WIDSETH SMITH NOLTING

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WidsethSmithNolting.com

UNSEWERED AREAS ENVIRONMENTAL ASSESSMENT

Reviewed with City Council at Special Meeting on July 25, 2019
No Formal Acceptance by City Council

Prepared for
City of Baxter

WSN No. 0102B0412.000

UNSEWERED AREAS ENVIRONMENTAL ASSESSMENT

Prepared for
City of Baxter

WSN No. 0102B0384.000

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Geologist under the laws of the State of Minnesota.

Brian A. Ross

Digitally signed by Brian A. Ross
DN: C=US, E=brian.ross@wsn.us.com, CN=Brian A. Ross
Reason: I am approving this document
Date: 2019.06.28 17:08:01-05'00'

Brian Ross Professional Geologist	30720 License Number	6/28/19 Date

CS

UNSEWERED AREAS ENVIRONMENTAL ASSESSMENT

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STATEMENT OF PURPOSE

This letter presents the results of a Unsewered Areas Environmental Assessment completed by Widseth Smith Nolting (WSN) for the City of Baxter. The sampling was requested to evaluate potential for groundwater and/or surface water impacts caused by individual sewer treatment systems (ISTSs).

BACKGROUND

The City of Baxter is looking at extending city sewer and water services to areas of town that currently have private domestic water wells and ISTSs. In order to help make this decision, the City of Baxter is requesting assistance to obtain data on the potential impacts to groundwater and surface water resources in the City's unsewered areas from the ISTSs. The data collected from this assessment will be used to aid the City when making the decision about whether or not the City will move ahead with installing municipal sewer and water systems in the unsewered areas.

SITE ASSESSMENT

On May 9, 2019, a WSN field technician mobilized to four separate residences located in the City of Baxter. The Lugo residence and Katzenberger residence which are located in the unsewered area of Lynndale Drive. The Bolt residence and another residence located were in the unsewered area of Scenic River Drive in Baxter, MN. A subcontractor's drilling equipment malfunction resulted in no samples being obtained at the other residence along Scenic River Drive. Two soil borings were advanced on the downgradient side of each ISTS on each property with one soil boring being located adjacent to the ISTS drainfield and the other boring being located approximately 50 to 60 feet downgradient of the drain field. The soil boring locations were chosen with the goal of trying to assess if the ISTSs are affecting the shallow groundwater. A groundwater sample was collected from each soil boring for the analysis of total coliforms, nitrate, and chloride. Water quality parameters were also collected from the groundwater purged from each soil boring for temperature, specific conductance, pH, and ORP using a Hydrolab Quanta water quality meter. The location of the sites is illustrated on Figure 1. Each site and the

sample locations are illustrated on Figures 2 through 4.

Two soil borings were advanced at the Lugo residence located on Lynndale Drive in Baxter, MN. The first soil boring (Lugo #1) was advanced on the south side of the septic system which is located on the north side of the house. The second soil boring (Lugo #2) was advanced to the southwest of Lugo #1 on the west side of the house. Both boring locations were advanced at locations that were downgradient of the septic drain field. Soil borings Lugo #1 and Lugo #2 were advanced to a depth of 8 feet below land surface (BLS). Static water was measured in Lugo #1 at a depth of 1.8 feet BLS while the static water level in Lugo #2 was measured at a depth of 1.1 feet BLS. Soils encountered in Lugo #1 and Lugo #2 were a fill material consisting of approximately a foot of silty sand with the top four inches being highly organic in nature. Underneath the fill material was a fine-grained sand to a depth of 8 feet BLS. A groundwater sample was collected from each soil boring and analyzed for total coliforms, nitrate, and chloride.

Two soil borings were completed at the Katzenberger residence located on Lynndale Lane in Baxter, MN. The first soil boring (Katzenberger #1) was advanced just south of the septic drain field located southeast of the house. The second soil boring (Katzenberger #2) was advanced directly to the west between Red Sand Lake and the septic drain field. Soil borings were advanced at locations that were downgradient of the septic drain field. Soil borings Katzenberger #1 and Katzenberger #2 were both advanced to a depth of 12 feet BLS. The static water level was measured in Katzenberger #1 at a depth of 8.7 feet BLS and 7.0 feet BLS in Katzenberger #2. Soils encountered in Katzenberger #1 and Katzenberger #2 were a fill material consisting of a dark brown silty sand to a depth of approximately 1 foot BLS. Underneath the fill material was a red/tan fine sand to a depth of four feet BLS underlain by a tan fine sand with trace gravel to a depth of 12 feet BLS. One groundwater sample was collected from each boring location and analyzed for total coliforms, nitrate, and chloride.

Two soil borings were completed at the Bolt residence located on Scenic River Drive in Baxter, MN. The first soil boring (Bolt #1) was advanced just south of the septic drain field located southeast of the house. The second soil boring (Bolt #2) was advanced directly to the east of the septic drain field. Soil borings were advanced at locations that were downgradient of the septic drain field. Soil borings Bolt #1 and Bolt #2 were both advanced to a depth of 24 feet BLS. The static water level was measured in Bolt #1 at a depth of 18.3 feet BLS and 23.7 feet BLS in Bolt

#2. Soils encountered in Bolt #1 and Bolt #2 consisted a fill material of dark brown silty sand to a depth of approximately 1 foot BLS. Underneath the fill material was a brown fine sand to a depth of seven feet BLS underlain by a tan fine to medium coarse grained sand with trace gravel to a depth of 24 feet BLS. One groundwater sample was collected from each boring location and analyzed for total coliforms, nitrate, and chloride

The soil borings were advanced using an AMS 9130-VTR-D power probe. During advancement of the soil borings, soil samples were collected every 24 inches for field organic vapor screening using a MiniRae Photoionization Detector (PID) equipped with a 10.6 eV lamp. Samples were screened for organic vapors by placing a portion of the sample in a sealed bag, breaking the sample apart to allow vapors to escape and measuring a reading by inserting the PID meter into the bag. The field organic vapor screening results are presented in Table 1. Soil samples were also inspected for visual and olfactory indications of contamination (i.e., discoloration and odors). Once the soil boring was completed a temporary screen was installed and a check ball with tubing was used to purge groundwater from the soil boring. One groundwater sample was collected for each soil boring and analyzed for total coliforms, nitrate, and chloride. Groundwater samples were collected in laboratory-supplied containers, placed on ice, and submitted for laboratory analysis following proper chain-of-custody procedures. Field methods and procedures are described in further detail in Attachment A.

DISCUSSION

Table 1 presents the field organic screening results. PID results ranged from 0.4 ppm to 1.8 ppm and indicates that no elevated organic vapors were encountered during this assessment. No visual signs of contamination were observed in the field during drilling actiivites.

Table 2 presents the groundwater analytical results from the assessment. Analytical results show that total coliforms were present in Lugo #1 at 100 CFU/100 mL and Katzenberger #2 at 300 CFU/100mL. Total coliforms were not reported in Lugo #2, Katzenberger #1, Bolt #1 and Bolt #2 above the laboratory detection limit. Nitrate was reported in groundwater samples collected from Lugo #1 and Katzenberger #1 at concentrations of 49.6 ppm and 31.1 ppm respectively. Naturally occurring background levels of nitrate concentrations were observed during the assessment ranging from 0.11 ppm to 1.6 ppm. The health risk limit (HRL)

established by the Minnesota Department of Health for nitrate in drinking water is 10 ppm. Chloride was reported in groundwater samples above background levels in Lugo #1 and Katzenberger #1 at concentrations of 118 ppm and 198 ppm. Background levels of chloride were reported during this investigation ranging from 20.8 ppm to 39.7 ppm.

Table 3 presents the field water quality readings collected from each soil boring. Parameters collected were temperature, specific conductance, dissolved oxygen, pH, and ORP.

