

Memo

To: Julie VanderWiere, Charter Township of Texas
From: Thomas Clement, Aquatic/Wetland Biologist GEI Consultants of Michigan, P.C.
CC: Thomas Wheat, P.E., Prein & Newhof
Date: June 4, 2019
Re: Escherichia coli and Fecal Coliform Sampling-Bentwood Trail

Introduction: Water samples were collected the morning of May 31, 2019, from Crooked and Eagle Lakes for Escherichia coli (*E. coli*) and fecal coliform analysis. Both *E. coli* and fecal coliform were analyzed to indicate levels of water quality. These samples were collected within 24 hours of the initiation of pumping from Eagle to Crooked Lake. The presence of either *E. coli* or fecal coliform does not directly inform the input or presence of human wastes, but rather the input of all wastes from animals including water fowl, dogs, and livestock.

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) surface water standard for *E. coli* is a Total Body Contact limit of 300 *E. coli* per 100 milliliters (Daily Maximum Geometric Mean) and a 30-Day Geometric Mean of 130 *E. coli* per 100 ml. Daily maximum geometric mean is the highest limit of *E. coli* that can be present in a water body and be acceptable for “bathing” (swimming, etc...). The 30-Day Geometric Mean is the highest average limit of *E. coli* in a 30-day period where *E. coli* is sampled daily.

Samples were collected one day after a ½-inch rain event had been reported within both lakes’ watersheds. Typically, after large rain events, *E. coli* counts tend to be high or rising because of increased runoff into the system. If high results are detected after a sampling event that follows a large rain event, a secondary sampling is recommended to determine a more accurate reflection of *E. coli* counts outside of large storm events.

Sample Collection Methods: Samples were collected in sterile bottles one foot below the surface of each lake. A total of two samples were taken from each lake. The Crooked Lake #1 sample was collected near the intake structure and the Crooked Lake #2 sample was taken on the west side of the lake near the boat ramp at the end of South 6th Street. The Eagle Lake #1 sample was collected near the intake structure, while Eagle Lake #2 sample was taken near the end of Eagle Lake Drive (Figure 1).

Sample Analysis Methods: Samples were analyzed using method HACH M-Coli Blue 24 for *E. coli* and method SM 9222D-97 was used to analyze fecal coliform. Method detection limits (MDL) and reporting detection limits (RDL) can be seen in the attached results document.



Results: The highest *E. coli* count came from the Crooked Lake samples with 3.0 *E. coli* per 100 ml. Eagle Lake samples were slightly lower at 2.0 and 1.0 *E. coli* per 100 ml at Eagle Lake #1 and Eagle Lake #2, respectively. Fecal coliforms were at 4.0 and 3.0 colony-forming unit (CFU) at sample points Crooked Lake #1 and Crooked Lake #2, while they were 3.0 and 6.0 CFU at Eagle Lake #1 and Eagle Lake #2, respectively.

