



March 29, 2016

VIA E-MAIL

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

**RE: FEBRUARY 2016 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 Barr Engineering (Barr) in February 2016 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 sixth (Year 1/Month 6) 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 inspection, monitoring, 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), e. Coli, 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

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

through 4 and on a semi-annual basis for post-construction years 5 and beyond. The sixth monthly (Year 1) post-construction monitoring event was completed on February 18, 2016. The results of this sampling event along with the results of the pre-construction (baseline) and prior 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 (13.4 mg/L) and downstream (14.3 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 (36.1°F) and downstream (35.8°F) stream gauges were lower than the Part 4 maximum temperature in February for streams supporting cold water fish (38°F).
- The pH readings at both the upstream (8.05 S.U.) and downstream (7.33 S.U.) stream gauges were both within the Part 4 pH range of 6.5 to 9.0 S.U.

Stream samples were also collected for laboratory 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 (33 colonies/100ml) and downstream E. Coli concentration (31 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.

Mr. John Iacoangeli

March 29, 2016

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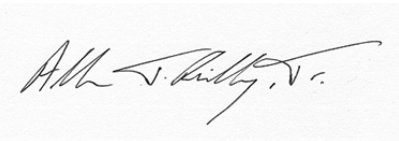
CONCLUSIONS

The results of the sixth 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,

BARR ENGINEERING

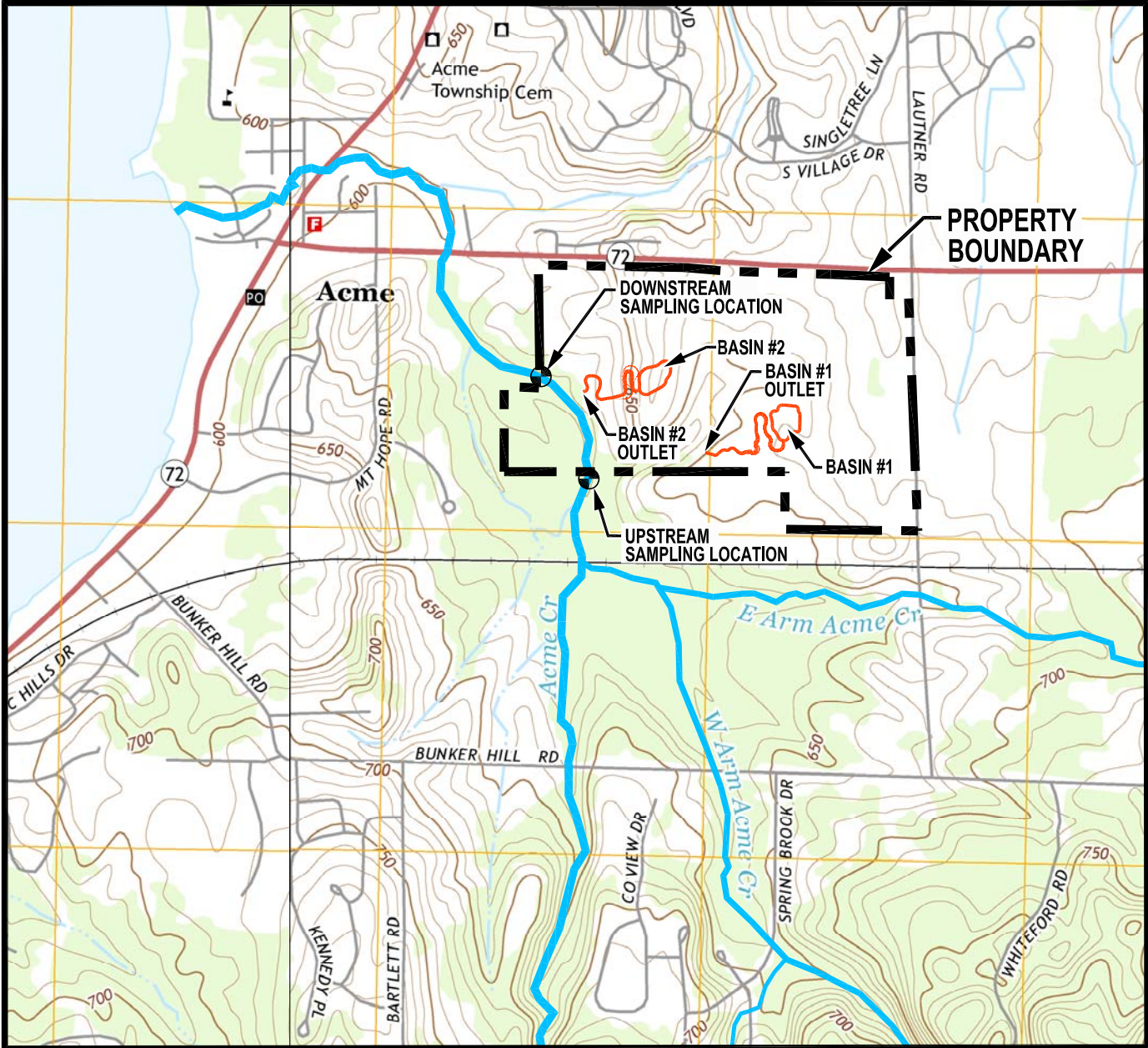
A handwritten signature in black ink on a light-colored background. The signature is cursive and appears to read "Allen J. Reilly, Jr.".