The results for total coliforms, nitrate, and chloride indicate that the groundwater downgradient of the ISTS on the Lugo property and Katzenberger property has been impacted from the use of ISTSs. The detections of chloride at concentrations of two or more times above background levels in Lugo #1 and Katzenberger #1 is most likely due to the presence of septic related contamination. It should also be noted that elevated water quality readings were also reported in Lugo #1 and Katzenberger #1 for specific conductance which can be an indicator of groundwater contamination because higher specific conductance readings is an indication that there are more chemicals dissolved in the water. As stated above, nitrate was reported in Lugo #1 and Katzenberger #1 at concentrations above the HRL of 10 ppm. Groundwater flow in the Lynndale area is believed to be to the west or towards Red Sand Lake and groundwater flow in the River Scenic Drive area is most likely to the east or southeast towards the Mississippi River. Results reported from the two soil borings advanced on the Bolt property did not appear to be significantly affected from the ISTS as no total coliforms were detected and detections of nitrate appear to be naturally occurring background levels. The chloride concentrations are above background levels and it maybe that groundwater is flowing a different direction than anticipated.

CONCLUSIONS AND RECOMMENDATIONS

WSN was contracted by the City to assess four residential properties, two in the Lynndale Lane area and two in the Scenic River/Forestview Drives area of Baxter, for groundwater contamination associated with their onsite sewage treatment systems. Subcontractor drilling equipment problems prevented completing the assessment at one of the properties along Scenic River Drive.

The results of the assessment indicated significant groundwater contamination near two of the

three systems. High levels of nitrate and total coliform bacteria and elevated levels of chloride were found in the groundwater near the sewage treatment systems and to a lesser extent downgradient of the systems. The high nitrate levels ranged from 31.1 milligram per liter (mg/L) to 49.6 mg/L, which are three and four times the drinking water limit of 10 mg/L. The detections of total coliform bacteria ranged from 100 to 300 colony forming units with the drinking water limit being zero. The third system had some indications of contamination in the form of elevated chloride levels.

Because of the limited nature of the assessment, it is uncertain where the downgradient sampling point was located in relation to the highest level of contamination in the groundwater plume from the system. In addition, the detection of nitrates and total coliforms are indicators of that the systems are affecting groundwater; analyzing for the many other contaminants possibly present such as pharmaceuticals, solvents, and chemical elements would likely indicate some of those contaminants are present as well.

WSN recommends additional sampling be completed, to gather more data related to groundwater contamination from ISTSs, on at least two more properties in the Scenic River Drive area of Baxter.

LIMITATIONS

WSN completed this assessment following standard field and laboratory methods of the industry. The conclusions represent the opinions of WSN's staff, in accordance with currently accepted geologic, hydrogeologic, and environmental practices at this time and location. This assessment was completed only for septic related contamination near ISTSs. The presence or absence of contamination can only be reported at the location of each sample location completed as part of this assessment. No other assurances are applied or assumed.

FIGURES

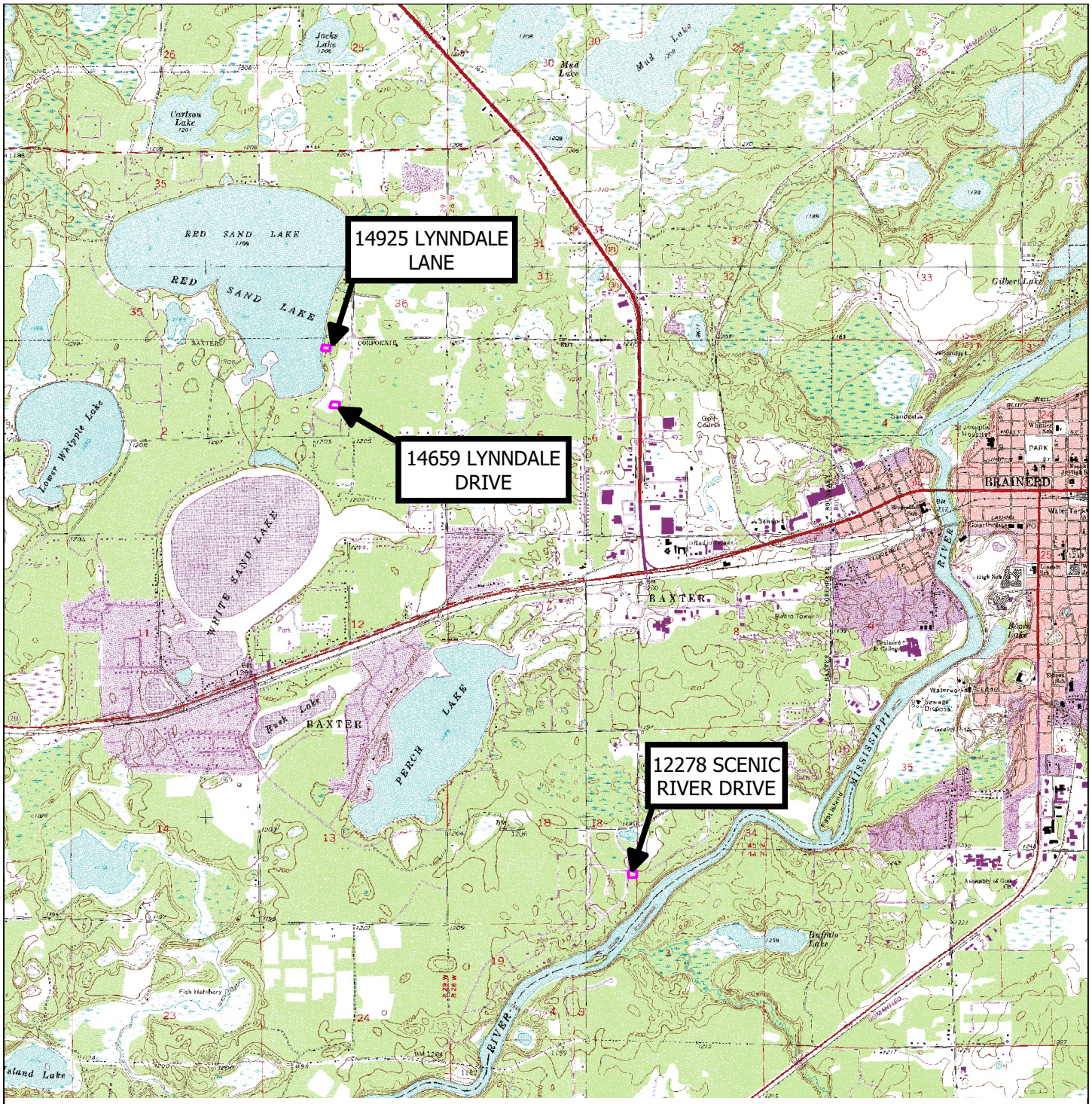
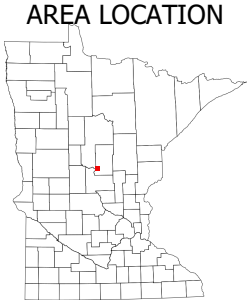


IMAGE: UNITED STATES DEPARTMENT OF THE INTERIOR - GEOLOGICAL SURVEY

AREA LOCATION



NORTH

0 0.5 1 1.5 mi

(IN FEET)

USGS QUADRANGLE MAPS:
BAXTER, BRAINERD, GULL LAKE, MERRIFIELD
PUBLISHED: 1954, 1973, 1973, 1973
PHOTOREVISED: 1994, 1994, 1994, 1994

