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BARR

Technical Memorandum

To: Dawn Tanner
From: Omid Mohseni
Subject: Pleasant Lake Bathymetry Survey
Date: July 22, 2020
c: 23/62-1356

Saint Paul Regional Water Services (SPRWS) operates a system that transports water from the Mississippi River at the Fridley Pump Station through two 60-inch pipes to Charley Lake. The Mississippi water flows by gravity from Charley Lake through a connecting channel to the west bay of Pleasant Lake, located in North Oaks, a suburb of Saint Paul, Minnesota. There have been reports by residents that a sandbar has formed as a result of water discharge from Charley Lake into Pleasant Lake. To address the potential adverse effects of the perceived sandbar, Vadnais Lake Area Water Management Organization (VLAWMO) retained Barr Engineering Co. (Barr) to complete a bathymetry survey of the west bay of Pleasant Lake in 2020 to accurately locate the sandbar. This memorandum is a summary of the bathymetry survey.

1.0 Field Work

The bathymetry survey was conducted on May 20, 2020, by a two-person surveying team. The instruments were a CEE Echo Hydrographic system, Trimble R7 GPS Receiver, and Topcon RTK GA GPS. The survey started at the north end of the west bay of Pleasant Lake. As the survey team proceeded to the north end, they noticed very thick weeds in the lake, predominately on the west and northern parts of the bay. The surveying team was concerned that the echo sounder would not be able to correctly capture the bottom shelf of the lake. As a result, they did some survey pole shots using GPS to check the actual depths in the area covered with aquatic plants. The pole shots verified that the echo sounder was occasionally capturing the lake bed. Accuracy of the data located in that area was within 0.5 feet.

The team surveyed a 50-foot grid across the bay. The coverage is shown in Figure 1. The echo sounder takes 15+ points per second. The west side of the bay was all weeds. In the northern part of the bay, most of these 15 points were on weeds. Once the team made it to the "sandbar," they could see sand and rock on the bottom. The depth over the sandbar was approximately 2 to 3 feet. As the team proceeded south of the sandbar, they encountered a very deep area, approximately 40 feet.

Where the channel from Charley Lake discharges into the west bay of Pleasant Lake, no sandbar was evident and depths were constant.

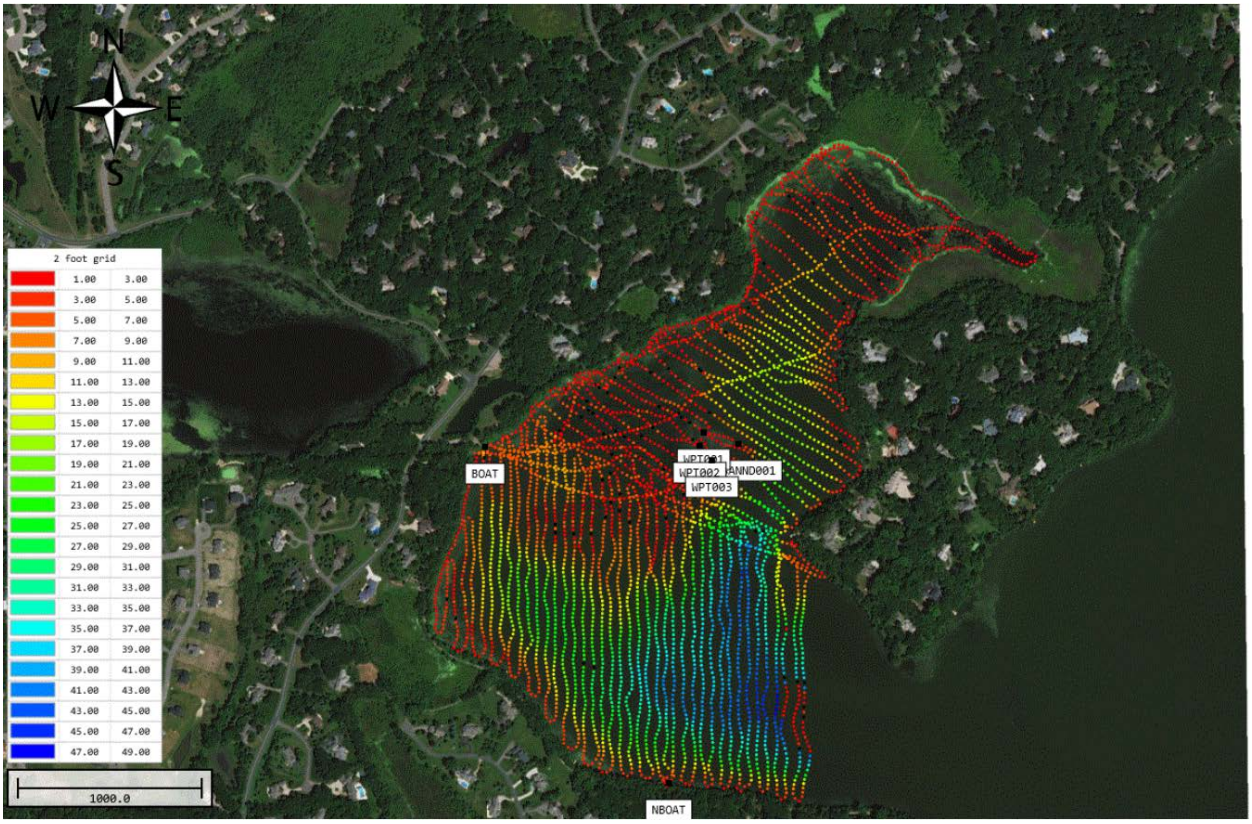

Figure 1. The survey paths of the west bay of Pleasant Lake

2.0 Bathymetry Map

The data collected during the survey was used to develop a bathymetry map of the west bay in the Civil 3D software program. To develop the map, 80 to 90 percent of the bathymetry data shots west of the "sandbar" were eliminated due to the weed thickness. This process was completed using HydroMagic hydrographic software.

The attached map is the result of the bathymetry survey. The horizontal datum is NAD83 and the vertical datum is NAVD88.

The map shows a hole approximately 400 feet to the east of the discharge point of the channel from Charley Lake. The identified sandbar is approximately 1,500 feet to the east of the discharge point.

0 200 400
SCALE IN FEET

SURVEY LEGEND

MAJOR CONTOUR
MINOR CONTOUR
GRID LINES (500')

WATER SURFACE 05-22-2020 = 893.6

BASIS OF DRAWING FILE:

DATE OF SURVEY: 05-20-2020

ORIGIN/DATE OF BASE: MSPN/2020

COORDINATE SYSTEM: Minnesota State Plane,SOUTH Zone

HORIZONTAL DATUM: NAD83 (2011) REF. VRS SYSTEM

VERTICAL DATUM: North American Vertical Datum of 1988

ADDITIONAL FILE INFORMATION:
CEE ECHO HYDROGRAPHIC SYSTEM

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF MINNESOTA.

PRINTED NAME
SIGNATURE
DATE LICENSE #

RELEASED TO/FOR	A	B	C	0	1	2	3
DATE RELEASED							

BARR

Project Office:
BARR ENGINEERING CO.
4300 MARKETPOINTE DRIVE
Suite 200
MINNEAPOLIS, MN 55435
Ph: 1-800-632-2277
Fax: (952) 832-2601
www.barr.com

Corporate Headquarters:
Minneapolis, Minnesota
Ph: 1-800-632-2277

Scale	AS SHOWN
Date	
Drawn	JHS
Checked	
Designed	
Approved	

VADNAIS LAKE WATER MANAGEMENT
VADNAIS HEIGHTS, MINNESOTA

PLEASANT LAKE
NORTH OAKS, MINNESOTA

BATHYMETRY SURVEY WEST BAY
05-2020

BARR PROJECT No. 23/62-1356.00
CLIENT PROJECT No.
DWG. No.
REV. No.

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BARR

Technical Memorandum

To: Dawn Tanner
From: Kevin Menken and Omid Mohseni
Subject: Pleasant Lake Sediment Study
Date: August 29, 2020
c: 23/62-1356

Pleasant Lake in North Oaks, Minnesota, is listed by the Minnesota Pollution Control Agency (MPCA) as impaired for mercury and high levels of nutrients. The MPCA requires a total maximum daily load (TMDL) or equivalent study to address the nutrient impairment of the lake. In addition, it appears that there are some potential issues with sediment transport from Charley Lake into Pleasant Lake through the connecting channel between the two lakes.

Vadnais Lake Area Water Management Organization (VLAWMO) retained Barr Engineering Co. (Barr) to conduct a field study to (1) investigate the physical characteristics of the sandbar in the shallow area in the west bay of Pleasant Lake, and (2) determine the concentrations of various phosphorus fractions in sediment in deep areas of Pleasant Lake. The purpose of this field study is to aid VLAWMO with a future TMDL or equivalent study of the lake. This memorandum summarizes the results of the field study conducted by Barr in 2020.

1.0 General Description of Pleasant Lake

Pleasant Lake is located in North Oaks, a suburb of the city of Saint Paul. The surface area of the lake is 607 acres and the maximum depth is 58 feet. The littoral zone includes about 45 percent of the lake.

Saint Paul Regional Water Services (SPRWS) operates the system that transports water from the Mississippi River at the Fridley Pump Station through two 60-inch pipes to Charley Lake. The Mississippi water flows by gravity from Charley Lake through a connecting channel to the west bay of Pleasant Lake. The transported water is then routed through Sucker Lake and Vadnais Lake into the McCarrons Water Treatment Plant, which serves Saint Paul residents.

Barr collected sediment samples from Pleasant Lake on May 29, 2020, and June 24, 2020. The sampling locations are shown in Figure 1.

2.0 Physical Characteristics of the Sandbar in the West Bay

2.1 Field Work

The bathymetry of the west bay of Pleasant Lake shows a shallow sandbar near the center of the west bay (Figure 1). Water depth is approximately 2 to 3 feet over the sandbar, and vegetation is sparse. Sand, gravel, cobble, and boulders (1 to 2 feet in diameter) were observed in this area. To the north, west, and

south of this sandbar, water depth increases and thick, curlyleaf pondweed was observed during the field work.

