LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUNDWATER AND ENVIRONMENTAL ENGINEERING SERVICES

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www.lbgweb.com

MEMORANDUM

TO:	**Neil Soltis, City of Scandia**
FROM:	**Dave Hume, LBG**
CC:	**Sherri Buss, TKDA** **Roscoe Sopiwnik, LBG** **Jed Chesnut - WCD**
DATE:	**January 15, 2016**
RE:	**Groundwater Monitoring Update (July through December 2015)** **Zavoral Mining and Reclamation Project** **Scandia, MN**

The purpose of this correspondence is to provide the City of Scandia (City) with a summary of the groundwater monitoring results from the Zavoral Mining and Reclamation Project (Site). This memorandum includes results from July through December 2015, and is referred to herein as the reporting period.

The monitoring results from January 2014 through June 2015 were provided in Leggette, Brashears & Graham, Inc.'s (LBG's) June 2014, January 2015, and October 2015 Groundwater Monitoring Update memorandums, dated June 20, 2014; January 16, 2015; and, October 9, 2015. Groundwater monitoring well installation, monitoring procedures, and 2013 results were provided in LBG's *2013 Groundwater Monitoring Summary* letter report dated January 15, 2014.

GROUNDWATER MONITORING ACTIVITIES

The following groundwater monitoring activities were conducted:

- LBG conducted Site visits on September 4th, and December 6th.
- LBG manually measured water levels and downloaded water level data from the data loggers in the four observation wells (MW-1, PZ-1, PZ-2, and Trails End Well), and downloaded water quality parameter data from the logger in MW-1;
- Pace Analytical Services, Inc. (Pace) collected a groundwater sample from MW-1 on December 6, 2015;

- Obtained surface water monitoring data from the Washington County Conservation District (WCD) and provided WCD with groundwater data; and,
- Updated the water quality data plots and well hydrographs included in the memorandum.

GROUNDWATER MONITORING RESULTS

Groundwater Level Measurements

Groundwater levels across the Site decreased from approximately 0.25 to 0.75 feet from January through June 2105, then increased approximately 0.5 to 1.25 feet from July through December 2015. These trends follow the same general patterns observed in 2013 and 2014, and are typical of seasonal variations caused by variable precipitation and subsequent recharge to the aquifer. Water levels in December 2016 were approximately 0.5 to 1 foot higher than when mining operations began in 2013. This is appears to be related to more precipitation in 2015 compared to the previous two years.

Groundwater Flow Direction

The groundwater surface contour map is shown on Figure 1 for measurements collected on December 16, 2015. The hydraulic gradient and flow direction is consistent with the 2013, 2014, and those measured in early 2015. Flow is southeast toward the Saint Croix River.

Mining Depth and Groundwater Levels

According to Tiller staff, active mining excavation and reclamation activities occurred during the reporting period during the months of September, October, November, and December 2015. The maximum mining depth during the 2015 season ranged between 843 and 855 feet above mean sea level (ft-amsl), which is between 3 and 15 feet above the permitted depth of 840 ft-amsl. This maintains the required 25 feet minimum separation distance from the water table under the mining area as required by the condition outlined in the Conditional Use Permit (CUP).

Zavoral Site Well

The Zavoral Site Well was pumped in September, October, and November 2015 for dust control activities. A total of 114,000 gallons were pumped with 24,000 gallons withdrawn in September, 66,000 gallons withdrawn in October, and 24,000 gallons withdrawn in November. According to Tiller staff, this was the only groundwater withdrawn during the reporting period. Groundwater levels in the uppermost aquifer below the site were not affected by pumping.

Groundwater Quality - Petroleum Parameters (MW-1)

Groundwater samples were collected by Pace Analytical from MW-1 on December 16, 2015. The results are provided on Table 1 and in Attachment 1. Petroleum compounds (benzene, toluene, ethylbenzene, and xylene) and diesel range organics (DRO) were not detected at or above the method detection limit. The sampling plan and protocol is consistent with Tiller's *Groundwater Quality Protection Plan* (GQPP).

Groundwater Quality – Indicator Parameters (MW-1)

The water quality indicators recorded by the logger in MW-1 are presented in Attachment 2. The values are generally in the range of those recorded in 2013 during the pre-Tiller mining period. The plots show decreases in conductivity, salinity, and total dissolved solids (TDS) beginning in late August 2015. Although slightly delayed, the signatures follow a similar trend to those observed during the 2013 and 2014 monitoring periods. The changes in concentrations, although slightly more or less pronounced depending on the year, are following the seasonal variations observed during the 2013 and 2014 monitoring periods.

The abrupt change in conductivity, salinity, and TDS levels observed on the graphs immediately following the Pace January 2015 sampling event is a result of the logger being removed from the well during the sampling activities. This type of signature was also observed during the September 10, 2013 sampling event. After sampling was completed, the logger was placed back in the well and the levels returned to pre-sample conditions.

SUMMARY AND RECOMMENDATIONS

Based on the groundwater monitoring data from this most recent and prior reporting periods, mining and reclamation operations have not impacted groundwater below the Site.

Based on LBG's review and evaluation of the monitoring procedures and data from 2013 through 2015, all CUP conditions related to groundwater monitoring have been met by Tiller. At this time, LBG recommends the conditions of the CUP remain in place and the *Groundwater Quality Protection Plan* GWQPP continue to be followed.

TABLE

TABLE 1

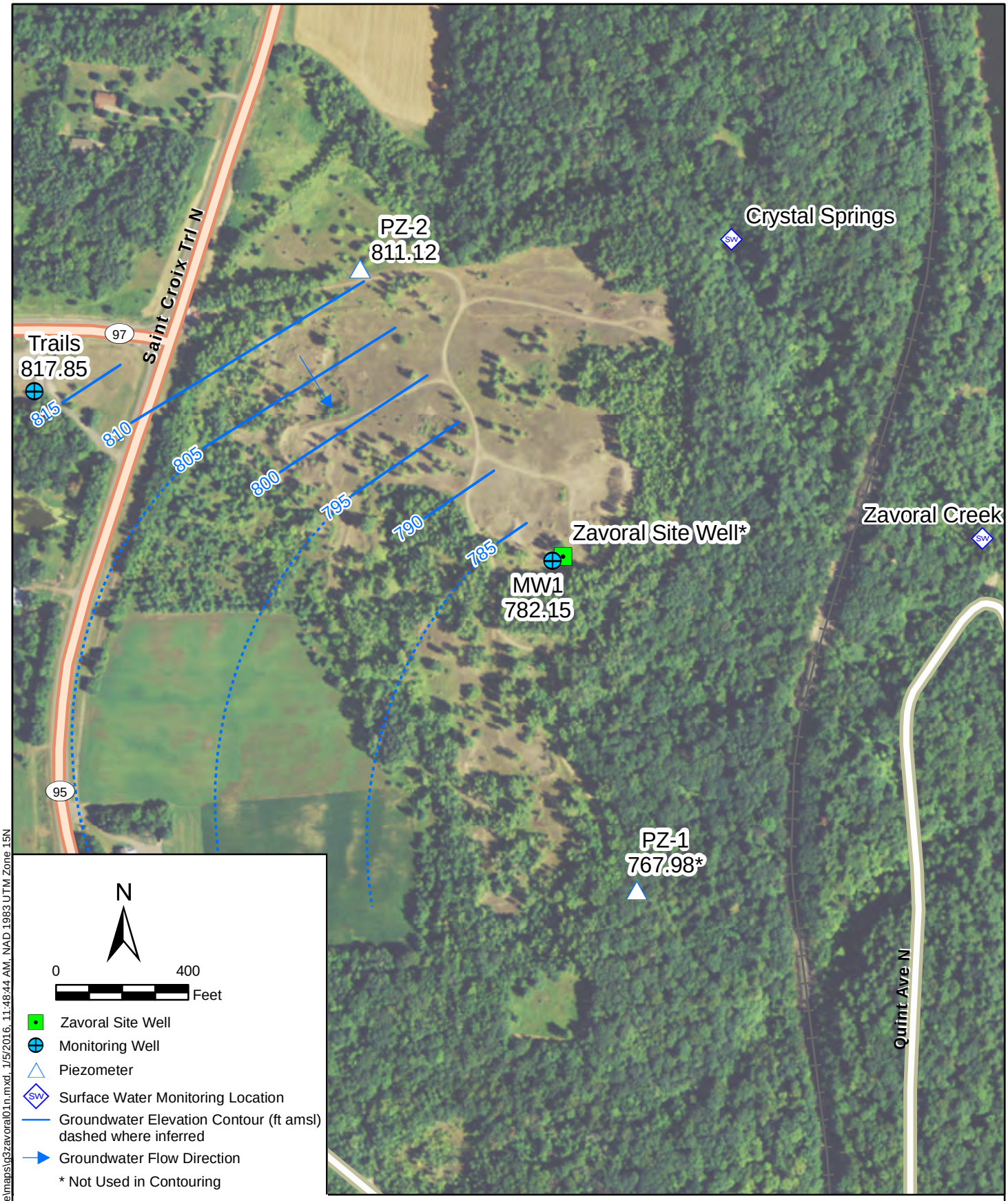
ZAVORAL AGGREGATE MINING AND RECLAMATION PROJECT
SCANDIA, MN

MW-1 GROUNDWATER ANALYTICAL RESULTS
THROUGH DECEMBER 2015

Sample Date	Diesel Range Organics (DRO)	Benzene	Ethylbenzene	Toluene	Xylene (Total)
Units	mg/L	ug/L	ug/L	ug/L	ug/L
Method Detection Limit	0.10	1.0	1.0	1.0	3.0
10-Sep-13	<0.10	<1.0	<1.0	<1.0	<3.0
15-Jan-14	<0.10	<1.0	<1.0	<1.0	<3.0
15-Jan-15	<0.10	<1.0	<1.0	<1.0	<3.0
16-Dec-15	<0.10	<1.0	<1.0	<1.0	<3.0

mg/L: Milligrams per Liter
ug/L: Micrograms per Liter

FIGURE



Source: LIDAR DEM from Minnesota Geospatial Information Office. Well Locations Located by LBG. Surface Water Monitoring Locations from MNWCD.