WIDSETH SMITH NOLTING

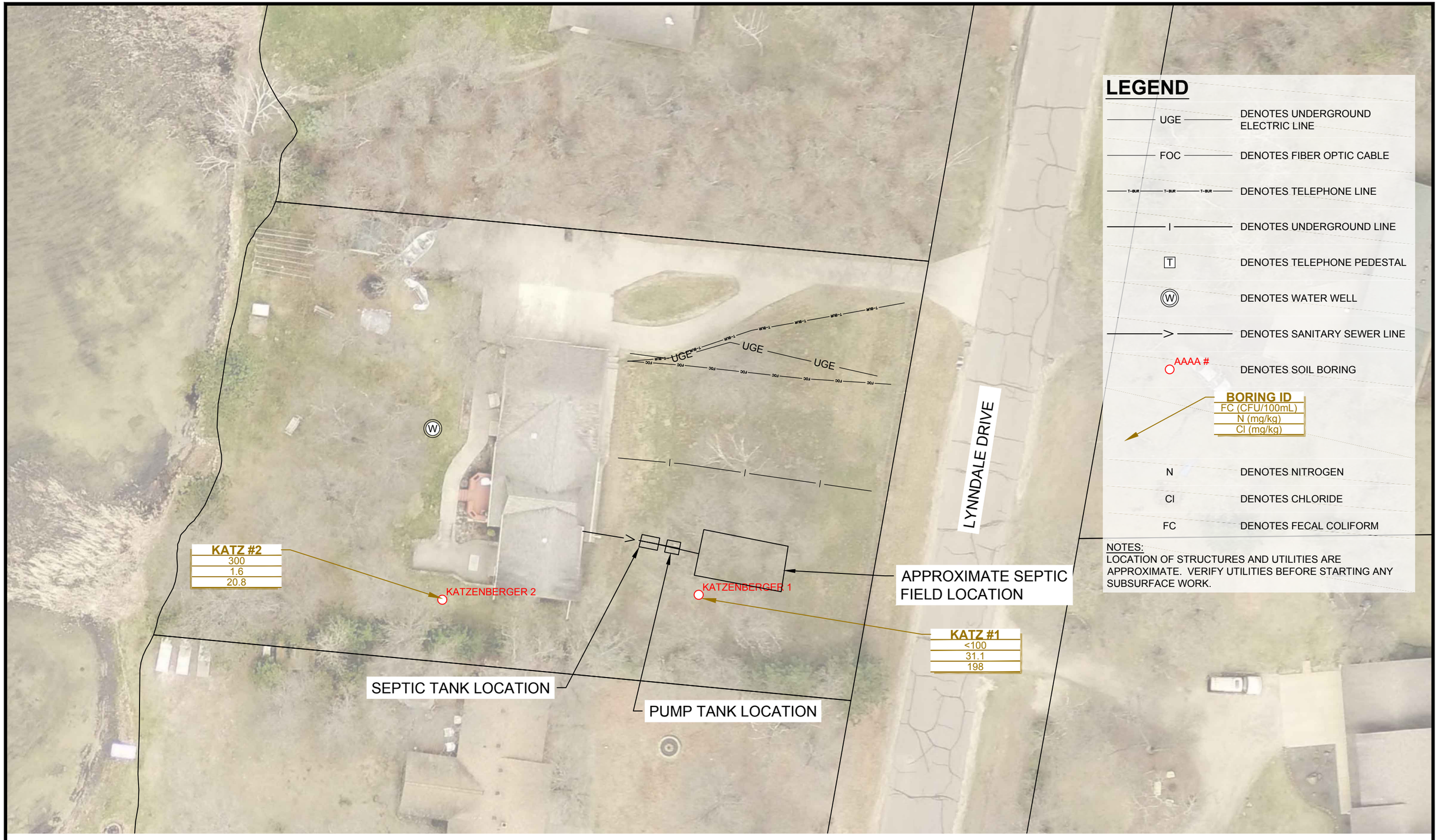
UNSEWERED AREAS ENV. ASSESSMENT
CITY OF BAXTER
BAXTER, MN

Date:
MAY 2019

JOB No.
0102B0412.000

FIGURE
1

SITE LOCATION MAP



LEGEND

- UGE — DENOTES UNDERGROUND ELECTRIC LINE
- FOC — DENOTES FIBER OPTIC CABLE
- T-BUR — DENOTES TELEPHONE LINE
- I — DENOTES UNDERGROUND LINE
- T — DENOTES TELEPHONE PEDESTAL
- W — DENOTES WATER WELL
- DENOTES SANITARY SEWER LINE
- AAAA # — DENOTES SOIL BORING

BORING ID
FC (CFU/100mL)
N (mg/kg)
Cl (mg/kg)

- N — DENOTES NITROGEN
- Cl — DENOTES CHLORIDE
- FC — DENOTES FECAL COLIFORM

NOTES:
LOCATION OF STRUCTURES AND UTILITIES ARE APPROXIMATE. VERIFY UTILITIES BEFORE STARTING ANY SUBSURFACE WORK.

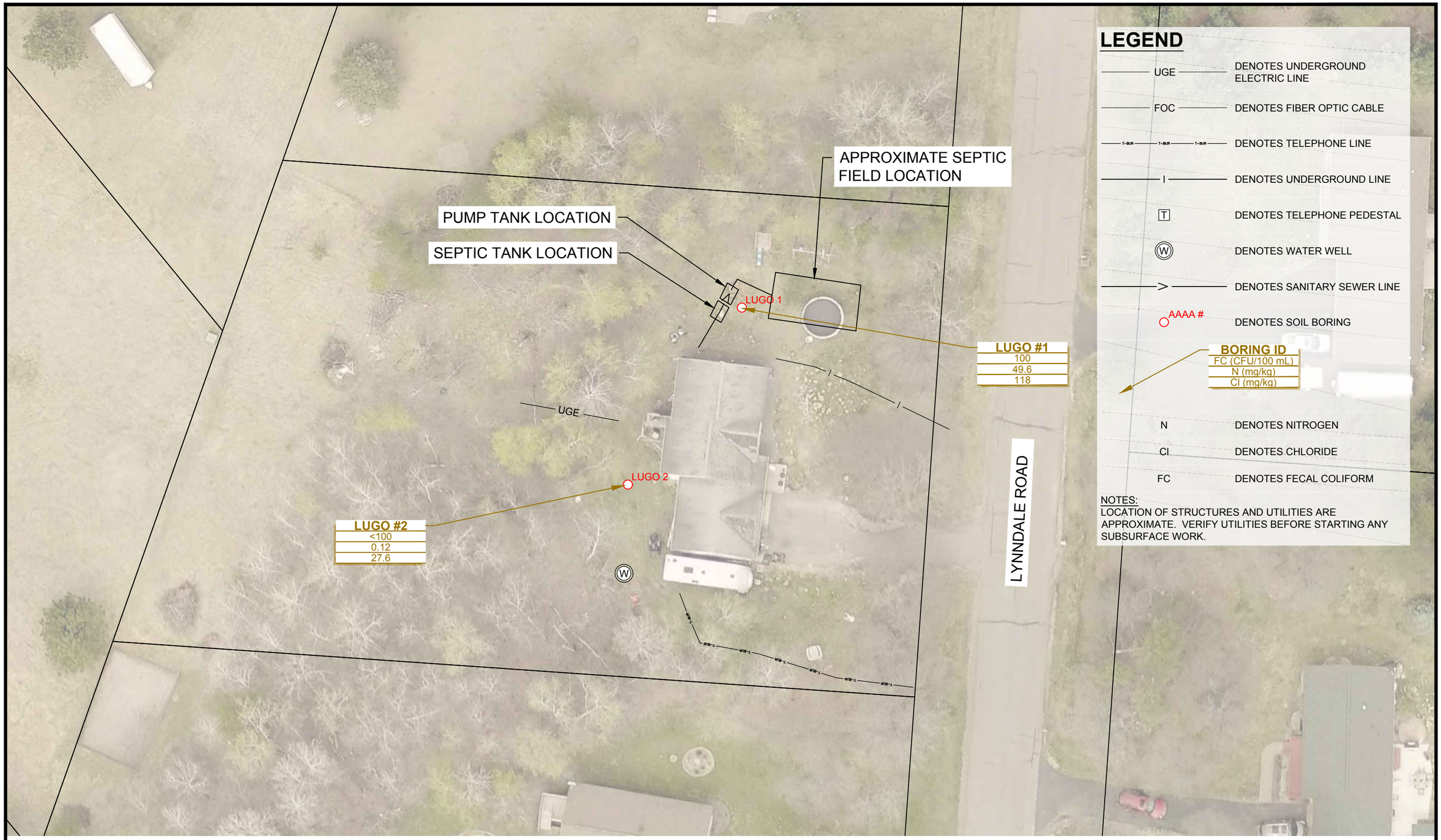
CROW WING 3-INCH AERIAL (2011)