Sediment cores were collected at four locations in shallow water in the west bay of the lake using a 3-inch-diameter push corer. Sediment cores were extruded in a plastic tray in the boat and logged for appearance and physical characteristics. On May 29, 2020, sediment samples were collected from coring locations S7 and S8. These two locations were identified after the bathymetry survey of the west bay that was performed on May 20, 2020.

2.2 Analysis of the Sandbar Samples

The sediment samples were sent to Soil Engineering Testing (SET) in Bloomington, Minnesota, for grain-size analysis and sediment density measurement. The SET lab report is provided in Attachment A. On June 24, 2020, additional sediment samples were collected to verify the location of the sandbar. These samples were collected at locations S9 and S10 and logged for physical description, but no analysis was performed. They contained the root system of aquatic plants (macrophytes) with little-to-no sand particles, i.e., locations S7 and S8 more accurately represent a sandbar in the west bay than locations S9 and S10. Observations of sediment samples collected at locations S7, S8, S9, and S10 are summarized below.

- Sediment sample S7
    - Water depth: 2 feet
    - Sediment core interval: 0–1 foot
    - Area: Sparse vegetation, sand and gravel visible on lake bottom
    - Sediment: Medium-to-dark brown; sand with silt and a little bit of gravel, shell fragments, plant roots, and dead plant matter
    - Percent fines: 6%
    - Median size (d_{50}): 220 microns
    - Specific gravity: 2.63
- Sediment Sample S8
    - Water depth: 2.6 feet
    - Sediment core interval: 0–1 foot
    - Sparse vegetation; sand and gravel visible on lake bottom
    - Medium-to-dark brown; sand with silt and a little bit of gravel and plant roots. Small plant roots were quite numerous and seemed to be helping sediment core hold its shape after extruding from coring tube.
    - Percent fines: 12%

  - Median size (d_{50}): 280 microns
  - Specific gravity: 2.57

- Sediment sample S9
  - Water depth: 4 feet
  - Medium-to-dark brown soft organic muck
- Sediment sample S10
  - Water depth: 4 feet
  - Medium-to-dark brown soft organic muck

2.3 Synthesis of the Sandbar Data

Based on the bathymetry survey conducted in 2020, the particle size distribution of samples collected at locations S7 and S8, and the presence of dense aquatic plants, it is unlikely that the sandbar located about 1,500 feet away from the discharge point of the channel from Charley Lake is the result of water discharge from Charley Lake into Pleasant Lake. However, the hole near the discharge point may be the result of water discharge from Charley Lake into the west bay of Pleasant Lake.

3.0 Sediment Phosphorus Fractionation

3.1 Field Work

Sediment cores were collected for phosphorus analyses at coring locations S1 through S6, where water depth was greater than 20 feet (Figure 1). Areas with water depths greater than 20 feet normally exhibit thermal stratification and anoxia (low oxygen) in summer months, which could result in internal loading. Currently, SPRWS is managing a direct oxygen injection system at the three deepest points in Pleasant Lake (see Figure 1). At these locations, sediments that would normally experience anoxic conditions during summer thermal stratification may stay partially oxygenated at the sediment-water interface due to the oxygen injection at the bottom of the lake.

Sediment cores were collected by a gravity corer suspended on a rope. A 7-centimeter (cm)-diameter core tube is pushed into the sediment from weights attached to the coring device, and a messenger is sent down the rope to close a stopper on the top of the coring tube. Each sediment core was extruded from the coring tube and sliced into 2-cm-thick intervals from 0 cm to 10 cm, and 4-cm intervals from 10 cm to 18 cm. The sediment samples were placed in a cooler with ice for transport until they could be stored in a refrigerator at Barr's field office.

3.2 Analysis of the Bed Sediment Samples

Sediment samples were analyzed for several phosphorus fractions, percent moisture content, and percent organic matter. Moisture content was determined by measuring the mass loss of samples dried in an oven at 100 °C. Percent organic matter was determined by measuring the mass lost by burning the

samples at 550 °C (loss on ignition). Measurement of various phosphorus fractions was achieved by subjecting the sediment samples to various extraction solutions, as summarized below:

- Mobile phosphorus, including iron-bound phosphorus fraction (mobile-P): solution of sodium dithionite and sodium bicarbonate. Dithionite reduces insoluble ferric iron to soluble ferrous iron, while bicarbonate buffers the pH.
- Aluminum-bound phosphorus fraction (Al-P): solution of 0.1M NaOH (sodium hydroxide) to raise the pH and dissolve aluminum-bound phosphorus.
- Organic phosphorus fraction (Org-P): solution of 0.1M NaOH digested with potassium persulfate.
- Calcium phosphorus fraction (Ca-P): solution of 0.5M HCl (hydrogen chloride) to lower the pH and dissolve calcium-bound phosphorus.

Results of sediment phosphorus fractionation are plotted in Figure 2, reported as milligram phosphorus per gram dry sediment (mg P/g dry sediment), and Figure 3, reported as mg P/cm^3 wet sediment. Average concentrations of mobile-P and organic-P in the top 6 cm of each core were calculated and are summarized in Table 1. Results in Table 1 are presented as g P/cm-m^2, a unit of concentration that makes it easier to assess the amount of phosphorus per square meter of lake bed, i.e., 1 g P/cm-m^2 is equal to 10 mg P/cm^3.

Table 1. Concentrations of Mobile-P and Organic-P in Top 6cm of Sediment

Sediment Core	Mobile-P (g P/cm-m^2)	Org-P (g P/cm-m^2)
S1	0.82	0.25
S2	0.85	0.24
S3	1.73	0.33
S4	0.36	0.22
S5	0.71	0.27
S6	0.88	0.32

3.3 Synthesis of the Sediment Data

Concentrations of mobile-P are high in Pleasant Lake sediment cores, likely due to the oxygen injection system keeping more iron oxidized. The oxygenation of the hypolimnion (the water column below the thermocline) prevents the top of the sediment from going anoxic and allows for the buildup of oxidized iron, or ferric iron [Fe(III)]. Without the oxygenation system, the hypolimnion would be depleted of oxygen in the warm summer months, and microorganisms in the anoxic sediment would use iron for respiration in place of oxygen, converting insoluble ferric iron [Fe(III)] to soluble ferrous iron [Fe(II)].

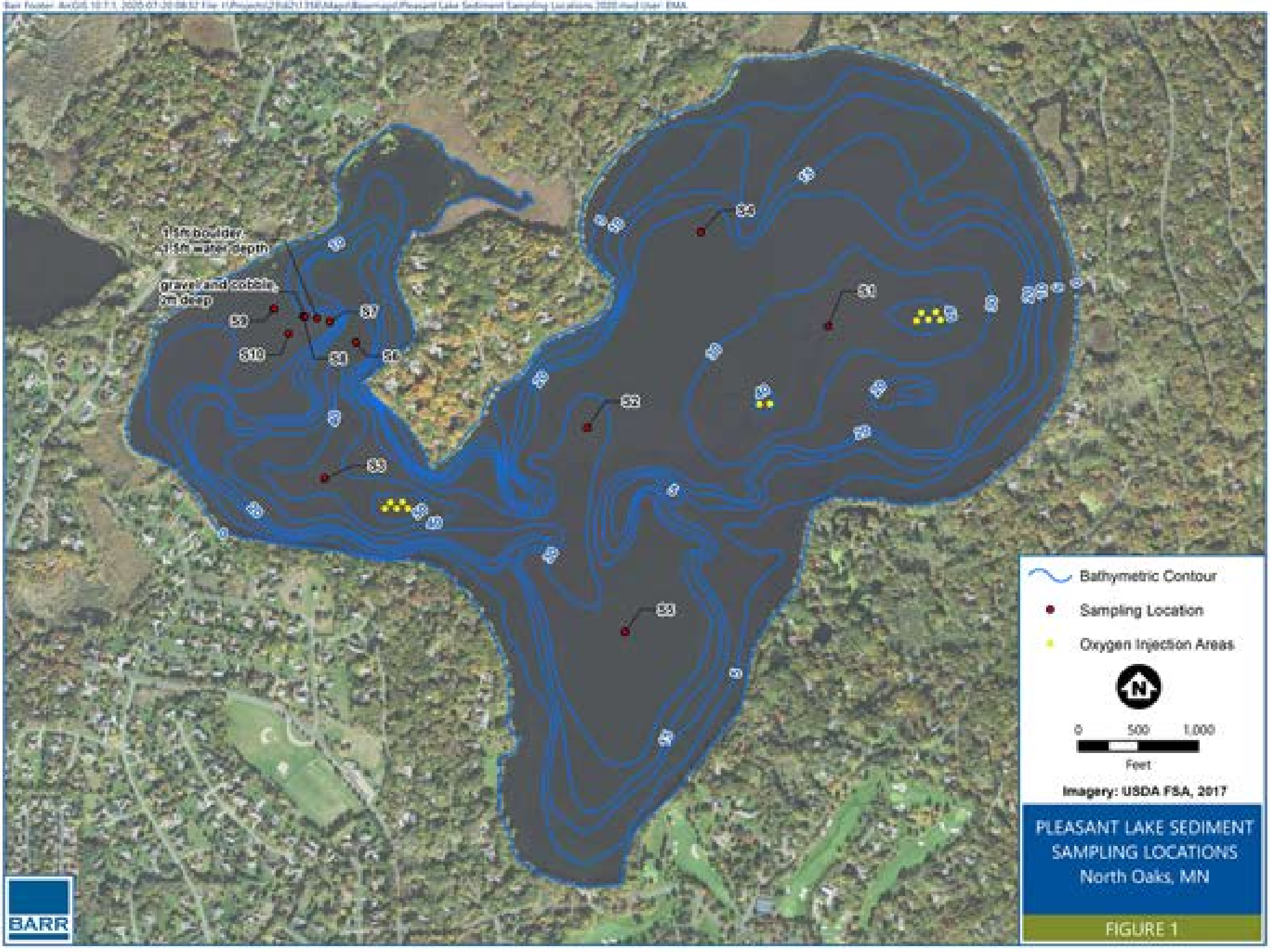
Relationships between concentrations of mobile-P and internal loading rates of phosphorus from lake sediments have been studied. Pilgrim et al. (2007) reported phosphorus internal loading rates under anoxic conditions for sediment cores collected from Minnesota lakes with a range of sediment mobile-P

