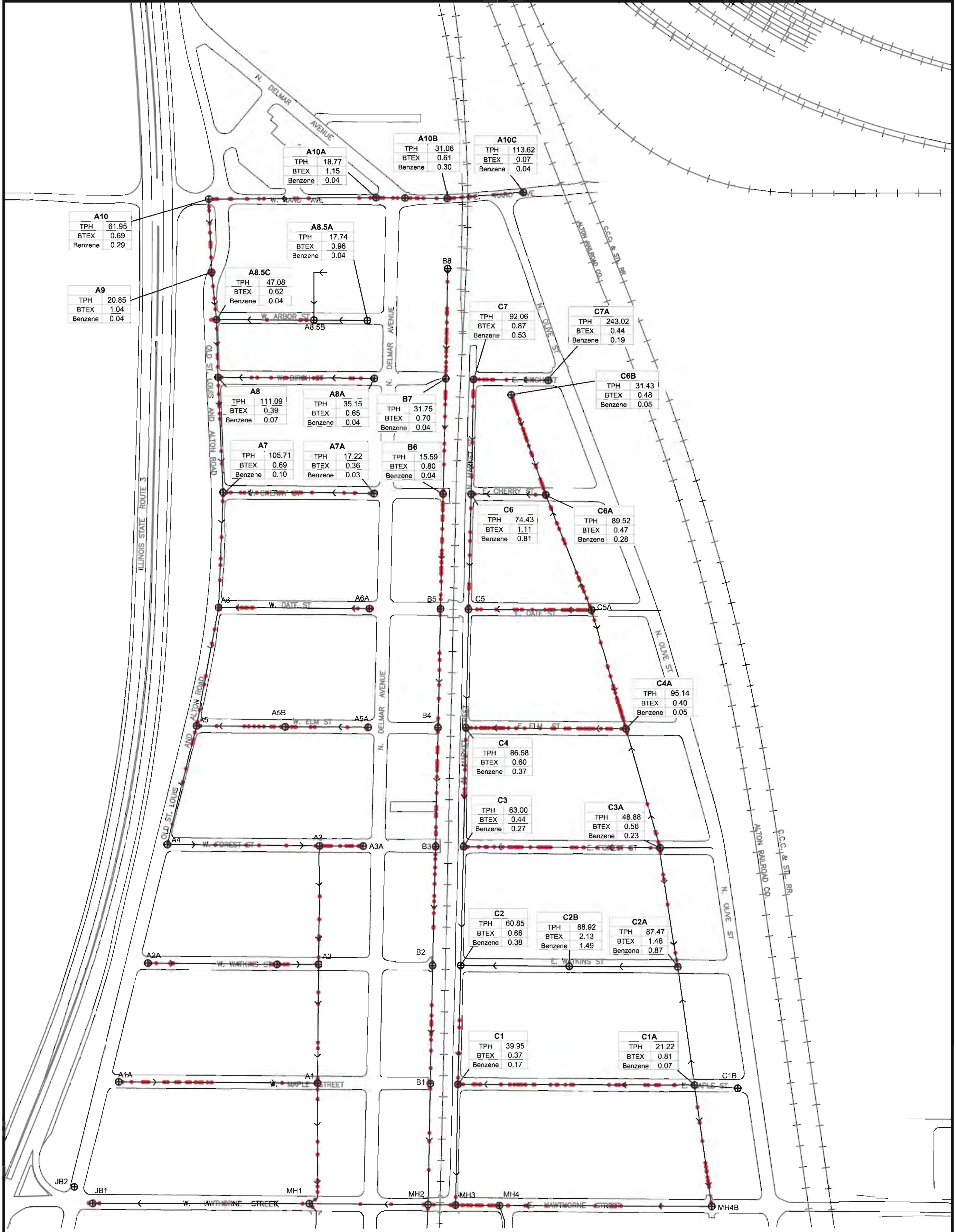

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

←— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

FIGURE J-5

GORE-SORBER ANALYTICAL DATA
(1/13/05 - 1/26/2005)
HARTFORD, ILLINOIS

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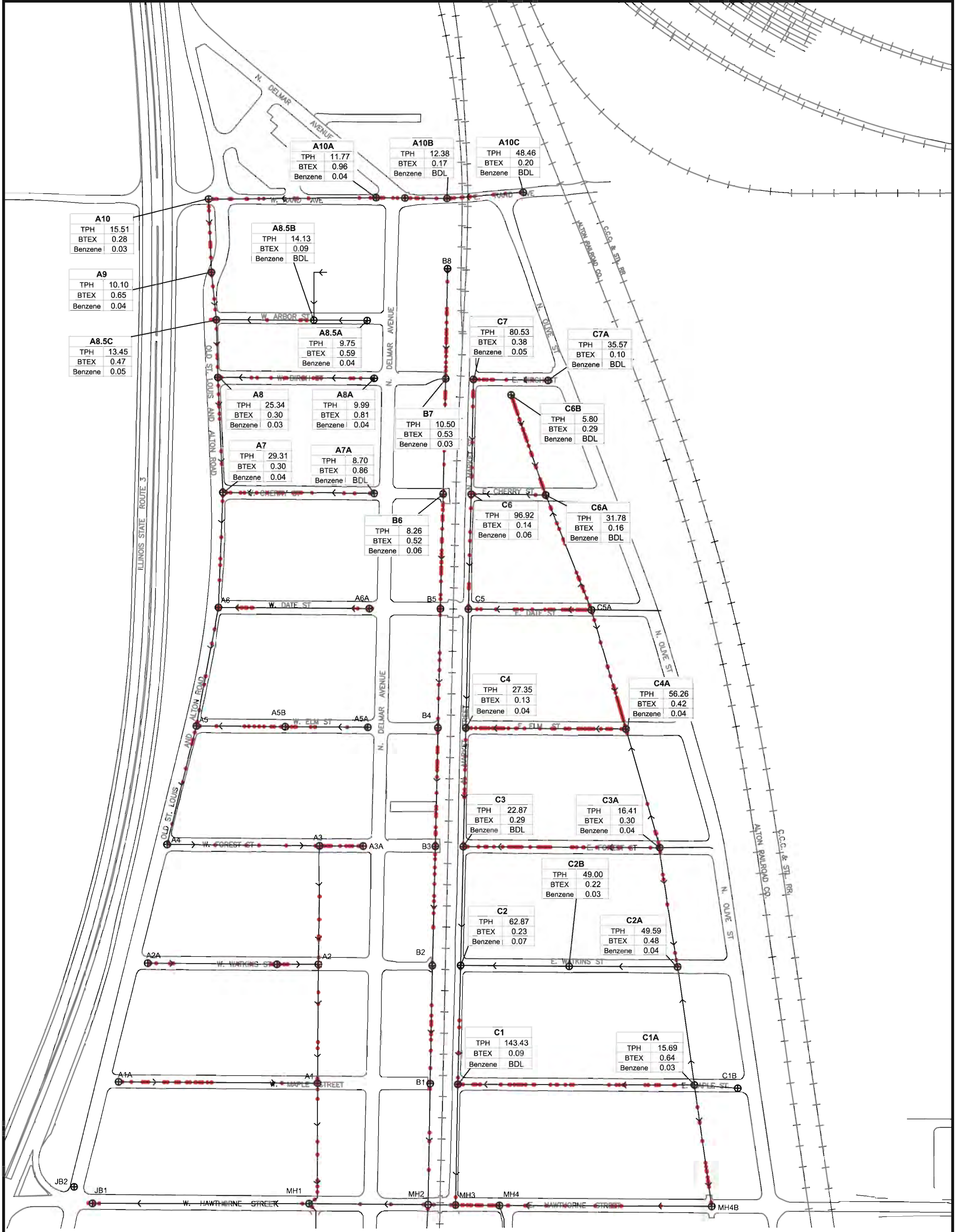

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

—<— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

GORE-SORBER ANALYTICAL DATA
(1/26/05 - 2/10/2005)
HARTFORD, ILLINOIS

FIGURE J-6

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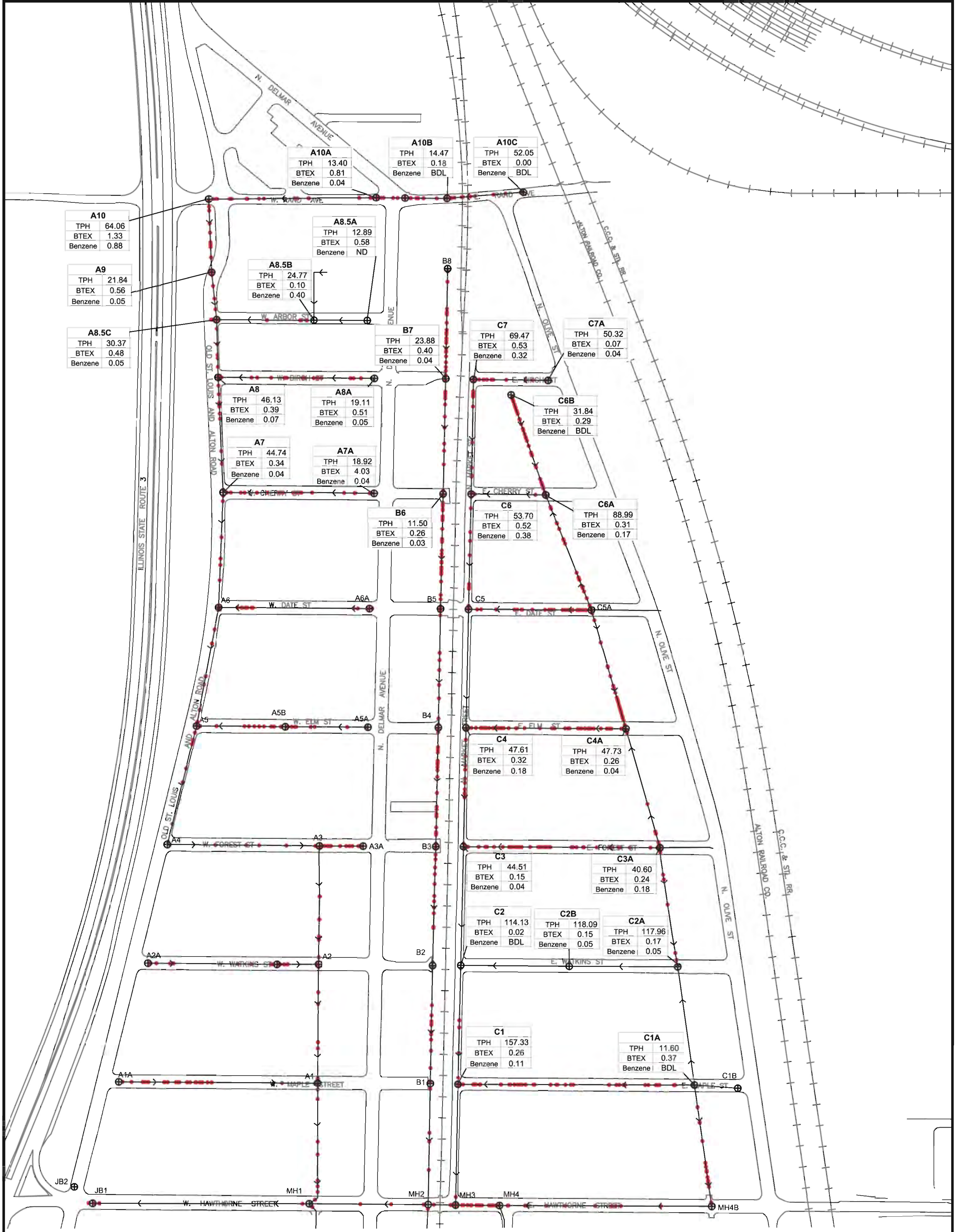

