November 20, 2015

VIA E-MAIL

Mr. John Iacoangeli, Principal
Beckett & Raeder, Inc.
535 West William, Suite 101
Ann Arbor, MI 48013

RE: OCTOBER 2015 RESULTS
POST CONSTRUCTION ACME CREEK MONITORING
GRAND TRAVERSE TOWN CENTER, ACME, MICHIGAN

Dear Mr. Iacoangeli:

The purpose of this letter is to transmit the results of post-construction surface water monitoring of Acme Creek completed by Horizon Environmental Corporation ("Horizon") in October 2015 on behalf of the Village at Grand Traverse, LLC ("VGT") at the Grand Traverse Town Center ("GTTC") site in Acme Township, Grand Traverse County, Michigan. As you are aware, post-construction monitoring activities were initiated in September 2015. This report presents the results of the second (Year 1/Month 2) post-construction monitoring event.

Post-construction stream sampling recommendations were outlined in the site development plan for the GTTC (Site Plan Approval for Phase I of the SUP)[1] and later incorporated into a site monitoring, inspection and maintenance plan submitted to the Township in September 2015 (Monitoring Plan).[2] The goal of the post-construction monitoring program is to evaluate water quality in Acme Creek over time. To facilitate the monitoring program, two fixed testing locations--one at the upstream point where Acme Creek enters the property and one at the downstream point where Acme Creek leaves the site--have been established (see Figure 1). Baseline (pre-construction) water quality samples were collected from both locations on July 26, 2011.

The Monitoring Plan calls for the receiving water for the GTTC site (Acme Creek) to be monitored for dissolved oxygen concentration, water temperature, specific conductivity, pH, volatile organic compounds (VOCs), total organic carbon (TOC), eColi, total dissolved solids (TDS), total suspended solids (TSS), water velocity and elevation. The monitoring is scheduled to be performed on a monthly basis for a period of one year following the completion of construction, on a quarterly basis during post-construction years 2 through 4 and on a semi-

[1] The Village at Grand Traverse Phase 1, Stormwater Management Recommendations, King & MacGregor Environmental, Inc., December 22, 2011
[2] Inspection, Monitoring and Maintenance Plan for the Storm Water Management System, Horizon Environmental Corporation, September 2015

annual basis for post-construction years 5 and beyond. The second monthly, year 1 post-construction monitoring event was completed on October 13, 2015. The results of this sampling event along with the results of the pre-construction (baseline) and previous post-construction sampling events are provided on Table 1.

DATA SUMMARY/EVALUATION

Dissolved oxygen, water temperature, specific conductivity and pH were measured at both of the stream gauges using an YSI 556 multi-parameter water quality meter. The data collected at each stream gauge was compared to available water quality standards in the Part 4 Water Quality Standards of Part 31, Water Resources Protection (MCL 324.3101) of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (Part 4). The following provides a summary of these results:

- The dissolved oxygen concentrations at both the upstream (11.0 mg/L) and downstream (11.2 mg/L) stream gauges were significantly higher than the Part 4 minimum standard of 7.0 mg/L.
- The water temperature at both the upstream (50.2°F) and downstream (50.9°F) stream gauges were lower than the maximum Part 4 maximum temperature in October for streams supporting cold water fish (56°F).
- The pH readings at both the upstream (8.24 S.U.) and downstream (8.23 S.U.) stream gauges were nearly identical and were both within the Part 4 pH range of 6.5 to 9.0 S.U.

Stream samples were collected for analyses of VOCs, TOC, TDS, TSS and E. Coli at both the upstream and downstream stream gauges. Laboratory data sheets are provided in Attachment I. A summary of the results compared to available water quality standards under Part 4 is provided as follows:

- VOCs were below laboratory detection limits at both the upstream and downstream gauges.
- The TDS concentrations at both the upstream (240 mg/L) and downstream (230 mg/L) stream gauges were significantly lower than the Part 4 maximum TDS standard of 500 mg/L.
- The upstream E. coli concentration (129 colonies/100ml) and downstream E. Coli concentration (52 colonies/100 ml) were both lower than the Part 4 maximum E. Coli concentration of 130 colonies/100 ml.

- There was no significant difference in the TOC, TSS, and turbidity levels observed at the upstream and downstream locations.