G:\GIS\Tiller_Zavoral_Mine\maps\g3zavoral01n.mxd, 1/5/2016, 11:48:44 AM, NAD 1983 UTM Zone 15N

Prepared By:
LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Groundwater and
Environmental Engineering Services
8 Pine Tree Drive, Suite 250
St. Paul, Minnesota 55112
(651) 470-1405

CITY OF SCANDIA
SCANDIA, MINNESOTA

GROUNDWATER ELEVATIONS
DECEMBER 16, 2015

FILE: g3zavoral01n.MXD	DATE: 1/5/2016	FIGURE: 1

ATTACHMENT 1

PACE LABS ANALYTICAL REPORT

Pace Analytical®
Field Services Division

Pace Analytical Services, Inc.
1700 Elm Street, Suite 200
Minneapolis, MN 55414
Phone: 612.607.1700
Fax: 612.607.6444
www.pacelabs.com

January 04, 2016

Mr. Mike Caron
Barton Sand and Gravel
P.O. Box 1480
Maple Grove, MN 55311-6480

RE: Pace Project No. 15-1462
Client Project ID: Barton Sand and Gravel- Zavoral Pit 744, Annual

Dear Mr. Caron:

Enclosed are the analytical results for the sample(s) received by the laboratory on December 16, 2015 for the annual sampling and analysis at Zavoral Pit 744. The result for DRO and BTEX was ND (Not Detected), so that was good to see.

Results reported herein conform to the most current NELAC standards, where applicable, unless otherwise narrated in the body of the report.

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

Sincerely,

David Anderson

David Anderson
Project Manager
612-607-6377

State of Minnesota Laboratory No. 027-053-137

CC: Mr. Paul Schultz

Pace Analytical® Field Services Division

Well Sampling Field Data Log Sheet

Client: Barton Sand + Gravel **Project:** Pit 744, Zavoral **Project #:** 15-1462

Well Description and Presampling Information

Monitoring Point ID MW-1 (772842) Labeled 772842

Inside Diameter 2 (inches) Key # _____ ☐ Locked ☐ Not Locked

Casing Material: ☐ PVC ☐ Steel ☐ Stainless Steel

Depth Measurement and Elevations (from top of well casing)

Top of Casing Elevation 867.43 Feet

Well depth 92.44 Feet

Static water level measurement before purging 85.30 Feet

Static water level measurement at time of sampling 85.34 Feet

Static Water Level Elevation Before Purging 782.13 Feet

Purge Method 2" Grundfos Rediflo sub pump

Date Purged 12-16-15 Water Column 7.14 Feet

Time Purged 1135-1144 One Casing Volume 1.2 Gallons

Pump Rate 0.5 (GPM / LPM) Volume Purged 4.5 Gallons

Field Sampling Data

Date Sampled 12-16-15

Time Sampled 1155

Sampling Equip. above pump

Analyzed by DJA

Field Parameter Measurements of Sample

pH 7.3 (units) D.O NA (mg/l)

Spec. Cond. 450 (µmhos/cm) Turbidity NA (NTU)

Temp. 10.0 (°C) Eh NA (mV)

Other NA

Field Measurements Temp. Corrected: ☒ Yes ☐ No ☐ NA

Sample for Soluble Metals Filtered in Field: ☐ Yes ☐ No ☒ NA

Weather Conditions During Sampling: 36°+ cloudy, wind SE 10

Sample Description: clear + odorless

Observations:

DJA 12-16-15

Stabilization Test

Time	pH (units)	Specifc Conductance (µmhos/cm)	Temp (°C)	D.O (mg/l)	Turbidity (NTU)	Eh (mV)	Volume Purged (cumulative gal)
1138	7.4	450	9.5	NA	NA	NA	1.5
1141	7.3	450	10.0	NA	NA	NA	3.0
1144	7.3	450	10.0	NA	NA	NA	4.5

DJA 12/16/15

Form Revised: 01/24/2012

Name/Affiliation of Sampler(s): David Anderson / Pace Analytical

Lead Technician Signature: David Anderson Date: 12-16-15

Barton Sand + Gravel — Pit 744, Zavoral
Field Proj. # 15-1462

Pace Analytical® Field Services Division

pH and Conductivity

Field Calibration and Verification Sheet

Technician(s) DJA Date 12/16/15 Page 1 of 1

pH

Meter Make YSI Sonde Meter ID #5

Initial Calibration (IC)

Buffer Value / Manufacturer / Lot No. / Exp. Date	Meter Value	Temp (°C)	Time	Initials
Buffer: 4.0 units Fisher - Lot #: 148130 Exp Date: 12/2016	4.00	13.5	0930	DJA
7.0 Ricca 4508D35 08/2017	7.05	13.5	0930	DJA
Buffer: 10.0 units ERA - Lot #: 081114 Exp Date: 11/10/16	10.14	13.5	0930	DJA

IC Slope (%) N/R (Pass) / Fail (Acceptable Slope: 92-102%)

Initial Calibration Verification (ICV)

Buffer Value / Manufacturer / Lot No. / Exp. Date	Meter Value	Temp (°C)	Time	Initials
Buffer: 7.0 units ERA - Lot #: 150515 Exp Date: 06/11/17	7.06	13.5	0940	DJA

(Pass) / Fail (ICV acceptable if ± 0.1 s.u. of buffer value)

Continuing Calibration Verification (CCV)

See Below ☒ See Field Data Log Sheet ☐ See Raw Data (continuous pH) ☐

Buffer Value / Manufacturer / Lot No. / Exp. Date	Meter Value	Temp (°C)	Time	Initials
7.0 Ricca 4508D35 08/2017	7.05	13.5	1340	DJA

(Pass) / Fail (CCV acceptable if ± 0.1 s.u. of buffer value)

Conductivity

Initial Calibration (IC)

High Standard Value: 1411

Cond Std: 1411 umhos/cm
Fisher - Lot #: CC13535
Exp Date: 03/16/16

Meter Result (µS/cm)	Temp (°C)
1100	13.5

Initial Cal. Verification (ICV)

Low Standard Value: 100

Cond Std: 100 umhos/cm
Ricca - Lot #: 1506D34
Exp Date: 12/2016

Meter Result (µS/cm)	Temp (°C)
100	13.5

Meter Make YSI Sonde ID #5
IC/ICV Time 0945 / 0950
Initials DJA
ICV: (Pass) / Fail
(ICV acceptable if ± 5% of standard value or 10 µS/cm, which ever is greater)

Continuing Calibration Verification (CCV)

Time 1345 Initials DJA Std. Value 1411 ☒ High Standard ☐ Low Standard
Result (µS/cm) 1100 Temp (°C) 13.5 CCV: (Pass) / Fail (CCV acceptable if ± 5% of standard value or 10 µS/cm, which ever is greater)

~~DJA 12/16/15~~
Time ____ Initials ____ Std. Value ____ ☐ High Standard ☐ Low Standard
Result (µS/cm) ____ Temp (°C) ____ CCV: Pass / Fail (CCV acceptable if ± 5% of standard value or 10 µS/cm, which ever is greater)

Time ____ Initials ____ Std. Value ____ ☐ High Standard ☐ Low Standard
Result (µS/cm) ____ Temp (°C) ____ CCV: Pass / Fail (CCV acceptable if ± 5% of standard value or 10 µS/cm, which ever is greater)

Form Revised: 11/13/2013

Lead Technician Signature: David Anderson Date: 12/16/15

Pace Analytical®
www.pacelabs.com

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1700 Elm Street - Suite 200
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(612)607-1700

December 30, 2015

Mr. David Anderson
Pace Analytical Services, Inc.
1700 Elm Street
Suite 200
Minneapolis, MN 55414

RE: Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Dear Mr. Anderson:
Enclosed are the analytical results for sample(s) received by the laboratory on December 16, 2015. The results relate only to the samples included in this report. Results reported herein conform to the most current TNI 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 for
Zach Wagner
zach.wagner@pacelabs.com
Project Coordinator