WIDSETH SMITH NOLTING
Engineering
Architecture
Surveying
Environmental

NORTH
0 30
(SCALE IN FEET)

UNSEWERED AREAS ENV. ASSESSMENT
CITY OF BAXTER
BAXTER, MN
14925 LYNNDALE LANE

DATE: MAY 2019
JOB No. 0102B0412.000
FIGURE 2



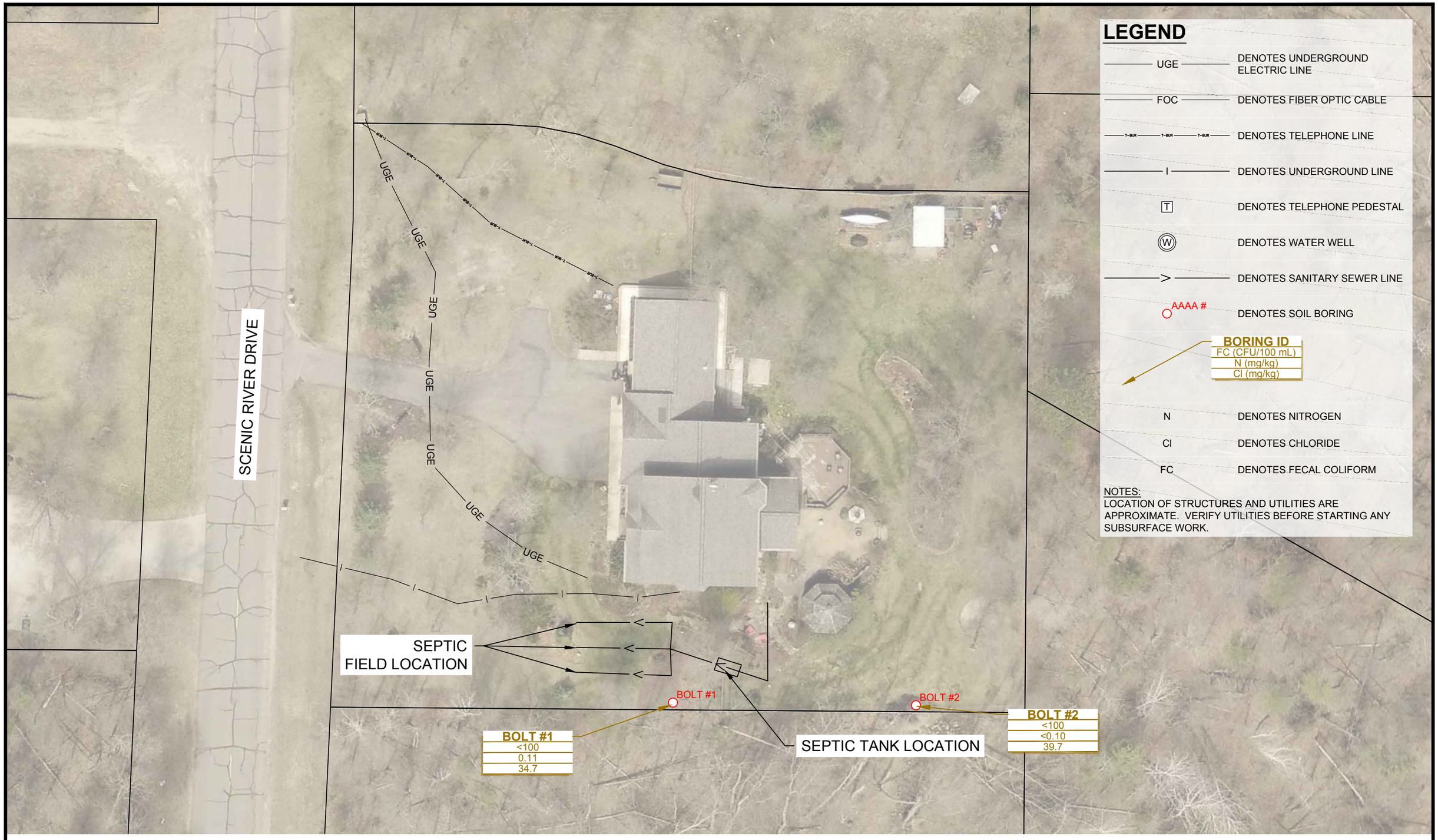
CROW WING 3-INCH AERIAL (2011)

WIDSETH SMITH NOLTING
Engineering
Architecture
Surveying
Environmental

NORTH
0 30
(SCALE IN FEET)

UNSEWERED AREAS ENV. ASSESSMENT
CITY OF BAXTER
BAXTER, MN
14659 LYNNDALE DRIVE

DATE: MAY 2019
JOB No. 0102B0412.000
FIGURE 3



LEGEND

UGE	DENOTES UNDERGROUND ELECTRIC LINE
FOC	DENOTES FIBER OPTIC CABLE
T–BUR	DENOTES TELEPHONE LINE
I	DENOTES UNDERGROUND LINE
T	DENOTES TELEPHONE PEDESTAL
W	DENOTES WATER WELL
>	DENOTES SANITARY SEWER LINE
AAAA #	DENOTES SOIL BORING
N	DENOTES NITROGEN
Cl	DENOTES CHLORIDE
FC	DENOTES FECAL COLIFORM

BORING ID
FC (CFU/100 mL)
N (mg/kg)
Cl (mg/kg)

NOTES:
LOCATION OF STRUCTURES AND UTILITIES ARE APPROXIMATE. VERIFY UTILITIES BEFORE STARTING ANY SUBSURFACE WORK.

CROW WING 3-INCH AERIAL (2011)

WIDSETH SMITH NOLTING
Engineering
Architecture
Surveying
Environmental

NORTH
0 30
(SCALE IN FEET)

UNSEWERED AREAS ENV. ASSESSMENT
CITY OF BAXTER
BAXTER, MN
12278 SCENIC RIVER DRIVE

DATE: MAY 2019
JOB No. 0102B0412.000
FIGURE 4

TABLES

Table 1

Unsewered Areas Environmental Assessment

Baxter, MN

PID Results (ppm)

Depth	Lugo #1	Lugo #2	Katzenberger #1	Katzenberger #2	Bolt #1	Bolt #2
0-2	0.4	1.1	0.4	0.9	1.3	1
2-4	1.1	1.3	0.8	1.1	1.1	1.3
4-6	1.2	1.4	1.1	1.7	1.2	0.7
6-8	1.2	1.5	1.4	1.6	1.4	1
8-10			1.6	1.4	1.6	1.3
10-12			1.2	1.3	1.7	1.2
12-14					1.8	1.2
14-16					1.7	1.7
16-18					1.5	0.9
18-20					1.6	1.8
20-22					1.3	1.2
22-24					1.3	1.1

Table 2

Unsewered Areas Environmental Assessment

Baxter, MN

Groundwater Analytical Results

	Units	Lugo #1	Lugo #2	Katzenberger #1	Katzenberger #2	Bolt #1	Bolt #2
Date Sampled		5/9/2019	5/9/2019	5/9/2019	5/9/2019	5/9/2019	5/9/2019
Total Coliforms	CFU/100mL	**100**	<100	<100	**300**	<100	<100
Nitrate	mg/L	**49.6**	**0.12**	**31.1**	**1.6**	**0.11**	<0.10
Chloride	mg/L	**118**	**27.6**	**198**	**20.8**	**34.7**	**39.7**

CFU/100mL = colony forming units per 100 mL

mg/L = milligrams per liter = parts per million (PPM)

Table 3

Unsewered Area Environmental Assessment

Baxter, MN

Water Quality Readings

	Units	Lugo #1	Lugo #2	Katzenberger #1	Kaztenberger #2	Bolt #1	Bolt #2
Temp	°F	46.3	43.2	45.2	43.8	50.2	51.6
Specific Conductance	µS/cm	945	220	1080	162	311	477
Dissloved Oxygen	mg/l	6.76	6.69	6.76	6.30	6.09	4.32
pH	units	6.29	6.74	6.87	7.02	7.12	7.56
ORP	mv	291	77	168	180	161	209

µS/cm = micro-Siemens per centimeter

APPENDICES

ATTACHMENT A
Field Methods and Procedures

FIELD METHODS AND PROCEDURES

1.0 SOIL SAMPLING

Soil samples were collected using Macro-Core Samplers, which provide continuous sample collection downward using 48"long X 1.5" diameter tool and retains the sample in a PETG (clear plastic) liner tube. This allows for continuous sampling the entire length of the Geoprobe bore hole. After collection, the sample tubes are removed from the macro-core barrel, the liner tube is cut open and grab samples are collected from the liner tube for field analysis of organic vapors. In addition, a grab sample is obtained for laboratory analyses following MPCA Fact Sheet 3.22.