Additional stream data, including water velocity and water elevation, were collected as part of this monitoring event. Field analyses for turbidity were completed using a Hach 2100P portable turbidimeter. Stream velocities were measured using a Global Water FP201 probe. The results of the additional data collected are summarized on Table 1.

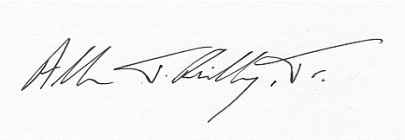
CONCLUSIONS

The results of the second post-construction monitoring event indicate that water quality in Acme Creek adjacent to the GTTC site meets or exceeds the Part 4 Water Quality Standards prescribed under Part 31 of the Water Resources Protection Section of NREPA (MCL 324.3101).

If you have questions or require additional information regarding this sampling event, please contact me at 616.554.3210.

Sincerely,

HORIZON ENVIRONMENTAL

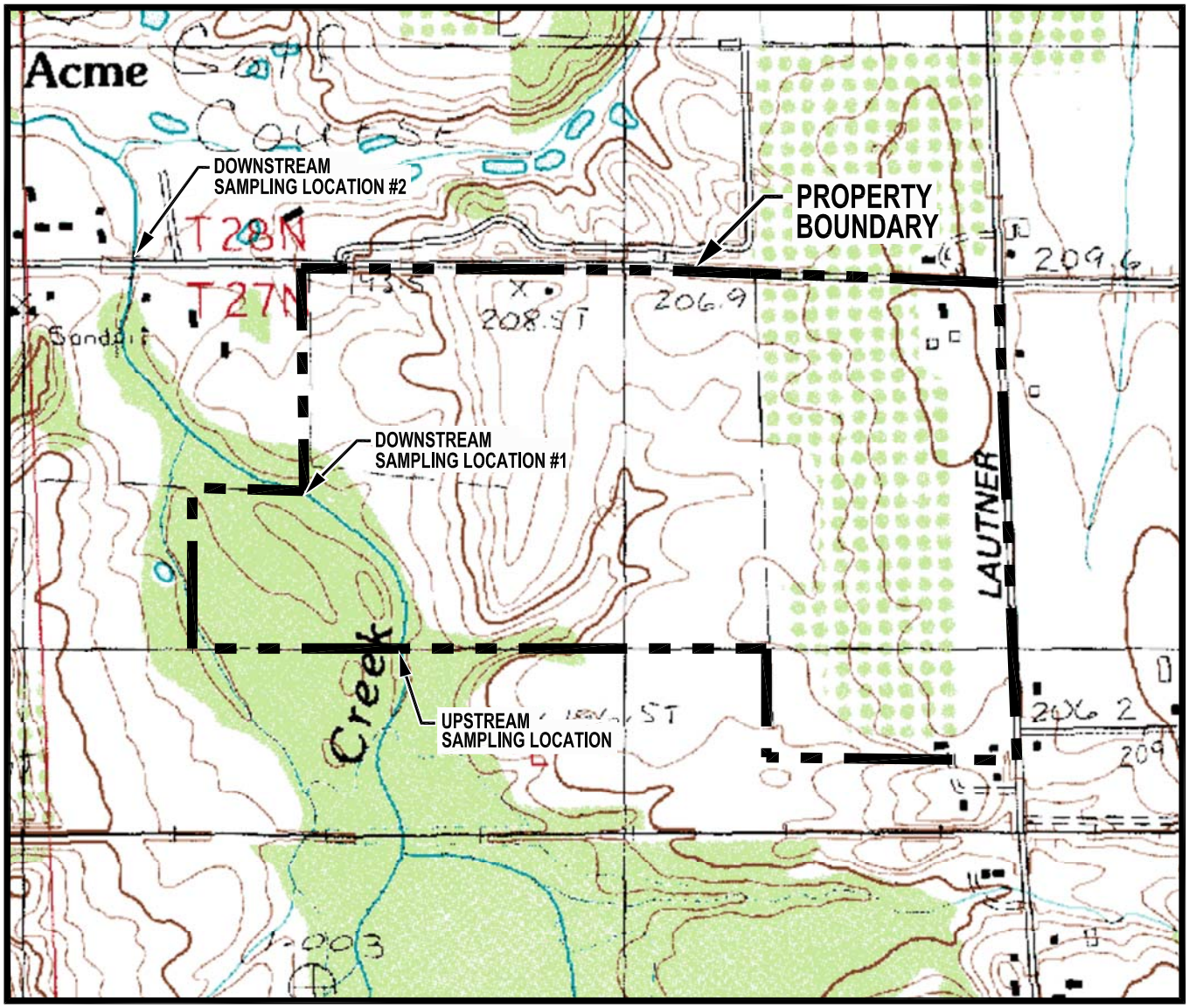


Allen J. Reilly, Jr.
Director, Environmental Risk Management

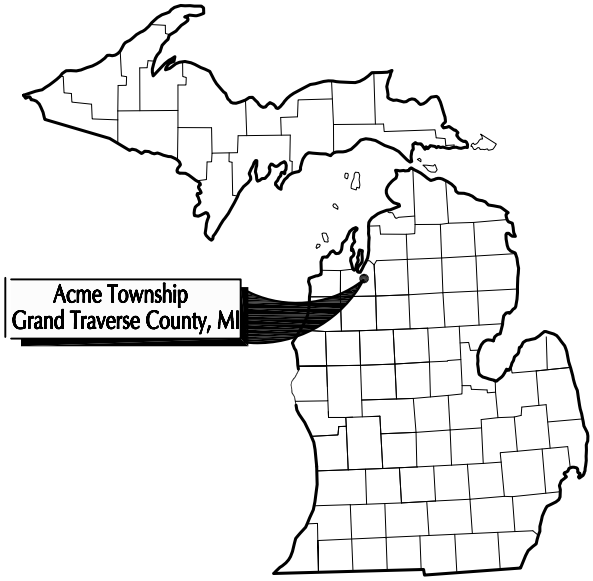
cc: J. Zollinger, Acme Township
S. Schooler, VGT
S. Smith, VGT

enclosures

WNJ1401SLM01—ACME



TAKEN FROM 7.5 MINUTE SERIES TOPOGRAPHIC MAP
GRAWN QUADRANGLE PHOTOREVISED 1983
NOT TO SCALE



North

HORIZON ENVIRONMENTAL

PROJECT NUMBER: WNJ—1401

Village at Grand Traverse
Acme Township, Grand Traverse County, Michigan

FIGURE: 1

SITE LOCATION MAP

DECEMBER 2014

TABLE 1
ACME CREEK MONITORING RESULTS
GRAND TRAVERSE TOWN CENTER SITE
ACME TOWNSHIP, GRAND TRAVERSE COUNTY, MICHIGAN