Enclosures

cc: Pace Analytical - Field, Pace Analytical Field Services

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CERTIFICATIONS

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Minnesota Certification IDs
1700 Elm Street SE Suite 200, Minneapolis, MN 55414
525 N 8th Street, Salina, KS 67401
A2LA Certification #: 2926.01
Alaska Certification #: UST-078
Alaska Certification #MN00064
Alabama Certification #40770
Arizona Certification #: AZ-0014
Arkansas Certification #: 88-0680
California Certification #: 01155CA
Colorado Certification #Pace
Connecticut Certification #: PH-0256
EPA Region 8 Certification #: 8TMS-L
Florida/NELAP Certification #: E87605
Guam Certification #:14-008r
Georgia Certification #: 959
Georgia EPD #: Pace
Idaho Certification #: MN00064
Hawaii Certification #MN00064
Illinois Certification #: 200011
Indiana Certification#C-MN-01
Iowa Certification #: 368
Kansas Certification #: E-10167
Kentucky Dept of Envi. Protection - DW #90062
Kentucky Dept of Envi. Protection - WW #:90062
Louisiana DEQ Certification #: 3086
Louisiana DHH #: LA140001
Maine Certification #: 2013011
Maryland Certification #: 322
Michigan DEPH Certification #: 9909
Minnesota Certification #: 027-053-137
Mississippi Certification #: Pace
Montana Certification #: MT0092
Nevada Certification #: MN_00064
Nebraska Certification #: Pace
New Jersey Certification #: MN-002
New York Certification #: 11647
North Carolina Certification #: 530
North Carolina State Public Health #: 27700
North Dakota Certification #: R-036
Ohio EPA #: 4150
Ohio VAP Certification #: CL101
Oklahoma Certification #: 9507
Oregon Certification #: MN200001
Oregon Certification #: MN300001
Pennsylvania Certification #: 68-00563
Puerto Rico Certification
Saipan (CNMI) #:MP0003
South Carolina #:74003001
Texas Certification #: T104704192
Tennessee Certification #: 02818
Utah Certification #: MN000642013-4
Virginia DGS Certification #: 251
Virginia/VELAP Certification #: Pace
Washington Certification #: C486
West Virginia Certification #: 382
West Virginia DHHR #:9952C
Wisconsin Certification #: 999407970

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SAMPLE SUMMARY

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Lab ID	Sample ID	Matrix	Date Collected	Date Received
10333654001	**MW-1 (772842)**	Water	12/16/15 11:55	12/16/15 13:13

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SAMPLE ANALYTE COUNT

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Lab ID	Sample ID	Method	Analysts	Analytes Reported
10333654001	**MW-1 (772842)**	WI MOD DRO	JRH	2
		EPA 8260B	PRD	7

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ANALYTICAL RESULTS

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Sample: MW-1 (772842) **Lab ID: 10333654001** Collected: 12/16/15 11:55 Received: 12/16/15 13:13 Matrix: Water

Parameters	Results	Units	Report Limit	DF	Prepared	Analyzed	CAS No.	Qual
WIDRO GCS	Analytical Method: WI MOD DRO Preparation Method: WI MOD DRO							
WDRO C10-C28	ND	mg/L	0.10	1	12/18/15 10:08	12/19/15 12:36		
Surrogates								
n-Triacontane (S)	84	%.	50-150	1	12/18/15 10:08	12/19/15 12:36	638-68-6	
8260B MSV UST	Analytical Method: EPA 8260B							
Benzene	ND	ug/L	4.0	1		12/24/15 09:22	71-43-2	
Ethylbenzene	ND	ug/L	1.0	1		12/24/15 09:22	100-41-4	
Toluene	ND	ug/L	4.0	1		12/24/15 09:22	108-88-3	
Xylene (Total)	ND	ug/L	3.0	1		12/24/15 09:22	1330-20-7	
Surrogates								
1,2-Dichloroethane-d4 (S)	105	%.	75-125	1		12/24/15 09:22	17060-07-0	
Toluene-d8 (S)	98	%.	75-125	1		12/24/15 09:22	2037-26-5	
4-Bromofluorobenzene (S)	98	%.	75-125	1		12/24/15 09:22	460-00-4	

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QUALITY CONTROL DATA

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

QC Batch: MSV/34206
QC Batch Method: EPA 8260B
Analysis Method: EPA 8260B
Analysis Description: 8260B MSV UST-WATER
Associated Lab Samples: 10333654001

METHOD BLANK: 2164607
Matrix: Water
Associated Lab Samples: 10333654001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
Benzene	ug/L	ND	4.0	12/24/15 03:39	
Ethylbenzene	ug/L	ND	1.0	12/24/15 03:39	
Toluene	ug/L	ND	4.0	12/24/15 03:39	
Xylene (Total)	ug/L	ND	3.0	12/24/15 03:39	
1,2-Dichloroethane-d4 (S)	%.	102	75-125	12/24/15 03:39	
4-Bromofluorobenzene (S)	%.	101	75-125	12/24/15 03:39	
Toluene-d8 (S)	%.	101	75-125	12/24/15 03:39	

LABORATORY CONTROL SAMPLE: 2164608

Parameter	Units	Spike Conc.	LCS Result	LCS % Rec	% Rec Limits	Qualifiers
Benzene	ug/L	20	19.7	98	71-125	
Ethylbenzene	ug/L	20	18.6	93	75-125	
Toluene	ug/L	20	19.7	98	74-125	
Xylene (Total)	ug/L	60	55.7	93	75-125	
1,2-Dichloroethane-d4 (S)	%.			104	75-125	
4-Bromofluorobenzene (S)	%.			100	75-125	
Toluene-d8 (S)	%.			101	75-125	

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2164609 2164610

Parameter	Units	10333363013 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	12.2	20	20	31.1	31.4	95	96	53-139	1	30	H1
Ethylbenzene	ug/L	ND	20	20	18.4	19.0	91	94	55-139	3	30	H1
Toluene	ug/L	ND	20	20	19.6	20.1	93	95	52-148	2	30	H1
Xylene (Total)	ug/L	8.0	60	60	64.6	67.0	94	98	54-144	4	30	
1,2-Dichloroethane-d4 (S)	%.						105	105	75-125			
4-Bromofluorobenzene (S)	%.						100	100	75-125			
Toluene-d8 (S)	%.						100	100	75-125			

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2164611 2164612

Parameter	Units	10333363036 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Benzene	ug/L	604	20	20	608	592	19	-57	53-139	3	30	E
Ethylbenzene	ug/L	338	20	20	349	330	58	-37	55-139	6	30	E

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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QUALITY CONTROL DATA

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

MATRIX SPIKE & MATRIX SPIKE DUPLICATE: 2164611 2164612

Parameter	Units	10333363036 Result	MS Spike Conc.	MSD Spike Conc.	MS Result	MSD Result	MS % Rec	MSD % Rec	% Rec Limits	RPD	Max RPD	Qual
Toluene	ug/L	711	20	20	725	706	69	-25	52-148	3	30	E
Xylene (Total)	ug/L	1460	60	60	1510	1410	68	-83	54-144	6	30	ES
1,2-Dichloroethane-d4 (S)	%.						97	95	75-125			
4-Bromofluorobenzene (S)	%.						102	102	75-125			
Toluene-d8 (S)	%.						101	100	75-125			

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.

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(612)607-1700

QUALITY CONTROL DATA

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

QC Batch: OEXT/32078 | Analysis Method: WI MOD DRO
QC Batch Method: WI MOD DRO | Analysis Description: WIDRO GCS
Associated Lab Samples: 10333654001

METHOD BLANK: 2161224 | Matrix: Water
Associated Lab Samples: 10333654001

Parameter	Units	Blank Result	Reporting Limit	Analyzed	Qualifiers
WDRO C10-C28	mg/L	ND	0.10	12/19/15 11:41	
n-Triacontane (S)	%.	82	50-150	12/19/15 11:41	

LABORATORY CONTROL SAMPLE & LCSD: 2161225 2161226

Parameter	Units	Spike Conc.	LCS Result	LCSD Result	LCS % Rec	LCSD % Rec	% Rec Limits	RPD	Max RPD	Qualifiers
WDRO C10-C28	mg/L	2	1.7	1.7	84	84	75-115	0	20	
n-Triacontane (S)	%.				77	69	50-150			

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.

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

QUALIFIERS

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

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.

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.

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

E	Analyte concentration exceeded the calibration range. The reported result is estimated.
ES	The reported result is estimated because one or more of the constituent results are qualified as such.
H1	Analysis conducted outside the recognized method holding time.

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

QUALITY CONTROL DATA CROSS REFERENCE TABLE

Project: 15-1462 Barton Sand and Gravel
Pace Project No.: 10333654

Lab ID	Sample ID	QC Batch Method	QC Batch	Analytical Method	Analytical Batch
10333654001	**MW-1 (772842)**	WI MOD DRO	OEXT/32078	WI MOD DRO	GCSV/17548
10333654001	**MW-1 (772842)**	EPA 8260B	MSV/34206		

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Pace Analytical®
www.pacelabs.com

RUSH
A 12-16-15

CHAIN-OF-CUSTODY / Analytical Request Document

The Chain-of-Custody is a LEGAL DOCUMENT. All relevant fields must be completed accurately.