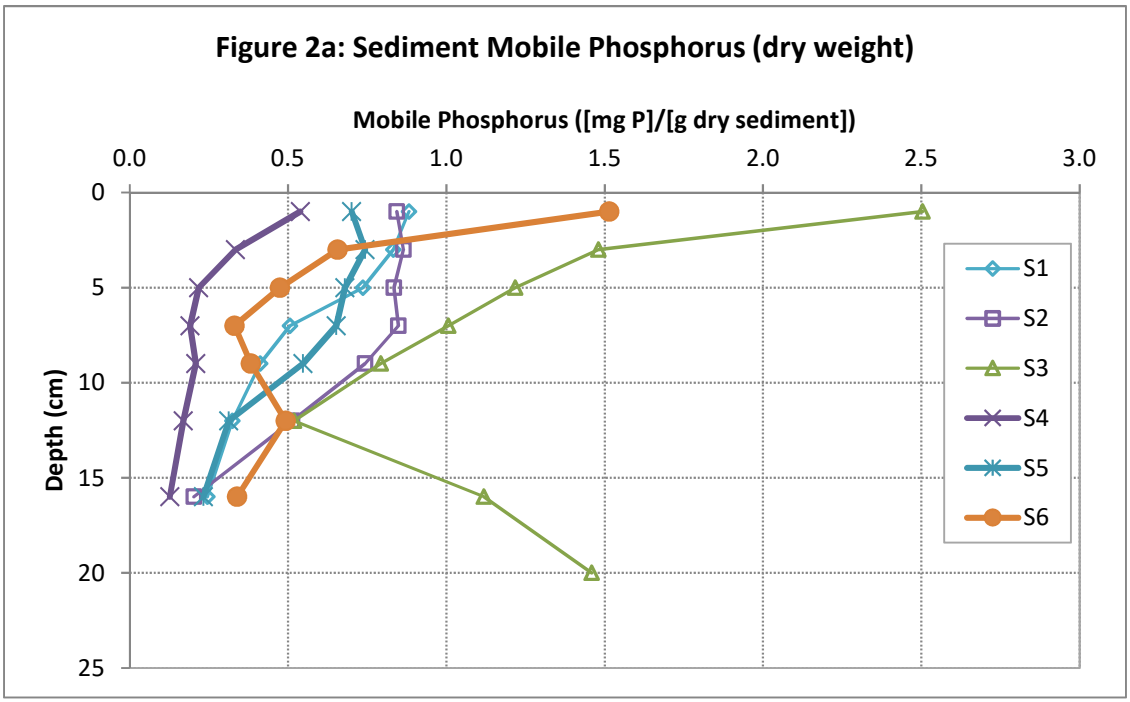
concentrations. The concentrations of mobile-P in Pleasant Lake sediment cores S1, S2, S5, and S6 are comparable to the highest mobile-P observed in that study, while mobile-P concentrations in S3 are nearly double those observed by Pilgrim et al. (2007). The oxygen injection system in Pleasant Lake appears to be effectively keeping iron oxidized in the top several centimeters of sediment, building up iron-bound phosphorus (mobile-P). However, if the sediment of Pleasant Lake were to turn anoxic, the insoluble ferric iron would start to be reduced to ferrous iron and could contribute to high rates of internal loading.

The sediment mobile-P concentrations can provide an estimate of the maximum internal loading rate of phosphorus that might be expected under continuous anoxic conditions in a stratified lake, using the relationship developed by Pilgrim et al. (2007). The dynamics of anoxia in sediment, and therefore internal loading of phosphorus in Pleasant Lake, are more complex due to the oxygen injection system. To better understand internal loading that may still be occurring in Pleasant Lake, more detailed water quality data could be collected, such as dissolved oxygen concentration profiles near the lake bottom at various distances from the oxygen injection points and at different points in the season. Sediment samples that were collected for phosphorus fractionation could also be analyzed for total iron concentrations to determine the ratio of iron to mobile-P in the sediment. This would help assess whether there is sufficient iron in the sediment to potentially bind more phosphorus under oxic conditions. A phosphorus mass balance model could also be developed for the lake that could simulate phosphorus concentrations in the hypolimnion (deep water) and epilimnion (surface mixed layer) of the lake.

References

Pilgrim, K.M., Huser, B., and Brezonik, P.L. 2007. A method for comparative evaluation of whole-lake and inflow alum treatment. *Water Research*, 41(6):1215-24. DOI: 10.1016/j.watres.2006.12.025.


1-1ft boulder
<1ft water depth
gravel and cobble
>1ft deep
SB1
SB2
SB3
SB4
SB5
SB6
SB7
SB8
SB9
SB10
Bathymetric Contour
Sampling Location
Oxygen Injection Areas
N
0
500
1,000
Feet
Imagery: USDA FSA, 2017
PLEASANT LAKE SEDIMENT SAMPLING LOCATIONS
North Oaks, MN
FIGURE 1
BARR



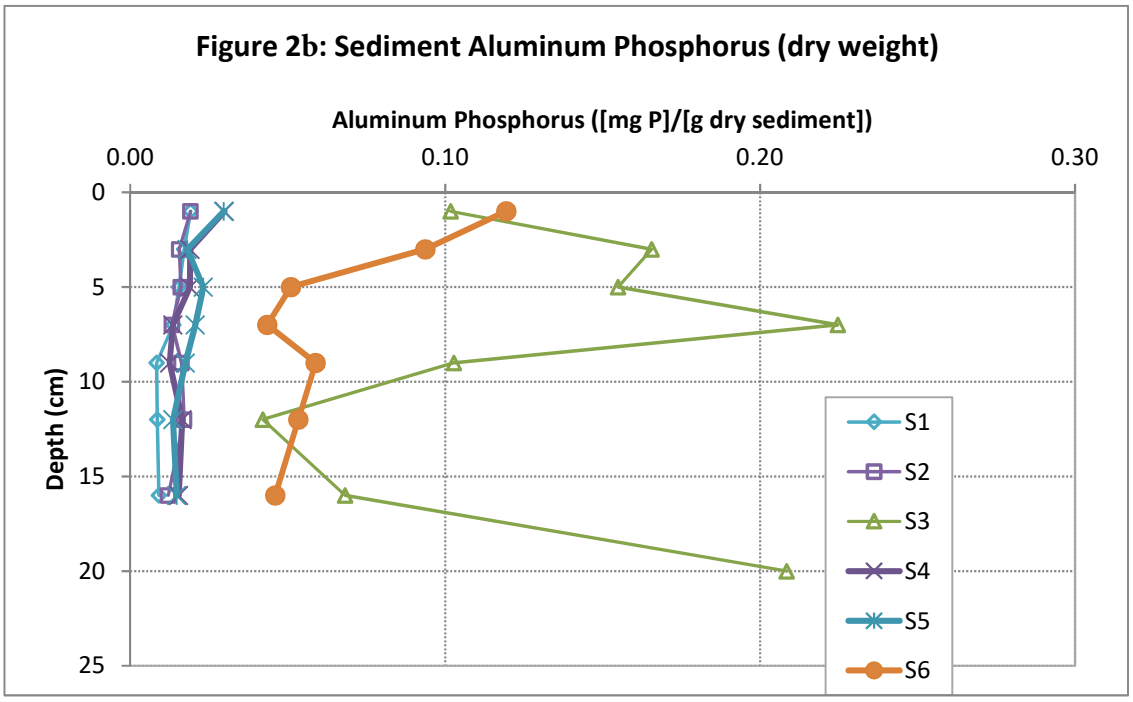
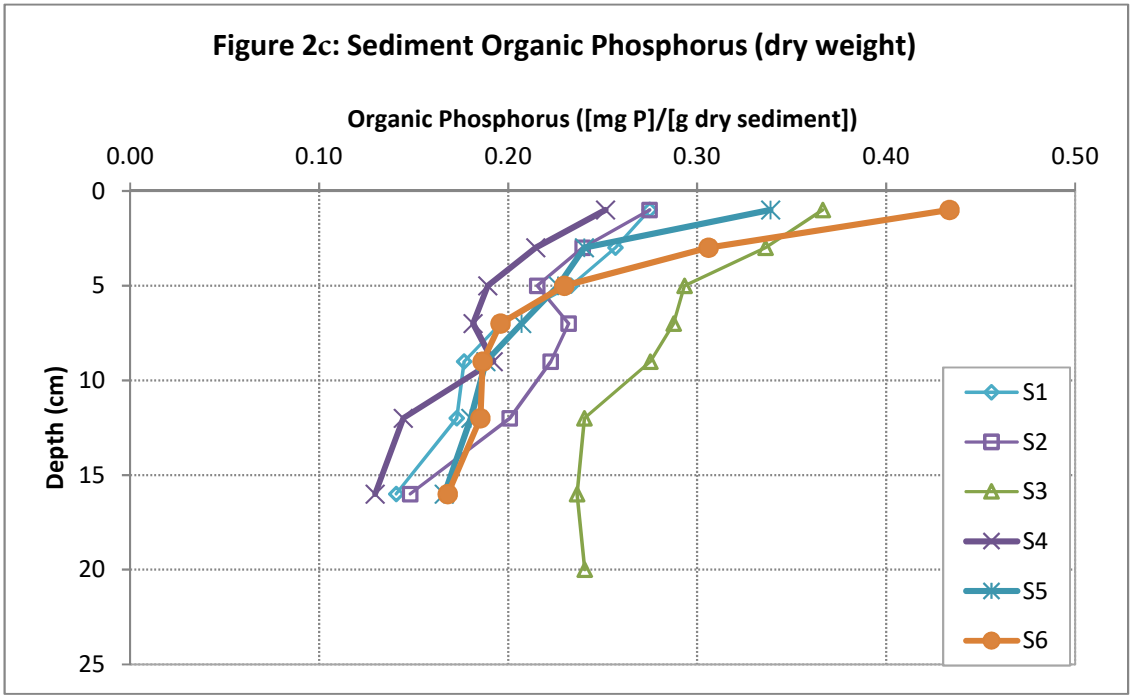


Figure 2. Pleasant Lake Sediment Phosphorus Fractionation, Dry Weight Basis.