Allen J. Reilly, Jr.

Project Manager

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

enclosures



TAKEN FROM 7.5 MINUTE SERIES TOPOGRAPHIC MAP
 TRAVERSE CITY SE AND WILLIAMSBURG 2014 QUADRANGLES
 NORTH AMERICAN VERTICAL DATUM OF 1988
 SCALE APPROX. 1" = 1600'

LEGEND:

 - CREEK SAMPLING LOCATION

Figure 1

SITE LOCATION MAP
 Village at Grand Traverse
 Acme Township, Grand
 Traverse County, Michigan



4771 50th Street SE
 Grand Rapids, MI 49512

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/Month 2)		November 16, 2015 Post-Construction (Year 1/Month 3)		December 4, 2015 Post-Construction (Year 1/Month 4)		January 29, 2016 Post-Construction (Year 1/Month 5)		February 18, 2016 Post-Construction (Year 1/Month 6)	
		Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream	Upstream	Downstream
Macroinvertebrates	NA	-5													
e Coli (colonies/100 ml)	130	100	72	55	81	129	53	29	17	22	27	20	36	33	31
Dissolved Oxygen (mg/L)	7 (minimum)	11.4 ⁽¹⁾	11.6 ⁽¹⁾	12.4	12.4	11.0	11.2	10.9	11.3	11.5	11.5	13.8	13.7	13.4	14.3
Water Temperature (°F)	38 ⁽²⁾	56.1	55.6	49.1	49.0	50.2	50.9	46.3	46.0	42.9	42.8	39.0	39.0	36.1	35.8
Specific Conductivity (µs/cm)	NA	334	334	294	293	343	432	345	358	339	341	346	346	338	330
pH (S.U.)	6.5 to 9.0	8.36	8.39	7.70	6.95	8.24	8.23	8.81	8.82	8.21	8.05	8.03	8.08	8.05	7.33
Volatile Organic Compounds	Various	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
Total Organic Carbon (mg/L)	NA	1.3	1	<1.0	1.0	1.6	1.5	1.6	1.4	1.4	1.4	1.4	1.4	<1.0	<1.0
Total Dissolved Solids (mg/L)	500	204	180	250	260	240	230	240	240	240	240	210	240	240	230
Total Suspended Solids (mg/L)	Visual Standard	11.2	4.4	<5.0	<5.0	8	7	4	5	5	6	5	4	6	9
Turbidity (NTU)	Visual Standard			1.99	1.48	3.06	3.10	2.3	1.7	3.0	2.4	0.93	0.98	1.52	1.61
Water Velocity (ft/sec)	NA	1.3	1.2	0.9	1.6	1.4	3.2	3.1	2.8	1.9	2.0	1.7	1.8	1.8	1.6
Water Elevation (NAVD 88)	NA	609.97	606.04	610.01	606.11	610.12	606.17	610.09	606.22	610.10	606.23	610.08	606.23	610.04	606.13

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 (February Value Shown)
- 3) EPA 8260 scan. All compounds below laboratory detection limits

ATTACHMENT I

LABORATORY DATA SHEETS



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 # **160589**

Client / Company Name : **BARR**

Site Address : **VGT ACME MI**

Project # / WSSN # :

Sampling Company : **BARR**

Sampler's Name : **DOUG LARSON**

Send Results To : **JAMIE EDELYN**

Address : **4771 50th ST GRAND RAPIDS 49512**

Phone : Fax / E-mail :

Invoice To : **EMAIL: JEDELYN@BARR.COM**

Address :

Cooler Temp (°C) _____ Page **1** of **1**

Analysis Information

Quote # : PO # :
Miscellaneous Information :