2.0 DECONTAMINATION OF DRILLING EQUIPMENT

The geoprobe and associated tools were steam cleaned prior to the start of any project work. The geoprobe sampler was cleaned between samples to minimize cross-contamination and the geoprobe sample tube inserts are disposable and a new insert is used for each new sample. The cleaning procedure for the sampler consisted of scrubbing the sampler with a brush in a soap and water solution followed by a tap water rinse. The soap and water were changed regularly during the sampling. Fluids used for on-site cleaning of the split barrel sampler and drilling equipment were disposed on the site.

3.0 SOIL CLASSIFICATION

As the samples were obtained in the field, they were visually and manually classified by a WSN representative in accordance with ASTM: D2488-93. Representative portions of the samples were then returned to WSN's office in the event there is need for further examination and verification of the field classification. The classification of soil boring samples, soil boring depths, identification of the various strata, the soil consistency, water level information, and pertinent information regarding the method of maintaining and advancing the drill holes are presented on boring logs. Charts describing the soil classification procedure, the descriptive terminology, and symbols used on the boring logs are included with the logs.

4.0 SOIL ORGANIC VAPOR MONITORING

Soil samples were screened for organic vapors with a Mini Rae 2000 photoionization detector (PID) equipped with a 10.6 eV lamp and calibrated for a direct equivalent reading of parts per million. Organic vapor concentrations were recorded using the headspace method. During cold weather, PID headspace readings were taken in a heated space.

6.0 GROUNDWATER LEVEL MEASUREMENTS

Groundwater level measurements were obtained using an electronic measuring instrument. The instrument is equipped with a probe that emits an electric signal when in contact with water. Measurements are obtained by lowering the probe into the boring or well and recording the depth of the probe when the electric signal indicates contact with water. Measurements are referenced to the top of ground surface or the top of the monitoring well casing (if installed) and recorded to the nearest 0.01 feet.

The manufacturer's reported accuracy for the instrument is 0.04 feet.

7.0 GROUNDWATER SAMPLING FOR CHEMICAL ANALYSIS

Groundwater samples from the geoprobes were obtained using disposable Teflon tubing and a check valve. Insufficient water was present to use a small electric pump or bailer. New tubing is used for each sample. Trip blanks of distilled water are also collected at the site.

Groundwater samples are collected in clean, laboratory supplied, glass containers affixed with labels listing the type of analysis and sample identification. Appropriate preservation techniques are used for those samples as required. The sample bottles are appropriately labeled with the job number, location number, date sampled, and initials of the individual sampler. A chain-of-custody form is completed and shipped with the samples to the laboratory. Upon arrival at the laboratory, the samples are checked in and signed over to the appropriate laboratory personnel. At that time, a copy of the chain-of-custody form is retained and returned to the project manager.

ATTACHMENT B
Laboratory Analytical Data

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

May 17, 2019

Mr. Brian Ross
Widseth Smith Nolting
7804 Industrial Park Road
Box 2730
Baxter, MN 56425

RE: Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Dear Mr. Ross:
Enclosed are the analytical results for sample(s) received by the laboratory on May 10, 2019. The results relate only to the samples included in this report. Results reported herein conform to the most current, applicable TNI/NELAC standards and the laboratory's Quality Assurance Manual, where applicable, unless otherwise noted in the body of the report.

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

Sincerely,

Oyeyemi Odujole
oyeyemi.odujole@pacelabs.com
(612)607-6402
Project Manager

Enclosures

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

CERTIFICATIONS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Minnesota Certification IDs

1700 Elm Street SE, Minneapolis, MN 55414-2485
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 Certification #: M-MN064
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

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

SAMPLE SUMMARY

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10474250001	**Lugo #1**	Water	05/09/19 09:34	05/10/19 09:30
10474250002	**Lugo #2**	Water	05/09/19 10:15	05/10/19 09:30
10474250003	**Katzenberger #1**	Water	05/09/19 11:11	05/10/19 09:30
10474250004	**Katzenberger #2**	Water	05/09/19 11:47	05/10/19 09:30
10474250005	**Bolt #1**	Water	05/09/19 13:54	05/10/19 09:30
10474250006	**Bolt #2**	Water	05/09/19 14:55	05/10/19 09:30

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

SAMPLE ANALYTE COUNT

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10474250001	**Lugo #1**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1
10474250002	**Lugo #2**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1
10474250003	**Katzenberger #1**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1
10474250004	**Katzenberger #2**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1
10474250005	**Bolt #1**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1
10474250006	**Bolt #2**	SM 9222B	JFP	1
		EPA 353.2	JFP	1
		SM 4500-Cl E	KEO	1

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

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Lugo #1 **Lab ID: 10474250001** Collected: 05/09/19 09:34 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**100**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		H1
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	**49.6**	mg/L	5.0	50		05/10/19 12:12	14797-55-8	
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**118**	mg/L	20.0	10		05/13/19 09:44	16887-00-6	M6

REPORT OF LABORATORY ANALYSIS

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

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Lugo #2 **Lab ID: 10474250002** Collected: 05/09/19 10:15 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**<100**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	**0.12**	mg/L	0.10	1		05/10/19 11:49	14797-55-8	FS
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**27.6**	mg/L	4.0	2		05/13/19 09:24	16887-00-6	

REPORT OF LABORATORY ANALYSIS

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

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Katzenberger #1 **Lab ID: 10474250003** Collected: 05/09/19 11:11 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**<100**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	**31.1**	mg/L	5.0	50		05/10/19 12:13	14797-55-8	
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**198**	mg/L	20.0	10		05/13/19 09:44	16887-00-6	

REPORT OF LABORATORY ANALYSIS

Pace Analytical Services, LLC
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Minneapolis, MN 55414
(612)607-1700

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Katzenberger #2 **Lab ID: 10474250004** Collected: 05/09/19 11:47 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**300**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	**1.6**	mg/L	0.10	1		05/10/19 11:52	14797-55-8	FS
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**20.8**	mg/L	2.0	1		05/13/19 09:03	16887-00-6	

REPORT OF LABORATORY ANALYSIS

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

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Bolt #1 **Lab ID: 10474250005** Collected: 05/09/19 13:54 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**<100**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	**0.11**	mg/L	0.10	1		05/10/19 11:53	14797-55-8	FS
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**34.7**	mg/L	4.0	2		05/13/19 09:24	16887-00-6	

REPORT OF LABORATORY ANALYSIS

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

ANALYTICAL RESULTS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Sample: Bolt #2 **Lab ID: 10474250006** Collected: 05/09/19 14:55 Received: 05/10/19 09:30 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
MBIO 9222B Total Coliform MF	Analytical Method: SM 9222B Preparation Method: SM 9222B							
Total Coliforms	**<100**	CFU/100 mL	100	100	05/10/19 10:14	05/11/19 10:14		
353.2 Nitrate + Nitrite	Analytical Method: EPA 353.2							
Nitrate as N	ND	mg/L	0.10	1		05/10/19 11:54	14797-55-8	FS
SM4500Cl-E Chloride	Analytical Method: SM 4500-Cl E							
Chloride	**39.7**	mg/L	4.0	2		05/13/19 09:31	16887-00-6	