Study Parameter	Part 4 Water Quality Standards	July 26, 2011 Baseline Pre-Construction		September 18, 2015 Post-Construction (Year 1/Month 1)		October 13, 2015 Post-Construction (Year 1/Month2)	
		Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Macroinvertebrates	NA	-5					
e Coli (colonies/100 ml)	130	100	72	55	81	129	53
Dissolved Oxygen (mg/L)	7 (minimum)	11.4(1)	11.6(1)	12.4	12.4	11.0	11.2
Water Temperature (°F)	56(2)	56.1	55.6	49.1	49.0	50.2	50.9
Specific Conductivity (µs/cm)	NA	334	334	294	293	343	432
pH (S.U.)	6.5 to 9.0	8.36	8.39	7.70	6.95	8.24	8.23
Volatile Organic Compounds	Various	(3)	(3)	(3)	(3)	(3)	(3)
Total Organic Carbon (mg/L)	NA	1.3	1	<1.0	1.0	1.6	1.5
Total Dissolved Solids (mg/L)	500	204	180	250	260	240	230
Total Suspended Solids (mg/L)	Visual Standard	11.2	4.4	<5.0	<5.0	8	7
Turbidity (NTU)	Visual Standard			1.99	1.48	3.06	3.1
Water Velocity (ft/sec)	NA	1.3	1.2	0.9	1.6	1.4	3.2
Water Elevation (NAVD 88)	NA	609.97	606.04	610.01	606.11	610.12	606.17

Notes:

1) Baseline sample reported as percent saturation. Value converted to mg/L utilizing reported temperature, specific conductivity and standard barometric pressure

2) Temperature varies seasonally (October Value Shown)

3) EPA 8260 scan. All compounds below laboratory detection limits

ATTACHMENT I

LABORATORY DATA SHEETS

SOS ANALYTICAL
4125 Cedar Run Road, Suite B
Traverse City, MI 49684
Phone: (231) 946-6767 Fax: (231) 946-8741
Email: shanna@sosanalytical.com www.sosanalytical.com