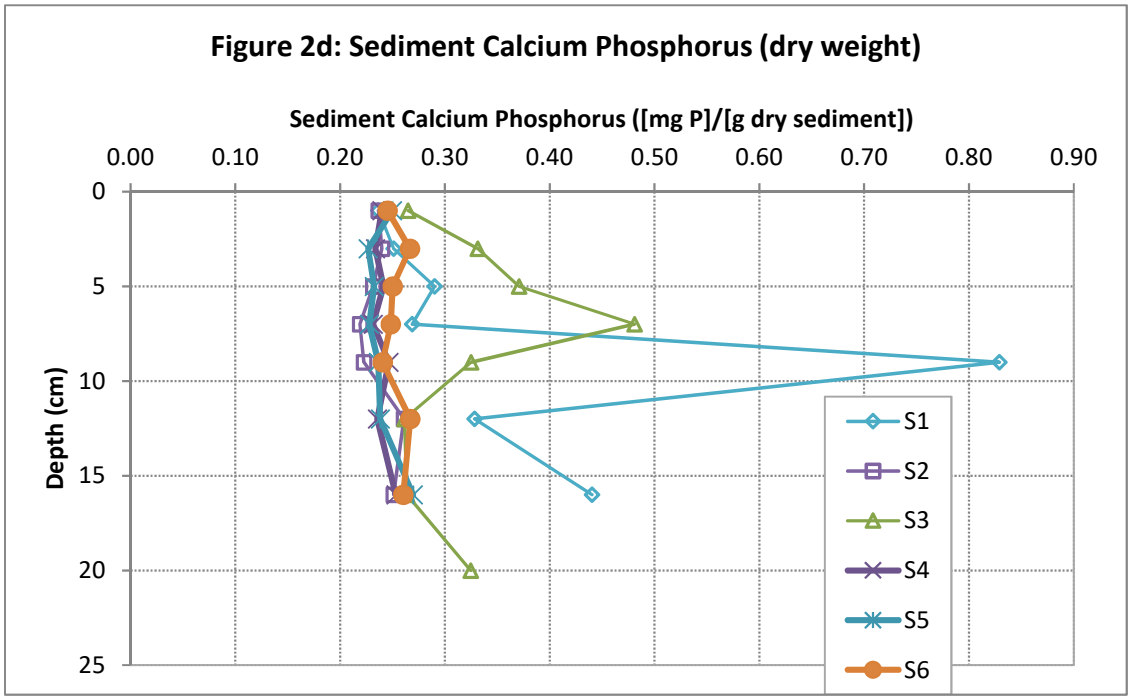
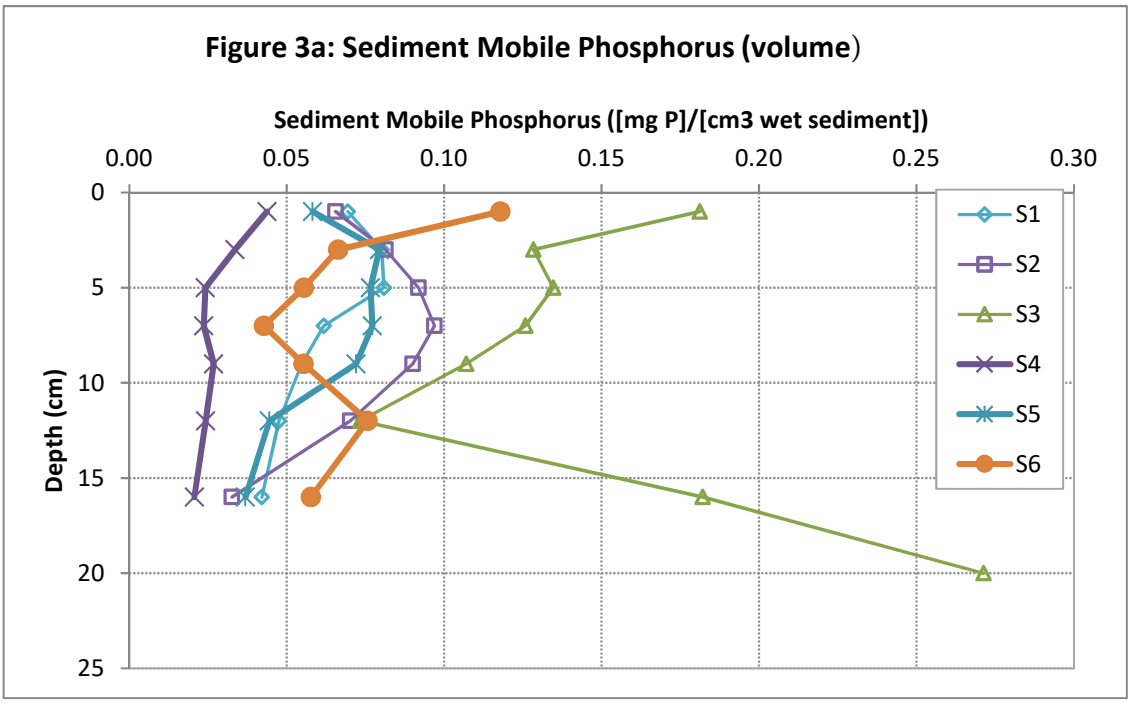


Figure 2. Pleasant Lake Sediment Phosphorus Fractionation, Dry Weight Basis.



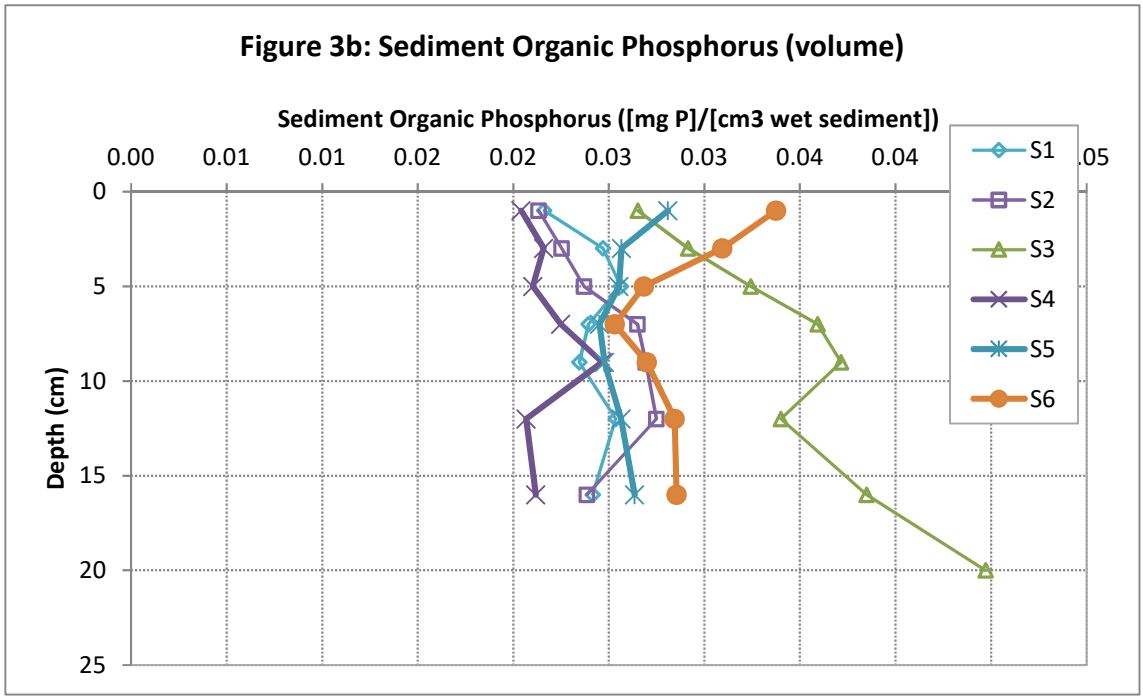
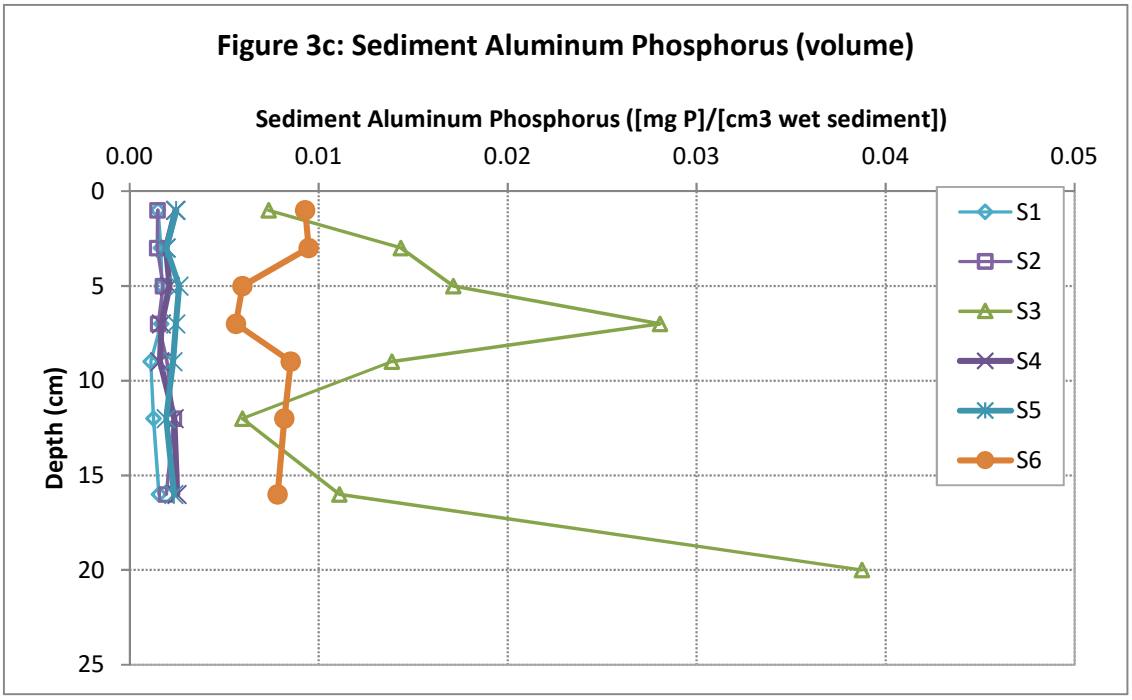


Figure 3. Pleasant Lake Sediment Phosphorus Fractionation, Sediment Volume Basis.