REPORT OF LABORATORY ANALYSIS

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

QUALITY CONTROL DATA

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

QC Batch: 605113 Analysis Method: SM 9222B
QC Batch Method: SM 9222B Analysis Description: 9222B MBIO Total Coliforms
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

METHOD BLANK: 3271225 Matrix: Water
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Total Coliforms	CFU/100 mL	<1	1.0	05/11/19 10:14	

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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Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

QC Batch: 605133 Analysis Method: EPA 353.2
QC Batch Method: EPA 353.2 Analysis Description: 353.2 Nitrate + Nitrite, preserved
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

METHOD BLANK: 3271296 Matrix: Water
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Nitrate as N	mg/L	ND	0.10	05/10/19 11:55	FS

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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Minneapolis, MN 55414
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QUALITY CONTROL DATA

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

QC Batch: 605370 Analysis Method: SM 4500-Cl E
QC Batch Method: SM 4500-Cl E Analysis Description: SM4500Cl-E Chloride
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

METHOD BLANK: 3272920 Matrix: Water
Associated Lab Samples: 10474250001, 10474250002, 10474250003, 10474250004, 10474250005, 10474250006

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Chloride	mg/L	ND	2.0	05/13/19 09:00	

LABORATORY CONTROL SAMPLE: 3272921

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Chloride	mg/L	15	15.3	102	90-110	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 3272922 3272923

Parameter	Units	10473720001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	18.8	15	15	30.8	31.6	80	85	80-120	3	20	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 3272924 3272925

Parameter	Units	10474250001 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Chloride	mg/L	118	15	15	137	138	121	129	80-120	1	20	M6

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

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

QUALIFIERS

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

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

FS	The sample was filtered in the laboratory prior to analysis.
H1	Analysis conducted outside the recognized method holding time.
M6	Matrix spike and Matrix spike duplicate recovery not evaluated against control limits due to sample dilution.

Pace Analytical Services, LLC
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Minneapolis, MN 55414
(612)607-1700

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 0102B0412.000 City of Baxter
Pace Project No.: 10474250

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10474250001	**Lugo #1**	SM 9222B	605113	SM 9222B	605117
10474250002	**Lugo #2**	SM 9222B	605113	SM 9222B	605117
10474250003	**Katzenberger #1**	SM 9222B	605113	SM 9222B	605117
10474250004	**Katzenberger #2**	SM 9222B	605113	SM 9222B	605117
10474250005	**Bolt #1**	SM 9222B	605113	SM 9222B	605117
10474250006	**Bolt #2**	SM 9222B	605113	SM 9222B	605117
10474250001	**Lugo #1**	EPA 353.2	605133		
10474250002	**Lugo #2**	EPA 353.2	605133		
10474250003	**Katzenberger #1**	EPA 353.2	605133		
10474250004	**Katzenberger #2**	EPA 353.2	605133		
10474250005	**Bolt #1**	EPA 353.2	605133		
10474250006	**Bolt #2**	EPA 353.2	605133		
10474250001	**Lugo #1**	SM 4500-Cl E	605370		
10474250002	**Lugo #2**	SM 4500-Cl E	605370		
10474250003	**Katzenberger #1**	SM 4500-Cl E	605370		
10474250004	**Katzenberger #2**	SM 4500-Cl E	605370		
10474250005	**Bolt #1**	SM 4500-Cl E	605370		
10474250006	**Bolt #2**	SM 4500-Cl E	605370		

CHAIN-OF-CUSTODY RECORD

WIDSETH SMITH NOLTING

ALEXANDRIA 320.762.8149 | BEMIDJI 218.444.1859 | BRAINERD/ BAXTER 218.829.5117 | CROOKSTON 218.281.6522 | EAST GRAND FORKS 218.773.1185 | FOREST LAKE 651.464.3130 | GRAND FORKS 701.795.1975 | ROCHESTER 507.292.8743

WidsethSmithNolting.com | ENGINEERING ARCHITECTURE LAND SURVEYING ENVIRONMENTAL SERVICES

WO# : 10474250

10474250

PROJECT NUMBER	PROJECT NAME	NUMBER OF CONTAINERS
0102B0412.000	City of Baxter Unsewered Areas EA	
	LOCATION: Baxter, MN	

SAMPLERS: *(Signature)* [signature]

SAMPLERS: *(Print)* Michael Bogert

SAMPLE DESCRIPTION	DATE	TIME	COMP	GRAB	SAMPLE MATERIAL	NUMBER OF CONTAINERS	ANALYSES REQUEST: Chloride	Nitrates	Total Col:Form/E. Coli			REMARKS
Lugo #1	5/9/19	9:34		X	H_2O	4	X	X	X			Pace Profile # 22189
Lugo #2	5/9/19	10:15		X	H_2O	4	X	X	X			W1
Katzenberger #1	5/9/19	11:11		X	H_2O	4	X	X	X			W2
Katzenberger #2	5/9/19	11:47		X	H_2O	4	X	X	X			W3
Bolt #1	5/9/19	13:54		X	H_2O	4	X	X	X			W4
Bolt #2	5/9/19	14:55		X	H_2O	4	X	X	X			W5
												Cole

Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*	Relinquished by: *(Signature)*	Date / Time	Received by: *(Signature)*
[signature]	5/9/19 17:41				
Relinquished by: *(Signature)*	**Date / Time**	**Received for Laboratory by:** *(Signature)*	**Date / Time**	**Report To:**	
		[signature]	5/10/19 930	Brian Ross	
		T=0.1c		**Bill To:** 0102B0412.000	

Distribution: White – Accompanies Shipment; Pink – Project File; Yellow – Laboratory

No. 6228

Pace Analytical	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 05Apr2019 Page 1 of 1
	Document No.: **F-MN-L-213-rev.27**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt **Client Name:** Widseth **Project #:** WO#: 10474250

PM: OEO Due Date: 05/17/19
CLIENT: Widseth

Courier: ☑ Fed Ex ☑ UPS ☐ USPS ☐ Client ☐ Pace ☐ SpeeDee ☐ Commercial **See Exception** ☐

Tracking Number: 1Z5546730194914271 ☐

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: _____ **Temp Blank?** ☑ Yes ☐ No

Thermometer: ☑ T1(0461) ☐ T2(1336) ☐ T3(0459) ☐ T4(0254) ☐ T5(0048) **Type of Ice:** ☑ Wet ☐ Blue ☐ None ☐ Dry ☐ Melted

Note: Each West Virginia Sample must have temp taken (no temp blanks)

Temp should be above freezing to 6°C **Cooler Temp Read w/temp blank:** 0.4 °C **Average Corrected Temp (no temp blank only):** ____ °C **See Exceptions** ☐

Correction Factor: TRUE **Cooler Temp Corrected w/temp blank:** 0.0 °C

USDA Regulated Soil: (☑ N/A, water sample/Other: _____) **Date/Initials of Person Examining Contents:** _____

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:** 002 ~~Frozen~~ Ice present pH1 Cloudy sample **See Exception** ☐
Matrix: ☑ Water ☐ Soil ☐ Oil ☐ Other _____				
All containers needing acid/base preservation have been checked?	☑ Yes	☐ No	☐ N/A	12. Sample # ~~Cloudy~~
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO3, H2SO4, <2pH, NaOH >9 Sulfide, NaOH>12 Cyanide)	☑ Yes	☐ No	☐ N/A	☐ NaOH ☐ HNO_3 ☑ H_2SO_4 ☐ Zinc Acetate 001-006 1/1
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
Headspace in VOA Vials (greater than 6mm)?	☐ Yes	☐ No	☑ N/A	13. **See Exception** ☐
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: _____ Date/Time: _____

Comments/Resolution: _____

Project Manager Review: Oyeyemi Odujole **Date:** 5/10/19

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: _____

ATTACHMENT C
Soil Boring Logs

Log of Test Borings

WIDSETH SMITH NOLTING
Engineering
Architecture
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Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Lugo #1
Surface Elevation:	1203.83
Start Date:	5/9/2019
Time:	9:00
Completion Date:	5/9/2019
Time:	9:40