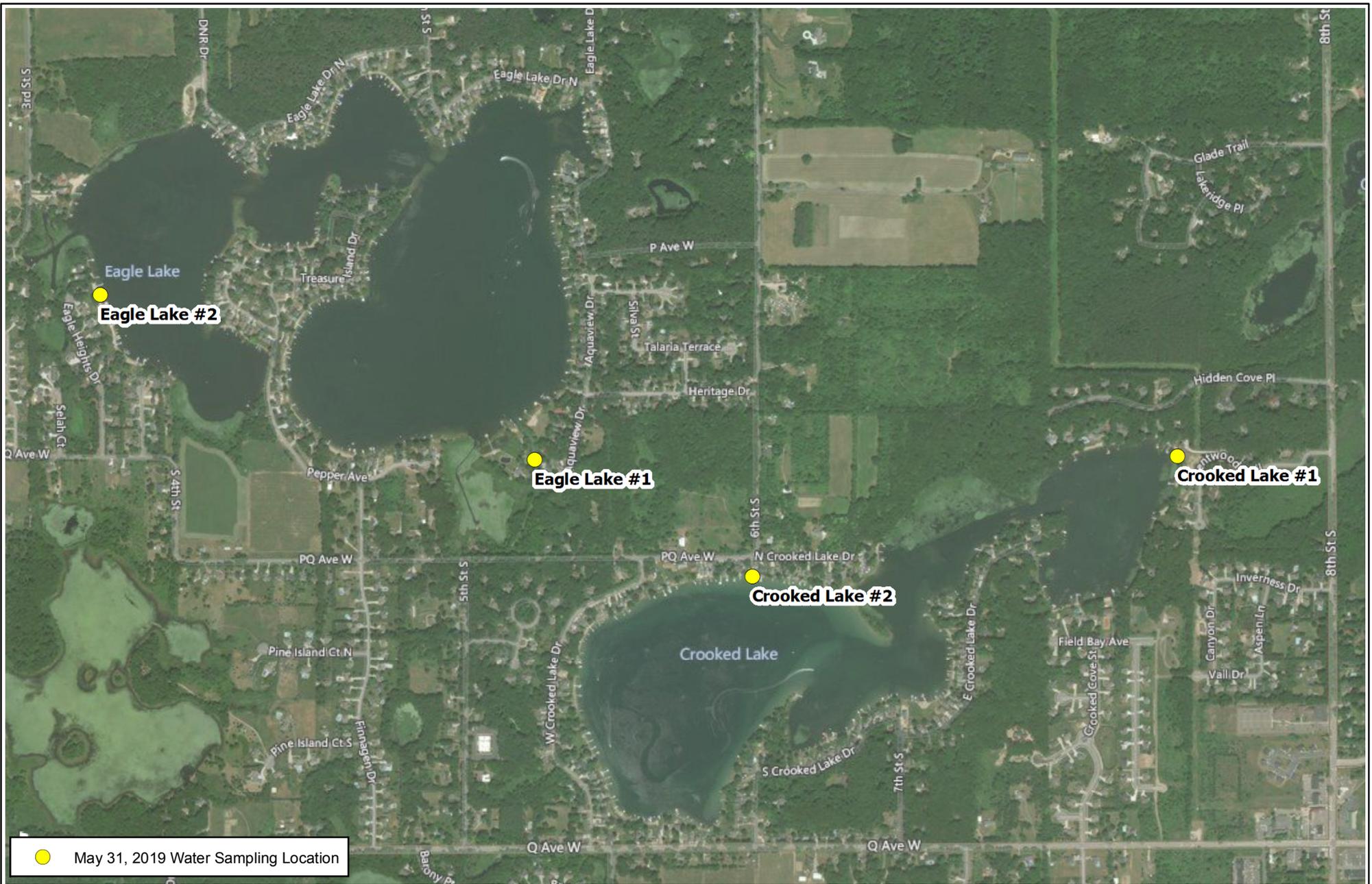
Conclusions: Both the *E. coli* and fecal coliform results from the May 31, 2019, sampling efforts are very low and *E. coli* samples are well below the state recommended Total Body Contact limits in both lakes.

In addition to reviewing results from the May 31, 2019, sampling event, GEI also reviewed the sampling results provided in the Water Quality, Phytoplankton, and Aquatic Invasive Species Survey of Eagle, Crooked, and Bass Lakes in Texas Charter Township of Kalamazoo, Michigan, report completed by Advanced Ecological Management (AEM), December 6, 2018. Results from AEM's report appear to support low *E. coli* counts in the lakes with an average of 2.0 CFU in Eagle Lake and 1.0 CFU in Crooked Lake.

With the *E. coli* and fecal coliform sample levels being so low, there are likely no issues with pumping water from one lake to another in regard to fecal contamination. The levels are also very similar between lakes, and it is unlikely a rise will be seen in *E. coli* from one lake to the other with the pumping of water.

Attachments:

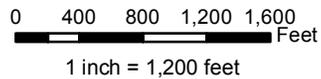
- *E. coli* and Fecal Coliform Sampling Location Map
- Trace Lab Sample Results for *E. coli* and Fecal Coliform, dated June 3, 2019
- Table 2 from AEM's Water Quality, Phytoplankton, and Aquatic Invasive Species Survey of Eagle, Crooked, and Bass Lakes in Texas Charter Township of Kalamazoo, Michigan, report, dated December 6, 2018



● May 31, 2019 Water Sampling Location

MDEQ Permit No. WRP015489 v.1
Bentwood Trail
Kalamazoo County, Michigan

Charter Township of Texas



**ESCHERICHIA COLI AND
FECAL COLIFORM SAMPLING**

Project: 1902439

Figure: 1

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June 03, 2019

Mr. Steve Rice
GEI Consultants of Michigan, P.C.
5225 Edgewater Drive
Allendale, MI 49401

Phone: (616) 384-2656

RE: Trace Project T19E906
Client Project Texas Twp. 1902439 Task 1.3

Dear Mr. Rice:

Enclosed are your analytical results. The results of this report relate only to the samples listed in the body of this report.