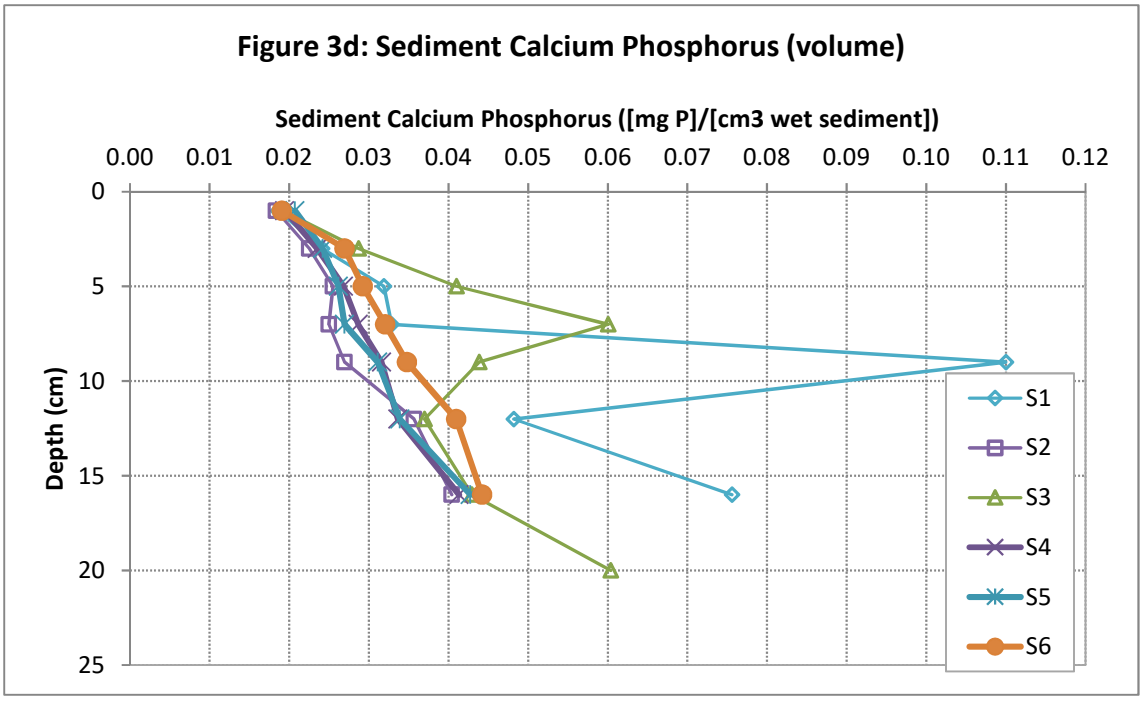


Figure 3. Pleasant Lake Sediment Phosphorus Fractionation, Sediment Volume Basis.

Attachment A:

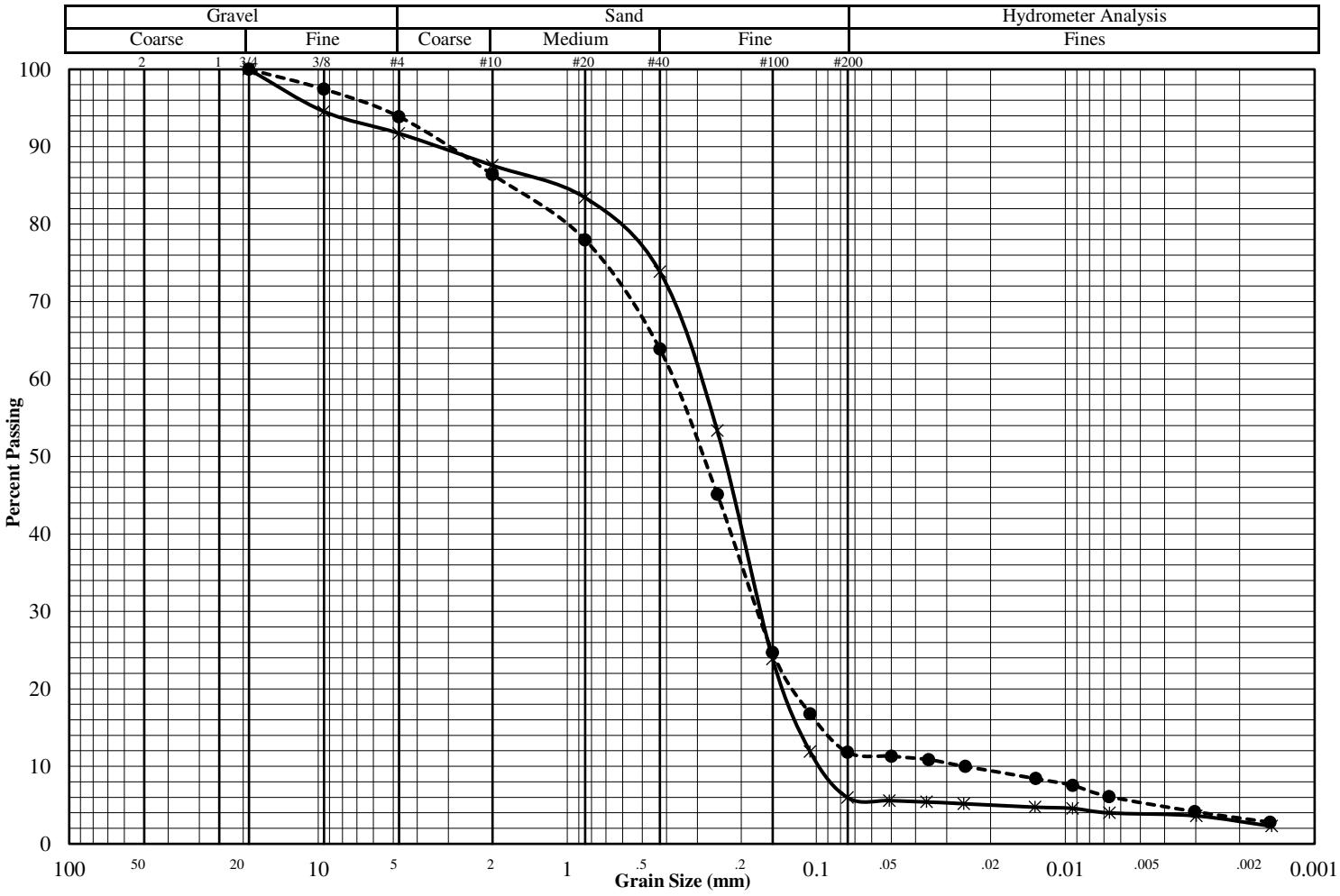
SET Laboratory Report on the Sandbar Sediment Samples

Grain Size Distribution ASTM D6913/D7928

Job No. : **12586**

Project:	Pleasant Lake	Test Date:	6/12/20
Reported To:	Barr Engineering Company	Report Date:	6/22/20

	Sample Date / Time	Sample No.	Depth (ft)	Sample Type	Soil Classification
*	5/29/20, 15:30	S7		Bag	Sand w/silt, a little gravel, and a trace of organic material, fine grained (SP-SM/SP)
●	5/29/20, 16:00	S8		Bag	Sand w/silt, a little gravel, and a trace of organic material, fine grained (SP-SM/SM)
◇					



Additional Results	*	●	◇
Liquid Limit			
Plastic Limit			
Plasticity Index ASTM:D4316			
Water Content ASTM:D2216			
Dry Density (pcf) ASTM:D7263			
Specific Gravity ASTM:D854	2.63	2.57	
Porosity			
Organic Content ASTM:D2974			
pH ASTM:D4972 Method B			

(* = assumed)

Percent Passing (Single Set)

	*	●	◇
Mass (g)	752.7	597.6	
1"			
3/4"	100.0	100.0	
3/8"	94.6	97.4	
#4	91.7	93.9	
#10	87.6	86.4	
#20	83.4	78.0	
#40	73.9	63.9	
#60	53.3	45.1	
#100	23.9	24.7	
#140	11.9	16.8	
#200	6.0	11.8	

**Sieves larger than 1" reported on page 2

	*	●	◇
D_{60}			
D_{30}			
D_{10}			
C_U			
C_C			

Remarks:

**The specific gravities were run only on material passing the #200 sieve.

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Grain Size Distribution ASTM D6913/D7928

Job No. : **12586**

Project:	Pleasant Lake	Test Date:	6/12/20
Reported To:	Barr Engineering Company	Report Date:	6/22/20

	Sample Date / Time	Sample No.	Depth (ft)	Sample Type	Soil Classification
Spec 1	5/29/20, 15:30	S7		Bag	Sand w/silt and a little gravel, fine grained (SP-SM/SP)
Spec 2	5/29/20, 16:00	S8		Bag	Sand w/silt and a little gravel, fine grained (SP-SM/SM)
Spec 3					

Sieve Data

Specimen 1		Specimen 2		Specimen 3	
Sieve	% Passing	Sieve	% Passing	Sieve	% Passing
3"		3"		3"	
2"		2"		2"	
1 1/2"		1 1/2"		1 1/2"	
1"		1"		1"	
3/4"	100.0	3/4"	100.0	3/4"	
3/8"	94.6	3/8"	97.4	3/8"	
#4	91.7	#4	93.9	#4	
#10	87.6	#10	86.4	#10	
#20	83.4	#20	78.0	#20	
#40	73.9	#40	63.9	#40	
#60	53.3	#60	45.1	#60	
#100	23.9	#100	24.7	#100	
#140	11.9	#140	16.8	#140	
#200	6.0	#200	11.8	#200	

Hydrometer Data

Specimen 1		Specimen 2		Specimen 3	
Diameter (mm)	% Passing	Diameter	% Passing	Diameter	% Passing
0.051	5.6	0.050	11.3		
0.036	5.4	0.035	10.9		
0.026	5.2	0.025	10.0		
0.013	4.7	0.013	8.4		
0.009	4.6	0.009	7.6		
0.007	4.0	0.007	6.1		
0.003	3.6	0.003	4.2		
0.001	2.3	0.002	2.8		

Remarks

Specimen 1	Specimen 2	Specimen 3

9530 James Ave South

SOIL ENGINEERING TESTING, INC.