CUSTODY TRANSFER RECORD

SOS Project ID # 154802

Cooler Temp (°C) _____ Page _____ of _____

Client / Company Name : BARR ENGINEERING
Site Address : 4771 50TH ST. SE
Project # / WSSN # : WNS-1401
Sampling Company : BARR
Sampler's Name : Mike Potter
Send Results To : JAMIE EDELIN
Address :
Phone : Fax / E-mail : JEDELIN@BARR.COM
Invoice To :
Address :

Quote # : PO # :
Miscellaneous Information :

E-MAILED
OCT 27 2015

Analysis Information

Sample Identification	Collection Date	Collection Time	# of Containers	Matrix (DW, WW, GW, Soil, Oil, Sludge)	Comments / Other Analysis	HNO3 H2SO4 NaOH MEOH (HCL) VOC'S	HCL HNO3 H2SO4 NaOH MEOH TOC	HCL HNO3 H2SO4 NaOH MEOH E. coli	HCL HNO3 H2SO4 NaOH MEOH TDS TSS	HCL HNO3 H2SO4 NaOH MEOH	HCL HNO3 H2SO4 NaOH MEOH	HCL HNO3 H2SO4 NaOH MEOH	HCL HNO3 H2SO4 NaOH MEOH	HCL HNO3 H2SO4 NaOH MEOH	RUSH Due: Call To Schedule
1 Downstream	10-13	AM / PM	5	Grab / Comp		X	X	X	X						
2 Upstream	10-13	AM / PM	5	Grab / Comp		X	X	X	X						
3		AM / PM		Grab / Comp											
4		AM / PM		Grab / Comp											
5		AM / PM		Grab / Comp											
6		AM / PM		Grab / Comp											
7		AM / PM		Grab / Comp											
8		AM / PM		Grab / Comp											
9		AM / PM		Grab / Comp											
10		AM / PM		Grab / Comp											
11		AM / PM		Grab / Comp											
12		AM / PM		Grab / Comp											
13		AM / PM		Grab / Comp											
14		AM / PM		Grab / Comp											
15		AM / PM		Grab / Comp											

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
MJPott	10-13-15	AM / PM			AM / PM
Relinquished by:	Date:	Time:	Received in lab by: SSHEG	Date: 10/13/15	Time: 2:10 AM / PM

SOS ANALYTICAL

4125 Cedar Run Rd., Suite B
Traverse City, MI 49684
Phone 231-946-6767
Fax 231-946-8741
www.sosanalytical.com

COMPANY: BARR ENGINEERING

NAME:
PROJECT NO: WNJ-1401
WSSN:
WELL PERMIT:
TAX ID:
LOCATION: 4771 50TH ST SE

MI

COUNTY:
TWP:

SOS PROJECT NO: 154802
SAMPLED BY: MIKE POTTER/BARR ENGINEERING
DATE SAMPLED: 10/13/2015
TIME SAMPLED:
SAMPLE MATRIX: GRAB/WATER
DATE RECEIVED: 10/13/2015
TIME RECEIVED: 2:10 PM

INORGANICS

No:	Analysis	Concentration	LOD	Units	Analyst	Date Completed	Drinking Water Reg Limit(MCL)
SAMPLE ID: DOWNSTREAM							
1	E.COLI SM9223-B MPN	53		Colonies/100 mL	KMJ	10/14/2015	
1	RESIDUE, FILTERABLE(TDS)/SM2540C	230	10	mg/L (PPM)	KMJ	10/15/2015	
1	RESIDUE, NON-FILTERABLE(TSS)/SM2540D	7	1	mg/L (PPM)	AD	10/15/2015	
1	TOTAL ORGANIC CARBON EPA 415.1	1.5	0.5	mg/L (PPM)	FT	10/21/2015	
SAMPLE ID: UPSTREAM							
2	E.COLI SM9223-B MPN	129		Colonies/100 mL	KMJ	10/14/2015	
2	RESIDUE, FILTERABLE(TDS)/SM2540C	240	10	mg/L (PPM)	KMJ	10/15/2015	
2	RESIDUE, NON-FILTERABLE(TSS)/SM2540D	8	1	mg/L (PPM)	AD	10/15/2015	
2	TOTAL ORGANIC CARBON EPA 415.1	1.6	0.5	mg/L (PPM)	FT	10/21/2015	