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

← SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

GORE-SORBER ANALYTICAL DATA
(2/10/05 - 2/23/2005)
HARTFORD, ILLINOIS

FIGURE J-7

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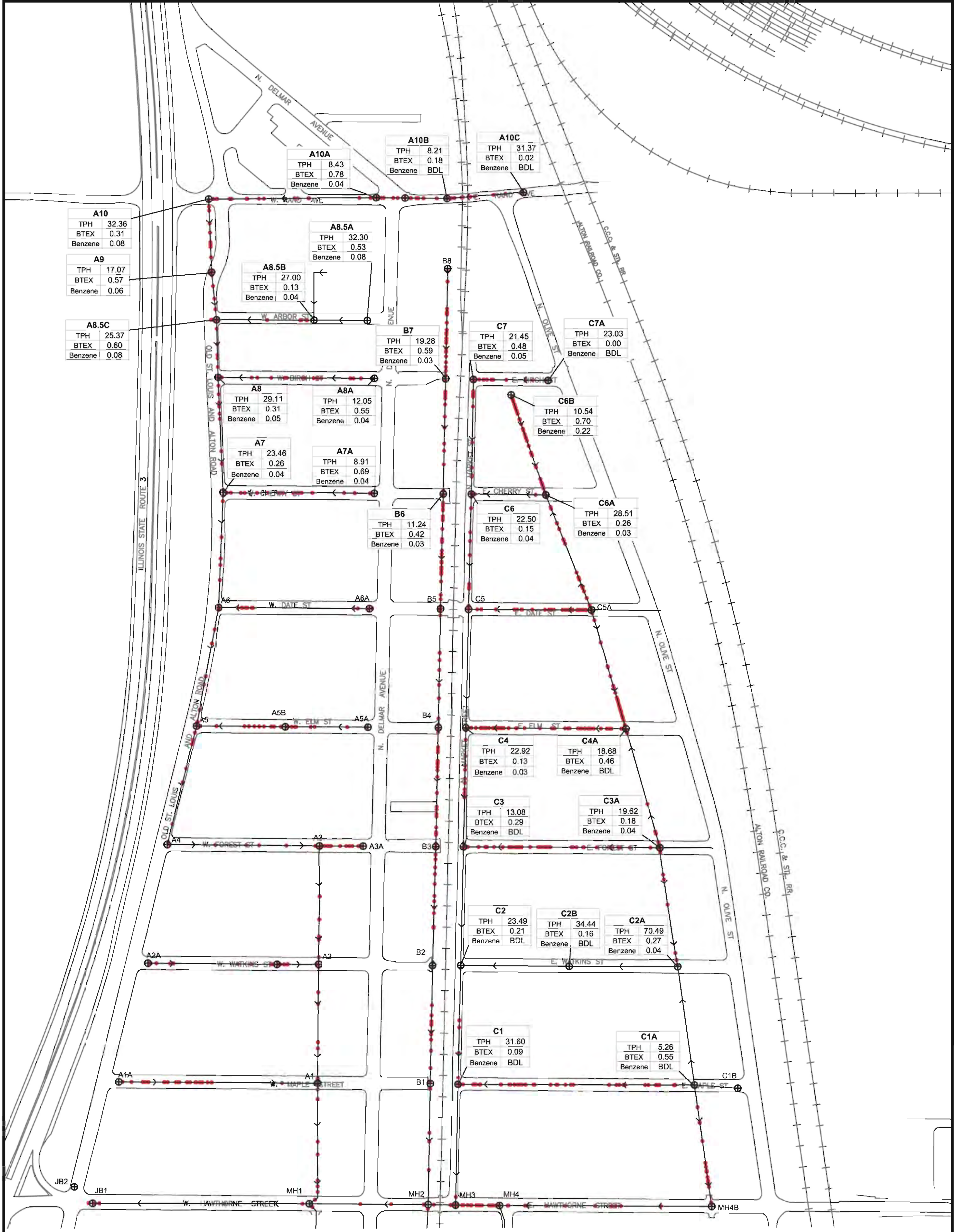

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

←— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

FIGURE J-8

GORE-SORBER ANALYTICAL DATA
(2/23/05 - 3/9/2005)
HARTFORD, ILLINOIS

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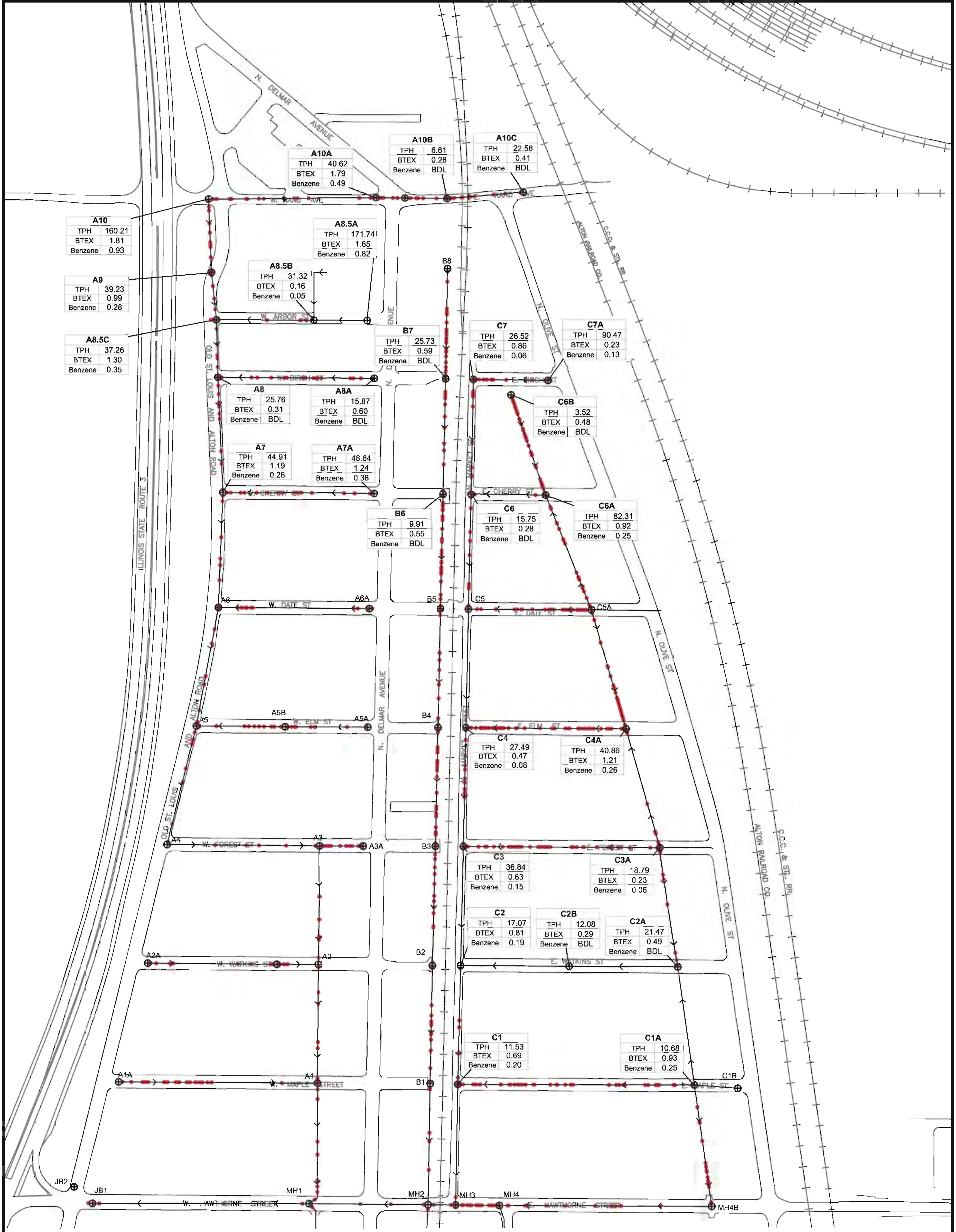