Bloomington, MN 55431

Attachment B:

Pace Analytical Services, LLC, Sediment Iron Content Laboratory Report

Pleasant Lake Mobile-P and Total Iron

Core	Interval (cm)		Mid (cm)	Mobile-P (mg P/cm3)	Total Iron (mg/cm3)	Ratio of Total Fe/Fe-P
S1	0	2	1	0.0694	2.31	33
S1	2	4	3	0.0801	2.40	30
S1	4	6	5	0.0809	2.49	31
S1	6	8	7	0.0618		
S1	8	10	9	0.0547		
S1	10	14	12	0.0476		
S1	14	18	16	0.0421		
S2	0	2	1	0.0655	2.77	42
S2	2	4	3	0.0813	2.66	33
S2	4	6	5	0.0918	2.90	32
S2	6	8	7	0.0969		
S2	8	10	9	0.0900		
S2	10	14	12	0.0702		
S2	14	18	16	0.0326		
S3	0	2	1	0.1812	3.84	21
S3	2	4	3	0.1283	3.58	28
S3	4	6	5	0.1346	4.34	32
S3	6	8	7	0.1257		
S3	8	10	9	0.1070		
S3	10	14	12	0.0734		
S3	14	18	16	0.1821		
S3	18	22	20	0.2713		
S4	0	2	1	0.0437	2.22	51
S4	2	4	3	0.0336	2.23	66
S4	4	6	5	0.0242	2.31	95
S4	6	8	7	0.0236		
S4	8	10	9	0.0268		
S4	10	14	12	0.0242		
S4	14	18	16	0.0207		
S5	0	2	1	0.0582	2.73	47
S5	2	4	3	0.0794	2.90	37
S5	4	6	5	0.0766	2.85	37
S5	6	8	7	0.0772		
S5	8	10	9	0.0720		
S5	10	14	12	0.0445		
S5	14	18	16	0.0369		
S6	0	2	1	0.1179	3.01	26
S6	2	4	3	0.0664	3.51	53
S6	4	6	5	0.0555	3.54	64
S6	6	8	7	0.0427		
S6	8	10	9	0.0554		
S6	10	14	12	0.0757		
S6	14	18	16	0.0577		

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
(612)607-1700

August 17, 2020

Kevin Menken
Barr Engineering
4300 MarketPointe Drive
Suite 200
Minneapolis, MN 55435

RE: Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Dear Kevin Menken:

Enclosed are the analytical results for sample(s) received by the laboratory on August 07, 2020. The results relate only to the samples included in this report. Results reported herein conform to the applicable TNI/NELAC Standards and the laboratory's Quality Manual, where applicable, unless otherwise noted in the body of the report.

The test results provided in this final report were generated by each of the following laboratories within the Pace Network:

- Pace Analytical Services - Minneapolis

If you have any questions concerning this report, please feel free to contact me.

Sincerely,

Amanda Albrecht
amanda.albrecht@pacelabs.com
(612)607-6382
Project Manager

Enclosures

cc: BarrDM, Barr Engineering Company
Data Management, Barr Engineering
Terri Olson, Barr Engineering Company
Accounts Payable, Barr Engineering

Pace Analytical Services, LLC
1700 Elm Street - Suite 200
Minneapolis, MN 55414
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CERTIFICATIONS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Pace Analytical Services - Minneapolis MN

A2LA Certification #: 2926.01
Alabama Certification #: 40770
Alaska Contaminated Sites Certification #: 17-009
Alaska DW Certification #: MN00064
Arizona Certification #: AZ0014
Arkansas DW Certification #: MN00064
Arkansas WW Certification #: 88-0680
California Certification #: 2929
CNMI Saipan Certification #: MP0003
Colorado Certification #: MN00064
Connecticut Certification #: PH-0256
EPA Region 8+Wyoming DW Certification #: via MN 027-053-137
Florida Certification #: E87605
Georgia Certification #: 959
Guam EPA Certification #: MN00064
Hawaii Certification #: MN00064
Idaho Certification #: MN00064
Illinois Certification #: 200011
Indiana Certification #: C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky DW Certification #: 90062
Kentucky WW Certification #: 90062
Louisiana DEQ Certification #: 03086
Louisiana DW Certification #: MN00064
Maine Certification #: MN00064
Maryland Certification #: 322
Massachusetts DWP Certification #: via MN 027-053-137
Michigan Certification #: 9909
Minnesota Certification #: 027-053-137
Minnesota Dept of Ag Certifcation #: via MN 027-053-137
Minnesota Petrofund Certification #: 1240
Mississippi Certification #: MN00064
Missouri Certification #: 10100
Montana Certification #: CERT0092
Nebraska Certification #: NE-OS-18-06
Nevada Certification #: MN00064
New Hampshire Certification #: 2081
New Jersey Certification #: MN002
New York Certification #: 11647
North Carolina DW Certification #: 27700
North Carolina WW Certification #: 530
North Dakota Certification #: R-036
Ohio DW Certification #: 41244
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Primary Certification #: MN300001
Oregon Secondary Certification #: MN200001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification #: MN00064
South Carolina Certification #:74003001
Tennessee Certification #: TN02818
Texas Certification #: T104704192
Utah Certification #: MN00064
Vermont Certification #: VT-027053137
Virginia Certification #: 460163
Washington Certification #: C486
West Virginia DEP Certification #: 382
West Virginia DW Certification #: 9952 C
Wisconsin Certification #: 999407970
Wyoming UST Certification #: via A2LA 2926.01

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SAMPLE SUMMARY

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10527724001	**S1_0-2**	Solid	05/29/20 15:00	08/07/20 10:55
10527724002	**S1_2-4**	Solid	05/29/20 15:01	08/07/20 10:55
10527724003	**S1_4-6**	Solid	05/29/20 15:02	08/07/20 10:55
10527724004	**S2_0-2**	Solid	05/29/20 15:15	08/07/20 10:55
10527724005	**S2_2-4**	Solid	05/29/20 15:16	08/07/20 10:55
10527724006	**S2_4-6**	Solid	05/29/20 15:17	08/07/20 10:55
10527724007	**S3_0-2**	Solid	05/29/20 15:30	08/07/20 10:55
10527724008	**S3_2-4**	Solid	05/29/20 15:31	08/07/20 10:55
10527724009	**S3_4-6**	Solid	05/29/20 15:32	08/07/20 10:55
10527724010	**S4_0-2**	Solid	05/29/20 15:45	08/07/20 10:55
10527724011	**S4_2-4**	Solid	05/29/20 15:46	08/07/20 10:55
10527724012	**S4_4-6**	Solid	05/29/20 15:47	08/07/20 10:55
10527724013	**S5_0-2**	Solid	05/29/20 16:01	08/07/20 10:55
10527724014	**S5_2-4**	Solid	05/29/20 16:02	08/07/20 10:55
10527724015	**S5_4-6**	Solid	05/29/20 16:03	08/07/20 10:55
10527724016	**S6_0-2**	Solid	05/29/20 16:15	08/07/20 10:55
10527724017	**S6_2-4**	Solid	05/29/20 16:16	08/07/20 10:55
10527724018	**S6_4-6**	Solid	05/29/20 16:17	08/07/20 10:55

REPORT OF LABORATORY ANALYSIS

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SAMPLE ANALYTE COUNT

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Lab ID	Sample ID	Method	Analysts	Analytes Reported	Laboratory
10527724001	**S1_0-2**	EPA 6010D	IP	1	PASI-M
10527724002	**S1_2-4**	EPA 6010D	IP	1	PASI-M
10527724003	**S1_4-6**	EPA 6010D	IP	1	PASI-M
10527724004	**S2_0-2**	EPA 6010D	IP	1	PASI-M
10527724005	**S2_2-4**	EPA 6010D	IP	1	PASI-M
10527724006	**S2_4-6**	EPA 6010D	IP	1	PASI-M
10527724007	**S3_0-2**	EPA 6010D	IP	1	PASI-M
10527724008	**S3_2-4**	EPA 6010D	IP	1	PASI-M
10527724009	**S3_4-6**	EPA 6010D	IP	1	PASI-M
10527724010	**S4_0-2**	EPA 6010D	IP	1	PASI-M
10527724011	**S4_2-4**	EPA 6010D	IP	1	PASI-M
10527724012	**S4_4-6**	EPA 6010D	IP	1	PASI-M
10527724013	**S5_0-2**	EPA 6010D	IP	1	PASI-M
10527724014	**S5_2-4**	EPA 6010D	IP	1	PASI-M
10527724015	**S5_4-6**	EPA 6010D	IP	1	PASI-M
10527724016	**S6_0-2**	EPA 6010D	IP	1	PASI-M
10527724017	**S6_2-4**	EPA 6010D	IP	1	PASI-M
10527724018	**S6_4-6**	EPA 6010D	IP	1	PASI-M