ND = NOT DETECTED
LOD = LIMIT OF DETECTION
SMCL = FEDERAL NON-ENFORCEABLE LIMIT
MCL = MAXIMUM CONTAMINANT LEVEL
s.u. = STANDARD pH UNITS REPORTED AT 25 C
DISS = DISSOLVED

APPROVED BY: Shanna Shea
SHANNA SHEA
LAB MANAGER

SOS ANALYTICAL, INC. IS CERTIFIED FOR COMPLIANCE MONITORING UNDER THE SAFE DRINKING WATER ACT.

SOS ANALYTICAL

4125 Cedar Run Rd., Suite B
Traverse City, MI 49684
Phone 231-946-6767
Fax 231-946-8741
www.sosanalytical.com

COMPANY:	BARR ENGINEERING	SOS PROJECT NO:	154802 - 1
NAME:		DATE SAMPLED:	10/13/2015
PROJECT NO:	WNJ-1401	TIME SAMPLED:	
WSSN:		SAMPLE MATRIX:	GRAB/WATER
LOCATION:	4771 50TH ST SE	SAMPLE ID:	DOWNSTREAM
		DATE RECEIVED:	10/13/2015
SAMPLED BY:	MIKE POTTER/BARR ENGINEERING	TIME RECEIVED:	2:10 PM

EPA 8260 VOLATILE ORGANICS

Units= ug/L (PPB) **Analyst=** RS **Date Extracted=** **Date Completed=**10/14/2015 **Prep Method=** EPA 5030B

Analyte	Concentration	LOD	Analyte	Concentration	LOD
ACETONE	ND	5	cis-1,3-DICHLOROPROPENE	ND	1
BENZENE	ND	1	trans-1,3-DICHLOROPROPENE	ND	1
BROMOBENZENE	ND	1	DIETHYL ETHER	ND	5
BROMOCHLOROMETHANE	ND	1	ETHYLBENZENE	ND	1
BROMODICHLOROMETHANE	ND	1	IODOMETHANE	ND	1
BROMOFORM	ND	1	ISOPROPYLBENZENE	ND	1
BROMOMETHANE	ND	1	ISOPROPYLTOLUENE	ND	1
n-BUTYLBENZENE	ND	1	METHYL ETHYL KETONE	ND	5
s-BUTYLBENZENE	ND	1	METHYL-t-BUTYL ETHER	ND	5
t-BUTYLBENZENE	ND	1	METHYLENE CHLORIDE	ND	5
CARBON DISULFIDE	ND	1	MIBK	ND	5
CARBON TETRACHLORIDE	ND	1	2-METHYLNAPHTHALENE	ND	5
CHLOROBENZENE	ND	1	NAPHTHALENE	ND	5
CHLOROFORM	ND	1	n-PROPYLBENZENE	ND	1
CHLOROETHANE	ND	1	STYRENE	ND	1
CHLOROMETHANE	ND	1	1,1,1,2-TETRACHLOROETHANE	ND	1
DIBROMOCHLOROMETHANE	ND	1	1,1,2,2-TETRACHLOROETHANE	ND	1
DIBROMOMETHANE	ND	1	TETRACHLOROETHENE	ND	1
1,2-DIBROMO3CHLOROPROPANE	ND	5	TOLUENE	ND	1
1,2-DIBROMOETHANE	ND	1	1,2,3-TRICHLOROBENZENE	ND	1
1,2-DICHLOROBENZENE	ND	1	1,2,4-TRICHLOROBENZENE	ND	1
1,3-DICHLOROBENZENE	ND	1	1,1,1-TRICHLOROETHANE	ND	1
1,4-DICHLOROBENZENE	ND	1	1,1,2-TRICHLOROETHANE	ND	1
DICHLORODIFLUOROMETHANE	ND	1	TRICHLOROETHENE	ND	1
1,1-DICHLOROETHANE	ND	1	TRICHLORFLUOROMETHANE	ND	1
1,2-DICHLOROETHANE	ND	1	1,2,3-TRICHLOROPROPANE	ND	1
1,1-DICHLOROETHENE	ND	1	1,2,4-TRIMETHYLBENZENE	ND	1
cis-1,2-DICHLOROETHENE	ND	1	1,3,5-TRIMETHYLBENZENE	ND	1
trans-1,2-DICHLOROETHENE	ND	1	VINYL CHLORIDE	ND	1
1,2-DICHLOROPROPANE	ND	1	XYLENE (TOTAL)	ND	3