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
9:16	CS	31	Da	0.4	FILL		Fill- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Brown, FINE GRAINED SAND
			M	1.1			Some Mottling Present
9:21	CS	46	M	1.2	SP	5	
			W				Trace Gravel Present
							Turns Dark Brown in Color
			M	1.2			
							End of Boring @ 8'
						10	
						15	
						20	
						25	
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	9:34	4-8	8	8	1.8

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

Log of Test Borings

WIDSETH SMITH NOLTING
Engineering
Architecture
Surveying
Environmental
WidsethSmithNolting.com

Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Lugo #2
Surface Elevation:	1202.70
Start Date:	5/9/2019
Time:	9:40
Completion Date:	5/9/2019
Time:	10:20

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
9:49	CS	44	Da	1.1	FILL		Fill- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Brown, FINE GRAINED SAND
			M				WITH SOME MEDIUM COARSE GRAINED SAND
				1.3			Turns Tan, Some Mottling Present
9:56	CS	48	W	1.4	SP	5	
							Turns Gray/Tan in Color
				1.5			Turn Tan in Color
							End of Boring @ 8'
						10	
						15	
						20	
						25	
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	10:15	4-8	8	8	1.1

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

Log of Test Borings

WIDSETH SMITH NOLTING
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Architecture
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Environmental
WidsethSmithNolting.com

Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Katz #1
Surface Elevation:	1209.13
Start Date:	5/9/2019
Time:	10:30
Completion Date:	5/9/2019
Time:	11:20

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
10:51	CS	40	Da	0.4	FILL		Fill- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Red/Tan, FINE GRAINED SAND
				0.8			
10:55	CS	44	Da	1.1	SP	5	Turns Tan in Color
				1.4			
11:00	CS	42	Da	1.6	SP		Turns Brown in Color, Some Medium Grained Sand and Trace
			w			10	Gravel Present
				1.2			
							End of Boring @ 12'
						15	
						20	
						25	
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	11:11	8-12	12	12	8.7

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

Log of Test Borings

WIDSETH SMITH NOLTING
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Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Katz #2
Surface Elevation:	1207.41
Start Date:	5/9/2019
Time:	11:25
Completion Date:	5/9/2019
Time:	12:00

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
11:31	CS	38	Da	0.9	FILL		Fill- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Red/Tan, FINE GRAINED SAND
				1.1			Some Small Roots Present
11:34	CS	40	Da	1.7	SP	5	
							Turns Tan in Color
			M			▼	
			W	1.6			
11:39	CS	44	W	1.4	SP		Turns Tan/Brown in Color With Trace Mottling Present
						10	
				1.3			
							End of Boring @ 12"
						15	
						20	
						25	
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	11:47	8-12	12	12	7.05

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

Log of Test Borings

WIDSETH SMITH NOLTING
Engineering
Architecture
Surveying
Environmental
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Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Bolt #1
Surface Elevation:	1195.41
Start Date:	5/9/2019
Time:	13:00
Completion Date:	5/9/2019
Time:	14:00

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
13:13	CS	42	Da	1.3	FILL		FILL- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Brown, FINE GRAINED SAND
				1.1			
13:15	CS	46	Da	1.2	SP	5	Turns Tan in Color
							Becomes Fine to Medium Coarse Grained
				1.4			
13:20	CS	47	Da	1.6	SP		
						10	Trace Mottling Present
				1.7			
13:24	CS	46	Da	1.8	SP		
						15	Becomes Coarse Grained With Some Gravel
				1.7			
13:30	CS	42	Da	1.5	SP		Becomes Fine to Medium Coarse Grained With Trace Gravel
			W			▼	Becomes Light Tan
				1.6		20	
13:38	CS	40	W	1.3	SP		Becomes Medium Coarse With Some Gravel
							Turns Rust Red in Color
				1.3			
						25	End of Boring @ 24'
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	14:00	20-24	24	24	18.3

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

Log of Test Borings

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Project Number:	0102B0412.000
Project Name:	City of Baxter Unsewered Areas EA
Project Location:	Baxter, MN
Boring Number:	Bolt #2
Surface Elevation:	1191.30
Start Date:	5/9/2019
Time:	14:05
Completion Date:	5/9/2019
Time:	15:00

Sample # and Time	Sample Type	Recovery (inches)	Moisture	PID Readings (ppm)	U.S.C.S. Symbol	Depth (feet)	Description
14:13	CS	41	Da	1	FILL		FILL- Silty Sand, Loose, Dark Brown, Highly Organic
					SP		COARSE ALLUVIUM, Loose, Brown, FINE GRAINED SAND
				1.3			Turn Tan in Color
14:16	CS	46	Da	0.7	SP	5	
				1			Becomes Fine to Medium Coarse Grained, Trace Gravel Present
14:24	CS	41	Da	1.3	SP	10	
				1.2			
14:29	CS	49	Da	1.2	SP	15	
				1.7			No Gravel Present
14:35	CS	38	Da	0.9	SP		Turns Light Tan in Color
				1.8		20	
14:49	CS	41	Da	1.2	SP		
			W	1.1		▼	
						25	End of Boring @ 24'
						30	

Water Level Measurments (feet)

Date	Time	Sample Depth	Casing Depth	Cave-in Depth	Water Level
5/9/2019	14:55	20-24	24	24	23.7

Drilling Method:	Geoprobe
Backfill Method:	Bentonite
Field Representative:	MB

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SOIL BORING LOG
DESCRIPTIVE TERMINOLOGY

GRAIN SIZE

Soil Fraction	Particle Size	U.S. Standard Sieve
Boulders	Larger than 300mm	Larger than 12"
Cobbles	75mm to 33mm	3" to 12"
Gravel: Coarse	19mm to 75mm	3/4" to 3"
Fine	4.75mm to 19mm	#4 to 3/4"
Sand: Coarse	2.00mm to 4.75mm	#10 to #4
Medium	0.425mm to 2.00 mm	#40 to #10
Fine	0.075mm to 0.425mm	#200 to #40
Silt	0.005mm to 0.075mm	Smaller than #200
Clay	Smaller than 0.005mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

RELATIVE PROPORTIONS

Term	Range	Term	Range
Trace	0-5%	Some	10-30%
Little	5-10%	With	30-50%

DENSITY	BLOW COUNTS	CONSISTENCY
Term	N - Value	Term
Very Loose	0-4	Very Soft
Loose	5-8	Soft
Medium Dense	9-15	Firm
Dense	16-30	Hard
Very Dense	Over 30	Very Hard

Standard Penetration Test (N–Value): Blows per foot of a 140 pound hammer falling 30 inches on a 2-inch O.D. Split Barrel Sampler

SOIL MOISTURE

Dry	DR	Powdery, absence of moisture
Damp	Da	Residual moisture on soil grains
Moist	M	Below saturation
Wet	W	Saturated, visible free water

SOIL STRUCTURE

Fracture	Cracks of fissures
Seam	Up to 1/8" thick
Lamination	1/8" to 1/2" thick
Lense	½" to 6" thick stratum
Layer	Over 6" thick stratum
Varved	Alternating colored laminations of clay, silt, and/or fine-grained sand

DRILLING AND SAMPLING

CS	Continuous Sampling
RC	Rock Coring; Size AQ,BQ,NQ,PQ,PQ
RB	Rock Bit
CW	Clear Water
DM	Drilling Mud
MR	Mud Rotary
AR	Air Rotary
CT	Cable Tool
HSA	Hollow Stem Auger
FA	Flight Auger
HA	Hand Auger
SS	2" Diameter Split-Barrel Sample
2ST	2" Diameter Thin-Walled Tube Sample
3ST	3" Diameter Thin-Walled Tube Sample
AS	Auger Sample
CTC	Cable Tool Cuttings
WS	Washed Sample
NR	No Recovery
NMR	No Measurement Recorded
JW	Jetting Water
ND	Not Detected Above Background
NS	Not Sampled