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

←— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

GORE-SORBER ANALYTICAL DATA
(3/9/05 - 3/21/2005)
HARTFORD, ILLINOIS

FIGURE J-9

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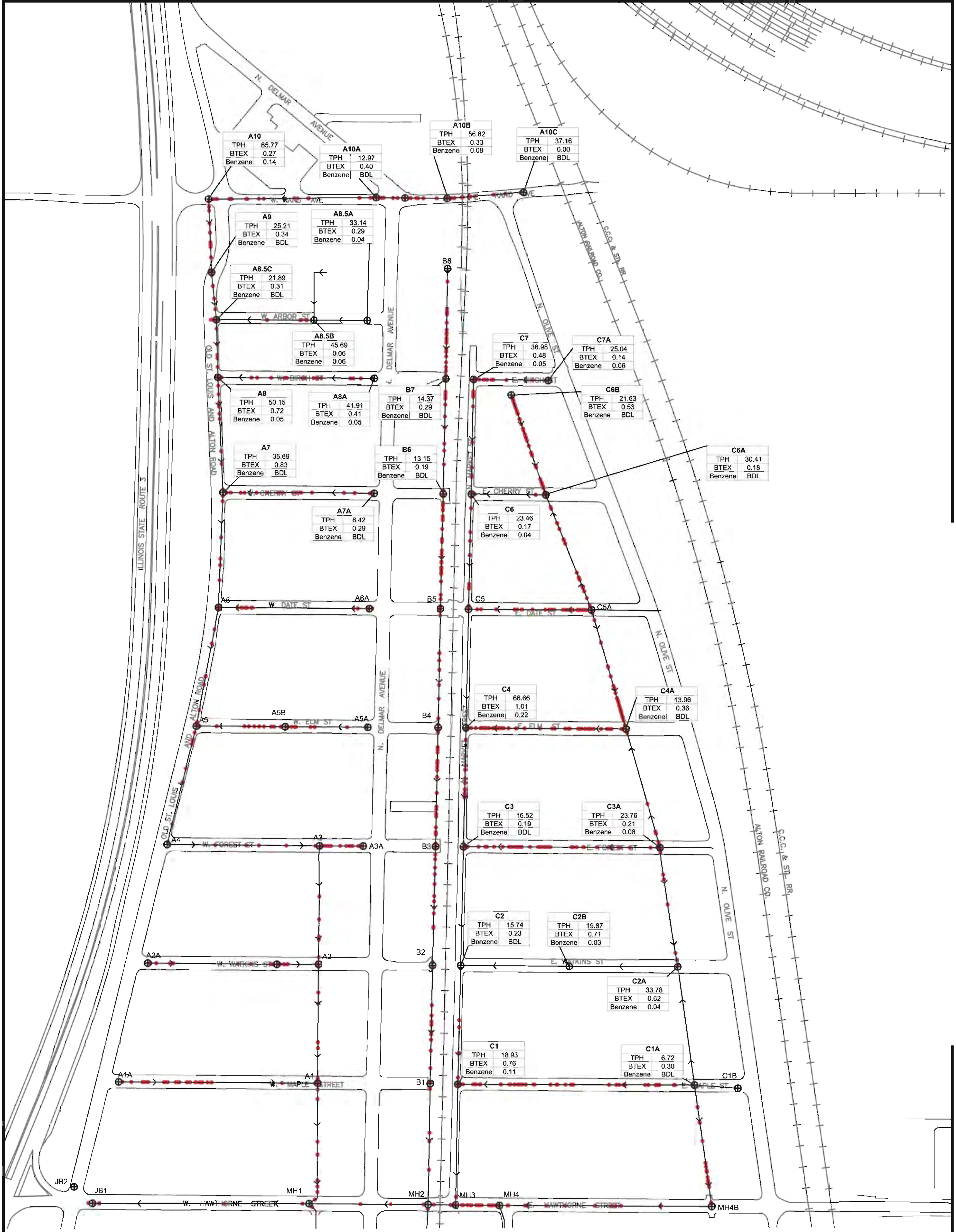

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

—<— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)/DAY

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

FIGURE J-10

GORE-SORBER ANALYTICAL DATA
(3/21/05 - 4/04/05)
HARTFORD, ILLINOIS

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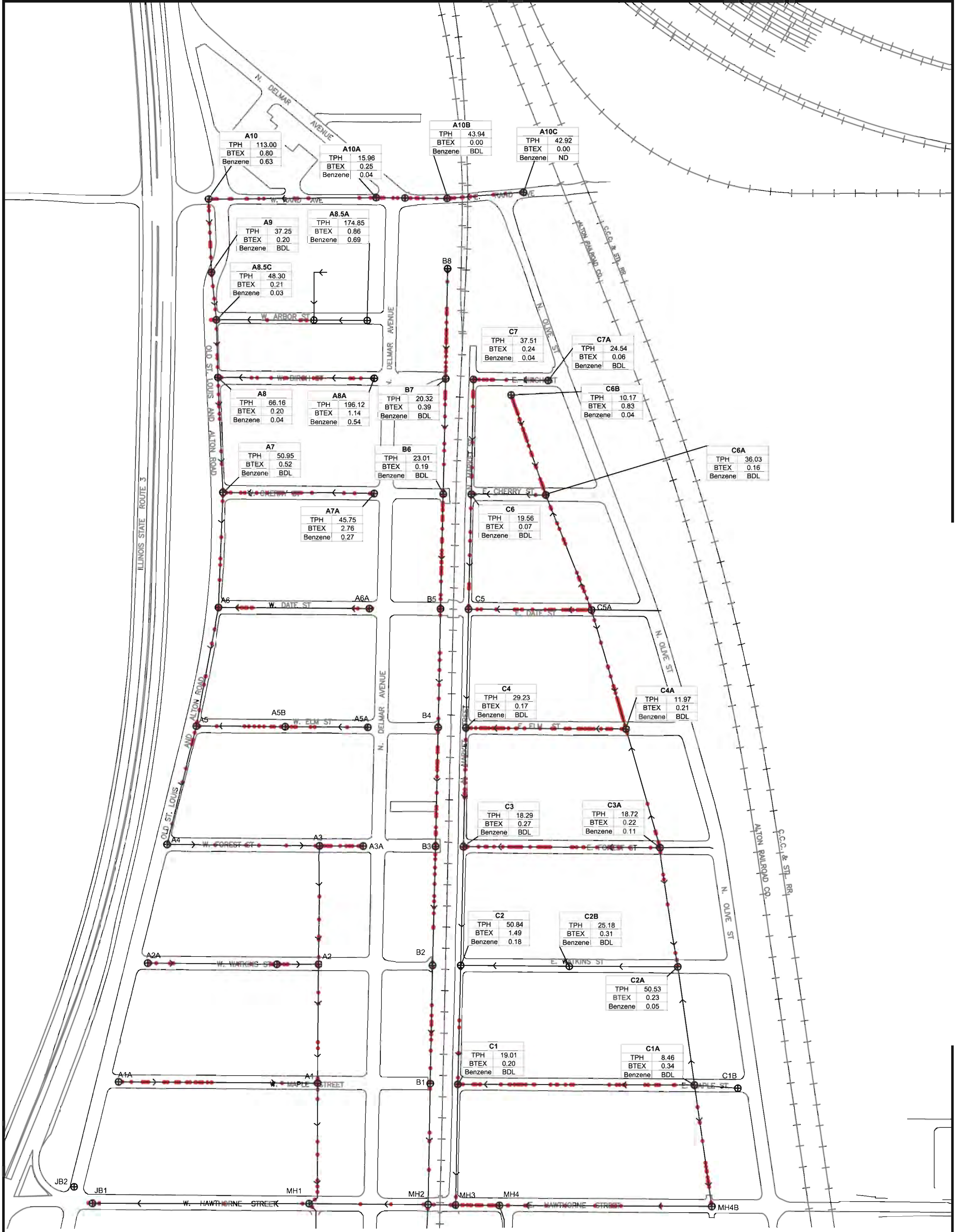

LEGEND:

⊕ VILLAGE SEWER MANHOLE LOCATION WITH ID LABEL

—<— SEWER ALIGNMENT SHOWING FLOW DIRECTION

TPH TOTAL PETROLEUM HYDROCARBONS

BTEX BENZENE, TOLUENE, ETHYLBENZENE, TOTAL XYLENE

ANALYTICAL VALUES IN MICROGRAMS (ug)/DAY

● OBSERVED SEWER PIPELINE INTEGRITY BREACH (e.g. BREAK, CRACK, HOLE, JOINT DISPLACEMENT, BLOCKAGE). ADAPTED FROM CLAYTON GROUP SERVICES. REVIEW AND COMMENTS ON VIDEO SURVEY OF SEWERS PERFORMED BY WALDEN ASSOCIATED TECHNOLOGIES, INC. (GLEN CARBON, IL) IN 2003.

PHYSICAL FEATURES ADAPTED FROM CLAYTON GROUP SERVICES GIS DATABASE

SCALE IN FEET

0 250 500

N

FIGURE J-11

GORE-SORBER ANALYTICAL DATA
(4/04/05 - 4/19/05)
HARTFORD, ILLINOIS

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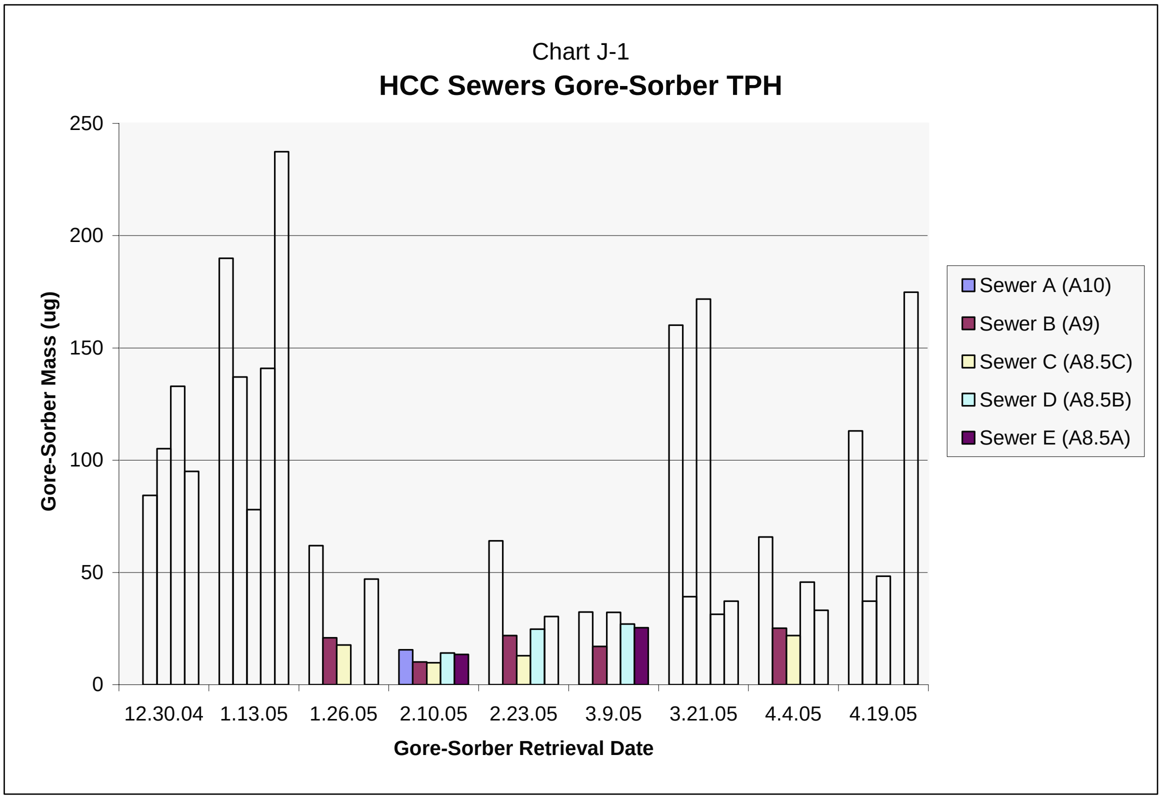