Sample Identification	Collection Information		# of Containers	Matrix DW, WW, GW, Soil, Oil, Sludge	Comments / Other Analysis	VOC HCL HNO, H ₂ SO, NaOH MEOH	TOL HCL HNO, H ₂ SO, NaOH MEOH	TSS TDS HCL HNO, H ₂ SO, NaOH MEOH	ECOLI HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	HCL HNO, H ₂ SO, NaOH MEOH	RUSH Due : Call To Schedule
	Date	Time															
1 UPSTREAM	2-18-16	09:43 AM	5	SW	Grab	X	X	X	X								
2 DOWNSTREAM	2-18-16	09:20 AM	5	SW	Grab	X	X	X	X								
3		AM			Grab												
3		PM			Comp												
4		AM			Grab												
4		PM			Comp												
5		AM			Grab												
5		PM			Comp												
6		AM			Grab												
6		PM			Comp												
7		AM			Grab												
7		PM			Comp												
8		AM			Grab												
8		PM			Comp												
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12		AM			Grab												
12		PM			Comp												
13		AM			Grab												
13		PM			Comp												
14		AM			Grab												
14		PM			Comp												
15		AM			Grab												
15		PM			Comp												

Relinquished by: *[Signature]* Date: **2-18-16** Time: **10:45** AM/PM

Received by: _____ Date: _____ Time: _____ AM/PM

Relinquished by: _____ Date: _____ Time: _____ AM/PM

Received in lab by: **C. Herhard** Date: **2/18/16** Time: **10:45** AM/PM



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: 160589

NAME:
 PROJECT NO: VGT
 WSSN:
 WELL PERMIT:
 TAX ID:
 LOCATION:

SAMPLED BY: DOUG LARSON

DATE SAMPLED: 2/18/2016
 TIME SAMPLED: 9:43 AM

SAMPLE MATRIX: SURFACE WATER

DATE RECEIVED: 2/18/2016
 TIME RECEIVED: 10:45 AM

ACME
 MI

COUNTY:
 TWP:

WET CHEMISTRY/BACTERIA

No:	Analysis	Concentration	LOD	Units	Analyst	Date Completed	Drinking Water Reg Limit(MCL)
SAMPLE ID: UPSTREAM							
1	E.COLI SM9223-B MPN	33		Colonies/100 mL	KMJ	2/19/2016	
1	RESIDUE, FILTERABLE(TDS)/SM2540C	240	10	mg/L (PPM)	KMJ	2/18/2016	
1	RESIDUE, NON-FILTERABLE(TSS)/SM2540D	6	1	mg/L (PPM)	KMJ	2/18/2016	
1	TOTAL ORGANIC CARBON EPA 415.1	ND	1.0	mg/L (PPM)	FT	2/25/2016	
SAMPLE ID: DOWNSTREAM							
2	E.COLI SM9223-B MPN	31		Colonies/100 mL	KMJ	2/19/2016	
2	RESIDUE, FILTERABLE(TDS)/SM2540C	230	10	mg/L (PPM)	KMJ	2/18/2016	
2	RESIDUE, NON-FILTERABLE(TSS)/SM2540D	9	1	mg/L (PPM)	KMJ	2/18/2016	
2	TOTAL ORGANIC CARBON EPA 415.1	ND	1.0	mg/L (PPM)	FT	2/25/2016	

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



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 Traverse City, MI 49684
 Phone 231-946-6767
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COMPANY: BARR ENGINEERING
 NAME:
 PROJECT NO: VGT
 WSSN:
 LOCATION:

SOS PROJECT NO: 160589 - 1
 DATE SAMPLED: 2/18/2016
 TIME SAMPLED: 9:43 AM
 SAMPLE MATRIX: SURFACE WATER
 SAMPLE ID: UPSTREAM

SAMPLED BY: ACME
 DOUG LARSON

DATE RECEIVED: 2/18/2016
 TIME RECEIVED: 10:45 AM

EPA 8260 VOLATILE ORGANICS

Units= ug/L (PPB) Analyst= RS Date Extracted= Date Completed= 2/22/2016 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-TRICHLOROENZENE	ND	1
1,2-DICHLOROENZENE	ND	1	1,2,4-TRICHLOROENZENE	ND	1
1,3-DICHLOROENZENE	ND	1	1,1,1-TRICHLOROETHANE	ND	1
1,4-DICHLOROENZENE	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 / LAB MANAGER
 R. SIMMERMAN / ANALYTICAL CHEMIST



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COMPANY: BARR ENGINEERING
 NAME:
 PROJECT NO: VGT
 WSSN:
 LOCATION:

SOS PROJECT NO: 160589 - 2
 DATE SAMPLED: 2/18/2016
 TIME SAMPLED: 9:20 AM
 SAMPLE MATRIX: SURFACE WATER
 SAMPLE ID: DOWNSTREAM

SAMPLED BY: ACME
 DOUG LARSON

DATE RECEIVED: 2/18/2016
 TIME RECEIVED: 10:45 AM

EPA 8260 VOLATILE ORGANICS

Units= ug/L (PPB) Analyst= RS Date Extracted= Date Completed= 2/22/2016 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