10333654

Page: 1 of 1

1942298

Section A Required Client Information:

Company: Barton Sand and Gravel
Address: c/o Pace MN Field
Email To:
Phone: Fax:
Requested Due Date/TAT: 5 Day TAT / 12/23/15

Section B Required Project Information:

Report To: David Anderson
Copy To:
Purchase Order No.:
Project Name: 15-1462, Barton Sand and Gravel - Zavoral, Pit 744
Project Number:

Section C Invoice Information:

Attention: C.J. Ruikkie
Company Name:
Address:
Pace Quote Reference: DJA
Pace Project Manager: Zach Wagner
Pace Profile #:

REGULATORY AGENCY: ☐ NPDES ☐ GROUND WATER ☐ DRINKING WATER ☐ UST ☐ RCRA ☐ OTHER
Site Location STATE:

Section D Required Client Information

Matrix Codes (MATRIX / CODE): Drinking Water DW, Water WT, Waste Water WW, Product P, Soil/Solid SL, Oil OL, Wipe WP, Air AR, Tissue TS, Other OT

SAMPLE ID (A-Z, 0-9 / ,-) Sample IDs MUST BE UNIQUE

Requested Analysis Filtered (Y/N)

ITEM #	SAMPLE ID	MATRIX CODE (see valid codes to left)	SAMPLE TYPE (G=GRAB C=COMP)	COLLECTED Composite Start Date	Composite Start Time	Composite End/Grab Date	Composite End/Grab Time	SAMPLE TEMP AT COLLECTION	# OF CONTAINERS	Preservatives: Unpreserved	H_2SO_4	HNO_3	HCl	NaOH	$Na_2S_2O_3$	Methanol	Other	Analysis Test Y/N: *PAH (HOLD)	WT DRO	BTEX	Residual Chlorine (Y/N)	Pace Project No./ Lab I.D.
1	MW-1 (772842)	WT				12/16/15	1155		7				5						✓	✓		01
2																						
3																						
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

DJA 12/16/15

ADDITIONAL COMMENTS	RELINQUISHED BY / AFFILIATION	DATE	TIME	ACCEPTED BY / AFFILIATION	DATE	TIME	SAMPLE CONDITIONS: Temp in °C	Received on Ice (Y/N)	Custody Sealed Cooler (Y/N)	Samples Intact (Y/N)
*5 Day TAT on DRO. PAH on HOLD until DRO analysis is complete. If DRO present, we will analyze for PAH.	David Anderson	12/16/15	1310	E YL Pace	12/16/15	1515	2.7	Y	N	Y

SAMPLER NAME AND SIGNATURE
PRINT Name of SAMPLER: David Anderson
SIGNATURE of SAMPLER: David Anderson
DATE Signed (MM/DD/YY): 12/16/15

*Important Note: By signing this form you are accepting Pace's NET 30 day payment terms and agreeing to late charges of 1.5% per month for any invoices not paid within 30 days.

ORIGINAL

F-ALL-Q-020rev.07, 15-May-2007

Pace Analytical®	Document Name: **Sample Condition Upon Receipt Form**	Document Revised: 23Feb2015 Page 1 of 1
	Document No.: **F-MN-L-213-rev.13**	Issuing Authority: Pace Minnesota Quality Office

Sample Condition Upon Receipt

Client Name: Berton Sand & Gravel / FSD

Project #: WO#: 10333654

10333654

Courier: ☐Fed Ex ☐UPS ☐USPS ☐Client ☐Commercial ☑Pace ☐SpeeDee ☐Other:_____

Tracking Number: _____

Custody Seal on Cooler/Box Present? ☐Yes ☑No **Seals Intact?** ☐Yes ☑No

Optional: Proj. Due Date: Proj. Name:

Packing Material: ☐Bubble Wrap ☑Bubble Bags ☐None ☐Other:_____ **Temp Blank?** ☐Yes ☑No

Thermometer Used: ☐ B88A9130516413 ☑B88A912167504 ☐B88A0143310098 **Type of Ice:** ☑Wet ☐Blue ☐None ☐Samples on ice, cooling process has begun

Cooler Temp Read (°C): 3.4 **Cooler Temp Corrected (°C):** 3.7 **Biological Tissue Frozen?** ☐Yes ☐No ☑N/A

Temp should be above freezing to 6°C **Correction Factor:** +0.3 **Date and Initials of Person Examining Contents:** 12-16-15 AA

USDA Regulated Soil (☑ N/A, water sample)

Did samples originate in a quarantine zone within the United States: AL, AR, AZ, CA, FL, GA, ID, LA. MS, NC, NM, NY, OK, OR, SC, TN, TX or WA (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?	☑Yes	☐No	☐N/A	1.
Chain of Custody Filled Out?	☑Yes	☐No	☐N/A	2.
Chain of Custody Relinquished?	☑Yes	☐No	☐N/A	3.
Sampler Name and/or Signature on COC?	☑Yes	☐No	☐N/A	4.
Samples Arrived within Hold Time?	☑Yes	☐No	☐N/A	5.
Short Hold Time Analysis (<72 hr)?	☐Yes	☑No	☐N/A	6.
Rush Turn Around Time Requested?	☑Yes	☐No	☐N/A	7.
Sufficient Volume?	☑Yes	☐No	☐N/A	8.
Correct Containers Used?	☑Yes	☐No	☐N/A	9.
-Pace Containers Used?	☑Yes	☐No	☐N/A	
Containers Intact?	☑Yes	☐No	☐N/A	10.
Filtered Volume Received for Dissolved Tests?	☐Yes	☐No	☑N/A	11. Note if sediment is visible in the dissolved container
Sample Labels Match COC? -Includes Date/Time/ID/Analysis Matrix: WT	☑Yes	☐No	☐N/A	12.
All containers needing acid/base preservation have been checked?	☐Yes	☐No	☑N/A	13. ☐HNO_3 ☐H_2SO_4 ☐NaOH ☐HCl Sample #
All containers needing preservation are found to be in compliance with EPA recommendation? (HNO_3, H_2SO_4, HCl<2; NaOH >9 Sulfide, NaOH>12 Cyanide)	☐Yes	☐No	☑N/A	
Exceptions: VOA, Coliform, TOC, Oil and Grease, DRO/8015 (water) DOC	☑Yes	☐No	☐N/A	Initial when completed: _____ Lot # of added preservative: _____
Headspace in VOA Vials (>6mm)?	☐Yes	☑No	☐N/A	14.
Trip Blank Present?	☐Yes	☑No	☐N/A	15.
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: [signature] **Date:** Dec 17 2015

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).