Chart J-1

HCC Sewers Gore-Sorber TPH

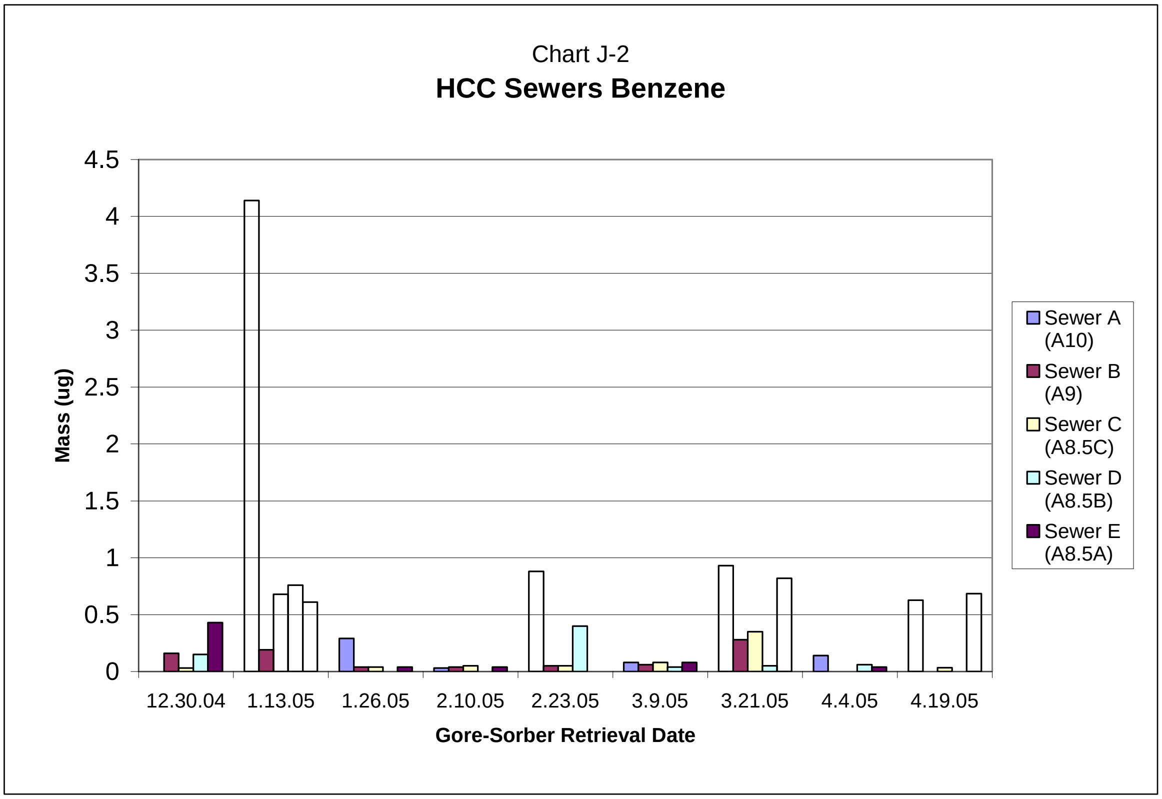


Chart J-2

HCC Sewers Benzene

Chart J-3

Sewer D (A8.5) LEL and Gore TPH vs. Time

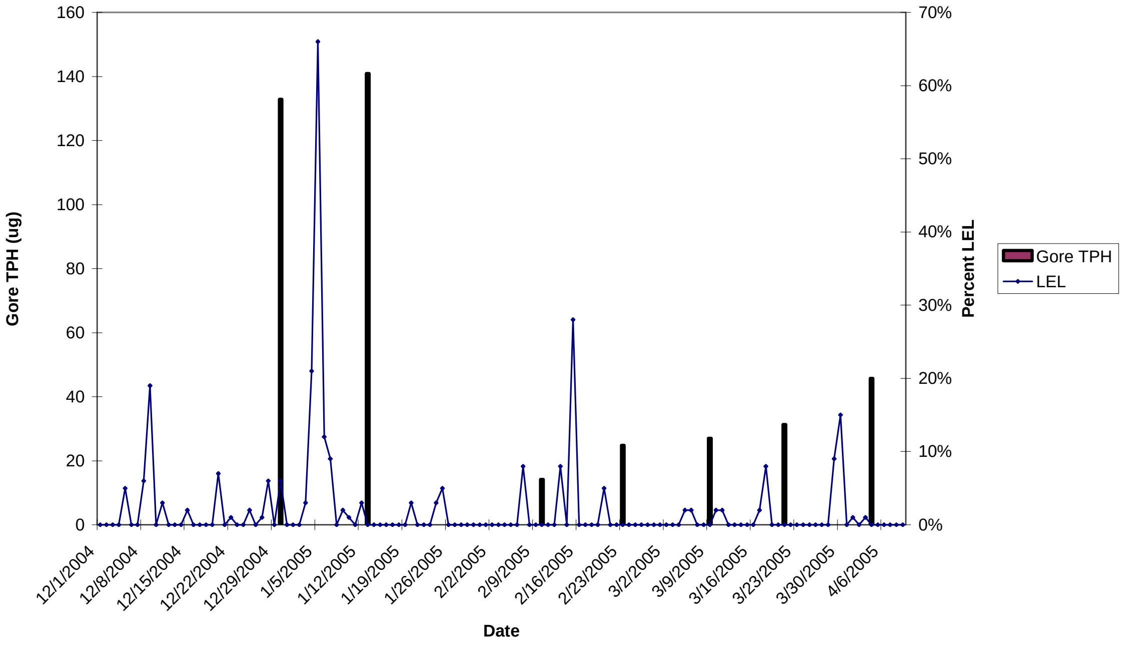


Chart J-4

Gore TPH Values in Old St. Louis Rd. and W. Arbor St. Sewers

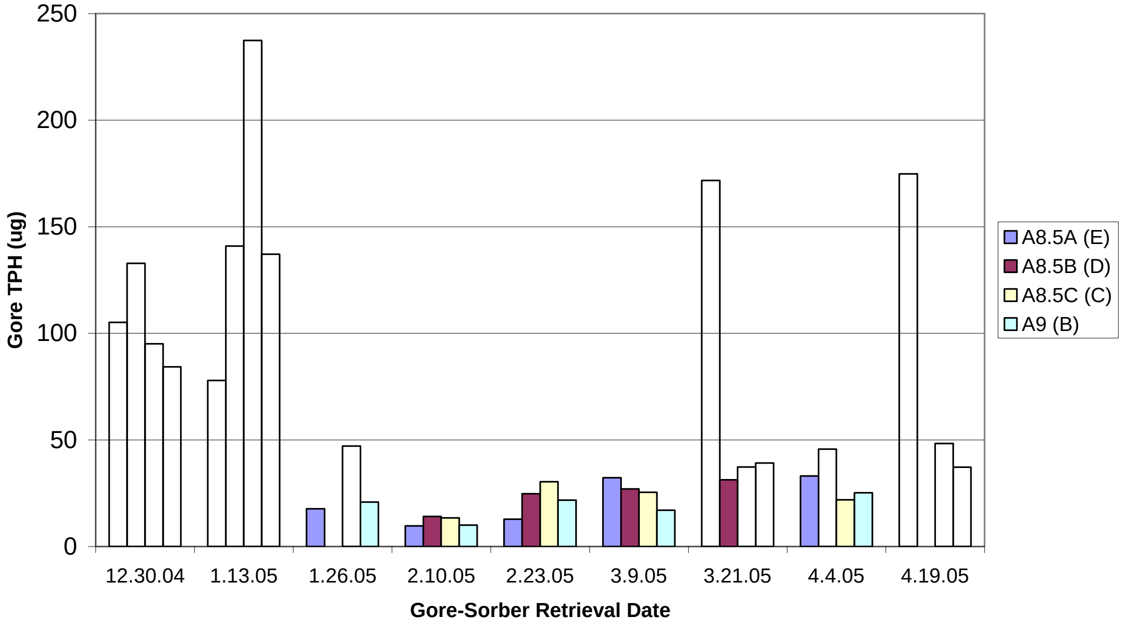


Chart J-5

Gore TPH Values in W. Birch and W. Cherry St. Sewers

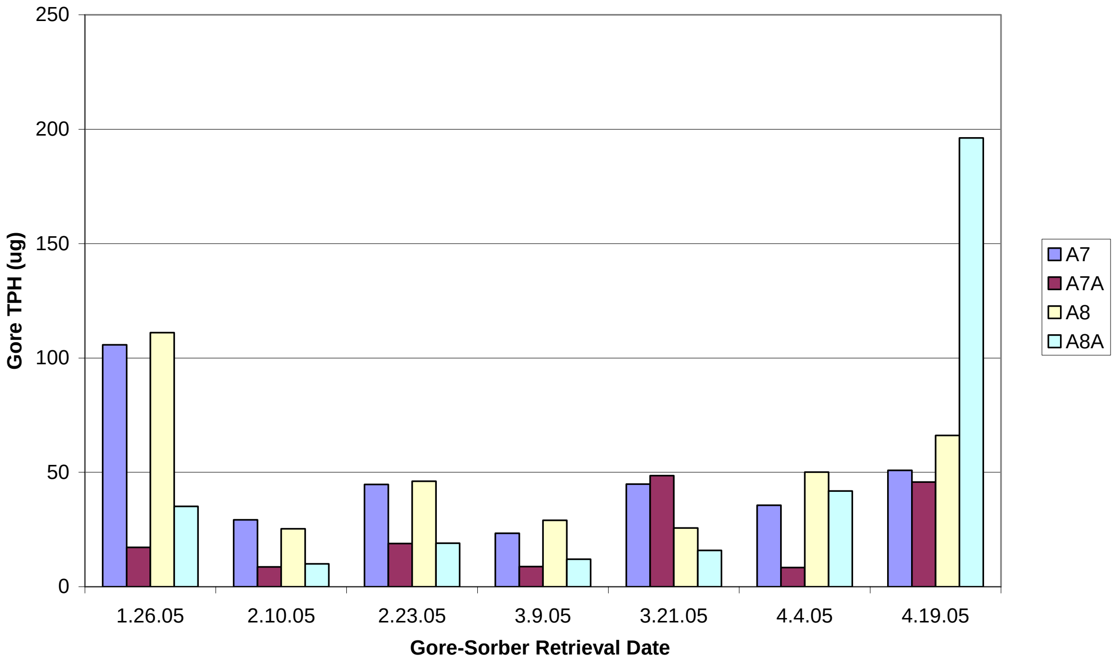