All reports were examined through Trace's validation process to ensure that requirements for quality and completeness were satisfied. All reported analytical results were obtained in accordance with the methods referenced on the reports. Every practical effort was made to meet the reporting limit specifications for this work, however, some results may have raised reporting limits to correct for percent solids.

For clients that require NELAP Accreditation, Trace certifies that these test results meet all requirements of the NELAP Standard, except for those analytes with a "N" notation. These analytes have not been evaluated by NELAP at Trace's discretion and will not be reported unless requested by client.

If you have questions concerning this report, please contact me at 231.773.5998 or by email at jmink@trace-labs.com.

Sincerely,

A handwritten signature in black ink, appearing to read "Jon Mink".

Jon Mink
Senior Project Manager
Enclosures



NJDEP Accreditation No. MI008

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SAMPLE SUMMARY

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID	Sample ID	Matrix	Collected By	Date Collected	Date Received
T19E906-01	Crooked Lake #1	Water	sr	05/31/19 07:55	05/31/19 11:55
T19E906-02	Crooked Lake #1	Water	sr	05/31/19 07:55	05/31/19 11:55
T19E906-03	Crooked Lake #2	Water	sr	05/31/19 08:10	05/31/19 11:55
T19E906-04	Crooked Lake #2	Water	sr	05/31/19 08:10	05/31/19 11:55
T19E906-05	Eagle Lake #1	Water	sr	05/31/19 08:25	05/31/19 11:55
T19E906-06	Eagle Lake #1	Water	sr	05/31/19 08:25	05/31/19 11:55
T19E906-07	Eagle Lake #2	Water	sr	05/31/19 08:40	05/31/19 11:55
T19E906-08	Eagle Lake #2	Water	sr	05/31/19 08:40	05/31/19 11:55

CERTIFICATE OF ANALYSIS

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AN EXPLANATION OF TERMS AND SYMBOLS WHICH MAY OCCUR IN THIS REPORT

DEFINITIONS

LCS	Laboratory Control Sample
LCSD	Laboratory Control Sample Duplicate
MS	Matrix Spike
MSD	Matrix Spike Duplicate
RPD	Relative Percent Difference
DUP	Matrix Duplicate
RDL	Reporting Detection Limit
MCL	Maximum Contamination Limit
TIC	Tentatively Identified Compound
<, ND or U	Indicates the compound was analyzed for but not detected
*	Indicates a result that exceeds its associated MCL or Surrogate control limits
N	Indicates that the compound has not been evaluated by NELAC
NA	Indicates that the compound is not available.

NOTE: Samples for volatiles that have been extracted with a water miscible solvent were corrected for the total volume of the solvent/water mixture.
Solid matrices Method Blanks are at 100% solids as such results are the same wet or dry.

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ANALYTICAL RESULTS

Trace Project ID: T19E906
 Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID: T19E906-01 Date Collected: 05/31/19 07:55 Matrix: Water
 Sample ID: Crooked Lake #1 Date Received: 05/31/19 11:55

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: SM 9222D-97
 Batch: T087655

Fecal Coliforms	3.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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ANALYTICAL RESULTS

Trace Project ID: T19E906
 Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID: T19E906-03 Date Collected: 05/31/19 08:10 Matrix: Water
 Sample ID: Crooked Lake #2 Date Received: 05/31/19 11:55

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: SM 9222D-97
 Batch: T087655

Fecal Coliforms	6.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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ANALYTICAL RESULTS

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID:	T19E906-05	Date Collected:	05/31/19 08:25	Matrix:	Water
Sample ID:	Eagle Lake #1	Date Received:	05/31/19 11:55		

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: SM 9222D-97
Batch: T087655

Fecal Coliforms	4.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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ANALYTICAL RESULTS

Trace Project ID: T19E906
 Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID: T19E906-06 Date Collected: 05/31/19 08:25 Matrix: Water
 Sample ID: Eagle Lake #1 Date Received: 05/31/19 11:55

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: HACH M-Coli Blue 24
 Batch: T087656

E. Coli	2.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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ANALYTICAL RESULTS

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID: T19E906-07 Date Collected: 05/31/19 08:40 Matrix: Water
Sample ID: Eagle Lake #2 Date Received: 05/31/19 11:55

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: SM 9222D-97
Batch: T087655

Fecal Coliforms	3.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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ANALYTICAL RESULTS

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

Trace ID: T19E906-08 Date Collected: 05/31/19 08:40 Matrix: Water
Sample ID: Eagle Lake #2 Date Received: 05/31/19 11:55