Data File: \\192.168.10.12\chem\10gcs9.i\121915dro.b/121915000018.D

Report Date: 12/19/2015

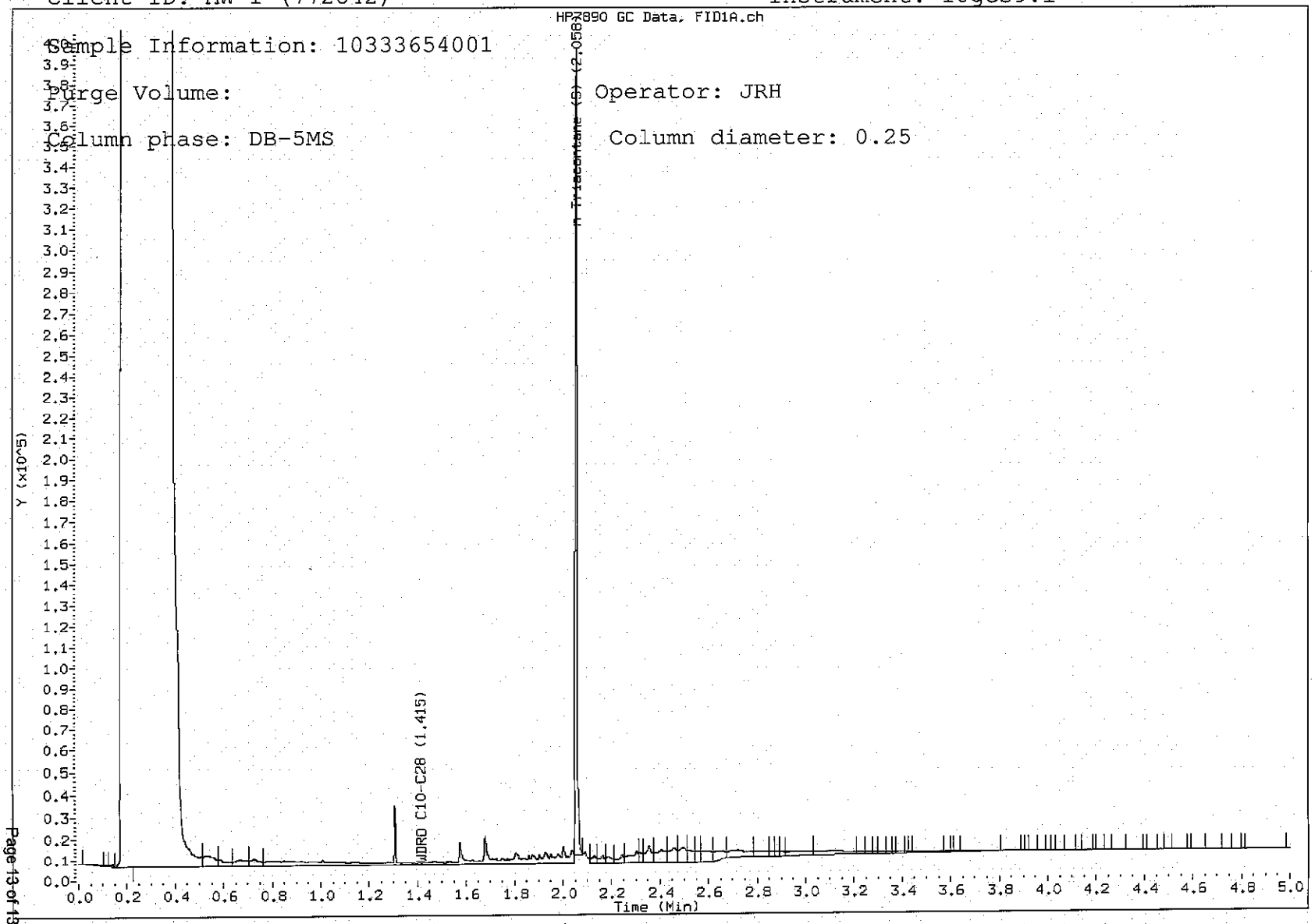
Sample ID: 10333654001

Client ID: MW-1 (772842) Instrument: 10gcs9.i

Sample Information: 10333654001

Purge Volume: Operator: JRH

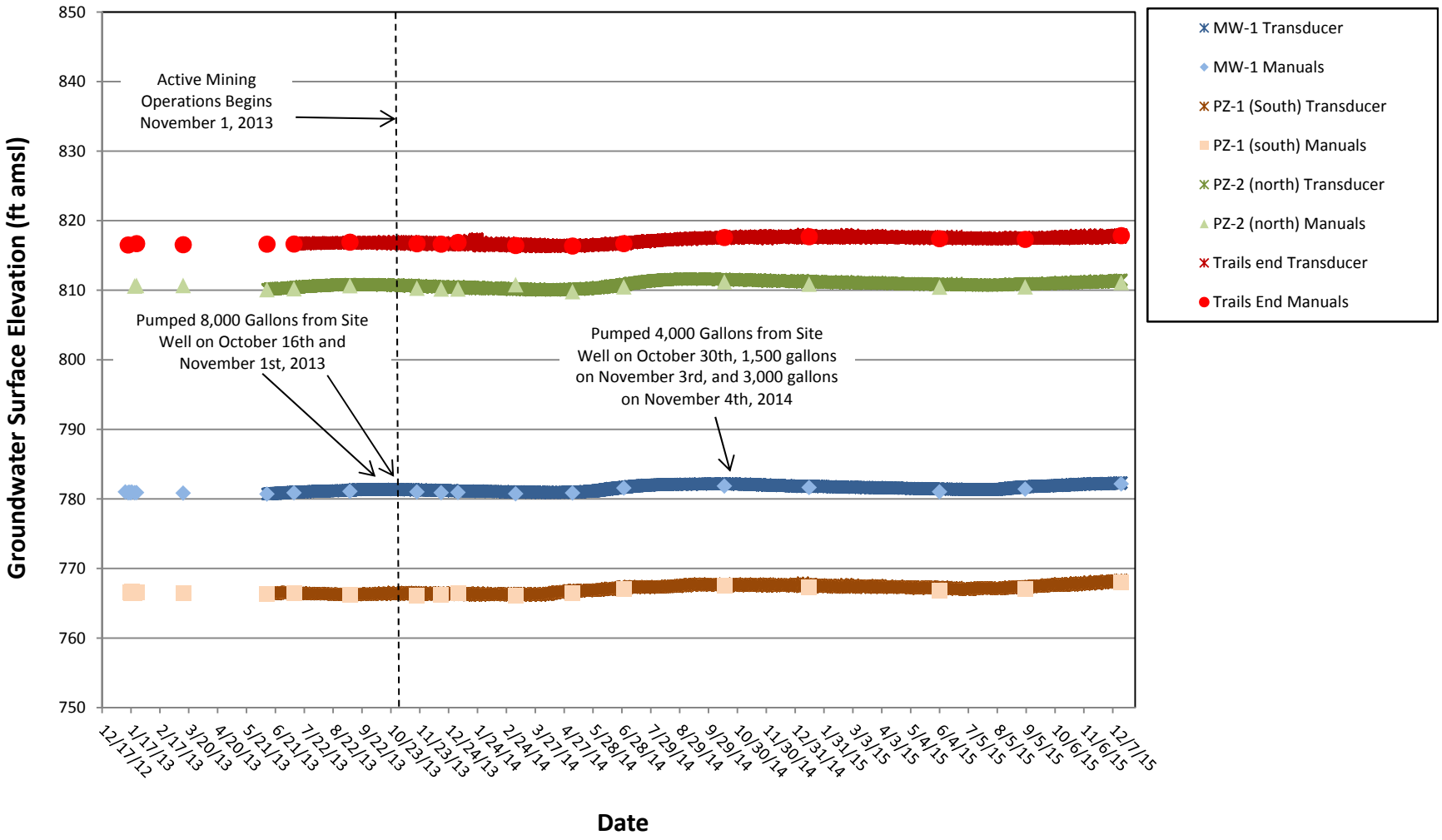
Column phase: DB-5MS Column diameter: 0.25



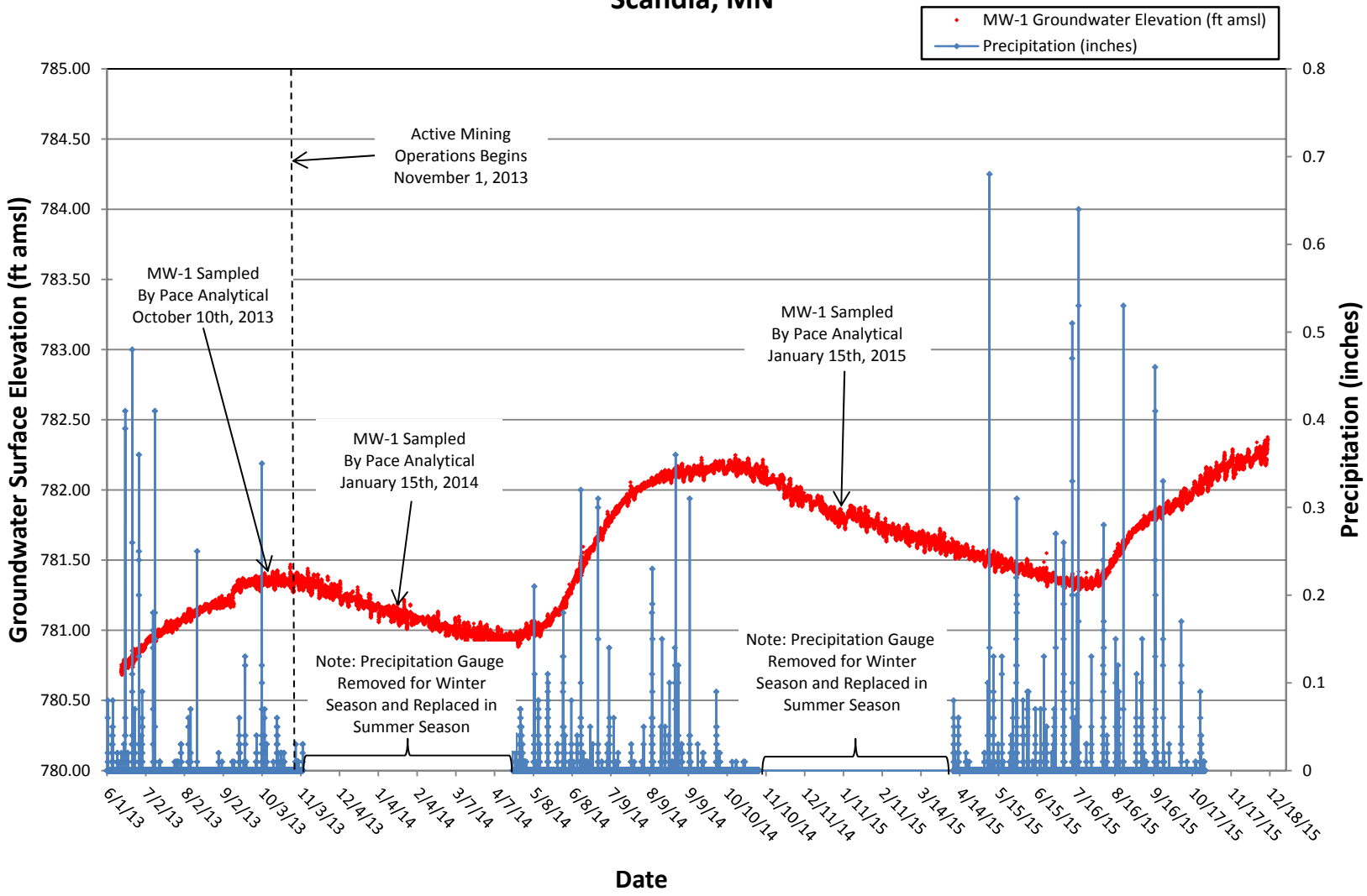
ATTACHMENT 2

WELL HYDROGRAPHS AND
WATER QUALITY INDICATOR PARAMETER DATA PLOTS

MW-1 Monitoring Well and PZ-1, PZ-2, and Trails End Observation Wells
Groundwater Surface Elevation vs. Time
Zavoral Aggregate Mining and Reclamation Project
Scandia, Minnesota



MW-1
Groundwater Surface Elevation and Precipitation vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