Chart J-6

Gore TPH Values in W. Rand Ave. Sewers

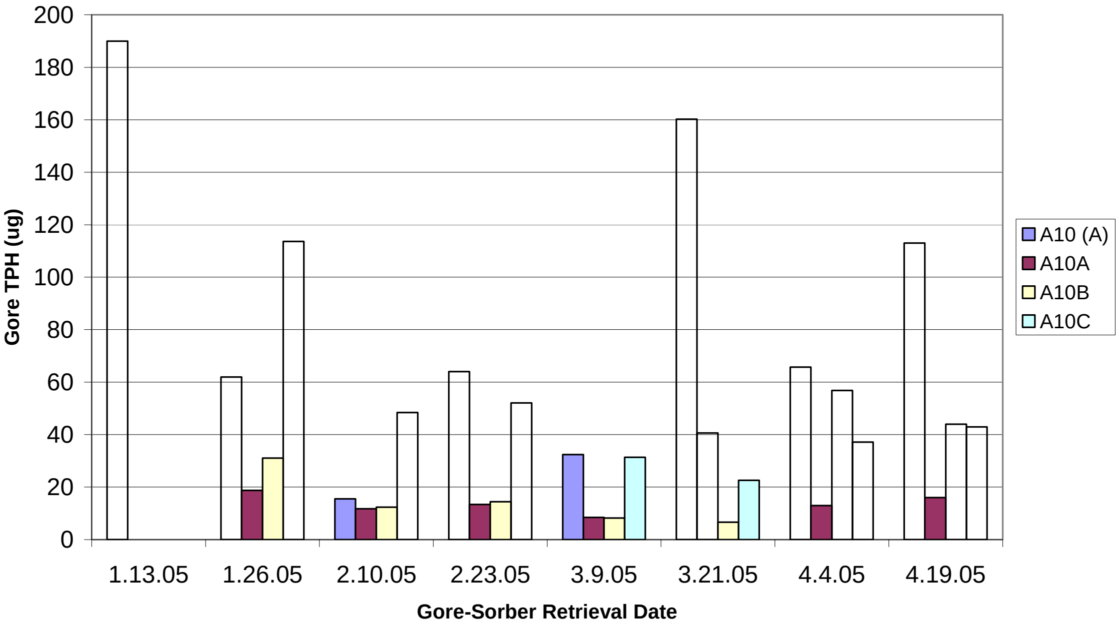


Chart J-7

Gore TPH Values in 'B' Sewers

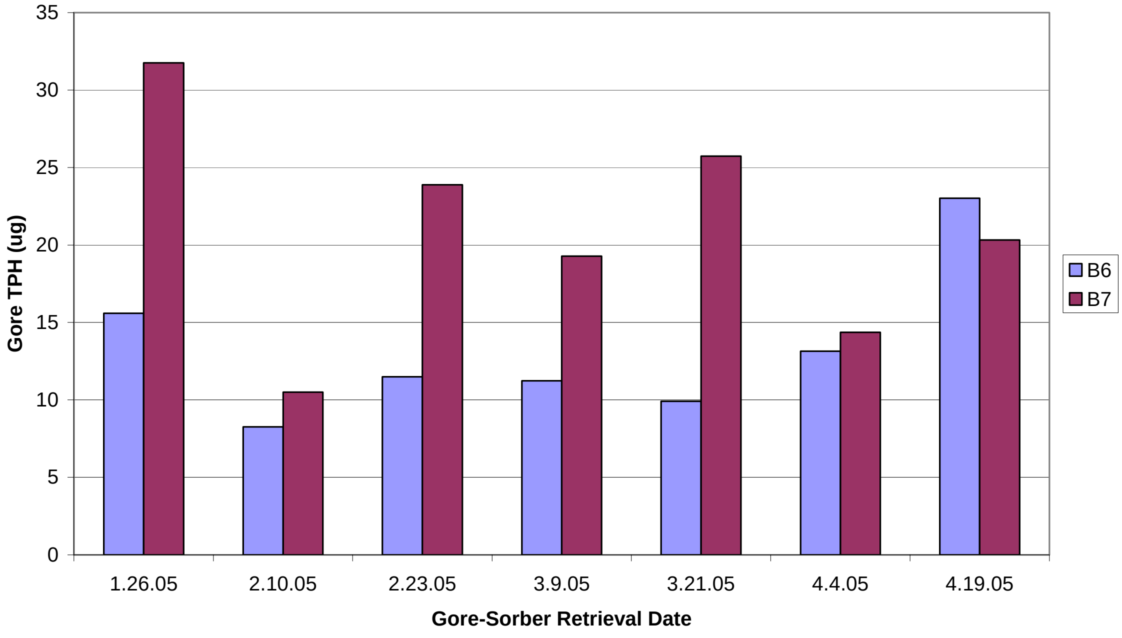


Chart J-8

Gore TPH in E. Watkins and E. Maple St. Sewers

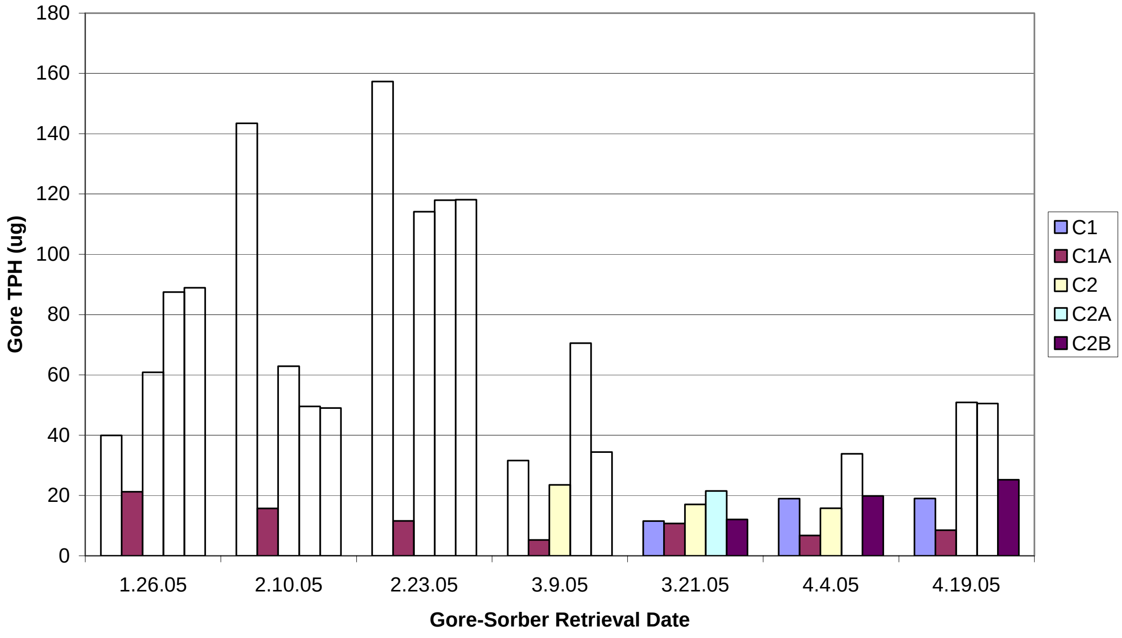


Chart J-9

Gore TPH Values in E. Elm St. and E. Forest St. Sewers

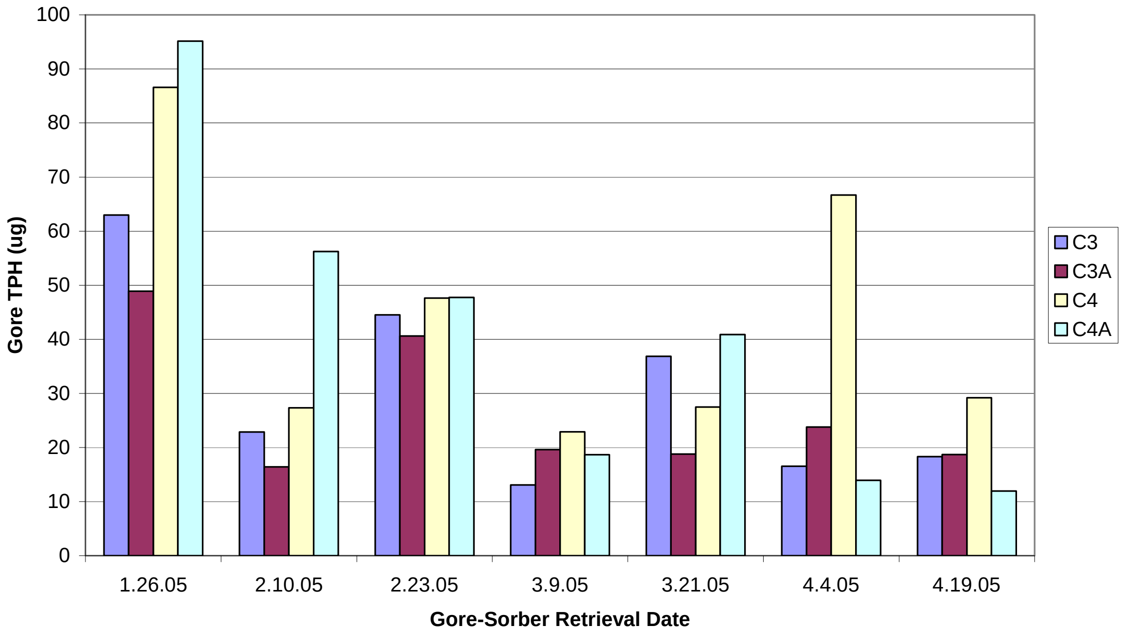
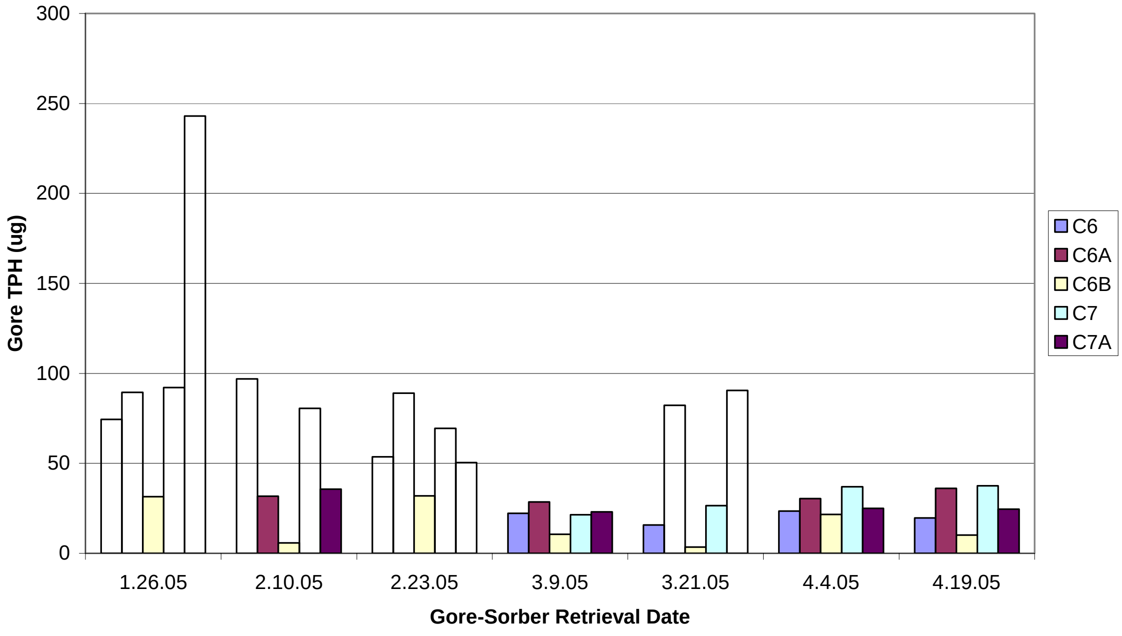