ND = NOT DETECTED
LOD = LIMIT OF DETECTION

APPROVED BY: Shanna Shea
SHANNA SHEA / LAB MANAGER
R. SIMMERMAN / ANALYTICAL CHEMIST

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COMPANY:	BARR ENGINEERING	SOS PROJECT NO:	154802 - 2
NAME:		DATE SAMPLED:	10/13/2015
PROJECT NO:	WNJ-1401	TIME SAMPLED:	
WSSN:		SAMPLE MATRIX:	GRAB/WATER
LOCATION:	4771 50TH ST SE	SAMPLE ID:	UPSTREAM
		DATE RECEIVED:	10/13/2015
SAMPLED BY:	MIKE POTTER/BARR ENGINEERING	TIME RECEIVED:	2:10 PM

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Units= ug/L (PPB) **Analyst=** RS **Date Extracted=** **Date Completed=**10/14/2015 **Prep Method=** EPA 5030B

Analyte	Concentration	LOD	Analyte	Concentration	LOD
ACETONE	ND	5	cis-1,3-DICHLOROPROPENE	ND	1
BENZENE	ND	1	trans-1,3-DICHLOROPROPENE	ND	1
BROMOBENZENE	ND	1	DIETHYL ETHER	ND	5
BROMOCHLOROMETHANE	ND	1	ETHYLBENZENE	ND	1
BROMODICHLOROMETHANE	ND	1	IODOMETHANE	ND	1
BROMOFORM	ND	1	ISOPROPYLBENZENE	ND	1
BROMOMETHANE	ND	1	ISOPROPYLTOLUENE	ND	1
n-BUTYLBENZENE	ND	1	METHYL ETHYL KETONE	ND	5
s-BUTYLBENZENE	ND	1	METHYL-t-BUTYL ETHER	ND	5
t-BUTYLBENZENE	ND	1	METHYLENE CHLORIDE	ND	5
CARBON DISULFIDE	ND	1	MIBK	ND	5
CARBON TETRACHLORIDE	ND	1	2-METHYLNAPHTHALENE	ND	5
CHLOROBENZENE	ND	1	NAPHTHALENE	ND	5
CHLOROFORM	ND	1	n-PROPYLBENZENE	ND	1
CHLOROETHANE	ND	1	STYRENE	ND	1
CHLOROMETHANE	ND	1	1,1,1,2-TETRACHLOROETHANE	ND	1
DIBROMOCHLOROMETHANE	ND	1	1,1,2,2-TETRACHLOROETHANE	ND	1
DIBROMOMETHANE	ND	1	TETRACHLOROETHENE	ND	1
1,2-DIBROMO3CHLOROPROPANE	ND	5	TOLUENE	ND	1
1,2-DIBROMOETHANE	ND	1	1,2,3-TRICHLOROBENZENE	ND	1
1,2-DICHLOROBENZENE	ND	1	1,2,4-TRICHLOROBENZENE	ND	1
1,3-DICHLOROBENZENE	ND	1	1,1,1-TRICHLOROETHANE	ND	1
1,4-DICHLOROBENZENE	ND	1	1,1,2-TRICHLOROETHANE	ND	1
DICHLORODIFLUOROMETHANE	ND	1	TRICHLOROETHENE	ND	1
1,1-DICHLOROETHANE	ND	1	TRICHLORFLUOROMETHANE	ND	1
1,2-DICHLOROETHANE	ND	1	1,2,3-TRICHLOROPROPANE	ND	1
1,1-DICHLOROETHENE	ND	1	1,2,4-TRIMETHYLBENZENE	ND	1
cis-1,2-DICHLOROETHENE	ND	1	1,3,5-TRIMETHYLBENZENE	ND	1
trans-1,2-DICHLOROETHENE	ND	1	VINYL CHLORIDE	ND	1
1,2-DICHLOROPROPANE	ND	1	XYLENE (TOTAL)	ND	3

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R. SIMMERMAN / ANALYTICAL CHEMIST

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