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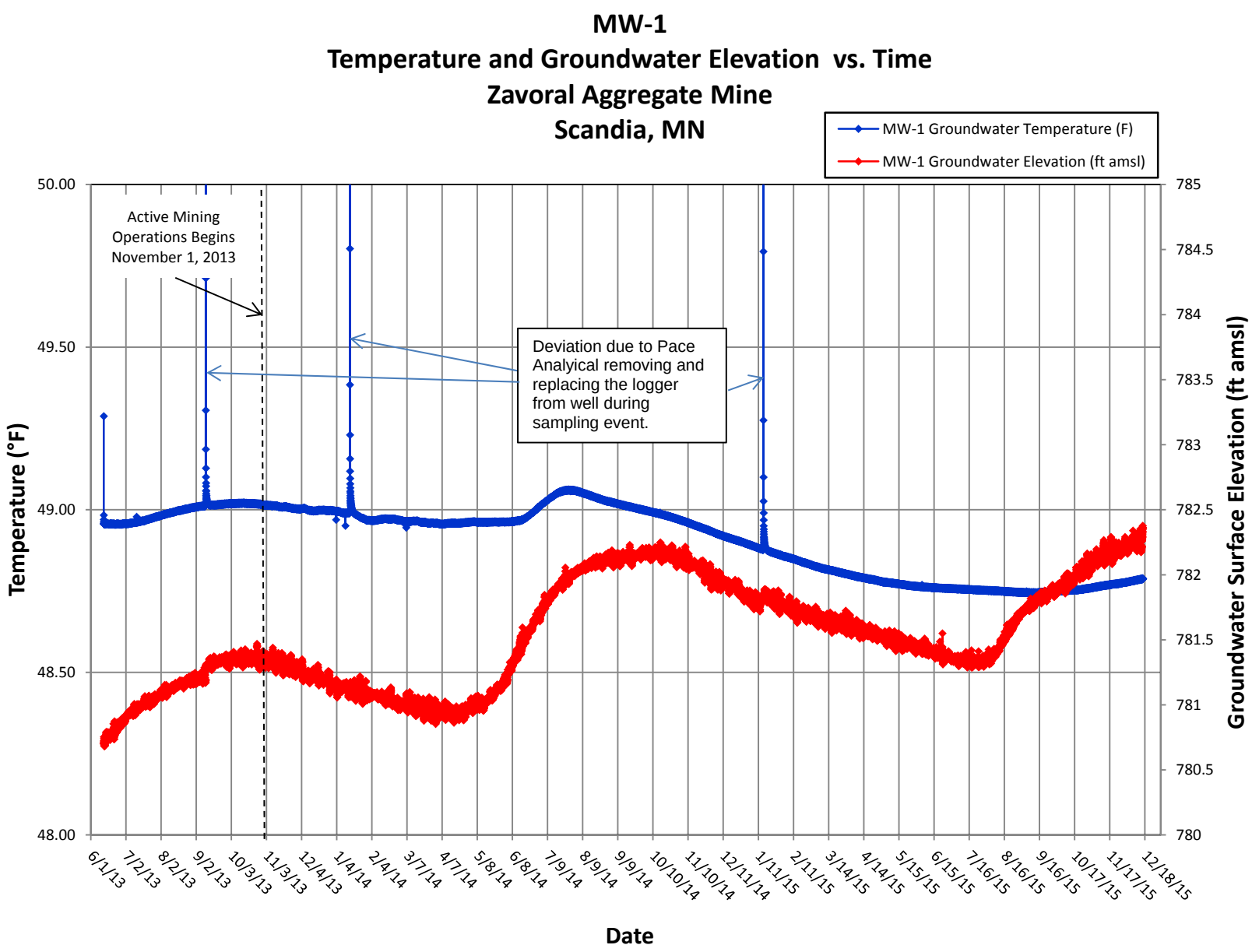
MW-1
Temperature and Groundwater Elevation vs. Time
Zavoral Aggregate Mine
Scandia, MN
MW-1 Groundwater Temperature (F)
MW-1 Groundwater Elevation (ft amsl)
Active Mining Operations Begins November 1, 2013
Deviation due to Pace Analyical removing and replacing the logger from well during sampling event.
Temperature (°F)
Groundwater Surface Elevation (ft amsl)
Date
50.00
49.50
49.00
48.50
48.00
785
784.5
784
783.5
783
782.5
782
781.5
781
780.5
780
6/1/13
7/2/13
8/2/13
9/2/13
10/3/13
11/3/13
12/4/13
1/4/14
2/4/14
3/7/14
4/7/14
5/8/14
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7/9/14
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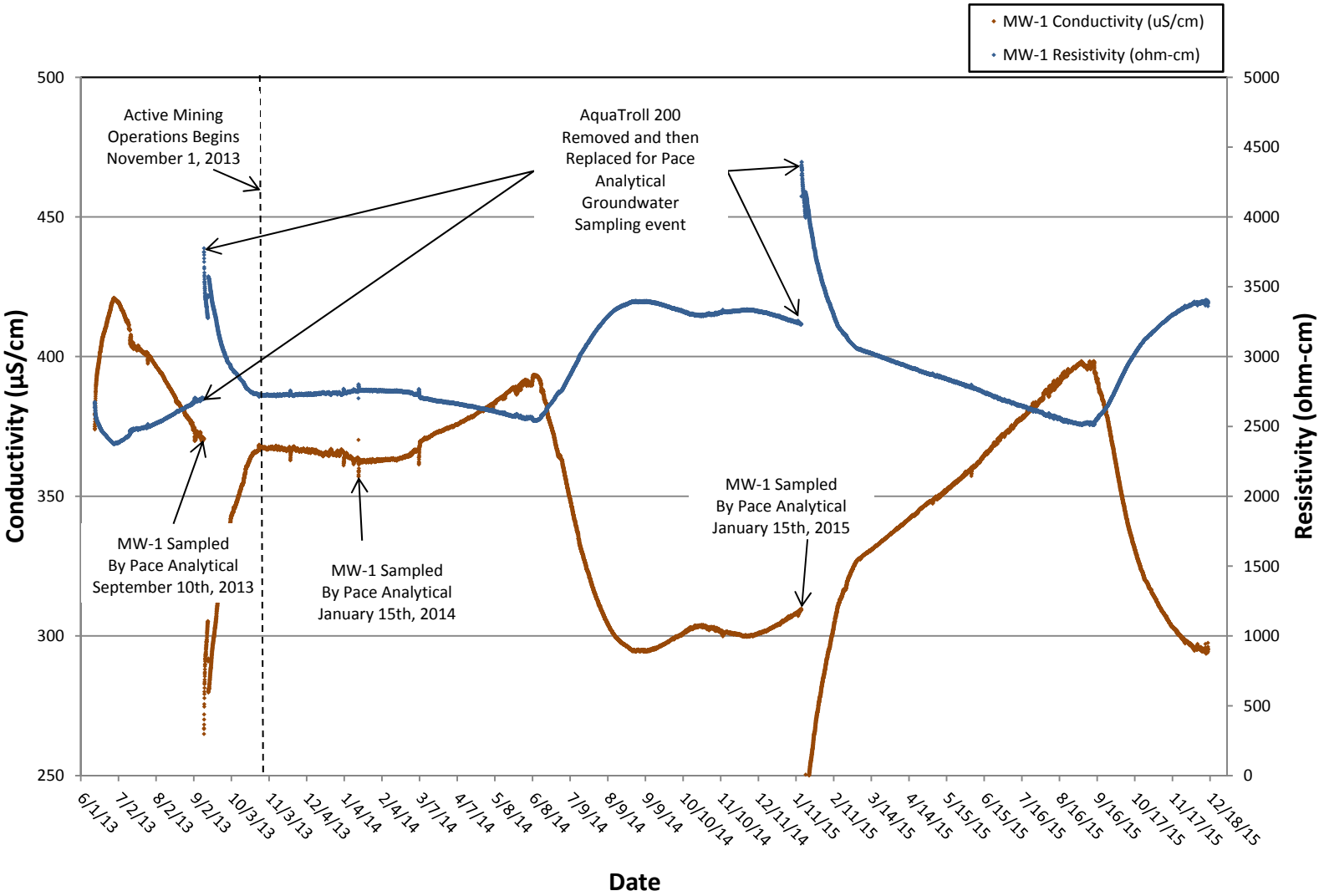
11/10/14
12/11/14
1/11/15
2/11/15
3/14/15
4/14/15
5/15/15
6/15/15
7/16/15
8/16/15
9/16/15
10/17/15
11/17/15
12/18/15

MW-1
Conductivity and Resistivity vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