Chart J-10

Gore TPH Values in E. Birch and E. Cherry Sewers



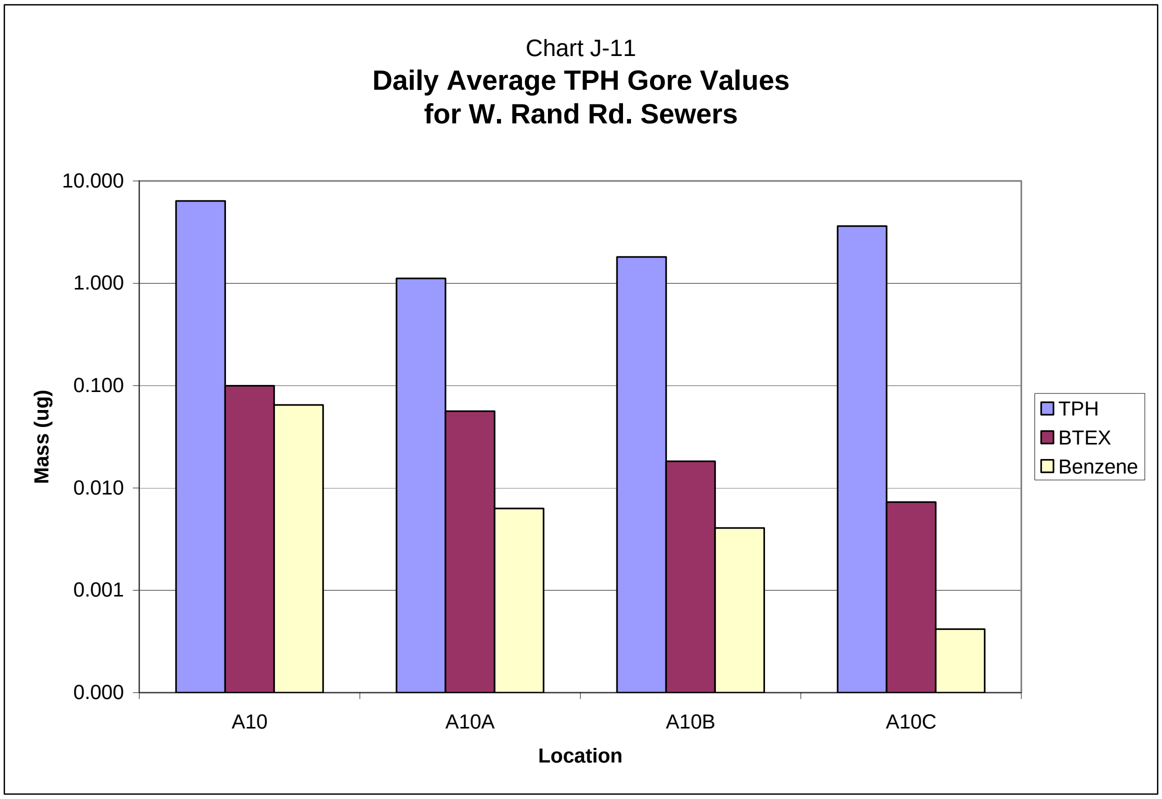


Chart J-11

Daily Average TPH Gore Values for W. Rand Rd. Sewers

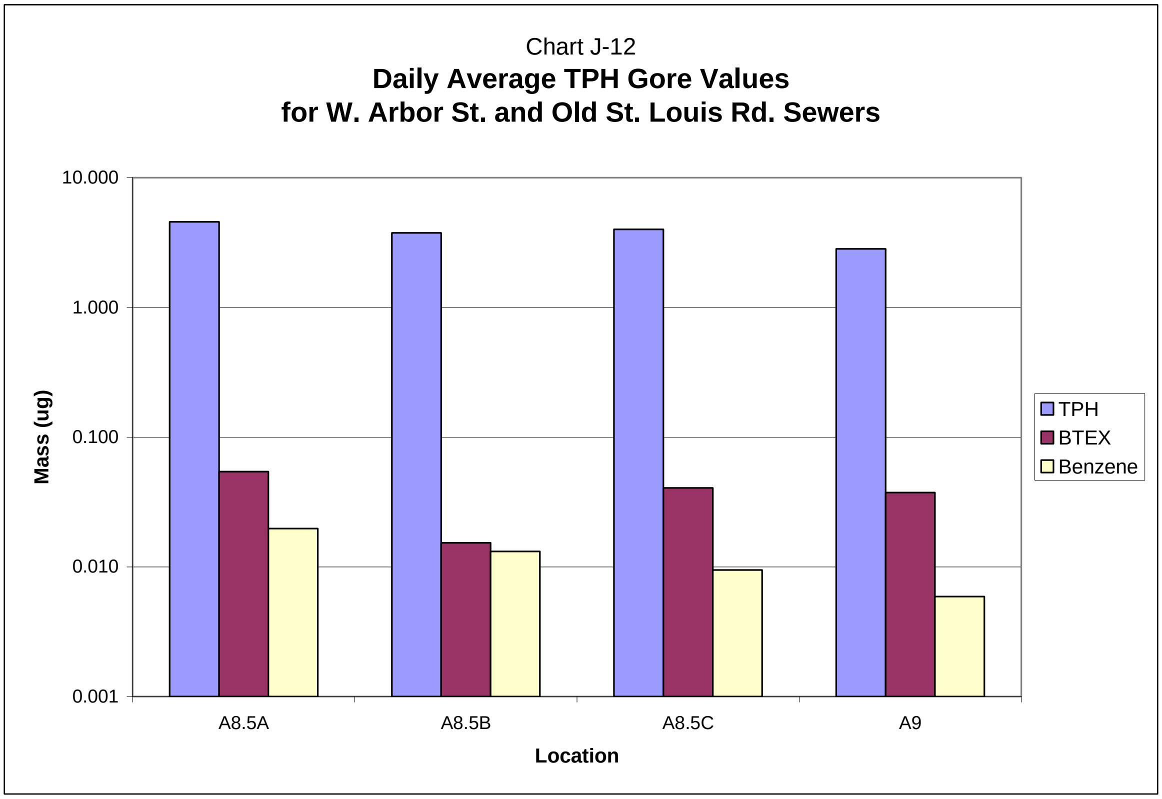


Chart J-12

Daily Average TPH Gore Values for W. Arbor St. and Old St. Louis Rd. Sewers

Chart J-13

Daily Average TPH Gore Values
for W. Birch St. and W. Cherry St. Sewers

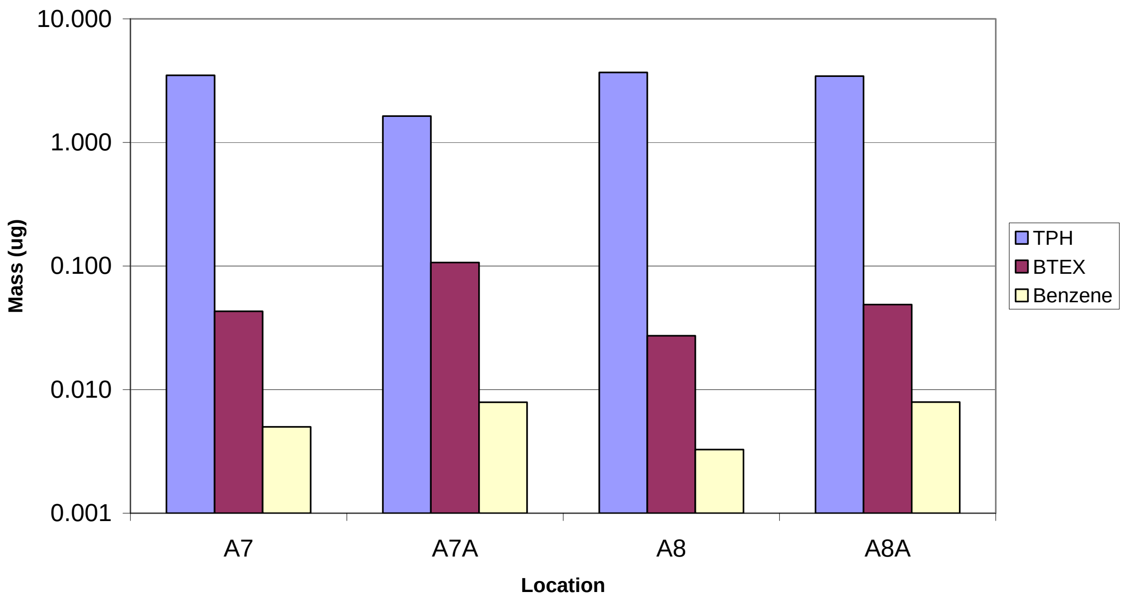


Chart J-14

Daily Average TPH Gore Values for 'B' Sewers

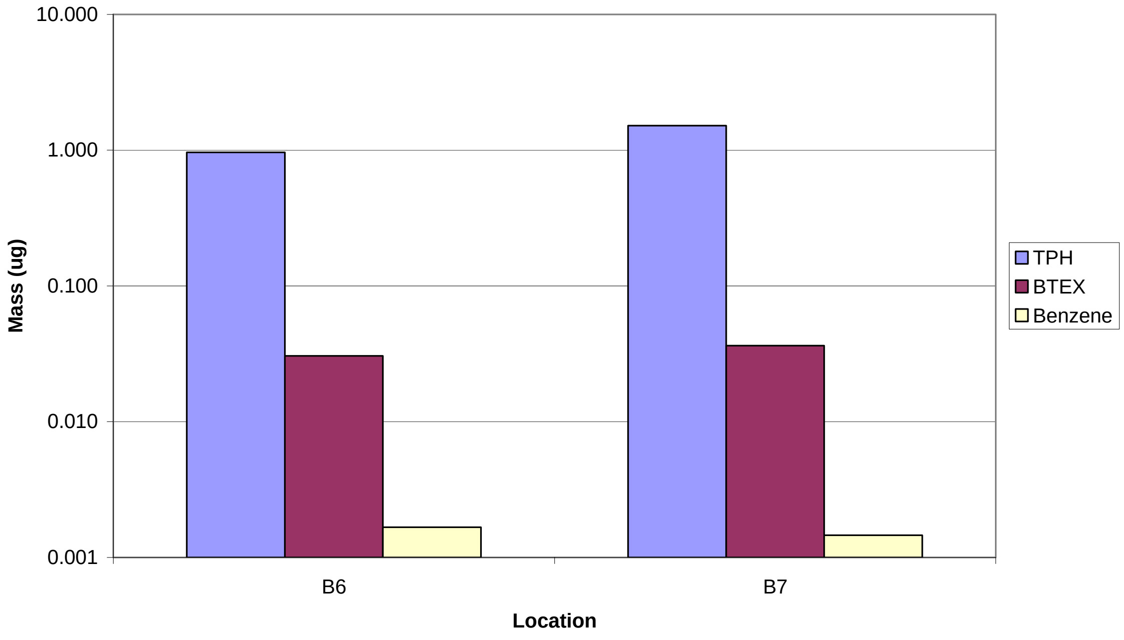


Chart J-15

Daily Average TPH Gore Values for E. Maple St. and E. Watkins St. Sewers

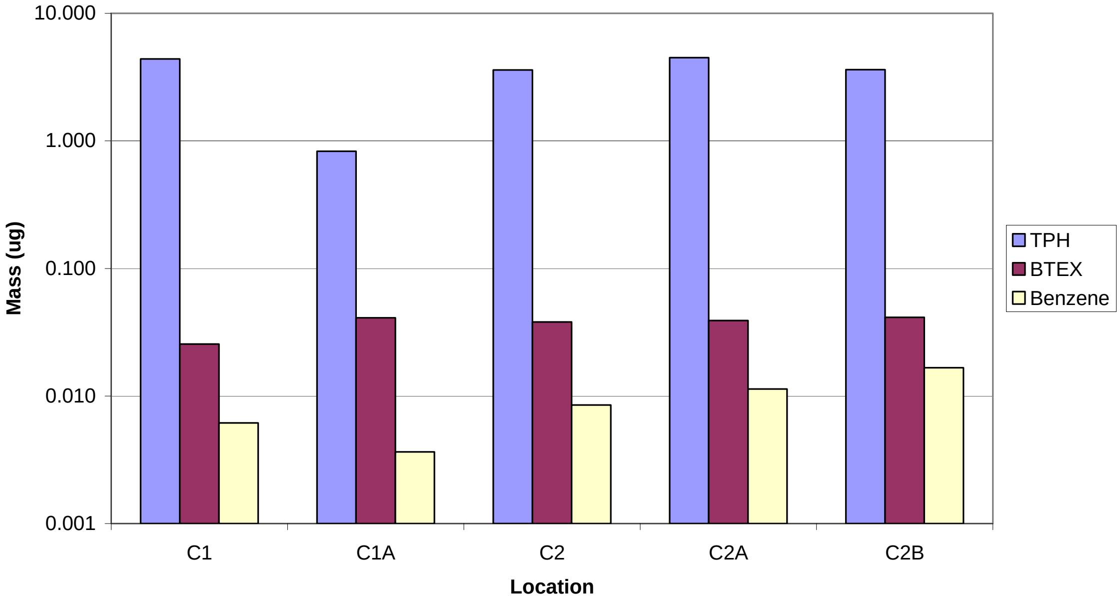


Chart J-16

Daily Average TPH Gore Values for E. Forest St. and E. Elm St. Sewers

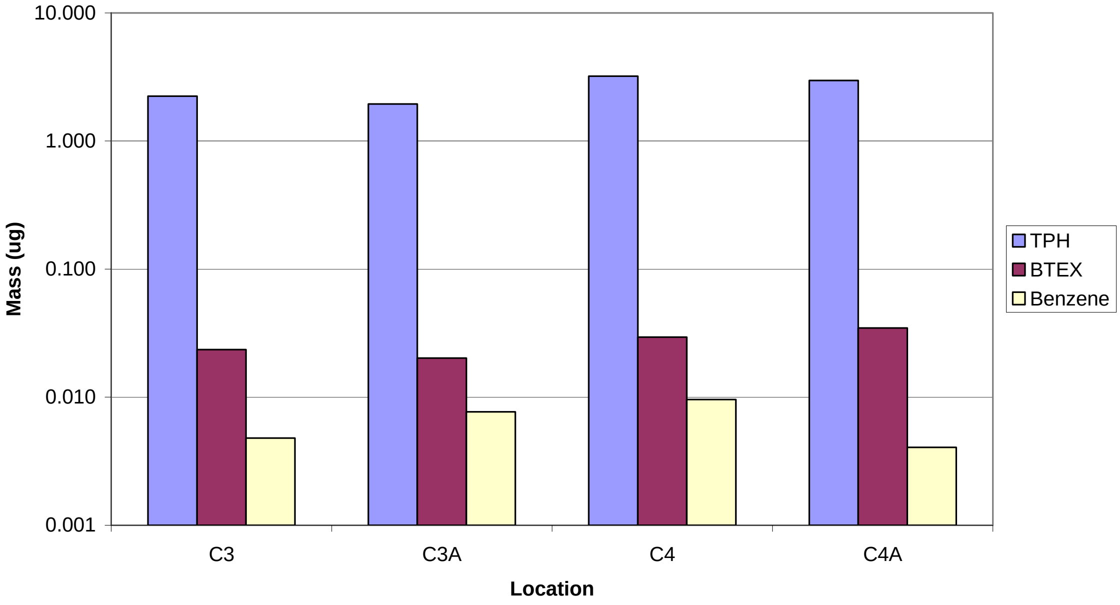
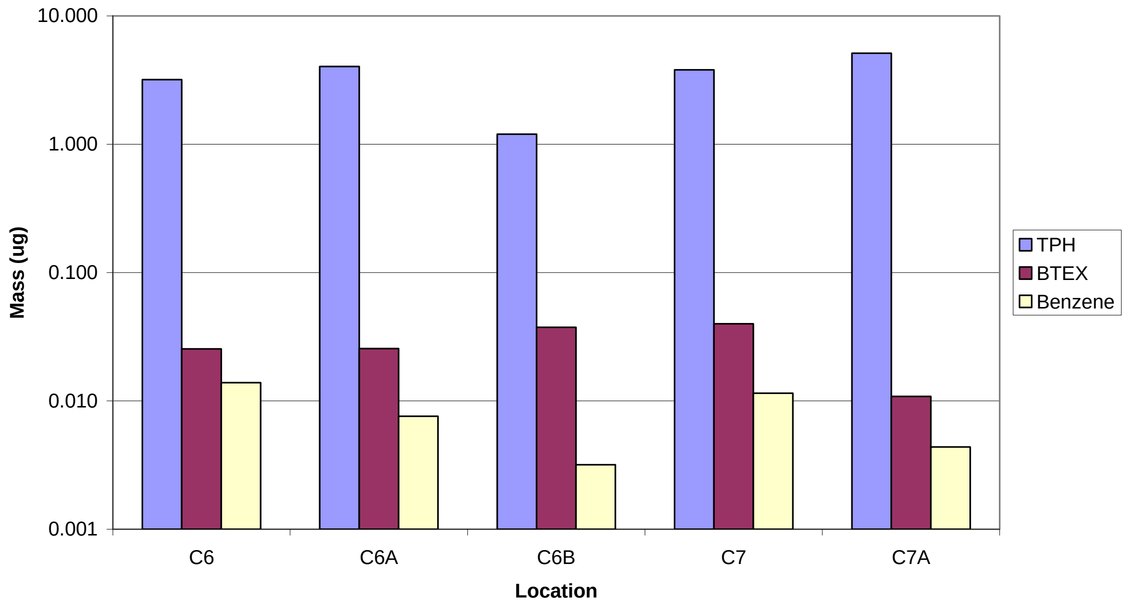


Chart J-17

Daily Average TPH Gore Values for E. Cherry St. and E. Birch St. Sewers



ENCLOSURE 7