PASI-M = Pace Analytical Services - Minneapolis

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S1_0-2 **Lab ID: 10527724001** Collected: 05/29/20 15:00 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2230**	mg/kg	5.0	1.9	1	08/13/20 07:37	08/13/20 17:03	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S1_2-4 **Lab ID: 10527724002** Collected: 05/29/20 15:01 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2300**	mg/kg	4.7	1.8	1	08/13/20 07:37	08/13/20 17:06	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S1_4-6 **Lab ID: 10527724003** Collected: 05/29/20 15:02 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2370**	mg/kg	4.8	1.8	1	08/13/20 07:37	08/13/20 17:09	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S2_0-2 **Lab ID: 10527724004** Collected: 05/29/20 15:15 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2680**	mg/kg	5.0	1.9	1	08/13/20 07:37	08/13/20 17:12	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S2_2-4 **Lab ID: 10527724005** Collected: 05/29/20 15:16 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2550**	mg/kg	4.6	1.8	1	08/13/20 07:37	08/13/20 17:14	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S2_4-6 **Lab ID: 10527724006** Collected: 05/29/20 15:17 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2760**	mg/kg	4.7	1.8	1	08/13/20 07:37	08/13/20 17:23	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S3_0-2 **Lab ID: 10527724007** Collected: 05/29/20 15:30 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**3720**	mg/kg	4.9	1.8	1	08/13/20 07:37	08/13/20 17:26	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S3_2-4 **Lab ID: 10527724008** Collected: 05/29/20 15:31 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**3450**	mg/kg	5.0	1.9	1	08/13/20 07:37	08/13/20 17:29	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S3_4-6 **Lab ID: 10527724009** Collected: 05/29/20 15:32 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**4130**	mg/kg	5.0	1.9	1	08/13/20 07:37	08/13/20 17:32	7439-89-6	

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S4_0-2 **Lab ID: 10527724010** Collected: 05/29/20 15:45 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2140**	mg/kg	4.6	1.7	1	08/13/20 07:37	08/13/20 17:35	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S4_2-4 **Lab ID: 10527724011** Collected: 05/29/20 15:46 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2140**	mg/kg	4.5	1.7	1	08/13/20 07:37	08/13/20 17:38	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S4_4-6 **Lab ID: 10527724012** Collected: 05/29/20 15:47 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2200**	mg/kg	4.8	1.8	1	08/13/20 07:37	08/13/20 17:41	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S5_0-2 **Lab ID: 10527724013** Collected: 05/29/20 16:01 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2630**	mg/kg	4.6	1.8	1	08/13/20 07:37	08/13/20 17:44	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S5_2-4 **Lab ID: 10527724014** Collected: 05/29/20 16:02 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2770**	mg/kg	4.8	1.8	1	08/13/20 07:37	08/13/20 17:47	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S5_4-6 **Lab ID: 10527724015** Collected: 05/29/20 16:03 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2710**	mg/kg	4.5	1.7	1	08/13/20 07:37	08/13/20 17:50	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S6_0-2 **Lab ID: 10527724016** Collected: 05/29/20 16:15 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**2910**	mg/kg	4.5	1.7	1	08/13/20 07:37	08/13/20 17:59	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S6_2-4 **Lab ID: 10527724017** Collected: 05/29/20 16:16 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**3360**	mg/kg	4.9	1.8	1	08/13/20 07:37	08/13/20 18:02	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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ANALYTICAL RESULTS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Sample: S6_4-6 **Lab ID: 10527724018** Collected: 05/29/20 16:17 Received: 08/07/20 10:55 Matrix: Solid

Results reported on a "wet-weight" basis

Parameters	Results	Units	PQL	MDL	DF	Prepared	Analyzed	CAS No.	Qual
6010D MET ICP	Analytical Method: EPA 6010D Preparation Method: EPA 3050B Pace Analytical Services - Minneapolis								
Iron	**3360**	mg/kg	4.7	1.8	1	08/13/20 07:37	08/13/20 18:04	7439-89-6	

REPORT OF LABORATORY ANALYSIS

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QUALITY CONTROL DATA

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

QC Batch: 691690
QC Batch Method: EPA 3050B
Analysis Method: EPA 6010D
Analysis Description: 6010D Solids
Laboratory: Pace Analytical Services - Minneapolis
Associated Lab Samples: 10527724001, 10527724002, 10527724003, 10527724004, 10527724005, 10527724006, 10527724007, 10527724008, 10527724009, 10527724010, 10527724011, 10527724012, 10527724013, 10527724014, 10527724015, 10527724016, 10527724017, 10527724018

METHOD BLANK: 3697981 Matrix: Solid
Associated Lab Samples: 10527724001, 10527724002, 10527724003, 10527724004, 10527724005, 10527724006, 10527724007, 10527724008, 10527724009, 10527724010, 10527724011, 10527724012, 10527724013, 10527724014, 10527724015, 10527724016, 10527724017, 10527724018

Parameter	Units	Blank Result	Reporting Limit	MDL	Analyzed	Qualifiers
Iron	mg/kg	2.8J	4.9	1.9	08/13/20 16:33	P8

LABORATORY CONTROL SAMPLE: 3697982

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Iron	mg/kg	962	997	104	80-120	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 3697983 3697984

Parameter	Units	10527756001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Iron	mg/kg	7900	1000	1000	8880	9050	98	115	75-125	2	20	

Results presented on this page are in the units indicated by the "Units" column except where an alternate unit is presented to the right of the result.

REPORT OF LABORATORY ANALYSIS

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QUALIFIERS

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

DEFINITIONS

DF - Dilution Factor, if reported, represents the factor applied to the reported data due to dilution of the sample aliquot.

ND - Not Detected at or above adjusted reporting limit.

TNTC - Too Numerous To Count

J - Estimated concentration above the adjusted method detection limit and below the adjusted reporting limit.

MDL - Adjusted Method Detection Limit.

PQL - Practical Quantitation Limit.

RL - Reporting Limit - The lowest concentration value that meets project requirements for quantitative data with known precision and bias for a specific analyte in a specific matrix.

S - Surrogate

1,2-Diphenylhydrazine decomposes to and cannot be separated from Azobenzene using Method 8270. The result for each analyte is a combined concentration.

Consistent with EPA guidelines, unrounded data are displayed and have been used to calculate % recovery and RPD values.

LCS(D) - Laboratory Control Sample (Duplicate)

MS(D) - Matrix Spike (Duplicate)

DUP - Sample Duplicate

RPD - Relative Percent Difference

NC - Not Calculable.

SG - Silica Gel - Clean-Up

U - Indicates the compound was analyzed for, but not detected.

N-Nitrosodiphenylamine decomposes and cannot be separated from Diphenylamine using Method 8270. The result reported for each analyte is a combined concentration.

Pace Analytical is TNI accredited. Contact your Pace PM for the current list of accredited analytes.

TNI - The NELAC Institute.

ANALYTE QUALIFIERS

P8	Analyte was detected in the method blank. All associated samples had concentrations of at least ten times greater than the blank or were below the reporting limit.

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QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 23621356.00 Pleasant Lake
Pace Project No.: 10527724

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10527724001	**S1_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724002	**S1_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724003	**S1_4-6**	EPA 3050B	691690	EPA 6010D	692421
10527724004	**S2_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724005	**S2_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724006	**S2_4-6**	EPA 3050B	691690	EPA 6010D	692421
10527724007	**S3_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724008	**S3_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724009	**S3_4-6**	EPA 3050B	691690	EPA 6010D	692421
10527724010	**S4_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724011	**S4_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724012	**S4_4-6**	EPA 3050B	691690	EPA 6010D	692421
10527724013	**S5_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724014	**S5_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724015	**S5_4-6**	EPA 3050B	691690	EPA 6010D	692421
10527724016	**S6_0-2**	EPA 3050B	691690	EPA 6010D	692421
10527724017	**S6_2-4**	EPA 3050B	691690	EPA 6010D	692421
10527724018	**S6_4-6**	EPA 3050B	691690	EPA 6010D	692421

Barr Engineering Co. Chain of Custody

Sample Origination State: ☐ CO ☐ MI ☒ MN ☐ MO ☐ ND ☐ TX ☐ UT ☐ WI ☐ Other: _____

COC Number: № 585953
COC 1 of 2

REPORT TO		INVOICE TO	
Company:	Barr Eng.	Company:	Barr Eng.
Address:		Address:	
Address:		Address:	
Name:	Kevin Menken	Name:	
email:	kmenken@barr.com	email:	
Copy to:	~~BarrDM@barr.com~~	P.O.	
Project Name:	Pleasant Lake	Barr Project No:	23621356.00

Matrix Code: GW = Groundwater, SW = Surface Water, WW = Waste Water
Preservative Code: A = None, B = HCl, C = HNO, K = Other

WO# : 10527724
10527724

	Location	Sample Depth Start	Stop	Unit (m./ft. or in.)	Collection Date (mm/dd/yyyy)	Collection Time (hh:mm)	Matrix Code	Perform MS/MSD Y / N	Total Number Of Containers	Analysis Requested: Water	Soil: Total Fe	Soil: % Solids	Preservative Code	Field Filtered Y/N	
1.	S1_0-2cm				5/29/20	15:00	SD		1		X		A		Can report total iron (W1
2.	S1_2-4cm					15:01			1		X				as wet weight, no (W2
3.	S1_4-6cm					15:02			1		X				need for % solids (W3
4.	S2_0-2cm					15:15			1		X				measurements. (W4
5.	S2_2-4cm					15:16			1		X				W5
6.	S2_4-6cm					15:17			1		X				W6
7.	S3_0-2cm					15:30			1		X				W7
8.	S3_2-4cm					15:31			1		X				W8
9.	S3_4-6cm					15:32			1		X				W9
10.	S4_0-2cm				↓	15:45	↓		1		X				W10

BARR USE ONLY	
Sampled by:	Kevin Menken
Barr Proj. Manager:	Kevin Menken
Barr DQ Manager:	NA
Lab Name:	Pace
Lab Location:	Mpls

Relinquished by: Kevin Menken — On Ice? (Y) N — Date 8/6/20 — Time 16:15 — Received by: Pace — Date 8.6.20 — Time 1620

Relinquished by: Pace — On Ice? (Y) N — Date 8.6.20 — Time 1620 — Received by: Chad Pace — Date 8/7/20 — Time 0850

Samples Shipped VIA: ☐ Ground Courier ☐ Air Carrier ☐ Sampler ☐ Other: _____

Air Bill Number:

Lab WO: Temperature on Receipt (°C): 13.9 Custody Seal Intact? ☐ Y ☐ N ☒ None

Requested Due Date: ☒ Standard Turn Around Time ☐ Rush _____ (mm/dd/yyyy)

Distribution - **White-Original:** Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Scan and email:** a copy to BarrDM@barr.com for tracking and filing procedures

Rel. Chad Pace 8/7/20 10:55 Rec Pace 8/7/20 1055

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Barr Engineering Co. Chain of Custody

Sample Origination State
☐ CO ☐ MI ☒ MN ☐ MO ☐ ND ☐ TX ☐ UT ☐ WI ☐ Other: _____

COC Number: **№ 585954**
COC 2 of 2

REPORT TO		INVOICE TO	
Company:	Barr Eng	Company:	Barr Eng
Address:		Address:	
Address:		Address:	
Name:		Name:	
email:		email:	
Copy to:	BarrDM@barr.com	P.O.	
Project Name:	Pleasant Lake	Barr Project No:	23621356.00

Matrix Code: GW = Groundwater; SW = Surface Water; WW = Waste Water; DW = Drinking Water; S = Soil/Solid; SD = Sediment; O = Other

Preservative Code: A = None; B = HCl; C = HNO_3; D = H_2SO_4; E = NaOH; F = MeOH; G = $NaHSO_4$; H = $Na_2S_2O_3$; I = Ascorbic Acid; J = Zn Acetate; K = Other

	Location	Sample Depth Start	Stop	Unit (m./ft. or in.)	Collection Date (mm/dd/yyyy)	Collection Time (hh:mm)	Matrix Code	Perform MS/MSD Y / N	Total Number Of Containers	Analysis Requested: Water	Soil: Total Fe	Soil: % Solids	Preservative Code	Field Filtered Y/N
1.	S4_2-4cm				5/29/20	15:46	SD				X		A	011
2.	S4_4-6cm					15:47					X			012
3.	S5_0-2cm					16:01					X			013
4.	S5_2-4cm					16:02					X			014
5.	S5_4-6cm					16:03					X			015
6.	S6_0-2cm					16:15					X			016
7.	S6_2-4cm					16:16					X			017
8.	S6_4-6cm					16:17					X			018
9.											X			
10.											X			

BARR USE ONLY

Sampled by:	Kevin Menken
Barr Proj. Manager:	Kevin Menken
Barr DQ Manager:	NA
Lab Name:	Pace
Lab Location:	Mpls

		On Ice?	Date	Time		Date	Time
Relinquished by:	Kevin Menken	(Y) N	8/6/20	16:15	Received by: PACE	8.6.20	1620
Relinquished by:	PACE	On Ice? (Y) N	8.6.20	1620	Received by: Client S/ Pace	8/7/20	0850

Samples Shipped VIA: ☐ Ground Courier ☐ Air Carrier ☐ Sampler ☐ Other: _____

Air Bill Number:

Requested Due Date: ☐ Standard Turn Around Time ☐ Rush _____ (mm/dd/yyyy)

Lab WO: Temperature on Receipt (°C): 13.9 Custody Seal Intact? ☐ Y ☐ N ☒ None

Distribution - **White-Original:** Accompanies Shipment to Laboratory; **Yellow Copy:** Include in Field Documents; **Scan and email:** a copy to BarrDM@barr.com for tracking and filing procedures

Rec. Client S/ Pace 8/7/20 10:55 Pace 8/7/20 1055

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Pace Analytical®	Document Name: **Sample Condition Upon Receipt (SCUR) - MN**	Document Revised: 27Mar2020 **Page 1 of 1**
	Document No.: **ENV-FRM-MIN4-0150 Rev.00**	Pace Analytical Services - **Minneapolis**

Sample Condition Upon Receipt

Client Name: Barr Eng.

Project #: WO#: 10527724

PM: AA1 Due Date: 08/21/20

CLIENT: BARR

Courier: ☐Fed Ex ☐UPS ☐USPS ☒Client ☐Pace ☐SpeeDee ☐Commercial See Exceptions ☐

Tracking Number:

Custody Seal on Cooler/Box Present? ☐Yes ☒No **Seals Intact?** ☐Yes ☒No **Biological Tissue Frozen?** ☐Yes ☐No ☒N/A

Packing Material: ☐Bubble Wrap ☐Bubble Bags ☐None ☒Other: PB **Temp Blank?** ☒Yes ☐No

Thermometer: ☐T1(0461) ☐T2(1336) ☐T3(0459) ☐T4(0254) ☒T5(0489) **Type of Ice:** ☒Wet ☐Blue ☐None ☐Dry ☐Melted

Did Samples Originate in West Virginia? ☐Yes ☒No **Were All Container Temps Taken?** ☐Yes ☐No ☒N/A

Temp should be above freezing to 6°C **Cooler Temp Read w/temp blank:** 14.1 °C

Correction Factor: -0.2 **Cooler Temp Corrected w/temp blank:** 13.9 °C

Average Corrected Temp (no temp blank only): ☐See Exceptions ☐1 Container °C

USDA Regulated Soil: (☐ N/A, water sample/Other:) **Date/Initials of Person Examining Contents:** CEG 8/7/20

Did samples originate in a quarantine zone within the United States: AL, AR, CA, FL, GA, ID, LA. MS, NC, NM, NY, OK, OR, SC, TN, TX or VA (check maps)? ☐Yes ☒No

Did samples originate from a foreign source (internationally, including Hawaii and Puerto Rico)? ☐Yes ☒No

If Yes to either question, fill out a Regulated Soil Checklist (F-MN-Q-338) and include with SCUR/COC paperwork.

				COMMENTS:
Chain of Custody Present and Filled Out?	☒Yes	☐No		1.
Chain of Custody Relinquished?	☒Yes	☐No		2.
Sampler Name and/or Signature on COC?	☒Yes	☐No	☐N/A	3.
Samples Arrived within Hold Time?	☒Yes	☐No		4.
Short Hold Time Analysis (<72 hr)?	☐Yes	☒No		5. ☐Fecal Coliform ☐HPC ☐Total Coliform/E coli ☐BOD/cBOD ☐Hex Chrome ☐Turbidity ☐Nitrate ☐Nitrite ☐Orthophos ☐Other
Rush Turn Around Time Requested?	☐Yes	☒No		6.
Sufficient Volume?	☒Yes	☐No		7.
Correct Containers Used?	☒Yes	☐No		8.
-Pace Containers Used?	☐Yes	☒No		
Containers Intact?	☒Yes	☐No		9.
Field Filtered Volume Received for Dissolved Tests?	☐Yes	☐No	☒N/A	10. Is sediment visible in the dissolved container? ☐Yes ☐No
Is sufficient information available to reconcile the samples to the COC?	☒Yes	☐No		11. **If no, write ID/ Date/Time on Container Below:** **See Exception** ☐
Matrix: ☐Water ☒Soil ☐Oil ☐Other				
All containers needing acid/base preservation have been checked?	☐Yes	☐No	☒N/A	12. Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☐Yes	☐No	☒N/A	☐ NaOH ☐ HNO_3 ☐ H_2SO_4 ☐ Zinc Acetate
Exceptions: VOA, Coliform, TOC/DOC Oil and Grease, DRO/8015 (water) and Dioxin/PFAS	☐Yes	☐No	☒N/A	Positive for Res. Chlorine? ☐Yes ☐No **pH Paper Lot#** **See Exception** ☐
				Res. Chlorine | 0-6 Roll | 0-6 Strip | 0-14 Strip
Extra labels present on soil VOA or WIDRO containers?	☐Yes	☐No	☒N/A	13. **See Exception** ☐
Headspace in VOA Vials (greater than 6mm)?	☐Yes	☐No	☒N/A	
Trip Blank Present?	☐Yes	☐No	☒N/A	14.
Trip Blank Custody Seals Present?	☐Yes	☐No	☒N/A	Pace Trip Blank Lot # (if purchased):

CLIENT NOTIFICATION/RESOLUTION **Field Data Required?** ☐Yes ☐No

Person Contacted: Kevin M. Date/Time: 8/6/20

Comments/Resolution: Report as wet weight. No temp requirement.

Project Manager Review: Amanda J Albrecht **Date:** 8/10/20

Note: Whenever there is a discrepancy affecting North Carolina compliance samples, a copy of this form will be sent to the North Carolina DEHNR Certification Office (i.e out of hold, incorrect preservative, out of temp, incorrect containers).

Labeled by: CEG

SCUR Exceptions:

Workorder #: 10527724

Out of Temp Sample IDs	Container Type	# of Containers

PM Notified? ☐Yes ☐No

If yes, indicate who was contacted/date/time.
If no, indicate reason why.

Multiple Cooler Project? ☐Yes ☐No
If you answered yes, fill out information to the left.

No Temp Blank		
Read Temp	Corrected Temp	Average Temp
14.5	14.3	13.9
15.6	15.4	
12.8	12.6	
13.6	13.4	

Tracking Number/Temperature	

Issue Type: Sample ID	Container Type	# of Containers

pH Adjustment Log for Preserved Samples

Sample ID	Type of Preserv.	pH Upon Receipt	Date Adjusted	Time Adjusted	Amount Added (mL)	Lot # Added	pH After	In Compliance after addition?	Initials
								☐Yes ☐No	
								☐Yes ☐No	
								☐Yes ☐No	
								☐Yes ☐No	

Comments:

Service Center Transfer Checklist

Service Center: MPLS ☐ BLM ☒ AZ ☐

Client: BAKER

Destination Lab: MPLS ☒ VM ☐ Duluth ☐

National ☐ Other _____

Received w/ Custody Seal ? Yes ☐ No ☑

Custody Seal Intact ? Yes ☐ No ☑

	Temp Read	Corr. Factor	Corr. Temp
Temperature °C	7.8	+0.1	7.9

IR Gun: B88A0143310092 ☐ Samples on ice, in cool down

Rush ☐ **Short Hold** ☐ **N/A** ☑

Containers Intact ? Yes ☑ No ☐

Repacked and Re-Iced ? Yes ☐ No ☑

Notes:

5.6, 8.6, 9.1

Avg = 7.8