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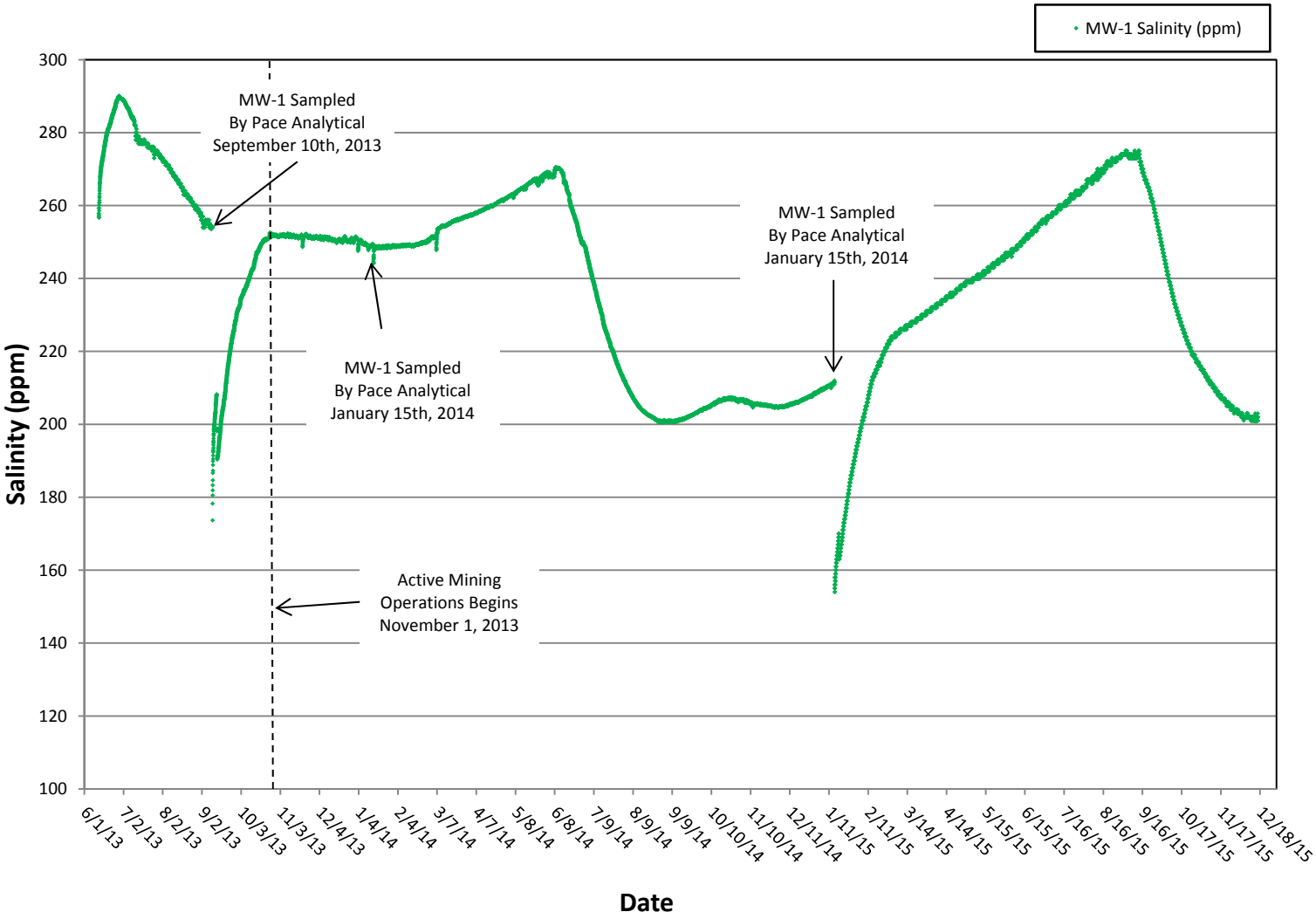
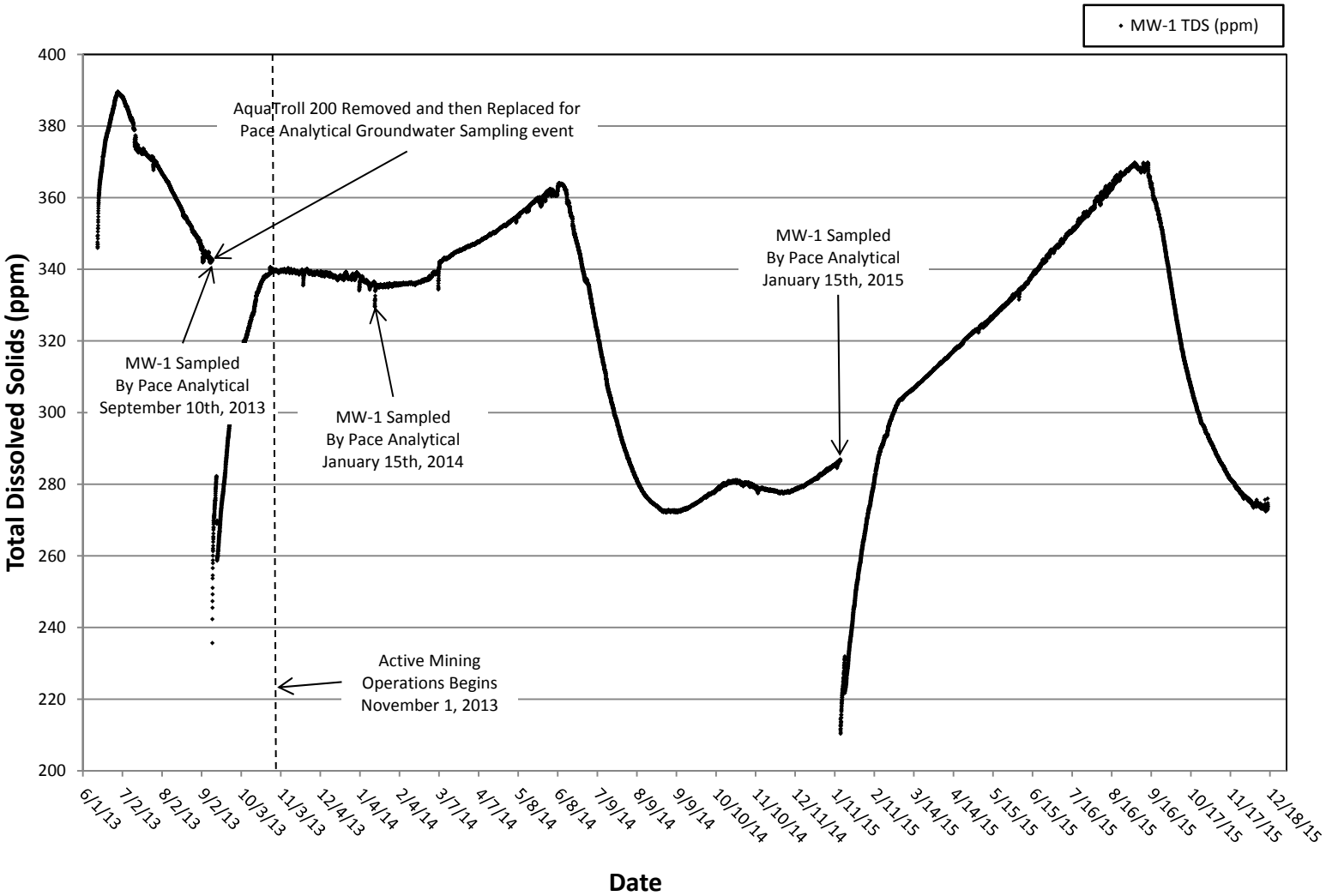
MW-1
Salinity vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



MW-1
Total Dissolved Solids vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