CALCULATIONS OF THE VOLUME OF HYDROCARBONS BENEATH THE HARTFORD SITE BASED ON ROST AND CORE ANALYSES

Table 1
LNAPL and Geologic Properties at Paired Data Points
(core hole / well and adjacent ROST profiles)

Core Hole	Well	ROST	USCS code for saturated interval	ROST fluorescence interval[1] (feet)	ROST response type[2]	Total Porosity of upper formations[3]	Total Porosity of Main and EPA Sands	Percent LNAPL Sat. in Vadose Zone	Percent LNAPL Sat. in Saturated Zone
HCSB-1	HMW-44C	HROST-40	SW	12.0	yellow	51.4	41.0	2.5	4.6
HCSB-2	RW-5	HROST-126	?	12.5	blue	51.7	44.2	1.1	4.6
HCSB-3	MP-50C	HROST-24	SP	1.0	blue	N/A	42.7	4.6	5.9
HCSB-4	MP-39C	HROST-20	SW	1.0	blue	48.3	45.7	1.5	7.8
HCSB-5	MP-29D	HROST-130	SP	17.0	green	48.2	42.9	7.3	5.6
Overall[4]						50.5	43.0	3.4	5.5
Undifferentiated[4]						**45.2**		**4.8**	

Notes:

1 ROST fluorescence interval is the sum of all intervals where fluorescence is greater than 30 percent, as indicated by the ROST log.