PARAMETERS	RESULTS	UNITS	RDL	DILUTION	PREPARED	BY	ANALYZED	BY	NOTES	MCL
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WET CHEMISTRY

Analysis Method: HACH M-Coli Blue 24
Batch: T087656

E. Coli	<1.0	CFU/100 ml	1.0	1	05/31/19	dc	06/01/19	ans	N	
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QUALITY CONTROL RESULTS

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

QC Batch: T087656
QC Batch Method: HACH M-Coli Blue 24

Analysis Description: E.Coli, Hach
Analysis Method: HACH M-Coli Blue 24

Trace Project ID: T19E906
Client Project ID: Texas Twp. 1902439 Task 1.3

QC Batch: T087655
QC Batch Method: SM 9222D-97

Analysis Description: Fecal Coliform
Analysis Method: SM 9222D-97

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SAMPLE LOG IN CHECKLIST

Trace ID #: T19E906 Date: 5/31/19 Package Description: Cooler Temperature: -0.6
 Client Name: GEE Consultants Time: 11:55 Logged in by: JS

Cooler Receipt

Cooler/samples delivered by: Trace courier
 Hand delivered Name of delivery person: _____
 Commercial courier UPS FED EX US Mail
 Tracking Number: Not Applicable
 Tracking #: _____
 COC Seals present and intact on cooler? Not Applicable No Yes
 Custody seals signed by Client? No Yes Client custody seal # (if applicable): _____

Coolant and Temperature

<p>Type of Coolant Used</p> <p>Slurry w/ crushed, cubed, or chip ice? <input checked="" type="checkbox"/></p> <p>Multiple bags of ice around samples? <input type="checkbox"/></p> <p>Ice Packs/ Blue Ice : <input type="checkbox"/></p> <p>No Coolant Present: <input type="checkbox"/></p> <p>Ice still present upon receipt (circle one): <input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> N/A</p>	<p>Cooler Temperature</p> <p>Correction Factors: •Digital Stick Thermometer CF = -0.5°C •IR Thermometer CF = -0.6°C</p> <p>Representative Sample Temperature: <u>3.8</u> °C (check one below)</p> <p><input type="checkbox"/> Temp Blank (Stick Thermometer) <input checked="" type="checkbox"/> Client Sample (IR Thermometer)</p> <p>Melt Water: <u>none</u> °C (Use Digital Stick Thermometer)</p>
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General			Comments
Yes	No	NA	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	_____
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
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Notes:

***EMD pH Test Strips Used:**

pH 0-2.5 Lot: HC862115 pH 11.0-13.0 Lot: HC600691

Other: _____

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Table 2. Summary water quality laboratory results from samples collected by AEM from Eagle Lake, Crooked Lake, and Bass Lake in October and November 2018.

Parameter	Eagle 1	Eagle 2	Eagle 3	Crooked 1	Crooked 2	Crooked 3	Bass 1	Bass 2	Bass 3
Hydrocarbons*	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nitrate-Nitrite*	<0.05	<0.05	<0.05	<0.02	<0.05	<0.05	<0.05	<0.05	<0.05
Ammonia*	<0.01	0.016	0.026	0.010	0.012	0.013	0.051	0.055	0.049
TKN*	0.9	0.9	<0.5	<0.5	<0.5	<0.5	0.63	<0.5	<0.5
SRP*	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
TP*	0.011	0.01	<0.01	0.015	0.012	0.011	0.017	0.016	0.012
TSS*	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total coliform [‡]	480	280	640	91	55	120	140	340	140
<i>E. coli</i> [‡]	2.0	<2.0	<2.0	1.0	<1.0	<1.0	1.0	<1.0	<1.0
Chlorophyll <i>a</i> **	-1.07	0.00	-0.534	1.60	-0.178	-0.763	-2.97	-1.33	-1.60
Pheophytin <i>a</i> **	1.57	4.61	12.7	0.641	0.676	0.362	3.68	4.89	2.72
Sediment									
TKN	17,000	13,000	11,000	9,600	1,500	22,000	26,000	16,000	27,000
TP	630	600	690	780	82	440	1,700	1,100	2,000

* – Units are reported as milligrams per liter

‡ – Units are reported as Colony Forming Unit per 100 milliliters

** – Units are reported as micrograms per liter

ND – Less than the detectable limit of the test

TKN – Total Kjeldhal Nitrogen

SRP – Soluble Reactive Phosphorus

TP – Total phosphorus

TSS – Total suspended solids