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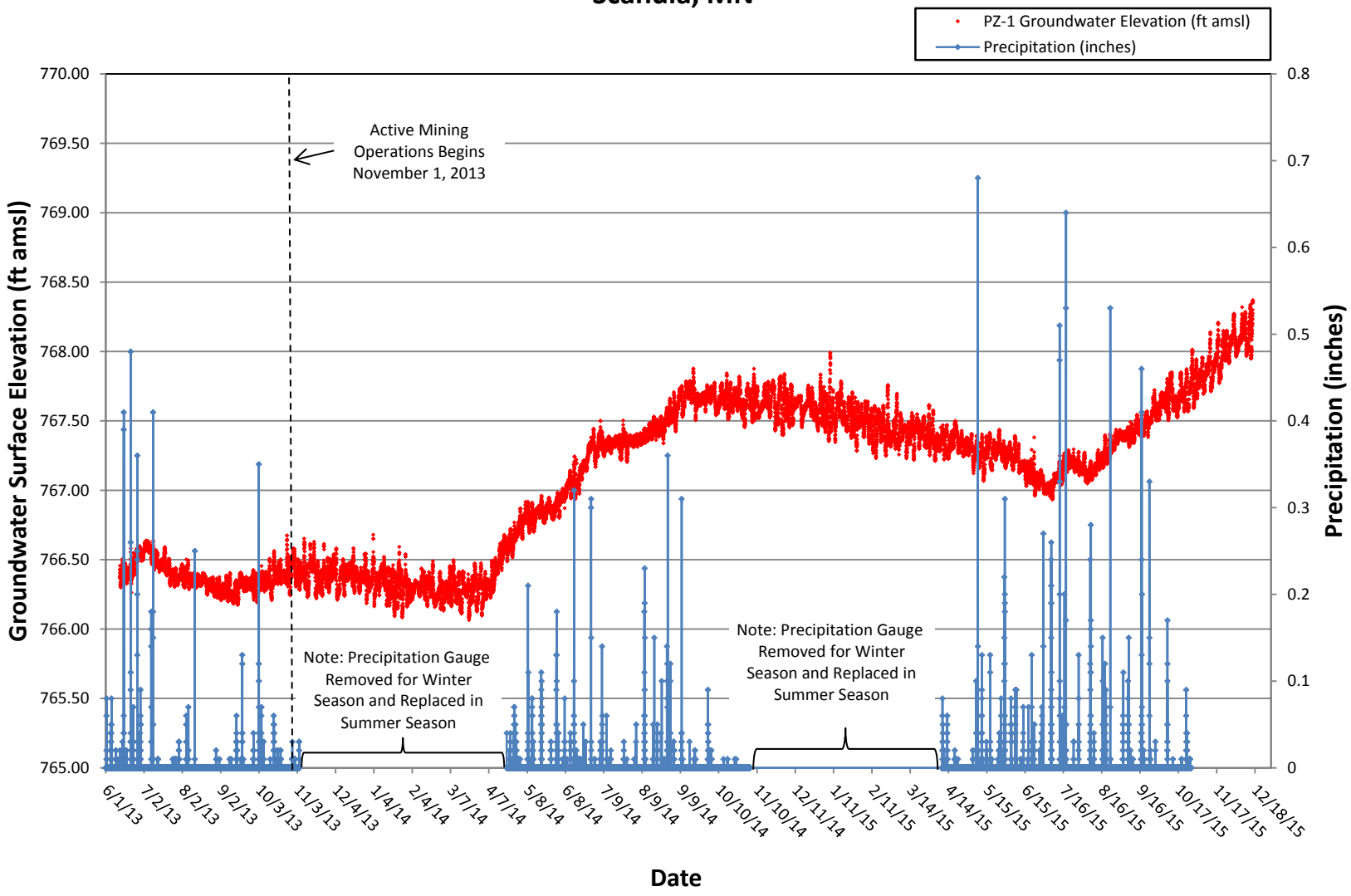
PZ-1
Groundwater Surface Elevation and Precipitation vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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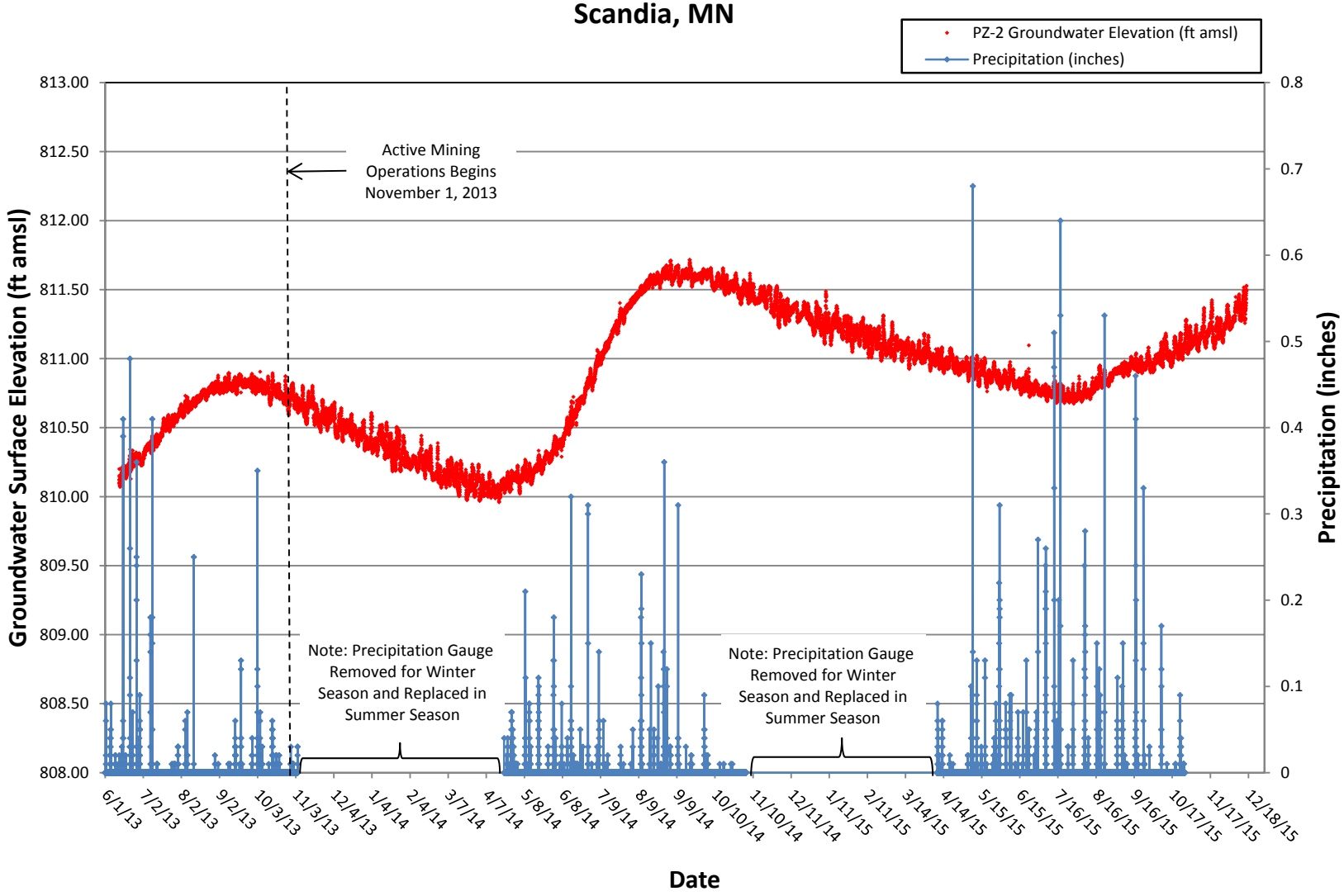
MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

LEGGETTE, BRASHEARS & GRAHAM, INC.

PZ-2
Groundwater Surface Elevation and Precipitation vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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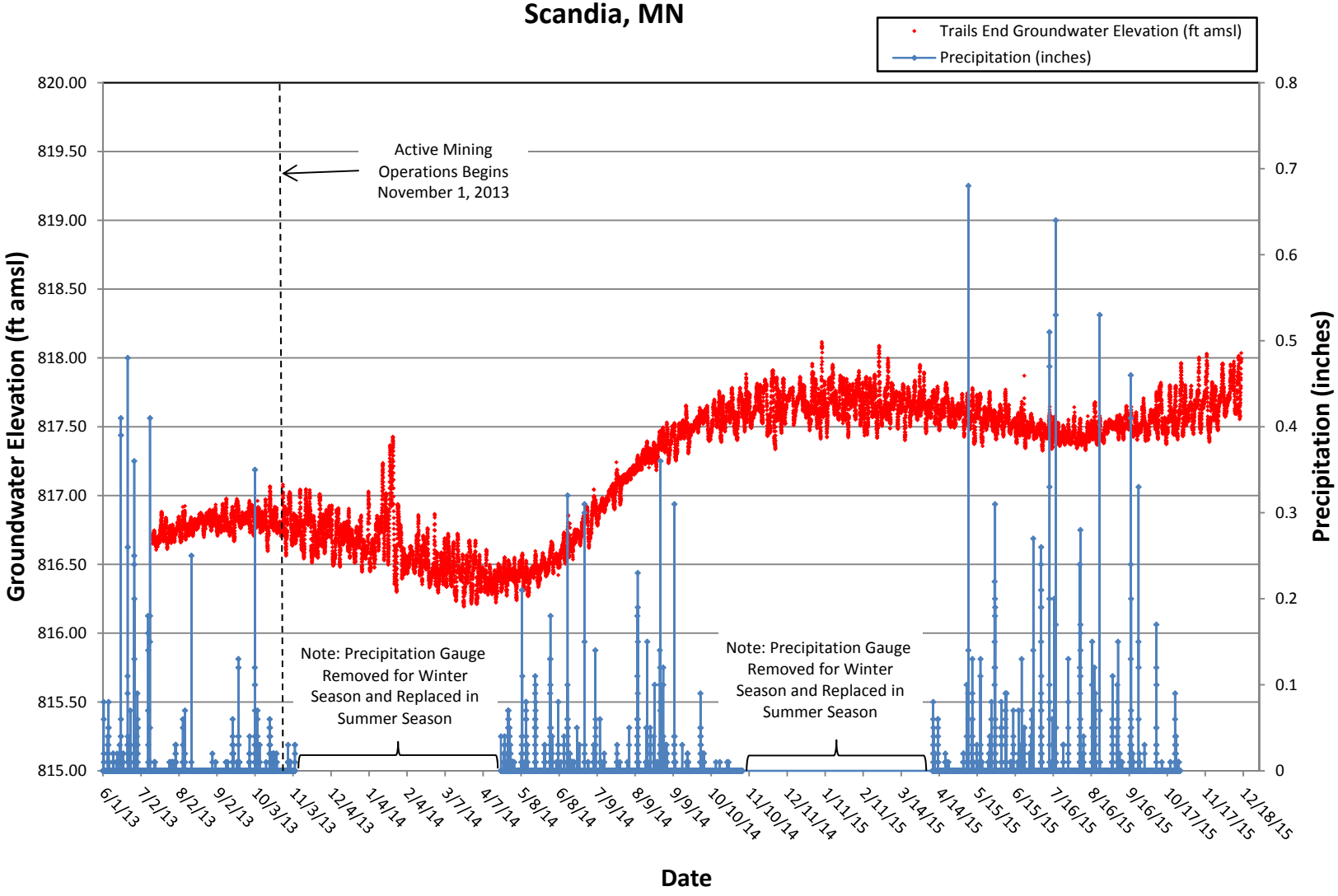
MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

LEGGETTE, BRASHEARS & GRAHAM, INC.

Trails End
Groundwater Surface Elevation and Precipitation vs. Time
Zavoral Mining and Reclamation Project
Scandia, MN



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MW-1, PZ-1, 2, Trails Groundwater Quality Parameters - Master

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