2 ROST response type is based on the color of the ROST log, which is based on the types of petroleum product present (blue represents gasoline-range petroleum hydrocarbons while yellow and green represent mixtures of gasoline-range and diesel-range hydrocarbons)..

3 Upper formations include the North Olive and Rand strata as well as the B and C Clays.

4 "Overall" refers to an average parameter value calculated from samples from all 5 boreholes for the specified group of geologic units, while "undifferentaited" refers to an average parameter value calculated from samples from all 5 borings for all geologic units.

LNAPL = Light Nonaqueous Phase Liquid
ROST = Rapid optical Screening Tool
Sat. = saturation
USCS = Unified Soil Classification System

boring	depth	sat/unsat	Formation	Porosity total	Porosity air-filled	Saturation Water	Saturation NAPL	Saturation total
HCSB-1	10	U	N. Olive	49	8.3	78.4	4.7	83.1
HCSB-1	10.15	U	N. Olive	51.2	12.4	70.9	4.8	75.7
HCSB-1	10.6	U	N. Olive	50.9	16.1	65.8	2.5	68.3
HCSB-1	11.1	U	N. Olive	49.7	14.7	69.5	0.9	70.4
HCSB-1	12.1	U	N. Olive	53.2	28.7	42.1	3.9	46
HCSB-1	17.15	U	B-Clay	58.4	7.2	85	2.6	87.6
HCSB-1	19.1	U	Rand	51.5	18.3	62.5	2	64.5
HCSB-1	19.4	U	Rand	49.3	15.9	65.6	2.2	67.8
HCSB-1	20.2	U	Rand	49	7.7	81.8	2.4	84.2
HCSB-1	21.9	U	Rand	53.2	7.8	85.3	ND	85.3
HCSB-1	22.4	U	Rand	54.1	7.9	84.5	0.9	85.4
HCSB-1	27.3	U	C-Clay	51.2	4.2	89.7	2	91.7
HCSB-1	27.8	U	C-Clay	47.1	8.9	79.8	1.3	81.1
HCSB-1	28.4	U	Main	41.4	8	78.9	1.8	80.7
HCSB-1	29.75	S	Main	42.7	21.9	44.2	4.6	48.8
HCSB-1	30.15	S	Main	42.5	28	27.4	6.7	34.1
HCSB-1	31.15	S	Main	46.2	26.6	15.2	27.2	42.4
HCSB-1	31.6	S	Main	43.1	17.4	19.4	40.2	59.6
HCSB-1	32.25	S	Main	43.7	14.7	44.6	21.6	66.2
HCSB-1	33.3	S	Main	45.1	15.4	63	2.7	65.7
HCSB-1	37.6	S	Main	44.9	14.9	61.9	4.9	66.8
HCSB-1	39.2	S	Main	35.2	9.6	66.8	5.8	72.6
HCSB-1	39.4	S	Main	33.6	11.3	60.6	5.8	66.4
HCSB-1	39.7	S	Main	33.2	13	52.5	8.3	60.8
HCSB-1	41.6	S	Main	40.4	13	64.9	2.8	67.7
HCSB-2	17.7	U	B-Clay	50.9	7.9	83.3	1.1	84.4
HCSB-2	28.5	U	C-Clay	52.4	6.2	87	1.1	88.1
HCSB-2	29.3	U	Main	45.3	7.1	84.4	ND	84.4
HCSB-2	31.2	S	Main	42.7	32.4	21.6	2.6	24.2
HCSB-2	31.5	S	Main	45.6	34.6	23.8	0.3	24.1
HCSB-2	31.75	S	Main	46.2	35.6	20.4	2.5	22.9
HCSB-2	32.15	S	Main	44.7	16.2	55.1	8.5	63.6
HCSB-2	32.2	S	Main	44	18.7	52.2	5.2	57.4
HCSB-2	33.35	S	Main	44.3	14	63	5.3	68.3
HCSB-2	33.8	S	Main	46.1	17.1	58.4	4.5	62.9
HCSB-2	35.5	S	Main	41.7	10.2	70.8	4.8	75.6
HCSB-2	35.65	S	Main	43.5	11.3	68	6	74
HCSB-2	36.2	S	Main	42.8	11.9	68.2	4	72.2
HCSB-2	37.6	S	Main	43.9	10.6	69.2	6.8	76
HCSB-3	30.2	U	Main	47.4	9.9	74.6	4.6	79.2
HCSB-3	30.8	S	Main	43.7	28.9	31.3	2.5	33.8
HCSB-3	31.4	S	Main	40.3	14.3	58.7	5.8	64.5
HCSB-3	32.2	S	Main	43.1	30.1	27.1	3.2	30.3
HCSB-3	32.6	S	Main	43.2	19.5	50	4.9	54.9
HCSB-3	32.8	S	Main	43.3	18.2	51.5	6.6	58.1
HCSB-3	34.4	S	Main	43.2	9.2	69.5	9.2	78.7
HCSB-3	35	S	Main	41.9	9.3	69.1	8.6	77.7
HCSB-3	38.1	S	Main	38.4	10.3	67.2	6.1	73.3
HCSB-4	29.5	U	C-Clay	48.3	10.5	78	0.3	78.3
HCSB-4	30.1	U	Main	43.5	17.1	58.1	2.6	60.7
HCSB-4	31	S	Main	47.6	11.8	66	9.2	75.2
HCSB-4	35	S	Main	43.8	17.2	53.7	7	60.7
HCSB-4	38.55	S	Main	43.3	10.9	68	6.9	74.9
HCSB-4	41.2	S	Main	50.4	7.1	78	8	86
HCSB-5	17.5	U	B-Clay	45.6	10.4	76.2	1	77.2
HCSB-5	20.8	U	Rand	52	7.1	76.1	10.2	86.3
HCSB-5	23.45	U	Rand	50.2	8.2	74.5	9.2	83.7
HCSB-5	23.6	U	Rand	47.6	17	55.4	8.8	64.2
HCSB-5	23.9	U	Rand	45.8	12.8	64.7	7.3	72
HCSB-5	31.1	S	EPA	41.8	21.8	38.1	9.7	47.8
HCSB-5	32.8	S	EPA	44.9	18.5	51.6	7.2	58.8
HCSB-5	33.3	S	Main	45.6	14.7	59.5	8.2	67.7
HCSB-5	33.7	S	Main	45.2	13	65.2	6	71.2
HCSB-5	34	S	Main	43.6	15.7	57.5	6.5	64
HCSB-5	34.8	S	Main	45.8	16	59.7	5.4	65.1
HCSB-5	35.1	S	Main	44.7	13.8	63.8	5.4	69.2
HCSB-5	35.6	S	Main	43.7	14.4	61.3	5.8	67.1
HCSB-5	35.8	S	Main	45.2	15.8	60.7	4.9	65.6
HCSB-5	37	S	Main	42.7	9.8	74.3	2.8	77.1
HCSB-5	38.5	S	Main	39.6	11	70.4	1.8	72.2
HCSB-5	39.1	S	Main	44.1	14.6	61.6	5.3	66.9
HCSB-5	39.5	S	Main	42.3	13.1	68	1	69
HCSB-5	41.1	S	Main	31.5	10.1	59.3	8.5	67.8

Legend:

🟩	Upper formations, including North Olive, Rand and clays
🟨	Main Sand/Silt and EPA Sand
🟥	Suite of parameter values possibly indicative of concentrated NAPL layer
--------------	*interpreted top of fluid satuartion*

HCSB-1 - porosity of upper formations	**51.4**
HCSB-1 : NAPL sat. of vadose zone	**2.5**
HCSB-1: porosity of Main	**41**
HCSB-1 : NAPL sat. of saturated zone[1]	**5.2**

Note:

[1] Anomolously-high layer not included to be conservative

HCSB-2 - porosity of upper formations	**51.7**
HCSB-2 : NAPL sat. of vadose zone	**1.1**
HCSB-2: porosity of Main	**44.2**
HCSB-2 : NAPL sat. of saturated zone	**4.6**

HCSB-3 : NAPL sat. of vadose zone	**4.6**
HCSB-3: porosity of Main	**42.7**
HCSB-3 : NAPL sat. of saturated zone	**5.9**

HCSB-4: porosity of upper formations	**48.3**
HCSB-4 : NAPL sat. of vadose zone	**1.5**
HCSB-4: porosity of Main	**45.7**
HCSB-4 : NAPL sat. of saturated zone	**7.8**

HCSB-5: porosity of upper formations	**48.2**
HCSB-5: NAPL sat. of vadose zone	**7.3**
HCSB-5: porosity of Main/EPA	**42.9**
HCSB-5: NAPL sat. of saturated zone	**5.6**

Overall porosity of upper formations	**50.5**
Overall NAPL sat. of vadose zone	**3.4**
Overall porosity of Main/EPA	**43.0**
Overall NAPL sat. of saturated zone	**5.5**

Undifferentiated porosity	**45.2**
Undifferentiated NAPL saturation	**4.8**

Core Hole	Top of Concentrated NAPL Zone[1]	Bottom of Concentrated NAPL Zone[1]	Thickness of NAPL Zone in Core	Total D_0 for Mobile Interval	Total D_0 for Smear Zone	ROST	ROST fluorescence interval (feet)	Well	Product Thickness in Well[2]	Product Thickness in Well[3]
HCSB-1	29.1	32.8	3.7	0.3	**0.60**	HROST-40	**12.0**	HMW-44C	2.00	2.10
HCSB-2	29.75	31.95	2.2	0.01	**0.15**	HROST-126	**12.5**	RW-5	1.13	0.32
HCSB-3	30.5	32.4	1.9	0.01	**0.21**	HROST-24	**1.0**	MP-50C	1.45	0.40
HCSB-4	NE	NE	NE	0.38	**0.38**	HROST-20	**1.0**	MP-39C	1.00	1.62
HCSB-5	NE	31.95	NE	0.04	**0.47**	HROST-130	**17.0**	MP-29D	0.44	0.48
Average D_0 for Smear Zone for Site					***0.36***					

1 Top and bottom of NAPL zone is estimated from core sample physical properties, specifically, the zone in which water saturation is significantly reduced. This may be a more reliable indicator of NAPL presence than NAPL saturation becuase drainage of NAPL likley occurred as cores were being retrieved. The upper and lower extents of the zone are assumed to be the midpoints between sample depths where water saturation changes significantly (Data is from Appendix C - PTS Laboratory Report).

2 Product thickness reported on Table 3-6 of report, dates of measurement not given.

3 Product thickness reported on Table 5-1 of report, measured 9/20 through 10/5 of 2005.