GEOLOGIC TERMS

Coarse Alluvium	Sand and/or gravel sediments deposited by water action
Fine Alluvium	Silt and/or clay sediment deposited by water action
Mixed Alluvium	Mixture of Coarse and Fine Alluvium
Till	Unsorted sediments deposited directly by glacial ice
Colluvium	Talus and slope deposits
Eolian or Loess	Sediments deposited by wind action
Lacustrine	Sediments deposited at the bottom of a lake or pond
Peat	Organic material deposited in swamp or marsh
Fill	Sediments placed by man

WATER LEVEL MEASUREMENT

Perched Water Level

Water level

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

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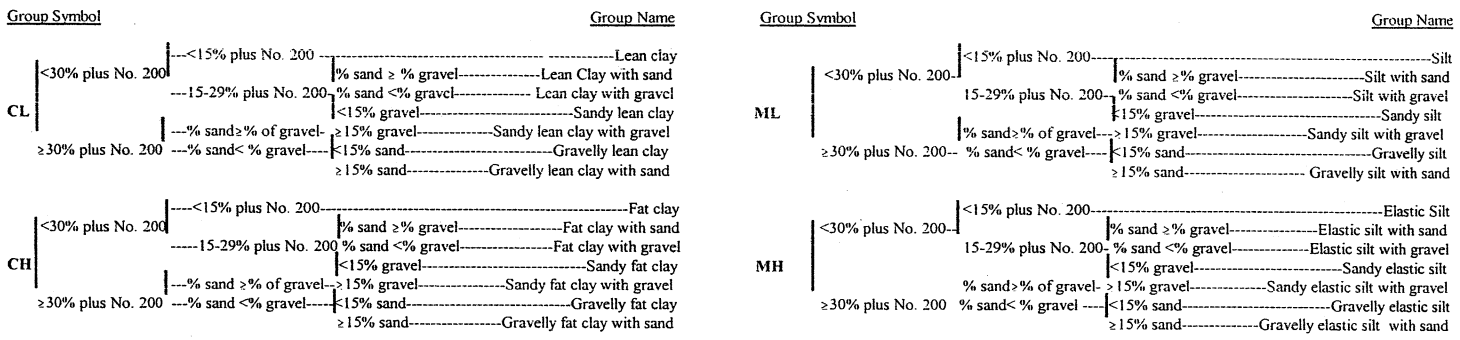
DESCRIPTION AND IDENTIFICATION OF SOILS

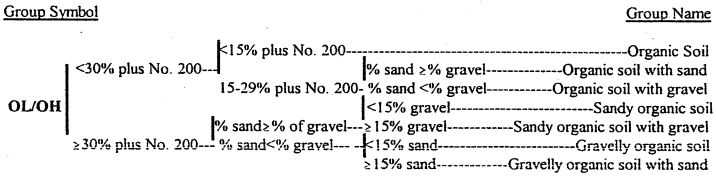
ASTM Designation D 2488-93

(Visual-Manual Procedure)

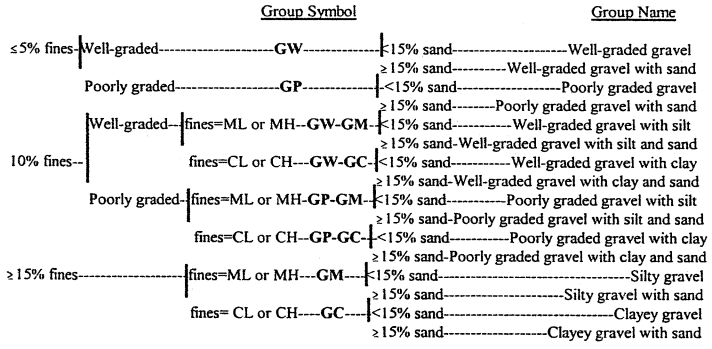
Flow Chart for Identifyng Inorganic Fine-Grained Soil (50% or more fines)

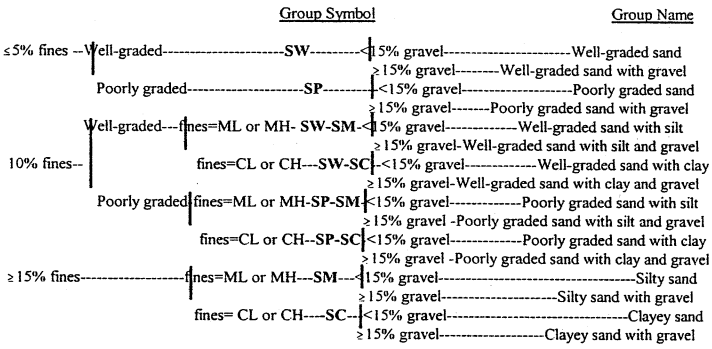


Flow Chart for Identifying Organic Fine-Grained Soil (50% or more fines)



Flow Chart for Identifying Coarse-Grained Soils (less than 50% fines)





Criteria for Describing Dry Strength

Description	Criteria
None	The dry speciment crumbles into powder with mere pressure of handling
Low	The dry speciment crumbles into powder with some finger pressure
Medium	The dry specimen breaks into pieces or crumbles with considerable finger pressure
High	The dry specimen cannot be broken with finger pressure. Specimen will break into pieces between thumb and a hard surface
Very High	The dry specimen cannot be broken between the thumb and a hard surface

Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness

Identification of Inorganic Fine-Grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot be formed
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

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CLASSIFICATION OF SOIL FOR ENGINEERING PURPOSES
ASTM Designation: D 2487-93
(Based on Unified Soil Classification System)

COARSE-GRAINED SOILS
(50% or more larger than No. 200 sieve size)

GRAVELS 50% or more of coarse fraction larger than No. 4 sieve	**Clean Gravels (Less than 5% fines)** **GW** Well-graded gravels, gravel-sand mixtures, little or no fines
	Clean Gravels (Less than 5% fines) **GP** Poorly graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (Greater than 12% fines) **GM** Silty gravels, gravel-sand-silt mixtures
	Gravels with fines (Greater than 12% fines) **GC** Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve	**Clean sands (Less than 5% fines)** **SW** Well-graded sands, gravelly sands, little or no fines
	Clean sands (Less than 5% fines) **SP** Poorly graded sands, gravelly sands, little or no fines
	Sand with Fines (Greater than 12% fines) **SM** Silty sands, sand-silt mixtures
	Sand with Fines (Greater than 12% fines) **SC** Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS
(50% or more smaller than No. 200 Sieve)

SILTS AND CLAYS Liquid limit less than 50%	**ML** Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticility
	CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL Organic silts & organic silty clays of low
SILTS AND CLAYS Liquid Limit 50% or More	**MH** Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH Inorganic clays of high plasticity, fat clays
	OH Organic clays of medium to high plasticity, organic silts

HIGHLY ORGANIC SOILS

PEAT Primarily Organic Matter	Fibric Peat > 67% fibers **PT** Hemic Peat 33%-67% fibers Sapric Peat < 33% fibers

LABORATORY CLASSIFICATION CRITERIA

GW $\frac{D_{60}}{D_{10}}$ greater than or equal to 4; $\frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
Where D_{60},D_{30},D_{10} are the particle diameters corresponding to 60%, 30%,10% passing on the cumulative particle-size distribution curve.

GP Not meeting all gradation requirements for GW

GM *Atterberg limits below "A" line or P.I. less than 4	*Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols GC-GM
GC *Atterberg limits above "A" line with P.I. greater than 7	*For fine-grained fraction

SW $\frac{D_{60}}{D_{10}}$ greater than or equal to 6; $\frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
Where D_{60},D_{30},D_{10} are the particle diameters corresponding to 60%, 30%,10% passing on the cumulative particle-size distribution curve.

SP Not meeting all gradation requirements for SW

SM *Atterberg limits below "A" line or P.I. less than 4	*Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols SC-SM
SC *Atterberg limits above "A" line with P.I. greater than 7	*For fine-grained fraction

Gravels with 5 to 12% fines require dual symbols:

GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

Sands with 5 to 12% fines require dual symbols:

SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay