AECOM
9 Jonathan Bourne Drive
Pocasset, MA 02559
www.aecom.com

508.833.6950 tel
508.833.6951 fax

Memorandum

To	George Meservey, Director of Planning & Community Development
CC	Betsy Shreve, AICP, AECOM Project Director James Begley, LSP, MT Environmental AECOM PRB Team
Subject	**Town of Orleans, MA** **Water Quality and Wastewater Planning** **NT Demonstration Projects** **Task Number 14.1.B.2 – Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project** **March 2021 Groundwater Monitoring Quarterly Report**
Project Number	60476644
From	Thomas Parece, P.E., AECOM Project Manager
Date	May 18, 2021

1. Executive Summary

The Eldredge Parkway Demonstration Test Permeable Reactive Barrier (PRB) was installed at the parking lot area southwest of the Nauset Middle School in November 2016. Baseline groundwater monitoring was completed before the PRB installation. Groundwater monitoring since implementation has included sampling events in 2017 (January, March, June and September), 2018 (January, April and September), 2019 (January, April, July, and November), 2020 (February, May, August, and November), and 2021 (March). The results of the March 2021 groundwater monitoring event are presented in this memorandum.

This memorandum is the fifth to present new data since the PRB was modified by extending it to the north in June 2018. A portion of the area originally targeted for assessment of PRB performance to the north of the PRB installed in 2016 had been found to be outside of the area of influence of the PRB due a difference in groundwater flow direction in this northerly area. Consistent with the Adaptive Management Approach, a modification of the Demonstrations Test PRB was implemented. This modification included extending the PRB treatment line to the north to intercept and treat nitrate in groundwater along this untreated flow path.

Clear trends have developed that provide for interpretation of PRB performance to date. Based on multiple lines of evidence including 1) observed groundwater flow direction, 2) dissolved organic carbon concentrations (DOC) in groundwater derived from the injected PRB emulsified vegetable oil (EVO) substrate, 3) reductions in nitrate concentration, and 4) changes in redox conditions, the PRB is performing well and continuing to cut off the flux of nitrate to the area downgradient of the PRB. Monitoring wells immediately downgradient of the PRB extension line indicate near complete removal of nitrate in groundwater, reduced redox conditions, and observed initial increases in DOC concentrations, evidence consistent with effective PRB nitrate treatment.

2. Background

This purpose of this technical memorandum is to provide an update of quarterly groundwater monitoring results as part of the Eldredge Parkway Permeable Reactive Barrier demonstration program. In addition to presenting baseline and quarterly groundwater monitoring data, this memorandum also summarizes PRB construction with emulsified vegetable oil (EVO) substrate injections for the Eldredge Park demonstration test site. AECOM Technical Services, Inc. (AECOM) PRB Technical Team (AECOM and MT Environmental Restoration) prepared this technical memorandum for the Town of Orleans. AECOM is providing water quality and wastewater planning and engineering services to the Town to reduce excessive nitrogen loading to the Town's ponds, estuaries and embayments.

3. Introduction

A. The full Project represents the first to implement a "Hybrid" approach under the Cape Cod 208 Water Quality Plan, which has been approved by both the United States Environmental Protection Agency (USEPA) and the Massachusetts Department of Environmental Protection (MassDEP). The Project goal is to reduce the nitrate load to impacted estuaries in the most cost-effective manner by maximizing the use of several non-traditional technologies (Coastal Habitat Restoration, Aquaculture, and Permeable Reactive Barriers) in combination with limited centralized wastewater treatment.

B. PRBs are a non-traditional treatment technology with the potential to reduce the levels of nitrate in the groundwater by treating groundwater biologically before it reaches sensitive surface water bodies such as estuaries.

C. The results of the demonstration will be incorporated into an overall Adaptive Management Plan which will be implemented to evaluate the impacts of the selected technologies to reduce nitrogen loading to surface water. AECOM will continue to work closely with the Town and the regulatory agencies including the Cape Cod Commission (CCC) and MassDEP, in implementing the Adaptive Management Plan as it is critical to obtaining one of the first watershed permits granted by MassDEP.

D. The PRB Demonstration Test aims to provide data to assess the cost effectiveness and applicability of PRBs as a treatment alternative for the Town. It is expected that the test will demonstrate the level of nitrate removal that can be achieved with PRBs and provide data to prepare a full-scale design. The Demonstration Tests will be evaluated by the following performance objectives:

1) Achieve satisfactory distribution of the EVO substrate into the subsurface soils;

2) Establish and maintain necessary dissolved organic carbon concentrations and anaerobic (reducing) conditions in the groundwater while maintaining groundwater flow throughout the targeted treatment area;

3) Demonstrate reduced nitrate concentrations and the mass of nitrate transported in groundwater (nitrate flux) through groundwater monitoring;

4) Evaluate performance through compliance monitoring and assessment of treated water quality, including potential secondary water quality affects, through a groundwater monitoring program;

5) Evaluate the life expectancy of the EVO and time frame for technology performance;

6) Evaluate potential impacts to sensitive receptors (surface water, private wells, etc.); and

7) Obtain data for engineering evaluations and to optimize full scale design and implementation to meet nitrate reduction targets.

4. Demonstration Test Location

A. The Eldredge Parkway Demonstration Test site is located in the parking lot area between the Nauset Middle School playing fields and the Town-owned Eldredge Park baseball field. The demonstration site is owned by Nauset Public Schools. The Nauset Regional School Committee granted permission to install monitoring wells and conduct the PRB Demonstration Test at this location. Town Cove is located approximately 2,400 feet to the northeast of the PRB Demonstration Test site. Groundwater in this area generally flows in a northeasterly direction, toward Town Cove (Figure 1). Localized variation in groundwater flow direction has been observed at the Demonstration Test site with flow to the northeast and flow to the east southeast.

B. Existing groundwater monitoring wells were identified at the Nauset Regional Middle School (NRMS) in the recreational field and parking lot area providing background groundwater quality data. These wells were installed in 1992 as part of an ongoing program to monitor groundwater in the vicinity of the NRMS wastewater treatment facility's leaching fields. An irrigation well for Eldredge Park was also identified near the corner of Eldredge Park and South Orleans Road with an available boring log and groundwater quality data.

5. Demonstration Test Overview

A. PRB Treatment Process Description

1) PRBs are a passive treatment technology, designed in this application to intercept and treat nitrate in groundwater through biological denitrification before groundwater reaches downgradient surface waters. The PRB treatment zone is located in the groundwater saturated zone below the water table, where amendments are injected along a line to form the PRB. PRBs are typically oriented perpendicular to the direction of groundwater flow and rely on the natural groundwater gradient to carry the contaminant through the PRB (ITRC, 2011). The system is permeable because the amendments added are designed not to interfere with groundwater flow.

2) The PRB in-situ (in place in the ground) treatment method typically introduces a carbon food substrate into the aquifer, allowing naturally occurring microbes in the aquifer to consume the carbon substrate while respiring oxygen and creating anoxic conditions (without oxygen) favorable for denitrifying bacteria. Under anoxic or anaerobic conditions, maximum energy is gained by microbes using nitrate as an electron acceptor (denitrification reaction). Nitrate is the preferred electron acceptor to soil microbes after dissolved oxygen in the groundwater is consumed. This process of bacterial metabolism results in the conversion of nitrate to inert nitrogen gas and requires both anoxic conditions and sufficient food substrate for bacterial growth.

Denitrification: $NO_3^- \rightarrow NO_2^- \rightarrow NO + N_2O \rightarrow N_{2\,(g)}$

B. Demonstration Test Layout

The initial PRB Demonstration test line (November 2016) was oriented northwest to southeast (perpendicular) to the northeasterly regional groundwater flow direction and was approximately 110 feet long. Future full-scale PRBs or sections or PRBs are anticipated to be longer (500 to 3,000 feet, depending on the location). Demonstration Test locations are shorter in length, selected to assess construction/implementation, and allow intensive monitoring of groundwater conditions in the vicinity of the PRB. A 30-foot vertical treatment interval was selected extending down from near the top of the groundwater table into saturated soils for the initial Demonstration Test PRB line. Additional injection details are included in Table 5-1.

Table 5-1 - Summary of Design Parameters for Permeable Reactive Barrier Demonstration Test

Parameter	November 2016 Demonstration	June 2018 Extension
Area Description	Parking lot between the playing fields at Eldredge Park	Eldredge Park edge of soccer field by the parking lot
Depth to Ground Water	Approximately 30 to 34 feet below grade	Approximately 30 to 34 feet below grade
Demonstration Test PRB Length	110 feet	110 feet
Injection Interval	38 to 68 feet below grade	32 to 70 feet below grade
Injection Point Spacing	10 feet	10-foot 2-row grid (5-6 foot plus radius of influence)
Injection Points	17	20
Injection Pore Volume	12 percent (assumed effective porosity of 25 percent)	12 percent (assumed effective porosity of 25 percent)
Total Injection Volume (gal)	10,800	14,800
Injection Volume Per Point (gal)	600 (Three points received 720, 820, 860 gal in order to use the remainder of the EVO.)	~750
Injection Flow Rate (gpm)		~4.62
EVO Dilution	15.5 percent	14.2 percent
Total 60% EVO (gal)	2,620	3,696
Total Lactate (gal)	0	225

The PRB Demonstration Test extension line installed in June 2018 was oriented to intercept flow coming more from the west in the area north of the existing PRB, and then flowing through part of the existing field of groundwater monitoring wells. The PRB extension included injection of emulsified vegetable oil (EVO) along a line approximately 110 feet long with 20 injection points in the grass area adjacent to the Middle School parking lot as shown on Figure 1. The south end of the injection line overlapped the previous PRB injection line, oriented northwest to southeast, installed in November 2016. The new injection points were oriented roughly south to north in two parallel offset rows. A 38-foot vertical treatment injection interval was selected extending down from near the water table in saturated soils for the PRB extension. The completed PRB line including the extension intercepts groundwater flow along a line approximately 200 feet in length, formed in a wide-angle V pattern to intercept groundwater flow from both the southwest and northwest. A Technical Memorandum with PRB extension construction details was completed in December 2018 (AECOM, December 2018).

C. Reactive Amendment Application Method

PRBs have been designed and implemented through several construction methods. During this demonstration test, direct-push methods were used place the EVO substrate in the subsurface. Direct–push injection is a method of soil boring modified with a down-hole injection screen and tubing used for placement of organic carbon electron donor EVO substrate. The direct-push injections are temporary injection points that are sealed following injection.

D. PRB Demonstration Test Substrate and System Details

An EVO solution with a larger droplet size was used during both injection events and was selected so that the EVO droplets will adhere to sand grains in the formation to minimize the advection, or distribution, of EVO after injection. EVO adheres to the sandy aquifer material in the treatment zone and provides a slow release of soluble organic carbon compounds that are distributed by advection, dispersion, and diffusion in groundwater. A larger droplet size also maximizes the persistence of the carbon substrate within the PRB. Terra System's 60 percent Large Droplet Slow Release EVO for Nitrate Reduction (SRS-NR) was used. The SRS NR is a modified formulation developed so that the emulsion is "stickier" to further reduce migration after injection and increase persistence. Sodium lactate was also added to the injection solution for the extension to supply additional quick release carbon substrate to jumpstart treatment. During both injection events, sodium bicarbonate was added as a pH buffer with the EVO to establish more favorable pH conditions for denitrifying bacteria. The 60 percent EVO solution was delivered to the site and additives were mixed with water making an approximately 15 and 14 percent EVO solution for injection in the November 2016 and June 2018 respectively. Representative PRB design parameters are summarized below:

PRB installation methodology and field injection activities are summarized in two installation reports (AECOM, March 2017 and AECOM, December 2018).

6. Permitting

The EPA Underground Injection Control (UIC) Program is responsible for regulating the construction, operation, permitting, and closure of injection wells that place fluids underground for storage and disposal. The UIC Program requirements were developed by EPA and designed to be adopted by states. The Massachusetts Department of Environmental Protection (MassDEP) UIC Program is defined in 310 CMR 27.00: Underground Injection Control Regulations and details the regulation of injection of fluids within Massachusetts.

To implement the Demonstration Test with the initial injection in November 2016, a UIC permit application (MassDEP form BRPWS 06) was filed with MassDEP under the category "Aquifer Remediation." Similar injections of carbon substrates to enhance biodegradation of chemicals in groundwater have been commonly implemented in Massachusetts. Many of these sites are exempt from the UIC registration process if the injections are conducted for waste site cleanup in accordance with the Massachusetts Contingency Plan (MCP, 310 CMR 40.0000) or similar federal statutes. In implementing the Demonstration Test all injections associated with the PRB complied with the requirements of the Massachusetts UIC regulations and the MCP requirements, including all required monitoring. MassDEP issued UIC Registration ID#MAS41A224209-5B6 for the Demonstration Test in September 2016. Plans for the extension were provided to the MassDEP and MassDEP approved the PRB extension injection event under the existing UIC registration #MAS41A224209-5B6 in April 2018.

7. PRB Demonstration Test Performance Monitoring

A. General

Performance monitoring of the PRB Demonstration Test is being implemented to assess nitrate reduction, concentrations of biogeochemical indicators, and the distribution of the injected reagents. The monitoring program is designed to be dynamic and modified to respond to observations, adjusting the monitoring as necessary.

Groundwater samples are collected from selected monitoring wells in the Demonstration Test area. The monitoring well network includes multi-level monitoring wells and single monitoring wells upgradient and downgradient of the PRB within the regional flow system. These wells were originally aligned in two transects oriented from southwest to northeast with additional monitoring wells located cross gradient in the vicinity of the PRB and more regional monitoring wells around the PRB area. Additional monitoring wells have been installed to evaluate placement of the PRB extension and now form a third monitoring transect oriented northwest to southeast. The monitoring network plan view is presented on Figure 1 and PRB monitoring well transects are shown on Figure 2. Cross sections Transect 1 A-A', Transect 2 (B-B', and Transect 3 (C-C' are shown with nitrate data on Figure 3,

Figure 4, and Figure 5, respectively. Transect 3 Cross section C-C' will help assess performance of the PRB extension implemented in June 2018. The monitoring wells upgradient and downgradient of the PRB are used to evaluate changes to nitrate concentrations and groundwater quality based on PRB performance. Monitoring wells downgradient of the PRB are located at selected distances from the PRB along the transects to assess distance of emulsion travel, extent of reducing conditions for denitrification, and the potential for metals mobilization. The wells are also used for collection of groundwater elevation data for monitoring groundwater flow.

B. Sampling Method, Frequency, and Analyses

Groundwater samples are collected using a submersible pump. Groundwater quality parameters measured in the field include pH, oxidation reduction potential (ORP), dissolved oxygen (DO), specific conductivity, temperature, and turbidity. Field parameters are monitored with the use of a multi-parameter probe in a flow-through cell. Samples are collected after field water quality parameters stabilize.

Groundwater samples were collected prior to EVO injection to provide a comparative baseline to evaluate performance of the Demonstration Test. Baseline groundwater samples were analyzed to determine pre-treatment concentrations of nitrate and other indicator parameters. Concentration change in the treatment area relative to concentrations at upgradient monitoring wells is indicative of the impact of the PRB. Several synoptic water level monitoring events were conducted prior to the start of injections to assess the groundwater flow direction and gradient. Monitoring well construction details are provided in Table 1 and elevation data is included in Table 2.

The first post-injection sampling event following the initial PRB injection was a stand-alone sampling event approximately 7 weeks after the injections with samples collected on January 5, 2017 and January 10, 2017. Following first post injection sampling, groundwater sampling is being performed quarterly for a projected period of three years. Primary objectives of the post-injection sampling are to:

1) Assess potential reduction in nitrate concentrations in groundwater compared to baseline samples and/or wells upgradient of the PRB;
2) Identify distance traveled by EVO emulsion and DOC;
3) Identify extent of generated reducing conditions;
4) Evaluate potential for reduction in aquifer permeability as a result of EVO application;
5) Evaluate persistence of EVO emulsion and anaerobic conditions favorable for denitrifying bacteria after PRB injection; and
6) Assess changes in groundwater monitoring parameters as a result of the PRB.

As a result of the generation of reducing conditions in groundwater, temporary mobilization of some metals native to the aquifer material may result. Table 7-1 presents an overview of the Demonstration Test performance monitoring analyses and relevance to the PRB Demonstration Test. The monitoring program was designed to be dynamic and continuously evaluated to adjust the selected monitoring parameters and frequency of monitoring based on data collected and observations.

Table 7-1 - Summary of Potential Analyses for Groundwater Performance Evaluation

Parameter	Relevance to PRB Demonstration Test
Nitrate	Primary groundwater compound targeted for treatment.
Nitrite	Intermediate nitrogen species from the aerobic nitrification of ammonia to nitrate.
Ammonia	Reduced inorganic nitrogen species that occurs in proximity of septic system leach fields and landfills.
TKN	Total Kjeldahl Nitrogen (TKN) is the total concentration of organic nitrogen and ammonia.
Total Nitrogen	Analyses provide a summation of all organic and inorganic nitrogen species in groundwater as a result of leach fields and landfill.
Metals (Fe, Mn, As)	Mobility of metals can be impacted by groundwater geochemistry changes, notably pH and ORP.
DOC	Dissolved Organic Carbon (DOC) is the limiting factor in enhancing denitrification-and is increased by injection of EVO. DOC tracks the area of influence of the PRB.
Sulfate	Sulfate will decrease with generation of sufficiently anaerobic conditions favorable for sulfate-reducing bacteria.
pH	Denitrification optimal pH (6.0 and 8.5). Groundwater pH can decrease as a result of fermentation of injected carbon substrates.
ORP	Oxidation-reduction potential (ORP) will decrease with generation of reducing conditions following injection of carbon substrate.
Chloride	Chloride concentrations indicate potentially infiltrating stormwater.
Alkalinity	Denitrification reactions generate alkalinity (3.57 mg of $CaCO_3$ for each mg of nitrate reduced).
Boron	Boron is present in laundry detergents and is an indicator of groundwater flow emanating from leach fields.

8. PRB Demonstration Test Performance Monitoring Results to Date

1) Historical Data

A summary of baseline, post-injection, and prior quarterly sampling results is found in Appendix A.

2) Q-15 March 2021

The fifteenth post-injection quarterly sampling (Q-15) event occurred on March 2nd, 3rd, and 4th 2021, approximately 52 months) after the first injections (November 2016) and approximately 33 months after the extension injections (June 2018). During the March 2021 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and most monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Select monitoring wells were also analyzed for arsenic and/or methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field.

a) Assessment of Groundwater Flow Through the PRB March 2021

Groundwater elevations calculated from the March 2021 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). The NRMS is operating at reduced capacity due to the Covid-19 pandemic. Reduced wastewater flow recharging to the septic system as a result may account for the continued shift to more significant flow from the northwest to southeast. Groundwater flow remains mainly through the PRB toward downgradient monitoring wells. Historically the average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the March 2021 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L (or 0.21 mg/L) immediately downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

Charts 1 through 10 provide graphs of nitrate concentration, dissolved organic carbon substrate concentration, and ORP. These parameters provide three lines of evidence to track PRB performance. In general, the changes in geochemistry stimulated by the injection of carbon substrate results in anoxic conditions. Lower negative ORP readings indicate the anoxic conditions suitable for denitrification are stimulated. The DOC concentrations show the residual substate at monitoring wells downgradient of the PRB and nitrate concentrations indicate the extent of denitrification.

The monitoring wells used to assess groundwater conditions are located upgradient and downgradient of the PRB, and these data can be compared to track PRB function. The charts represent conditions at monitoring wells that are close to the PRB and at locations further downgradient. Groundwater at downgradient monitoring wells has traveled a longer distance over a longer time since passing through the PRB compared to closer downgradient monitoring wells. The more distant monitoring wells are also affected by local recharge of stormwater and periodic changes in groundwater flow direction. In addition, some of the monitoring well screens are in lower permeability fine sand with suspected lower groundwater flux, e.g., MW-B2020B. Nitrate has been retained in these areas over longer periods than at wells screened in more permeable material. Groundwater samples from lower permeability zones show a delayed response to PRB nitrate plume cutoff occurring upgradient. These data suggest reliance on monitoring well locations near the PRB to assess PRB performance may be most appropriate. The objective of the PRB is to cut off the migration of nitrate at the PRB. It can take significant time for the nitrate plume downgradient of the PRB to flush out of the area after cutoff and the downgradient area may be affected by other local sources of nitrate.

Secondary groundwater quality parameters associated with PRB nitrate treatment are also being monitored. Sample results indicate that the groundwater in the treatment zone is generally anaerobic under reducing condition close to the PRB; some mobilization of naturally occurring metals (iron, manganese, and arsenic) is expected and has been observed. These metals are expected to precipitate downgradient after only limited migration.

9. Summary, Schedule, and Coordination

The groundwater data collected in March 2021 indicates that the PRB treatment area as defined by increased DOC concentrations, decreased oxidation-reduction potential, and reduced nitrate concentrations has been expanded to the north with the installation of the PRB extension.

The current proposed plan includes collecting quarterly samples through Fall 2021 with the next quarterly monitoring event in June 2021. Periodic reporting will be conducted to share results and observations with the Town, regulatory agencies, and the public.

10. References

AECOM - Technical Memorandum Final for Preliminary Engineering Work Plan for Permeable Reactive Barriers. May 19, 2016.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Overview of Baseline Sampling, Injection Activities and Post-Injection Groundwater Monitoring – Final. March 1, 2017.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – January 2017 Groundwater Monitoring Quarterly Report – Final. March 2017.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – March 2017 Groundwater Monitoring Quarterly Report – Final. June 2017.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – June 2017 Groundwater Monitoring Quarterly Report – Final. February 2018.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – September 2017 Groundwater Monitoring Quarterly Report – Final. March 2018.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – January 2018 Groundwater Monitoring Quarterly Report – Final. May 2018.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – April 2018 Groundwater Monitoring Quarterly Report – Final. June 2018.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – PRB Extension – Final. December 2018.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – September 2018 Groundwater Monitoring Quarterly Report – Final, March 2019.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – January 2019 Groundwater Monitoring Quarterly Report – Final, July 2019.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – April 2019 Groundwater Monitoring Quarterly Report – Final, August 2019.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – July 2019 Groundwater Monitoring Quarterly Report – Final. October 2019.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – November 2019 Groundwater Monitoring Quarterly Report – Final. February 2020.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – February 2020 Groundwater Monitoring Quarterly Report – Final. April 2020.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – May 2020 Groundwater Monitoring Quarterly Report – Final. June 2020.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – August 2020 Groundwater Monitoring Quarterly Report – Final. October 2020.

AECOM - Technical Memorandum for Eldredge Park Permeable Reactive Barrier Demonstration Project – November 2020 Groundwater Monitoring Quarterly Report – Final. February 2021.Cape Cod Commission - Cape Code Regional Wastewater Management Plan Technology Assessment – Conventional Infrastructure, March 2013.

Cape Cod Commission - Cape Cod Area Wide Water Quality Management Plan Update, June 2015.

Interstate Technology & Regulatory Council (ITRC) - Permeable Reactive Barrier: Technology Update (PRB-5), November 2011.

Terra Systems - Personal communications with Michael Lee, PhD, 2016.

11. List of Appendices

Appendix A – Historical Monitoring Data

Appendix B – Monitoring Well Coordinates

Appendix C – Analytical Laboratory Reports

Tables

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Table 1 Orleans Monitoring Well Construction Details

Well ID	Surface Elevation (ft)	TOC Elevation (ft)	Total Well Depth (ft bgs)	Screen Beginning Depth (ft bgs)	Screen End Depth (ft bgs)	Top Screen Elevation (ft)	Bottom Screen Elevation (ft)	Mid-Screen Elevation (ft)	Screen Length (ft)	Inst. Date	Location
MW-12A	45.6	45.57	Table	70.0	80.0	-24.40	-34.40	-29.40	10.0	October 2016	Eldredge Park
MW-12B	45.6	45.58	65.0	55.0	65.0	-9.40	-19.40	-14.40	10.0	October 2016	Eldredge Park
MW-12C (Repaired)	45.6	45.36								April 2018	Eldredge Park
MW-BU1A	43.7	43.48	80.0	70.0	80.0	-26.30	-36.30	-31.30	10.0	September 2016	Eldredge Park
MW-BU1C	44.0	43.65	50.0	40.0	50.0	4.00	-6.00	-1.00	10.0	September 2016	Eldredge Park
MW-BU2A	45.1	44.56	80.0	70.0	80.0	-24.90	-34.90	-29.90	10.0	October 2016	Eldredge Park
MW-BU2B	45.1	44.70	65.0	55.0	65.0	-9.90	-19.90	-14.90	10.0	October 2016	Eldredge Park
MW-BU2C	45.1	44.68	50.0	40.0	50.0	5.10	-4.90	0.10	10.0	October 2016	Eldredge Park
MW-BC1C	42.5	42.50	50.0	40.0	50.0	2.50	-7.50	-2.50	10.0	September 2016	Eldredge Park
MW-BC2C	43.81	43.5	55.0	45.0	55.0	-1.48	-11.48	-6.48	10.0	October 2016	Eldredge Park
MW-B1010C	44.9	44.46	55.0	45.0	55.0	-0.10	-10.10	-5.10	10.0	October 2016	Eldredge Park
MW-B1020B	44.6	44.18	65.0	55.0	65.0	-10.40	-20.40	-15.40	10.0	October 2016	Eldredge Park
MW-B1020C	44.5	44.10	50.0	40.0	50.0	4.50	-5.50	-0.50	10.0	October 2016	Eldredge Park
MW-B1050A	43.9	43.42	80.0	70.0	80.0	-26.10	-36.10	-31.10	10.0	October 2016	Eldredge Park
MW-B1050B	43.9	43.54	65.0	55.0	65.0	-11.10	-21.10	-16.10	10.0	October 2016	Eldredge Park
MW-B1050C	44.9	43.55	50.0	40.0	50.0	4.90	-5.10	-0.10	10.0	October 2016	Eldredge Park
MW-B1075B	43.5	43.29	65.0	55.0	65.0	-11.50	-21.50	-16.50	10.0	October 2016	Eldredge Park
MW-B2010C	45.0	44.70	55.0	45.0	55.0	0.00	-10.00	-5.00	10.0	October 2016	Eldredge Park
MW-B2020B	44.9	44.50	65.0	55.0	65.0	-10.10	-20.10	-15.10	10.0	October 2016	Eldredge Park
MW-B2020C	44.8	44.45	50.0	40.0	50.0	4.80	-5.20	-0.20	10.0	October 2016	Eldredge Park
MW-B2050A	44.6	44.06	80.0	70.0	80.0	-25.40	-35.40	-30.40	10.0	October 2016	Eldredge Park
MW-B2050B	44.6	44.28	65.0	55.0	65.0	-10.40	-20.40	-15.40	10.0	October 2016	Eldredge Park
MW-B2050C	44.6	44.17	50.0	40.0	50.0	4.60	-5.40	-0.40	10.0	October 2016	Eldredge Park
MW-B2075A	44.6	44.23	75.0	65.0	75.0	-20.40	-30.40	-25.40	10.0	March 2017	Eldredge Park
MW-B2100	44.6	44.23	45.0	35.0	45.0	9.60	-0.40	4.60	10.0	September 2016	Eldredge Park
MW-BC3	44.2	43.86	65.0	55.0	65.0	-10.80	-20.80	-15.80	10.0	March 2017	Eldredge Park
MW-BX1B	45.6	45.38	65.0	55.0	65.0	-9.40	-19.40	-14.40	10.0	March 2017	Eldredge Park
MW-BX1C	45.37	45.7	50.0	40.0	50.0	5.37	-4.63	0.37	10.0	March 2017	Eldredge Park
MW-1R	44.40	47.2	45.0	35.0	45.0	9.40	-0.60	4.40	10.0	April 2018	Eldredge Park
MW-BX2A	46.40	46.1	80.0	70.0	80.0	-23.60	-33.60	-28.60	10.0	April 2018	Eldredge Park
MW-BX2B	46.40	46.1	65.0	55.0	65.0	-8.60	-18.60	-13.60	10.0	April 2018	Eldredge Park
MW-BX2C	46.47	46.0	50.0	40.0	50.0	6.47	-3.53	1.47	10.0	April 2018	Eldredge Park
MW-BN1A	44.50	44.0	80.0	70.0	80.0	-25.50	-35.50	-30.50	10.0	April 2018	Eldredge Park
MW-BN1B	44.40	43.9	65.0	55.0	65.0	-10.60	-20.60	-15.60	10.0	April 2018	Eldredge Park
MW-BN1C	44.38	44.2	50.0	40.0	50.0	4.38	-5.63	-0.63	10.0	April 2018	Eldredge Park
MW-BN2C	45.21	44.9	45.0	35.0	45.0	10.21	0.21	5.21	10.0	April 2018	Eldredge Park

Table 1 Orleans Monitoring Well Construction Details

Well ID	Surface Elevation (ft)	TOC Elevation (ft)	Total Well Depth (ft bgs)	Screen Beginning Depth (ft bgs)	Screen End Depth (ft bgs)	Top Screen Elevation (ft)	Bottom Screen Elevation (ft)	Mid-Screen Elevation (ft)	Screen Length (ft)	Inst. Date	Location
MW-BM050A	44.68	44.3	80.0	70.0	80.0	-25.32	-35.32	-30.32	10.0	April 2018	Eldredge Park
MW-BM050B	44.80	44.4	65.0	55.0	65.0	-10.20	-20.20	-15.20	10.0	April 2018	Eldredge Park
MW-BM050C	44.80	44.4	50.0	40.0	50.0	4.80	-5.20	-0.20	10.0	April 2018	Eldredge Park
MW-BC4A	43.50	43.0	80.0	70.0	80.0	-26.50	-36.50	-31.50	10.0	April 2018	Eldredge Park
MW-BC4B	43.50	43.1	65.0	55.0	65.0	-11.50	-21.50	-16.50	10.0	April 2018	Eldredge Park
MW-BC4C	43.50	43.2	50.0	40.0	50.0	3.50	-6.50	-1.50	10.0	April 2018	Eldredge Park

Notes:

N/A = Not Available

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-1	Eldredge Park	11/3/2016	41.31	30.10	11.21
MW-1	Eldredge Park	11/14/2016	41.31	30.20	11.11
MW-1	Eldredge Park	1/18/2017	41.31	30.43	10.88
MW-1	Eldredge Park	1/27/2017	41.31	30.25	11.06
MW-1	Eldredge Park	2/24/2017	41.31	29.50	11.81
MW-1	Eldredge Park	4/25/2017	41.31	28.17	13.14
MW-1	Eldredge Park	6/29/2017	41.31	28.37	12.94
MW-1	Eldredge Park	9/13/2017	41.31	N/A	N/A
MW-1	Eldredge Park	1/10/2018	41.31	28.15	13.16
MW-1	Eldredge Park	4/18/2018	41.31	N/A	N/A
MW-1	Eldredge Park	9/20/2018	41.31	28.65	12.66
MW-11	Eldredge Park	11/3/2016	45.14	34.20	10.94
MW-11	Eldredge Park	11/14/2016	45.14	34.20	10.94
MW-11	Eldredge Park	1/18/2017	45.14	34.42	10.72
MW-11	Eldredge Park	1/27/2017	45.14	33.31	11.83
MW-11	Eldredge Park	2/24/2017	45.14	33.87	11.27
MW-11	Eldredge Park	4/25/2017	45.14	32.84	12.30
MW-11	Eldredge Park	6/29/2017	45.14	32.82	12.32
MW-11	Eldredge Park	9/13/2017	45.14	N/A	N/A
MW-11	Eldredge Park	1/10/2018	45.14	32.89	12.25
MW-11	Eldredge Park	4/19/2018	45.14	30.30	14.84
MW-11	Eldredge Park	9/20/2018	45.14	33.95	11.19
MW-11S	Eldredge Park	11/3/2016	45.25	34.15	11.10
MW-11S	Eldredge Park	11/14/2016	45.25	34.25	11.00
MW-11S	Eldredge Park	1/18/2017	45.25	34.51	10.74
MW-11S	Eldredge Park	1/27/2017	45.25	34.36	10.89
MW-11S	Eldredge Park	2/24/2017	45.25	33.93	11.32
MW-11S	Eldredge Park	4/25/2017	45.25	32.92	12.33
MW-11S	Eldredge Park	6/29/2017	45.25	32.90	12.35
MW-11S	Eldredge Park	9/13/2017	45.25	32.95	12.30
MW-11S	Eldredge Park	1/10/2018	45.25	32.97	12.28
MW-11S	Eldredge Park	4/19/2018	45.25	30.39	14.86
MW-11S	Eldredge Park	9/20/2018	45.25	33.00	12.25
MW-12A	Eldredge Park	11/3/2016	45.57	34.40	11.17
MW-12A	Eldredge Park	11/14/2016	45.57	35.01	10.56
MW-12A	Eldredge Park	1/18/2017	45.57	34.71	10.86
MW-12A	Eldredge Park	1/27/2017	45.57	34.57	11.00
MW-12A	Eldredge Park	2/23/2017	45.57	34.16	11.41
MW-12A	Eldredge Park	4/25/2017	45.57	33.85	11.72
MW-12A	Eldredge Park	6/29/2017	45.57	33.17	12.40
MW-12A	Eldredge Park	9/12/2017	45.57	33.17	12.40
MW-12A	Eldredge Park	1/8/2018	45.57	33.19	12.38
MW-12A	Eldredge Park	4/18/2018	45.57	30.77	14.80
MW-12A	Eldredge Park	9/19/2018	45.57	33.29	12.28
MW-12A	Eldredge Park	1/3/2019	45.57	32.36	13.21
MW-12A	Eldredge Park	4/9/2019	45.57	31.62	13.95
MW-12A	Eldredge Park	7/24/2019	45.57	32.27	13.30
MW-12A	Eldredge Park	11/5/2019	45.57	33.58	11.99
MW-12A	Eldredge Park	2/19/2020	45.57	32.45	13.12
MW-12A	Eldredge Park	5/13/2020	45.57	31.88	13.69
MW-12A	Eldredge Park	8/12/2020	45.57	33.53	12.04
MW-12A	Eldredge Park	11/17/2020	45.57	34.84	10.73
MW-12A	Eldredge Park	3/3/2021	45.57	34.09	11.48

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-12B	Eldredge Park	11/3/2016	45.58	34.50	11.08
MW-12B	Eldredge Park	11/14/2016	45.58	34.90	10.68
MW-12B	Eldredge Park	1/18/2017	45.58	34.79	10.79
MW-12B	Eldredge Park	1/27/2017	45.58	34.64	10.94
MW-12B	Eldredge Park	2/23/2017	45.58	34.24	11.34
MW-12B	Eldredge Park	4/25/2017	45.58	33.70	11.88
MW-12B	Eldredge Park	6/29/2017	45.58	33.21	12.37
MW-12B	Eldredge Park	9/12/2017	45.58	33.12	12.46
MW-12B	Eldredge Park	1/8/2018	45.58	33.30	12.28
MW-12B	Eldredge Park	4/18/2018	45.58	30.80	14.78
MW-12B	Eldredge Park	9/19/2018	45.58	33.35	12.23
MW-12B	Eldredge Park	1/3/2019	45.58	32.35	13.23
MW-12B	Eldredge Park	4/9/2019	45.58	31.66	13.92
MW-12B	Eldredge Park	7/24/2019	45.58	32.36	13.22
MW-12B	Eldredge Park	11/5/2019	45.58	33.71	11.87
MW-12B	Eldredge Park	2/19/2020	45.58	32.50	13.08
MW-12B	Eldredge Park	5/13/2020	45.58	31.91	13.67
MW-12B	Eldredge Park	8/12/2020	45.58	33.65	11.93
MW-12B	Eldredge Park	11/17/2020	45.58	34.90	10.68
MW-12B	Eldredge Park	3/3/2021	45.58	34.05	11.53
MW-12C (Existing)	Eldredge Park	11/3/2016	46.61	36.27	10.34
MW-12C (Existing)	Eldredge Park	11/14/2016	46.61	35.99	10.62
MW-12C (Existing)	Eldredge Park	1/18/2017	46.61	36.21	10.40
MW-12C (Existing)	Eldredge Park	1/27/2017	46.61	36.06	10.55
MW-12C (Existing)[1]	Eldredge Park	2/23/2017	46.61	36.30	10.31
MW-12C (Existing)[1]	Eldredge Park	4/25/2017	46.61	34.95	11.66
MW-12C (Existing)[1]	Eldredge Park	6/29/2017	46.61	34.79	11.82
MW-12C (Existing)[1]	Eldredge Park	9/13/2017	46.61	13.00	33.61
MW-12C (Existing)[1]	Eldredge Park	1/8/2018	46.61	26.50	20.11
MW-12C (Existing)[1]	Eldredge Park	4/18/2018	46.61	N/A	N/A
MW-12C (Repaired)	Eldredge Park	9/19/2018	45.36	33.31	12.05
MW-12C (Repaired)	Eldredge Park	1/3/2019	45.36	31.98	13.38
MW-12C (Repaired)	Eldredge Park	4/9/2019	45.36	31.37	13.99
MW-12C (Repaired)	Eldredge Park	7/24/2019	45.36	32.22	13.14
MW-12C (Repaired)	Eldredge Park	11/5/2019	45.36	33.72	11.64
MW-12C (Repaired)	Eldredge Park	2/19/2020	45.36	32.31	13.05
MW-12C (Repaired)	Eldredge Park	5/13/2020	45.36	31.66	13.70
MW-12C (Repaired)	Eldredge Park	8/12/2020	45.36	33.62	11.74
MW-12C (Repaired)	Eldredge Park	11/17/2020	45.36	34.97	10.39
MW-12C (Repaired)	Eldredge Park	3/3/2021	45.36	33.90	11.46
MW-2	Eldredge Park	11/3/2016	44.82	33.65	11.17
MW-2	Eldredge Park	11/14/2016	44.82	33.83	10.99
MW-2	Eldredge Park	1/18/2017	44.82	34.03	10.79
MW-2	Eldredge Park	1/27/2017	44.82	33.91	10.91
MW-2	Eldredge Park	2/24/2017	44.82	33.43	11.39
MW-2	Eldredge Park	4/25/2017	44.82	32.68	12.14
MW-2	Eldredge Park	6/29/2017	44.82	32.54	12.28
MW-2	Eldredge Park	9/13/2017	44.82	32.15	12.67
MW-2	Eldredge Park	1/10/2018	44.82	32.55	12.27
MW-2	Eldredge Park	4/19/2018	44.82	30.07	14.75
MW-2	Eldredge Park	9/20/2018	44.82	32.67	12.15
MW-2	Eldredge Park	4/9/2019	44.82	30.93	13.89
MW-2	Eldredge Park	7/25/2019	44.82	31.50	13.32
MW-2	Eldredge Park	11/5/2019	44.82	32.75	12.07
MW-2	Eldredge Park	2/20/2020	44.82	31.76	13.06

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-4	Eldredge Park	11/3/2016	46.57	35.53	11.04
MW-4	Eldredge Park	11/14/2016	46.57	35.71	10.86
MW-4	Eldredge Park	1/18/2017	46.57	35.98	10.59
MW-4	Eldredge Park	1/27/2017	46.57	35.83	10.74
MW-4	Eldredge Park	2/24/2017	46.57	35.48	11.09
MW-4	Eldredge Park	4/25/2017	46.57	35.63	10.94
MW-4	Eldredge Park	6/29/2017	46.57	34.41	12.16
MW-4	Eldredge Park	9/13/2017	46.57	34.52	12.05
MW-4	Eldredge Park	1/10/2018	46.57	34.42	12.15
MW-4	Eldredge Park	4/19/2018	46.57	31.15	15.42
MW-4	Eldredge Park	9/19/2018	46.57	N/A	N/A
MW-4	Eldredge Park	1/4/2019	46.57	33.62	12.95
MW-4	Eldredge Park	4/9/2019	46.57	32.79	13.78
MW-4	Eldredge Park	7/25/2019	46.57	32.40	14.17
MW-4	Eldredge Park	11/5/2019	46.57	33.27	13.30
MW-4	Eldredge Park	2/20/2020	46.57	32.66	13.91
MW-8	Eldredge Park	October 2016	46.16	35.30	10.86
MW-8	Eldredge Park	11/14/2016	46.16	35.22	10.94
MW-8	Eldredge Park	1/18/2017	46.16	35.62	10.54
MW-8	Eldredge Park	1/27/2017	46.16	35.50	10.66
MW-8	Eldredge Park	2/24/2017	46.16	35.12	11.04
MW-8	Eldredge Park	4/25/2017	46.16	24.51	21.65
MW-8	Eldredge Park	6/29/2017	46.16	34.03	12.13
MW-8	Eldredge Park	9/13/2017	46.16	34.21	11.95
MW-8	Eldredge Park	1/10/2018	46.16	N/A	N/A
MW-8	Eldredge Park	4/19/2018	46.16	N/A	N/A
MW-8	Eldredge Park	9/19/2018	46.16	N/A	N/A
MW-B1010C	Eldredge Park	11/3/2016	44.46	33.60	10.86
MW-B1010C	Eldredge Park	11/14/2016	44.46	33.98	10.48
MW-B1010C	Eldredge Park	1/18/2017	44.46	33.97	10.49
MW-B1010C	Eldredge Park	1/27/2017	44.46	33.81	10.65
MW-B1010C	Eldredge Park	2/23/2017	44.46	33.25	11.21
MW-B1010C	Eldredge Park	4/25/2017	44.46	32.53	11.93
MW-B1010C	Eldredge Park	6/29/2017	44.46	32.15	12.31
MW-B1010C	Eldredge Park	9/12/2017	44.46	32.13	12.33
MW-B1010C	Eldredge Park	1/9/2018	44.46	32.18	12.28
MW-B1010C	Eldredge Park	4/18/2018	44.46	27.37	17.09
MW-B1010C	Eldredge Park	9/19/2018	44.46	32.32	12.14
MW-B1010C	Eldredge Park	1/3/2019	44.46	31.01	13.45
MW-B1010C	Eldredge Park	4/9/2019	44.46	30.39	14.07
MW-B1010C	Eldredge Park	7/25/2019	44.46	31.28	13.18
MW-B1010C	Eldredge Park	11/5/2019	44.46	32.86	11.60
MW-B1010C	Eldredge Park	2/19/2020	44.46	31.34	13.12
MW-B1010C	Eldredge Park	5/13/2020	44.46	30.70	13.76
MW-B1010C	Eldredge Park	8/12/2020	44.46	32.68	11.78
MW-B1010C	Eldredge Park	11/17/2020	44.46	34.07	10.39
MW-B1010C	Eldredge Park	3/4/2021	44.46	33.94	10.52

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B1020B	Eldredge Park	11/3/2016	44.18	33.42	10.76
MW-B1020B	Eldredge Park	11/14/2016	44.18	33.68	10.50
MW-B1020B	Eldredge Park	1/18/2017	44.18	33.81	10.37
MW-B1020B	Eldredge Park	1/27/2017	44.18	33.66	10.52
MW-B1020B	Eldredge Park	2/23/2017	44.18	33.18	11.00
MW-B1020B	Eldredge Park	4/25/2017	44.18	32.60	11.58
MW-B1020B	Eldredge Park	6/29/2017	44.18	32.14	12.04
MW-B1020B	Eldredge Park	9/12/2017	44.18	32.01	12.17
MW-B1020B	Eldredge Park	1/9/2018	44.18	N/A	N/A
MW-B1020B	Eldredge Park	4/18/2018	44.18	29.63	14.55
MW-B1020B	Eldredge Park	9/19/2018	44.18	32.39	11.79
MW-B1020B	Eldredge Park	1/3/2019	44.18	31.01	13.17
MW-B1020B	Eldredge Park	4/9/2019	45.18	30.54	14.64
MW-B1020B	Eldredge Park	7/25/2019	45.18	31.40	13.78
MW-B1020B	Eldredge Park	11/5/2019	45.18	32.72	12.46
MW-B1020B	Eldredge Park	2/19/2020	45.18	31.50	13.68
MW-B1020B	Eldredge Park	5/13/2020	45.18	30.98	14.20
MW-B1020B	Eldredge Park	8/12/2020	45.18	32.68	12.50
MW-B1020B	Eldredge Park	11/17/2020	45.18	33.88	11.30
MW-B1020B	Eldredge Park	3/4/2021	45.18	33.04	12.14
MW-B1020C	Eldredge Park	11/3/2016	44.10	33.16	10.94
MW-B1020C	Eldredge Park	11/14/2016	44.10	33.32	10.78
MW-B1020C	Eldredge Park	1/18/2017	44.10	33.53	10.57
MW-B1020C	Eldredge Park	1/27/2017	44.10	33.32	10.78
MW-B1020C	Eldredge Park	2/23/2017	44.10	32.80	11.30
MW-B1020C	Eldredge Park	4/25/2017	44.10	32.10	12.00
MW-B1020C	Eldredge Park	6/29/2017	44.10	31.71	12.39
MW-B1020C	Eldredge Park	9/12/2017	44.10	31.74	12.36
MW-B1020C	Eldredge Park	1/8/2018	44.10	31.74	12.36
MW-B1020C	Eldredge Park	4/18/2018	44.10	28.90	15.20
MW-B1020C	Eldredge Park	9/19/2018	44.10	31.93	12.17
MW-B1020C	Eldredge Park	1/3/2019	44.10	30.48	13.62
MW-B1020C	Eldredge Park	4/9/2019	44.10	29.88	14.22
MW-B1020C	Eldredge Park	7/25/2019	44.10	30.81	13.29
MW-B1020C	Eldredge Park	11/5/2019	44.10	32.37	11.73
MW-B1020C	Eldredge Park	2/19/2020	44.10	30.81	13.29
MW-B1020C	Eldredge Park	5/13/2020	44.10	31.04	13.06
MW-B1020C	Eldredge Park	8/12/2020	44.10	32.43	11.67
MW-B1020C	Eldredge Park	11/17/2020	44.10	33.65	10.45
MW-B1020C	Eldredge Park	3/4/2021	44.10	32.48	11.62

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B1050A	Eldredge Park	11/3/2016	43.42	32.84	10.58
MW-B1050A	Eldredge Park	11/14/2016	43.42	32.92	10.50
MW-B1050A	Eldredge Park	1/18/2017	43.42	32.91	10.51
MW-B1050A	Eldredge Park	1/27/2017	43.42	32.88	10.54
MW-B1050A	Eldredge Park	2/23/2017	43.42	32.54	10.88
MW-B1050A	Eldredge Park	4/25/2017	43.42	31.28	12.14
MW-B1050A	Eldredge Park	6/29/2017	43.42	31.42	12.00
MW-B1050A	Eldredge Park	9/12/2017	43.42	31.45	11.97
MW-B1050A	Eldredge Park	1/9/2018	43.42	31.46	11.96
MW-B1050A	Eldredge Park	4/18/2018	43.42	28.74	14.68
MW-B1050A	Eldredge Park	9/20/2018	43.42	31.68	11.74
MW-B1050A	Eldredge Park	1/4/2019	43.42	30.46	12.96
MW-B1050A	Eldredge Park	4/9/2019	43.42	29.92	13.50
MW-B1050A	Eldredge Park	7/25/2019	43.42	29.34	14.08
MW-B1050A	Eldredge Park	11/5/2019	43.42	31.99	11.43
MW-B1050A	Eldredge Park	2/20/2020	43.42	30.80	12.62
MW-B1050A	Eldredge Park	5/13/2020	43.42	30.13	13.29
MW-B1050A	Eldredge Park	8/12/2020	43.42	31.99	11.43
MW-B1050A	Eldredge Park	11/17/2020	43.42	33.10	10.32
MW-B1050A	Eldredge Park	3/4/2021	43.42	32.32	11.10
MW-B1050B	Eldredge Park	11/3/2016	43.54	32.65	10.89
MW-B1050B	Eldredge Park	11/14/2016	43.54	32.72	10.82
MW-B1050B	Eldredge Park	1/18/2017	43.54	32.98	10.56
MW-B1050B	Eldredge Park	1/27/2017	43.54	32.81	10.73
MW-B1050B	Eldredge Park	2/23/2017	43.54	32.28	11.26
MW-B1050B	Eldredge Park	4/25/2017	43.54	31.45	12.09
MW-B1050B	Eldredge Park	6/29/2017	43.54	31.21	12.33
MW-B1050B	Eldredge Park	9/12/2017	43.54	31.19	12.35
MW-B1050B	Eldredge Park	1/9/2018	43.54	31.18	12.36
MW-B1050B	Eldredge Park	4/18/2018	43.54	28.35	15.19
MW-B1050B	Eldredge Park	9/20/2018	43.54	31.41	12.13
MW-B1050B	Eldredge Park	1/4/2019	43.54	29.97	13.57
MW-B1050B	Eldredge Park	4/9/2019	43.54	29.46	14.08
MW-B1050B	Eldredge Park	7/25/2019	43.54	30.29	13.25
MW-B1050B	Eldredge Park	11/5/2019	43.54	31.81	11.73
MW-B1050B	Eldredge Park	2/20/2020	43.54	30.30	13.24
MW-B1050B	Eldredge Park	5/13/2020	43.54	29.69	13.85
MW-B1050B	Eldredge Park	8/12/2020	43.54	31.72	11.82
MW-B1050B	Eldredge Park	11/17/2020	43.54	33.10	10.44
MW-B1050B	Eldredge Park	3/4/2021	43.54	31.45	12.09

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B1050C	Eldredge Park	11/3/2016	43.55	32.80	10.75
MW-B1050C	Eldredge Park	11/14/2016	43.55	32.80	10.75
MW-B1050C	Eldredge Park	1/18/2017	43.55	33.02	10.53
MW-B1050C	Eldredge Park	1/27/2017	43.55	32.96	10.59
MW-B1050C	Eldredge Park	2/23/2017	43.55	32.40	11.15
MW-B1050C	Eldredge Park	4/25/2017	43.55	31.52	12.03
MW-B1050C	Eldredge Park	6/29/2017	43.55	31.21	12.34
MW-B1050C	Eldredge Park	9/12/2017	43.55	31.22	12.33
MW-B1050C	Eldredge Park	1/9/2018	43.55	31.36	12.19
MW-B1050C	Eldredge Park	4/18/2018	43.55	28.52	15.03
MW-B1050C	Eldredge Park	9/20/2018	43.55	31.55	12.00
MW-B1050C	Eldredge Park	1/4/2019	43.55	30.14	13.41
MW-B1050C	Eldredge Park	4/9/2019	43.55	29.72	13.83
MW-B1050C	Eldredge Park	7/25/2019	43.55	30.58	12.97
MW-B1050C	Eldredge Park	11/5/2019	43.55	32.03	11.52
MW-B1050C	Eldredge Park	2/20/2020	43.55	30.43	13.12
MW-B1050C	Eldredge Park	5/13/2020	43.55	29.74	13.81
MW-B1050C	Eldredge Park	8/12/2020	43.55	31.86	11.69
MW-B1050C	Eldredge Park	11/17/2020	43.55	33.18	10.37
MW-B1050C	Eldredge Park	3/4/2021	43.55	31.75	11.80
MW-B1075B	Eldredge Park	11/3/2016	43.29	32.55	10.74
MW-B1075B	Eldredge Park	11/14/2016	43.29	32.57	10.72
MW-B1075B	Eldredge Park	1/18/2017	43.29	32.78	10.51
MW-B1075B	Eldredge Park	1/27/2017	43.29	32.62	10.67
MW-B1075B	Eldredge Park	2/23/2017	43.29	32.10	11.19
MW-B1075B	Eldredge Park	4/25/2017	43.29	31.22	12.07
MW-B1075B	Eldredge Park	6/29/2017	43.29	30.98	12.31
MW-B1075B	Eldredge Park	9/13/2017	43.29	30.93	12.36
MW-B1075B	Eldredge Park	1/9/2018	43.29	31.15	12.14
MW-B1075B	Eldredge Park	4/18/2018	43.29	29.25	14.04
MW-B1075B	Eldredge Park	9/20/2018	43.29	31.26	12.03
MW-B1075B	Eldredge Park	1/4/2019	43.29	29.93	13.36
MW-B1075B	Eldredge Park	4/9/2019	43.29	29.30	13.99
MW-B1075B	Eldredge Park	7/25/2019	43.29	30.16	13.13
MW-B1075B	Eldredge Park	11/5/2019	43.29	31.66	11.63
MW-B1075B	Eldredge Park	2/20/2020	43.29	30.21	13.08
MW-B1075B	Eldredge Park	5/14/2020	43.29	29.36	13.93
MW-B1075B	Eldredge Park	8/12/2020	43.29	31.64	11.65
MW-B1075B	Eldredge Park	11/17/2020	43.29	32.98	10.31
MW-B1075B	Eldredge Park	3/4/2021	43.29	30.07	13.22

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B2010C	Eldredge Park	11/3/2016	44.70	33.95	10.75
MW-B2010C	Eldredge Park	11/14/2016	44.70	34.10	10.60
MW-B2010C	Eldredge Park	1/18/2017	44.70	34.41	10.29
MW-B2010C	Eldredge Park	1/27/2017	44.70	34.21	10.49
MW-B2010C	Eldredge Park	2/24/2017	44.70	33.77	10.93
MW-B2010C	Eldredge Park	4/25/2017	44.70	33.00	11.70
MW-B2010C	Eldredge Park	6/29/2017	44.70	32.67	12.03
MW-B2010C	Eldredge Park	9/13/2017	44.70	32.52	12.18
MW-B2010C	Eldredge Park	1/10/2018	44.70	32.66	12.04
MW-B2010C	Eldredge Park	4/19/2018	44.70	30.28	14.42
MW-B2010C	Eldredge Park	9/19/2018	44.70	32.93	11.77
MW-B2010C	Eldredge Park	1/2/2019	44.70	31.90	12.80
MW-B2010C	Eldredge Park	4/9/2019	44.70	31.06	13.64
MW-B2010C	Eldredge Park	7/24/2019	44.70	31.83	12.87
MW-B2010C	Eldredge Park	11/5/2019	44.70	33.24	11.46
MW-B2010C	Eldredge Park	2/19/2020	44.70	32.06	12.64
MW-B2010C	Eldredge Park	5/12/2020	44.70	31.33	13.37
MW-B2010C	Eldredge Park	8/12/2020	44.70	32.43	12.27
MW-B2010C	Eldredge Park	11/16/2020	44.70	34.45	10.25
MW-B2010C	Eldredge Park	3/3/2021	44.70	33.51	11.19
MW-B2020B	Eldredge Park	11/3/2016	44.50	33.90	10.60
MW-B2020B	Eldredge Park	11/14/2016	44.50	33.90	10.60
MW-B2020B	Eldredge Park	1/18/2017	44.50	34.15	10.35
MW-B2020B	Eldredge Park	1/27/2017	44.50	34.03	10.47
MW-B2020B	Eldredge Park	2/24/2017	44.50	33.50	11.00
MW-B2020B	Eldredge Park	4/25/2017	44.50	32.88	11.62
MW-B2020B	Eldredge Park	6/29/2017	44.50	32.45	12.05
MW-B2020B	Eldredge Park	9/13/2017	44.50	32.32	12.18
MW-B2020B	Eldredge Park	1/9/2018	44.50	32.58	11.92
MW-B2020B	Eldredge Park	4/19/2018	44.50	29.98	14.52
MW-B2020B	Eldredge Park	9/19/2018	44.50	32.64	11.86
MW-B2020B	Eldredge Park	1/2/2019	44.50	31.64	12.86
MW-B2020B	Eldredge Park	4/9/2019	44.50	30.93	13.57
MW-B2020B	Eldredge Park	5/29/2019	44.50	31.13	13.37
MW-B2020B	Eldredge Park	7/24/2019	44.50	31.61	12.89
MW-B2020B	Eldredge Park	11/5/2019	44.50	33.08	11.42
MW-B2020B	Eldredge Park	2/17/2020	44.50	31.84	12.66
MW-B2020B	Eldredge Park	5/12/2020	44.50	31.12	13.38
MW-B2020B	Eldredge Park	8/11/2020	44.50	33.02	11.48
MW-B2020B	Eldredge Park	11/16/2020	44.50	34.22	10.28
MW-B2020B	Eldredge Park	3/3/2021	44.50	33.44	11.06

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B2020C	Eldredge Park	11/3/2016	44.45	33.80	10.65
MW-B2020C	Eldredge Park	11/14/2016	44.45	33.98	10.47
MW-B2020C	Eldredge Park	1/18/2017	44.45	34.22	10.23
MW-B2020C	Eldredge Park	1/27/2017	44.45	34.07	10.38
MW-B2020C	Eldredge Park	2/24/2017	44.45	33.55	10.90
MW-B2020C	Eldredge Park	4/25/2017	44.45	32.90	11.55
MW-B2020C	Eldredge Park	6/29/2017	44.45	32.43	12.02
MW-B2020C	Eldredge Park	9/13/2017	44.45	32.23	12.22
MW-B2020C	Eldredge Park	1/9/2018	44.45	32.72	11.73
MW-B2020C	Eldredge Park	4/19/2018	44.45	30.01	14.44
MW-B2020C	Eldredge Park	9/19/2018	44.45	32.63	11.82
MW-B2020C	Eldredge Park	1/2/2019	44.45	31.69	12.76
MW-B2020C	Eldredge Park	4/9/2019	44.45	30.99	13.46
MW-B2020C	Eldredge Park	7/24/2019	44.45	31.68	12.77
MW-B2020C	Eldredge Park	11/5/2019	44.45	33.09	11.36
MW-B2020C	Eldredge Park	2/19/2020	44.45	31.91	12.54
MW-B2020C	Eldredge Park	5/12/2020	44.45	31.14	13.31
MW-B2020C	Eldredge Park	8/11/2020	44.45	33.07	11.38
MW-B2020C	Eldredge Park	11/16/2020	44.45	34.26	10.19
MW-B2020C	Eldredge Park	3/3/2021	44.45	33.42	11.03
MW-B2050A	Eldredge Park	11/3/2016	44.06	33.41	10.65
MW-B2050A	Eldredge Park	11/14/2016	44.06	33.60	10.46
MW-B2050A	Eldredge Park	1/18/2017	44.06	33.88	10.18
MW-B2050A	Eldredge Park	1/27/2017	44.06	33.64	10.42
MW-B2050A	Eldredge Park	2/24/2017	44.06	33.04	11.02
MW-B2050A	Eldredge Park	4/25/2017	44.06	32.68	11.38
MW-B2050A	Eldredge Park	6/29/2017	44.06	32.12	11.94
MW-B2050A	Eldredge Park	9/13/2017	44.06	31.98	12.08
MW-B2050A	Eldredge Park	1/9/2018	44.06	32.23	11.83
MW-B2050A	Eldredge Park	4/19/2018	44.06	29.53	14.53
MW-B2050A	Eldredge Park	9/19/2018	44.06	32.35	11.71
MW-B2050A	Eldredge Park	1/2/2019	44.06	31.39	12.67
MW-B2050A	Eldredge Park	4/9/2019	44.06	30.72	13.34
MW-B2050A	Eldredge Park	7/24/2019	44.06	31.30	12.76
MW-B2050A	Eldredge Park	11/5/2019	44.06	32.80	11.26
MW-B2050A	Eldredge Park	2/17/2020	44.06	31.53	12.53
MW-B2050A	Eldredge Park	5/12/2020	44.06	31.01	13.05
MW-B2050A	Eldredge Park	8/11/2020	44.06	32.66	11.40
MW-B2050A	Eldredge Park	11/16/2020	44.06	33.90	10.16
MW-B2050A	Eldredge Park	3/3/2021	44.06	32.96	11.10
MW-B2050B	Eldredge Park	11/3/2016	44.28	33.60	10.68
MW-B2050B	Eldredge Park	11/14/2016	44.28	33.73	10.55
MW-B2050B	Eldredge Park	1/18/2017	44.28	34.00	10.28
MW-B2050B	Eldredge Park	1/27/2017	44.28	33.84	10.44
MW-B2050B	Eldredge Park	2/24/2017	44.28	33.32	10.96
MW-B2050B	Eldredge Park	4/25/2017	44.28	32.63	11.65
MW-B2050B	Eldredge Park	6/29/2017	44.28	32.20	12.08
MW-B2050B	Eldredge Park	9/13/2017	44.28	32.01	12.27
MW-B2050B	Eldredge Park	1/9/2018	44.28	32.42	11.86
MW-B2050B	Eldredge Park	4/19/2018	44.28	29.70	14.58
MW-B2050B	Eldredge Park	9/19/2018	44.28	32.40	11.88
MW-B2050B	Eldredge Park	1/2/2019	44.28	33.25	11.03
MW-B2050B	Eldredge Park	4/9/2019	44.28	30.66	13.62
MW-B2050B	Eldredge Park	7/24/2019	44.28	31.44	12.84
MW-B2050B	Eldredge Park	11/5/2019	44.28	32.60	11.68
MW-B2050B	Eldredge Park	2/17/2020	44.28	31.67	12.61
MW-B2050B	Eldredge Park	5/12/2020	44.28	30.90	13.38
MW-B2050B	Eldredge Park	8/11/2020	44.28	32.78	11.50
MW-B2050B	Eldredge Park	11/16/2020	44.28	34.05	10.23
MW-B2050B	Eldredge Park	3/3/2021	44.28	33.13	11.15

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-B2050C	Eldredge Park	11/3/2016	44.17	33.35	10.82
MW-B2050C	Eldredge Park	11/14/2016	44.17	33.51	10.66
MW-B2050C	Eldredge Park	1/18/2017	44.17	33.90	10.27
MW-B2050C	Eldredge Park	1/27/2017	44.17	33.87	10.30
MW-B2050C	Eldredge Park	2/24/2017	44.17	33.07	11.10
MW-B2050C	Eldredge Park	4/25/2017	44.17	32.31	11.86
MW-B2050C	Eldredge Park	6/29/2017	44.17	31.93	12.24
MW-B2050C	Eldredge Park	9/13/2017	44.17	32.07	12.10
MW-B2050C	Eldredge Park	1/9/2018	44.17	32.11	12.06
MW-B2050C	Eldredge Park	4/19/2018	44.17	27.61	16.56
MW-B2050C	Eldredge Park	9/19/2018	44.17	32.17	12.00
MW-B2050C	Eldredge Park	1/2/2019	44.17	31.06	13.11
MW-B2050C	Eldredge Park	4/9/2019	44.17	31.31	12.86
MW-B2050C	Eldredge Park	7/24/2019	44.17	31.15	13.02
MW-B2050C	Eldredge Park	11/5/2019	44.17	32.65	11.52
MW-B2050C	Eldredge Park	2/17/2020	44.17	31.35	12.82
MW-B2050C	Eldredge Park	5/12/2020	44.17	30.92	13.25
MW-B2050C	Eldredge Park	8/11/2020	44.17	32.59	11.58
MW-B2050C	Eldredge Park	11/16/2020	44.17	33.83	10.34
MW-B2050C	Eldredge Park	3/3/2021	44.17	33.03	11.14
MW-B2075A	Eldredge Park	4/25/2017	44.23	32.40	11.83
MW-B2075A	Eldredge Park	6/29/2017	44.23	31.97	12.26
MW-B2075A	Eldredge Park	9/12/2017	44.23	31.85	12.38
MW-B2075A	Eldredge Park	1/3/2018	44.23	31.16	13.07
MW-B2075A	Eldredge Park	1/10/2018	44.23	32.30	11.93
MW-B2075A	Eldredge Park	4/19/2018	44.23	29.44	14.79
MW-B2075A	Eldredge Park	9/20/2018	44.23	32.40	11.83
MW-B2075A	Eldredge Park	4/9/2019	44.23	30.54	13.69
MW-B2075A	Eldredge Park	7/24/2019	44.23	31.26	12.97
MW-B2075A	Eldredge Park	11/5/2019	44.23	32.70	11.53
MW-B2075A	Eldredge Park	2/17/2020	44.23	31.42	12.81
MW-B2075A	Eldredge Park	5/12/2020	44.23	30.64	13.59
MW-B2075A	Eldredge Park	8/11/2020	44.23	32.72	11.51
MW-B2075A	Eldredge Park	11/16/2020	44.23	33.94	10.29
MW-B2075A	Eldredge Park	3/3/2021	44.23	32.87	11.36
MW-B2100	Eldredge Park	11/3/2016	44.23	33.50	10.73
MW-B2100	Eldredge Park	11/14/2016	44.23	33.65	10.58
MW-B2100	Eldredge Park	1/18/2017	44.23	33.87	10.36
MW-B2100	Eldredge Park	1/27/2017	44.23	33.66	10.57
MW-B2100	Eldredge Park	2/24/2017	44.23	33.10	11.13
MW-B2100	Eldredge Park	4/25/2017	44.23	32.38	11.85
MW-B2100	Eldredge Park	6/29/2017	44.23	32.01	12.22
MW-B2100	Eldredge Park	9/12/2017	44.23	31.89	12.34
MW-B2100	Eldredge Park	1/10/2018	44.23	32.29	11.94
MW-B2100	Eldredge Park	4/19/2018	44.23	30.34	13.89
MW-B2100	Eldredge Park	9/20/2018	44.23	32.36	11.87
MW-B2100	Eldredge Park	1/3/2019	44.23	31.11	13.12
MW-B2100	Eldredge Park	4/9/2019	44.23	30.51	13.72
MW-B2100	Eldredge Park	7/24/2019	44.23	31.31	12.92
MW-B2100	Eldredge Park	11/5/2019	44.23	32.75	11.48
MW-B2100	Eldredge Park	2/17/2020	44.23	31.42	12.81
MW-B2100	Eldredge Park	5/12/2020	44.23	30.70	13.53
MW-B2100	Eldredge Park	8/11/2020	44.23	32.74	11.49
MW-B2100	Eldredge Park	11/16/2020	44.23	33.97	10.26
MW-B2100	Eldredge Park	3/3/2021	44.23	32.93	11.30
MW-BC1C	Eldredge Park	11/3/2016	42.50	31.36	11.14
MW-BC1C	Eldredge Park	11/14/2016	42.50	31.87	10.63
MW-BC1C	Eldredge Park	1/18/2017	42.50	31.81	10.69
MW-BC1C	Eldredge Park	1/27/2017	42.50	31.65	10.85
MW-BC1C	Eldredge Park	2/24/2017	42.50	31.14	11.36
MW-BC1C	Eldredge Park	4/25/2017	42.50	30.43	12.07
MW-BC1C	Eldredge Park	6/29/2017	42.50	30.07	12.43
MW-BC1C	Eldredge Park	9/12/2017	42.50	N/A	N/A
MW-BC1C	Eldredge Park	1/10/2018	42.50	N/A	N/A
MW-BC1C	Eldredge Park	4/19/2018	42.50	27.61	14.89
MW-BC1C	Eldredge Park	9/20/2018	42.50	30.31	12.19
MW-BC1C	Eldredge Park	1/4/2019	42.50	29.15	13.35
MW-BC1C	Eldredge Park	4/9/2019	42.50	28.64	13.86
MW-BC1C	Eldredge Park	7/25/2019	42.50	29.30	13.20
MW-BC1C	Eldredge Park	11/5/2019	42.50	30.58	11.92
MW-BC1C	Eldredge Park	2/20/2020	42.50	29.52	12.98

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-BC2C	Eldredge Park	11/3/2016	43.52	32.84	10.68
MW-BC2C	Eldredge Park	11/14/2016	43.52	N/A	N/A
MW-BC2C	Eldredge Park	1/18/2017	43.52	33.22	10.30
MW-BC2C	Eldredge Park	1/27/2017	43.52	33.08	10.44
MW-BC2C	Eldredge Park	2/24/2017	43.52	32.63	10.89
MW-BC2C	Eldredge Park	4/25/2017	43.52	31.93	11.59
MW-BC2C	Eldredge Park	6/29/2017	43.52	31.61	11.91
MW-BC2C	Eldredge Park	9/13/2017	43.52	31.26	12.26
MW-BC2C	Eldredge Park	1/10/2018	43.52	31.70	11.82
MW-BC2C	Eldredge Park	4/19/2018	43.52	27.65	15.87
MW-BC2C	Eldredge Park	9/20/2018	43.52	32.45	11.07
MW-BC2C	Eldredge Park	1/2/2019	43.52	30.63	12.89
MW-BC2C	Eldredge Park	4/9/2019	43.52	30.07	13.45
MW-BC2C	Eldredge Park	7/25/2019	43.52	30.61	12.91
MW-BC2C	Eldredge Park	11/5/2019	43.52	32.07	11.45
MW-BC2C	Eldredge Park	2/19/2020	43.52	30.82	12.70
MW-BC2C	Eldredge Park	5/14/2020	43.52	30.18	13.34
MW-BC2C	Eldredge Park	8/12/2020	43.52	32.11	11.41
MW-BC2C	Eldredge Park	11/18/2020	43.52	33.00	10.52
MW-BC2C	Eldredge Park	3/4/2021	43.52	32.46	11.06
MW-BC3B	Eldredge Park	4/25/2017	43.86	32.45	11.41
MW-BC3B	Eldredge Park	6/29/2017	43.86	31.90	11.96
MW-BC3B	Eldredge Park	9/12/2017	43.86	31.50	12.36
MW-BC3B	Eldredge Park	1/10/2018	43.86	32.36	11.50
MW-BC3B	Eldredge Park	4/19/2018	43.86	29.55	14.31
MW-BC3B	Eldredge Park	9/20/2018	43.86	32.47	11.39
MW-BC3B	Eldredge Park	1/2/2019	43.86	31.25	12.61
MW-BC3B	Eldredge Park	4/9/2019	43.86	30.61	13.25
MW-BC3B	Eldredge Park	7/24/2019	43.86	31.25	12.61
MW-BC3B	Eldredge Park	11/5/2019	43.86	32.62	11.24
MW-BC3B	Eldredge Park	2/17/2020	43.86	31.34	12.52
MW-BC3B	Eldredge Park	5/12/2020	43.86	30.81	13.05
MW-BC3B	Eldredge Park	8/11/2020	43.86	32.65	11.21
MW-BC3B	Eldredge Park	11/16/2020	43.86	33.70	10.16
MW-BC3B	Eldredge Park	3/3/2021	43.86	32.92	10.94
MW-BU1A	Eldredge Park	11/3/2016	43.48	32.55	10.93
MW-BU1A	Eldredge Park	11/14/2016	43.48	32.44	11.04
MW-BU1A	Eldredge Park	1/18/2017	43.48	32.86	10.62
MW-BU1A	Eldredge Park	1/27/2017	43.48	32.74	10.74
MW-BU1A	Eldredge Park	2/24/2017	43.48	32.30	11.18
MW-BU1A	Eldredge Park	4/25/2017	43.48	31.75	11.73
MW-BU1A	Eldredge Park	6/29/2017	43.48	31.36	12.12
MW-BU1A	Eldredge Park	9/13/2017	43.48	31.21	12.27
MW-BU1A	Eldredge Park	1/10/2018	43.48	31.40	12.08
MW-BU1A	Eldredge Park	4/18/2018	43.48	28.83	14.65
MW-BU1A	Eldredge Park	9/20/2018	43.48	31.45	12.03
MW-BU1A	Eldredge Park	1/4/2019	43.48	30.60	12.88
MW-BU1A	Eldredge Park	4/9/2019	43.48	29.84	13.64
MW-BU1A	Eldredge Park	7/25/2019	43.48	30.28	13.20
MW-BU1A	Eldredge Park	11/5/2019	43.48	31.57	11.91
MW-BU1A	Eldredge Park	2/20/2020	43.48	30.51	12.97

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-BU1C	Eldredge Park	11/3/2016	43.65	32.50	11.15
MW-BU1C	Eldredge Park	11/14/2016	43.65	N/A	N/A
MW-BU1C	Eldredge Park	1/18/2017	43.65	32.84	10.81
MW-BU1C	Eldredge Park	1/27/2017	43.65	32.72	10.93
MW-BU1C	Eldredge Park	2/24/2017	43.65	32.25	11.40
MW-BU1C	Eldredge Park	4/25/2017	43.65	31.71	11.94
MW-BU1C	Eldredge Park	6/29/2017	43.65	31.31	12.34
MW-BU1C	Eldredge Park	9/13/2017	43.65	31.03	12.62
MW-BU1C	Eldredge Park	1/10/2018	43.65	31.30	12.35
MW-BU1C	Eldredge Park	4/18/2018	43.65	28.88	14.77
MW-BU1C	Eldredge Park	9/20/2018	43.65	31.39	12.26
MW-BU1C	Eldredge Park	1/4/2019	43.65	30.18	13.47
MW-BU1C	Eldredge Park	4/9/2019	43.65	29.55	14.10
MW-BU1C	Eldredge Park	7/25/2019	43.65	30.11	13.54
MW-BU1C	Eldredge Park	11/5/2019	43.65	31.41	12.24
MW-BU1C	Eldredge Park	2/20/2020	43.65	30.39	13.26
MW-BU2A	Eldredge Park	11/3/2016	44.56	33.90	10.66
MW-BU2A	Eldredge Park	11/14/2016	44.56	34.03	10.53
MW-BU2A	Eldredge Park	1/18/2017	44.56	34.22	10.34
MW-BU2A	Eldredge Park	1/27/2017	44.56	34.05	10.51
MW-BU2A	Eldredge Park	2/23/2017	44.56	34.62	9.94
MW-BU2A	Eldredge Park	4/25/2017	44.56	33.25	11.31
MW-BU2A	Eldredge Park	6/29/2017	44.56	32.72	11.84
MW-BU2A	Eldredge Park	9/12/2017	44.56	32.56	12.00
MW-BU2A	Eldredge Park	1/10/2018	44.56	32.75	11.81
MW-BU2A	Eldredge Park	4/18/2018	44.56	30.26	14.30
MW-BU2A	Eldredge Park	9/20/2018	44.56	32.82	11.74
MW-BU2A	Eldredge Park	1/3/2019	44.56	31.81	12.75
MW-BU2A	Eldredge Park	4/9/2019	44.56	31.22	13.34
MW-BU2A	Eldredge Park	7/25/2019	44.56	31.84	12.72
MW-BU2A	Eldredge Park	11/5/2019	44.56	33.08	11.48
MW-BU2A	Eldredge Park	2/20/2020	44.56	32.06	12.50
MW-BU2A	Eldredge Park	5/13/2020	44.56	31.32	13.24
MW-BU2A	Eldredge Park	8/12/2020	44.56	33.11	11.45
MW-BU2A	Eldredge Park	11/16/2020	44.56	34.31	10.25
MW-BU2A	Eldredge Park	3/3/2021	44.56	33.50	11.06
MW-BU2B	Eldredge Park	11/3/2016	44.70	33.93	10.77
MW-BU2B	Eldredge Park	11/14/2016	44.70	34.07	10.63
MW-BU2B	Eldredge Park	1/18/2017	44.70	34.31	10.39
MW-BU2B	Eldredge Park	1/27/2017	44.70	34.15	10.55
MW-BU2B	Eldredge Park	2/23/2017	44.70	33.75	10.95
MW-BU2B	Eldredge Park	4/25/2017	44.70	33.10	11.60
MW-BU2B	Eldredge Park	6/29/2017	44.70	32.72	11.98
MW-BU2B	Eldredge Park	9/12/2017	44.70	32.47	12.23
MW-BU2B	Eldredge Park	1/10/2018	44.70	32.76	11.94
MW-BU2B	Eldredge Park	4/18/2018	44.70	30.26	14.44
MW-BU2B	Eldredge Park	9/20/2018	44.70	32.82	11.88
MW-BU2B	Eldredge Park	1/3/2019	44.70	31.89	12.81
MW-BU2B	Eldredge Park	4/9/2019	44.70	31.19	13.51
MW-BU2B	Eldredge Park	7/25/2019	44.70	31.86	12.84
MW-BU2B	Eldredge Park	11/5/2019	44.70	33.16	11.54
MW-BU2B	Eldredge Park	2/20/2020	44.70	32.03	12.67
MW-BU2B	Eldredge Park	5/13/2020	44.70	31.37	13.33
MW-BU2B	Eldredge Park	8/12/2020	44.70	33.20	11.50
MW-BU2B	Eldredge Park	11/16/2020	44.70	34.45	10.25
MW-BU2B	Eldredge Park	3/3/2021	44.70	33.65	11.05

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-BU2C	Eldredge Park	11/3/2016	44.68	33.99	10.69
MW-BU2C	Eldredge Park	11/14/2016	44.68	34.08	10.60
MW-BU2C	Eldredge Park	1/18/2017	44.68	34.30	10.38
MW-BU2C	Eldredge Park	1/27/2017	44.68	34.15	10.53
MW-BU2C	Eldredge Park	2/23/2017	44.68	34.05	10.63
MW-BU2C	Eldredge Park	4/25/2017	44.68	33.08	11.60
MW-BU2C	Eldredge Park	6/29/2017	44.68	32.64	12.04
MW-BU2C	Eldredge Park	9/12/2017	44.68	32.60	12.08
MW-BU2C	Eldredge Park	1/10/2018	44.68	32.72	11.96
MW-BU2C	Eldredge Park	1/10/2018	44.68	30.40	14.28
MW-BU2C	Eldredge Park	4/18/2018	44.68	30.40	14.28
MW-BU2C	Eldredge Park	9/20/2018	44.68	32.85	11.83
MW-BU2C	Eldredge Park	1/3/2019	44.68	31.79	12.89
MW-BU2C	Eldredge Park	4/9/2019	44.68	31.08	13.60
MW-BU2C	Eldredge Park	7/25/2019	44.68	31.98	12.70
MW-BU2C	Eldredge Park	11/5/2019	44.68	33.20	11.48
MW-BU2C	Eldredge Park	2/20/2020	44.68	32.02	12.66
MW-BU2C	Eldredge Park	5/13/2020	44.68	31.24	13.44
MW-BU2C	Eldredge Park	8/12/2020	44.68	33.26	11.42
MW-BU2C	Eldredge Park	11/16/2020	44.68	34.38	10.30
MW-BU2C	Eldredge Park	3/3/2021	44.68	33.74	10.94
MW-BX1B	Eldredge Park	4/25/2017	45.38	33.85	11.53
MW-BX1B	Eldredge Park	6/29/2017	45.38	33.46	11.92
MW-BX1B	Eldredge Park	9/12/2017	45.38	33.43	11.95
MW-BX1B	Eldredge Park	1/8/2018	45.38	33.46	11.92
MW-BX1B	Eldredge Park	4/18/2018	45.38	31.02	14.36
MW-BX1B	Eldredge Park	9/20/2018	45.38	33.61	11.77
MW-BX1B	Eldredge Park	1/3/2019	45.38	32.59	12.79
MW-BX1B	Eldredge Park	4/9/2019	45.38	31.92	13.46
MW-BX1B	Eldredge Park	7/24/2019	45.38	32.55	12.83
MW-BX1B	Eldredge Park	11/5/2019	45.38	33.89	11.49
MW-BX1B	Eldredge Park	2/19/2020	45.38	32.72	12.66
MW-BX1B	Eldredge Park	5/13/2020	45.38	32.10	13.28
MW-BX1B	Eldredge Park	8/13/2020	45.38	33.87	11.51
MW-BX1B	Eldredge Park	11/17/2020	45.38	35.10	10.28
MW-BX1B	Eldredge Park	3/4/2021	45.38	34.25	11.13
MW-BX1C	Eldredge Park	4/25/2017	45.37	33.29	12.08
MW-BX1C	Eldredge Park	6/29/2017	45.37	32.98	12.39
MW-BX1C	Eldredge Park	9/12/2017	45.37	32.98	12.39
MW-BX1C	Eldredge Park	1/8/2018	45.37	32.95	12.42
MW-BX1C	Eldredge Park	4/18/2018	45.37	30.10	15.27
MW-BX1C	Eldredge Park	9/20/2018	45.37	33.16	12.21
MW-BX1C	Eldredge Park	1/3/2019	45.37	31.66	13.71
MW-BX1C	Eldredge Park	4/9/2019	45.37	31.07	14.30
MW-BX1C	Eldredge Park	7/24/2019	45.37	31.82	13.55
MW-BX1C	Eldredge Park	11/5/2019	45.37	31.68	13.69
MW-BX1C	Eldredge Park	2/19/2020	45.37	31.96	13.41
MW-BX1C	Eldredge Park	5/13/2020	45.37	31.25	14.12
MW-BX1C	Eldredge Park	8/13/2020	45.37	33.46	11.91
MW-BX1C	Eldredge Park	11/17/2020	45.37	34.60	10.77
MW-BX1C	Eldredge Park	3/4/2021	45.37	33.71	11.66
MW-BX2A	Eldredge Park	5/9/2018	46.40	31.30	15.10
MW-BX2A	Eldredge Park	9/20/2018	46.40	34.31	12.09
MW-BX2A	Eldredge Park	1/4/2019	46.40	33.31	13.09
MW-BX2A	Eldredge Park	4/9/2019	46.40	32.63	13.77
MW-BX2A	Eldredge Park	7/25/2019	46.40	33.33	13.07
MW-BX2A	Eldredge Park	11/5/2019	46.40	34.62	11.78
MW-BX2A	Eldredge Park	2/19/2020	46.40	32.67	13.73
MW-BX2A	Eldredge Park	5/14/2020	46.40	32.83	13.57
MW-BX2A	Eldredge Park	8/13/2020	46.40	34.62	11.78
MW-BX2A	Eldredge Park	11/18/2020	46.40	35.90	10.50
MW-BX2A	Eldredge Park	3/4/2021	46.40	34.99	11.41

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-BX2B	Eldredge Park	5/9/2018	46.40	31.14	15.26
MW-BX2B	Eldredge Park	9/20/2018	46.40	34.37	12.03
MW-BX2B	Eldredge Park	1/4/2019	46.40	33.26	13.14
MW-BX2B	Eldredge Park	4/9/2019	46.40	32.58	13.82
MW-BX2B	Eldredge Park	7/25/2019	46.40	33.37	13.03
MW-BX2B	Eldredge Park	11/5/2019	46.40	34.61	11.79
MW-BX2B	Eldredge Park	2/19/2020	46.40	32.65	13.75
MW-BX2B	Eldredge Park	5/14/2020	46.40	32.85	13.55
MW-BX2B	Eldredge Park	8/13/2020	46.40	34.59	11.81
MW-BX2B	Eldredge Park	11/18/2020	46.40	35.94	10.46
MW-BX2B	Eldredge Park	3/4/2021	46.40	35.05	11.35
MW-BX2C	Eldredge Park	5/9/2018	46.47	31.07	15.40
MW-BX2C	Eldredge Park	9/20/2018	46.47	33.66	12.81
MW-BX2C	Eldredge Park	1/4/2019	46.47	32.07	14.40
MW-BX2C	Eldredge Park	4/9/2019	46.47	31.50	14.97
MW-BX2C	Eldredge Park	7/25/2019	46.47	32.48	13.99
MW-BX2C	Eldredge Park	11/5/2019	46.47	34.13	12.34
MW-BX2C	Eldredge Park	2/19/2020	46.47	32.36	14.11
MW-BX2C	Eldredge Park	5/14/2020	46.47	31.66	14.81
MW-BX2C	Eldredge Park	8/13/2020	46.47	34.07	12.40
MW-BX2C	Eldredge Park	11/18/2020	46.47	35.52	10.95
MW-BX2C	Eldredge Park	3/4/2021	46.47	34.21	12.26
MW-BN1A	Eldredge Park	5/9/2018	44.50	30.08	14.42
MW-BN1A	Eldredge Park	9/20/2018	44.50	32.36	12.14
MW-BN1A	Eldredge Park	1/4/2019	44.50	31.19	13.31
MW-BN1A	Eldredge Park	4/9/2019	44.50	30.61	13.89
MW-BN1A	Eldredge Park	7/25/2019	44.50	31.31	13.19
MW-BN1A	Eldredge Park	11/5/2019	44.50	32.71	11.79
MW-BN1A	Eldredge Park	2/20/2020	44.50	31.42	13.08
MW-BN1A	Eldredge Park	5/14/2020	44.50	30.72	13.78
MW-BN1A	Eldredge Park	8/13/2020	44.50	32.70	11.80
MW-BN1A	Eldredge Park	11/17/2020	44.50	34.12	10.38
MW-BN1A	Eldredge Park	3/4/2021	44.50	32.92	11.58
MW-BN1B	Eldredge Park	5/9/2018	44.40	29.10	15.30
MW-BN1B	Eldredge Park	9/20/2018	44.40	31.71	12.69
MW-BN1B	Eldredge Park	1/4/2019	44.40	30.21	14.19
MW-BN1B	Eldredge Park	4/9/2019	44.40	29.65	14.75
MW-BN1B	Eldredge Park	7/25/2019	44.40	30.49	13.91
MW-BN1B	Eldredge Park	11/5/2019	44.40	32.09	12.31
MW-BN1B	Eldredge Park	2/20/2020	44.40	30.49	13.91
MW-BN1B	Eldredge Park	5/14/2020	44.40	29.73	14.67
MW-BN1B	Eldredge Park	8/13/2020	44.40	32.13	12.27
MW-BN1B	Eldredge Park	11/17/2020	44.40	33.47	10.93
MW-BN1B	Eldredge Park	3/4/2021	44.40	32.23	12.17
MW-BN1C	Eldredge Park	5/9/2018	44.38	30.34	14.04
MW-BN1C	Eldredge Park	9/20/2018	44.38	31.87	12.51
MW-BN1C	Eldredge Park	1/4/2019	44.38	30.39	13.99
MW-BN1C	Eldredge Park	4/9/2019	44.38	29.73	14.65
MW-BN1C	Eldredge Park	7/25/2019	44.38	30.62	13.76
MW-BN1C	Eldredge Park	11/5/2019	44.38	32.29	12.09
MW-BN1C	Eldredge Park	2/20/2020	44.38	30.65	13.73
MW-BN1C	Eldredge Park	5/14/2020	44.38	29.84	14.54
MW-BN1C	Eldredge Park	8/13/2020	44.38	32.30	12.08
MW-BN1C	Eldredge Park	11/17/2020	44.38	33.67	10.71
MW-BN1C	Eldredge Park	3/4/2021	44.38	32.47	11.91
MW-BN2C	Eldredge Park	5/9/2018	45.21	30.42	14.79
MW-BN2C	Eldredge Park	9/25/2018	45.21	32.64	12.57
MW-BN2C	Eldredge Park	1/4/2019	45.21	30.93	14.28
MW-BN2C	Eldredge Park	4/9/2019	45.21	30.50	14.71
MW-BN2C	Eldredge Park	7/25/2019	45.21	31.20	14.01
MW-BN2C	Eldredge Park	11/5/2019	45.21	32.57	12.64
MW-BN2C	Eldredge Park	2/20/2020	45.21	31.20	14.01
MW-BN2C	Eldredge Park	5/14/2020	45.21	30.37	14.84
MW-BN2C	Eldredge Park	8/13/2020	45.21	32.70	12.51
MW-BN2C	Eldredge Park	11/18/2020	45.21	34.40	10.81
MW-BN2C	Eldredge Park	3/4/2021	45.21	32.65	12.56

Table 2 Orleans Groundwater Elevations

Well ID	Location	Date	TOC Elevation (ft)	Depth to Water (ft)	GW Elevation (ft)
MW-BM050A	Eldredge Park	5/9/2018	44.68	29.89	14.79
MW-BM050A	Eldredge Park	9/20/2018	44.68	32.29	12.39
MW-BM050A	Eldredge Park	1/3/2019	44.68	30.95	13.73
MW-BM050A	Eldredge Park	4/9/2019	44.68	30.46	14.22
MW-BM050A	Eldredge Park	7/24/2019	44.68	31.15	13.53
MW-BM050A	Eldredge Park	11/5/2019	44.68	32.75	11.93
MW-BM050A	Eldredge Park	2/17/2020	44.68	31.22	13.46
MW-BM050A	Eldredge Park	5/12/2020	44.68	30.53	14.15
MW-BM050A	Eldredge Park	8/13/2020	44.68	32.67	12.01
MW-BM050A	Eldredge Park	11/18/2020	44.68	33.98	10.70
MW-BM050A	Eldredge Park	3/4/2021	44.68	32.85	11.83
MW-BM050B	Eldredge Park	5/9/2018	44.80	29.81	14.99
MW-BM050B	Eldredge Park	9/20/2018	44.80	32.41	12.39
MW-BM050B	Eldredge Park	1/3/2019	44.80	31.21	13.59
MW-BM050B	Eldredge Park	4/9/2019	44.80	30.50	14.30
MW-BM050B	Eldredge Park	7/24/2019	44.80	31.21	13.59
MW-BM050B	Eldredge Park	11/5/2019	44.80	32.73	12.07
MW-BM050B	Eldredge Park	2/17/2020	44.80	31.41	13.39
MW-BM050B	Eldredge Park	5/12/2020	44.80	30.57	14.23
MW-BM050B	Eldredge Park	8/13/2020	44.80	32.81	11.99
MW-BM050B	Eldredge Park	11/18/2020	44.80	34.11	10.69
MW-BM050B	Eldredge Park	3/4/2021	44.80	33.02	11.78
MW-BM050C	Eldredge Park	5/9/2018	44.80	29.78	15.02
MW-BM050C	Eldredge Park	9/20/2018	44.80	32.38	12.42
MW-BM050C	Eldredge Park	1/3/2019	44.80	31.05	13.75
MW-BM050C	Eldredge Park	4/9/2019	44.80	30.46	14.34
MW-BM050C	Eldredge Park	7/24/2019	44.80	31.20	13.60
MW-BM050C	Eldredge Park	11/5/2019	44.80	32.70	12.10
MW-BM050C	Eldredge Park	2/17/2020	44.80	31.30	13.50
MW-BM050C	Eldredge Park	5/12/2020	44.80	30.53	14.27
MW-BM050C	Eldredge Park	8/13/2020	44.80	32.75	12.05
MW-BM050C	Eldredge Park	11/18/2020	44.80	34.05	10.75
MW-BM050C	Eldredge Park	3/4/2021	44.80	32.98	11.82
MW-BC4A	Eldredge Park	5/9/2018	43.50	29.48	14.02
MW-BC4A	Eldredge Park	9/20/2018	43.50	31.55	11.95
MW-BC4A	Eldredge Park	1/2/2019	43.50	30.40	13.10
MW-BC4A	Eldredge Park	4/9/2019	43.50	29.98	13.52
MW-BC4A	Eldredge Park	7/24/2019	43.50	30.68	12.82
MW-BC4A	Eldredge Park	11/5/2019	43.50	31.91	11.59
MW-BC4A	Eldredge Park	2/17/2020	43.50	30.93	12.57
MW-BC4A	Eldredge Park	5/12/2020	43.50	30.18	13.32
MW-BC4A	Eldredge Park	8/11/2020	43.50	32.01	11.49
MW-BC4A	Eldredge Park	11/16/2020	43.50	33.02	10.48
MW-BC4A	Eldredge Park	3/2/2021	43.50	32.62	10.88
MW-BC4B	Eldredge Park	5/9/2018	43.50	28.30	15.20
MW-BC4B	Eldredge Park	9/20/2018	43.50	29.45	14.05
MW-BC4B	Eldredge Park	1/2/2019	43.50	30.61	12.89
MW-BC4B	Eldredge Park	4/9/2019	43.50	29.88	13.62
MW-BC4B	Eldredge Park	7/24/2019	43.50	31.30	12.20
MW-BC4B	Eldredge Park	11/5/2019	43.50	31.88	11.62
MW-BC4B	Eldredge Park	2/17/2020	43.50	30.83	12.67
MW-BC4B	Eldredge Park	5/12/2020	43.50	30.10	13.40
MW-BC4B	Eldredge Park	8/11/2020	43.50	31.86	11.64
MW-BC4B	Eldredge Park	11/16/2020	43.50	33.05	10.45
MW-BC4B	Eldredge Park	3/2/2021	43.50	32.23	11.27
MW-BC4C	Eldredge Park	5/9/2018	43.50	29.47	14.03
MW-BC4C	Eldredge Park	9/20/2018	43.50	31.57	11.93
MW-BC4C	Eldredge Park	1/2/2019	43.50	30.63	12.87
MW-BC4C	Eldredge Park	4/9/2019	43.50	29.97	13.53
MW-BC4C	Eldredge Park	7/24/2019	43.50	30.77	12.73
MW-BC4C	Eldredge Park	11/5/2019	43.50	31.96	11.54
MW-BC4C	Eldredge Park	2/17/2020	43.50	30.90	12.60
MW-BC4C	Eldredge Park	5/12/2020	43.50	30.12	13.38
MW-BC4C	Eldredge Park	8/11/2020	43.50	32.00	11.50
MW-BC4C	Eldredge Park	11/16/2020	43.50	33.11	10.39
MW-BC4C	Eldredge Park	3/3/2021	43.50	32.29	11.21

Notes:

N/A = Not Available

1. MW-12C (Existing) was damaged during winter 2017. Water elevations taken prior to the repair in April 2018 may be affected.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-4**[3]		**MW-8**[3]	**MW-12A**																
Top of Screen Elevation (ft)	4.50		19.70	-24.4																
Bottom of Screen Elevation (ft)	-5.50		9.70	-34.4																
Sampling Date	10/4/2016	9/25/2018	10/4/2016	11/03/2016[1]	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/19/2018	1/3/2019	4/10/2019	7/24/2019	11/6/2019	2/19/2020	5/13/2020	8/12/2020	11/17/2020	3/3/2021
Type of Sample	Sample	Q6 Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																				
pH (SU)	5.52	6.30	5.23	6.94	5.46	5.53	5.58	5.59	4.89	5.60	5.44	5.56	5.44	5.57	5.12	5.25	5.29	5.60	6.01	5.74
Temperature (^{o}C)	15.54	12.65	15.87	14.38	11.78	13.81	13.91	14.02	13.62	13.7	15.3	13.4	13.7	14.5	14.6	13.9	13.6	15.4	14.0	13.4
Dissolved Oxygen (DO, mg/L)	7.89	7.99	9.58	1.13	3.69	7.03	14.81	6.92	7.65	7.99	7.33	8.36	8.53	8.07	8.30	7.22	8.41	8.31	8.29	8.01
Redox Potential (ORP; mV)	57.90	92.70	135.00	70.90	197.60	183.10	173.60	146.50	288.30	162.1	192.3	241.1	196.8	175.9	73.3	210.8	151.9	273.7	171.7	247.9
Specific Conductivity (µS/cm)[c]	171.00	170.00	190.00	667.00	572.00	550.00	537.00	518.00	563.00	483.9	445.0	491.0	534.0	749.0	631.0	641.0	498.0	396.4	304.0	297.0
Turbidity (NTU)	-	2.32	-	17.70	5.50	5.31	5.13	7.68	3.58	0.52	6.20	0.02	1.34	8.01	24.20	5.38	1.59	2.02	5.03	0.02
Laboratory Analyses																				
Nitrogen																				
Nitrate as N (mg/L)	**2.45**	**3.51**	**9.24**	**0.783**	**0.669**	**0.849**	**0.786**	**0.794**	**0.242**	**0.676**	**0.627**	**0.758**	**0.616**	**0.441**	**0.37**	**0.887**	**0.767**	**1.2**	**0.854**	**0.267**
Nitrite as N (mg/L)	-	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	**0.074**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	**0.1**	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.36**	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	**0.71**	-	**1.7**	-	<0.2	**0.4**	-	-	**0.22**	**0.57**	**0.4**	**0.6**	**0.31**	**0.34**	**0.54**	**0.23**	-	-	-	
Total Nitrogen (mg/L)	**3.15**	-	**10.9**	**1**	**0.669**	**1.25**	**0.79**	**1.11**	**0.533**	**1.25**	-	**1.36**	**0.92**	**0.777**	**0.905**	**1.12**	**0.767**	**1.2**	**1.19**	**0.267**
Anions																				
Chloride (mg/L)	**27.2**	-	**18.3**	**190**	**230**	**141**	**154**	**146**	**160**	**144**	**152**	**130**	**134**	**202**	**204**	**175**	**133**	**110**	**85.6**	**84.8**
Sulfate (mg/L)	**12.8**	-	**10.1**	**10**	**16.1**	**13.4**	**12.6**	**12.3**	**12.2**	**16.1**	**11.3**	**10.5**	**10.8**	**6.2**	**9.6**	**9.7**	**12**	**12.6**	**21.8**	**17.6**
Elements																				
Dissolved Iron (mg/L)	-	-	-	**0.7**	-	<0.1	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**-**	-	**-**	**-**
Dissolved Manganese (mg/L)	-	-	-	**0.325**	-	**0.033**	<0.02	**-**	<0.02	**0.023**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**-**	-	**-**	**-**
Total Arsenic (mg/L)	-	<0.0025	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	**-**	**-**
Boron (mg/L)	-	-	-	<0.05	-	<0.05	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	-	-	**98.3**	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Other																				
DOC (mg/L)	<0.5	-	<0.5	**0.55**	-	<0.5	**2.16**	**0.792**	**1.7**	**1.85**	**0.729**	**1.01**	**1.2**	**0.684**	**0.963**	**0.979**	**-**	-	**-**	**-**
Methane (µg/L)	-	-	-	-	-	-	**-**	-	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	-	-	-	**5**	**7**	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	-

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-12B**																
Top of Screen Elevation (ft)	-9.4																
Bottom of Screen Elevation (ft)	-19.4																
Sampling Date	11/03/2016[1]	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/19/2018	1/3/2019	4/10/2019	7/24/2019	11/6/2019	2/19/2020	5/13/2020	8/12/2020	11/17/200	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	6.90	5.43	5.40	5.39	5.45	4.78	5.30	5.38	5.41	5.32	4.93	4.88	5.14	5.21	5.27	5.74	5.40
Temperature (^{o}C)	14.50	11.82	14.18	14.37	14.56	13.80	14.1	19.2	13.2	14.0	15.0	14.6	14.4	14.0	16.4	14.1	13.8
Dissolved Oxygen (DO, mg/L)	1.05	1.16	6.39	12.40	5.51	5.67	5.45	5.41	6.90	6.66	5.90	6.34	4.05	4.33	3.32	2.24	0.82
Redox Potential (ORP; mV)	20.30	212.80	263.10	225.20	170.30	275.70	186.5	195.3	242.7	191.1	170.5	110.6	186.1	158.2	276.7	144.0	253.4
Specific Conductivity (µS/cm)[c]	231.00	243.00	235.00	253.00	257.00	249.00	230.2	233.0	268.0	275.0	298.1	279.0	324.0	284.0	278.3	239.0	248.0
Turbidity (NTU)	8.73	1.89	0.91	2.62	1.52	1.48	0.50	140.00	0.02	2.04	2.37	1.56	1.02	0.92	0.75	3.63	0.02
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**6.17**	**5.08**	**5.33**	**6.19**	**4.9**	**1.91**	**4.82**	**5.36**	**6.07**	**4.82**	**2.6**	**1.91**	**6.86**	**5.16**	**7.73**	**6.22**	**2.75**
Nitrite as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	<0.1	**0.19**	<0.1	**0.12**	**0.26**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.14**	<0.1	**0.11**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**0.79**	**1.18**	-	-	<0.2	<0.2	<0.2	**0.33**	<0.2	<0.2	<0.2	<0.2	-	-	-	
Total Nitrogen (mg/L)	**6.44**	**5.87**	**6.52**	**6.83**	**4.9**	**1.91**	**4.82**	-	**6.4**	**4.82**	**2.6**	**1.91**	**6.86**	**5.16**	**7.73**	**6.22**	**2.75**
Anions																	
Chloride (mg/L)	**34.1**	**24.2**	**41.6**	**48.9**	**50.5**	**47.3**	**46.7**	**52.1**	**53.3**	**58.6**	**59.3**	**68.7**	**57.6**	**58.2**	**58.1**	**53.2**	**51.3**
Sulfate (mg/L)	**9.8**	**13.6**	**9.7**	**9.2**	**12.1**	**11.2**	**13.2**	**10.7**	**9.1**	**11.3**	**10.1**	**11.5**	**10.6**	**11.8**	**11.5**	**18.1**	**12.5**
Elements																	
Dissolved Iron (mg/L)	**0.36**	-	<0.05	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**-**	-	**-**	**-**
Dissolved Manganese (mg/L)	**0.228**	-	**0.046**	<0.02	**-**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**-**	-	**-**	**-**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	-
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	-
Sodium (mg/L)	-	-	**18.7**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	-
Other																	
DOC (mg/L)	**1.82**	-	<0.5	**1.02**	**1.1**	**2.29**	**3.66**	**1.11**	**1.15**	**0.857**	**1.15**	**1.03**	**0.777**	**-**	-	**-**	**-**
Methane (µg/L)	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**2**	**10**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	-

Notes:

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-12C[2,3]**																**MW-BU1A**	**MW-BU1C**
Top of Screen Elevation (ft)	8.36																-26.3	4
Bottom of Screen Elevation (ft)	-1.64																-36.3	-6
Sampling Date	10/4/2016	11/03/2016[1]	11/17/2016	1/5/2017	2/23/2017	5/9/2018	9/19/2018	1/3/2019	4/11/2019	7/24/2019	11/7/2019	2/19/2020	5/13/2020	8/12/2020	11/17/2020	3/3/2021	10/4/2016	10/4/2016
Type of Sample	Sample	Sample	Sample	Sample	Q1 Sample[4]	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	Sample	Sample
Field Measurements																		
pH (SU)	4.98	6.45	5.23	5.09	NS	5.23	5.65	5.44	5.22	5.49	4.89	4.80	5.08	5.01	5.71	5.33	5.44	5.27
Temperature (^{o}C)	17.50	14.08	14.42	12.60	NS	11.10	16.18	14.0	14.3	14.5	14.8	14.3	13.8	16.9	14.6	14.2	13.75	13.95
Dissolved Oxygen (DO, mg/L)	6.93	0.83	0.68	1.61	NS	8.12	2.70	4.64	6.16	3.65	1.01	0.43	0.31	0.19	0.11	0.60	7.60	8.75
Redox Potential (ORP; mV)	167.80	246.00	279.70	205.60	NS	221.80	93.80	198.3	107.0	143.5	191.5	220.1	102.7	188.5	163.0	233.7	70.90	130.90
Specific Conductivity (µS/cm)[c]	178.00	216.00	156.00	199.00	NS	189.60	151.00	168.0	140.0	142.8	132.0	155.0	134.0	136.2	123.0	168.8	1464.00	351.00
Turbidity (NTU)	-	0.60	2.58	0.84	NS	2.49	9.60	0.02	1.38	5.00	0.90	7.61	0.05	1.28	3.38	0.02	-	-
Laboratory Analyses																		
Nitrogen																		
Nitrate as N (mg/L)	**6.74**	**6.51**	-	**6.03**	NS	**5.47**	**3.78**	**6.94**	**5.99**	**2.82**	**1.97**	**5.18**	**3.26**	**4.51**	**3.32**	**2.25**	**0.443**	**1.97**
Nitrite as N (mg/L)	-	-	-	<0.01	NS	<0.25	**0.047**	**0.018**	<0.01	**0.014**	**0.025**	**0.047**	**0.062**	**0.099**	**0.053**	**0.01**	-	-
Ammonia (mg/L)	<0.1	**0.11**	-	**0.12**	NS	**0.12**	**0.24**	**0.11**	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	**0.16**	**0.12**	**0.24**	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	**1.34**	-	-	**1.24**	NS	<0.2	**0.9**	<0.2	**0.22**	<0.2	**0.37**	**0.31**	-	-	-	**-**	**0.38**	**0.4**
Total Nitrogen (mg/L)	**8.08**	**6.51**	-	**7.27**	NS	**5.47**	-	**7.13**	**6.22**	**2.83**	**2.37**	**5.54**	**3.57**	**4.61**	**3.8**	**2.26**	**0.827**	**2.37**
Anions																		
Chloride (mg/L)	**24.1**	-	-	**22.4**	NS	**12.4**	**13.7**	**15.6**	**12.1**	**12.4**	**15.3**	**13.2**	**13**	**13.3**	**16.3**	**21.8**	**458**	**96.1**
Sulfate (mg/L)	**8.7**	**9.3**	-	**8.6**	NS	**13.9**	**11.8**	**7.5**	**9.8**	**9.6**	**10.8**	**11.2**	**11.6**	**9.1**	**16**	**10.1**	**6.9**	**9.1**
Elements																		
Dissolved Iron (mg/L)	-	<0.05	-	-	NS	<0.1	**3.67**	**0.735**	**0.211**	**0.149**	**0.152**	<0.1	**-**	-	**-**	**-**	**0.799**	**0.099**
Dissolved Manganese (mg/L)	-	**0.02**	-	-	NS	<0.02	**0.674**	**0.411**	**0.055**	**0.047**	**0.114**	**0.096**	**-**	-	**-**	**-**	**0.185**	**0.047**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**	-	-
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**	-	-
Boron (mg/L)	-	<0.05	-	-	NS	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**	<0.05	<0.05
Sodium (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**	-	-
Other																		
DOC (mg/L)	<0.5	**0.87**	**0.674**	-	NS	**3.96**	**2.75**	**1.47**	**1.95**	**1.3**	**1.71**	**1.12**	**-**	-	**-**	**-**	<0.5	<0.5
Methane (µg/L)	-	-	-	-	NS	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	**-**	<2	<2
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**	-	-
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	**-**	**-**	-	-
Alkalinity as CaCO3 (mg/L)	-	-	**4**	**6**	NS	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**	-	-

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BU2A**																
Top of Screen Elevation (ft)	-24.9																
Bottom of Screen Elevation (ft)	-34.9																
Sampling Date	11/03/2016[1]	1/5/2017	2/23/2017	6/29/2017	9/12/2017	1/10/2018	4/18/2018	9/20/2018	1/3/2019	4/11/2019	7/25/2019	11/6/2019	2/20/2020	5/13/2020	8/12/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	6.73	6.00	5.72	5.68	5.72	5.23	5.70	4.75	5.05	5.78	5.82	5.42	5.69	5.60	5.72	5.68	5.63
Temperature (^{o}C)	14.15	11.75	13.71	14.00	14.47	13.86	14.0	14.2	13.9	13.9	14.8	15.0	13.8	13.6	16.8	15.1	14.1
Dissolved Oxygen (DO, mg/L)	1.18	1.30	6.82	15.26	6.87	7.63	7.19	7.46	7.33	8.89	7.37	7.89	7.15	7.91	7.41	7.52	7.45
Redox Potential (ORP; mV)	37.50	127.00	149.50	225.20	172.00	211.40	111.5	101.6	131.8	36.3	125.7	150.8	106.8	238.0	204.3	143.6	140.1
Specific Conductivity (µS/cm)[c]	406.00	421.00	427.00	439.00	442.00	421.00	344.9	407.0	430.0	367.0	420.3	471.0	540.0	460.0	477.3	496.0	515.0
Turbidity (NTU)	44.50	257.00	378.00	2.55	4.02	20.90	32.00	8.48	0.02	8.82	6.70	3.67	1.86	0.05	0.30	1.29	0.45
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**0.357**	**0.426**	**0.452**	**0.408**	**0.61**	**0.467**	**0.374**	**0.617**	**0.652**	**0.578**	**0.59**	**0.192**	**0.518**	**0.373**	**0.495**	**0.486**	**0.16**
Nitrite as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	**0.065**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.91**	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	<0.2	**0.3**	-	-	<0.2	**0.4**	**0.43**	**0.29**	**0.31**	**0.26**	**0.79**	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**0.357**	**0.426**	**0.76**	**0.408**	**0.834**	**0.532**	**0.78**	**-**	**0.94**	**0.88**	**0.855**	**0.979**	**0.518**	**0.373**	**0.705**	**0.486**	<0.2
Anions																	
Chloride (mg/L)	**103**	**118**	**117**	**120**	**123**	**114**	**98.9**	**112**	**111**	**108**	**120**	**137**	**147**	**119**	**143**	**129**	**127**
Sulfate (mg/L)	**7.2**	**5.2**	**5.3**	<5	<5	**5.3**	**7.4**	**5.1**	<5	<5	**6.3**	<5	<5	<5	<5	**9.1**	**6.9**
Elements																	
Dissolved Iron (mg/L)	**1.09**	-	**0.477**	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**-**	-	**-**	**-**
Dissolved Manganese (mg/L)	**0.18**	-	**0.03**	<0.02	**-**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**-**	-	**-**	**-**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	-	-	**63**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Other																	
DOC (mg/L)	<0.5	-	**0.53**	<0.5	**0.707**	**1.14**	**1.58**	**0.258**	**0.688**	**0.619**	**0.948**	<0.25	**1.18**	**-**	-	**-**	**-**
Methane (µg/L)	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**11**	**10**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BU2B**																
Top of Screen Elevation (ft)	-9.9																
Bottom of Screen Elevation (ft)	-19.9																
Sampling Date	11/03/2016[1]	1/5/2017	2/23/2017	6/29/2017	9/12/2017	1/10/2018	4/18/2018	9/20/2018	1/3/2019	4/11/2019	7/25/2019	11/6/2019	2/20/2020	5/13/2020	8/12/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	7.11	5.94	5.73	5.68	5.75	5.24	5.60	4.77	5.03	5.73	5.93	5.31	5.68	5.68	5.71	5.64	5.62
Temperature (^{o}C)	14.70	12.07	14.18	14.70	15.21	14.53	14.8	14.8	14.4	14.3	15.7	15.6	14.0	14.7	17.3	15.6	14.2
Dissolved Oxygen (DO, mg/L)	1.30	1.07	6.25	13.80	6.19	6.42	6.20	6.43	6.39	7.87	6.60	7.09	6.59	8.13	6.74	6.88	5.87
Redox Potential (ORP; mV)	20.20	136.30	177.60	221.40	156.50	213.20	143.6	88.0	134.2	27.2	24.6	162.9	144.2	267.9	211.6	143.5	147.5
Specific Conductivity (µS/cm)[c]	379.00	362.00	343.00	336.00	350.00	410.00	394.7	490.0	443.0	319.0	384.8	343.0	365.0	365.0	343.0	368.0	362.0
Turbidity (NTU)	102.00	146.00	32.60	4.16	8.58	26.40	12.70	9.11	4.75	2.02	7.61	3.02	2.26	3.78	4.93	0.72	1.05
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**1.06**	**0.826**	**1.01**	**0.768**	**1.07**	**2.78**	**2.44**	**4.46**	**3.36**	**2.84**	**2.98**	**0.87**	**1.24**	**0.801**	**1.78**	**1.92**	**0.528**
Nitrite as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	<0.2	**0.43**	-	-	<0.2	**0.31**	**0.32**	<0.2	**0.21**	**0.26**	**0.43**	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**1.06**	**0.826**	**1.44**	**0.768**	**1.07**	**2.78**	**2.75**	-	**3.48**	**3.05**	**3.24**	**1.3**	**1.24**	**0.801**	**1.78**	**1.92**	**0.528**
Anions																	
Chloride (mg/L)	**97.3**	**92.2**	**90.7**	**88.3**	**93.2**	**106**	**115**	**125**	**109**	**97.2**	**97.6**	**100**	**91.5**	**87.6**	**93.1**	**85.8**	**81.5**
Sulfate (mg/L)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Elements																	
Dissolved Iron (mg/L)	**0.667**	-	**0.138**	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**-**	-	**-**	**-**
Dissolved Manganese (mg/L)	**0.088**	-	<0.02	<0.02	**-**	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	**-**	-	**-**	**-**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	-	-	**37.2**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Other																	
DOC (mg/L)	**0.612**	-	<0.5	**0.579**	**0.856**	**2.26**	**2.91**	**1.21**	**1.76**	**0.914**	**1.4**	**0.671**	**1.52**	**-**	-	**-**	**-**
Methane (µg/L)	<2	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**18**	**16**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BU2C**																		**MW-BC1C**	
Top of Screen Elevation (ft)	5.10																		2.5	
Bottom of Screen Elevation (ft)	-4.90																		-7.5	
Sampling Date	11/03/2016[1]	11/17/2016	1/10/2017	2/23/2017	6/29/2017	9/12/2017	1/10/2018	4/18/2018	9/20/2018	1/3/2019	4/11/2019	7/25/2019	11/6/2019	2/20/2020	5/13/2020	8/12/2020	11/16/2020	3/3/2021	10/4/2016	4/19/2018
Type of Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	Sample	Q5 Sample
Field Measurements																				
pH (SU)	7.14	5.46	5.49	5.62	5.27	5.26	4.85	5.12	4.36	4.64	5.23	5.48	4.96	5.31	5.44	5.25	5.24	5.20	5.48	5.47
Temperature (^{o}C)	15.20	14.89	12.78	14.78	15.22	15.67	14.76	15.2	15.0	14.9	15.0	16.3	15.8	14.5	15.1	17.8	15.3	14.0	13.37	13.2
Dissolved Oxygen (DO, mg/L)	1.31	2.17	2.40	5.96	11.94	5.59	6.22	6.05	6.59	6.20	7.72	6.43	7.31	6.30	7.97	6.40	6.77	5.93	7.75	7.94
Redox Potential (ORP; mV)	203.00	51.20	194.10	227.50	249.50	208.60	243.90	162.7	101.3	145.9	28.4	20.5	182.5	187.9	270.2	250.1	174.4	175.1	70.10	211.1
Specific Conductivity (µS/cm)[c]	535.00	516.00	569.00	367.00	579.00	658.00	630.00	538.2	618.0	531.0	467.0	487.3	332.0	410.0	346.0	478.1	321.0	315.0	1029.00	1122.0
Turbidity (NTU)	11.40	14.20	5.55	7.33	2.08	11.35	3.86	5.72	5.19	1.69	1.71	4.53	5.81	2.93	5.08	6.20	0.02	2.51	-	1.13
Laboratory Analyses																				
Nitrogen																				
Nitrate as N (mg/L)	**5.39**	-	**7.42**	**1.78**	**5.39**	**6.35**	**8.03**	**5.78**	**7.35**	**5.68**	**5.87**	**6.27**	**0.91**	**3.11**	**1.76**	**7.41**	**3.94**	**1.26**	**0.481**	**0.75**
Nitrite as N (mg/L)	<0.01	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01
Ammonia (mg/L)	<0.1	-	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	<0.2	**0.55**	-	-	<0.2	**0.26**	**0.22**	<0.2	<0.2	**0.25**	**0.42**	<0.2	-	-	-	**-**	-	-
Total Nitrogen (mg/L)	**5.39**	-	-	**2.32**	**5.39**	**6.35**	**8.03**	**6.04**	-	**5.68**	**5.87**	**6.52**	**1.34**	**3.11**	**1.76**	**7.41**	**3.94**	**1.26**	**0.481**	**1.19**
Anions																				
Chloride (mg/L)	**134**	-	**143**	**96.8**	**146**	**174**	**165**	**162**	**169**	**135**	**149**	**129**	**99.4**	**99.2**	**84.1**	**126**	**76**	**86.3**	**438**	**279**
Sulfate (mg/L)	<5	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	**11.5**	**9.2**
Elements																				
Dissolved Iron (mg/L)	**0.817**	-	-	<0.1	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**-**	-	**-**	**-**	-	<0.2
Dissolved Manganese (mg/L)	**0.26**	-	-	**0.077**	**0.081**	**-**	**0.076**	**0.078**	**0.078**	**0.064**	**0.067**	**0.06**	**0.041**	**0.044**	**-**	-	**-**	**-**	-	**0.066**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**	-	-
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**	-	-
Boron (mg/L)	<0.05	-	-	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**	**-**	-
Sodium (mg/L)	-	-	-	**44.9**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**	**-**	-
Other																				
DOC (mg/L)	**0.684**	**0.728**	<0.5	<0.5	**0.599**	**1.35**	**2.2**	**3.35**	**0.847**	**1.24**	**1.05**	**1.75**	**0.892**	**1.4**	**-**	-	**-**	**-**	<0.5	**1.99**
Methane (µg/L)	<2	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	**-**	-	**-**	**-**	-	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**	-	-
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**	-	-
Alkalinity as CaCO3 (mg/L)	-	**13**	**11**	**17**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**	-	**-**

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5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BC2C**																	
Top of Screen Elevation (ft)	-1.48																	
Bottom of Screen Elevation (ft)	-11.48																	
Sampling Date	11/04/2016	11/17/2016	1/10/2017	2/24/2017	6/29/2017	9/13/2017	1/10/2018	4/19/2018	9/20/2018	1/2/2019	4/9/2019	7/25/2019	11/6/2019	2/19/2020	5/14/2020	8/12/2020	11/18/2020	3/4/2021
Type of Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																		
pH (SU)	7.05	5.40	5.55	5.17	5.28	5.30	5.01	5.27	5.60	5.38	5.15	5.60	4.90	5.36	5.24	5.41	5.29	7.02
Temperature (^{o}C)	15.25	14.54	12.65	15.10	15.07	15.49	14.62	14.2	19.5	13.6	14.6	16.5	15.3	14.9	14.6	18.1	14.2	13.6
Dissolved Oxygen (DO, mg/L)	1.65	1.67	1.87	5.73	12.16	4.94	5.20	5.01	4.13	4.83	5.15	4.67	5.42	4.46	4.67	3.99	5.09	3.20
Redox Potential (ORP; mV)	74.80	100.70	169.00	259.10	239.90	256.70	184.90	215.0	165.2	161.3	195.9	188.9	183.9	87.1	257.9	186.9	184.8	200.1
Specific Conductivity (µS/cm)[c]	368.00	340.00	363.00	332.00	361.00	416.00	391.00	482.7	480.0	420.0	363.0	373.4	336.0	469.0	804.0	487.0	360.0	431.8
Turbidity (NTU)	6.00	19.20	16.60	20.40	3.76	2.62	2.40	0.37	478.00	0.32	6.11	10.50	5.16	1.97	0.05	5.50	5.80	9.40
Laboratory Analyses																		
Nitrogen																		
Nitrate as N (mg/L)	**4.16**	-	**5.91**	**3.32**	**3.42**	**3.13**	**4.25**	**3.26**	**0.407**	**2.29**	**3.18**	**2.9**	**0.981**	**1.88**	**2.09**	**0.392**	**1.86**	**0.294**
Nitrite as N (mg/L)	-	-	<0.01	<0.01	<0.01	<0.01	**0.08**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.011**
Ammonia (mg/L)	<0.1	-	<0.1	<0.1	<0.1	**0.12**	<0.1	<0.1	<0.1	<0.1	**0.14**	<0.1	<0.1	<0.1	<0.1	**0.91**	**0.15**	**0.26**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	<0.2	**0.92**	-	**-**	<0.2	-	**0.56**	**0.33**	**0.5**	**0.29**	**0.44**	**0.23**	<0.2	-	-	**-**
Total Nitrogen (mg/L)	**4.43**	-	-	**4.24**	**3.42**	**3.13**	**4.33**	**3.61**	**-**	**2.62**	**3.67**	**3.19**	**1.42**	**2.11**	**2.09**	**3.25**	**2.07**	**0.565**
Anions																		
Chloride (mg/L)	**83.8**	-	**85.4**	**83.3**	**86.5**	**92.5**	**96**	**103**	**10**	**104**	**97.5**	**94.1**	**94**	**122**	**235**	**25.2**	**107**	**1420**
Sulfate (mg/L)	**6.4**	-	<5	**6.3**	<5	<5	**5.3**	**7**	**12.2**	<5	<5	**7.8**	**6.6**	**5.5**	**5.6**	**9.6**	**7.4**	**28.4**
Elements																		
Dissolved Iron (mg/L)	-	-	-	<0.1	<0.1	**-**	<0.1	<0.2	**0.131**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.721**	<0.1	**0.14**
Dissolved Manganese (mg/L)	-	-	-	**0.092**	**0.062**	**-**	**0.063**	**0.05**	<0.02	**0.089**	**0.046**	**0.045**	**0.042**	**0.07**	**0.049**	**0.241**	**0.027**	**0.138**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	**-**
Boron (mg/L)	-	-	-	<0.05	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	41.8	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																		
DOC (mg/L)	**0.764**	**0.576**	<0.5	**1.54**	**1.68**	**3.32**	**1.67**	**3.31**	**2.68**	**2.44**	**1.05**	**2.29**	**0.87**	**0.532**	**1.71**	**11**	**1.19**	**1.26**
Methane (µg/L)	-	-	-	-	-	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	**-**
Alkalinity as CaCO3 (mg/L)	-	**8**	**9**	**9**	-	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BC3B**														
Top of Screen Elevation (ft)	-10.80														
Bottom of Screen Elevation (ft)	-20.80														
Sampling Date	3/27/2017	6/29/2017	9/13/2017	1/10/2018	4/19/2018	9/20/2018	1/2/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements															
pH (SU)	5.38	5.31	5.41	5.09	5.32	4.42	5.07	5.46	5.21	5.00	5.09	5.06	5.16	5.20	5.27
Temperature (^{o}C)	14.19	14.13	14.24	14.22	13.9	14.1	13.8	14.0	14.5	13.9	14.0	13.8	16.1	14.5	13.7
Dissolved Oxygen (DO, mg/L)	2.50	6.98	3.29	3.27	3.40	3.41	3.13	5.26	4.36	4.09	4.70	2.89	4.35	5.04	4.70
Redox Potential (ORP; mV)	113.80	251.90	238.30	137.40	191.4	104.5	99.8	74.9	245.9	191.6	149.5	241.7	346.8	156.7	271.20
Specific Conductivity (µS/cm)[c]	518.00	611.00	630.00	559.00	539.0	581.0	553.0	404.0	671.0	713.0	754.0	685.0	864.0	840.0	538.0
Turbidity (NTU)	5.69	16.40	5.82	4.65	2.82	3.62	0.02	1.01	0.31	0.02	0.59	1.24	0.02	3.33	0.02
Laboratory Analyses															
Nitrogen															
Nitrate as N (mg/L)	**2.2**	**4.59**	**3.45**	**4.26**	**3.45**	**4.96**	**3.32**	**3.66**	**1.8**	**1.85**	**3.74**	**3.7**	**3.31**	**3.51**	**0.78**
Nitrite as N (mg/L)	**0.032**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	**0.91**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.42**	<0.1	<0.1	<0.1	<0.1	**0.34**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	-	<0.2	-	**0.31**	**0.23**	**0.47**	<0.2	<0.2	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**2.59**	**4.59**	**3.45**	**4.26**	**3.69**	**-**	**3.55**	**4.14**	**1.8**	**1.85**	**3.74**	**3.7**	**3.31**	**3.51**	**0.78**
Anions															
Chloride (mg/L)	**143**	**161**	**153**	**140**	**136**	**154**	**128**	**130**	**172**	**228**	**196**	**179**	**256**	**210**	**326**
Sulfate (mg/L)	**8.3**	**6.8**	**9.1**	**13.6**	**12.6**	**10.4**	**5.1**	<5	**10.3**	**16.1**	**15.6**	**8.7**	**17**	**19**	**8.3**
Elements															
Dissolved Iron (mg/L)	<0.1	<0.1	**-**	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	**1.63**	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.298**	**0.077**	**-**	**0.078**	**0.048**	**0.046**	**0.05**	**0.038**	**0.043**	**0.046**	**1.34**	**0.072**	**0.08**	**0.078**	<0.02
Total Arsenic (mg/L)	-	-	-	-	-	-	<0.025	<0.025	<0.025	<0.05	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	<0.005	<0.005	<0.005	<0.001	<0.001
Boron (mg/L)	-	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other															
DOC (mg/L)	**1.86**	**1.02**	**3.79**	**2.36**	**4.95**	**1.65**	**2.15**	**3.39**	**1.95**	**1.99**	**1.7**	**1.48**	**2**	**1.26**	**1.04**
Methane (µg/L)	-	-	-	**-**	**-**	-	-	**-**	**-**	**-**	<2	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	<3	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	<5	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BX1B**														
Top of Screen Elevation (ft)	-9.40														
Bottom of Screen Elevation (ft)	-19.40														
Sampling Date	3/27/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/25/2018	1/3/2019	4/11/2019	7/24/2019	11/7/2019	2/19/2020	5/13/2020	8/13/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements															
pH (SU)	4.67	5.05	5.03	4.04	4.77	6.56	6.00	6.54	6.36	6.05	6.29	6.27	6.17	6.50	6.68
Temperature (^{o}C)	13.76	14.28	14.50	13.33	14.1	14.2	14.2	14.2	15.0	14.3	13.9	14.6	15.2	14.0	13.6
Dissolved Oxygen (DO, mg/L)	1.73	1.87	0.07	0.09	0.60	0.37	0.10	0.09	0.07	0.48	0.08	0.09	0.26	0.09	0.11
Redox Potential (ORP; mV)	153.70	283.60	202.90	302.90	207.9	-111.6	-105.8	-147.7	-156.0	-85.3	-113.9	-80.9	-12.5	-113.7	-105.3
Specific Conductivity (µS/cm)[c]	367.00	446.00	470.00	468.00	456.2	574.0	708.0	685.0	722.0	531.0	643.0	584.0	473.2	404.0	428.0
Turbidity (NTU)	29.80	326.00	19.44	68.80	100.00	218.00	4.14	6.70	5.32	0.02	1.60	4.10	1.18	10.00	10.20
Laboratory Analyses															
Nitrogen															
Nitrate as N (mg/L)	**11.4**	**34.4**	**39**	**10**	**28.5**	<0.03	<0.03	**0.173**	**0.16**	<0.03	**0.357**	**0.724**	**1.29**	**0.588**	**9.99**
Nitrite as N (mg/L)	**0.018**	<0.01	<0.01	<0.01	<0.01	**0.049**	**0.041**	**0.066**	**0.072**	**0.048**	**0.097**	**0.081**	**0.09**	**0.059**	**0.071**
Ammonia (mg/L)	**0.4**	**0.7**	**0.39**	**0.51**	**0.44**	<0.1	<0.1	<0.1	**0.14**	**0.21**	**0.12**	**0.21**	**0.19**	**0.28**	**1.11**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	-	<0.2	<0.2	**2.14**	**1.29**	**0.88**	**0.85**	**0.91**	**0.61**	-	**-**	-	**-**
Total Nitrogen (mg/L)	**12.9**	**37**	**39**	**10**	**28.5**		**1.29**	**1.12**	**1.08**	**0.988**	**1.07**	**1.44**	**2.05**	**1.47**	**11.3**
Anions															
Chloride (mg/L)	**43.1**	**41**	**37.9**	**33.4**	**47.1**	**38.5**	**37.9**	**27.3**	**29.4**	**33.3**	**28.2**	**-**	**28**	**-**	**45.7**
Sulfate (mg/L)	**7.6**	<5	<5	<5	**8.4**	**44**	**29.8**	**27.7**	**18.6**	**11.1**	**5.5**	**-**	**6.3**	**-**	**10.3**
Elements															
Dissolved Iron (mg/L)	<0.1	<0.1	**-**	<0.1	<0.1	**67.6**	**75.4**	**113**	**152**	**-**	**-**	**90.6**	**87**	**66.6**	**15.9**
Dissolved Manganese (mg/L)	**0.335**	**0.478**	**-**	**0.631**	**0.658**	**5.03**	**3.44**	**2.68**	**2.58**	**-**	**-**	**2.53**	**2.89**	**2.97**	**0.905**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	-	-	**-**	**0.052**	**0.056**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**
Sodium (mg/L)	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**
Other															
DOC (mg/L)	**2.97**	**1.55**	**2.31**	**5.16**	**6.5**	**80.7**	**28.2**	**64**	**112**	**-**	**-**	**50.6**	**45**	**18**	**7.36**
Methane (µg/L)	-	**-**	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	**16600**	**12400**	**13400**	**6460**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BX1C**														
Top of Screen Elevation (ft)	5.37														
Bottom of Screen Elevation (ft)	-4.63														
Sampling Date	3/27/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/25/2018	1/3/2019	4/11/2019	7/24/2019	11/7/2019	2/19/2020	5/13/2020	8/13/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements															
pH (SU)	4.44	4.70	4.80	3.89	4.59	4.82	5.62	6.23	6.21	5.88	5.94	5.76	5.93	6.25	6.18
Temperature (^{o}C)	13.87	14.32	14.44	13.44	14.1	13.5	14.4	14.3	14.8	15.0	14.1	14.5	15.2	14.0	14.0
Dissolved Oxygen (DO, mg/L)	0.63	2.30	0.79	1.56	1.30	1.10	0.01	0.05	0.07	0.74	0.16	0.07	0.19	0.10	0.12
Redox Potential (ORP; mV)	199.90	315.80	232.40	328.60	230.9	-29.7	-55.9	-124.4	-124.5	-84.7	-66.4	12.9	27.6	-72.4	-2.1
Specific Conductivity (µS/cm)[c]	521.00	473.00	447.00	499.00	450.0	499.0	556.0	573.0	654.0	770.0	539.0	536.0	425.7	454.0	386.0
Turbidity (NTU)	0.98	55.80	7.11	5.93	0.50	26.30	3.21	4.40	7.54	5.21	4.98	5.75	7.13	10.80	3.61
Laboratory Analyses															
Nitrogen															
Nitrate as N (mg/L)	**0.25**	**38.7**	**37.8**	**11.1**	**27.7**	**5.77**	**8.69**	**13**	**3.63**	<0.03	**15.9**	**17.5**	**17.3**	**11.5**	**0.581**
Nitrite as N (mg/L)	**0.012**	<0.01	<0.01	**0.074**	**0.016**	**0.118**	**0.027**	**0.037**	**0.07**	**0.034**	**0.037**	**0.066**	**0.028**	**0.034**	**0.084**
Ammonia (mg/L)	**1.09**	**0.5**	**0.22**	**0.18**	**0.37**	**0.16**	**0.33**	**0.8**	**0.51**	**0.14**	**0.69**	**1.09**	**0.97**	**1.04**	**0.19**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-		<0.2	<0.2	**2.9**	**1.95**	**2.36**	**2.18**	**2.36**	**1.49**	-	**-**	-	**-**
Total Nitrogen (mg/L)	**1.52**	**42**	**37.8**	**11.2**	**27.7**		**10.7**	**15.4**	**5.88**	**2.36**	**17.5**	**18.7**	**18.5**	**13.7**	**1.19**
Anions															
Chloride (mg/L)	**49.6**	**40.8**	**37.3**	**34.5**	**52.6**	**45.9**	**49.7**	**40.7**	**37.4**	**36.4**	**44.1**	**-**	**38.7**	**-**	**24.8**
Sulfate (mg/L)	<5	<5	<5	<5	**10**	**18.1**	**13.1**	**8**	**16.8**	**16.4**	**10.8**	**-**	**6.9**	**-**	**12.7**
Elements															
Dissolved Iron (mg/L)	<0.1	<0.1	**-**	<0.1	<0.1	**24.2**	**31.9**	**45.3**	**75.6**	**-**	**-**	**19.1**	**24.7**	**39.7**	**85.7**
Dissolved Manganese (mg/L)	**0.566**	**0.517**	**-**	**0.553**	**0.501**	**1.98**	**2.13**	**1.55**	**1.99**	**-**	**-**	**0.864**	**1.03**	**1.32**	**2.44**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	-	-	**-**	**0.052**	**0.057**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**
Sodium (mg/L)	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**
Other															
DOC (mg/L)	**2.7**	**2.02**	**2.69**	**4.53**	**6.38**	**78.7**	**32.7**	**31.4**	**62.7**	**-**	**-**	**12.3**	**12.7**	**11.6**	**17.8**
Methane (µg/L)	-	**-**	**-**	**-**	**-**	**-**	**-**	-	**-**	**7870**	**-**	**13200**	**13800**	**12200**	**11600**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	<3	**-**	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	<5	**-**	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	-	**-**	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1010C**																	
Top of Screen Elevation (ft)	-0.10																	
Bottom of Screen Elevation (ft)	-10.10																	
Sampling Date	11/03/2016[1]	11/17/2016	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/9/2018	4/18/2018	9/19/2018	1/3/2019	4/10/2019	7/25/2019	11/6/2019	2/19/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																		
pH (SU)	6.90	5.18	5.61	5.32	5.36	5.68	5.23	5.70	6.48	6.56	6.45	6.51	6.30	6.72	6.76	6.83	6.97	7.22
Temperature (^{o}C)	14.60	14.28	12.22	14.69	15.04	15.97	13.43	14.4	15.4	13.8	14.8	15.4	14.6	14.6	14.5	17.1	14.2	14.2
Dissolved Oxygen (DO, mg/L)	0.87	0.71	0.49	1.07	1.39	0.12	2.11	2.19	0.07	0.29	0.04	0.10	0.32	0.08	0.16	0.20	0.13	0.27
Redox Potential (ORP; mV)	110.70	231.60	190.80	252.20	204.80	2.70	86.20	-28.5	-121.7	-104.1	-158.0	-143.8	-128.2	-173.1	-146.2	-158.9	-178.1	-197.9
Specific Conductivity (µS/cm)[c]	262.00	230.00	289.00	258.00	269.00	238.00	249.00	240.0	920.0	835.0	786.0	869.0	799.0	889.0	784.0	804.0	717.0	563.0
Turbidity (NTU)	16.00	5.97	10.60	5.62	2.73	2.99	5.15	0.50	9.60	1.09	5.96	8.81	12.20	3.22	1.67	5.90	9.55	0.20
Laboratory Analyses																		
Nitrogen																		
Nitrate as N (mg/L)	**13.6**	-	**6.74**	**9.94**	**13.8**	**2.49**	**2.76**	**6.66**	<0.03	<0.03	<0.21	<0.21	<0.03	<0.21	<0.21	<0.21	<0.21	**0.638**
Nitrite as N (mg/L)	-	-	**0.509**	**0.474**	**0.171**	**0.185**	**0.052**	**0.026**	**0.049**	**0.036**	**0.05**	**0.051**	**0.062**	**0.109**	**0.097**	**0.121**	**0.104**	**0.104**
Ammonia (mg/L)	<0.1	-	<0.1	**0.18**	<0.1	<0.1	**0.13**	**0.16**	<0.1	**0.16**	**0.29**	**0.38**	**0.48**	**0.25**	**0.17**	**0.16**	**0.45**	**0.26**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	**1.36**	**1.95**	-	-	**0.88**	**1.03**	**1.9**	**2.02**	**2.25**	**1.1**	**1.44**	**1.65**	-	-	-	**-**
Total Nitrogen (mg/L)	**13.9**	-	**8.61**	**12.4**	**15.7**	**4.22**	**3.69**	**7.72**	-	**2.02**	**2.25**	**1.1**	**1.44**	**1.65**	**0.814**	**0.912**	**1.27**	**1.48**
Anions																		
Chloride (mg/L)	**27.5**	-	**24.3**	**25.2**	**24.2**	**23.6**	**22.6**	**21.5**	**27.5**	**26.5**	**23.5**	**23.4**	**24.5**	**21.7**	**25.8**	**21.8**	**21.7**	**21**
Sulfate (mg/L)	-	-	**23.7**	**16.5**	**11**	**22.6**	**10.8**	**14.3**	**19.9**	**15.7**	**12.8**	**20.3**	**21.3**	<5	**13.5**	<5	**24.8**	**5**
Elements																		
Dissolved Iron (mg/L)	-	-	-	<0.1	**0.143**	**3.88**	**9.69**	**9.62**	**87**	**83.4**	**105**	**104**	**127**	**97.2**	**90.5**	**126**	**139**	**123**
Dissolved Manganese (mg/L)	-	-	-	**0.234**	**0.324**	**0.996**	**0.531**	**0.6**	**5.78**	**4.49**	**5.14**	**5.3**	**5.44**	**4.38**	**4.42**	**4.07**	**4**	**3.73**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	**-**	**-**
Boron (mg/L)	-	-	-	<0.05	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	**22.8**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Other																		
DOC (mg/L)	-	**0.696**	-	**13.9**	**16.9**	**21.4**	**13.6**	**13**	**321**	**78.3**	**85.2**	**62.5**	**48.2**	**46.4**	**36.4**	**17.4**	**21.1**	**64.3**
Methane (µg/L)	-	-	-	-	<2	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	**16700**	**14700**	**9820**	**13100**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	**11**	**31**	**15**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**

Notes:

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1020B**																
Top of Screen Elevation (ft)	-10.4																
Bottom of Screen Elevation (ft)	-20.4																
Sampling Date	11/04/2016[1]	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/19/2018	1/3/2019	4/10/2019	7/25/2019	11/6/2019	2/19/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	6.78	5.20	5.01	5.00	5.12	4.54	5.00	5.93	6.36	6.40	6.23	6.05	6.30	6.29	6.32	6.30	6.61
Temperature (^{o}C)	13.70	11.94	14.13	14.71	15.69	13.82	14.4	21.9	13.9	14.7	5.5	14.7	14.3	14.3	15.8	14.3	14.0
Dissolved Oxygen (DO, mg/L)	1.03	0.60	2.77	1.44	0.20	0.16	5.90	4.05	0.16	0.14	0.17	0.30	0.17	0.14	0.14	0.15	0.23
Redox Potential (ORP; mV)	45.00	190.70	251.30	276.30	160.30	166.20	132.0	-65.0	-67.1	-154.2	-86.8	-83.8	-107.4	-101.3	-73.4	-108.8	-87.5
Specific Conductivity (µS/cm)[c]	465.00	355.00	353.00	352.00	332.00	288.00	302.8	1366.0	729.0	573.0	566.9	484.0	619.0	553.0	546.4	505.0	411.0
Turbidity (NTU)	67.90	321.00	11.00	14.60	2.50	2.84	0.50	207.00	3.66	5.57	9.76	5.33	5.84	0.05	9.60	0.84	1.88
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**28.4**	**17.9**	**20.1**	**24.9**	**19.7**	**4.71**	**18.3**	<0.03	**0.772**	<0.21	<0.03	**0.15**	**1.34**	**0.322**	<0.03	<0.03	<0.03
Nitrite as N (mg/L)	-	<0.01	<0.01	**0.158**	**0.076**	**0.091**	**0.028**	**0.02**	**0.072**	**0.023**	**0.034**	**0.026**	**0.08**	**0.056**	**0.068**	**0.043**	**0.053**
Ammonia (mg/L)	**0.53**	**0.11**	<0.1	<0.1	<0.1	**0.14**	<0.1	**0.21**	**0.18**	**0.22**	**0.32**	**0.5**	**0.39**	**0.43**	**0.36**	**0.55**	**0.38**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**1.79**	**2.92**	-	-	<0.2	<0.2	**5.48**	**1.76**	**2.07**	**0.84**	**1.73**	**1.04**	-	-	-	**-**
Total Nitrogen (mg/L)	**28.5**	**19.6**	**23**	**27.1**	**19.7**	**4.8**	**18.3**	-	**2.61**	**2.07**	**0.838**	**1.91**	**2.47**	**1.32**	**0.73**	**1.3**	**0.672**
Anions																	
Chloride (mg/L)	**49.8**	**33.6**	**34**	**32.3**	**30**	**25.1**	**25.2**	**35.1**	**35**	**30.2**	**34.1**	**33.6**	**33.2**	**36.5**	**32.3**	**33.7**	**68**
Sulfate (mg/L)	-	<5	<5	<5	<5	**6.8**	**6.1**	**33**	**16.4**	**21.4**	**25.7**	**28.5**	**10.8**	**27.2**	**12.4**	**31.5**	**26.3**
Elements																	
Dissolved Iron (mg/L)	**2.52**	-	**0.153**	<0.1	<0.1	<0.1	<0.1	**10**	**52.3**	**39.3**	**54**	**55.2**	**58.4**	**53.4**	**48.2**	**46.1**	**41.8**
Dissolved Manganese (mg/L)	**0.948**	-	**0.293**	**0.333**	**0.32**	**0.307**	**0.326**	**0.896**	**5.3**	**4.91**	**4.35**	**4.32**	**3.91**	**4.15**	**4.6**	**3.88**	**3.21**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	-	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	-	-	-	**-**	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	-	**0.053**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	**27.5**	-	**24.6**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Other																	
DOC (mg/L)	-	-	**1.11**	**3.24**	**3.67**	**6.02**	**5.43**	**668**	**82.1**	**14.9**	**19**	**4.99**	**5.87**	**5.89**	**2.31**	**3.21**	**5.87**
Methane (µg/L)	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**9**	**6**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1020C**																	
Top of Screen Elevation (ft)	4.50																	
Bottom of Screen Elevation (ft)	-5.50																	
Sampling Date	11/04/2016[1]	11/17/2016	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/8/2018	4/18/2018	9/19/2018	1/3/2019	4/10/2019	7/25/2019	11/6/2019	2/19/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																		
pH (SU)	6.88	5.27	5.38	5.17	5.16	5.22	4.54	5.09	5.74	6.26	5.96	6.21	6.13	6.40	6.25	6.33	6.34	6.80
Temperature (^{o}C)	14.24	14.66	12.73	15.06	15.26	15.97	13.97	14.9	21.4	14.3	14.9	16.0	14.9	15.0	14.5	16.6	14.7	14.6
Dissolved Oxygen (DO, mg/L)	1.44	0.56	0.31	2.69	3.72	1.81	3.78	4.05	0.74	1.29	0.07	0.21	0.34	0.07	0.14	0.11	0.12	0.17
Redox Potential (ORP; mV)	50.30	106.70	194.80	292.20	277.20	161.90	204.20	150.8	29.6	-36.2	-106.4	-90.1	-90.5	-120.4	-79.6	-77.2	-67.2	-105.3
Specific Conductivity (µS/cm)[c]	242.00	227.00	269.00	253.00	247.00	161.90	201.00	212.9	228.0	352.0	378.0	621.0	551.0	756.0	575.0	663.0	490.0	500.0
Turbidity (NTU)	321.00	15.60	6.31	18.00	8.87	243.00	14.60	1.17	30.00	4.33	6.67	5.02	8.38	2.98	0.05	6.68	2.61	4.53
Laboratory Analyses																		
Nitrogen																		
Nitrate as N (mg/L)	**10.6**	-	**11.1**	**12.6**	**13.9**	**12.4**	**2.97**	**9.7**	**1.92**	**0.492**	<0.03	<0.03	<0.03	<0.21	<0.03	<0.21	<0.03	<0.03
Nitrite as N (mg/L)	-	-	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.033**	**0.021**	**0.081**	**0.042**	**0.033**	**0.079**	**0.062**	**0.068**	**0.054**	**0.081**
Ammonia (mg/L)	<0.1	-	**0.19**	<0.1	<0.1	<0.1	**0.14**	<0.1	**0.14**	**0.11**	<0.1	<0.1	<0.1	**0.15**	**0.17**	**0.17**	**0.25**	**0.27**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	**1.99**	**2.25**	-	-	<0.2	<0.2	**1.33**	**2.12**	**1.76**	**0.77**	**1.32**	**0.53**	-	-	-	**-**
Total Nitrogen (mg/L)	**10.6**	-	**13.1**	**14.9**	**15**	**12.4**	**2.97**	**9.7**	-	**2.63**	**1.8**	**0.766**	**1.32**	**0.61**	**0.545**	**0.625**	**0.989**	**0.353**
Anions																		
Chloride (mg/L)	**25.5**	-	**25.6**	**25.6**	**24.8**	**24.1**	**18.7**	**18.7**	**16.7**	**24.5**	**26.2**	**29.5**	**28.9**	**26**	**27.7**	**27.9**	**21.3**	**70.1**
Sulfate (mg/L)	-	-	**5.6**	**6.1**	**5.8**	**5.8**	**6.7**	**8**	**20.4**	**11.6**	**19.4**	**54.5**	**44.5**	**18.9**	**28.8**	**22.5**	**33.5**	**15.6**
Elements																		
Dissolved Iron (mg/L)	**2.23**	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	**5.58**	**26.9**	**26.1**	**52.7**	**70.8**	**86.2**	**54.8**	**60.7**	**53.4**	**72.8**
Dissolved Manganese (mg/L)	**0.249**	-	-	**0.076**	**0.057**	**0.042**	**0.054**	**0.06**	**0.249**	**0.815**	**1.55**	**3.9**	**3.67**	**4.2**	**3.71**	**4.64**	**3.3**	**2.66**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**0.05**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	<0.05	**0.012**	**0.036**	**0.008**	**0.009**	**0.01**
Boron (mg/L)	**0.085**	-	-	**0.083**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	**13.4**	-	-	**18.4**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**
Other																		
DOC (mg/L)	-	**0.85**	-	**1.02**	**1.34**	**2.19**	**4.52**	**6.02**	**45.5**	**35.1**	**14.9**	**20**	**12.5**	**31.3**	**16.9**	**12.7**	**6.73**	**21.7**
Methane (µg/L)	-	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**	**31.4**	**445**	**2020**	**4730**	**1990**	**5900**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	<3	<3	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	**13**	**11**	**8**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1050A**																
Top of Screen Elevation (ft)	-26.1																
Bottom of Screen Elevation (ft)	-36.1																
Sampling Date	11/04/2016[1]	1/5/2017	2/23/2017	6/28/2017	9/12/2017	1/9/2018	4/18/2018	9/25/2018	1/4/2019	4/10/2019	7/25/2019	11/7/2019	2/20/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	7.15	5.60	5.50	5.00	5.27	5.06	5.35	6.19	6.57	6.76	6.27	6.10	6.35	6.37	6.45	6.10	8.74
Temperature (^{o}C)	13.77	11.87	14.05	14.27	15.87	14.11	14.3	14.8	13.7	14.7	15.3	15.7	14.0	14.9	17.0	15.7	13.6
Dissolved Oxygen (DO, mg/L)	1.34	0.26	4.24	1.75	0.06	0.75	1.90	0.18	0.27	0.13	0.03	0.24	0.20	0.08	0.11	0.27	1.06
Redox Potential (ORP; mV)	43.00	142.20	226.20	264.40	174.20	129.60	182.9	-52.1	-92.7	-113.1	-58.8	-7.0	-26.3	-52.5	-118.5	29.9	199.3
Specific Conductivity (µS/cm)[c]	612.00	505.00	1648.00	508.00	422.00	1486.00	281.5	457.0	671.0	166.0	315.2	219.0	267.0	316.0	467.8	74.0	2064.0
Turbidity (NTU)	962.00	297.00	76.60	4.10	3.10	9.57	5.70	8.10	0.99	5.55	4.28	12.70	8.20	4.95	15.70	2.02	190.00
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**37**	**26.6**	**11.8**	**26.8**	**26.7**	**4.89**	**13.1**	**11.7**	**0.806**	**0.135**	**0.585**	**0.163**	**0.124**	**0.106**	**0.0887**	**0.0429**	**0.24**
Nitrite as N (mg/L)	-	**0.105**	<0.01	**0.038**	**0.048**	**0.141**	**0.016**	**0.196**	**0.063**	**0.042**	**0.066**	**0.042**	**0.013**	**0.022**	**0.065**	**0.017**	<0.01
Ammonia (mg/L)	**1.93**	**1.72**	**0.54**	**0.57**	**1.24**	**0.38**	**0.28**	**0.28**	**0.21**	**0.32**	**1.04**	**0.3**	**0.23**	**0.35**	**0.87**	**0.24**	**0.28**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**3.75**	**1.83**	-	-	<0.2	<0.2	**1.85**	**0.78**	**0.92**	**1.59**	**0.93**	**0.49**	-	-	-	**-**
Total Nitrogen (mg/L)	**37.2**	**30.5**	**13.7**	**26.8**	**26.7**	**5.03**	**13.1**		**1.65**	**1.09**	**2.24**	**1.14**	**0.625**	**0.704**	**1.65**	**1.16**	**1.62**
Anions																	
Chloride (mg/L)	**54.8**	**48.9**	**399**	**48.9**	**41.4**	**429**	**44.8**	**63.7**	**44**	**23.3**	**38.3**	**26.4**	**44.6**	**46.7**	**63.2**	**10.4**	**651**
Sulfate (mg/L)	-	**6.1**	<5	<5	<5	<5	<5	**27.1**	**15.3**	**9.7**	**15.2**	**10**	**5.3**	**9.9**	**11.4**	**7.7**	**21.8**
Elements																	
Dissolved Iron (mg/L)	**4.29**	-	<0.1	<0.1	**-**	<0.1	<0.1	**41.4**	**50.8**	**5.79**	**13.4**	**13**	**3.63**	**11.2**	**25.3**	**1.83**	<0.1
Dissolved Manganese (mg/L)	**0.655**	-	**0.18**	**0.654**	**-**	**0.236**	**0.214**	**1.95**	**3.13**	**0.636**	**1.01**	**1.04**	**0.478**	**0.819**	**1.61**	**0.449**	**0.198**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	**33.7**	-	**345**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Other																	
DOC (mg/L)	-	-	**0.808**	**1.85**	**3.72**	**2.83**	**3.96**	**28**	**17.8**	**4.64**	**4.8**	**4.07**	**2.45**	**2.29**	**3.42**	**2.39**	**2.09**
Methane (µg/L)	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**24**	**11**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**

Notes:

NS - Not Sampled

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1050B**															
Top of Screen Elevation (ft)	-11.1															
Bottom of Screen Elevation (ft)	-21.1															
Sampling Date	11/04/2016[1]	2/23/2017	6/28/2017	9/12/2017	1/9/2018	4/18/2018	9/25/2018	1/4/2019	4/10/2019	7/25/2019	11/7/2019	2/20/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																
pH (SU)	7.06	5.13	5.10	5.22	4.74	5.08	3.81	6.27	6.72	6.53	5.86	6.39	6.49	6.71	6.41	8.73
Temperature (^{o}C)	14.08	14.27	14.70	15.48	14.19	14.5	14.1	13.7	14.6	15.4	15.2	14.0	15.1	16.1	14.6	12.1
Dissolved Oxygen (DO, mg/L)	1.17	2.12	4.53	1.06	2.17	3.38	3.22	0.16	0.11	0.02	0.59	0.31	0.08	0.21	0.10	4.30
Redox Potential (ORP; mV)	80.30	304.40	260.10	203.80	160.40	306.5	151.8	-29.5	-114.7	-118.9	27.3	-74.0	-94.3	-175.5	-59.9	176.0
Specific Conductivity (µS/cm)[c]	446.00	463.00	387.00	340.00	392.00	306.0	345.0	936.0	508.0	931.0	229.0	914.0	1107.0	1318.0	393.0	1835.0
Turbidity (NTU)	3.97	7.20	0.72	2.75	5.06	5.03	3.87	0.50	9.43	8.16	9.99	2.32	6.59	14.40	0.70	246.00
Laboratory Analyses																
Nitrogen																
Nitrate as N (mg/L)	**25.7**	**28.7**	**18.2**	**18**	**10.8**	**20.1**	**24.3**	<0.03	<0.21	<0.03	<0.03	<0.03	<0.21	<0.21	<0.03	**0.553**
Nitrite as N (mg/L)	-	<0.01	<0.01	<0.01	<0.01	<0.01	**0.049**	**0.017**	**0.019**	**0.06**	<0.01	**0.11**	**0.095**	**0.171**	**0.05**	**0.028**
Ammonia (mg/L)	**0.19**	<0.1	<0.1	**0.14**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.69**	**0.17**	**0.26**	**0.48**	**0.4**	**0.26**	**0.43**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**1.85**	-	-	<0.2	<0.2	<0.2	**2.03**	**1.74**	**1.29**	**0.77**	**0.57**	-	-	-	**-**
Total Nitrogen (mg/L)	**26**	**30.5**	**18.2**	**18**	**10.8**	**20.1**		**2.03**	**1.74**	**1.29**	**0.766**	**0.572**	**1.22**	**1.14**	**1.05**	**7.01**
Anions																
Chloride (mg/L)	**48.2**	**50.7**	**41.7**	**38.2**	**36.7**	**29.1**	**36.8**	**39.6**	**23**	**38.2**	**13.2**	**34.6**	**38.9**	**35.5**	**18.2**	**535**
Sulfate (mg/L)	-	<5	<5	<5	<5	<5	<5	**14.6**	**18.2**	**59.5**	**26.7**	**22.9**	**18.6**	<5	**13.6**	**15.3**
Elements																
Dissolved Iron (mg/L)	**0.734**	<0.1	<0.1	**-**	<0.1	<0.1	<0.1	**33.4**	**37.7**	**85.7**	**8.91**	**101**	**109**	**151**	**30.3**	**0.214**
Dissolved Manganese (mg/L)	**0.332**	**0.142**	**0.101**	**-**	**0.115**	**0.128**	**0.147**	**5.85**	**3.17**	**4.86**	**1.22**	**5.09**	**5.57**	**5.89**	**2.82**	**0.152**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	**26.8**	**16.9**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Other																
DOC (mg/L)	-	**0.722**	**1.31**	**3.43**	**3.21**	**3.68**	**9.71**	**243**	**62.7**	**41.2**	**6.74**	**20.5**	**14.9**	**9.05**	**7.78**	**1.55**
Methane (µg/L)	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	**5650**	**8590**	**4880**	**1080**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	**7**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1050C**															
Top of Screen Elevation (ft)	4.9															
Bottom of Screen Elevation (ft)	-5.1															
Sampling Date	11/04/2016[1]	2/23/2017	6/28/2017	9/12/2017	1/9/2018	4/18/2018	9/25/2018	1/4/2019	4/10/2019	7/25/2019	11/7/2019	2/20/2020	5/13/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																
pH (SU)	7.20	5.43	5.34	5.38	4.96	5.40	5.38	4.94	6.44	7.10	5.96	5.93	6.21	6.16	6.21	8.77
Temperature (^{o}C)	14.55	14.95	15.06	15.77	14.51	14.9	14.6	14.9	15.0	15.6	15.5	13.6	15.4	16.8	14.9	14.4
Dissolved Oxygen (DO, mg/L)	1.34	1.83	5.39	1.85	1.64	1.82	2.16	0.12	0.11	0.05	0.39	0.09	0.14	0.18	1.60	0.35
Redox Potential (ORP; mV)	48.60	205.90	230.20	176.50	167.20	171.8	157.7	157.5	-88.8	-79.5	-5.9	189.2	-41.3	-42.6	-16.6	57.1
Specific Conductivity (µS/cm)[c]	571.00	511.00	542.00	478.00	413.00	302.3	212.0	275.0	486.0	774.0	416.0	347.0	674.0	605.0	238.0	1554.0
Turbidity (NTU)	8.21	2.27	0.98	3.23	1.90	0.80	1.51	0.02	3.02	6.46	4.92	4.66	2.28	1.62	2.15	5.98
Laboratory Analyses																
Nitrogen																
Nitrate as N (mg/L)	**3.83**	**3.96**	**3.26**	**4.18**	**2**	**5.76**	**8.43**	**3.54**	<0.21	<0.03	<0.03	<0.03	<0.03	<0.21	<0.03	<0.03
Nitrite as N (mg/L)	-	<0.01	<0.01	<0.01	**0.088**	<0.01	<0.01	**0.213**	**0.031**	**0.036**	**0.017**	**0.023**	**0.041**	**0.056**	**0.016**	**0.04**
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.13**	**0.21**	**0.19**	**0.33**	**0.25**	**0.22**	**0.24**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	1.28	-		<0.2	<0.2	<0.2	**0.48**	**0.98**	**0.73**	**0.94**	**0.41**	-	-	-	**-**
Total Nitrogen (mg/L)	**4.05**	**5.24**	**3.26**	**4.4**	**2.08**	**5.76**	-	**4.23**	**0.98**	**0.726**	**0.94**	**0.431**	**0.811**	**0.658**	**0.624**	**0.395**
Anions																
Chloride (mg/L)	**141**	**123**	**134**	**120**	**85.7**	**61.7**	**32.8**	**31.5**	**19.7**	**25.2**	**25.3**	**25**	**44.1**	**30.5**	**17.5**	**446**
Sulfate (mg/L)	-	**20.1**	**15.2**	**14.6**	**17.9**	**22.2**	**15.3**	**18.8**	**37**	**43**	**32.5**	**17.9**	**33.4**	**28.1**	**18.2**	**29.1**
Elements																
Dissolved Iron (mg/L)	**0.493**	<0.1	<0.1	**-**	<0.1	<0.1	<0.1	<0.1	**54.6**	**60.7**	**34.2**	**15**	**37.4**	**49.2**	**13.2**	**26.6**
Dissolved Manganese (mg/L)	**0.146**	**0.042**	**0.057**	**-**	**0.034**	**0.025**	**0.021**	**0.137**	**4.92**	**4.91**	**2.34**	**1.53**	**3.33**	**4.29**	**1.81**	**2.77**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Boron (mg/L)	<0.05	<0.05	-	**-**	**-**	**-**	-	-	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	**81.6**	**94.5**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	-	-	-	-	**-**
Other																
DOC (mg/L)	-	**0.592**	**1.62**	**2.19**	**3.26**	**5.78**	**3.74**	**16**	**29.2**	**13**	**10.9**	**6.93**	**9.88**	**4.55**	**3.94**	**3.39**
Methane (µg/L)	-	-	-	-	**-**	**-**	-	-	-	**-**	**-**	-	**-**	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	**-**	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**17**	-	**-**	**-**	**-**	-	-	-	**-**	**-**	-	-	-	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B1075B**															
Top of Screen Elevation (ft)	-11.5															
Bottom of Screen Elevation (ft)	-21.5															
Sampling Date	11/04/2016[1]	2/23/2017	6/28/2017	9/13/2017	1/9/2018	4/18/2018	9/25/2018	1/4/2019	4/10/2019	7/25/2019	11/7/2019	2/20/2020	5/14/2020	8/12/2020	11/17/2020	3/4/2021
Type of Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																
pH (SU)	7.19	5.59	5.66	5.83	5.53	5.74	4.49	5.18	5.49	6.16	5.58	5.78	5.77	5.87	5.87	8.37
Temperature (^{o}C)	15.20	14.20	14.74	14.93	14.13	14.6	14.2	14.5	14.5	16.0	15.3	14.5	15.2	16.4	14.3	12.4
Dissolved Oxygen (DO, mg/L)	0.71	1.50	1.95	0.12	0.11	0.43	0.59	0.01	0.60	0.10	0.47	0.22	0.12	0.20	0.19	0.28
Redox Potential (ORP; mV)	82.20	157.90	223.10	99.00	135.00	95.5	25.2	145.9	97.8	-131.6	94.7	133.8	167.2	111.4	111.2	226.1
Specific Conductivity (µS/cm)[c]	631.00	1755.00	736.00	719.00	2688.00	1048.0	717.0	832.0	812.0	818.0	750.0	730.0	769.0	560.2	460.0	1022.0
Turbidity (NTU)	13.00	126.00	1.87	24.23	173.00	42.00	3.68	8.09	5.27	9.15	24.50	5.38	5.35	10.90	2.86	39.40
Laboratory Analyses																
Nitrogen																
Nitrate as N (mg/L)	**1.93**	**1**	**0.553**	**0.751**	**0.609**	**5.57**	**8.18**	**6.65**	**3.33**	**4.54**	**2.11**	**5.92**	**4.55**	**3.59**	**5.05**	**1.48**
Nitrite as N (mg/L)	-	**0.048**	**0.05**	**0.064**	**0.201**	**0.098**	**0.062**	**0.145**	**0.669**	**0.179**	**0.091**	**0.045**	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	**3.73**	**5.26**	**11**	**12.2**	**14.3**	**17.8**	**9.56**	**12**	**12.1**	**12.1**	**13**	**8.11**	**7.6**	**5.76**	**4.5**	**5.15**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**7.2**	-	**-**	**14.4**	**17.7**	**10.5**	**12**	**14**	**13.6**	**13.3**	**8.83**	**12.1**	-	-	**-**
Total Nitrogen (mg/L)	**6.36**	**8.25**	**13.6**	**15.1**	**15.3**	**23.4**	-	**18.8**	**18**	**18.3**	**15.5**	**14.8**	**16.7**	**9.86**	**10.4**	**7.47**
Anions																
Chloride (mg/L)	**96.3**	**440**	**170**	**147**	**764**	**258**	**159**	**187**	**174**	**185**	**194**	**147**	**140**	**108**	**88.8**	**309**
Sulfate (mg/L)	-	**25.6**	**28.9**	**26.8**	**31.6**	**24.8**	**15.8**	**15.4**	**19.6**	**19**	**19.4**	**20.4**	**18.7**	**22.5**	**21.5**	**27.8**
Elements																
Dissolved Iron (mg/L)	-	**0.342**	<0.1	**-**	**0.886**	**0.253**	<0.1	**0.175**	**0.154**	**0.241**	**0.243**	**0.191**	**0.189**	**0.218**	**0.15**	<0.1
Dissolved Manganese (mg/L)	-	**0.119**	**0.111**	**-**	**0.142**	**0.12**	**0.083**	**0.108**	**0.166**	**0.182**	**0.118**	**0.226**	**0.175**	**0.335**	**0.35**	**0.033**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	-	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	**-**	**-**
Boron (mg/L)	-	<0.05	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Sodium (mg/L)	-	**379**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**
Other																
DOC (mg/L)	-	**1.96**	**4.86**	**9.48**	**8.77**	**11.1**	**4.63**	**4.37**	**7.07**	**3.92**	**2.93**	**3.35**	**2.9**	**3.93**	**2.72**	**1.66**
Methane (µg/L)	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	-	-	-	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**46**	-	**-**	**-**	**-**	**-**	**-**	-	**-**	**-**	-	-	-	-	**-**

Notes:

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1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2010C**																
Top of Screen Elevation (ft)	0																
Bottom of Screen Elevation (ft)	-10																
Sampling Date	11/03/2016[1]	11/17/2016	2/24/2017	6/28/2017	9/13/2017	1/10/2018	4/19/2018	9/20/2018	1/2/2019	4/9/2019	7/24/2019	11/6/2019	2/19/2020	5/12/2020	8/13/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	7.04	5.32	5.70	6.11	6.29	6.20	6.51	6.53	6.59	6.42	7.32	6.35	6.52	6.57	6.88	6.75	6.56
Temperature (^{o}C)	15.12	14.58	14.81	15.39	15.69	14.71	14.6	16.9	14.3	15.1	16.4	14.4	15.1	15.9	16.0	15.4	14.2
Dissolved Oxygen (DO, mg/L)	0.67	0.61	3.38	1.78	0.10	0.10	0.30	0.14	0.07	0.05	0.08	0.61	0.12	0.08	0.07	0.43	0.19
Redox Potential (ORP; mV)	12.40	213.80	103.30	-41.60	-119.80	-102.10	-153.0	-133.0	-122.2	-137.0	-120.7	-127.5	-152.1	-130.5	-128.1	-143.8	-115.5
Specific Conductivity (µS/cm)[c]	333.00	304.00	302.00	431.00	689.00	862.00	860.0	764.0	977.0	1032.0	1105.0	1029.0	1197.0	873.0	972.0	988.0	838.0
Turbidity (NTU)	149.00	44.40	19.90	6.89	5.10	3.32	0.25	9.40	0.20	4.95	7.58	0.02	6.10	5.02	5.20	8.22	2.44
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**15.7**	-	**5.06**	**5.74**	**0.182**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.21	<0.03	<0.03	<0.21	<0.03
Nitrite as N (mg/L)	-	-	**0.499**	**0.128**	**0.081**	**0.027**	**0.09**	**0.058**	**0.044**	**0.056**	**0.079**	**0.077**	**0.127**	**0.079**	**0.119**	**0.08**	**0.083**
Ammonia (mg/L)	**0.14**	-	<0.1	**0.24**	<0.1	**0.17**	**0.49**	**0.86**	**0.79**	**0.58**	**0.6**	**0.53**	**0.48**	**0.58**	**0.89**	**0.99**	**1**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	**14.7**	-	-	**1.75**	-	**1.93**	**1.45**	**1.61**	**1.24**	**1.42**	**1.2**	-	**-**	-	**-**
Total Nitrogen (mg/L)	**16.1**	-	**20.3**	**7.69**	**2.26**	**1.75**	**2.34**	**-**	**1.45**	**1.61**	**1.24**	**1.42**	**1.33**	**1.16**	**1.89**	**1.58**	**1.14**
Anions																	
Chloride (mg/L)	**38.6**	-	**27.5**	**30**	**37.4**	**35.5**	**28.5**	**33.9**	**26.7**	**29.2**	**29.6**	**34.3**	**33.1**	**36.4**	**32.9**	**35.4**	**37.9**
Sulfate (mg/L)	**11**	-	**24.3**	**39.8**	**73.5**	**57**	**51.5**	**17.8**	**6.4**	**22.2**	**50.5**	**39**	**12**	**30.8**	**17.8**	**34**	**19.7**
Elements																	
Dissolved Iron (mg/L)	-	-	**1.84**	**24.2**	**46.2**	**88.2**	**110**	**89.1**	**89**	**90.9**	**133**	**157**	**123**	**105**	**91**	**2.92**	**87.9**
Dissolved Manganese (mg/L)	-	-	**0.189**	**1.62**	**2.56**	**5.15**	**5.77**	**4.54**	**5.19**	**7.92**	**7.68**	**7.64**	**7.37**	**5.65**	**5.68**	**4.73**	**4.07**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	**0.0599**	**0.055**	**0.087**	**0.09**	**0.063**	**-**	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	<0.05	**0.012**	**0.031**	**0.01**	<0.005	**0.043**
Boron (mg/L)	-	-	<0.05	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-	**-**
Sodium (mg/L)	-	-	**28.5**	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-	**-**
Other																	
DOC (mg/L)	**2.18**	**0.852**	**19.4**	**83.3**	**69.4**	**94.3**	**52.5**	**19.7**	**26.8**	**12.1**	**24.9**	**10.3**	**8.5**	**9.11**	**10.9**	**7.67**	**6.58**
Methane (µg/L)	-	-	-	**11.3**	-	**-**	**-**	-	-	**-**	**-**	**3450**	**5810**	**6240**	**8090**	**7030**	**10400**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	<3	<3	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	<5	<5	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	**16**	**48**	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-	**-**	-	**-**

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2020B**																	
Top of Screen Elevation (ft)	-10.1																	
Bottom of Screen Elevation (ft)	-20.1																	
Sampling Date	11/03/2016[1]	11/17/2016	1/10/2017	2/24/2017	6/28/2017	9/13/2017	1/9/2018	4/19/2018	9/25/2018	1/2/2019	4/9/2019[5]	7/24/2019	11/6/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																		
pH (SU)	7.00	5.22	5.05	5.10	5.04	5.45	4.95	5.62	5.82	5.82	5.28	6.49	4.87	5.09	5.13	5.23	5.65	5.82
Temperature (^{o}C)	14.91	14.39	12.23	14.53	14.86	15.14	14.28	14.4	14.5	14.1	14.6	15.8	14.1	14.6	14.9	15.7	14.9	14.1
Dissolved Oxygen (DO, mg/L)	1.15	0.63	0.85	2.03	3.88	0.08	0.08	0.30	0.66	0.35	0.17	0.10	0.43	0.29	0.07	0.20	0.62	0.15
Redox Potential (ORP; mV)	90.80	182.60	170.50	308.10	285.90	120.70	173.60	149.3	16.7	64.9	121.7	-33.4	180.1	76.1	139.2	243.3	180.0	139.8
Specific Conductivity (µS/cm)[c]	321.00	307.00	344.00	338.00	354.00	323.00	370.00	339.4	449.0	385.0	356.0	349.5	340.0	422.0	326.0	302.6	316.0	297.0
Turbidity (NTU)	14.30	17.40	6.95	6.11	8.12	5.91	10.00	4.01	4.40	1.00	1.12	2.00	0.02	0.09	0.94	0.30	2.66	6.91
Laboratory Analyses																		
Nitrogen																		
Nitrate as N (mg/L)	**16.9**	-	**25.6**	**14.8**	**22.4**	**5.96**	**3.26**	**2.4**	**3.06**	**5.66**	**14.6**	**8.66**	**7.63**	**22.7**	**12.8**	**6.26**	**7.24**	**1.85**
Nitrite as N (mg/L)	**0.022**	-	<0.01	<0.01	<0.01	**0.54**	**2.98**	**1.43**	**0.314**	**0.218**	**0.329**	**1.24**	**0.451**	**0.102**	**0.165**	**0.376**	**0.477**	**0.383**
Ammonia (mg/L)	**0.1**	-	<0.1	<0.1	<0.1	<0.1	**0.23**	<0.1	**0.11**	**0.16**	**0.18**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-	<0.2	**3.86**	-	-	**4.32**	-	**0.91**	**0.84**	**0.24**	**0.81**	<0.2	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**17.2**	-	-	**18.7**	**24.2**	**7.84**	**10.6**	**4.58**	**-**	**6.72**	**21.3**	**10.7**	**8.08**	**22.8**	**13**	**7.12**	**8.29**	**2.24**
Anions																		
Chloride (mg/L)	**32.5**	-	**34.9**	**32.7**	**39.3**	**38**	**51.4**	**34.8**	**46.9**	**43.9**	**38.7**	**37.1**	**44.6**	**47.3**	**37**	**29.8**	**30.7**	**29.5**
Sulfate (mg/L)	**7.7**	-	**6**	**7.1**	**6.4**	**29.7**	**19.3**	**37**	**42.5**	**19.5**	<5	**6.5**	**8.7**	**5.6**	**15.9**	**31.5**	**46.5**	**47**
Elements																		
Dissolved Iron (mg/L)	**1.2**	-	-	<0.1	<0.1	<0.1	<0.1	<0.2	**17.6**	**7.67**	<0.1	<0.1	<0.1	**0.109**	**0.182**	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.126**	-	-	**0.028**	**0.029**	**0.187**	**0.374**	**0.76**	**3.54**	**2.95**	**3.04**	**1.06**	**0.764**	**0.048**	**0.394**	**0.248**	**0.256**	**0.215**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	<0.0025	<0.025	<0.025	<0.025	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	<0.05	-	-	**0.054**	-	-	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	**21.6**	-	-	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																		
DOC (mg/L)	**1.45**	**0.694**	<0.5	**1.02**	**3.47**	**29.8**	**16.5**	**17**	**17.3**	**8.52**	**2.84**	**8.96**	**3.33**	**1.18**	**4.93**	**-**	**4.66**	**4.12**
Methane (µg/L)	<2	-	-	-	**-**	-	**-**	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**20**	**12**	**8**	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-		-	**-**

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2020C**																
Top of Screen Elevation (ft)	4.8																
Bottom of Screen Elevation (ft)	-5.2																
Sampling Date	11/03/2016[1]	1/10/2017	2/24/2017	6/28/2017	9/13/2017	1/9/2018	4/19/2018	9/19/2018	1/2/2019	4/9/2019	7/24/2019	11/6/2019	2/19/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	7.00	5.12	5.09	5.60	5.76	5.16	5.85	6.11	6.26	6.45	6.96	6.36	6.44	6.29	6.81	6.96	7.16
Temperature (^{o}C)	15.20	12.90	15.42	15.57	15.80	14.72	14.9	17.7	14.5	15.2	16.3	14.3	15.1	15.3	16.2	15.4	14.6
Dissolved Oxygen (DO, mg/L)	1.31	1.30	3.96	1.70	0.13	0.06	0.34	0.60	0.17	0.05	0.15	0.47	0.28	0.06	0.22	0.22	0.10
Redox Potential (ORP; mV)	29.80	201.50	316.20	73.80	-15.70	8.50	-36.0	15.2	-54.3	-113.8	-110.7	-115.9	-92.6	-153.4	-151.9	-159.4	-101.9
Specific Conductivity (µS/cm)[c]	249.00	251.00	225.00	264.00	248.00	250.00	303.4	309.0	426.0	654.0	670.0	579.0	608.0	630.0	694.0	718.0	540.0
Turbidity (NTU)	28.00	5.81	5.17	6.23	1.30	6.09	0.50	6.45	0.50	8.36	2.17	0.02	5.28	2.17	2.90	1.58	1.80
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**8.71**	**12.6**	**6.95**	**0.457**	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.21	**0.618**	<0.21	<0.21	<0.03
Nitrite as N (mg/L)	**0.016**	<0.01	<0.01	**0.072**	**0.01**	**0.083**	<0.01	**0.012**	**0.02**	**0.058**	**0.069**	**0.038**	**0.061**	**0.076**	**0.116**	**0.073**	**0.073**
Ammonia (mg/L)	**0.24**	<0.1	<0.1	<0.1	<0.1	**0.14**	**0.13**	<0.1	<0.1	<0.1	**0.22**	**0.15**	<0.1	**0.11**	<0.1	**0.12**	**0.13**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	<0.2	**2.33**	-	-	**1.04**	-	**0.84**	**0.5**	**0.97**	**0.64**	**1.12**	**0.41**	-	-	-	**-**
Total Nitrogen (mg/L)	**9.02**	-	**9.28**	**0.85**	**0.424**	**1.1**	**1.19**	-	**0.501**	**0.97**	**0.643**	**1.12**	**0.417**	**1.17**	**0.611**	**0.673**	<0.2
Anions																	
Chloride (mg/L)	**26.8**	**31**	**28.4**	**32.2**	**31.2**	**33**	**28.5**	**30.7**	**35.2**	**32.2**	**27.6**	**32.4**	**34.6**	**32**	**28.3**	**36.1**	**37.8**
Sulfate (mg/L)	**11.6**	**9.7**	**11.9**	**36.8**	**20.9**	**29**	**27.6**	**19.6**	**5.9**	<5	**15.8**	**10**	<5	**6.7**	**9.3**	**14.7**	<5
Elements																	
Dissolved Iron (mg/L)	**1.42**	-	<0.1	**7.97**	**13.1**	**1.83**	**4.56**	**14.5**	**23**	**93.3**	**96.7**	**95.3**	**65.4**	**74**	**92.9**	**103**	**77.7**
Dissolved Manganese (mg/L)	**1.14**	-	**0.067**	**0.964**	**2.08**	**5.09**	**8.28**	**11.1**	**11.5**	**9.12**	**8.28**	**7.78**	**8.42**	**5.21**	**6.31**	**7.33**	**6.5**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	**15.2**	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																	
DOC (mg/L)	**1.17**	<0.5	**2.04**	**23.3**	**14.2**	**11.8**	**7.76**	**11.5**	**12.2**	**43.5**	**57.3**	**30.4**	**24**	**37.3**	**28.7**	**14.8**	**8.73**
Methane (µg/L)	<2	-	-	**-**	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**11800**	**9200**	**10100**	**11400**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	-	**10**	**7**	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2050A**																
Top of Screen Elevation (ft)	-25.4																
Bottom of Screen Elevation (ft)	-35.4																
Sampling Date	11/03/2016[1]	1/10/2017	2/24/2017	6/28/2017	9/13/2017	1/9/2018	4/19/2018	9/19/2018	1/2/2019	4/9/2019	7/24/2019	11/6/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	7.11	5.39	5.29	5.27	5.34	4.85	5.25	5.20	5.13	5.52	6.15	4.96	5.32	5.38	5.48	5.74	6.16
Temperature (^{o}C)	14.44	11.96	14.06	14.47	14.58	14.05	13.9	14.4	14.2	14.3	15.1	14.4	14.5	14.6	15.1	14.5	13.6
Dissolved Oxygen (DO, mg/L)	0.60	0.09	0.83	1.66	0.06	0.07	0.52	0.04	1.74	0.36	4.96	0.53	0.10	0.06	0.09	0.50	0.06
Redox Potential (ORP; mV)	0.80	182.80	251.80	217.00	98.90	147.00	197.8	156.5	92.2	37.9	-30.3	169.1	50.6	197.0	223.6	0.5	193.7
Specific Conductivity (µS/cm)[c]	540.00	520.00	550.00	505.00	509.00	660.00	520.2	412.0	293.0	360.0	406.8	331.0	406.0	359.0	378.2	355.0	354.0
Turbidity (NTU)	50.70	8.10	14.10	26.70	5.04	4.16	10.40	5.25	3.34	7.41	8.80	12.90	1.82	2.26	0.18	5.56	9.80
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**35**	**39.3**	**27**	**32.8**	**25.5**	**11.6**	**24**	**22.9**	**10.6**	**17.1**	**8.43**	**4.74**	**12.8**	**7.66**	**5.02**	**5.3**	**1.76**
Nitrite as N (mg/L)	-	**0.025**	<0.010	<0.01	**0.166**	**0.04**	**0.179**	**0.215**	**0.058**	**0.214**	**0.904**	**0.96**	**0.695**	**0.766**	**0.6**	**0.822**	**0.434**
Ammonia (mg/L)	**1.05**	**0.87**	**0.89**	**1**	**0.63**	**0.78**	**0.83**	**0.68**	**0.18**	**0.29**	**0.47**	**0.22**	**0.35**	**0.63**	**0.3**	**0.14**	**0.47**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**3.32**	**3.5**	-	**-**	<0.2	-	<0.2	<0.2	**0.54**	**0.23**	**0.22**	**0.32**	-	-	-	**-**
Total Nitrogen (mg/L)	**35.3**	-	**30.5**	**35.4**	**25.6**	**11.6**	**24.2**	-	**10.7**	**17.9**	**9.57**	**5.92**	**13.8**	**9.06**	**6.08**	**6.35**	**2.53**
Anions																	
Chloride (mg/L)	**49.9**	**64.5**	**63.3**	**66.8**	**65.8**	**114**	**75.1**	**69.6**	**70.8**	**83.2**	**58**	**53.2**	**54.3**	**48.5**	**47**	**45**	**49.3**
Sulfate (mg/L)	**5.6**	**5.6**	**6.2**	**7.5**	**5.3**	**6.1**	**7.6**	**6.2**	<5	<5	**7.1**	**10.6**	**12.7**	**23.9**	**32**	**32**	**36**
Elements																	
Dissolved Iron (mg/L)	**3.2**	-	<0.1	<0.1	**-**	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.148**	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.407**	-	**0.293**	**0.26**	**-**	**0.258**	**0.265**	**0.222**	**0.128**	**0.131**	**0.201**	**0.181**	**0.191**	**0.215**	**0.203**	**0.224**	**0.213**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	**40**	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																	
DOC (mg/L)	**1.61**	-	**1.08**	**1.37**	**5.63**	**2.76**	**5.54**	**2.1**	**1.59**	**1.67**	**3.5**	**2.98**	**3.69**	**3.72**	**4.97**	**3.89**	**3.32**
Methane (µg/L)	-	-	-	**-**	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**17**	**13**	-	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

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3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2050B**															
Top of Screen Elevation (ft)	-10.4															
Bottom of Screen Elevation (ft)	-20.4															
Sampling Date	11/03/2016[1]	2/24/2017	6/28/2017	9/13/2017	1/9/2018	4/19/2018	9/19/2018	1/2/2019	4/9/2019	7/24/2019	11/6/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																
pH (SU)	7.06	5.22	5.29	5.30	4.79	5.24	5.22	4.79	5.45	6.38	5.02	5.35	5.37	5.27	5.52	6.27
Temperature (^{o}C)	14.95	14.64	15.27	15.31	14.32	14.7	14.8	14.5	14.9	15.9	14.5	14.9	15.2	18.1	15.0	14.0
Dissolved Oxygen (DO, mg/L)	1.29	3.75	5.97	1.27	1.43	1.97	1.67	1.37	1.71	0.66	0.56	0.20	0.09	0.15	0.09	0.14
Redox Potential (ORP; mV)	80.50	304.60	242.20	169.70	156.90	203.3	168.4	111.2	50.8	-20.0	168.6	31.1	180.9	192.8	103.3	170.8
Specific Conductivity (µS/cm)[c]	512.00	645.00	502.00	510.00	495.00	435.1	271.0	413.0	266.0	307.8	292.0	340.0	326.0	306.3	371.0	333.0
Turbidity (NTU)	123.00	4.67	5.78	0.61	1.54	0.50	1.02	2.58	2.21	3.38	0.02	0.02	0.89	0.02	2.40	0.02
Laboratory Analyses																
Nitrogen																
Nitrate as N (mg/L)	**4.75**	**3.64**	**5.27**	**3.94**	**1.72**	**4.04**	**4.94**	**4.97**	**7.48**	**2.55**	**1.45**	**3.15**	**0.849**	**2.55**	**1.72**	**0.171**
Nitrite as N (mg/L)	-	<0.010	<0.01	<0.01	**0.046**	<0.01	**0.011**	<0.01	<0.01	**0.382**	**0.623**	**0.754**	**0.974**	**0.811**	**0.346**	**0.371**
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1	**0.12**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**1.22**	-	-	<0.2	-	**0.35**	<0.2	**0.45**	**0.79**	**0.73**	**0.44**	-	-	-	**-**
Total Nitrogen (mg/L)	**5.15**	**4.86**	**5.91**	**3.94**	**1.76**	**4.27**	-	**4.97**	**7.93**	**3.73**	**2.81**	**4.34**	**2.31**	**4.01**	**2.67**	**0.542**
Anions																
Chloride (mg/L)	**123**	**173**	**124**	**119**	**121**	**82.4**	**63.9**	**85.2**	**60.1**	**45.8**	**52.9**	**48.6**	**49.5**	**47.2**	**36.9**	**42.3**
Sulfate (mg/L)	**11.5**	**11.5**	**11**	**8.7**	**11.4**	**15.2**	**10.3**	**11.2**	**8.7**	**18.2**	**19.8**	**28.7**	**37.4**	**31**	**41.5**	**41.5**
Elements																
Dissolved Iron (mg/L)	**0.551**	<0.1	<0.1	**-**	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	**0.268**	**0.151**	<0.1	**0.111**	**1.91**	**1.3**
Dissolved Manganese (mg/L)	**0.258**	**0.297**	**0.258**	**-**	**0.315**	**0.311**	**0.222**	**0.144**	**0.156**	**0.25**	**0.451**	**0.531**	**0.492**	**0.717**	**1.29**	**0.975**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	<0.05	<0.05	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	**81.7**	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																
DOC (mg/L)	**1.15**	**1.08**	**0.754**	**5.01**	**4.25**	**4.76**	**2.68**	**2.23**	**1.39**	**7.38**	**7.12**	**7.08**	**7.42**	**6.5**	**3.85**	**4.02**
Methane (µg/L)	-	-	**-**	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**11**	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2050C**															
Top of Screen Elevation (ft)	4.6															
Bottom of Screen Elevation (ft)	-5.4															
Sampling Date	11/03/2016[1]	2/24/2017	6/28/2017	9/13/2017	1/9/2018	4/19/2018	9/19/2018	1/2/2019	4/9/2019	7/24/2019	11/6/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																
pH (SU)	7.22	5.49	5.38	5.40	5.11	5.39	5.25	4.86	5.39	6.85	5.07	5.39	5.39	5.33	5.35	6.17
Temperature (^{o}C)	16.72	16.56	16.90	17.37	14.40	16.5	15.8	14.8	15.0	17.9	14.3	13.1	16.3	20.3	15.7	14.3
Dissolved Oxygen (DO, mg/L)	1.09	5.76	8.95	4.51	5.82	3.09	3.22	3.01	3.75	3.01	1.42	1.81	0.23	0.21	0.15	1.48
Redox Potential (ORP; mV)	82.50	179.50	236.30	177.90	171.50	207.7	179.7	132.4	65.2	271.1	192.8	63.7	150.1	224.2	169.7	177.3
Specific Conductivity (µS/cm)[c]	658.00	932.00	896.00	970.00	903.00	980.0	865.0	1115.0	769.0	1015.0	867.0	713.0	674.0	658.0	682.0	607.0
Turbidity (NTU)	212.00	36.10	9.68	20.03	16.10	86.50	120.00	1.12	3.12	8.98	0.02	9.60	5.90	0.02	2.85	0.68
Laboratory Analyses																
Nitrogen																
Nitrate as N (mg/L)	**3.01**	**1.68**	**3.05**	**2.19**	**1.41**	**2.9**	**3.47**	**3**	**3.86**	**2.53**	**1.59**	**0.54**	**2.21**	**1.68**	**2.47**	**0.681**
Nitrite as N (mg/L)	-	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.016**	<0.01	**0.501**	**0.774**	**0.663**	**0.497**
Ammonia (mg/L)	**0.11**	<0.1	**0.12**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.15**	**0.12**	<0.1	<0.1	**0.42**
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	**0.66**	-	-	<0.2	-	<0.2	<0.2	**0.32**	**0.26**	**0.3**	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**3.3**	**2.34**	**3.75**	**2.53**	**1.41**	**2.9**	-	**3.19**	**4.18**	**2.79**	**1.91**	**0.54**	**3.18**	**2.85**	**3.71**	**1.18**
Anions																
Chloride (mg/L)	-	**251**	**253**	**278**	**257**	**270**	**315**	**329**	**241**	**261**	**269**	**96.1**	**176**	**182**	**152**	**156**
Sulfate (mg/L)	**11.9**	**11.1**	**10.1**	**8.9**	**9.6**	**13.5**	**9.3**	<5	<5	**11.8**	**12.9**	**6.3**	**26.3**	**28.8**	**33**	**35**
Elements																
Dissolved Iron (mg/L)	-	**0.308**	<0.1	**-**	<0.1	<0.2	<0.1	**0.109**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	-	**0.254**	**0.13**	**-**	**0.102**	**0.09**	**0.077**	**0.065**	**0.05**	**0.053**	**0.051**	**0.058**	**0.093**	**0.106**	**0.122**	**0.112**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	-	<0.05	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	**120**	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																
DOC (mg/L)	**1.13**	**0.87**	**0.639**	**3.73**	**2.75**	**2.93**	**1.33**	**1.99**	**1.12**	**2.08**	**1.62**	**0.946**	**3.76**	**3.84**	**2.76**	**3.29**
Methane (µg/L)	-	-	**-**	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	**9**	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2075A**														
Top of Screen Elevation (ft)	-20.40														
Bottom of Screen Elevation (ft)	-30.40														
Sampling Date	3/27/2017	6/28/2017	9/12/2017	1/10/2018	4/19/2018	9/25/2018	1/3/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements															
pH (SU)	5.21	5.50	5.53	5.27	5.51	5.52	4.96	5.54	5.44	5.20	5.31	5.41	5.50	5.41	5.48
Temperature (^{o}C)	14.42	14.98	15.40	14.53	14.6	14.1	14.6	14.1	15.4	14.1	13.9	13.9	16.9	14.6	13.9
Dissolved Oxygen (DO, mg/L)	4.08	7.83	7.02	5.27	5.47	6.64	4.27	5.19	3.99	3.39	2.76	2.71	2.01	1.86	3.69
Redox Potential (ORP; mV)	130.70	234.90	205.30	173.40	152.7	193.6	132.2	81.8	247.5	183.6	196.4	242.1	226.7	188.4	259.3
Specific Conductivity (µS/cm)[c]	744.00	748.00	883.00	856.00	855.0	996.0	994.0	751.0	1027.0	949.0	1097.0	1015.0	1081.0	1104.0	547.0
Turbidity (NTU)	159.00	3.85	43.20	333.00	414.00	24.90	10.80	5.81	48.70	21.20	7.57	40.20	9.26	12.10	2.70
Laboratory Analyses															
Nitrogen															
Nitrate as N (mg/L)	**0.348**	**0.539**	**0.676**	**0.762**	**0.642**	**0.81**	**0.827**	**0.9**	**0.453**	**0.547**	**1.33**	**1.2**	**1.39**	**1.84**	**1.34**
Nitrite as N (mg/L)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	**0.12**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-	-		**0.31**	-	**0.45**	**0.37**	**0.57**	**0.59**	**0.47**	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**0.35**	**0.779**	**1.09**	**1.07**	**1.33**		**1.2**	**1.46**	**1.04**	**1.02**	**1.33**	**1.2**	**1.68**	**2.16**	**1.34**
Anions															
Chloride (mg/L)	**246**	**214**	**261**	**257**	**268**	**308**	**301**	**248**	**287**	**321**	**328**	**305**	**335**	**315**	**227**
Sulfate (mg/L)	**5.7**	<5	**5.4**	**6.5**	**7.7**	**7.7**	**5.1**	<5	**7**	**8.8**	**7.2**	**7.4**	**8.9**	**9.8**	**17.7**
Elements															
Dissolved Iron (mg/L)	**0.119**	<0.1	**-**	<0.1	<0.2	<0.1	**0.17**	<0.1	**0.401**	<0.1	<0.1	**0.183**	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.529**	**0.062**	**-**	**0.069**	**0.051**	**0.028**	**0.031**	<0.02	**0.021**	<0.02	<0.02	<0.02	<0.02	<0.02	**0.071**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	**-**	**-**	**-**	**-**	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**
Other															
DOC (mg/L)	**1.08**	**0.668**	**0.722**	**2.26**	**0.882**	**1.31**	**1.17**	**0.633**	**1.14**	**1.7**	**0.834**	**1.02**	**1.47**	**0.854**	**1.2**
Methane (µg/L)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

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2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-B2100C**																
Top of Screen Elevation (ft)	9.6																
Bottom of Screen Elevation (ft)	-0.4																
Sampling Date	10/4/2016	11/03/2016[1]	2/24/2017	6/28/2017	9/12/2017	1/10/2018	4/19/2018	9/25/2018	1/3/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021
Type of Sample	Sample	Sample	Q1 Sample	Q2 Sample	Q3 Sample	Q4 Sample	Q5 Sample	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																	
pH (SU)	5.26	6.98	5.46	5.27	5.41	4.93	5.32	6.09	4.64	5.33	5.16	4.97	4.99	5.20	5.27	5.61	5.40
Temperature (^{o}C)	14.42	14.95	16.84	14.44	14.43	14.55	14.4	14.0	14.6	14.4	14.9	14.3	14.6	14.2	17.7	14.4	14.3
Dissolved Oxygen (DO, mg/L)	5.90	1.50	7.37	10.84	5.09	4.99	4.35	4.71	4.38	5.44	4.81	5.33	4.20	7.45	4.58	5.14	4.82
Redox Potential (ORP; mV)	110.50	124.70	189.80	217.40	216.7	206	172.3	85.7	143.4	81.4	288.6	202.2	191.0	254.2	337.9	228.0	283.7
Specific Conductivity (µS/cm)[c]	272.00	297.00	346.00	364.00	377	378	322.8	458.0	429.0	354.0	572.8	530.0	564.0	486.0	428.6	484.0	337.5
Turbidity (NTU)	-	8.44	OVER	5.71	2.97	2.87	0.50	10.00	2.12	1.12	0.57	3.40	2.14	0.05	1.14	1.56	0.02
Laboratory Analyses																	
Nitrogen																	
Nitrate as N (mg/L)	**1.29**	**1.29**	**0.959**	**0.724**	**0.903**	**1.13**	**1.23**	**2.43**	**1.83**	**1.94**	**1**	**0.964**	**2.36**	**1.39**	**1.3**	**1.81**	**0.598**
Nitrite as N (mg/L)	-	-	<0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	<0.1	<0.1	<0.1	<0.1	**0.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	**0.72**	-	**0.54**	-		**0.21**	-	**0.39**	**0.3**	**0.51**	**0.31**	**0.41**	<0.2	-	-	-	**-**
Total Nitrogen (mg/L)	**2.01**	**1.29**	**1.5**	**0.724**	**1.31**	**1.33**	**1.57**		**2.13**	**2.45**	**1.31**	**1.38**	**2.36**	**1.39**	**1.3**	**2.24**	**0.598**
Anions																	
Chloride (mg/L)	**65.4**	**67.8**	**83.2**	**96.4**	**97.3**	**97.8**	**72.5**	**116**	**105**	**112**	**151**	**172**	**147**	**122**	**125**	**121**	**95.5**
Sulfate (mg/L)	**14.1**	**16.2**	**12.1**	**10**	**8.3**	**10.8**	**13.9**	**9.4**	**7.7**	<5	**7.6**	**8.5**	**8.4**	**8.3**	**11.4**	**10.8**	**13**
Elements																	
Dissolved Iron (mg/L)	**0.115**	-	**0.147**	<0.1	**-**	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.126**	-	**0.196**	**0.114**	**-**	**0.102**	**0.096**	**0.119**	**0.106**	**0.12**	**0.147**	**0.144**	**0.134**	**0.107**	**0.087**	**0.097**	**0.063**
Total Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**
Boron (mg/L)	<0.05	-	<0.05	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	**53.7**	-	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																	
DOC (mg/L)	<0.5	**0.866**	**0.862**	**0.959**	**0.78**	**2.28**	**2.25**	**1.17**	**1.94**	**0.958**	**1.66**	**1.34**	**0.983**	**1.03**	**1.16**	**0.965**	**1.18**
Methane (µg/L)	<2	-	-	-	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	-	-	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	-	**14**	-	**-**	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BC4A**											**MW-BC4B**										
Top of Screen Elevation (ft)	-26.50											-11.50										
Bottom of Screen Elevation (ft)	-36.50											-21.50										
Sampling Date	5/8/2018	9/20/2018	1/2/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/2/2021	5/8/2018	9/20/2018	1/2/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/2/2021
Type of Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																						
pH (SU)	5.34	4.32	5.05	5.17	5.33	5.49	5.85	5.77	5.75	5.56	8.43	5.34	5.40	5.25	5.08	5.37	5.24	5.65	5.70	6.72	6.05	5.79
Temperature (^{o}C)	11.2	13.6	13.8	13.9	14.3	13.7	13.7	13.4	16.2	14.6	13.2	12.1	17.6	13.5	14.2	15.2	14.5	14.2	14.6	15.7	14.3	13.4
Dissolved Oxygen (DO, mg/L)	0.13	0.95	0.06	0.18	0.53	0.46	0.11	0.20	0.27	0.28	0.07	0.06	1.68	0.30	0.06	0.37	0.23	0.09	0.13	0.01	0.63	0.02
Redox Potential (ORP; mV)	74.1	119.9	100.1	224.9	-14.1	127.3	-13.0	91.2	154.3	67.0	75.9	100.3	164.3	245.8	207.0	229.3	102.0	-15.3	108.5	228.8	169.1	176.1
Specific Conductivity (µS/cm)[c]	601.8	326.0	344.0	344.0	464.3	429.0	530.0	516.0	514.8	543.0	531.0	567.0	274.0	411.0	287.0	370.1	364.0	422.0	421.0	467.4	431.0	438.0
Turbidity (NTU)	14.00	3.85	9.50	3.80	9.20	0.02	0.85	0.67	0.45	3.43	0.44	4.11	520.00	0.02	7.17	7.48	2.05	5.50	5.84	3.44	8.24	5.67
Laboratory Analyses																						
Nitrogen																						
Nitrate as N (mg/L)	**5.65**	**1.72**	**1.23**	**0.919**	**0.328**	**0.225**	**0.154**	**0.196**	**0.297**	**0.503**	**0.172**	**1.25**	**1.88**	**0.275**	**0.127**	**3.93**	**1.64**	**3.53**	**9.5**	**8.52**	**2.53**	<0.03
Nitrite as N (mg/L)	<0.25	**0.164**	**0.247**	**0.142**	**0.171**	**0.224**	**0.223**	**0.12**	**0.057**	**0.044**	**0.027**	<0.25	**0.324**	**0.083**	**0.115**	**0.76**	**1.2**	**0.71**	**0.158**	**0.282**	**0.414**	**0.046**
Ammonia (mg/L)	**0.38**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.12**	**0.15**	**0.14**	<0.1	**0.12**	**0.36**	<0.1	**0.11**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.15**	<0.1	**0.12**
Total Kjeldahl Nitrogen (TKN) (mg/L)	**0.97**	**0.46**	**0.41**	**0.77**	**0.33**	**0.55**	<0.2	-	-	-	**-**	**0.64**	**0.52**	**0.44**	**0.71**	**0.57**	**0.76**	**0.38**	-	-	-	**-**
Total Nitrogen (mg/L)	**0.97**		**1.89**	**1.83**	**0.829**	**0.997**	**0.377**	**0.674**	**0.987**	**1.07**	<0.2	**0.64**	**-**	**0.793**	**0.95**	**5.25**	**3.6**	**4.62**	**9.66**	**8.8**	**3.33**	<0.2
Anions																						
Chloride (mg/L)	**77.2**	**60.2**	**70.4**	**59.6**	**69.4**	**70.6**	**74.3**	**79.1**	**85.1**	**86.3**	**69.4**	**70.7**	**72.6**	**92.7**	**37.3**	**47.8**	**50.5**	**40.2**	**57.1**	**63.3**	**47.7**	**51.9**
Sulfate (mg/L)	**14.8**	**27.5**	**19.4**	**24**	**37.5**	**32.8**	**31.2**	**35.6**	**37.5**	**43**	**42.5**	**26.3**	**33**	**28.2**	**25.9**	**50.5**	**45**	**36.6**	**27.1**	**29.8**	**46**	**47**
Elements																						
Dissolved Iron (mg/L)	**0.212**	<0.1	**0.101**	<0.1	<0.1	<0.1	<0.1	**0.212**	**0.111**	**0.183**	<0.1	**0.491**	<0.217	<0.1	<0.1	**0.106**	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.176**	**0.075**	**0.105**	**0.142**	**0.278**	**0.524**	**1.14**	**1.97**	**2.68**	**2.27**	**2.73**	**0.296**	**0.428**	**0.244**	**0.193**	**0.286**	**0.272**	**0.295**	**0.337**	**0.491**	**0.504**	**0.846**
Total Arsenic (mg/L)	-	-	<0.025	**-**	**-**	**-**	**-**	-	-	-	**-**	-	-	<0.025	<0.025	<0.025	<0.05	**-**	-	-	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	-	**-**	<0.001	<0.001	<0.001	<0.001
Boron (mg/L)	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Sodium (mg/L)	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**	-	-	-	**-**	**-**	**-**	**-**	-	-	-	**-**
Other																						
DOC (mg/L)	**6.67**	**11.4**	**14.5**	**7.81**	**6.24**	**5.83**	**4.35**	**5.43**	**9.52**	**5.48**	**4.22**	**13.5**	**14.1**	**4.04**	**8.02**	**9.34**	**7.8**	**5.33**	**3.16**	**5.92**	**4.73**	**4.22**
Methane (µg/L)	**-**	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	-	**-**	**-**	**223**	**-**	**362**	**831**	**3560**	**5880**
Ethane (µg/L)	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	<3	**-**	<3	<3	<3	<3
Ethene (µg/L)	-	-	-	-	-	**-**	**-**	**-**	**-**	**-**	**-**	-	-	-	-	-	<5	**-**	<5	<5	<5	<5
Alkalinity as CaCO3 (mg/L)	**-**	-	-	-	**-**	**-**	**-**	-		-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BC4C**											**MW-BM050A**										
Top of Screen Elevation (ft)	3.50											-25.32										
Bottom of Screen Elevation (ft)	-6.50											-35.32										
Sampling Date	5/8/2018	9/20/2018	1/2/2019	4/9/2019	7/24/2019	11/5/2019	2/17/2020	5/12/2020	8/11/2020	11/16/2020	3/3/2021	5/8/2018	9/20/2018	1/3/2019	4/10/2019	7/24/2019	11/7/2019	2/17/2020	5/12/2020	8/13/2020	11/18/2020	3/4/2021
Type of Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																						
pH (SU)	5.37	5.21	5.44	5.40	5.56	5.54	5.96	6.08	6.08	6.30	5.94	5.90	4.83	5.64	5.70	5.64	5.28	5.43	5.46	5.64	5.84	8.53
Temperature (^{o}C)	12.0	15.2	13.8	14.4	15.1	14.6	14.2	14.6	16.5	14.6	14.0	12.0	14.0	13.6	14.2	15.0	14.3	14.1	14.1	15.6	14.1	13.6
Dissolved Oxygen (DO, mg/L)	0.09	0.30	0.42	0.05	0.13	0.22	0.15	0.14	0.01	0.57	0.34	0.77	1.03	0.94	0.83	67.00	0.82	0.39	0.87	0.32	0.36	0.38
Redox Potential (ORP; mV)	120.1	173.6	212.3	175.1	152.8	60.4	-135.5	38.2	19.8	64.0	58.7	27.5	32.9	169.1	80.1	169.5	139.7	206.4	240.5	177.2	127.1	135.2
Specific Conductivity (µS/cm)[c]	380.5	287.0	214.0	299.0	375.6	400.0	450.0	425.0	455.6	449.0	460.9	811.2	570.0	573.0	435.0	584.6	544.0	646.0	596.0	594.1	518.0	554.0
Turbidity (NTU)	4.49	over	0.89	2.81	5.60	5.22	4.56	5.26	0.02	1.67	0.02	13.20	53.20	6.15	2.28	6.66	4.18	7.64	5.11	7.91	7.63	0.02
Laboratory Analyses																						
Nitrogen																						
Nitrate as N (mg/L)	**1.47**	**2.67**	**0.46**	**2.24**	**0.645**	<0.03	**0.535**	<0.03	<0.03	**0.0733**	**0.042**	**2.57**	**2.23**	**2.38**	**2.33**	**0.964**	**0.988**	**2.83**	**2.3**	**3.47**	**3.61**	**1.35**
Nitrite as N (mg/L)	<0.27	**0.521**	<0.181	**0.223**	**0.232**	<0.01	**0.176**	<0.01	<0.01	**0.014**	**0.1**	<0.25	**0.01**	<0.01	<0.01	<0.01	<0.01	**0.013**	<0.01	<0.01	**0.016**	**0.034**
Ammonia (mg/L)	**0.22**	<0.1	**0.2**	<0.1	**0.11**	<0.1	<0.1	**0.14**	<0.1	<0.1	**0.12**	**0.24**	<0.1	<0.1	<0.1	<0.1	<0.1	**0.14**	<0.1	<0.1	**0.11**	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	**0.54**	**0.39**	**0.27**	**0.64**	**0.27**	**0.7**	**0.29**	-	-	-	**-**	**0.57**	**0.45**	**0.31**	**0.25**	**0.33**	**0.35**	<0.2	-	**-**	-	**-**
Total Nitrogen (mg/L)	**0.54**		**0.908**	**3.1**	**1.15**	**0.696**	**1**	**0.419**	**0.526**	**0.556**	<0.2	**0.57**		**2.68**	**2.58**	**1.29**	**1.34**	**2.85**	**2.3**	**3.47**	**3.63**	**1.38**
Anions																						
Chloride (mg/L)	**33.2**	**72.1**	**30.3**	**39**	**33.7**	**31.9**	**41.2**	**32.4**	**26.6**	**45.6**	**39.6**	**150**	**153**	**151**	**126**	**150**	**159**	**165**	**154**	**158**	**161**	**167**
Sulfate (mg/L)	**25.6**	**17.8**	**18.4**	**13**	**33.6**	**32.6**	**13.4**	**16.2**	**21.2**	**19.9**	**19.8**	**7.7**	**5**	<5	**5.8**	**6.5**	**8.8**	**7**	**7.1**	**6.3**	**6.8**	**9.5**
Elements																						
Dissolved Iron (mg/L)	**0.486**	<0.1	<0.1	<0.1	**0.182**	**3.67**	<0.1	**1.04**	**0.571**	<0.1	**1.05**	**1.83**	<0.143	**0.626**	<0.1	**0.185**	**0.234**	<0.1	**0.145**	<0.1	**0.241**	<0.1
Dissolved Manganese (mg/L)	**0.173**	**0.278**	**0.484**	**0.629**	**0.747**	**1.46**	**0.047**	**3.23**	**5.17**	**4.46**	**5.2**	**0.211**	**0.163**	**0.083**	**0.055**	**0.039**	**0.044**	**0.03**	**0.036**	**0.024**	**0.032**	**0.026**
Total Arsenic (mg/L)	-	-	<0.025	**-**	**-**	**-**	**-**	-	-	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	-	<0.005	**-**	**-**	**-**	**-**	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**
Boron (mg/L)	-	-	-	**-**	**-**	**-**	-	-	-	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Sodium (mg/L)	-	-	-	**-**	**-**	**-**	-	-	-	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Other																						
DOC (mg/L)	**9.39**	**7.49**	**4.04**	**5.17**	**8.15**	**7.5**	**4.67**	**6.58**	**6.79**	**3.75**	**1.33**	**1.2**	**1.33**	**3.37**	**2.45**	**2.09**	**1.86**	**0.853**	**1.14**	**2.85**	**1.74**	**9.54**
Methane (µg/L)	**-**	-	-	**-**	**-**	**-**	**726**	**-**	**-**	**-**	**-**	**-**	-	-	-	**-**	**-**	**-**	**-**	**-**	-	**-**
Ethane (µg/L)	-	-	-	-	-	**-**	<3	**-**	**-**	**-**	**-**	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**
Ethene (µg/L)	-	-	-	-	-	**-**	<5	**-**	**-**	**-**	**-**	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**
Alkalinity as CaCO3 (mg/L)	**-**	-	-	**-**	**-**	**-**	**-**	-		-	**-**	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BM050B**											**MW-BM050C**										
Top of Screen Elevation (ft)	-10.20											4.80										
Bottom of Screen Elevation (ft)	-20.20											-5.20										
Sampling Date	5/8/2018	9/20/2018	1/3/2019	4/10/2019	7/24/2019	11/7/2019	2/17/2020	5/12/2020	8/13/2020	11/18/2020	3/4/2021	5/9/2018	9/20/2018	1/3/2019	4/10/2019	7/24/2019	11/6/2019	2/17/2020	5/12/2020	8/13/2020	11/18/2020	3/4/2021	5/9/2018
Type of Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline
Field Measurements																						
pH (SU)	5.38	4.48	5.38	5.42	5.44	5.24	5.47	5.69	5.83	5.89	8.30	5.47	4.37	5.11	5.16	5.34	5.11	5.33	5.53	5.83	5.93	8.01	5.39
Temperature (^{o}C)	13.4	14.6	13.9	14.5	15.8	14.1	14.5	14.6	16.1	14.2	14.1	12.6	15.1	14.3	15.1	16.0	13.7	14.8	15.0	16.4	14.1	14.6	11.5
Dissolved Oxygen (DO, mg/L)	0.01	0.30	0.11	0.09	0.07	0.59	0.01	0.18	0.01	0.09	0.09	4.05	5.31	5.40	6.40	4.72	4.96	5.13	5.49	4.91	5.22	3.47	0.00
Redox Potential (ORP; mV)	132.2	35.5	199.3	116.8	186.3	185.1	214.7	217.7	181.5	143.0	183.3	186.9	78.7	231.0	150.8	277.5	193.7	213.0	220.9	180.1	159.2	183.2	178.3
Specific Conductivity (µS/cm)[c]	1312.5	886.0	833.0	784.0	1084.0	868.0	930.0	793.0	761.0	581.0	592.0	717.0	649.0	1138.0	915.0	700.0	440.0	396.0	286.0	234.1	189.0	201.0	405.6
Turbidity (NTU)	1.54	3.53	0.02	4.61	4.66	0.02	6.01	0.05	0.96	8.67	0.02	7.00	7.70	0.02	3.61	2.24	0.02	4.12	0.05	2.02	6.65	97.20	18.00
Laboratory Analyses																							
Nitrogen																							
Nitrate as N (mg/L)	**4.9**	**6.39**	**6.4**	**5.53**	**2.9**	**1.51**	**6.13**	**3.14**	**3.36**	**2.14**	**0.992**	**1.06**	**1.05**	**0.662**	**0.709**	**0.39**	**0.346**	**3.97**	**0.589**	**1.17**	**0.961**	**0.228**	**10.1**
Nitrite as N (mg/L)	<0.25	**0.016**	**0.043**	**0.04**	**0.125**	**0.181**	**0.046**	<0.01	**0.015**	<0.01	<0.01	<0.25	**0.01**	<0.01	<0.01	<0.01	<0.01	**0.264**	<0.01	<0.01	<0.01	<0.01	<0.25
Ammonia (mg/L)	**0.55**	<1.52	**1.62**	**4.96**	**8.84**	**7.24**	**6.66**	**9.39**	**6.82**	**4.44**	**4.92**	**0.12**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.5**
Total Kjeldahl Nitrogen (TKN) (mg/L)	**0.37**	**2.15**	**1.63**	**5.39**	**8.34**	**7.73**	**7.78**	-	**-**	-	**-**	**0.59**	**0.4**	**0.35**	**0.3**	**0.38**	**0.42**	**0.25**	-	**-**	-	**-**	<0.2
Total Nitrogen (mg/L)	**0.37**		**8.07**	**11**	**11.4**	**9.42**	**14**	**13.5**	**10.5**	**7.69**	**6.74**	**1.65**		**1.01**	**1.01**	**0.771**	**0.763**	**4.48**	**0.972**	**1.43**	**1.19**	**0.228**	**10.1**
Anions																							
Chloride (mg/L)	**258**	**238**	**218**	**249**	**269**	**265**	**235**	**193**	**186**	**167**	**164**	**115**	**193**	**377**	**303**	**183**	**144**	**198**	**68.3**	**49.2**	**44.1**	**49.2**	**28**
Sulfate (mg/L)	**25.7**	**17.3**	**22.7**	**22.3**	**21.5**	**23.1**	**29.2**	**28.7**	**26.7**	**23.7**	**27**	**5**	**5**	<5	<5	**5.7**	**6**	**27.6**	**9**	**9**	**6.6**	**9.3**	**20.2**
Elements																							
Dissolved Iron (mg/L)	**0.537**	<0.1	**0.196**	<0.1	**0.226**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.348**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.225**
Dissolved Manganese (mg/L)	**0.319**	**0.06**	**0.055**	**0.078**	**0.068**	**0.057**	**0.607**	**0.037**	**0.024**	**0.031**	**0.028**	**0.072**	**0.041**	**0.111**	**0.086**	**0.032**	**0.021**	<0.02	<0.02	<0.02	<0.02	<0.02	**0.342**
Total Arsenic (mg/L)	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-
Dissolved Arsenic (mg/L)	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	-
Boron (mg/L)	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-
Sodium (mg/L)	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-
Other																							
DOC (mg/L)	**2.42**	**2.26**	**2.43**	**1.56**	**2.66**	**3.15**	**1.7**	**1.53**	**2.03**	**2.02**	**1.91**	**2.43**	**1.38**	**0.917**	**0.734**	**1.15**	**0.914**	**2.92**	**1.16**	**2.47**	**0.946**	**1.06**	**3.69**
Methane (µg/L)	**-**	-	-	-	**-**	**-**	**-**	-	-	-	**-**	**-**	-	-	-	-	**-**	**-**	-	-	-	**-**	**-**
Ethane (µg/L)	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-
Ethene (µg/L)	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-	-	-	-	-	**-**	**-**	**-**	**-**	-	**-**	-
Alkalinity as CaCO3 (mg/L)	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	**-**

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5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	
Top of Screen Elevation (ft)	
Bottom of Screen Elevation (ft)	
Sampling Date	9/20/2018
Type of Sample	Q6 Sample
Field Measurements	
pH (SU)	4.39
Temperature (^{o}C)	14.0
Dissolved Oxygen (DO, mg/L)	0.21
Redox Potential (ORP; mV)	38.8
Specific Conductivity (µS/cm)[c]	267.0
Turbidity (NTU)	48.10
Laboratory Analyses	
Nitrogen	
Nitrate as N (mg/L)	**11.1**
Nitrite as N (mg/L)	**0.019**
Ammonia (mg/L)	**1.13**
Total Kjeldahl Nitrogen (TKN) (mg/L)	**1.32**
Total Nitrogen (mg/L)	
Anions	
Chloride (mg/L)	**28.2**
Sulfate (mg/L)	**16.7**
Elements	
Dissolved Iron (mg/L)	**0.248**
Dissolved Manganese (mg/L)	**0.232**
Total Arsenic (mg/L)	-
Dissolved Arsenic (mg/L)	-
Boron (mg/L)	**-**
Sodium (mg/L)	**-**
Other	
DOC (mg/L)	**2.83**
Methane (µg/L)	**-**
Ethane (µg/L)	-
Ethene (µg/L)	-
Alkalinity as CaCO3 (mg/L)	**-**

Notes:

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BN1A**									**MW-BN1B**										
Top of Screen Elevation (ft)	-25.50									-10.60										
Bottom of Screen Elevation (ft)	-35.50									-20.60										
Sampling Date	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/20/2020	5/14/2020	8/13/2020	11/17/2020	3/4/2021	5/9/2018	9/20/2018	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/20/2020	5/14/2020	8/13/2020	11/17/2020	3/4/2021
Type of Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																				
pH (SU)	4.82	5.53	5.20	4.92	5.27	5.18	5.39	5.30	8.38	5.50	4.52	4.96	5.69	5.34	5.19	5.53	5.44	5.65	5.55	8.15
Temperature (^{o}C)	13.8	14.2	14.5	14.1	13.3	13.9	15.0	14.1	13.3	12.0	14.1	14.1	14.9	14.8	14.0	13.2	14.2	15.0	14.1	13.6
Dissolved Oxygen (DO, mg/L)	0.13	0.07	0.05	0.22	0.04	0.15	0.01	0.05	0.14	0.08	0.26	0.06	0.09	0.07	0.38	0.04	0.13	0.01	0.03	0.09
Redox Potential (ORP; mV)	159.7	14.4	206.0	186.8	220.5	251.9	224.4	179.0	219.4	169.2	46.3	160.3	2.6	210.3	164.5	216.5	227.2	213.0	168.8	219.1
Specific Conductivity (µS/cm)[c]	189.0	167.0	222.2	224.0	266.0	233.0	244.3	245.0	223.0	623.8	369.0	318.0	203.0	235.9	226.0	235.0	196.0	184.2	178.0	170.0
Turbidity (NTU)	10.20	9.82	2.36	4.91	6.48	0.05	0.80	0.02	0.02	6.29	2.41	9.09	2.91	2.57	6.46	7.01	0.05	0.02	0.02	0.02
Laboratory Analyses																				
Nitrogen																				
Nitrate as N (mg/L)	**9.56**	**10.7**	**12.7**	**5.56**	**14.6**	**12.7**	**16.3**	**15.2**	**5.74**	**8.85**	**10.6**	**8.95**	**9.6**	**8.33**	**3.02**	**7.27**	**5.97**	**7.44**	**6.44**	**2.6**
Nitrite as N (mg/L)	**0.027**	**0.024**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.25	**0.046**	**0.045**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	**1.41**	**1.86**	**1.97**	**1.67**	**1.82**	**1.8**	**1.97**	**1.74**	**1.46**	**0.72**	**1.26**	**1.67**	**1.85**	**2.05**	**2.05**	**2.08**	**2.37**	**2.45**	**2.38**	**2.03**
Total Kjeldahl Nitrogen (TKN) (mg/L)	**1.23**	**1.98**	**1.68**	**1.68**	**1.15**	**1.27**	**-**	-	**-**	**0.45**	**1.16**	**0.81**	**1.98**	**2.27**	**2.35**	**1.97**	**2.66**	**-**	-	**-**
Total Nitrogen (mg/L)	**10.8**	**12.7**	**14.3**	**7.24**	**15.8**	**14**	**18.3**	**16.9**	**5.94**	**9.3**	**-**	**9.81**	**11.6**	**10.6**	**5.37**	**9.24**	**8.62**	**9.73**	**8.68**	**3.86**
Anions																				
Chloride (mg/L)	**23.9**	**24.8**	**16.6**	**19.9**	**20.3**	**19.5**	**19.8**	**21**	**21.1**	**70.6**	**52.3**	**39.3**	**15.4**	**24.7**	**29.5**	**21.4**	**20.7**	**16.2**	**19**	**18.9**
Sulfate (mg/L)	**11.8**	**17.4**	**8.8**	**8.2**	**6.4**	**5.9**	<5	**8.7**	**6.2**	**33.2**	**24.7**	**18.8**	**11.1**	**15.7**	**18**	**14.4**	**13**	**13.4**	**16.1**	**11.4**
Elements																				
Dissolved Iron (mg/L)	**0.419**	<0.1	<0.1	<0.1	<0.1	**0.107**	<0.1	<0.1	<0.1	**0.33**	<0.1	<0.1	**0.131**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.18**	**0.028**	**0.151**	**0.162**	**0.169**	**0.163**	**0.192**	**0.227**	**0.203**	**0.089**	**0.042**	**0.037**	**0.141**	**0.027**	**0.033**	**0.029**	**0.023**	**0.023**	**0.024**	**0.027**
Total Arsenic (mg/L)	-	-	**-**	**-**	-	-	**-**	-	**-**	-	-	-	-	**-**	**-**	-	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**
Boron (mg/L)	-	-	**-**	**-**	-	-	**-**	-	**-**	-	**-**	**-**	-	**-**	**-**	-	-	**-**	-	**-**
Sodium (mg/L)	-	-	**-**	**-**	-	-	**-**	-	**-**	-	**-**	**-**	-	**-**	**-**	-	-	**-**	-	**-**
Other																				
DOC (mg/L)	**2.48**	**1.74**	**1.8**	**1.89**	**1.07**	**1.46**	**1.44**	**1.71**	**3.45**	**6.18**	**3.66**	**2.03**	**1.56**	**1.84**	**1.77**	**1.95**	**1.4**	**1.68**	**1.47**	**1.36**
Methane (µg/L)	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	**-**	-	-	**-**	**-**	-	-	**-**	**-**	**-**
Ethane (µg/L)	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**
Ethene (µg/L)	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**
Alkalinity as CaCO3 (mg/L)	-	-	**-**	**-**	-	-	**-**	-	**-**	**-**	**-**	-	-	**-**	**-**	-	-	**-**	-	**-**

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5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BN1C**											**MW-BN2C**		**MW-BX2A**								
Top of Screen Elevation (ft)	4.38											10.21		-23.60								
Bottom of Screen Elevation (ft)	-5.63											0.21		-33.60								
Sampling Date	5/9/2018	9/20/2018	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/20/2020	5/14/2020	8/13/2020	11/17/2020	3/4/2021	5/9/2018	9/25/2018	5/9/2018	9/20/2018	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/19/2020	5/14/2020	8/13/2020	11/18/2020
Type of Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample
Field Measurements																							
pH (SU)	NS	5.08	5.39	6.14	5.84	5.63	6.08	5.86	6.03	6.18	8.18	5.20	5.40	4.79	4.96	5.17	5.05	5.05	4.56	5.15	5.09	5.05	5.10
Temperature (^{o}C)	NS	14.4	14.3	15.7	15.3	15.0	12.2	14.8	15.3	14.0	13.6	14.6	15.4	10.9	13.8	12.8	13.7	15.0	14.3	13.4	13.9	14.5	13.4
Dissolved Oxygen (DO, mg/L)	NS	0.86	0.21	0.18	0.06	0.43	0.11	0.25	0.04	0.16	0.50	3.75	4.71	0.00	3.56	3.49	2.47	2.47	1.92	1.29	1.78	1.41	0.45
Redox Potential (ORP; mV)	NS	32.7	154.9	20.9	170.4	130.1	215.4	206.7	172.8	68.9	221.9	147.8	20.3	234.0	215.0	166.8	206.2	30.3	156.6	128.5	189.3	135.9	251.1
Specific Conductivity (µS/cm)[c]	NS	628.0	470.0	304.0	481.2	312.0	328.0	318.0	347.3	285.0	273.0	9096.0	2223.0	713.1	184.0	242.0	229.0	231.7	206.0	242.0	254.0	196.7	173.0
Turbidity (NTU)	NS	19.10	4.61	7.55	2.28	34.60	5.49	0.50	32.80	9.38	10.70	186.00	165.00	1.04	200.00	5.61	15.00	10.20	53.30	5.69	4.78	15.40	1.35
Laboratory Analyses																							
Nitrogen																							
Nitrate as N (mg/L)	NS	**9.66**	**8.9**	**6.65**	**6.53**	**1.89**	**5.7**	**4.28**	**5.97**	**4.04**	**2.04**	**0.84**	**0.942**	**29**	**10.8**	**11.1**	**10.1**	**10.8**	**3.07**	**8.7**	**10.4**	**10.6**	**8.11**
Nitrite as N (mg/L)	NS	**0.128**	**0.136**	**0.064**	**0.016**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.25	<0.01	<0.25	<0.01	<0.01	**0.024**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	NS	**9.97**	**10.5**	**10.1**	**10.9**	**6.82**	**6.56**	**7.32**	**8.68**	**5.45**	**5.93**	<0.1	<0.1	**0.57**	<0.1	<0.1	<0.1	<0.1	**0.13**	**0.54**	<0.1	<0.1	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	NS	**11.4**	**9.03**	**10.5**	**10.8**	**7.96**	**9.13**	**10.3**	**-**	-	**-**	**0.32**	**0.61**	**0.25**	**0.32**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**-**	-
Total Nitrogen (mg/L)	NS		**18.1**	**17.2**	**17.4**	**9.85**	**14.8**	**14.6**	**15.4**	**9.37**	**8.45**	**1.16**		**29.2**		**11.1**	**10.1**	**10.8**	**3.07**	**8.7**	**10.4**	**10.6**	**8.11**
Anions																							
Chloride (mg/L)	NS	**109**	**65.8**	**51.5**	**88.7**	**54.4**	**41.9**	**53.9**	**57.3**	**61.8**	**50.2**	**2620**	**1000**	**42.2**	**26.5**	**29.5**	**27.6**	**28.6**	**27.4**	**25.9**	**25.2**	**23.5**	**23.7**
Sulfate (mg/L)	NS	**28.1**	**21.8**	**16.6**	**11.9**	**11.5**	**9.2**	**7.3**	**5**	**6.3**	**5.5**	<5	**5.7**	**8.6**	**9.8**	**8.2**	**11.5**	**12.7**	**11.4**	**15.1**	**13.7**	**10.1**	**13**
Elements																							
Dissolved Iron (mg/L)	NS	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**2.68**	<0.1	<0.1	**0.159**	**0.575**	**0.26**	**0.379**	**0.428**	<0.1	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	NS	**0.36**	**0.221**	**0.141**	**0.171**	**0.115**	**0.095**	**0.083**	**0.095**	**0.085**	**0.105**	**0.944**	**0.158**	**0.614**	**0.143**	**0.163**	**0.14**	**0.134**	**0.123**	**0.118**	**0.106**	**0.11**	**0.109**
Total Arsenic (mg/L)	NS	-	-	-	**-**	**-**	-	-	**-**	-	**-**	-	-	-	<0.0025	-	-	**-**	**-**	**-**	-	**-**	-
Dissolved Arsenic (mg/L)	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	-	-	**-**	**-**	-	**-**	-
Boron (mg/L)	NS	-	**-**	-	**-**	**-**	-	-	**-**	-	**-**	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	-
Sodium (mg/L)	NS	-	**-**	-	**-**	**-**	-	-	**-**	-	**-**	-	-	-	-	-	-	**-**	**-**	**-**	-	**-**	-
Other																							
DOC (mg/L)	NS	**4.16**	**2.35**	**2.12**	**2.26**	**1.75**	**1.78**	**1.25**	**1.62**	**1.56**	**1.32**	**1.15**	**1.01**	**5.32**	**1.41**	**1.75**	**1.53**	**1.61**	**1.71**	**1.54**	**-**	**-**	**-**
Methane (µg/L)	NS	-	-	-	**-**	**-**	-	-	**-**	**-**	**-**	**-**	-	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-
Ethane (µg/L)	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	-	-	**-**	**-**	-	**-**	-
Ethene (µg/L)	-	-	-	-	-	**-**	-	-	**-**	**-**	**-**	-	-	-	-	-	-	-	**-**	**-**	-	**-**	-
Alkalinity as CaCO3 (mg/L)	NS	-	-	-	**-**	**-**	-	-	**-**	-	**-**	**-**	-	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-

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4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	
Top of Screen Elevation (ft)	
Bottom of Screen Elevation (ft)	
Sampling Date	3/4/2021
Type of Sample	Q15 Sample
Field Measurements	
pH (SU)	5.67
Temperature (^{o}C)	13.1
Dissolved Oxygen (DO, mg/L)	0.15
Redox Potential (ORP; mV)	170.2
Specific Conductivity (µS/cm)[c]	163.0
Turbidity (NTU)	1.15
Laboratory Analyses	
Nitrogen	
Nitrate as N (mg/L)	**2.8**
Nitrite as N (mg/L)	<0.01
Ammonia (mg/L)	<0.1
Total Kjeldahl Nitrogen (TKN) (mg/L)	-
Total Nitrogen (mg/L)	**2.8**
Anions	
Chloride (mg/L)	**25.3**
Sulfate (mg/L)	**14.9**
Elements	
Dissolved Iron (mg/L)	<0.1
Dissolved Manganese (mg/L)	**0.15**
Total Arsenic (mg/L)	-
Dissolved Arsenic (mg/L)	-
Boron (mg/L)	-
Sodium (mg/L)	-
Other	
DOC (mg/L)	-
Methane (µg/L)	-
Ethane (µg/L)	-
Ethene (µg/L)	-
Alkalinity as CaCO3 (mg/L)	-

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5. MW-B2020B nitrate was re-tested.

Table 3 Orleans Monitoring Well Groundwater Data Summary

Sample ID	**MW-BX2B**											**MW-BX2C**										
Top of Screen Elevation (ft)	-8.60											6.47										
Bottom of Screen Elevation (ft)	-18.60											-3.53										
Sampling Date	5/9/2018	9/25/2018	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/19/2020	5/14/2020	8/13/2020	11/18/2020	3/4/2021	5/9/2018	9/20/2018	1/4/2019	4/11/2019	7/25/2019	11/7/2019	2/19/2020	5/14/2020	8/13/2020	11/18/2020	3/4/2021
Type of Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample	D2 Baseline	Q6 Sample	Q7 Sample	Q8 Sample	Q9 Sample	Q10 Sample	Q11 Sample	Q12 Sample	Q13 Sample	Q14 Sample	Q15 Sample
Field Measurements																						
pH (SU)	4.68	4,05	5.47	5.23	5.23	4.85	5.37	5.25	5.25	5.19	5.60	4.74	4.85	4.91	4.83	4.88	4.42	4.60	4.89	4.91	4.87	5.35
Temperature (^{o}C)	11.1	13.4	12.8	13.9	15.5	14.1	13.3	14.2	14.9	13.3	13.1	11.6	17.7	12.4	14.1	14.8	14.0	13.5	14.1	15.1	13.1	13.5
Dissolved Oxygen (DO, mg/L)	1.12	1.58	1.79	2.55	0.63	0.29	0.87	1.44	1.32	0.09	1.43	3.79	3.21	3.46	3.62	3.32	3.83	3.03	3.80	3.78	3.52	3.50
Redox Potential (ORP; mV)	250.5	23.5	179.2	215.8	213.4	160.2	136.4	204.9	139.5	240.9	190.4	257.1	202.8	236.1	260.5	112.6	197.2	226.1	223.1	257.4	279.1	154.2
Specific Conductivity (µS/cm)[c]	690.0	290.0	271.0	239.0	258.5	224.0	279.0	290.0	228.8	246.0	195.0	769.4	395.0	458.0	445.0	459.0	407.0	471.0	442.0	333.1	317.0	233.0
Turbidity (NTU)	4.18	2.97	0.05	2.55	9.11	3.30	5.84	0.16	1.36	8.76	0.50	7.37	over	9.98	2.08	5.71	3.53	1.36	0.84	5.03	8.50	0.02
Laboratory Analyses																						
Nitrogen																						
Nitrate as N (mg/L)	**27.9**	**9.55**	**11.6**	**10.9**	**14.9**	**4.58**	**14.2**	**12.5**	**14.4**	**15.6**	**5.32**	**39.7**	**42.8**	**33.6**	**35.2**	**38**	**13.8**	**38.3**	**24.8**	**29.1**	**25.7**	**8.33**
Nitrite as N (mg/L)	<0.25	**0.198**	**0.08**	**0.027**	<0.01	<0.01	<0.01	<0.01	<0.01	**0.015**	<0.01	<0.25	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia (mg/L)	**0.3**	**0.11**	**0.15**	**0.1**	**0.26**	**0.15**	**0.21**	**0.17**	**0.26**	**0.19**	**0.19**	**0.29**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**0.11**
Total Kjeldahl Nitrogen (TKN) (mg/L)	<0.2	**0.42**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**-**	-	**-**	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**-**	-	**-**
Total Nitrogen (mg/L)	**27.9**	-	**11.6**	**11**	**14.9**	**4.58**	**14.2**	**12.5**	**14.4**	**15.6**	**5.32**	**39.7**	-	**33.6**	**35.2**	**38**	**13.8**	**38.3**	**24.8**	**29.1**	**25.7**	**8.33**
Anions																						
Chloride (mg/L)	**43**	**29.7**	**29.8**	**26.1**	**24.7**	**26.6**	**26.4**	**26.8**	**25.6**	**31.3**	**27.2**	**29.3**	**34**	**32.8**	**36**	**38.5**	**41.3**	**39.6**	**34**	**32.8**	**34**	**29.8**
Sulfate (mg/L)	**9.6**	**16.9**	**9.2**	**9.8**	**9.8**	**5.6**	**9.6**	**8**	**7.4**	**8**	**12.6**	**7.3**	**7.2**	<5	<5	<5	**5.5**	<5	<5	<5	<5	**5.2**
Elements																						
Dissolved Iron (mg/L)	<0.1	<0.1	**0.39**	<0.1	<0.1	<0.1	<0.1	**0.714**	<0.1	<0.1	<0.1	<0.1	**0.164**	**0.145**	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1
Dissolved Manganese (mg/L)	**0.433**	**0.324**	**0.417**	**0.376**	**0.434**	**0.388**	**0.472**	**0.439**	**0.481**	**0.585**	**0.524**	**0.833**	**0.728**	**0.617**	**0.58**	**0.633**	**0.561**	**0.573**	**0.483**	**0.501**	**0.519**	**0.441**
Total Arsenic (mg/L)	-	<0.0025	-	-	**-**	**-**	**-**	-	**-**	-	**-**	**-**	<0.0025	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Dissolved Arsenic (mg/L)	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**
Boron (mg/L)	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Sodium (mg/L)	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	-	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Other																						
DOC (mg/L)	**4.89**	**27.7**	**3.16**	**1.22**	**2.01**	**1.77**	**1.02**	**-**	**-**	**-**	**-**	**4.18**	**1.36**	**2.22**	<0.25	**2.15**	**1.54**	**1.15**	**-**	**-**	**-**	**-**
Methane (µg/L)	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**
Ethane (µg/L)	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**
Ethene (µg/L)	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**	-	-	-	-	-	**-**	**-**	-	**-**	-	**-**
Alkalinity as CaCO3 (mg/L)	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**	**-**	-	-	-	**-**	**-**	**-**	-	**-**	-	**-**

Notes:

NS - Not Sampled

Bold - detected above the Minimum Detection Limit

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

1. DO was measured in the field as DO(%) and was converted using the online tool at: http://www.hbuehrer.ch/Rechner/O2satur.html

2. MW-12C references "MW-12" that was installed as part of the Nauset Regional Middle School monitoring well network.

3. Existing wells (MW-4, MW-8, MW-12C) screen elevations were determined based on field measurement of depth to bottom of well. Actual screen depths may vary if bottom was affected by silt build-up in well.

4. MW-12C (existing) was damaged during snow removal at the site in Winter 2017. A sample was unable to be taken during subsequent events. It was repaired in April 2018.

5. MW-B2020B nitrate was re-tested.

Figures

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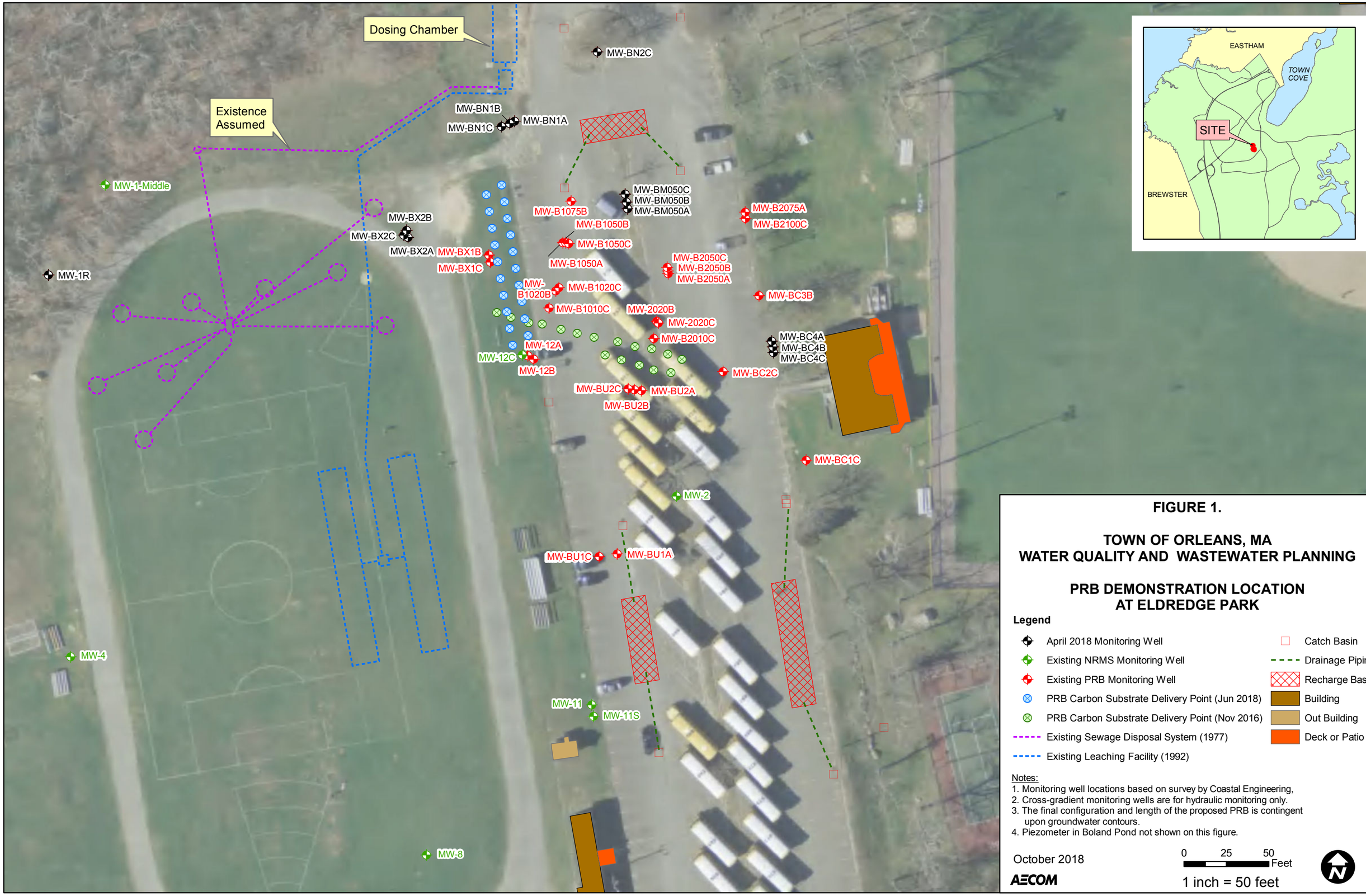

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FIGURE 1.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

PRB DEMONSTRATION LOCATION AT ELDREDGE PARK

Legend

- April 2018 Monitoring Well
- Existing NRMS Monitoring Well
- Existing PRB Monitoring Well
- PRB Carbon Substrate Delivery Point (Jun 2018)
- PRB Carbon Substrate Delivery Point (Nov 2016)
- Existing Sewage Disposal System (1977)
- Existing Leaching Facility (1992)
- Catch Basin
- Drainage Piping
- Recharge Basin
- Building
- Out Building
- Deck or Patio

Notes:
1. Monitoring well locations based on survey by Coastal Engineering,
2. Cross-gradient monitoring wells are for hydraulic monitoring only.
3. The final configuration and length of the proposed PRB is contingent upon groundwater contours.
4. Piezometer in Boland Pond not shown on this figure.

October 2018

AECOM

0 25 50 Feet

1 inch = 50 feet

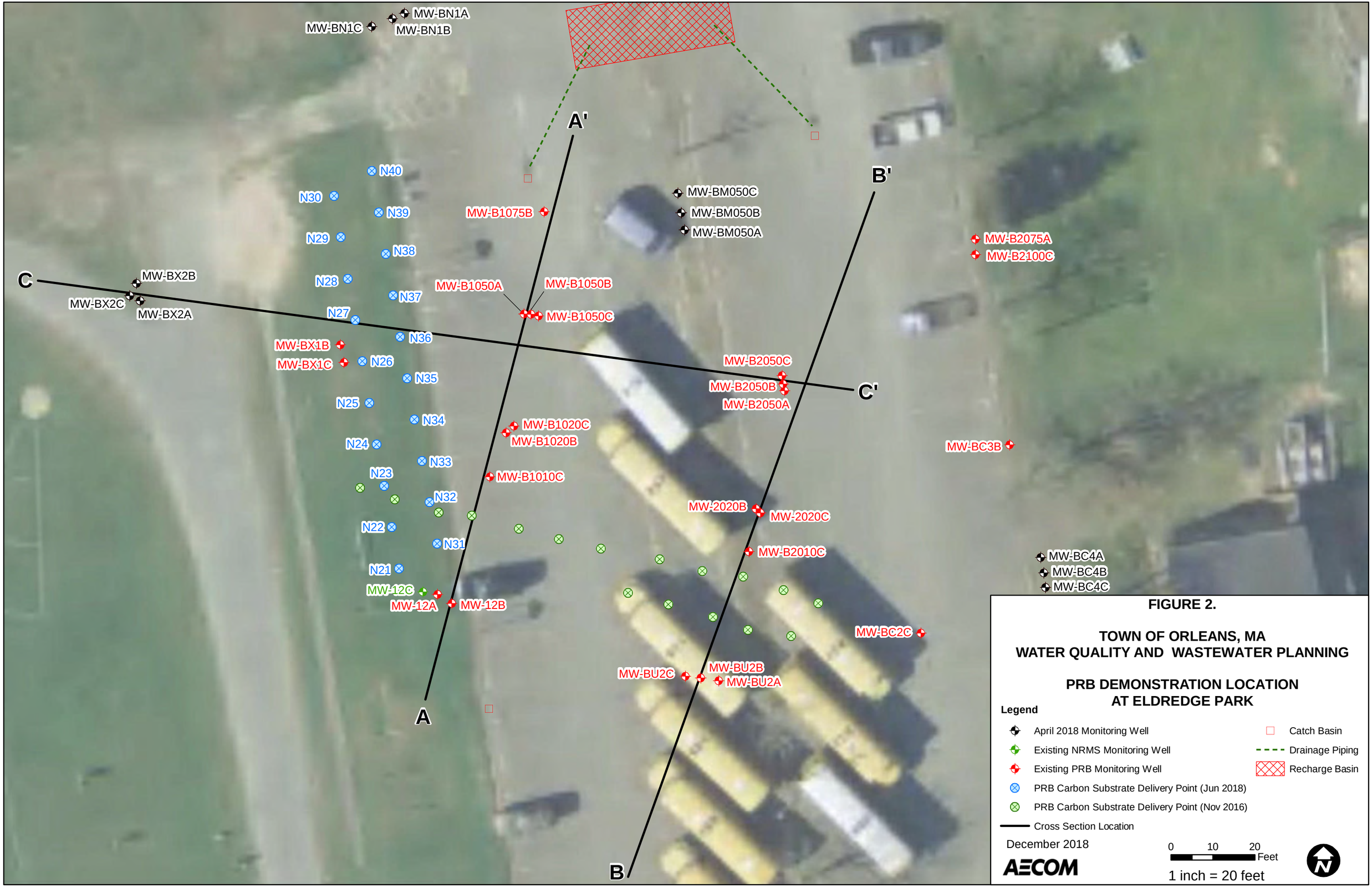

FIGURE 2.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

PRB DEMONSTRATION LOCATION AT ELDREDGE PARK

Legend

- April 2018 Monitoring Well
- Existing NRMS Monitoring Well
- Existing PRB Monitoring Well
- PRB Carbon Substrate Delivery Point (Jun 2018)
- PRB Carbon Substrate Delivery Point (Nov 2016)
- Cross Section Location
- Catch Basin
- Drainage Piping
- Recharge Basin

December 2018

AECOM

0 10 20 Feet

1 inch = 20 feet

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A
SOUTHWEST

A'
NORTHEAST

MW-12B
MW-12
MW-12A
MW-B1010C
MW-B1020B
MW-B1020C
Approximate Ground Surface
MW-B1050A
MW-B1050B
MW-B1050C
MW-B1075B

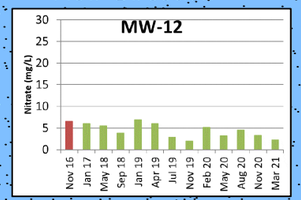
Unsaturated Zone

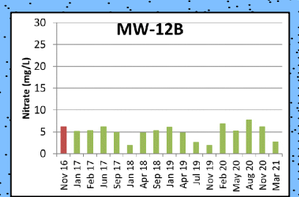
Saturated Zone

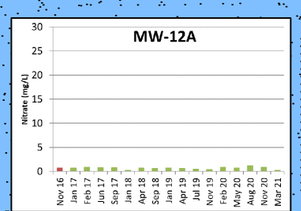
Approximate Water Table

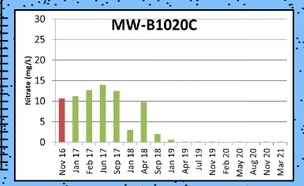
Approximate Groundwater Flow Direction

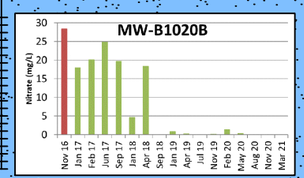
PRB INJECTION ZONE (NOVEMBER 2016)

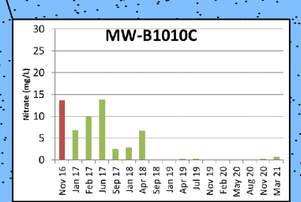


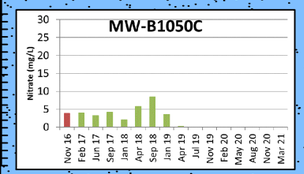


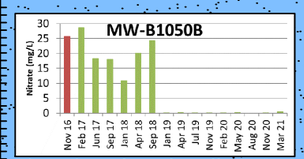


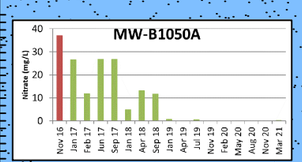


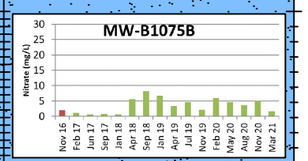












Elevation (ft)

Feet Below Ground Surface

Horizontal Scale (ft)

CROSS SECTION A-A'
WITH NITRATE CONCENTRATION DATA
TOWN OF ORLEANS, MA
Project No.: 60476644 Date: 2021-04-05

AECOM
Figure: 3

B
SOUTHWEST

B'
NORTHEAST

MW-BU2C
MW-BU2B
MW-BU2A
MW-B2010C
MW-B2020C
MW-B2020B
MW-B2050A
MW-B2050B
MW-B2050C
MW-B2100
MW-B2075A

Approximate
Ground Surface

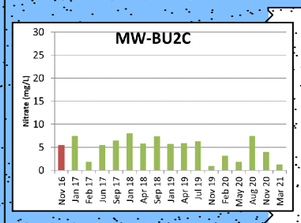
Unsaturated
Zone

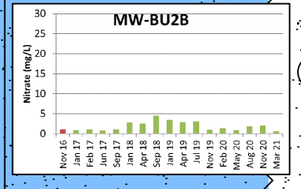
Approximate
Water Table

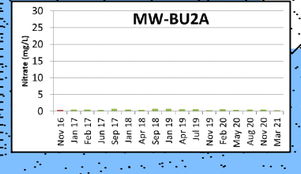
Approximate
Groundwater
Flow Direction

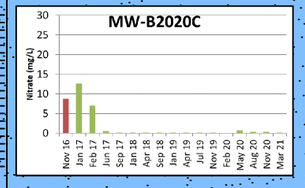
PRB
INJECTION
ZONE
(NOVEMBER
2016)

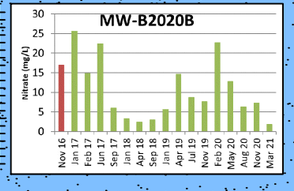
Saturated
Zone

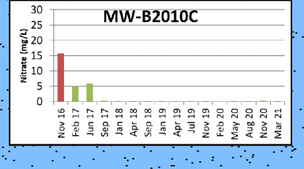


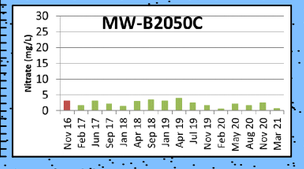


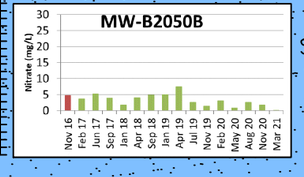


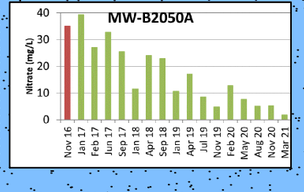


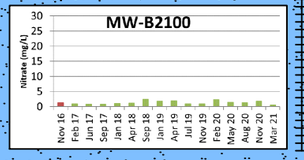


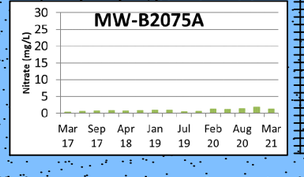












Elevation (ft)
40
30
20
10
0
−10
−20
−30
−40

Feet Below Ground Surface
0
−5
−15
−25
−35
−45
−55
−65
−75
−85

0 10 20 30 40 50 60 70 80 90 100 110 120 130
Horizontal Scale (ft)

AECOM
Figure: 4

CROSS SECTION B-B'
WITH NITRATE CONCENTRATION DATA
TOWN OF ORLEANS, MA
Project No.: 60476644 Date: 2021-04-05

AECOM

Figure: 5

C
NORTHWEST

C'
NORTHEAST

MW-BX2A
MW-BX2B
MW-BX2C

MW-BX1B
MW-BX1C

Approximate
Ground Surface

MW-B1010C

MW-B1020B
MW-B1020C

MW-B1050A
MW-B1050B
MW-B1050C

MW-B2050A
MW-B2050B
MW-B2050C

Unsaturated
Zone

Saturated
Zone

Approximate
Water Table

Approximate
Groundwater
Flow Direction

PRB
INJECTION
ZONE
(JUNE 2018)

MW-BX1C

MW-B2010C

MW-B1010C

MW-BX2C

MW-BX2B

MW-BX2A

MW-BX1B

MW-B1020B

MW-B1050C

MW-B1050B

MW-B1050A

MW-B2050C

MW-B2050B

MW-B2050A

Nitrate (mg/L)

Elevation (ft)

Feet Below Ground Surface

Horizontal Scale (ft)

NOTE
THE PROJECTION OF THE WELL LOCATIONS ARE RELATIVE TO THE PRB.

CROSS SECTION C-C'
WITH NITRATE CONCENTRATION DATA
TOWN OF ORLEANS, MA
Project No.: 60476644 Date: 2021-04-05

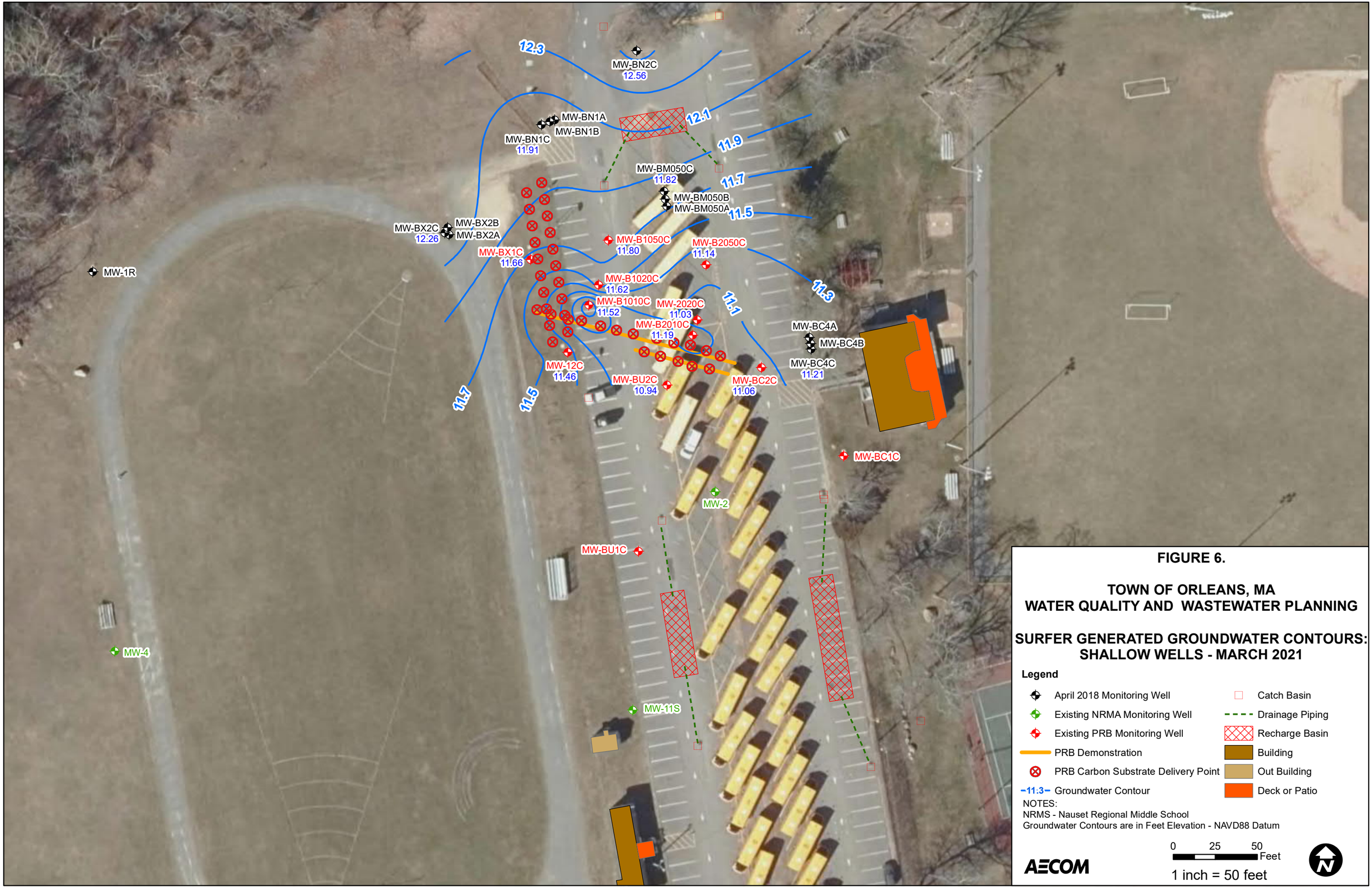


FIGURE 6.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

SURFER GENERATED GROUNDWATER CONTOURS: SHALLOW WELLS - MARCH 2021

Legend

- April 2018 Monitoring Well
- Existing NRMA Monitoring Well
- Existing PRB Monitoring Well
- PRB Demonstration
- PRB Carbon Substrate Delivery Point
- 11.3 Groundwater Contour
- Catch Basin
- Drainage Piping
- Recharge Basin
- Building
- Out Building
- Deck or Patio

NOTES:
NRMS - Nauset Regional Middle School
Groundwater Contours are in Feet Elevation - NAVD88 Datum

AECOM

0 25 50 Feet

1 inch = 50 feet

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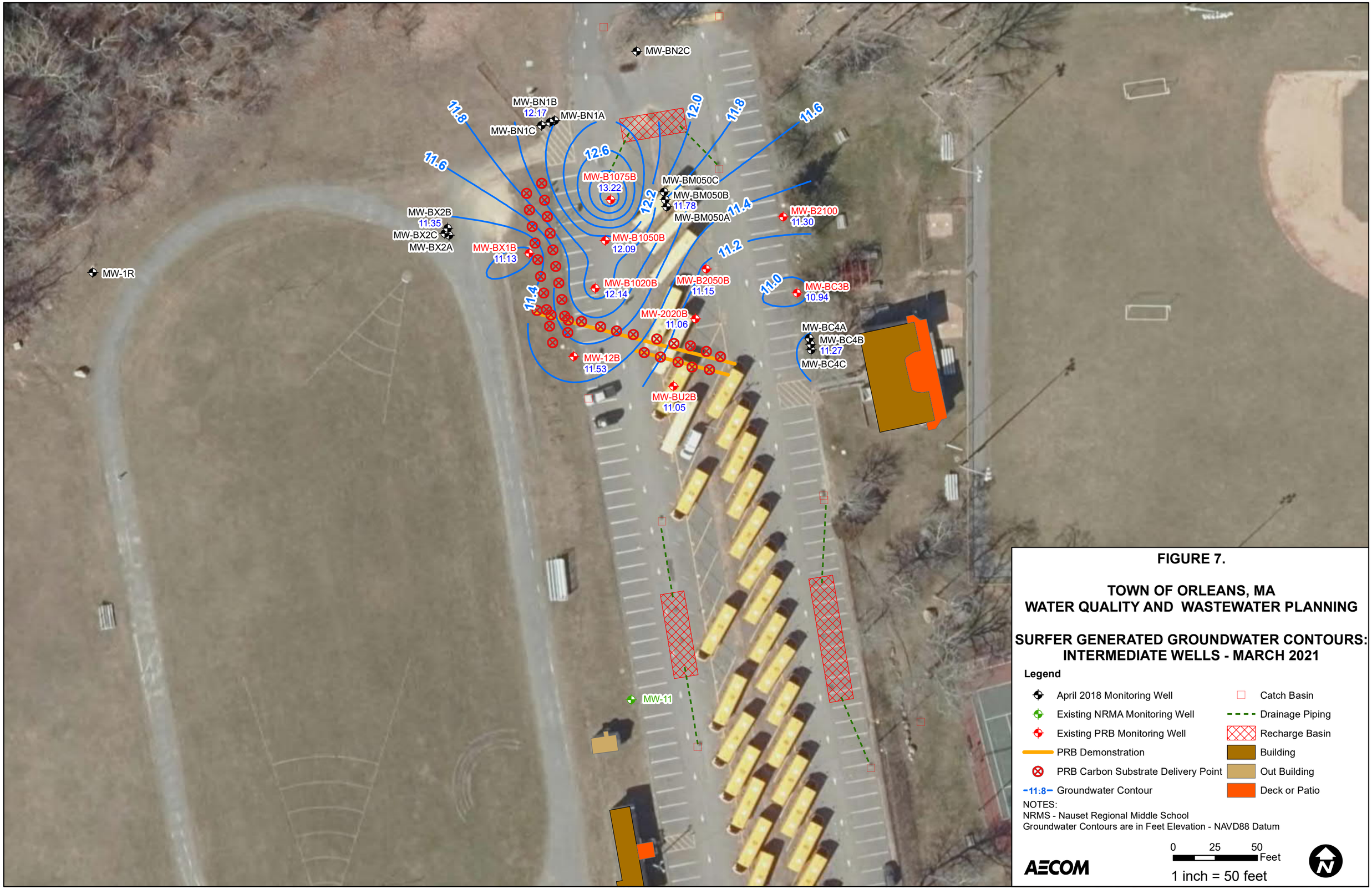

FIGURE 7.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

SURFER GENERATED GROUNDWATER CONTOURS: INTERMEDIATE WELLS - MARCH 2021

Legend

- April 2018 Monitoring Well
- Existing NRMA Monitoring Well
- Existing PRB Monitoring Well
- PRB Demonstration
- PRB Carbon Substrate Delivery Point
- 11.8 Groundwater Contour
- Catch Basin
- Drainage Piping
- Recharge Basin
- Building
- Out Building
- Deck or Patio

NOTES:
NRMS - Nauset Regional Middle School
Groundwater Contours are in Feet Elevation - NAVD88 Datum

AECOM

0 25 50 Feet

1 inch = 50 feet

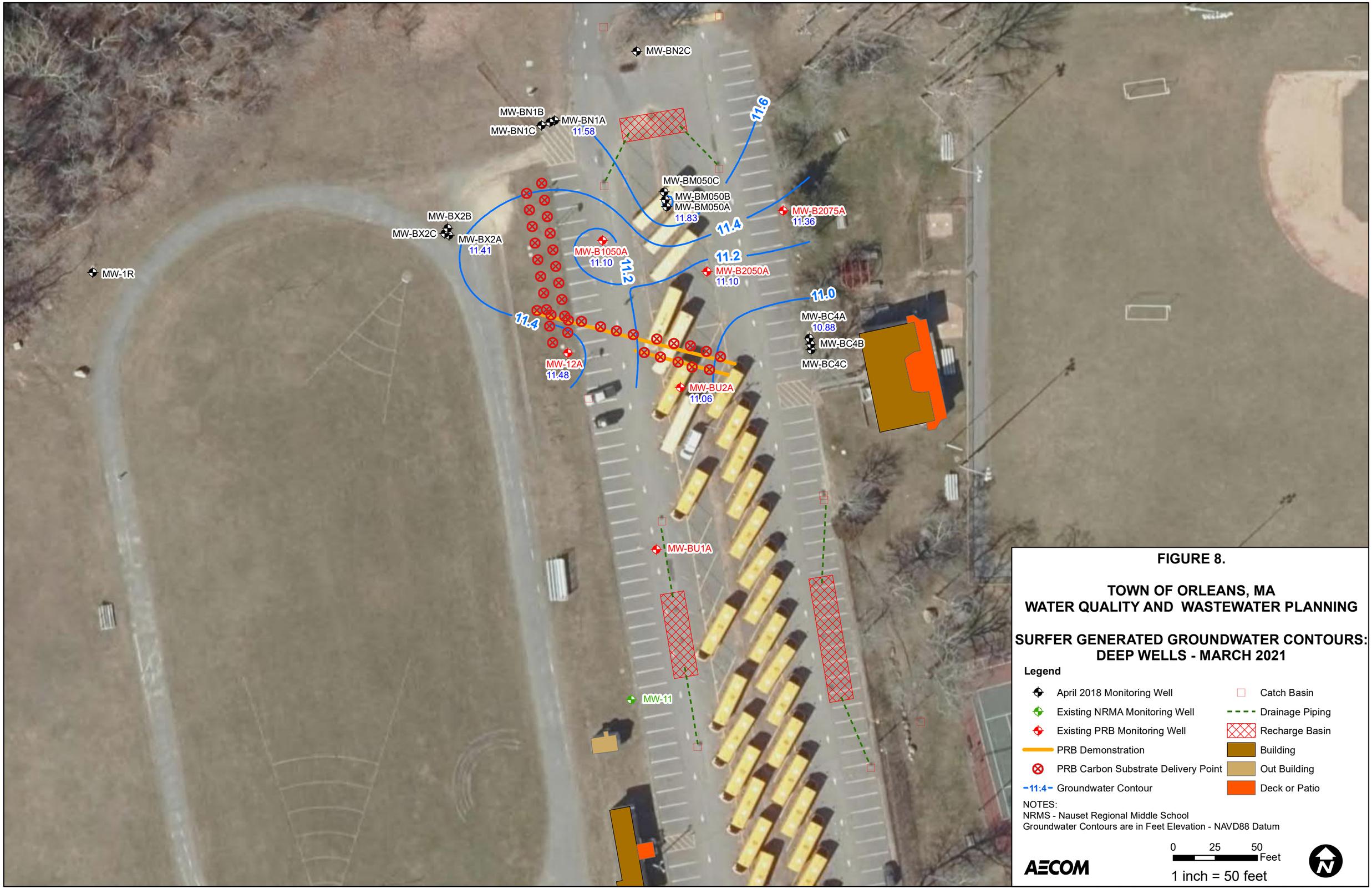

FIGURE 8.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

SURFER GENERATED GROUNDWATER CONTOURS: DEEP WELLS - MARCH 2021

Legend

- April 2018 Monitoring Well
- Existing NRMA Monitoring Well
- Existing PRB Monitoring Well
- PRB Demonstration
- PRB Carbon Substrate Delivery Point
- 11:4 Groundwater Contour
- Catch Basin
- Drainage Piping
- Recharge Basin
- Building
- Out Building
- Deck or Patio

NOTES:
NRMS - Nauset Regional Middle School
Groundwater Contours are in Feet Elevation - NAVD88 Datum

AECOM

0 25 50 Feet

1 inch = 50 feet

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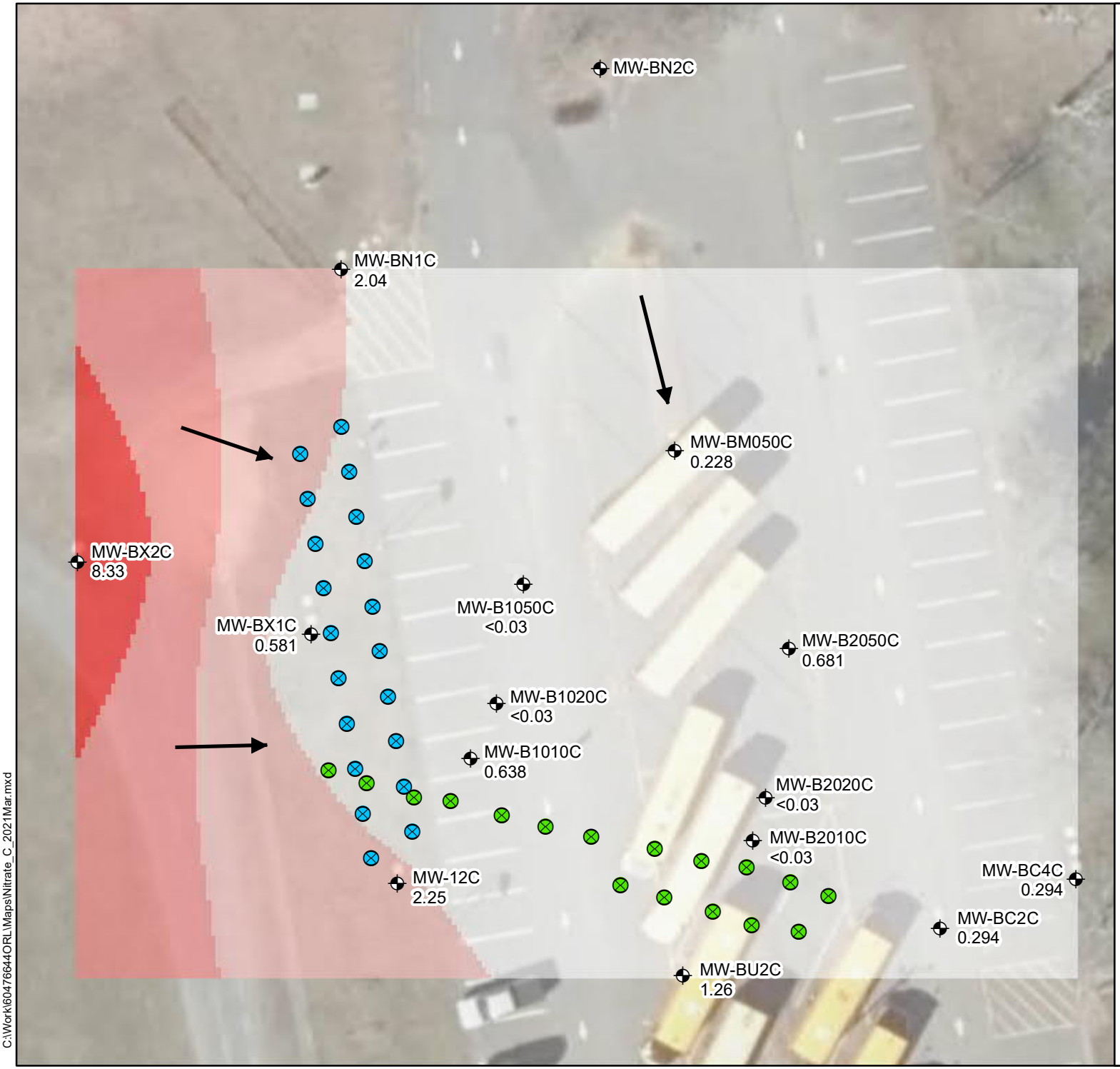

FIGURE 9.

TOWN OF ORLEANS, MA
WATER QUALITY AND WASTEWATER PLANNING

NITRATE ZONE C SHALLOW
MARCH 2021

Legend

- Monitoring Well

PRB Carbon Substrate Delivery Point

- Jun 2018 Injection
- Nov 2016 Injection
- Approximate Groundwater Flow

Nitrate Concentration (mg/L)

- 0 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- >6.0

0 5 10 Meters

0 10 20 30 Feet

1 inch = 30 feet

N

AECOM

C:\Work\60476644ORL\Maps\Nitrate_C_2021Mar.mxd

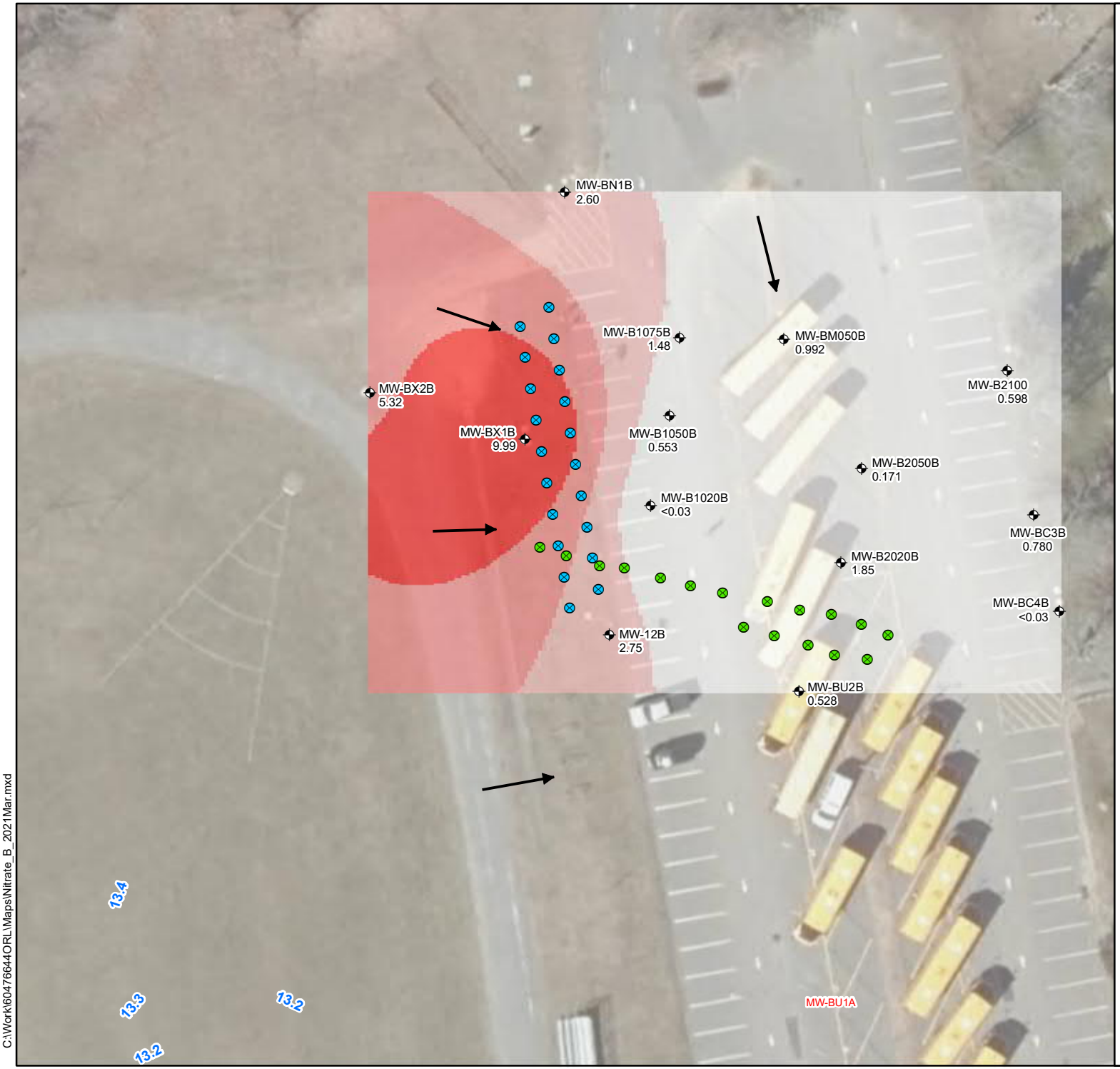

FIGURE 10.

TOWN OF ORLEANS, MA WATER QUALITY AND WASTEWATER PLANNING

NITRATE ZONE B INTERMEDIATE MARCH 2021

Legend

- Monitoring Well

PRB Carbon Substrate Delivery Point

- Jun 2018 Injection
- Nov 2016 Injection
- Approximate Groundwater Flow

Nitrate Concentration (mg/L)

- 0 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- >6.0

0 7 14 Meters

0 10 20 30 Feet

1 inch = 43 feet

AECOM

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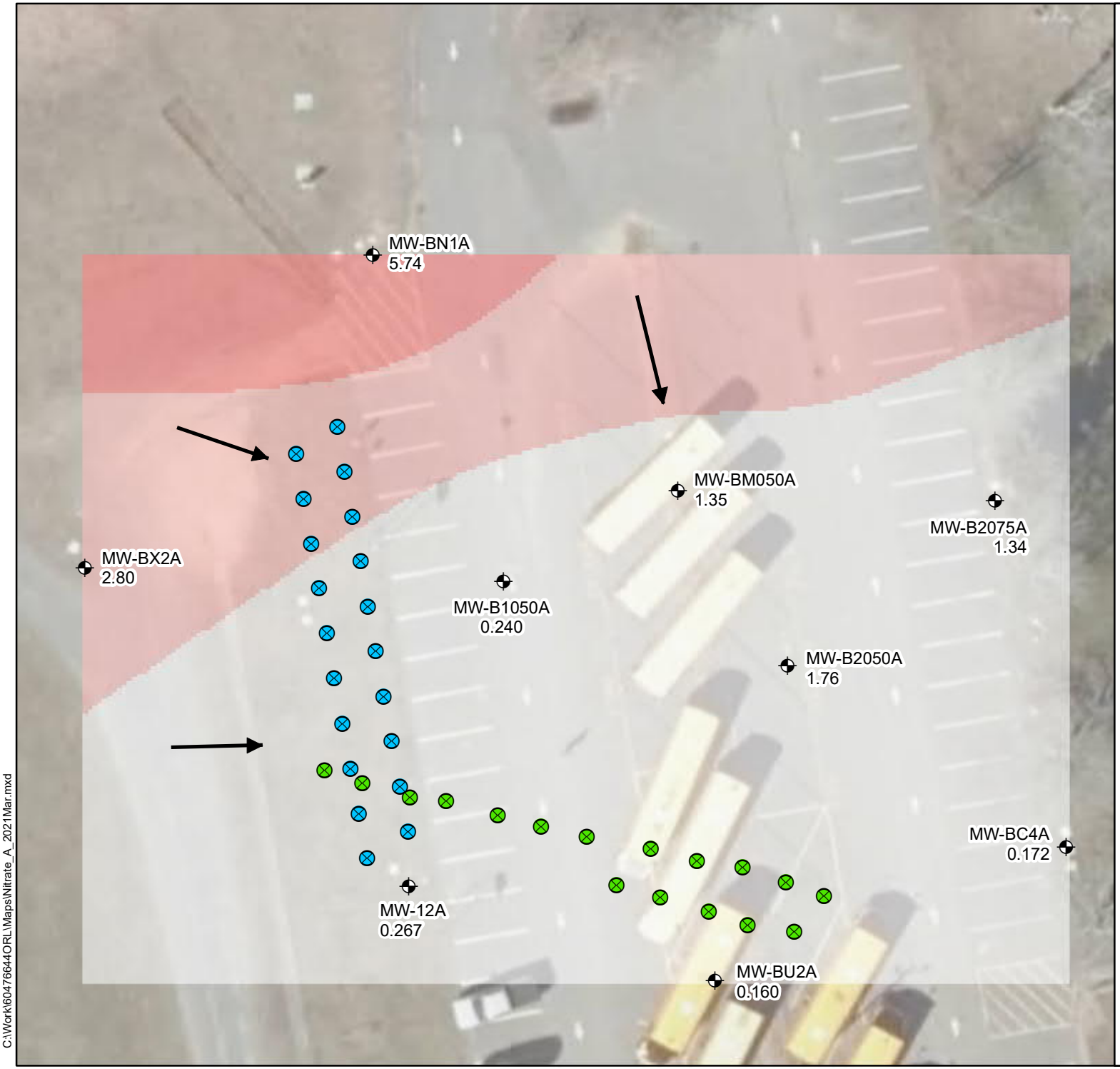

FIGURE 11.

TOWN OF ORLEANS, MA WATER QUALITY AND WASTEWATER PLANNING

NITRATE ZONE A DEEP MARCH 2021

Legend

- Monitoring Well

PRB Carbon Substrate Delivery Point

- Jun 2018 Injection
- Nov 2016 Injection
- Approximate Groundwater Flow

Nitrate Concentration (mg/L)

- 0 - 2.0
- 2.0 - 4.0
- 4.0 - 6.0
- >6.0

0 5 10 Meters

0 10 20 30 Feet

1 inch = 30 feet

N

AECOM

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Chart 1
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B1010C

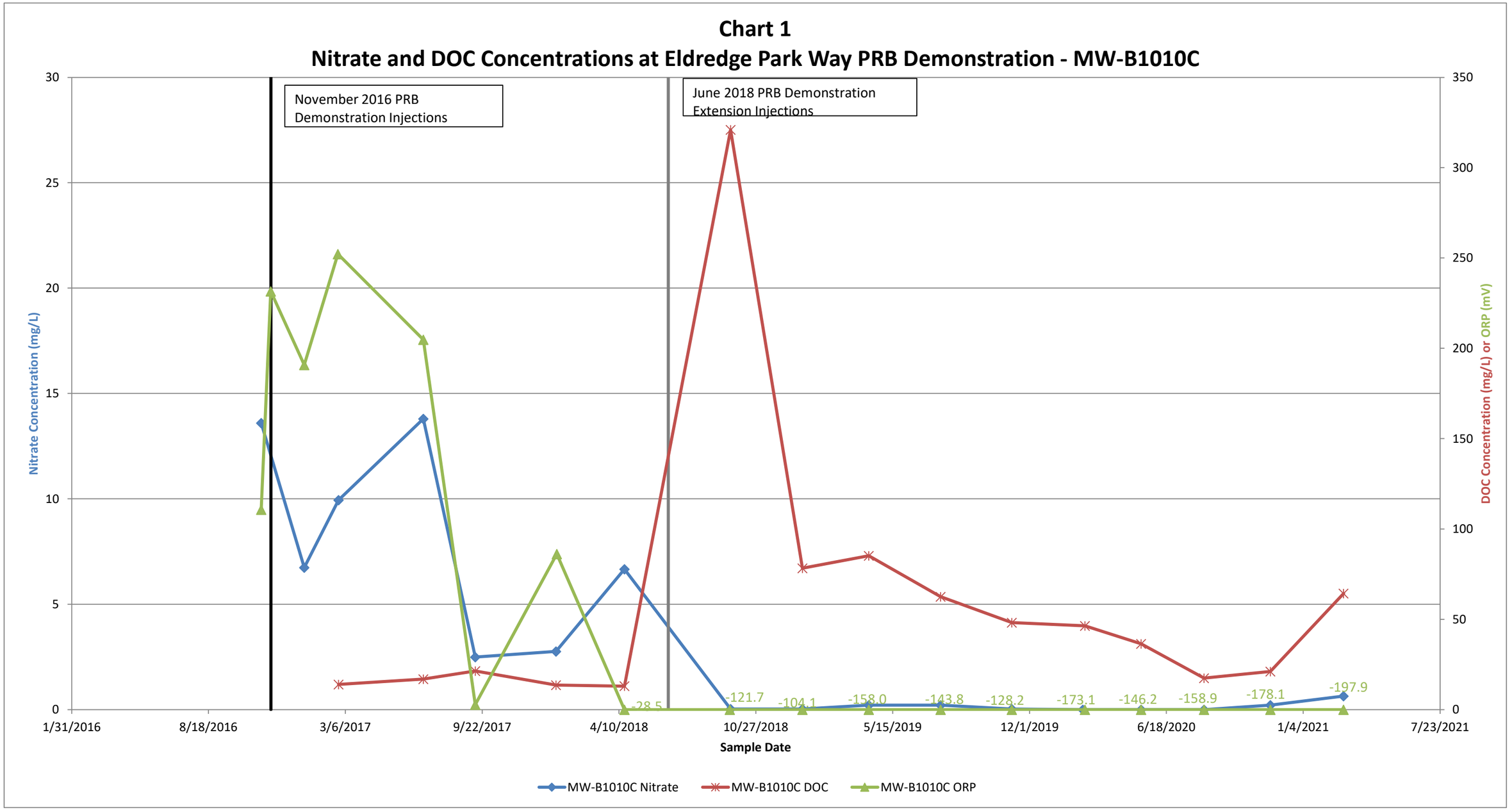


Chart 2
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B2010C

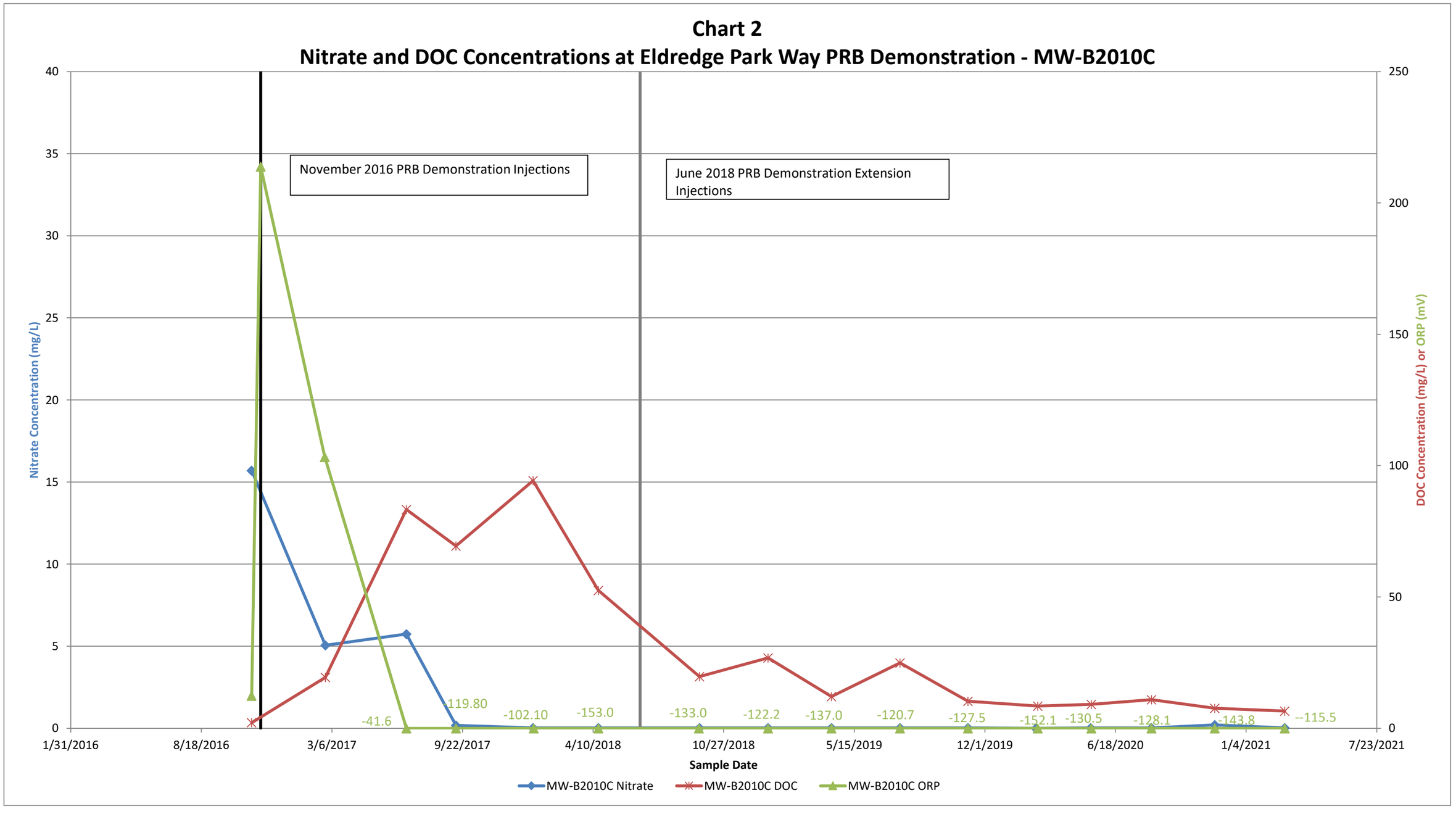


Chart 3
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B1020B

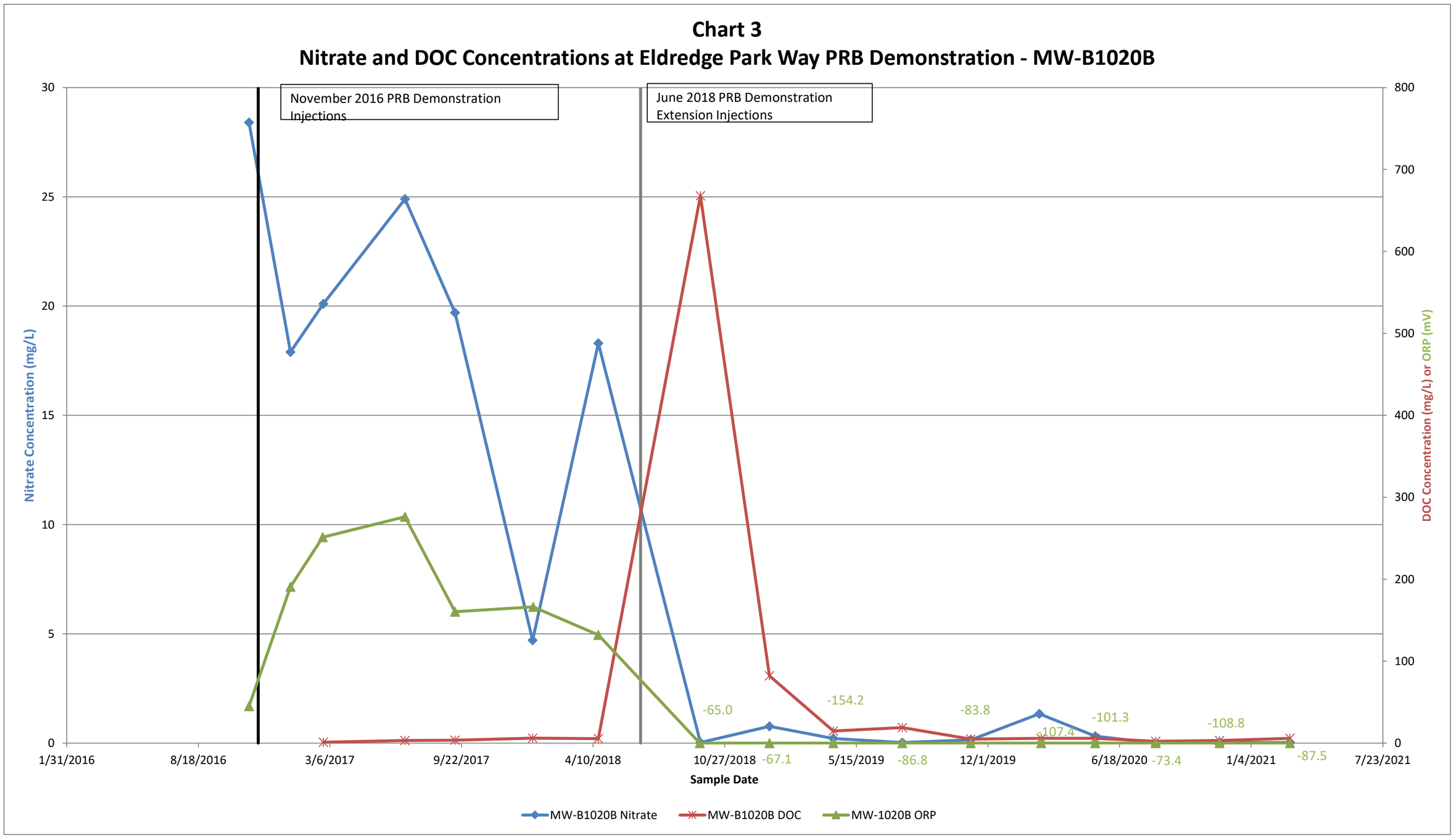


Chart 4

Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B1020C

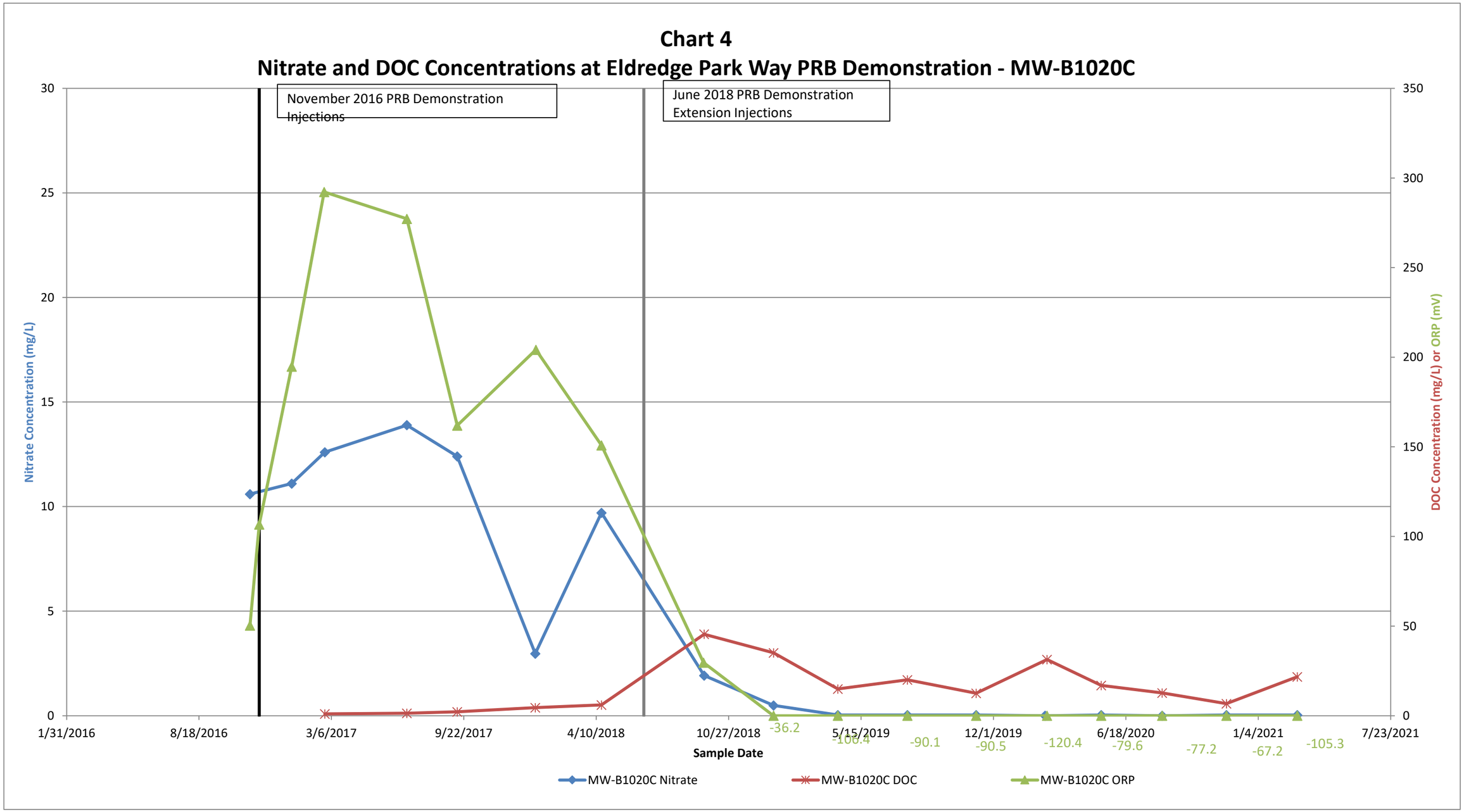


Chart 5
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B2020B

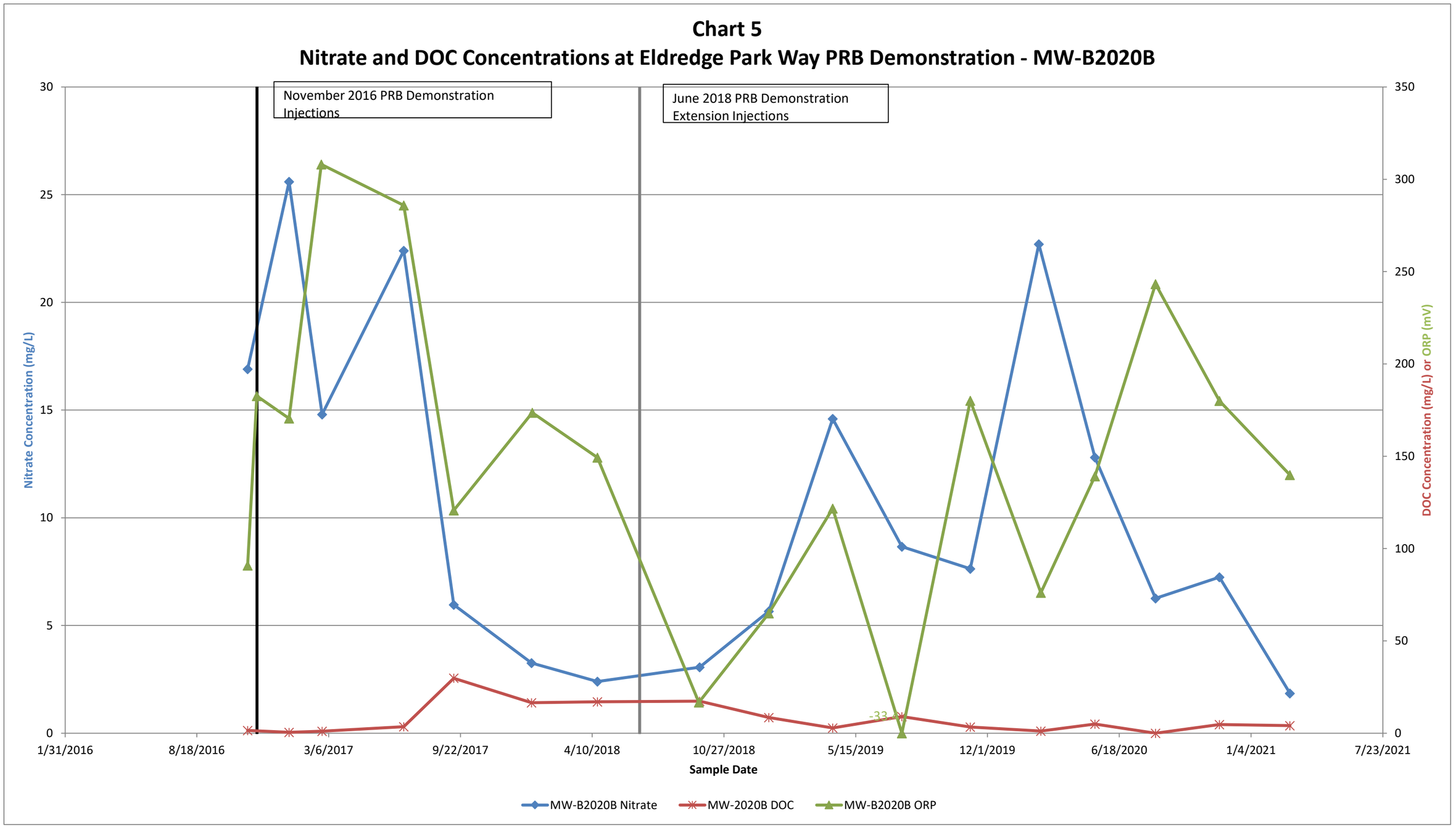


Chart 6
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B2020C

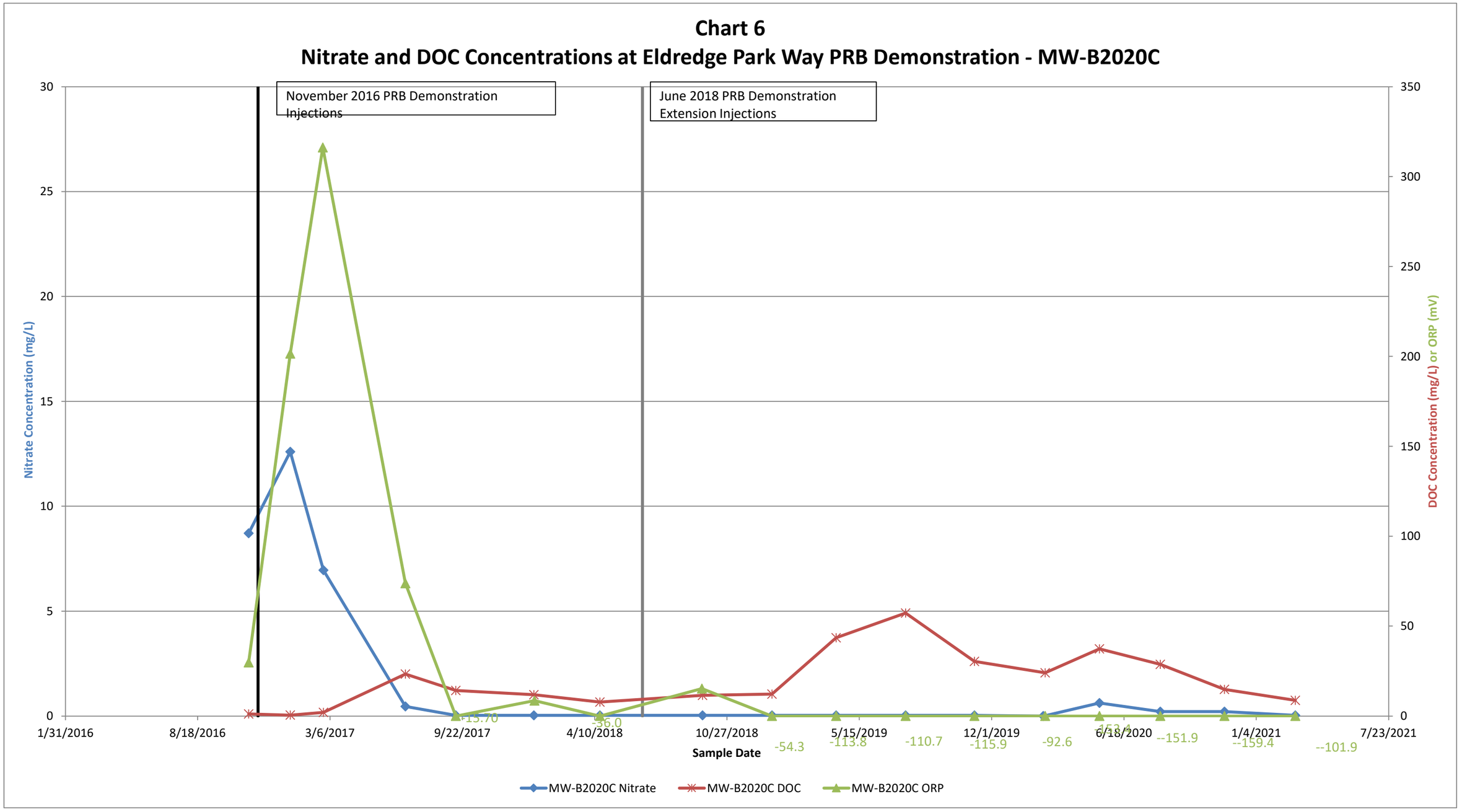


Chart 7
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B1050A

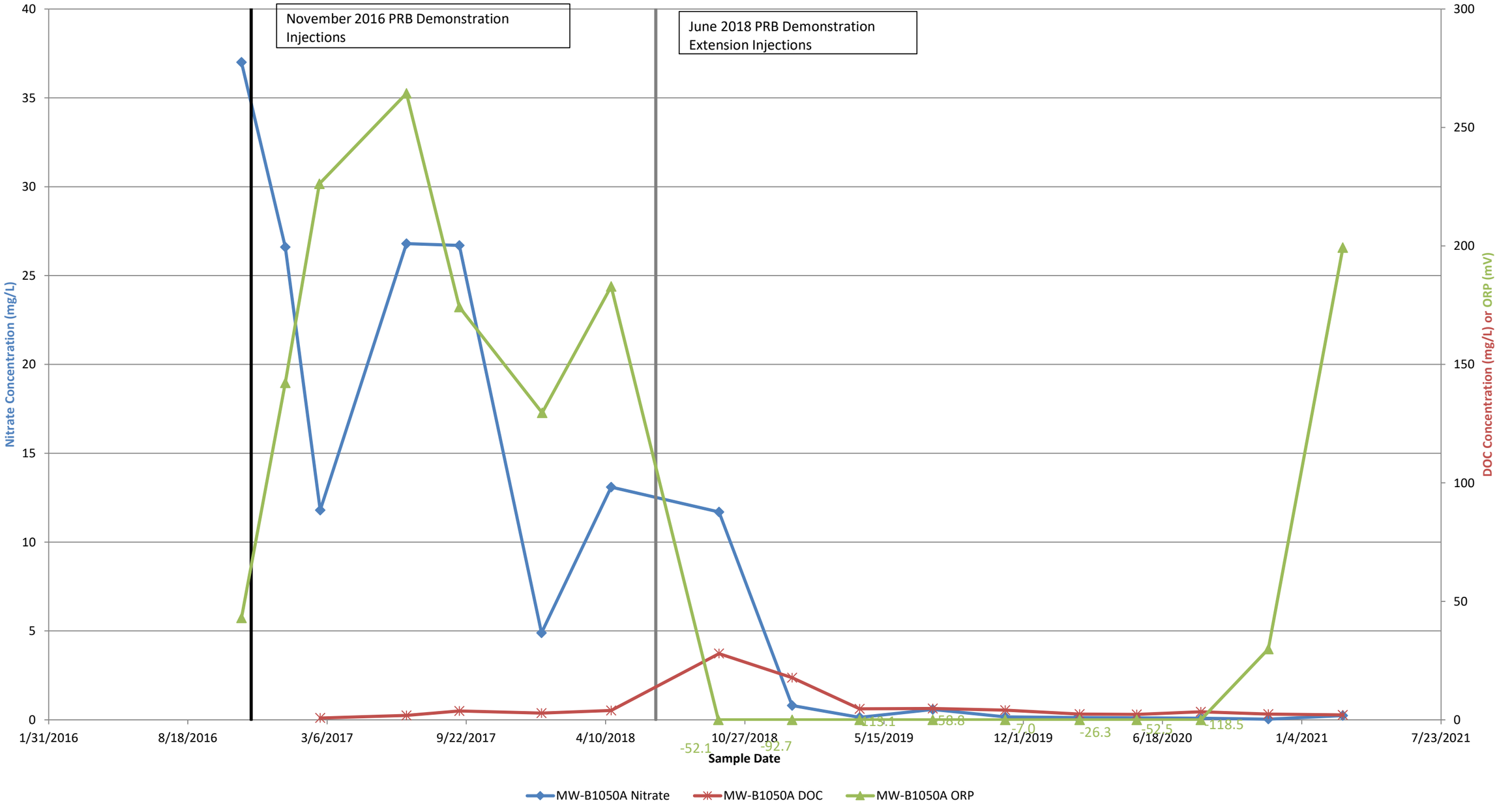


Chart 8
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B2050A

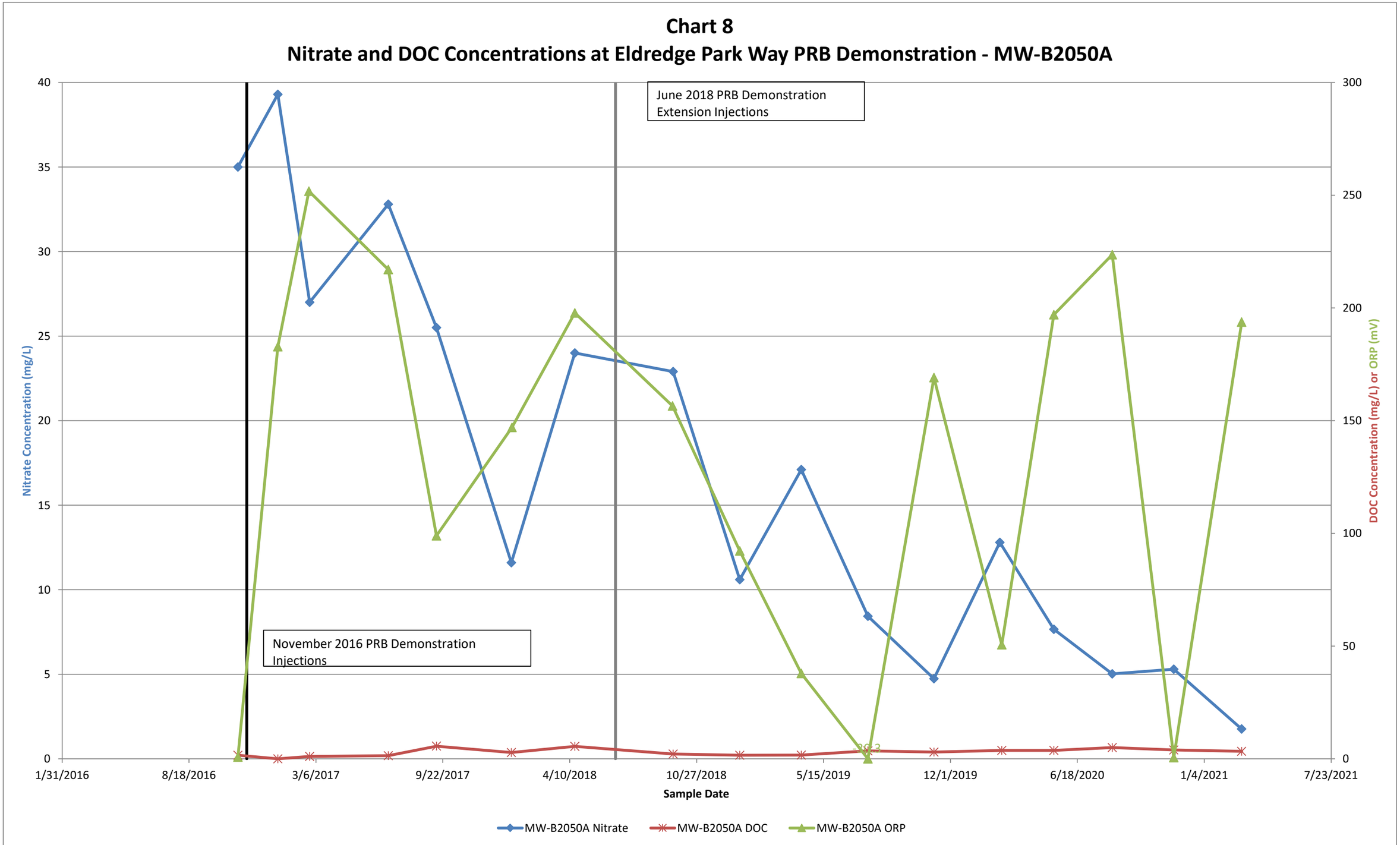


Chart 9
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B1050B

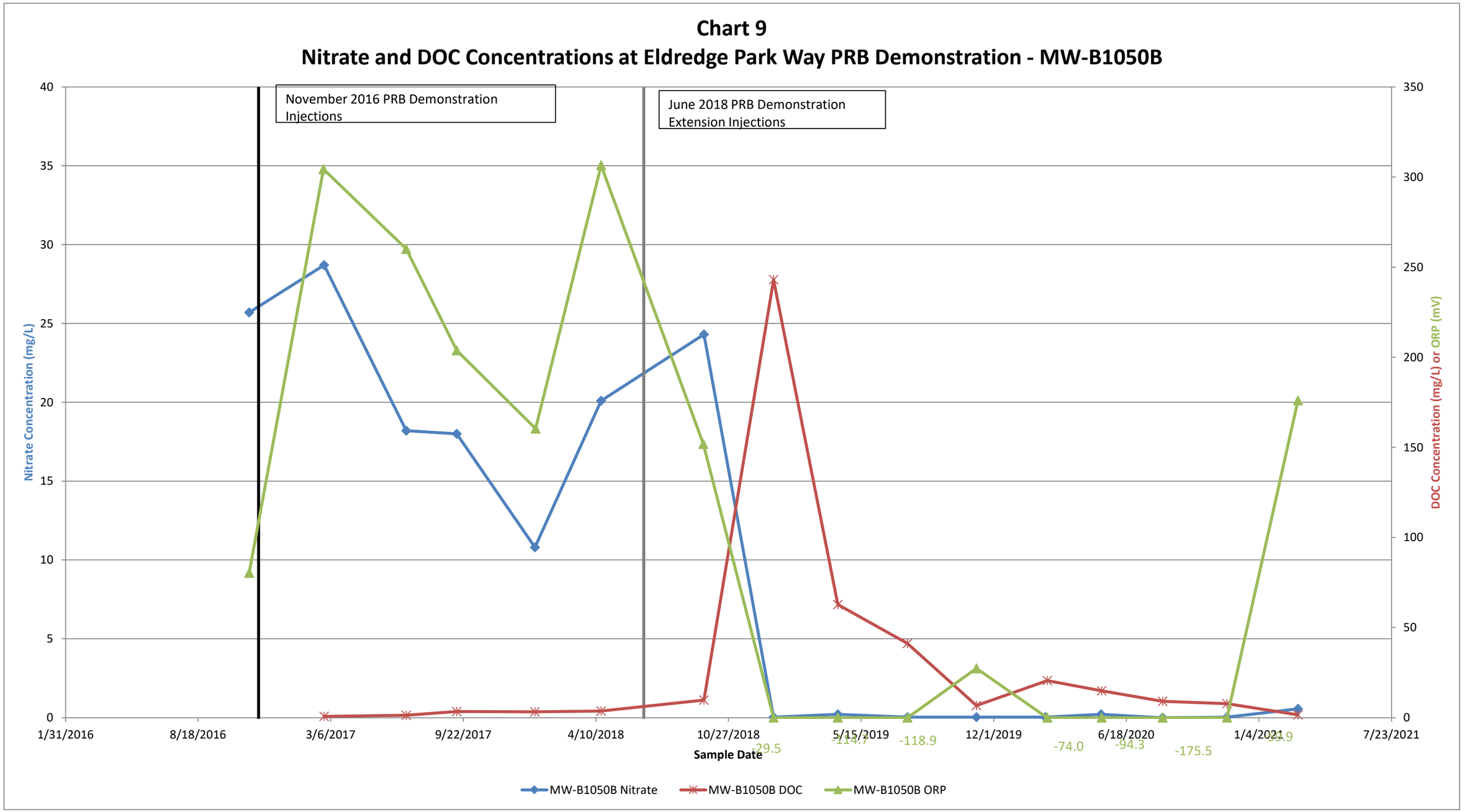


Chart 10
Nitrate and DOC Concentrations at Eldredge Park Way PRB Demonstration - MW-B2050B

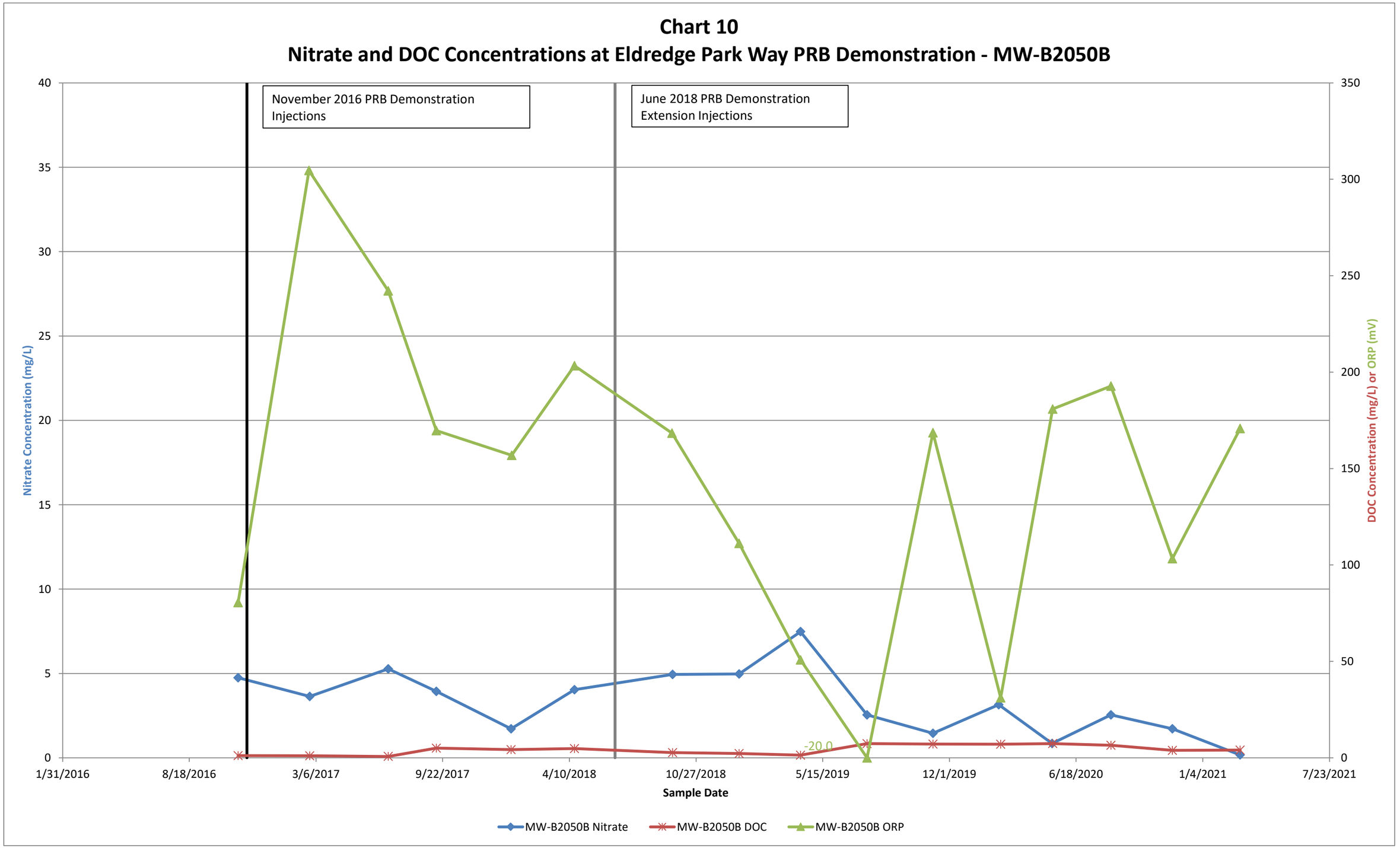
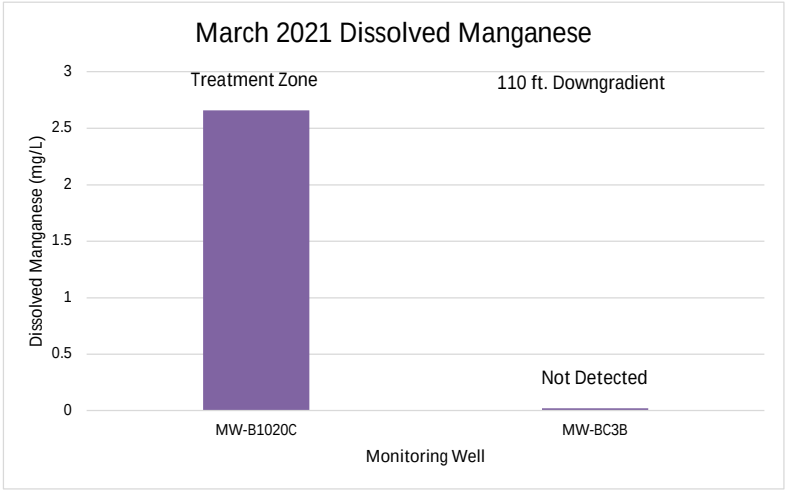
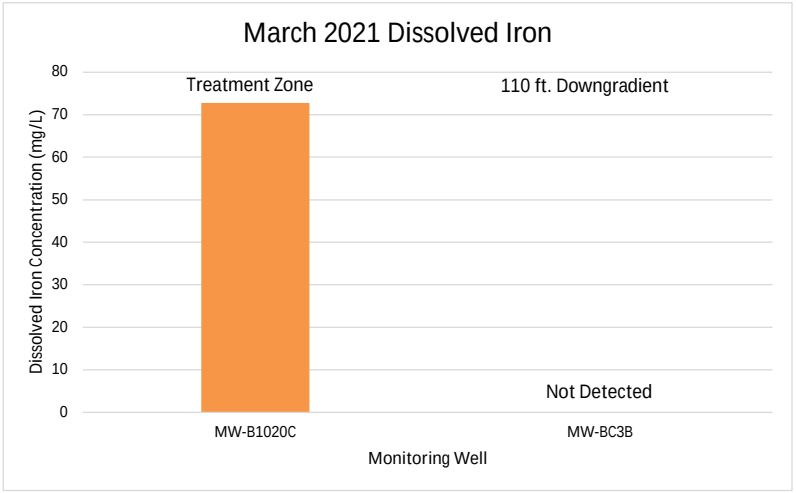
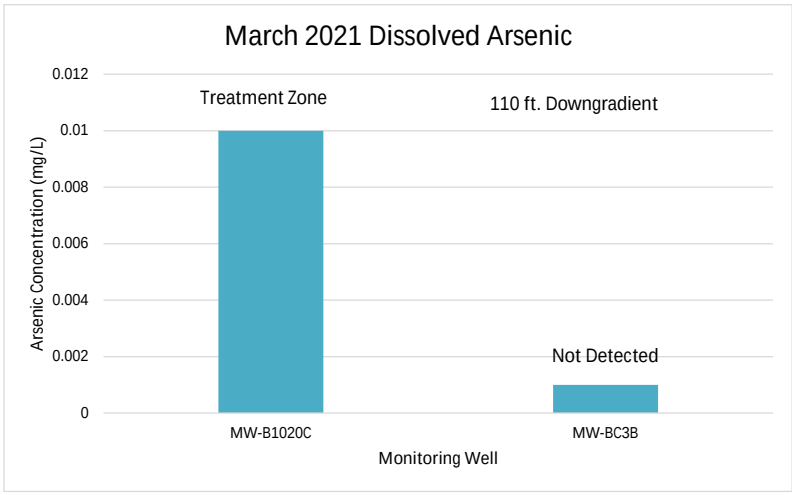


Chart 11

Assessment of Secondary Water Quality at Eldredge Park Way PRB Demonstration







Appendix A

Historical Monitoring Data

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Historical Monitoring Data

A. Baseline Groundwater Monitoring

Baseline and cumulative quarterly field and laboratory test results are all shown in Table 3. Baseline groundwater monitoring samples were collected on October 4, 2016, November 3, 2016 and November 4, 2016. Baseline sampling indicated nitrate concentrations ranging from 0.357 mg/L (MW-BU2A) to 37 mg/L (MW-1050A) and generally aerobic redox conditions.

B. Monitoring during Initial Injection Activities (November 2016)

During the demonstration injections, field parameters were monitored at select upgradient and downgradient wells. Overall, no distinct patterns between the field parameters (temperature, pH, dissolved oxygen, conductivity, and turbidity) were observed before, during, and immediately following the injections

Laboratory dilutions were completed by Terra Systems producing stock solutions of EVO at various dilutions to determine a reasonable correlation between turbidity and the estimated SRS-NR concentrations. Based on these dilutions and the turbidity measured, data suggests the potential for movement of the SRS-NR emulsion up to 20 feet from the injection at certain depths. However, the conductivity was variable and did not correlate to turbidity. Field visual observations did not indicate significant quantities of emulsion at the downgradient wells. There was potentially a dilute “milky” coloration to the groundwater at the 10-foot and 20-foot wells, however, these observations were soon followed by indications of “clearer” water. These observations support the target area distribution of EVO along the PRB. EVO was not observed following completion of injection indicating the injected material was stable and not migrating.

Groundwater samples were collected from seven wells on November 17, 2016 and analyzed for alkalinity and DOC. Alkalinity was measured as a potential indication of the pH buffer that was added with the injections and DOC was measured as a potential indication of the EVO. The alkalinity at the downgradient wells (MW-1010C, MW-1020C, MW-2010C, and MW-2020B) ranged from 11 to 20 mg/L, which is slightly higher than the upgradient and cross-gradient wells (MW-12C, MW-BC2C, and MW-BU2C), which ranged from 4 to 13 mg/L. DOC ranged from 0.576 to 0.852 mg/L and was similar for both upgradient/cross-gradient and downgradient wells.

C. Initial Post-Injection Sampling (7 weeks)

A total of 14 groundwater samples were collected from select wells on January 5, 2017 and January 10, 2017. The wells sampled included upgradient wells MW-12A/B/C and MW-BU2A/B/C, cross-gradient well MW-BC2C, and downgradient wells MW-B1010C, MW-B1020B/C, MW-B1050A, MW-B2020B/C, and MW-B2050A. MW-B2010C was not sampled due to snow cover.

D. Quarterly Sampling

1) Q-1 February 2017

The first post-injection quarterly sampling event occurred on February 23, 2017 and February 24, 2017 (Q-1). Four additional monitoring wells were installed and sampled in March 2017 for supplementary assessment of groundwater flow direction and nitrate concentration.

The expected lag time from PRB injection to measurable nitrate reduction in groundwater immediately downgradient of the barrier is two to four months. During this time the EVO begins to increase DOC concentrations, stimulating biological activity, which leads to an increase in the biomass of desired nitrate reducing bacteria.

The February samples were collected approximately three months post injection. Shallow groundwater monitoring wells closest to the PRB (MW-B1010C and MW-B2010C) are located approximately ten feet downgradient of the injection zone (Figure 1). The February Quarter-1 (Q-1) sample at MW-B1010C indicated an increase in DOC from less than 1 mg/L during baseline sampling (November 2016) to 14 mg/L at Q-1. The MW-B1010C nitrate concentration decreased 27 percent from 13.6 at baseline to 9.94 mg/L at Q-1. Nitrate concentration data for baseline and quarterly sampling is included in Table 3 and on the cross-sections shown in Figures 3, 4 and 5.

Monitoring well MW-B2010C laboratory results also showed an increase in DOC concentrations. DOC increased from 2.2 mg/L at baseline to 19 mg/L at Q-1. Over the same period of time, the nitrate concentration decreased 68 percent from 15.7 to 5.06 mg/L.

Significant increases in DOC were not observed at other monitoring well locations and changes in nitrate concentration also did not appear to be significant with the exception of nitrate at monitoring well B1050A, where the nitrate concentration decreased 68 percent from 37 mg/L at baseline to 11.8 mg/L at Q-1.

No significant changes for dissolved iron and manganese were noted between the baseline and Q-1 sampling. Methane was not detected in groundwater at any of the locations sampled. These results indicate no significant impacts with respect to secondary water quality had occurred. No migration of EVO material was indicated by sampling observations or test results.

2) Q-2 June 2017

The second post-injection quarterly sampling (Q-2) event occurred on June 28, 2017 and June 29, 2017, approximately seven months post injection.

During the June 2017 quarterly sampling event, groundwater samples were collected from 24 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, dissolved iron, dissolved manganese, total alkalinity, and DOC. Field-measured parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured. MW-12C has not been repaired from the damage during snow removal and was unable to be sampled. Additionally, water levels were collected from 9 monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB June 2017

The initial PRB treatment line was composed of a series of injection points-oriented northwest to southeast (perpendicular) to the northeasterly regional groundwater flow direction and is approximately 110 feet long. Depth to groundwater measurements at monitoring wells in the immediate vicinity of the PRB were completed prior to sampling during each monitoring event. The depth to water information was used to calculate water elevation and assess the direction of groundwater flow by developing contour maps of water level. Water elevation in shallow, intermediate depth, and deep wells were evaluated separately to assess flow direction at different depths.

Note that groundwater elevation can vary over time due to seasonal changes in groundwater recharge and can also change over the short term due to significant precipitation events. These changes can result in local variations in groundwater flow. Groundwater flow direction can also be in different directions at different depths below the water table, resulting in a complex 3-dimensional groundwater flow system.

MW-BX1B and MW-BX1C are intermediate and shallow wells that were installed in March 2017 approximately 20 feet northwest of where EVO was injected during the November 2016 demonstration initial injection activities. The purpose of installing MW-BX1B and MW-BX1C was to gather more information to get a better understand the groundwater flow pattern across the site and help with the interpretation of observed nitrate concentrations. High nitrate concentrations had been noted along the monitoring transects east of the selected location for these new monitoring wells (e.g. at MW-B1020C, MW-B1050B, MW-B1050A, and MW-B2020B) shown on Figure 1. No similar high nitrate concentrations were observed in monitoring wells upgradient to the southwest of the PRB (e.g. MW-12A, MW-12B, and MW-12C).

Groundwater elevations calculated from the June 2017 data were interpolated to develop groundwater contour lines and assess groundwater flow direction (See AECOM – Technical Memorandum for Eldredge Park Permeable Reactive Barriers Demonstration Project – Groundwater Monitoring Quarterly Report – Final dated February 5, 2018. Figure 6, Figure 7, and Figure 8). Based on this assessment, flow through the PRB did not appear to reach the full set of monitoring wells along the established monitoring well transects. Treated water may only be reaching the nearest monitoring wells on the north side and easterly of the PRB (e.g. MW-B1010C, MW-B2010C, MW-B2020B, and MW-B2020C). Monitoring wells further to the north along transects 1 and 2 also appeared to be affected by a local source of high nitrate concentration.

b) Assessment of Groundwater Chemistry Data June 2017

Groundwater sample locations closest to the initial PRB (MW-B1010C and MW-B2010C) are located approximately ten feet downgradient of the injection zone (Figure 1). The June Quarter-2 (Q-2) sample at MW-B1010C indicated an increase in DOC from 14 mg/L during Q-1 sampling (February 2017) to 17 mg/L at Q-2. Similarly, MW-B2010C indicated an increase in DOC from 19 mg/L during Q-1 to 83 mg/L during Q-2. The nitrate concentrations at MW-B1010C appear similar to baseline. The nitrate concentrations at MW-B2010C continued to show a concentration (5.7 mg/L) significantly below baseline (15.7 mg/L) and the oxidation-reduction potential (ORP) at MW-B2010C was negative, which indicates reducing conditions favorable to denitrification.

The DOC concentrations also increased slightly at the wells located approximately 20 feet from the injection points. MW-B1020B increased from 1.1 mg/L in Q-1 to 3.2 mg/L in Q-2, MW-B2020B increased from 1.0 mg/L in Q-1 to 3.5 mg/L in Q-2, MW-B2020C increased from 2 mg/L in Q-1 to 23 mg/L in Q-2.

Nitrate increased at upgradient monitoring wells MW-BX1B from 11.4 mg/L at Q-1 to 34.4 mg/L at Q-2, at MW-BX1C from 0.3 mg/L at Q-1 to 38.7 mg/L at Q-2. These high nitrate concentrations appear to be from a local source and are not within the target PRB treatment area.

Nitrate increased at MW-B1050A from 11.8 mg/L at Q-1 to 26.8 mg/L at Q-2, and at MW-B2020B from 14.8 mg/L at Q-1 to 22.4 mg/L at Q-2. While MW-B1050A and MW-B2020B both saw increases in nitrate concentrations, the shallow wells at those locations saw decreases in nitrate concentrations. Nitrate decreased at MW-B1050B from 28.7 mg/L at Q-1 to 18.2 mg/L at Q-2, at MW-B1050C from 4.0 mg/L at Q-1 to 3.3 mg/L at Q-2, and at MW-B2020C from 7.0 mg/L at Q-1 to 0.5 mg/L at Q-2.

Significant increases in DOC were not observed at other monitoring well locations and changes in nitrate concentration also did not appear to be significant.

It was also noted that dissolved iron increased from 1.8 mg/L at Q-1 to 24.2 mg/L at Q-2 and dissolved manganese increased from 0.2 mg/L at Q-1 to 1.6 mg/L at Q-2 in MW-B2010C. Dissolved iron increased from <0.1 mg/L at Q-1 to 8.0 mg/L at Q-2 and dissolved manganese increased from 0.1 mg/L at Q-1 to 1.0 mg/L at Q-2 in MW-B2020C. These two locations are also where the significant increases in DOC were observed. The increases in iron and manganese are also indications of the reducing conditions favorable to denitrification. No significant changes for dissolved iron and manganese were noted between the Q-1 and Q-2 sampling at other locations. Methane was not detected in groundwater at MW-B1010C but was present at 11.3 µg/L at MW-B2010C. This location demonstrated the highest increase in DOC and dissolved iron. No migration of EVO material was indicated by sampling observations or test results.

3) Q-3 September 2017

The third post-injection quarterly sampling (Q-3) event occurred on September 12, 2017 and September 13, 2017, approximately ten months post-injection. During the September 2017 quarterly sampling event, groundwater samples were collected from 24 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and DOC. Select groundwater samples were also analyzed for dissolved iron and dissolved manganese. Field-measured parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured. Additionally, water levels were collected from 6 monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB September 2017

Groundwater elevations calculated from the September 2017 data were interpolated to develop groundwater contour lines. These groundwater data indicated a similar pattern to the June 2017 contours and confirmed that flow through the initial PRB does not likely reach the full set of monitoring wells along the established monitoring well transects. Treated water may have only be reaching the nearest monitoring wells on the north side and easterly of the PRB. Monitoring wells along transects 1 and 2 further to the north also continued to be affected by a local source of high nitrate concentration originating upgradient to the west of MW-BX1B and MW-BX1C.

b) Assessment of Groundwater Chemistry Data

Groundwater sample locations closest to the PRB (MW-B1010C and MW-B2010C) are located approximately ten feet downgradient of the initial injection zone (Figure 1). The September Quarter-3 (Q-3) sample at MW-B1010C indicated an increase in DOC from 16.9 mg/L during Q-2 sampling (June 2017) to 21.4 mg/L at Q-3. MW-B2010C indicated a slight decrease in DOC from 83.3 mg/L during Q-2 to 69.4 mg/L during Q-3, however, this is still significantly elevated over the baseline DOC of 2.2 mg/L. The nitrate concentrations at MW-B1010C decreased to 2.5 mg/L at Q-3 compared to 13.6 mg/L at baseline. The nitrate concentrations at MW-B2010C showed a concentration (0.18 mg/L) well below baseline (15.7 mg/L) and the oxidation-reduction potential (ORP) at MW-B2010C was negative (-119.80 mV), which indicates more reducing conditions favorable to denitrification.

The DOC concentrations increased slightly at almost all other monitoring wells. The largest of these increases was noted at MW-2020B, which increased from 3.5 mg/L in Q-2 to 29.8 mg/L in Q-3 indicating this location was likely affected by the initial PRB. MW-2020B also showed a significant decrease in nitrate concentration from 22.4 mg/L in Q-2 to 6.0 mg/L in Q-3. Nitrate concentrations showed little to no change at most of the monitoring wells located 50 to 75 feet from the PRB along transect 1 (A to A'). Nitrate concentrations decreased slightly at the three 50-foot wells on Transect 2 (B to B'), with the largest decrease at MW-B2050A, from 32.8 mg/L in Q-2 to 25.5 mg/L in Q-3.

Groundwater nitrate concentrations increased at the upgradient monitoring well MW-BX1B from 34.4 mg/L at Q-2 to 39.0 mg/L at Q-3. The concentration at MW-BX1C remained high at 37.8 mg/L. These high nitrate concentrations appear to be from a local source and are not within the target PRB treatment area.

Dissolved iron increased at MW-1010C from 0.14 mg/L in Q-2 to 3.88 mg/L in Q-3. There was no major increase in dissolved manganese at this location. It was also noted that dissolved iron increased from 24.2 mg/L at Q-2 to 46.2 mg/L at Q-3 and dissolved manganese increased from 1.6 mg/L at Q-2 to 2.6 mg/L at Q-3 in MW-B2010C. Dissolved iron increased from 8.0 mg/L at Q-2 to 13.1 mg/L at Q-3 and dissolved manganese increased from 1.0 mg/L at Q-2 to 2.1 mg/L at Q-3 in MW-B2020C. Increases in iron and manganese are also indications of the reducing conditions favorable to denitrification. No significant changes for dissolved iron and manganese were noted between the Q-2 and Q-3 sampling at other locations where analyzed. No migration of EVO material was indicated by sampling observations or test results.

4) Q-4 January 2018

The fourth post-injection quarterly sampling (Q-4) event occurred on January 8, 2018 through January 10, 2018, approximately fourteen months following the initial injection. During the January 2018 quarterly sampling event, groundwater samples were collected from 24 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron and dissolved manganese. Two select wells were also analyzed for boron. Field-measured parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured. Water levels were also collected from seven monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB January 2018

Groundwater elevations calculated from the January 2018 data were interpolated to develop groundwater contour lines. The groundwater data again indicated a similar groundwater flow pattern to that observed in June 2017 and September 2017. These data again confirmed that flow through the PRB does not appear to reach the full set of monitoring wells along the established monitoring well transects and treated water may only be reaching the monitoring wells approximately 20 feet north of the PRB due to groundwater flow directions.

b) Assessment of Groundwater Chemistry Data

Nitrate concentrations at sample locations closest to the initial PRB, including MW-B1010C on Transect 1 (A-A') and MW-B2010C on Transect 2 (B to B'), appear to be significantly reduced by the PRB. Graphs of nitrate and DOC concentrations show generally decreasing nitrate concentration trends and increasing DOC concentration trends. Decreasing nitrate concentrations and increasing DOC concentrations provide two lines of evidence for PRB performance. The January Quarter-4 (Q-4) sample at MW-B1010C indicated a slight decrease in DOC from 21.4 mg/L at Q-3 to 13.6 mg/L at Q-4. MW-B2010C indicated an increase in DOC from 69.4 mg/L during Q-3 to 94.3 mg/L in Q-4. The nitrate concentrations at MW-B1010C increased slightly to 2.76 mg/L, which is still well below the baseline concentration of 13.6 mg/L. The nitrate concentrations at MW-B2010C was below detection at <0.03 mg/L, dissolved oxygen was less than 0.5 mg/L, and the oxidation-reduction potential (ORP) at MW-B2010C was negative (-102.1 mV), all indicators of reducing conditions favorable to denitrification.

The monitoring wells located 20 feet from the initial PRB including MW-B1020B and MW-B1020C on Transect 1 (A to A'), and MW-2020B and MW-2020C on Transect 2 (B to B') also appeared to be significantly affected by the PRB with increased DOC concentrations and decreased nitrogen concentrations. Dissolved iron increased at MW-1010C from 3.88 mg/L in Q-3 to 9.69 mg/L in Q-4. There was no major increase in dissolved manganese at this location. It was also noted that dissolved iron increased from 46.2 mg/L at Q-3 to 88.2 mg/L at Q-4 and dissolved manganese increased from 2.6 mg/L at Q-3 to 5.2 mg/L at Q-4 in MW-B2010C. The increases in iron and manganese are also indications of the reducing conditions favorable to denitrification. No migration of EVO material was indicated by sampling observations or test results.

Nitrate concentrations also decreased at all monitoring wells located in the area approximately 50 feet north from the PRB. The largest decreases were at MW-1050A, from 26.7 mg/L in Q-3 to 4.89 mg/L in Q-4 and MW-B2050A, from 25.5 mg/L in Q-3 to 11.6 mg/L in Q-4. Nitrate was also noted top have decreased at the upgradient monitoring wells MW-BX1B and MW-BX1C from 39.0 mg/L at Q-3 to 10 mg/L at Q-4 and at MW-BX1C from 37.8 mg/L at Q-3 to 11.1 mg/L at Q-4. The lower nitrate concentrations in the area 50 feet north of the PRB were not associated with increased DOC concentrations. These nitrate test results are similar to concentrations observed during the first sampling event for MW-BX1B in March 2017. BX1B and MW-BX1C appear to be located upgradient from MW-1050A and MW-2050A based on groundwater contours. Changes in concentration in the area 50 feet north of the PRB are not likely associated with the initial PRB.

Nitrate concentration data for baseline and quarterly sampling is included in Table 3 and on the cross-sections shown in Figures 3, 4, and 5. Nitrate data are also included with January 2018 groundwater contours and flow direction for shallow, intermediate depth, and deep groundwater monitoring wells on Figure 6, Figure 7, and Figure 8 respectively, within the January 2018 Quarterly Report.

5) Q-5 April 2018

The fifth post-injection quarterly sampling (Q-5) event occurred on April 18th and 19th, 2018, approximately 17 months post-injection. During the April 2018 quarterly sampling event, groundwater samples were collected from 25 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron and dissolved manganese. Two select wells were also analyzed for boron. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were measured in the field. Water levels were also collected from several other monitoring wells outside of the core monitoring well network.

Concurrent with this quarterly sampling event, several monitoring wells were in the process of being installed and repairs were made to existing wells. These efforts included: repairing MW-1 and installing four triplet wells and one single screen well. These were installed at various locations to allow for better assessment of groundwater flow direction and were not yet developed or sampled as part of this event.

a) Assessment of Groundwater Flow Through the PRB April 2018

Groundwater elevations calculated from the April 2018 data were interpolated to develop groundwater contour lines. The groundwater data again indicated a similar groundwater flow pattern to that observed in June 2017 and September 2017. These data again confirmed that flow through the PRB does not appear to reach the full set of monitoring wells along the established monitoring well transects and treated water may only be reaching the monitoring wells up to 20 feet north of the initial PRB due to groundwater flow directions.

b) Assessment of Groundwater Chemistry Data

Nitrate concentration data for baseline and quarterly sampling is included in Table 3 and on the cross-sections shown in Figure 3, Figure 4 and Figure 5. Nitrate data are also included with April 2018 groundwater contours and flow direction for shallow, intermediate depth, and deep groundwater monitoring wells on Figure 6, Figure 7, and Figure 8 respectively within the April 2018 Quarterly Report.

Groundwater quality at the Transect 1 wells generally showed an increase in nitrate concentration. This increase in nitrate concentration was also observed at the upgradient monitoring wells MW-BX1B and MW-BX1C. This correlation further supports the observation that this area to the north is affected by a high concentrations source, likely the section of the Nauset Regional Middle School 1977 leaching pit wastewater infiltration system located under the north end of the soccer field.

In general, the wells near the eastern half of the PRB (MW-B2020C, MW-2020B, and MW-2020C) showed a correlating trend between elevated DOC and reduced nitrate concentrations compared with the wells on the western half of the PRB (MW-B1020C, MW-1020B). The nitrate concentration at MW-B2020B continued to decrease compared to previous sampling events. MW-B2010C and MW-B2020C nitrate concentrations remained below detection having been previously reduced by effective PRB treatment in this area.

6) Q-6 September 2018

The sixth post-injection quarterly sampling (Q-6) event occurred on September 19, 2018, September 20, 2018, and September 25, 2018, approximately 22 months after the first injections (November 2016) and 3 months after the extension injections (June 2018). During the September 2018 quarterly sampling event, groundwater samples were collected from 38 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron, and dissolved manganese. One additional monitoring well upgradient of the PRB was sampled and analyzed for select parameters. Several monitoring wells were also analyzed for arsenic. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB September 2018

Groundwater elevations calculated from the September 2018 data were interpolated to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8).

b) Assessment of Groundwater Chemistry Data

Nitrate concentration data for baseline and quarterly sampling is included in Table 3 and on the cross-sections shown in Figures 3, Figure 4 and Figure 5.

Nitrate concentrations at the Transect 2 wells generally had similar concentrations to the April 2018 event. MW-B2010C and MW-B2020C on Transect 2 were non-detect at both sampling events. MW-B2020B nitrate increased from 2.4 mg/L in April to 3.06 mg/L in September, however, this is still lower than all other prior sampling events indicating a downward trend.

The monitoring wells on Transect 1 closest to the 2016 PRB injection line overlap with those on Transect 3. Due to current understanding of groundwater flow direction and the decision to implement the PRB extension, Transect 3 will be used to assess PRB performance in this area going forward. Transect 3 wells closest to the PRB extension showed a significant decrease in nitrate concentration compared with the April 2018 data collected prior to the PRB extension injections in June 2018. Samples collected from MW-B1010C located approximately 10 feet downgradient of the PRB extension and MW-B1020B located approximately 20 feet downgradient of the PRB extension were non-detect for nitrate (<0.03 mg/L), compared with concentrations of 18.3 and 9.7 mg/L, respectively, in April 2018. The DOC concentration also increased significantly at these wells. The DOC increased from 13 mg/L in April to 321 mg/L in September at MW-B1010C and increased from 5.43 mg/L in April to 668 mg/L in September at MW-B1020B. MW-B1020C nitrate concentration decreased from 9.7 mg/L in April to 1.92 mg/L in September and the DOC increased from 6.02 mg/L to 45.5 mg/L.

MW-BX1B and MW-BX1C located in the PRB extension injection zone also had much lower nitrate concentration in September compared to April. MW-BX1B had a nitrate concentration of 28.5 mg/L in April and non-detect in September and MW-BX1C had a nitrate concentration of 27.7 mg/L in April and 5.77 mg/L in September. These wells are located near the upgradient edge of the PRB extension zone and are part of Transect 3 C-C'. Monitoring wells MW-BX2A, MW-BX2B, and MW-BX2C located approximately 45 feet upgradient of the PRB extension along Transect 3 had high nitrate concentrations in April (baseline for these newer wells) and again in September with concentrations of 10.8, 9.5, and 42.8 mg/L in September respectively. Samples were collected for arsenic analyses from six monitoring wells including upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C; MW-BX1C located within the PRB extension injection areas; and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring

wells sampled and analyzed for arsenic, five were non-detect (<0.0025 mg/L). MW-B2010C, had an arsenic concentration of 0.06 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L. MW-2010C is in an area affected by the PRB. Sample results indicate that the groundwater is anaerobic under reducing condition with a negative oxidation-reduction potential and some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are also expected to precipitate downgradient where more aerobic conditions are encountered. Monitoring wells located further downgradient will be tested during the next sampling event to determine the extent of dissolved metal migration.

The observed DOC concentrations in groundwater can now be used to roughly estimate groundwater velocity through the treatment area. DOC is subject to biological degradation and therefore is not a conservative tracer. However, an approximation of groundwater velocity can be made with the data. Monitoring wells located up to 20 feet downgradient of the PRB extension were found to have significantly increased DOC concentrations. Groundwater sampling occurred approximately 90 days following the PRB extension injections indicating a groundwater velocity of at least 0.2 feet/day. Monitoring wells MW-B1050A, MW-B1050B, and MW-B1050C located approximately 30 feet downgradient have not shown increased DOC concentrations during this time frame indicating the groundwater velocity is less than 0.3 feet per day. Based on a groundwater velocity of 0.22 feet per day DOC concentration increases and potentially reduced nitrate concentrations can be expected at monitoring wells MW-B1050A and MW-B1050B, and MW-B1050C approximately 140 days following the PRB extension injections (by December 2018).

7) Q-7 January 2019

The seventh post-injection quarterly sampling (Q-7) event occurred on January 2-4, 2019, approximately 26 months after the first injections (November 2016) and approximately 6 months (185 days) after the extension injections (June 2018). During the January 2019 quarterly sampling event, groundwater samples were collected from 38 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron, and dissolved manganese. Six monitoring wells were also analyzed for arsenic. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from five monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB January 2019

Groundwater elevations calculated from the January 2019 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8 in the January 2019 report). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding. Generally, groundwater flow is from west to east in the soccer field area upgradient of the PRB with the flow direction shifting around to localized flow to the south-southeast at the northern end of the parking lot where a large stormwater recharge gallery is located. Groundwater chemistry data allows for additional interpretation of groundwater flow based on transport DOC downgradient from the PRB, and downgradient changes in geochemistry as a result of PRB induced reducing conditions. The interpretation based on groundwater chemistry shows the average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the January 2019 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 9 in the January 2019 memorandum.

Overall assessment of PRB performance demonstrates that the PRB is now effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limit of 0.03 mg/L in the downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. The apparent treatment area and groundwater flow directions are shown on Figure 9 of the January 2019 memorandum.

The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from September 2018 was collected approximately 90 days following the PRB extension injections. The September data indicated that treated groundwater had migrated approximately 20 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3) and MW-B1020C (Chart 4). Spikes in DOC concentration in September likely represent initial release of DOC from the PRB that would have triggered an increase in the biomass of denitrifying bacteria. Lower but still significant DOC concentrations observed in January 2019 indicate increased biomass and consumption of released DOC downgradient of the PRB as expected (see Chart 3).

The January 2019 sampling event shows treated groundwater has now migrated approximately 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1050A (Chart 7) and MW-1050B (Chart 9). The shallowest monitoring well at this location, MW-1050C, has not shown any significant change except for a small increase in DOC concentration. Stormwater infiltration in the parking lot area where PRB performance monitoring wells are located appears to have a significant effect on horizontal and vertical groundwater flow direction based on water table elevation measurements and mounding observed in groundwater contour plots. These groundwater recharge conditions may account for the delay in treatment at MW-1050C.

The horizontal and vertical movement of groundwater has also been noted based on observations of nitrate plume migration. High concentration nitrate has been persistent at the monitoring wells upgradient of the 2018 PRB extension at MW-BX2A, MW-BX2B, MW-BX2C with average concentrations of 17, 16, and 39 mg/L nitrate respectively. Concentrations of nitrate between 2 and 5 mg/L are more typical locally so the path of this high concentration plume can be traced. Note that the A well screen is set deepest in the aquifer, B well screens are at an intermediate depth, and the C well are set at the water table as shown in cross-sections (Figures 3, Figure 4 and Figure 5). The highest average concentration 39 mg/L is near the water table and likely close to its source. The source of this high nitrate concentration plume appears to be the septic leaching galleries for the Middle School located under the northern end of the soccer field (see Figure 1). This high concentration nitrate plume was originally observed extending downgradient approximately 175 feet to the east to MW-B2050A. An average concentration of 27 mg/L nitrate was calculated for MW-B2050A based on data collected from November 2016 through September 2018. The shallower well screens at this

location had lower average concentrations. MW-B2050B, the mid-level screen, showed an average concentration of 4 mg/L, and the shallowest screen, MW-B2050C, showed and average nitrate concentration of 2.5 mg/L. These data indicate the high concentration nitrate plume is diving deeper as it migrates in an easterly direction under the parking lot influenced by stormwater recharge. This diving plume is significant because the same conditions will likely also drive the PRB treated groundwater deeper as it follows this easterly flow path, and this observation should be considered in the performance evaluation.

In an effort to evaluate secondary groundwater quality issues associated with PRB nitrate treatment, groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018 and January 2019. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.0025 mg/L). MW-B2010C, had an arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L. MW-2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential and some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are also expected to precipitate downgradient where more aerobic conditions are encountered. Monitoring well MW-B2010C was retested for arsenic in January 2019 and showed a similar concentration at 0.055 mg/L. Monitoring wells located further downgradient, including nearby MW-2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.0025 mg/L), indicating arsenic was not migrating downgradient beyond the PRB treatment zone.

8) Q-8 April 2019

The eighth post-injection quarterly sampling (Q-8) event occurred on April 9-11, 2019, approximately 29 months after the first injections (November 2016) and approximately 10 months after the extension injections (June 2018). During the April 2019 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron, and dissolved manganese. Four monitoring wells were also analyzed for arsenic. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from six monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB April 2019

Groundwater elevations calculated from the April 2019 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The persistent rainy conditions during the spring of 2019 produced significant groundwater mounding and additional localized flow to the south in April 2019. Groundwater chemistry data allows for additional interpretation of groundwater flow velocity based on transport DOC downgradient from the PRB, and downgradient changes in geochemistry as a result of PRB induced reducing conditions. The interpretation based on groundwater chemistry shows the average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the April 2019 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is now effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L or 0.21 mg/L in the downgradient treated area. The observed treated area is expected to expand further downgradient with groundwater transport over time. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively.

The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from April 2019 was collected approximately 308 days following the PRB extension injections. As seen in Figures 9, 10, and 11, treated groundwater has now migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. MW-1075B appears to be significantly affected by groundwater flow from the north that includes elevated ammonia concentrations. Similar elevated concentrations of ammonia have been observed in monitoring well MW-BN1C, located further to the north near the Middle School septic system dosing chamber. The presence of ammonia may indicate a wastewater leak in the vicinity of the dosing chamber. April 2019 groundwater contours indicate the heavy precipitation experienced this spring has resulted in significant groundwater mounding at the northern end of the parking lot as a result of infiltration of stormwater. This mound has resulted in more flow to the south that may account for the slow progress of the front of treated groundwater that has not progressed to deeper downgradient monitoring wells MW-B2020B (Chart 2) and MW-B2050B (Chart 10).

Secondary groundwater quality affects associated with PRB nitrate treatment are being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018, January 2019, and April 2019. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.0025 mg/L). MW-B2010C, had an arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L. MW-2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential and some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are also expected to precipitate downgradient where more aerobic conditions are encountered. Monitoring well MW-B2010C was retested for arsenic in January and April 2019 and showed a similar concentration at 0.055 and 0.087 mg/L, respectively. Monitoring wells located further downgradient, including nearby MW-2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.0025 mg/L), indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April 2019 and still all showed less than the detection limit.

9) Q-9 July 2019

The ninth post-injection quarterly sampling (Q-9) event occurred on July 24-25, 2019, approximately 32 months after the first injections (November 2016) and approximately 13 months after the extension injections (June 2018). During the July 2019 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, DOC, dissolved iron, and dissolved manganese. Four monitoring wells were also analyzed for arsenic. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from six monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB July 2019

Groundwater elevations calculated from the July 2019 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. There was approximately 1.75 inches of rainfall measured at Barnstable Municipal Airport (Weather Underground, 2019) on the two days prior to the July 2019 sampling event. These rainy conditions produced groundwater mounding and additional localized flow to the south. Groundwater chemistry data allows for additional interpretation of groundwater flow velocity based on transport DOC downgradient from the PRB, and downgradient changes in geochemistry as a result of PRB induced reducing conditions. The interpretation based on groundwater chemistry shows the average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the July 2019 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L or 0.21 mg/L in the downgradient treated area. The observed treated area is expected to expand further downgradient with groundwater transport over time. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively.

The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from July 2019 was collected approximately 13 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). Limited evidence including a trend of lower nitrate concentration and decreased ORP observed at monitoring wells MW-B2050B and MW-B2050A also indicate treatment extending approximately 90 feet downgradient in intermediate and deep groundwater (see Chart 10 and Chart 8). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber. The presence of ammonia may indicate a wastewater leak in the vicinity of the dosing chamber. July 2019 groundwater contours indicate some groundwater mounding at the northern end of the parking lot as a result of infiltration of stormwater. This mounding impact has lessened from the April 2019 sampling.

Secondary groundwater quality affects associated with PRB nitrate treatment are being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018 and January/April/July 2019. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.0025 mg/L). MW-B2010C, had an arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L. MW-2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential and some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are also expected to precipitate downgradient where more aerobic conditions are encountered. Monitoring well MW-B2010C was retested for arsenic in January, April, and July 2019 and showed a similar concentration at 0.055, 0.087, and 0.09 mg/L, respectively. Monitoring wells located further downgradient, including nearby MW-2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.0025 mg/L), indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April and July 2019 and still all showed less than the detection limit.

10) Q-10 November 2019

The tenth post-injection quarterly sampling (Q-10) event occurred on November 5-7, 2019, approximately 36 months after the first injections (November 2016) and approximately 17 months after the extension injections (June 2018). During the November 2019 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and the majority of monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Four monitoring wells were also analyzed for arsenic and methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from six monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB November 2019

Groundwater elevations calculated from the November 2019 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the November 2019 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L mg/L in the downgradient treated area. The observed treated area appears to be expanding further downgradient with groundwater transport over time. Prior to the PRB

extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from November 2019 was collected approximately 17 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). Limited evidence including a trend of lower nitrate concentration and decreased ORP observed at monitoring wells MW-B2050B and MW-B2050A also indicate treatment extending approximately 90 feet downgradient in intermediate and deep groundwater (see Chart 10 and Chart 8). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber. The presence of ammonia may indicate a wastewater leak in the vicinity of the dosing chamber. November 2019 groundwater contours indicate some groundwater mounding at the northern end of the parking lot as a result of infiltration of stormwater.

Secondary groundwater quality parameters associated with PRB nitrate treatment are being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018 and January/April/July/November 2019. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.025 mg/L). MW-B2010C, had a total arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L if all the arsenic is assumed to be dissolved. MW-2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential; some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are expected to precipitate downgradient after only limited migration. Monitoring well MW-B2010C was retested for total arsenic in January, April, July, and November 2019 and showed similar concentrations at 0.055, 0.087, 0.09, and 0.063 mg/L, respectively. Monitoring wells located further

downgradient, including nearby MW-2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.025 mg/L), indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April and July 2019 and still all showed less than the detection limit. MW-BC3B and MW-BC4B were both tested in November 2019 and were non-detect (<0.05 mg/L). MW-B1020C showed an arsenic concentration of 0.05 mg/L. Two monitoring wells including MW-B1020C (close downgradient to the PRB) and sentinel MW-BC3B (~110 feet downgradient) are examples for monitoring results for secondary water quality parameters. Groundwater test results for secondary compounds from November 2019 shown on Chart 11 indicate elevated levels of dissolved iron, manganese, and total arsenic close to the PRB. The dissolved iron and manganese are elevated close to the PRB but are either not detected or at low level in the downgradient well. The total arsenic concentration was elevated at MW-B1020C but was not detected in the downgradient monitoring well. Methane is also periodically monitored to assess for carbon fermentation byproducts. Methane analyses indicate the maximum detected concentration was found at monitoring well MW-B2010C in November 2019 at a concentration of 3.45 mg/L, which is far below the 30 mg/L solubility of methane in water and below any level of concern.

11) Q-11 February 2020

The eleventh post-injection quarterly sampling (Q-11) event occurred on February 17th, 19th, and 20th 2020, approximately 39 months after the first injections (November 2016) and approximately 20 months after the extension injections (June 2018). During the February 2020 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and the majority of monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Four monitoring wells were also analyzed for arsenic and methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, water levels were collected from six monitoring wells outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB February 2020

Groundwater elevations calculated from the February 2020 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the February 2020 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L immediately downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from February 2020 was collected approximately 20 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Monitoring wells MW-2020B, MW2050A, MW-2050B, and MW-2050C located approximately 90 feet downgradient of the 2018 PRB line have exhibited some downward nitrate concentration trends with fluctuations and limited additional evidence of treatment. Based on boring records these monitoring wells appear to be located in an area of finer grained aquifer material. This finer silty sand is suspected to be a localized lower hydraulic-conductivity area that has significantly slower groundwater flow than other areas with medium sand. The monitoring wells in the MW-2020 pair and MW-2050 cluster were redeveloped to assess well condition in early February 2020 prior to the current round of groundwater sampling. The results of sampling and analysis following redevelopment indicated higher concentrations of nitrate at some of these monitoring locations supporting the that these areas may be isolated low flow zones.

Test results at MW-2020C, the shallow monitoring location screened in higher permeability material has clearly shown all lines of evidence supporting that groundwater has been treated, while the intermediate depth screen MW-2020B at this location has shown less evidence of treatment and a significant increase in nitrate concentration after redevelopment. In contrast monitoring well cluster MW-1020B, the intermediate depth screen well located upgradient of MW-2020B but downgradient of the 2018 PRB line has shown full cut off of nitrate and all supporting lines of evidence indicating treatment. Similarly monitoring wells at the MW-1050 cluster have shown full treatment at all elevations upgradient of the MW-2050 cluster.

These data support reliance of monitoring well locations in closer proximity to the PRB to support the evaluation of PRB performance with fewer confounding variables associated with geologic and groundwater flow conditions.

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber.

Secondary groundwater quality parameters associated with PRB nitrate treatment are also being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018, January/April/July/November 2019, and February 2020. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-2010C and MW-2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.025 mg/L). MW-B2010C, had a total arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L if all the arsenic is assumed to be dissolved. MW-2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential; some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are expected to precipitate downgradient after only limited migration.

Monitoring well MW-B2010C was retested for total arsenic in January, April, July, and November 2019 and showed similar concentrations at 0.055, 0.087, 0.09, and 0.063 mg/L, respectively. The dissolved arsenic concentration was 0.012 mg/L in February 2020. Monitoring wells located further downgradient, including nearby MW-2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.025 mg/L), indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April and July 2019 and still all showed less than the detection limit. MW-BC3B and MW-BC4B were both tested in November 2019 and were non-detect (<0.05 mg/L) and were non-detect for dissolved arsenic (<0.005 mg/L) in February 2020. MW-B1020C showed a dissolved arsenic concentration of 0.012 mg/L in February 2020. Two monitoring wells including MW-B1020C (close downgradient to the PRB) and sentinel MW-BC3B (~110 feet downgradient) are examples for monitoring results for secondary water quality parameters.

Groundwater test results for secondary compounds from February 2020 shown on Chart 11 indicate elevated levels of dissolved iron, manganese, and arsenic close to the PRB. The dissolved iron and manganese are elevated close to the PRB but are either not detected or at low levels in the downgradient well. The arsenic concentration was detected at MW-B1020C but was not detected in the downgradient monitoring well. Methane is also periodically monitored to assess for carbon fermentation byproducts. Methane analyses indicate the maximum detected concentration was found at monitoring well MW-B2010C in February 2020 at a concentration of 5.81 mg/L, which is far below the 30 mg/L solubility of methane in water and below any level of concern.

12) Q-12 May 2020

The twelfth post-injection quarterly sampling (Q-12) event occurred on May 12th, 13th, and 14th 2020, approximately 42 months after the first injections (November 2016) and approximately 23 months after the extension injections (June 2018). During the May 2020 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and the majority of monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Select monitoring wells were also analyzed for arsenic and/or methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field. Additionally, the water level was collected from one monitoring well outside of the core monitoring well network.

a) Assessment of Groundwater Flow Through the PRB May2020

Groundwater elevations calculated from the May 2020 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the May 2020 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L immediately downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from May 2020 was collected approximately 23 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Monitoring wells MW-B2020B, MW-B2050A, MW-B2050B, and MW-B2050C located approximately 90 feet downgradient of the 2018 PRB line have exhibited some downward nitrate concentration trends with fluctuations and limited additional evidence of treatment. Based on boring records these monitoring wells appear to be located in an area of finer grained aquifer material. This finer silty sand is suspected to be a localized lower hydraulic-conductivity area that has significantly slower groundwater flow than other areas with medium sand. The monitoring wells in the MW-B2020 pair and MW-B2050 cluster were redeveloped to assess well condition in early February 2020. The results of February 2020 sampling and analysis following redevelopment indicated higher concentrations of nitrate at some of these monitoring locations supporting the that these areas may be isolated low flow zones, however, the concentrations at these wells were lower in the May 2020 sampling event.

Test results at MW-B2020C, the shallow monitoring location screened in higher permeability material has clearly shown all lines of evidence supporting that groundwater has been treated, while the intermediate depth screen MW-B2020B at this location has shown less evidence of treatment. In contrast monitoring well cluster MW-B1020B, the intermediate depth screen well located upgradient of MW-B2020B but downgradient of the 2018 PRB line has shown full cut off of nitrate and all supporting lines of evidence indicating treatment. Similarly monitoring wells at the MW-B1050 cluster have shown cutoff of nitrate migration at all elevations.

These data suggest reliance on monitoring well locations in close proximity to the PRB to assess PRB performance. The objective of the PRB is to cut off the migration of nitrate at the PRB. It can take significant time for the nitrate plume downgradient of the PRB to flush out of the area after cutoff and the downgradient area may be affected by other sources of nitrogen.

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber.

Secondary groundwater quality parameters associated with PRB nitrate treatment are also being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018, January/April/July/November 2019, and February/May 2020. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-B2010C and MW-B2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.025 mg/L). MW-B2010C, had a total arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L if all the arsenic is assumed to be dissolved. MW-B2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential; some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are expected to precipitate downgradient after only limited migration.

Monitoring well MW-B2010C was retested for total arsenic in January, April, July, and November 2019 and showed similar concentrations at 0.055, 0.087, 0.09, and 0.063 mg/L, respectively. The dissolved arsenic concentration was 0.012 mg/L in February 2020 and 0.031 mg/L in May 2020. Monitoring wells located further downgradient, including nearby MW-B2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.025 mg/L),

indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April and July 2019 and still all showed less than the detection limit. MW-BC3B and MW-BC4B were both tested in November 2019 and were non-detect (<0.05 mg/L) and were non-detect for dissolved arsenic (<0.005 mg/L) in February and May 2020. MW-B1020C showed a dissolved arsenic concentration of 0.012 mg/L in February 2020 and 0.036 mg/L in May 2020.

Two monitoring wells including MW-B1020C (close downgradient to the PRB) and sentinel MW-BC3B (~110 feet downgradient) are examples for monitoring results for secondary water quality parameters. Groundwater test results for secondary compounds from May 2020 shown on Chart 11 indicate elevated levels of dissolved iron, manganese, and arsenic close to the PRB. The dissolved iron and manganese are elevated close to the PRB but are either not detected or at low levels in the downgradient well. The arsenic and dissolved iron concentration was detected at MW-B1020C but was not detected in the downgradient monitoring well. Methane is also periodically monitored to assess for carbon fermentation byproducts. Methane analyses indicate the highest detected concentration were found at monitoring well MW-BX1B and MW-BX1C in May 2020 at a concentration of 16.6 mg/L and 13.2 mg/L, respectively, which is below the 30 mg/L solubility of methane in water and below any level of concern.

13) Q-13 August 2020

The thirteenth post-injection quarterly sampling (Q-13) event occurred on August 11th, 12th, and 13th 2020, approximately 45 months after the first injections (November 2016) and approximately 26 months after the extension injections (June 2018). During the August 2020 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and the majority of monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Select monitoring wells were also analyzed for arsenic and/or methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field.

c) Assessment of Groundwater Flow Through the PRB August 2020

Groundwater elevations calculated from the August 2020 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations continue to show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

d) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the August 2020 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L immediately downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1),

MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from August 2020 was collected approximately 26 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Monitoring wells MW-B2020B, MW-B2050A, MW-B2050B, and MW-B2050C located approximately 90 feet downgradient of the 2018 PRB line have exhibited some downward nitrate concentration trends with fluctuations and limited additional evidence of treatment. Based on boring records these monitoring wells appear to be located in an area of finer grained aquifer material. This finer silty sand is suspected to be a localized lower hydraulic-conductivity area that has significantly slower groundwater flow than other areas with medium sand. The monitoring wells in the MW-B2020 pair and MW-B2050 cluster were redeveloped to assess well condition in early February 2020. The results of February 2020 sampling and analysis following redevelopment indicated higher concentrations of nitrate at some of these monitoring locations supporting the that these areas may be isolated low flow zones, however, the concentrations at these wells were lower in the May and August 2020 sampling events.

Test results at MW-B2020C, the shallow monitoring location screened in higher permeability material has clearly shown all lines of evidence supporting that groundwater has been treated, while the intermediate depth screen MW-B2020B at this location has shown less evidence of treatment. In contrast monitoring well cluster MW-B1020B, the intermediate depth screen well located upgradient of MW-B2020B but downgradient of the 2018 PRB line has shown full cut off of nitrate and all supporting lines of evidence indicating treatment. Similarly monitoring wells at the MW-B1050 cluster have shown cutoff of nitrate migration at all elevations.

These data suggest reliance on monitoring well locations in close proximity to the PRB to assess PRB performance. The objective of the PRB is to cut off the migration of nitrate at the PRB. It can take significant time for the nitrate plume downgradient of the PRB to flush out of the area after cutoff and the downgradient area may be affected by other sources of nitrogen.

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber.

Secondary groundwater quality parameters associated with PRB nitrate treatment are also being monitored. Groundwater samples were collected for arsenic analyses from selected monitoring wells in September 2018, January/April/July/November 2019, and February/May/August 2020. The September 2018 sampling included upgradient monitoring wells MW-4 and MW-BX2A, MW-BX2B, and MW-BX2C and monitoring wells MW-B2010C and MW-B2020B downgradient of the PRB. Of the six monitoring wells sampled and analyzed for arsenic, five were non-detect (<0.025 mg/L). MW-B2010C, had a total arsenic concentration of 0.059 mg/L which above the arsenic Massachusetts Maximum Contaminant Level (MMCL) groundwater standard 0.010 mg/L if all the arsenic is assumed to be dissolved. MW-B2010C is in the PRB treatment zone. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential; some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected. These metals are expected to precipitate downgradient after only limited migration.

Monitoring well MW-B2010C was retested for total arsenic in January, April, July, and November 2019 and showed similar concentrations at 0.055, 0.087, 0.09, and 0.063 mg/L, respectively. The dissolved arsenic concentration was 0.012, 0.031, and 0.01 mg/L in February, May, and August 2020, respectively. Monitoring wells located further downgradient, including nearby MW-B2020B and monitoring wells MW-BC3B, MW-BC4A, MW-BC4B, and MW-BC4C were tested for arsenic in January 2019 and all showed less than the detection limit (<0.025 mg/L), indicating arsenic had not migrated downgradient beyond the PRB treatment zone. MW-B2020B, MW-BC3B, and MW-BC4B were tested again in April and July 2019 and still all showed less than the detection limit. MW-BC3B and MW-BC4B were both tested in November 2019 and were non-detect (<0.05 mg/L) and were non-detect for dissolved arsenic (<0.005 mg/L) in February, May, and August 2020. MW-B1020C showed a dissolved arsenic concentration of 0.012, 0.036, and 0.008 mg/L in February, May, and August 2020, respectively.

Two monitoring wells including MW-B1020C (close downgradient to the PRB) and sentinel MW-BC3B (~110 feet downgradient) are examples for monitoring results for secondary water quality parameters. Groundwater test results for secondary compounds from August 2020 shown on Chart 11 indicate elevated levels of dissolved iron, manganese, and arsenic close to the PRB. The dissolved iron and manganese are elevated close to the PRB but are either not detected or at low levels in the downgradient well. The dissolved arsenic and dissolved iron concentration were detected at MW-B1020C but was not detected in the downgradient monitoring well. Methane is also periodically monitored to assess for carbon fermentation byproducts. Methane analyses indicate the highest detected concentration were found at monitoring well MW-BX1B and MW-BX1C in August 2020 at a concentration of 12.4 mg/L and 13.8 mg/L, respectively, which is below the 30 mg/L solubility of methane in water and below any level of concern.

14) Q-14 November 2020

The fourteenth post-injection quarterly sampling (Q-14) event occurred on November 16th, 17th, and 18th 2020, approximately 4 years (48 months) after the first injections (November 2016) and approximately 29 months after the extension injections (June 2018). During the November 2020 quarterly sampling event, groundwater samples were collected from 37 monitoring wells and analyzed for nitrate, nitrite, ammonia, total nitrogen, chloride, sulfate, and most monitoring wells were analyzed for DOC, dissolved iron, and dissolved manganese. Select monitoring wells were also analyzed for arsenic and/or methane. Parameters, such as water level, pH, temperature, DO, ORP, conductivity, and turbidity, were also measured in the field.

a) Assessment of Groundwater Flow Through the PRB November 2020

Groundwater elevations calculated from the November 2020 data were interpolated using Golden Software's Surfer program to develop groundwater contour lines (Figure 6, Figure 7, and Figure 8). These groundwater contour and flow direction interpretations show a significant effect from local recharge and groundwater mounding in the parking lot area. Generally, groundwater flow is from west to east from the northern end of the soccer field and through the PRB to the parking lot area. Under the parking lot the flow direction shifts around to include localized flow to the south-southeast from the northern end of the parking lot where a large stormwater recharge gallery is located. The NRMS is operating at reduced capacity due to the Covid-19 pandemic. Reduced wastewater flow recharging to the septic system as a result may account of a noted shift to more significant flow from the northwest to southeast. Concentrations of nitrate also appear to be lower at the upgradient MW-BX2 monitoring well cluster. Historically the average groundwater flow through the PRB is from west to east with a net groundwater velocity of 0.2 to 0.3 feet/day. Significant precipitation events resulting in stormwater recharge are likely to continue to induce periodic temporal changes in horizontal flow direction and may also affect vertical groundwater flow.

b) Assessment of Groundwater Chemistry Data and PRB Performance

Nitrate concentration and additional groundwater chemistry data for baseline and quarterly sampling has been updated with data from the November 2020 sampling event and is included in Table 3. Nitrate data is also shown on cross-sections in Figures 3, Figure 4 and Figure 5. Graphs showing nitrate and DOC concentrations along with ORP are shown for selected monitoring wells in Chart 1 through Chart 10.

Overall assessment of PRB performance demonstrates that the PRB is effectively reducing significant nitrate concentrations, up to 39 mg/L, to low concentrations or to below the detection limits of 0.03 mg/L (or 0.21 mg/L) immediately downgradient treated area. Prior to the PRB extension injections in June 2018, data indicated effective PRB treatment downgradient of the November 2016 PRB section was limited to a wedge-shaped area bounded by the southeast to northwest oriented PRB section and including downgradient monitoring wells MW-B1010C (Chart 1), MW-B2010C (Chart 2), MW-B2020B (Chart 5), and MW-B2020C (Chart 6). These monitoring wells were close enough to the original southeast to northwest oriented PRB to be downgradient of the PRB in the easterly groundwater flow field.

Available data at the time of installation of the original section of PRB had indicated groundwater flow from southwest to northeast. The groundwater flow direction was later refined with data from additional monitoring well installations. The addition of the north-south PRB extension crossing the northwest end of the original PRB section has resulted in an expanded treatment area, extending to the north and affecting a significantly larger area including additional downgradient monitoring wells as discussed below. Data visualization heat maps showing the flow direction and concentration of nitrate in the vicinity of the PRB for shallow, intermediate and deep groundwater are shown in Figures 9, 10 and 11 respectively. There are no indications of nitrate breakthrough at the PRB and nitrate mass flux has been cut off. The effectiveness of PRB treatment is based on multiple lines of evidence including:

- Observation of the groundwater flow direction,
- Reduced concentrations of nitrate,
- Lower redox conditions (ORP) more favorable to denitrification, and
- Increased DOC concentrations indicating release of organic carbon from the PRB.

The last Quarterly data set from November 2020 was collected approximately 29 months following the PRB extension injections. Multiple lines of evidence as seen in Figures 9, 10, and 11, indicate treated groundwater has migrated more than 30 feet downgradient from the June 2018 PRB extension reaching monitoring wells MW-B1020B (Chart 3), MW-B1050A (Chart 7) and MW-B1050B (Chart 9). The November 2016 PRB injections continue to affect treatment at shallow monitoring wells MW-B2010C (Chart 2) and MW-B2020C (Chart 6).

Monitoring wells MW-B2020B, MW-B2050A, MW-B2050B, and MW-B2050C located approximately 90 feet downgradient of the 2018 PRB line have exhibited a mostly downward nitrate concentration trends with fluctuations and limited additional evidence of treatment. Based on boring records these monitoring wells appear to be located in an area of finer grained aquifer material. This finer silty sand is suspected to be a localized lower hydraulic-conductivity area that has significantly slower groundwater flow than other areas with medium sand. The monitoring wells in the MW-B2020 pair and MW-B2050 cluster were redeveloped to assess well condition in early February 2020. The results of February 2020 sampling and analysis following redevelopment indicated higher concentrations of nitrate at some of these monitoring locations supporting the that these areas may be isolated low flow zones, however, the concentrations at these wells were lower in the May, August, and November 2020 sampling events, indicating that upgradient treatment is gradually reducing concentrations in this area.

Test results at MW-B2020C, the shallow monitoring location screened in higher permeability material has clearly shown all lines of evidence supporting that groundwater has been treated, while the intermediate depth screen MW-B2020B at this location has shown less evidence of treatment. In contrast monitoring well cluster MW-B1020B, the intermediate depth screen well located upgradient of MW-B2020B but downgradient of the 2018 PRB line has shown full cut off of nitrate and all supporting lines of evidence indicating treatment. Similarly monitoring wells at the MW-B1050 cluster have shown cutoff of nitrate migration at all elevations.

These data suggest reliance on monitoring well locations in close proximity to the PRB to assess PRB performance. The objective of the PRB is to cut off the migration of nitrate at the PRB. It can take significant time for the nitrate plume downgradient of the PRB to flush out of the area after cutoff and the downgradient area may be affected by other sources of nitrogen.

Additional observations were noted to develop a more complete understanding of groundwater flow dynamics and interpret performance data. Elevated concentrations of ammonia have been observed in monitoring well MW-B1075B, MW-BM050B, and MW-BN1, located further to the north near the Middle School septic system dosing chamber.

Secondary groundwater quality parameters associated with PRB nitrate treatment are also being monitored. Sample results indicate that the groundwater in the treatment zone is anaerobic under reducing condition with a negative oxidation-reduction potential; some mobilization of naturally occurring metals (iron, manganese and arsenic) is expected and has been observed. These metals are expected to precipitate downgradient after only limited migration.

Appendix B

Monitoring Well Coordinates

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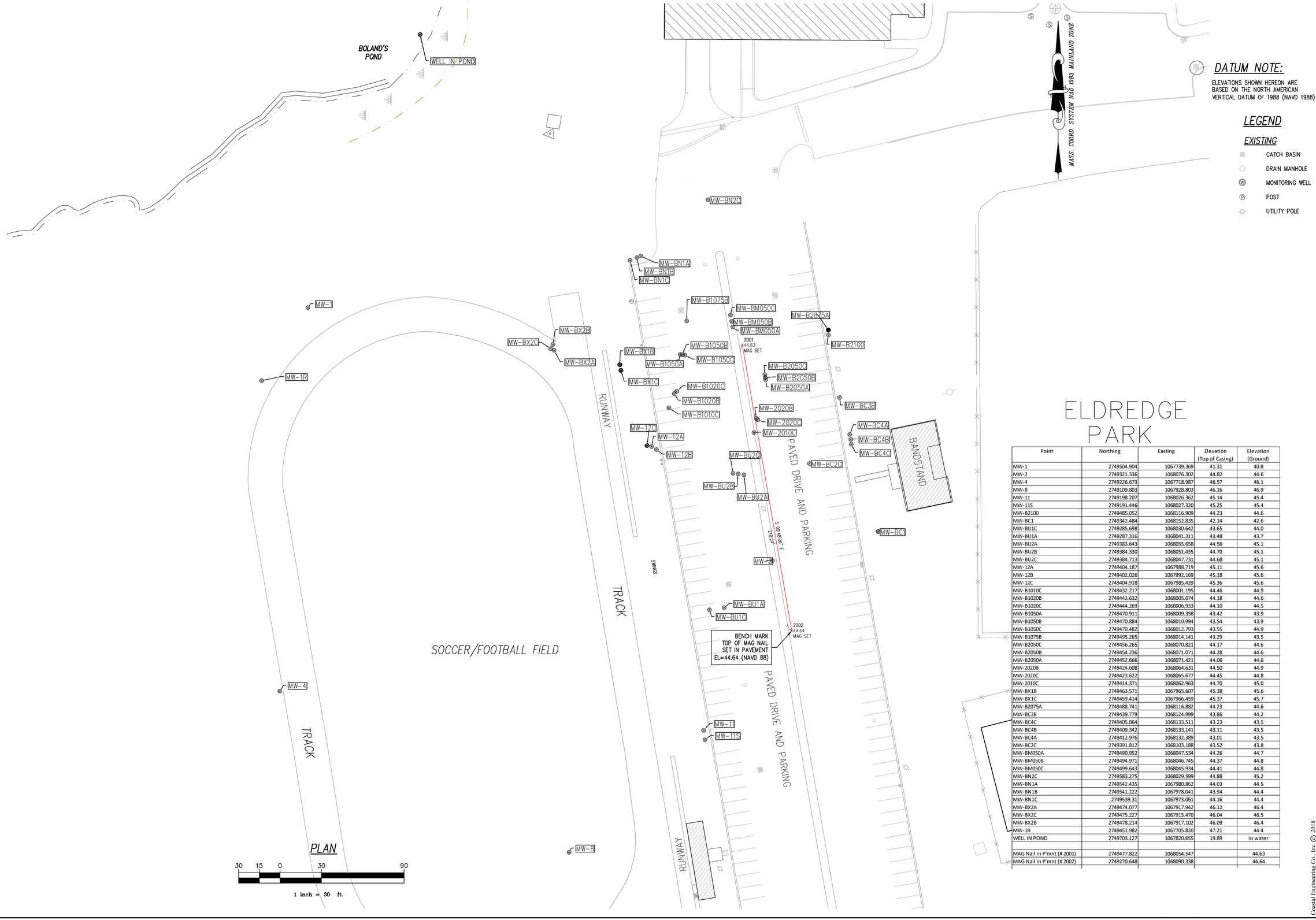

DATUM NOTE:

ELEVATIONS SHOWN HEREON ARE BASED ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 1988)

LEGEND

EXISTING

- CATCH BASIN
- DRAIN MANHOLE
- MONITORING WELL
- POST
- UTILITY POLE

ELDREDGE PARK

Point	Northing	Easting	Elevation (Top of Casing)	Elevation (Ground)
MW-1	2749504.904	1067739.369	41.31	40.8
MW-2	2749321.336	1068076.302	44.82	44.6
MW-4	2749226.673	1067718.987	46.57	46.1
MW-8	2749109.803	1067928.803	46.16	46.9
MW-11	2749198.207	1068026.362	45.14	45.4
MW-11S	2749191.446	1068027.320	45.25	45.4
MW-B2100	2749485.052	1068116.909	44.23	44.6
MW-BC1	2749342.484	1068152.835	42.14	42.6
MW-BU1C	2749285.698	1068030.642	43.65	44.0
MW-BU1A	2749287.316	1068041.311	43.48	43.7
MW-BU2A	2749383.643	1068055.658	44.56	45.1
MW-BU2B	2749384.330	1068051.435	44.70	45.1
MW-BU2C	2749384.713	1068047.731	44.68	45.1
MW-12A	2749404.187	1067988.719	45.11	45.6
MW-12B	2749402.026	1067992.169	45.18	45.6
MW-12C	2749404.918	1067985.439	45.36	45.6
MW-B1010C	2749432.217	1068001.195	44.46	44.9
MW-B1020B	2749442.632	1068005.074	44.18	44.6
MW-B1020C	2749444.269	1068006.933	44.10	44.5
MW-B1050A	2749470.911	1068009.358	43.42	43.9
MW-B1050B	2749470.884	1068010.994	43.54	43.9
MW-B1050C	2749470.482	1068012.793	43.55	44.9
MW-B1075B	2749495.265	1068014.141	43.29	43.5
MW-B2050C	2749456.265	1068070.821	44.17	44.6
MW-B2050B	2749454.236	1068071.071	44.28	44.6
MW-B2050A	2749452.666	1068071.421	44.06	44.6
MW-2020B	2749424.608	1068064.631	44.50	44.9
MW-2020C	2749423.622	1068065.677	44.45	44.8
MW-2010C	2749414.371	1068062.963	44.70	45.0
MW-BX1B	2749463.571	1067965.607	45.38	45.6
MW-BX1C	2749459.414	1067966.459	45.37	45.7
MW-B2075A	2749488.741	1068116.882	44.23	44.6
MW-BC3B	2749439.779	1068124.999	43.86	44.2
MW-BC4C	2749405.864	1068133.511	43.23	43.5
MW-BC4B	2749409.342	1068133.141	43.11	43.5
MW-BC4A	2749412.976	1068132.389	43.01	43.5
MW-BC2C	2749391.812	1068103.188	43.52	43.8
MW-BM050A	2749490.952	1068047.534	44.26	44.7
MW-BM050B	2749494.971	1068046.745	44.37	44.8
MW-BM050C	2749499.643	1068045.934	44.41	44.8
MW-BN2C	2749583.275	1068029.599	44.88	45.2
MW-BN1A	2749542.435	1067980.862	44.03	44.5
MW-BN1B	2749541.222	1067978.041	43.94	44.4
MW-BN1C	2749539.31	1067973.061	44.16	44.4
MW-BX2A	2749474.077	1067917.942	46.12	46.4
MW-BX2C	2749475.227	1067915.470	46.04	46.5
MW-BX2B	2749478.214	1067917.102	46.09	46.4
MW-1R	2749451.982	1067705.820	47.21	44.4
WELL IN POND	2749703.127	1067820.655	19.89	in water
MAG Nail in P'mnt (# 2001)	2749477.822	1068054.547		44.63
MAG Nail in P'mnt (# 2002)	2749270.648	1068090.338		44.64

COASTAL engineering co.
260 Cranberry Hwy, Orleans, MA 02653
508.255.6511 P 508.255.6700 F

NO.	DATE	REVISION	BY

SEAL

PROJECT
AECOM
NAUSET REGIONAL MIDDLE SCHOOL - OFF ELDGREDGE PARK WAY ORLEANS, MA

SHEET TITLE
WELL PLAN OF LAND
SHOWING MONITOR WELL LOCATIONS

SCALE: AS NOTED
DRAWING FILE: C18470-C3D-NRMS.dwg
DATE: REV 5/9/2018 ~~1/26/2017~~
DRAWN BY: BPM
CHECKED BY:

SKC-5

⊥ OF ⊥ SHEETS

PROJECT NO. C18470.00

F:\SDSK\PROJ\C18000\C18470\C18470-00\NRMS\C18470-C3D-NRMS.dwg May 09, 2018 - 10:44am

Appendix C

Analytical Laboratory Reports

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CERTIFICATE OF ANALYSIS

Julianne Marrion
AECOM Environment - ENSR
9 Jonathan Bourne Dr
Pocasset, MA 02559

RE: Orleans MA (60476644)
ESS Laboratory Work Order Number: 21C0096

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

SAMPLE RECEIPT

The following samples were received on March 02, 2021 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR Part 136, as amended.

Lab Number	Sample Name	Matrix	Analysis
21C0096-01	MW-BC4A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0096-02	MW-BC4B	Ground Water	200.7, 200.8, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4A
Date Sampled: 03/02/21 10:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0096
ESS Laboratory Sample ID: 21C0096-01
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 14:35	10	10	DC10332
Manganese	**2.73** (0.020)		200.7		1	KJK	03/04/21 14:35	10	10	DC10332

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4A
Date Sampled: 03/02/21 10:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0096
ESS Laboratory Sample ID: 21C0096-01
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.12** (0.10)		350.1		1	EEM	03/04/21 12:02	mg/L	DC10334
Chloride	**69.4** (3.0)		9250		1	JLK	03/04/21 16:28	mg/L	DC10439
Dissolved Organic Carbon (Average)	**4.22** (0.250)		5310B		1	CCP	03/03/21 20:08	mg/L	[CALC]
Nitrate as N	**0.172** (0.0300)		353.2		1	JLK	03/02/21 20:51	mg/L	[CALC]
Nitrite as N	**0.027** (0.010)		353.2		1	JLK	03/02/21 20:07	mg/L	DC10228
Sulfate	**42.5** (25.0)		9038		5	EEM	03/03/21 14:30	mg/L	DC10312
Total Nitrogen	ND (0.200)		4500N		1	JLK	03/08/21 16:49	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4B
Date Sampled: 03/02/21 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0096
ESS Laboratory Sample ID: 21C0096-02
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (0.001)		200.8		1	KJK	03/04/21 12:13	10	10	DC10332
Iron	ND (0.100)		200.7		1	KJK	03/04/21 14:37	10	10	DC10332
Manganese	**0.846** (0.020)		200.7		1	KJK	03/04/21 14:37	10	10	DC10332

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4B
Date Sampled: 03/02/21 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0096
ESS Laboratory Sample ID: 21C0096-02
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.12** (0.10)		350.1		1	EEM	03/04/21 12:03	mg/L	DC10334
Chloride	**51.9** (3.0)		9250		1	JLK	03/04/21 16:32	mg/L	DC10439
Dissolved Organic Carbon (Average)	**4.22** (0.250)		5310B		1	CCP	03/03/21 20:46	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/02/21 20:52	mg/L	[CALC]
Nitrite as N	**0.046** (0.010)		353.2		1	JLK	03/02/21 20:08	mg/L	DC10228
Sulfate	**47.0** (25.0)		9038		5	EEM	03/03/21 14:30	mg/L	DC10312
Total Nitrogen	ND (0.200)		4500N		1	JLK	03/08/21 16:51	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4B
Date Sampled: 03/02/21 10:20
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0096
ESS Laboratory Sample ID: 21C0096-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:07	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:07	D1C0123	DC10807
Methane	**5880** (40.0)		RSK175		20	NXL	03/08/21 12:09	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Dissolved Metals										
Batch DC10332 - 200.7/6010BNoDigest										
Blank										
Arsenic	ND	0.001	mg/L							
Iron	ND	0.100	mg/L							
Manganese	ND	0.020	mg/L							
LCS										
Iron	2.50		mg/L	2.500		100	80-120			
Manganese	0.512		mg/L	0.5000		102	80-120			
LCS										
Arsenic	19.4		ug/L	20.00		97	85-115			
Classical Chemistry										
Batch DC10228 - General Preparation										
Blank										
Nitrite as N	ND	0.010	mg/L							
Nitrite as N	ND	0.010	mg/L							
LCS										
Nitrite as N	0.261		mg/L	0.2497		104	90-110			
Nitrite as N	0.261		mg/L	0.2497		104	90-110			
Batch DC10229 - General Preparation										
Blank										
Nitrate/Nitrite as N	ND	0.020	mg/L							
Nitrate/Nitrite as N	ND	0.020	mg/L							
LCS										
Nitrate/Nitrite as N	0.516		mg/L	0.5000		103	90-110			
Nitrate/Nitrite as N	0.516		mg/L	0.5000		103	90-110			
Batch DC10312 - General Preparation										
Blank										
Sulfate	ND	5.0	mg/L							
LCS										
Sulfate	9.8		mg/L	9.988		98	85-115			
Batch DC10326 - General Preparation										
Blank										
Dissolved Organic Carbon (1)	ND	0.500	mg/L							
Dissolved Organic Carbon (2)	ND	0.500	mg/L							
LCS										
Dissolved Organic Carbon (1)	5.20	0.500	mg/L	5.000		104	80-120			
Dissolved Organic Carbon (2)	5.27	0.500	mg/L	5.000		105	80-120			
LCS Dup										
Dissolved Organic Carbon (1)	5.29	0.500	mg/L	5.000		106	80-120	2	20	
Dissolved Organic Carbon (2)	5.31	0.500	mg/L	5.000		106	80-120	0.9	20	
Batch DC10334 - NH4 Prep										

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch DC10334 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	1.02	0.10	mg/L	0.9994		102	80-120			
Batch DC10439 - General Preparation										
Blank										
Chloride	ND	3.0	mg/L							
LCS										
Chloride	31.7		mg/L	30.00		106	90-110			
Batch DC10519 - TKN Prep										
Blank										
Total Kjeldahl Nitrogen as N	ND	0.20	mg/L							
LCS										
Total Kjeldahl Nitrogen as N	16.1	2.00	mg/L	17.50		92	80-120			
Methane / Ethane / Ethene by Headspace GCFID (RSK175)										
Batch DC10807 - No Prep										
Blank										
Ethane	ND	3.0	ug/L							
Ethene	ND	5.0	ug/L							
Methane	ND	2.0	ug/L							
LCS										
Ethane	70.5	3.0	ug/L	68.00		104	60-140			
Ethene	64.6	5.0	ug/L	64.00		101	60-140			
Methane	37.1	2.0	ug/L	36.00		103	60-140			
LCS Dup										
Ethane	67.5	3.0	ug/L	68.00		99	60-140	4	30	
Ethene	63.0	5.0	ug/L	64.00		98	60-140	3	30	
Methane	35.3	2.0	ug/L	36.00		98	60-140	5	30	

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0096

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 21C0096
Date Received: 3/2/2021
Project Due Date: 3/9/2021
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: -0.8 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No

11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? Yes / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

14. Was there a need to contact Project Manager? Yes / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	139830	Yes	N/A	Yes	1L Poly	NP	
1	139832	Yes	N/A	Yes	1L Poly	H2SO4	
1	139834	Yes	N/A	Yes	250 mL Poly	NP	
1	139836	Yes	N/A	Yes	250 mL Amber	NP	
2	139831	Yes	N/A	Yes	1L Poly	NP	
2	139833	Yes	N/A	Yes	1L Poly	H2SO4	
2	139835	Yes	N/A	Yes	250 mL Poly	NP	
2	139837	Yes	N/A	Yes	250 mL Amber	NP	
2	139838	Yes	N/A	Yes	250 mL Poly	NP	
2	139839	Yes	N/A	Yes	VOA Vial	HCl	
2	139840	Yes	N/A	Yes	VOA Vial	HCl	

2nd Review
Were all containers scanned into storage/lab? Initials AG
Are barcode labels on correct containers? Yes / No
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

ESS Project ID: 21C0096

Date Received: 3/2/2021

Are all QC stickers attached? Yes / No / NA

Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: Amber Jarvis Date & Time: 3/2/21 17:09

Reviewed By: [signature] Date & Time: 3/2/21 1722

21C0096

AECOM

CHAIN OF CUSTODY RECORD

Page 1 of 1

Client/Project Name: Orleans PRB	Project Location: Nauset MS
Project Number: 60476644	Field Logbook No.:
Sampler (Print Name)/(Affiliation): Briley Barra AECOM	Chain of Custody Tape Nos.:
Signature: Briley Barra	Send Results/Report to: Julianne.marione@aecom.com — TAT: STAND

Container Type: P – Plastic; A – Amber Glass; G – Clear Glass; V – VOA Vial; O – Other; E – Encore

Preservation: 1 – HCl, 4°; 2 – H2SO4, 4°; 3 – HNO3, 4°; 4 – NaOH, 4°; 5 – NaOH/ZnAc, 4°; 6 – Na2S2O3, 4°; 7 – 4°

Matrix Codes: DW – Drinking Water; WW – Wastewater; GW – Groundwater; SW – Surface Water; ST – Storm Water; W – Water; S – Soil; SL – Sludge; SD – Sediment; SO – Solid; A – Air; L – Liquid; P – Product

	Field Sample No./Identification	Date	Time	COMP	GRAB	Sample Container (Size/Mat'l)	Matrix	Preserv.	Field Filtered	Analysis Requested: NO2, NO3, Cl, SO4	Amm + TN	Diss Fe, Mn	DOC	Methane	Diss Arsenic	Lab I.D.	Remarks
1	MW-BC4A	03/02/21	1025		X	—	GW	—	—	X	X	X	X				
2	MW-BC4B	03/02/21	1020		X	—	GW	—	—	X	X	X	X	X	X		

-0.8

Relinquished by: (Print Name)/(Affiliation): Briley Barra AECOM	Date: 03/02/21	Received by: (Print Name)/(Affiliation):	Date: 3/2/21
Signature: Briley Barra	Time: 1433	Signature:	Time: 14:37
Relinquished by: (Print Name)/(Affiliation):	Date: 3/2/21	Received by: (Print Name)/(Affiliation):	Date: 3/2/21
Signature:	Time: 16:08	Signature: Amber Garcia	Time: 16:08
Relinquished by: (Print Name)/(Affiliation):	Date:	Received by: (Print Name)/(Affiliation):	Date:
Signature:	Time:	Signature:	Time:

Analytical Laboratory (Destination):

Sample Shipped Via: UPS FedEx Courier Other

Temp blank: Yes No

CERTIFICATE OF ANALYSIS

Julianne Marrion
AECOM Environment - ENSR
9 Jonathan Bourne Dr
Pocasset, MA 02559

RE: Orleans MA (60476644)
ESS Laboratory Work Order Number: 21C0153

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

SAMPLE RECEIPT

The following samples were received on March 03, 2021 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR Part 136, as amended.

Lab Number	Sample Name	Matrix	Analysis
21C0153-01	MW-B2010C	Ground Water	200.7, 200.8, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0153-02	MW-B2020C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0153-03	MW-BC4C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-04	MW-B2020B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-05	MW-BC3B	Ground Water	200.7, 200.8, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-06	MW-B2050C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-07	MW-B2050B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-08	MW-B2050A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-09	MW-B2100	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-10	MW-B2075A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0153-11	MW-BU2A	Ground Water	350.1, 353.2, 4500N, 9038, 9250
21C0153-12	MW-BU2B	Ground Water	350.1, 353.2, 4500N, 9038, 9250
21C0153-13	MW-BU2C	Ground Water	350.1, 353.2, 4500N, 9038, 9250
21C0153-14	MW-12A	Ground Water	350.1, 353.2, 4500N, 9038, 9250
21C0153-15	MW-12B	Ground Water	350.1, 353.2, 4500N, 9038, 9250
21C0153-16	MW-12C	Ground Water	350.1, 353.2, 4500N, 9038, 9250

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2010C
Date Sampled: 03/03/21 09:55
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-01
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**0.043** (0.001)		200.8		1	KJK	03/04/21 14:17	10	10	DC10428
Iron	**87.9** (0.100)		200.7		1	KJK	03/04/21 15:15	10	10	DC10428
Manganese	**4.07** (0.020)		200.7		1	KJK	03/04/21 15:15	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2010C
Date Sampled: 03/03/21 09:55
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-01
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**1.00** (0.10)		350.1		1	EEM	03/08/21 12:09	mg/L	DC10538
Chloride	**37.9** (3.0)		9250		1	JLK	03/04/21 16:33	mg/L	DC10439
Dissolved Organic Carbon (Average)	**6.58** (0.500)		5310B		2	CCP	03/09/21 16:20	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/04/21 20:41	mg/L	[CALC]
Nitrite as N	**0.083** (0.010)		353.2		1	JLK	03/04/21 19:40	mg/L	DC10442
Sulfate	**19.7** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**1.14** (0.200)		4500N		1	JLK	03/08/21 16:52	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2010C
Date Sampled: 03/03/21 09:55
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-01
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:40	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:40	D1C0123	DC10807
Methane	**10400** (50.0)		RSK175		25	NXL	03/08/21 12:42	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2020C
Date Sampled: 03/03/21 10:45
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-02
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**77.7** (0.100)		200.7		1	KJK	03/04/21 15:16	10	10	DC10428
Manganese	**6.50** (0.020)		200.7		1	KJK	03/04/21 15:16	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2020C
Date Sampled: 03/03/21 10:45
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-02
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.13** (0.10)		350.1		1	EEM	03/08/21 12:10	mg/L	DC10538
Chloride	**37.8** (3.0)		9250		1	JLK	03/04/21 16:34	mg/L	DC10439
Dissolved Organic Carbon (Average)	**8.73** (0.500)		5310B		2	CCP	03/09/21 17:22	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/04/21 20:42	mg/L	[CALC]
Nitrite as N	**0.073** (0.010)		353.2		1	JLK	03/04/21 19:41	mg/L	DC10442
Sulfate	ND (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	ND (0.200)		4500N		1	JLK	03/08/21 16:53	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2020C
Date Sampled: 03/03/21 10:45
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-02
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:46	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:46	D1C0123	DC10807
Methane	**11400** (40.0)		RSK175		20	NXL	03/08/21 12:48	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4C
Date Sampled: 03/03/21 09:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-03
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**1.05** (0.100)		200.7		1	KJK	03/04/21 15:31	10	10	DC10428
Manganese	**5.20** (0.020)		200.7		1	KJK	03/04/21 15:31	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC4C
Date Sampled: 03/03/21 09:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-03
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.12** (0.10)		350.1		1	EEM	03/08/21 12:10	mg/L	DC10538
Chloride	**39.6** (3.0)		9250		1	JLK	03/04/21 16:35	mg/L	DC10439
Dissolved Organic Carbon (Average)	**1.33** (0.500)		5310B		2	CCP	03/09/21 17:34	mg/L	[CALC]
Nitrate as N	**0.0420** (0.0300)		353.2		1	JLK	03/04/21 20:43	mg/L	[CALC]
Nitrite as N	**0.100** (0.010)		353.2		1	JLK	03/04/21 19:42	mg/L	DC10442
Sulfate	**19.8** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	ND (0.200)		4500N		1	JLK	03/08/21 16:54	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2020B
Date Sampled: 03/03/21 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-04
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:33	10	10	DC10428
Manganese	**0.215** (0.020)		200.7		1	KJK	03/04/21 15:33	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2020B
Date Sampled: 03/03/21 10:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-04
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:11	mg/L	DC10538
Chloride	**29.5** (3.0)		9250		1	JLK	03/04/21 16:40	mg/L	DC10439
Dissolved Organic Carbon (Average)	**4.12** (0.500)		5310B		2	CCP	03/09/21 17:46	mg/L	[CALC]
Nitrate as N	**1.85** (0.110)		353.2		5	JLK	03/04/21 21:14	mg/L	[CALC]
Nitrite as N	**0.383** (0.010)		353.2		1	JLK	03/04/21 19:43	mg/L	DC10442
Sulfate	**47.0** (25.0)		9038		5	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**2.24** (0.200)		4500N		5	JLK	03/08/21 16:54	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC3B
Date Sampled: 03/03/21 10:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-05
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	ND (0.001)		200.8		1	KJK	03/04/21 14:23	10	10	DC10428
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:35	10	10	DC10428
Manganese	ND (0.020)		200.7		1	KJK	03/04/21 15:35	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC3B
Date Sampled: 03/03/21 10:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-05
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.34** (0.10)		350.1		1	EEM	03/08/21 12:12	mg/L	DC10538
Chloride	**326** (12.0)		9250		4	JLK	03/04/21 17:12	mg/L	DC10439
Dissolved Organic Carbon (Average)	**1.04** (0.500)		5310B		2	CCP	03/09/21 18:24	mg/L	[CALC]
Nitrate as N	**0.780** (0.0300)		353.2		1	JLK	03/04/21 20:45	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:44	mg/L	DC10442
Sulfate	**8.3** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**0.780** (0.200)		4500N		1	JLK	03/08/21 17:01	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050C
Date Sampled: 03/03/21 11:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-06
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:37	10	10	DC10428
Manganese	**0.112** (0.020)		200.7		1	KJK	03/04/21 15:37	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050C
Date Sampled: 03/03/21 11:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-06
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.42** (0.10)		350.1		1	EEM	03/08/21 12:13	mg/L	DC10538
Chloride	**156** (6.0)		9250		2	JLK	03/04/21 17:02	mg/L	DC10439
Dissolved Organic Carbon (Average)	**3.29** (0.500)		5310B		2	CCP	03/09/21 18:36	mg/L	[CALC]
Nitrate as N	**0.681** (0.110)		353.2		5	JLK	03/04/21 21:15	mg/L	[CALC]
Nitrite as N	**0.497** (0.010)		353.2		1	JLK	03/04/21 19:45	mg/L	DC10442
Sulfate	**35.0** (25.0)		9038		5	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**1.18** (0.200)		4500N		5	JLK	03/08/21 17:02	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050B
Date Sampled: 03/03/21 12:05
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-07
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**1.30** (0.100)		200.7		1	KJK	03/04/21 15:39	10	10	DC10428
Manganese	**0.975** (0.020)		200.7		1	KJK	03/04/21 15:39	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050B
Date Sampled: 03/03/21 12:05
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-07
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:14	mg/L	DC10538
Chloride	**42.3** (3.0)		9250		1	JLK	03/04/21 16:43	mg/L	DC10439
Dissolved Organic Carbon (Average)	**4.02** (0.500)		5310B		2	CCP	03/09/21 18:48	mg/L	[CALC]
Nitrate as N	**0.171** (0.0300)		353.2		1	JLK	03/04/21 20:47	mg/L	[CALC]
Nitrite as N	**0.371** (0.010)		353.2		1	JLK	03/04/21 19:46	mg/L	DC10442
Sulfate	**41.5** (25.0)		9038		5	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**0.542** (0.200)		4500N		1	JLK	03/08/21 17:03	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050A
Date Sampled: 03/03/21 12:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-08
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:41	10	10	DC10428
Manganese	**0.213** (0.020)		200.7		1	KJK	03/04/21 15:41	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2050A
Date Sampled: 03/03/21 12:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-08
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.47** (0.10)		350.1		1	EEM	03/08/21 12:15	mg/L	DC10538
Chloride	**49.3** (3.0)		9250		1	JLK	03/04/21 16:44	mg/L	DC10439
Dissolved Organic Carbon (Average)	**3.32** (0.500)		5310B		2	CCP	03/09/21 19:00	mg/L	[CALC]
Nitrate as N	**1.76** (0.110)		353.2		5	JLK	03/04/21 21:16	mg/L	[CALC]
Nitrite as N	**0.434** (0.010)		353.2		1	JLK	03/04/21 19:47	mg/L	DC10442
Sulfate	**36.0** (25.0)		9038		5	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**2.53** (0.200)		4500N		5	JLK	03/08/21 17:03	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2100
Date Sampled: 03/03/21 11:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-09
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:44	10	10	DC10428
Manganese	**0.063** (0.020)		200.7		1	KJK	03/04/21 15:44	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2100
Date Sampled: 03/03/21 11:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-09
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:16	mg/L	DC10538
Chloride	**95.5** (3.0)		9250		1	JLK	03/04/21 16:45	mg/L	DC10439
Dissolved Organic Carbon (Average)	**1.18** (0.500)		5310B		2	CCP	03/09/21 19:12	mg/L	[CALC]
Nitrate as N	**0.598** (0.0300)		353.2		1	JLK	03/04/21 20:53	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:53	mg/L	DC10442
Sulfate	**13.0** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**0.598** (0.200)		4500N		1	JLK	03/08/21 17:04	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2075A
Date Sampled: 03/03/21 12:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-10
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/04/21 15:46	10	10	DC10428
Manganese	**0.071** (0.020)		200.7		1	KJK	03/04/21 15:46	10	10	DC10428

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B2075A
Date Sampled: 03/03/21 12:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-10
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:24	mg/L	DC10538
Chloride	**227** (12.0)		9250		4	JLK	03/04/21 17:13	mg/L	DC10439
Dissolved Organic Carbon (Average)	**1.20** (0.500)		5310B		2	CCP	03/09/21 19:50	mg/L	[CALC]
Nitrate as N	**1.34** (0.110)		353.2		5	JLK	03/04/21 21:17	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:54	mg/L	DC10442
Sulfate	**17.7** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**1.34** (0.200)		4500N		5	JLK	03/08/21 17:05	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BU2A
Date Sampled: 03/03/21 14:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-11
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:25	mg/L	DC10538
Chloride	**127** (6.0)		9250		2	JLK	03/04/21 17:05	mg/L	DC10439
Nitrate as N	**0.160** (0.0300)		353.2		1	JLK	03/04/21 20:57	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:56	mg/L	DC10442
Sulfate	**6.9** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	ND (0.200)		4500N		1	JLK	03/08/21 17:06	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BU2B
Date Sampled: 03/03/21 14:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-12
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:26	mg/L	DC10538
Chloride	**81.5** (3.0)		9250		1	JLK	03/04/21 16:49	mg/L	DC10439
Nitrate as N	**0.528** (0.0300)		353.2		1	JLK	03/04/21 20:58	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:57	mg/L	DC10442
Sulfate	ND (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**0.528** (0.200)		4500N		1	JLK	03/08/21 17:07	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BU2C
Date Sampled: 03/03/21 15:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-13
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/08/21 12:27	mg/L	DC10538
Chloride	**86.3** (3.0)		9250		1	JLK	03/04/21 16:50	mg/L	DC10439
Nitrate as N	**1.26** (0.110)		353.2		5	JLK	03/04/21 21:24	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:58	mg/L	DC10442
Sulfate	ND (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**1.26** (0.200)		4500N		5	JLK	03/08/21 17:08	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-12A
Date Sampled: 03/03/21 15:05
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-14
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/09/21 12:10	mg/L	DC10801
Chloride	**84.8** (3.0)		9250		1	JLK	03/04/21 16:55	mg/L	DC10439
Nitrate as N	**0.267** (0.0300)		353.2		1	JLK	03/04/21 21:00	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 19:59	mg/L	DC10442
Sulfate	**17.6** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**0.267** (0.200)		4500N		1	JLK	03/08/21 17:08	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-12B
Date Sampled: 03/03/21 14:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-15
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.11** (0.10)		350.1		1	EEM	03/09/21 12:13	mg/L	DC10801
Chloride	**51.3** (3.0)		9250		1	JLK	03/04/21 16:56	mg/L	DC10439
Nitrate as N	**2.75** (0.110)		353.2		5	JLK	03/04/21 21:25	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/04/21 20:00	mg/L	DC10442
Sulfate	**12.5** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**2.75** (0.200)		4500N		5	JLK	03/08/21 17:15	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-12C
Date Sampled: 03/03/21 15:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0153
ESS Laboratory Sample ID: 21C0153-16
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.12** (0.10)		350.1		1	EEM	03/09/21 12:14	mg/L	DC10801
Chloride	**21.8** (3.0)		9250		1	JLK	03/04/21 16:57	mg/L	DC10439
Nitrate as N	**2.25** (0.110)		353.2		5	JLK	03/04/21 21:26	mg/L	[CALC]
Nitrite as N	**0.010** (0.010)		353.2		1	JLK	03/04/21 20:01	mg/L	DC10442
Sulfate	**10.1** (5.0)		9038		1	EEM	03/08/21 16:45	mg/L	DC10821
Total Nitrogen	**2.26** (0.200)		4500N		5	JLK	03/08/21 17:16	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Dissolved Metals										
Batch DC10428 - 200.7/6010BNoDigest										
Blank										
Arsenic	ND	0.001	mg/L							
Iron	ND	0.100	mg/L							
Manganese	ND	0.020	mg/L							
LCS										
Iron	2.50		mg/L	2.500		100	80-120			
Manganese	0.512		mg/L	0.5000		102	80-120			
LCS										
Arsenic	19.4		ug/L	20.00		97	85-115			
Classical Chemistry										
Batch DC10439 - General Preparation										
Blank										
Chloride	ND	3.0	mg/L							
LCS										
Chloride	31.7		mg/L	30.00		106	90-110			
Batch DC10442 - General Preparation										
Blank										
Nitrite as N	ND	0.010	mg/L							
Nitrite as N	ND	0.010	mg/L							
LCS										
Nitrite as N	0.256		mg/L	0.2497		102	90-110			
Nitrite as N	0.256		mg/L	0.2497		102	90-110			
Batch DC10445 - General Preparation										
Blank										
Nitrate/Nitrite as N	ND	0.020	mg/L							
Nitrate/Nitrite as N	ND	0.020	mg/L							
LCS										
Nitrate/Nitrite as N	0.499		mg/L	0.5000		100	90-110			
Nitrate/Nitrite as N	0.499		mg/L	0.5000		100	90-110			
Batch DC10519 - TKN Prep										
Blank										
Total Kjeldahl Nitrogen as N	ND	0.20	mg/L							
LCS										
Total Kjeldahl Nitrogen as N	16.1	2.00	mg/L	17.50		92	80-120			
Batch DC10538 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	1.01	0.10	mg/L	0.9994		101	80-120			

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch DC10801 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	1.01	0.10	mg/L	0.9994		101	80-120			
Batch DC10821 - General Preparation										
Blank										
Sulfate	ND	5.0	mg/L							
LCS										
Sulfate	9.7		mg/L	9.988		97	85-115			
Batch DC10929 - General Preparation										
Blank										
Dissolved Organic Carbon (1)	ND	0.500	mg/L							
Dissolved Organic Carbon (2)	ND	0.500	mg/L							
LCS										
Dissolved Organic Carbon (1)	4.97	0.500	mg/L	5.000		99	80-120			
Dissolved Organic Carbon (2)	5.03	0.500	mg/L	5.000		101	80-120			
LCS Dup										
Dissolved Organic Carbon (1)	5.06	0.500	mg/L	5.000		101	80-120	2	20	
Dissolved Organic Carbon (2)	5.02	0.500	mg/L	5.000		100	80-120	0.1	20	
Methane / Ethane / Ethene by Headspace GCFID (RSK175)										
Batch DC10807 - No Prep										
Blank										
Ethane	ND	3.0	ug/L							
Ethene	ND	5.0	ug/L							
Methane	ND	2.0	ug/L							
LCS										
Ethane	70.5	3.0	ug/L	68.00		104	60-140			
Ethene	64.6	5.0	ug/L	64.00		101	60-140			
Methane	37.1	2.0	ug/L	36.00		103	60-140			
LCS Dup										
Ethane	67.5	3.0	ug/L	68.00		99	60-140	4	30	
Ethene	63.0	5.0	ug/L	64.00		98	60-140	3	30	
Methane	35.3	2.0	ug/L	36.00		98	60-140	5	30	

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0153

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 21C0153
Date Received: 3/3/2021
Project Due Date: 3/10/2021
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 4.7 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? Yes
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No

11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? Yes / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

COC: 12:30 Bottle: 10:35 — COC: 10:35 Bottle: 12:30 — COC: 09:55 Bottle: 09:50

Collection times for samples 10, 5, and 3 don't match COC.
Rec'd 2 NP bottles for samples 5 and 1 - one is mistakenly labeled as HNO3.

14. Was there a need to contact Project Manager? AC 3/3/21 Yes / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	140235	Yes	N/A	Yes	1L Poly	NP	
1	140251	Yes	N/A	Yes	1L Poly	H2SO4	
1	140267	Yes	N/A	Yes	250 mL Amber	NP	
1	140277	Yes	N/A	Yes	250 mL Poly	NP	
1	140287	Yes	N/A	Yes	250 mL Poly	NP	
1	140289	Yes	N/A	Yes	VOA Vial	HCl	
1	140290	Yes	N/A	Yes	VOA Vial	HCl	
2	140236	Yes	N/A	Yes	1L Poly	NP	
2	140252	Yes	N/A	Yes	1L Poly	H2SO4	
2	140268	Yes	N/A	Yes	250 mL Amber	NP	
2	140278	Yes	N/A	Yes	250 mL Poly	NP	
2	140291	Yes	N/A	Yes	VOA Vial	HCl	
2	140292	Yes	N/A	Yes	VOA Vial	HCl	
3	140237	Yes	N/A	Yes	1L Poly	NP	
3	140253	Yes	N/A	Yes	1L Poly	H2SO4	
3	140269	Yes	N/A	Yes	250 mL Amber	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

ESS Project ID: 21C0153

Date Received: 3/3/2021

3	140279	Yes	N/A	Yes	250 mL Poly	NP
4	140238	Yes	N/A	Yes	1L Poly	NP
4	140254	Yes	N/A	Yes	1L Poly	H2SO4
4	140270	Yes	N/A	Yes	250 mL Amber	NP
4	140280	Yes	N/A	Yes	250 mL Poly	NP
5	140239	Yes	N/A	Yes	1L Poly	NP
5	140255	Yes	N/A	Yes	1L Poly	H2SO4
5	140271	Yes	N/A	Yes	250 mL Amber	NP
5	140281	Yes	N/A	Yes	250 mL Poly	NP
5	140288	Yes	N/A	Yes	250 mL Poly	NP
6	140240	Yes	N/A	Yes	1L Poly	NP
6	140256	Yes	N/A	Yes	1L Poly	H2SO4
6	140272	Yes	N/A	Yes	250 mL Amber	NP
6	140282	Yes	N/A	Yes	250 mL Poly	NP
7	140241	Yes	N/A	Yes	1L Poly	NP
7	140257	Yes	N/A	Yes	1L Poly	H2SO4
7	140273	Yes	N/A	Yes	250 mL Amber	NP
7	140283	Yes	N/A	Yes	250 mL Poly	NP
8	140242	Yes	N/A	Yes	1L Poly	NP
8	140258	Yes	N/A	Yes	1L Poly	H2SO4
8	140274	Yes	N/A	Yes	250 mL Amber	NP
8	140284	Yes	N/A	Yes	250 mL Poly	NP
9	140243	Yes	N/A	Yes	1L Poly	NP
9	140259	Yes	N/A	Yes	1L Poly	H2SO4
9	140275	Yes	N/A	Yes	250 mL Amber	NP
9	140285	Yes	N/A	Yes	250 mL Poly	NP
10	140244	Yes	N/A	Yes	1L Poly	NP
10	140260	Yes	N/A	Yes	1L Poly	H2SO4
10	140276	Yes	N/A	Yes	250 mL Amber	NP
10	140286	Yes	N/A	Yes	250 mL Poly	NP
11	140245	Yes	N/A	Yes	1L Poly	NP
11	140261	Yes	N/A	Yes	1L Poly	H2SO4
12	140246	Yes	N/A	Yes	1L Poly	NP
12	140262	Yes	N/A	Yes	1L Poly	H2SO4
13	140247	Yes	N/A	Yes	1L Poly	NP
13	140263	Yes	N/A	Yes	1L Poly	H2SO4
14	140248	Yes	N/A	Yes	1L Poly	NP
14	140264	Yes	N/A	Yes	1L Poly	H2SO4
15	140249	Yes	N/A	Yes	1L Poly	NP
15	140265	Yes	N/A	Yes	1L Poly	H2SO4
16	140250	Yes	N/A	Yes	1L Poly	NP
16	140266	Yes	N/A	Yes	1L Poly	H2SO4

2nd Review

Were all containers scanned into storage/lab? Initials

Are barcode labels on correct containers? Yes / No

Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA

Are all Hex Chrome stickers attached? Yes / No / NA

Are all QC stickers attached? Yes / No / NA

Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By:

Date & Time: 3/3/21 1914

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

ESS Project ID: 21C0153

Date Received: 3/3/2021

Reviewed By: Amber Herrin

Date & Time: 3/3/21 19:43

ESS Laboratory Sample and Cooler Receipt Checklist

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   Air No.: NA
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   Temp: 4.7 Iced with: Ice
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11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
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1	140289	Yes	N/A	Yes	VOA Vial	HCl	
1	140290	Yes	N/A	Yes	VOA Vial	HCl	
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2	140252	Yes	N/A	Yes	1L Poly	H2SO4	
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6	140256	Yes	N/A	Yes	1L Poly	H2SO4
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13	140247	Yes	N/A	Yes	1L Poly	NP
13	140263	Yes	N/A	Yes	1L Poly	H2SO4
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CHAIN OF CUSTODY

ESS Lab # 21C0153

Turn Time: 5 Days
Regulatory State: Massachusetts
Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP
Reporting Limits:
Electonic Deliverables: ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

	Address		
Julianne Marrion	250 Apollo Dr		
City	**State**	**Zip Code**	**PO #**
Chelmsford	MA	01824	
Telephone Number	**FAX Number**	**Email Address**	
978-905-2419		julianne.marrion@aecom.com	

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
1	03/03/21	0955	Grab	Ground Water	MW-B201C	X	X	X	X	X	X	X
2	03/03/21	~~1020~~ 1045	Grab	Ground Water	MW-B2020BC	X	X	X		X	X	X
3	03/03/21	0955	Grab	Ground Water	MW-BC4C	X	X	X		X		X
4	03/03/21	~~1045~~ 1020	Grab	Ground Water	MW-B2020BB	X	X	X		X		X
5	03/03/21	1035	Grab	Ground Water	MW-BC3B	X	X	X	X	X		X
6	03/03/21	1140	Grab	Ground Water	MW-B2050C	X	X	X		X		X
7	03/03/21	1205	Grab	Ground Water	MW-B2050B	X	X	X		X		X
8	03/03/21	1225	Grab	Ground Water	MW-B2050A	X	X	X		X		X
9	03/03/21	1140	Grab	Ground Water	MW-B2100	X	X	X		X		X
10	03/03/21	1230	Grab	Ground Water	MW-B2075A	X	X	X		X		X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Type:	P	P	P	P	P	~~AG~~ P	~~AG~~ P
Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*	6	6	6	3	3	7	3
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*	1	1	3	1	1	2	1
Number of Containers per Sample:	1	1	1	1	1	2	1

Laboratory Use Only

Cooler Present: 4 ○Drop Off
Seals Intact: ○Pickup
Cooler Temperature: 2.4, 2.6, 4.7 °C

Sampled by : B.Barra Bailey Barra AECOM

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/3/21 5:00pm	3/3/21 1700	3/3/21 1843	Taylor Davis 3/3/21 1843
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 21C0153

Turn Time	5	Days
Regulatory State	Massachusetts	
Is this project for any of the following?:	○CT RCP ○MA MCP ○RGP	
Reporting Limits		
Electonic Deliverables	☐Data Checker ☐Excel ☐Other (Please Specify →)	

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB
Address		
Julianne Marrion	250 Apollo Dr	
City	**State**	**Zip Code** / **PO #**
Chelmsford	MA	01824
Telephone Number	**FAX Number**	**Email Address**
978-905-2419		julianne.marrion@aecom.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
11	03/03/21	1420	Grab	Ground Water	MW-BU2A	X	X	X				
12	03/03/21	1450	Grab	Ground Water	MW-BU2B	X	X	X				
13	03/03/21	1515	Grab	Ground Water	MW-BU2C	X	X	X				
14	03/03/21	1505	Grab	Ground Water	MW-12A	X	X	X				
15	03/03/21	1430	Grab	Ground Water	MW-12B	X	X	X				
16	03/03/21	1550	Grab	Ground Water	MW-12C	X	X	X				
			Grab	Ground Water								
			Grab	Ground Water								
			Grab	Ground Water								
			Grab	Ground Water								
Container Type:						P	P	P	P	P	V	AG
Container Volume:						6	6	6	3	3	7	3
Preservation Code:						1	1	3	1	1	2	1
Number of Containers per Sample:						1	1	1	1	1	2	1

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Laboratory Use Only

Cooler Present: Y ○Drop Off

Seals Intact: ○Pickup

Cooler Temperature: 2.5, 2.4, 4.7 °C

Sampled by : Briley Barra AECOM Briley Barra

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/3/21 5:00 pm	3/3/21 1700	3/3/21 1843	Taylor Davis 3/3/21 1843
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

ESS Laboratory

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CHAIN OF CUSTODY

ESS Lab # 21C0153

Turn Time	5	Days
Regulatory State	Massachusetts	
Reporting Limits		

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Electonic Deliverables: ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

Julianne Marrion	Address: 250 Apollo Dr		
City: Chelmsford	State: MA	Zip Code: 01824	PO #
Telephone Number: 978-905-2419	FAX Number	Email Address: julianne.marrion@aecom.com	

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
1	03/03/21	0955	Grab	Ground Water	MW-B201C	X	X	X	X	X	X	X
2	03/03/21	~~1020~~ 1045	Grab	Ground Water	MW-B2020BC	X	X	X		X	X	X
3	03/03/21	0955	Grab	Ground Water	MW-BC4C	X	X	X		X		X
4	03/03/21	~~1045~~ 1020	Grab	Ground Water	MW-B2020BB	X	X	X		X		X
5	03/03/21	1035	Grab	Ground Water	MW-BC3B	X	X	X	X	X		X
6	03/03/21	1140	Grab	Ground Water	MW-B2050C	X	X	X		X		X
7	03/03/21	1205	Grab	Ground Water	MW-B2050B	X	X	X		X		X
8	03/03/21	1225	Grab	Ground Water	MW-B2050A	X	X	X		X		X
9	03/03/21	1140	Grab	Ground Water	MW-B2100	X	X	X		X		X
10	03/03/21	1230	Grab	Ground Water	MW-B2075A	X	X	X		X		X

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

	NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
Container Type	P	P	P	P	P	AG	AG
Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*	6	6	6	3	3	7	3
Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*	1	1	3	1	1	2	1
Number of Containers per Sample:	1	1	1	1	1	2	1

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Seals Intact: ○Pickup
Cooler Temperature: 2.4, 2.6, 4.7 °C

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CHAIN OF CUSTODY

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Chelmsford	MA	01824
Telephone Number	**FAX Number**	**Email Address**
978-905-2419		julianne.marrion@aecom.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
11	03/03/21	1420	Grab	Ground Water	MW-BU2A	X	X	X				
12	03/03/21	1450	Grab	Ground Water	MW-BU2B	X	X	X				
13	03/03/21	1515	Grab	Ground Water	MW-BU2C	X	X	X				
14	03/03/21	1505	Grab	Ground Water	MW-12A	X	X	X				
15	03/03/21	1430	Grab	Ground Water	MW-12B	X	X	X				
16	03/03/21	1550	Grab	Ground Water	MW-12C	X	X	X				
			Grab	Ground Water								
			Grab	Ground Water								
			Grab	Ground Water								
			Grab	Ground Water								

Container Type:	AC-Air Cassette	AG-Amber Glass	B-BOD Bottle	C-Cubitainer	J-Jar	O-Other	P-Poly	S-Sterile	V-Vial	P	P	P	P	P	V	AG
Container Volume:	1-100 mL	2-2.5 gal	3-250 mL	4-300 mL	5-500 mL	6-1L	7-VOA	8-2 oz	9-4 oz	10-8 oz	11-Other*	6	6	6	3	3	7	3
Preservation Code:	1-Non Preserved	2-HCl	3-H2SO4	4-HNO3	5-NaOH	6-Methanol	7-Na2S2O3	8-ZnAce, NaOH	9-NH4Cl	10-DI H2O	11-Other*	1	1	3	1	1	2	1
											Number of Containers per Sample:	1	1	1	1	1	2	1

Laboratory Use Only

Cooler Present: Y ○Drop Off
Seals Intact: ○Pickup
Cooler Temperature: 2.5, 2.4, 4.7 °C

Sampled by : Briley Barra AECOM Briley Barra

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
3/3/21 5:00 pm	3/3/21 1700	3/3/21 1843	Taylor Davis 3/3/21 1843
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

CERTIFICATE OF ANALYSIS

Julianne Marrion
AECOM Environment - ENSR
9 Jonathan Bourne Dr
Pocasset, MA 02559

RE: Orleans MA (60476644)
ESS Laboratory Work Order Number: 21C0217

This signed Certificate of Analysis is our approved release of your analytical results. These results are only representative of sample aliquots received at the laboratory. ESS Laboratory expects its clients to follow all regulatory sampling guidelines. Beginning with this page, the entire report has been paginated. This report should not be copied except in full without the approval of the laboratory. Samples will be disposed of thirty days after the final report has been delivered. If you have any questions or concerns, please feel free to call our Customer Service Department.

Laurel Stoddard
Laboratory Director

Analytical Summary
The project as described above has been analyzed in accordance with the ESS Quality Assurance Plan. This plan utilizes the following methodologies: US EPA SW-846, US EPA Methods for Chemical Analysis of Water and Wastes per 40 CFR Part 136, APHA Standard Methods for the Examination of Water and Wastewater, American Society for Testing and Materials (ASTM), and other recognized methodologies. The analyses with these noted observations are in conformance to the Quality Assurance Plan. In chromatographic analysis, manual integration is frequently used instead of automated integration because it produces more accurate results.

The test results present in this report are in compliance with TNI and relative state standards, and/or client Quality Assurance Project Plans (QAPP). The laboratory has reviewed the following: Sample Preservations, Hold Times, Initial Calibrations, Continuing Calibrations, Method Blanks, Blank Spikes, Blank Spike Duplicates, Duplicates, Matrix Spikes, Matrix Spike Duplicates, Surrogates and Internal Standards. Any results which were found to be outside of the recommended ranges stated in our SOPs will be noted in the Project Narrative.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

SAMPLE RECEIPT

The following samples were received on March 04, 2021 for the analyses specified on the enclosed Chain of Custody Record.

The samples and analyses listed below were analyzed in accordance with the Guidelines Establishing Test Procedures for the Analysis of Pollutants, 40 CFR Part 136, as amended.

Lab Number	Sample Name	Matrix	Analysis
21C0217-01	MW-BC2C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-02	MW-B1075B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-03	MW-B1050A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-04	MW-B1050B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0217-05	MW-B1050C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-06	MW-BM050A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-07	MW-BM050B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-08	MW-BM050C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-09	MW-B1010C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0217-10	MW-B1020B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-11	MW-B1020C	Ground Water	200.7, 3113B, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0217-12	MW-BX1B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0217-13	MW-BX1C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250, RSK175
21C0217-14	MW-BX2A	Ground Water	200.7, 350.1, 353.2, 4500N, 9038, 9250
21C0217-15	MW-BX2B	Ground Water	200.7, 350.1, 353.2, 4500N, 9038, 9250
21C0217-16	MW-BX2C	Ground Water	200.7, 350.1, 353.2, 4500N, 9038, 9250
21C0217-17	MW-BN1A	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-18	MW-BN1B	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250
21C0217-19	MW-BN1C	Ground Water	200.7, 350.1, 353.2, 4500N, 5310B, 9038, 9250

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

PROJECT NARRATIVE

No unusual observations noted.

End of Project Narrative.

DATA USABILITY LINKS

To ensure you are viewing the most current version of the documents below, please clear your internet cookies for www.ESSLaboratory.com. Consult your IT Support personnel for information on how to clear your internet cookies.

Definitions of Quality Control Parameters

Semivolatile Organics Internal Standard Information

Semivolatile Organics Surrogate Information

Volatile Organics Internal Standard Information

Volatile Organics Surrogate Information

EPH and VPH Alkane Lists

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

CURRENT SW-846 METHODOLOGY VERSIONS

Analytical Methods

1010A - Flashpoint
6010C - ICP
6020A - ICP MS
7010 - Graphite Furnace
7196A - Hexavalent Chromium
7470A - Aqueous Mercury
7471B - Solid Mercury
8011 - EDB/DBCP/TCP
8015C - GRO/DRO
8081B - Pesticides
8082A - PCB
8100M - TPH
8151A - Herbicides
8260B - VOA
8270D - SVOA
8270D SIM - SVOA Low Level
9014 - Cyanide
9038 - Sulfate
9040C - Aqueous pH
9045D - Solid pH (Corrosivity)
9050A - Specific Conductance
9056A - Anions (IC)
9060A - TOC
9095B - Paint Filter
MADEP 04-1.1 - EPH
MADEP 18-2.1 - VPH

Prep Methods

3005A - Aqueous ICP Digestion
3020A - Aqueous Graphite Furnace / ICP MS Digestion
3050B - Solid ICP / Graphite Furnace / ICP MS Digestion
3060A - Solid Hexavalent Chromium Digestion
3510C - Separatory Funnel Extraction
3520C - Liquid / Liquid Extraction
3540C - Manual Soxhlet Extraction
3541 - Automated Soxhlet Extraction
3546 - Microwave Extraction
3580A - Waste Dilution
5030B - Aqueous Purge and Trap
5030C - Aqueous Purge and Trap
5035A - Solid Purge and Trap

SW846 Reactivity Methods 7.3.3.2 (Reactive Cyanide) and 7.3.4.1 (Reactive Sulfide) have been withdrawn by EPA. These methods are reported per client request and are not NELAP accredited.

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC2C
Date Sampled: 03/04/21 09:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-01
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**0.140** (0.100)		200.7		1	KJK	03/09/21 16:29	10	10	DC10853
Manganese	**0.138** (0.020)		200.7		1	KJK	03/09/21 16:29	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BC2C
Date Sampled: 03/04/21 09:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-01
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.26** (0.10)		350.1		1	EEM	03/09/21 12:29	mg/L	DC10801
Chloride	**1420** (60.0)		9250		20	JLK	03/09/21 16:55	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.26** (0.500)		5310B		2	CCP	03/09/21 20:02	mg/L	[CALC]
Nitrate as N	**0.294** (0.0300)		353.2		1	JLK	03/05/21 19:26	mg/L	[CALC]
Nitrite as N	**0.011** (0.010)		353.2		1	JLK	03/05/21 17:53	mg/L	DC10531
Sulfate	**28.4** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**0.565** (0.200)		4500N		1	EEM	03/10/21 11:51	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1075B
Date Sampled: 03/04/21 10:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-02
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 16:39	10	10	DC10853
Manganese	**0.033** (0.020)		200.7		1	KJK	03/09/21 16:39	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1075B
Date Sampled: 03/04/21 10:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-02
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**5.15** (0.50)		350.1		5	EEM	03/09/21 12:47	mg/L	DC10801
Chloride	**309** (30.0)		9250		10	JLK	03/09/21 16:58	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.66** (0.500)		5310B		2	CCP	03/09/21 20:14	mg/L	[CALC]
Nitrate as N	**1.48** (0.110)		353.2		5	JLK	03/05/21 20:11	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 17:56	mg/L	DC10531
Sulfate	**27.8** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**7.47** (1.00)		4500N		5	EEM	03/10/21 12:20	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050A
Date Sampled: 03/04/21 11:05
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-03
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 16:40	10	10	DC10853
Manganese	**0.198** (0.020)		200.7		1	KJK	03/09/21 16:40	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050A
Date Sampled: 03/04/21 11:05
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-03
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.28** (0.10)		350.1		1	EEM	03/09/21 12:31	mg/L	DC10801
Chloride	**651** (30.0)		9250		10	JLK	03/09/21 17:00	mg/L	DC10932
Dissolved Organic Carbon (Average)	**2.09** (0.500)		5310B		2	CCP	03/09/21 20:26	mg/L	[CALC]
Nitrate as N	**0.240** (0.0300)		353.2		1	JLK	03/05/21 19:30	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 17:57	mg/L	DC10531
Sulfate	**21.8** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**1.62** (0.200)		4500N		1	EEM	03/10/21 11:54	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050B
Date Sampled: 03/04/21 11:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-04
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**0.214** (0.100)		200.7		1	KJK	03/09/21 16:42	10	10	DC10853
Manganese	**0.152** (0.020)		200.7		1	KJK	03/09/21 16:42	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050B
Date Sampled: 03/04/21 11:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-04
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.43** (0.10)		350.1		1	EEM	03/09/21 12:32	mg/L	DC10801
Chloride	**535** (30.0)		9250		10	JLK	03/09/21 17:05	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.55** (0.500)		5310B		2	CCP	03/09/21 20:38	mg/L	[CALC]
Nitrate as N	**0.553** (0.0300)		353.2		1	JLK	03/05/21 19:31	mg/L	[CALC]
Nitrite as N	**0.028** (0.010)		353.2		1	JLK	03/05/21 17:58	mg/L	DC10531
Sulfate	**15.3** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**7.01** (1.00)		4500N		5	EEM	03/10/21 12:21	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050B
Date Sampled: 03/04/21 11:30
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-04
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:13	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:13	D1C0123	DC10807
Methane	**1080** (4.0)		RSK175		2	NXL	03/08/21 12:15	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050C
Date Sampled: 03/04/21 12:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-05
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**26.6** (0.100)		200.7		1	KJK	03/09/21 16:43	10	10	DC10853
Manganese	**2.77** (0.020)		200.7		1	KJK	03/09/21 16:43	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1050C
Date Sampled: 03/04/21 12:25
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-05
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.24** (0.10)		350.1		1	EEM	03/09/21 12:33	mg/L	DC10801
Chloride	**446** (30.0)		9250		10	JLK	03/09/21 17:06	mg/L	DC10932
Dissolved Organic Carbon (Average)	**3.39** (0.500)		5310B		2	CCP	03/09/21 21:16	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/05/21 19:32	mg/L	[CALC]
Nitrite as N	**0.040** (0.010)		353.2		1	JLK	03/05/21 17:59	mg/L	DC10531
Sulfate	**29.1** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**0.395** (0.200)		4500N		1	EEM	03/10/21 12:01	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050A
Date Sampled: 03/04/21 13:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-06
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 16:44	10	10	DC10853
Manganese	**0.026** (0.020)		200.7		1	KJK	03/09/21 16:44	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050A
Date Sampled: 03/04/21 13:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-06
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/09/21 12:40	mg/L	DC10801
Chloride	**167** (15.0)		9250		5	JLK	03/09/21 17:07	mg/L	DC10932
Dissolved Organic Carbon (Average)	**9.54** (0.250)		5310B		1	CCP	03/10/21 18:46	mg/L	[CALC]
Nitrate as N	**1.35** (0.110)		353.2		5	JLK	03/05/21 20:12	mg/L	[CALC]
Nitrite as N	**0.034** (0.010)		353.2		1	JLK	03/05/21 18:00	mg/L	DC10531
Sulfate	**9.5** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**1.38** (0.200)		4500N		5	EEM	03/10/21 12:02	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050B
Date Sampled: 03/04/21 13:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-07
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 16:46	10	10	DC10853
Manganese	**0.028** (0.020)		200.7		1	KJK	03/09/21 16:46	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050B
Date Sampled: 03/04/21 13:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-07
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**4.92** (0.50)		350.1		5	EEM	03/09/21 12:50	mg/L	DC10801
Chloride	**164** (15.0)		9250		5	JLK	03/09/21 17:09	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.91** (0.250)		5310B		1	CCP	03/10/21 18:58	mg/L	[CALC]
Nitrate as N	**0.992** (0.0300)		353.2		1	JLK	03/05/21 19:38	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:05	mg/L	DC10531
Sulfate	**27.0** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**6.74** (1.00)		4500N		5	EEM	03/10/21 12:22	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050C
Date Sampled: 03/04/21 14:10
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-08
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 16:47	10	10	DC10853
Manganese	ND (0.020)		200.7		1	KJK	03/09/21 16:47	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BM050C
Date Sampled: 03/04/21 14:10
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-08
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/09/21 12:42	mg/L	DC10801
Chloride	**49.2** (3.0)		9250		1	JLK	03/09/21 16:36	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.06** (0.250)		5310B		1	CCP	03/10/21 19:11	mg/L	[CALC]
Nitrate as N	**0.228** (0.0300)		353.2		1	JLK	03/05/21 19:39	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:06	mg/L	DC10531
Sulfate	**9.3** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**0.228** (0.200)		4500N		1	EEM	03/10/21 12:04	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1010C
Date Sampled: 03/04/21 10:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-09
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**123** (0.100)		200.7		1	KJK	03/09/21 16:49	10	10	DC10853
Manganese	**3.73** (0.020)		200.7		1	KJK	03/09/21 16:49	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1010C
Date Sampled: 03/04/21 10:30
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-09
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.26** (0.10)		350.1		1	EEM	03/09/21 12:43	mg/L	DC10801
Chloride	**21.0** (3.0)		9250		1	JLK	03/09/21 16:37	mg/L	DC10932
Dissolved Organic Carbon (Average)	**64.3** (2.50)		5310B		10	CCP	03/10/21 22:26	mg/L	[CALC]
Nitrate as N	**0.638** (0.210)		353.2		10	JLK	03/05/21 20:13	mg/L	[CALC]
Nitrite as N	**0.104** (0.010)		353.2		1	JLK	03/05/21 18:07	mg/L	DC10531
Sulfate	**5.0** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**1.48** (0.200)		4500N		10	EEM	03/10/21 12:04	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1010C
Date Sampled: 03/04/21 10:30
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-09
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:18	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:18	D1C0123	DC10807
Methane	**13100** (100)		RSK175		50	NXL	03/08/21 12:20	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1020B
Date Sampled: 03/04/21 11:10
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-10
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**41.8** (0.100)		200.7		1	KJK	03/09/21 16:55	10	10	DC10853
Manganese	**3.21** (0.020)		200.7		1	KJK	03/09/21 16:55	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1020B
Date Sampled: 03/04/21 11:10
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-10
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.38** (0.10)		350.1		1	EEM	03/09/21 12:44	mg/L	DC10801
Chloride	**68.0** (3.0)		9250		1	JLK	03/09/21 16:38	mg/L	DC10932
Dissolved Organic Carbon (Average)	**5.87** (0.250)		5310B		1	CCP	03/10/21 22:33	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/05/21 19:41	mg/L	[CALC]
Nitrite as N	**0.053** (0.010)		353.2		1	JLK	03/05/21 18:08	mg/L	DC10531
Sulfate	**26.3** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**0.672** (0.200)		4500N		1	EEM	03/10/21 12:05	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1020C
Date Sampled: 03/04/21 11:55
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-11
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Arsenic	**0.010** (0.005)		3113B		1	KJK	03/11/21 15:35	10	10	DC10853
Iron	**72.8** (0.100)		200.7		1	KJK	03/09/21 16:56	10	10	DC10853
Manganese	**2.66** (0.020)		200.7		1	KJK	03/09/21 16:56	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1020C
Date Sampled: 03/04/21 11:55
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-11
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.27** (0.10)		350.1		1	EEM	03/09/21 12:45	mg/L	DC10801
Chloride	**70.1** (3.0)		9250		1	JLK	03/09/21 16:39	mg/L	DC10932
Dissolved Organic Carbon (Average)	**21.7** (1.00)		5310B		4	CCP	03/10/21 23:16	mg/L	[CALC]
Nitrate as N	ND (0.0300)		353.2		1	JLK	03/05/21 19:42	mg/L	[CALC]
Nitrite as N	**0.081** (0.010)		353.2		1	JLK	03/05/21 18:09	mg/L	DC10531
Sulfate	**15.6** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**0.353** (0.200)		4500N		1	EEM	03/10/21 12:06	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-B1020C
Date Sampled: 03/04/21 11:55
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-11
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:24	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:24	D1C0123	DC10807
Methane	**5900** (40.0)		RSK175		20	NXL	03/08/21 12:25	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1B
Date Sampled: 03/04/21 13:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-12
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**15.9** (0.100)		200.7		1	KJK	03/09/21 16:58	10	10	DC10853
Manganese	**0.905** (0.020)		200.7		1	KJK	03/09/21 16:58	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1B
Date Sampled: 03/04/21 13:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-12
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**1.11** (0.10)		350.1		1	EEM	03/09/21 13:11	mg/L	DC10851
Chloride	**45.7** (3.0)		9250		1	JLK	03/09/21 16:40	mg/L	DC10932
Dissolved Organic Carbon (Average)	**7.36** (0.250)		5310B		1	CCP	03/10/21 20:38	mg/L	[CALC]
Nitrate as N	**9.99** (0.410)		353.2		20	JLK	03/05/21 20:14	mg/L	[CALC]
Nitrite as N	**0.071** (0.010)		353.2		1	JLK	03/05/21 18:10	mg/L	DC10531
Sulfate	**10.3** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**11.3** (0.400)		4500N		20	EEM	03/10/21 12:07	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1B
Date Sampled: 03/04/21 13:15
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-12
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:29	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:29	D1C0123	DC10807
Methane	**6460** (40.0)		RSK175		20	NXL	03/08/21 12:31	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1C
Date Sampled: 03/04/21 12:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-13
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	**85.7** (0.100)		200.7		1	KJK	03/09/21 16:59	10	10	DC10853
Manganese	**2.44** (0.020)		200.7		1	KJK	03/09/21 16:59	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1C
Date Sampled: 03/04/21 12:40
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-13
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.19** (0.10)		350.1		1	EEM	03/09/21 13:13	mg/L	DC10851
Chloride	**24.8** (3.0)		9250		1	JLK	03/09/21 16:41	mg/L	DC10932
Dissolved Organic Carbon (Average)	**17.8** (1.00)		5310B		4	CCP	03/10/21 21:12	mg/L	[CALC]
Nitrate as N	**0.581** (0.0300)		353.2		1	JLK	03/05/21 19:44	mg/L	[CALC]
Nitrite as N	**0.084** (0.010)		353.2		1	JLK	03/05/21 18:11	mg/L	DC10531
Sulfate	**12.7** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**1.19** (0.200)		4500N		1	EEM	03/10/21 12:08	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX1C
Date Sampled: 03/04/21 12:40
Percent Solids: N/A
Initial Volume: 1
Final Volume: 1
Extraction Method: No Prep

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-13
Sample Matrix: Ground Water
Units: ug/L
Analyst: NXL
Prepared: 3/8/21 10:30

All methods used are in accordance with 40 CFR 136.

Methane / Ethane / Ethene by Headspace GCFID (RSK175)

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Sequence	Batch
Ethane	ND (3.0)		RSK175		1	NXL	03/08/21 11:35	D1C0123	DC10807
Ethene	ND (5.0)		RSK175		1	NXL	03/08/21 11:35	D1C0123	DC10807
Methane	**11600** (50.0)		RSK175		25	NXL	03/08/21 12:37	D1C0123	DC10807

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2A
Date Sampled: 03/04/21 14:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-14
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:00	10	10	DC10853
Manganese	**0.150** (0.020)		200.7		1	KJK	03/09/21 17:00	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2A
Date Sampled: 03/04/21 14:35
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-14
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	ND (0.10)		350.1		1	EEM	03/09/21 13:14	mg/L	DC10851
Chloride	**25.3** (3.0)		9250		1	JLK	03/09/21 16:42	mg/L	DC10932
Nitrate as N	**2.80** (0.110)		353.2		5	JLK	03/05/21 20:15	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:12	mg/L	DC10531
Sulfate	**14.9** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**2.80** (0.200)		4500N		5	EEM	03/10/21 12:09	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2B
Date Sampled: 03/04/21 15:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-15
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest

All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:02	10	10	DC10853
Manganese	**0.524** (0.020)		200.7		1	KJK	03/09/21 17:02	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2B
Date Sampled: 03/04/21 15:20
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-15
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.19** (0.10)		350.1		1	EEM	03/09/21 13:15	mg/L	DC10851
Chloride	**27.2** (3.0)		9250		1	JLK	03/09/21 16:43	mg/L	DC10932
Nitrate as N	**5.32** (0.210)		353.2		10	JLK	03/05/21 20:15	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:13	mg/L	DC10531
Sulfate	**12.6** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**5.32** (0.200)		4500N		10	EEM	03/10/21 12:15	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2C
Date Sampled: 03/04/21 14:00
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-16
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:03	10	10	DC10853
Manganese	**0.441** (0.020)		200.7		1	KJK	03/09/21 17:03	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BX2C
Date Sampled: 03/04/21 14:00
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-16
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**0.11** (0.10)		350.1		1	EEM	03/09/21 13:16	mg/L	DC10851
Chloride	**29.8** (3.0)		9250		1	JLK	03/09/21 16:45	mg/L	DC10932
Nitrate as N	**8.33** (0.410)		353.2		20	JLK	03/05/21 20:16	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:14	mg/L	DC10531
Sulfate	**5.2** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**8.33** (0.400)		4500N		20	EEM	03/10/21 12:16	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1A
Date Sampled: 03/04/21 14:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-17
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:05	10	10	DC10853
Manganese	**0.203** (0.020)		200.7		1	KJK	03/09/21 17:05	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1A
Date Sampled: 03/04/21 14:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-17
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**1.46** (0.10)		350.1		1	EEM	03/09/21 13:24	mg/L	DC10851
Chloride	**21.1** (3.0)		9250		1	JLK	03/09/21 16:50	mg/L	DC10932
Dissolved Organic Carbon (Average)	**3.45** (0.250)		5310B		1	CCP	03/10/21 21:49	mg/L	[CALC]
Nitrate as N	**5.74** (0.210)		353.2		10	JLK	03/05/21 20:17	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:19	mg/L	DC10531
Sulfate	**6.2** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**5.94** (0.200)		4500N		10	EEM	03/10/21 12:17	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1B
Date Sampled: 03/04/21 15:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-18
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:06	10	10	DC10853
Manganese	**0.027** (0.020)		200.7		1	KJK	03/09/21 17:06	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1B
Date Sampled: 03/04/21 15:15
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-18
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**2.03** (0.10)		350.1		1	EEM	03/09/21 13:25	mg/L	DC10851
Chloride	**18.9** (3.0)		9250		1	JLK	03/09/21 16:51	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.36** (0.250)		5310B		1	CCP	03/10/21 22:01	mg/L	[CALC]
Nitrate as N	**2.60** (0.110)		353.2		5	JLK	03/05/21 20:18	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:20	mg/L	DC10531
Sulfate	**11.4** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**3.86** (0.200)		4500N		5	EEM	03/10/21 12:18	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1C
Date Sampled: 03/04/21 15:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-19
Sample Matrix: Ground Water
Units: mg/L

Extraction Method: 200.7/6010BNoDigest
All methods used are in accordance with 40 CFR 136.

Dissolved Metals

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	I/V	F/V	Batch
Iron	ND (0.100)		200.7		1	KJK	03/09/21 17:08	10	10	DC10853
Manganese	**0.105** (0.020)		200.7		1	KJK	03/09/21 17:08	10	10	DC10853

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA
Client Sample ID: MW-BN1C
Date Sampled: 03/04/21 15:50
Percent Solids: N/A

ESS Laboratory Work Order: 21C0217
ESS Laboratory Sample ID: 21C0217-19
Sample Matrix: Ground Water

All methods used are in accordance with 40 CFR 136.

Classical Chemistry

Analyte	Results (MRL)	MDL	Method	Limit	DF	Analyst	Analyzed	Units	Batch
Ammonia as N	**5.93** (0.50)		350.1		5	EEM	03/09/21 13:44	mg/L	DC10851
Chloride	**50.2** (3.0)		9250		1	JLK	03/09/21 16:52	mg/L	DC10932
Dissolved Organic Carbon (Average)	**1.32** (0.250)		5310B		1	CCP	03/10/21 22:14	mg/L	[CALC]
Nitrate as N	**2.04** (0.110)		353.2		5	JLK	03/05/21 20:19	mg/L	[CALC]
Nitrite as N	ND (0.010)		353.2		1	JLK	03/05/21 18:21	mg/L	DC10531
Sulfate	**5.5** (5.0)		9038		1	EEM	03/08/21 17:05	mg/L	DC10822
Total Nitrogen	**8.45** (1.00)		4500N		5	EEM	03/10/21 12:39	mg/L	[CALC]

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Dissolved Metals										
Batch DC10853 - 200.7/6010BNoDigest										
Blank										
Arsenic	ND	0.005	mg/L							
Iron	ND	0.100	mg/L							
Manganese	ND	0.020	mg/L							
LCS										
Iron	2.48		mg/L	2.500		99	80-120			
Manganese	0.502		mg/L	0.5000		100	80-120			
LCS										
Arsenic	26.5		ug/L	25.00		106	85-115			
Classical Chemistry										
Batch DC10531 - General Preparation										
Blank										
Nitrite as N	ND	0.010	mg/L							
Nitrite as N	ND	0.010	mg/L							
LCS										
Nitrite as N	0.258		mg/L	0.2497		103	90-110			
Nitrite as N	0.258		mg/L	0.2497		103	90-110			
Batch DC10533 - General Preparation										
Blank										
Nitrate/Nitrite as N	ND	0.020	mg/L							
Nitrate/Nitrite as N	ND	0.020	mg/L							
LCS										
Nitrate/Nitrite as N	0.484		mg/L	0.5000		97	90-110			
Nitrate/Nitrite as N	0.484		mg/L	0.5000		97	90-110			
Batch DC10801 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	1.01	0.10	mg/L	0.9994		101	80-120			
Batch DC10822 - General Preparation										
Blank										
Sulfate	ND	5.0	mg/L							
LCS										
Sulfate	9.8		mg/L	9.988		98	85-115			
Batch DC10851 - NH4 Prep										
Blank										
Ammonia as N	ND	0.10	mg/L							
LCS										
Ammonia as N	0.98	0.10	mg/L	0.9994		98	80-120			

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Classical Chemistry										
Batch DC10902 - TKN Prep										
Blank										
Total Kjeldahl Nitrogen as N	ND	0.20	mg/L							
LCS										
Total Kjeldahl Nitrogen as N	18.0	2.00	mg/L	17.50		103	80-120			
Batch DC10929 - General Preparation										
Blank										
Dissolved Organic Carbon (1)	ND	0.500	mg/L							
Dissolved Organic Carbon (2)	ND	0.500	mg/L							
LCS										
Dissolved Organic Carbon (1)	4.97	0.500	mg/L	5.000		99	80-120			
Dissolved Organic Carbon (2)	5.03	0.500	mg/L	5.000		101	80-120			
LCS Dup										
Dissolved Organic Carbon (1)	5.06	0.500	mg/L	5.000		101	80-120	2	20	
Dissolved Organic Carbon (2)	5.02	0.500	mg/L	5.000		100	80-120	0.1	20	
Batch DC10932 - General Preparation										
Blank										
Chloride	ND	3.0	mg/L							
LCS										
Chloride	29.4		mg/L	30.00		98	90-110			
Batch DC10933 - TKN Prep										
Blank										
Total Kjeldahl Nitrogen as N	ND	0.20	mg/L							
LCS										
Total Kjeldahl Nitrogen as N	18.2	2.00	mg/L	17.50		104	80-120			
Batch DC11039 - General Preparation										
Blank										
Dissolved Organic Carbon (1)	ND	0.500	mg/L							
Dissolved Organic Carbon (2)	ND	0.500	mg/L							
LCS										
Dissolved Organic Carbon (1)	4.89	0.500	mg/L	5.000		98	80-120			
Dissolved Organic Carbon (2)	4.99	0.500	mg/L	5.000		100	80-120			
LCS Dup										
Dissolved Organic Carbon (1)	4.95	0.500	mg/L	5.000		99	80-120	1	20	
Dissolved Organic Carbon (2)	4.93	0.500	mg/L	5.000		99	80-120	1	20	
Methane / Ethane / Ethene by Headspace GCFID (RSK175)										
Batch DC10807 - No Prep										
Blank										
Ethane	ND	3.0	ug/L							
Ethene	ND	5.0	ug/L							
Methane	ND	2.0	ug/L							

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

Quality Control Data

Analyte	Result	MRL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Methane / Ethane / Ethene by Headspace GCFID (RSK175)										
Batch DC10807 - No Prep										
LCS										
Ethane	70.5	3.0	ug/L	68.00		104	60-140			
Ethene	64.6	5.0	ug/L	64.00		101	60-140			
Methane	37.1	2.0	ug/L	36.00		103	60-140			
LCS Dup										
Ethane	67.5	3.0	ug/L	68.00		99	60-140	4	30	
Ethene	63.0	5.0	ug/L	64.00		98	60-140	3	30	
Methane	35.3	2.0	ug/L	36.00		98	60-140	5	30	

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

Notes and Definitions

U	Analyte included in the analysis, but not detected
D	Diluted.
ND	Analyte NOT DETECTED at or above the MRL (LOQ), LOD for DoD Reports, MDL for J-Flagged Analytes
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
MDL	Method Detection Limit
MRL	Method Reporting Limit
LOD	Limit of Detection
LOQ	Limit of Quantitation
DL	Detection Limit
I/V	Initial Volume
F/V	Final Volume
§	Subcontracted analysis; see attached report
1	Range result excludes concentrations of surrogates and/or internal standards eluting in that range.
2	Range result excludes concentrations of target analytes eluting in that range.
3	Range result excludes the concentration of the C9-C10 aromatic range.
Avg	Results reported as a mathematical average.
NR	No Recovery
[CALC]	Calculated Analyte
SUB	Subcontracted analysis; see attached report
RL	Reporting Limit
EDL	Estimated Detection Limit
MF	Membrane Filtration
MPN	Most Probably Number
TNTC	Too numerous to Count
CFU	Colony Forming Units

CERTIFICATE OF ANALYSIS

Client Name: AECOM Environment - ENSR
Client Project ID: Orleans MA

ESS Laboratory Work Order: 21C0217

ESS LABORATORY CERTIFICATIONS AND ACCREDITATIONS

ENVIRONMENTAL

Rhode Island Potable and Non Potable Water: LAI00179
http://www.health.ri.gov/find/labs/analytical/ESS.pdf

Connecticut Potable and Non Potable Water, Solid and Hazardous Waste: PH-0750
http://www.ct.gov/dph/lib/dph/environmental_health/environmental_laboratories/pdf/OutofStateCommercialLaboratories.pdf

Maine Potable and Non Potable Water, and Solid and Hazardous Waste: RI00002
http://www.maine.gov/dhhs/mecdc/environmental-health/dwp/partners/labCert.shtml

Massachusetts Potable and Non Potable Water: M-RI002
http://public.dep.state.ma.us/Labcert/Labcert.aspx

New Hampshire (NELAP accredited) Potable and Non Potable Water, Solid and Hazardous Waste: 2424
http://des.nh.gov/organization/divisions/water/dwgb/nhelap/index.htm

New York (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: 11313
http://www.wadsworth.org/labcert/elap/comm.html

New Jersey (NELAP accredited) Non Potable Water, Solid and Hazardous Waste: RI006
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/pi_main?mode=pi_by_site&sort_order=PI_NAMEA&Select+a+Site:=58715

United States Department of Agriculture Soil Permit: P330-12-00139

Pennsylvania: 68-01752
http://www.dep.pa.gov/Business/OtherPrograms/Labs/Pages/Laboratory-Accreditation-Program.aspx

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

Shipped/Delivered Via: ESS Courier

ESS Project ID: 21C0217
Date Received: 3/4/2021
Project Due Date: 3/11/2021
Days for Project: 5 Day

1. Air bill manifest present? No
   Air No.: NA
2. Were custody seals present? No
3. Is radiation count <100 CPM? Yes
4. Is a Cooler Present? Yes
   Temp: 2.9 Iced with: Ice
5. Was COC signed and dated by client? Yes
6. Does COC match bottles? Yes
7. Is COC complete and correct? No
8. Were samples received intact? Yes
9. **Were labs informed about short holds & rushes?** Yes / No / NA
10. Were any analyses received outside of hold time? Yes / No

11. Any Subcontracting needed? Yes / No
    ESS Sample IDs:
    Analysis:
    TAT:
12. Were VOAs received? Yes / No
    a. Air bubbles in aqueous VOAs? Yes / No
    b. Does methanol cover soil completely? Yes / No / NA
13. Are the samples properly preserved? Yes / No
    a. If metals preserved upon receipt: Date: Time: By:
    b. Low Level VOA vials frozen: Date: Time: By:

Sample Receiving Notes:

Rec'd vials for samples 12 + 13; methane analysis not checked off on the COC for these samples

14. Was there a need to contact Project Manager? Yes / No
    a. Was there a need to contact the client? Yes / No
    Who was contacted? Date: Time: By:

Sample Number	Container ID	Proper Container	Air Bubbles Present	Sufficient Volume	Container Type	Preservative	Record pH (Cyanide and 608 Pesticides)
1	140754	Yes	N/A	Yes	1L Poly	NP	
1	140773	Yes	N/A	Yes	1L Poly	H2SO4	
1	140792	Yes	N/A	Yes	250 mL Poly	NP	
1	140812	Yes	N/A	Yes	250 mL Amber	NP	
2	140755	Yes	N/A	Yes	1L Poly	NP	
2	140774	Yes	N/A	Yes	1L Poly	H2SO4	
2	140793	Yes	N/A	Yes	250 mL Poly	NP	
2	140813	Yes	N/A	Yes	250 mL Amber	NP	
3	140756	Yes	N/A	Yes	1L Poly	NP	
3	140775	Yes	N/A	Yes	1L Poly	H2SO4	
3	140794	Yes	N/A	Yes	250 mL Poly	NP	
3	140814	Yes	N/A	Yes	250 mL Amber	NP	
4	140757	Yes	N/A	Yes	1L Poly	NP	
4	140776	Yes	N/A	Yes	1L Poly	H2SO4	
4	140795	Yes	N/A	Yes	250 mL Poly	NP	
4	140815	Yes	N/A	Yes	250 mL Amber	NP	

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

ESS Project ID: 21C0217

Date Received: 3/4/2021

4	140828	Yes	N/A	Yes	VOA Vial	HCl
4	140829	Yes	N/A	Yes	VOA Vial	HCl
5	140758	Yes	N/A	Yes	1L Poly	NP
5	140777	Yes	N/A	Yes	1L Poly	H2SO4
5	140796	Yes	N/A	Yes	250 mL Poly	NP
5	140816	Yes	N/A	Yes	250 mL Amber	NP
6	140759	Yes	N/A	Yes	1L Poly	NP
6	140778	Yes	N/A	Yes	1L Poly	H2SO4
6	140797	Yes	N/A	Yes	250 mL Poly	NP
6	140817	Yes	N/A	Yes	250 mL Amber	NP
7	140760	Yes	N/A	Yes	1L Poly	NP
7	140779	Yes	N/A	Yes	1L Poly	H2SO4
7	140798	Yes	N/A	Yes	250 mL Poly	NP
7	140818	Yes	N/A	Yes	250 mL Amber	NP
8	140761	Yes	N/A	Yes	1L Poly	NP
8	140780	Yes	N/A	Yes	1L Poly	H2SO4
8	140799	Yes	N/A	Yes	250 mL Poly	NP
8	140819	Yes	N/A	Yes	250 mL Amber	NP
9	140762	Yes	N/A	Yes	1L Poly	NP
9	140781	Yes	N/A	Yes	1L Poly	H2SO4
9	140800	Yes	N/A	Yes	250 mL Poly	NP
9	140820	Yes	N/A	Yes	250 mL Amber	NP
9	140830	Yes	N/A	Yes	VOA Vial	HCl
9	140831	Yes	N/A	Yes	VOA Vial	HCl
10	140763	Yes	N/A	Yes	1L Poly	NP
10	140782	Yes	N/A	Yes	1L Poly	H2SO4
10	140801	Yes	N/A	Yes	250 mL Poly	NP
10	140821	Yes	N/A	Yes	250 mL Amber	NP
11	140764	Yes	N/A	Yes	1L Poly	NP
11	140783	Yes	N/A	Yes	1L Poly	H2SO4
11	140802	Yes	N/A	Yes	250 mL Poly	NP
11	140811	Yes	N/A	Yes	250 mL Poly	NP
11	140822	Yes	N/A	Yes	250 mL Amber	NP
11	140832	Yes	N/A	Yes	VOA Vial	HCl
11	140833	Yes	N/A	Yes	VOA Vial	HCl
12	140765	Yes	N/A	Yes	1L Poly	NP
12	140784	Yes	N/A	Yes	1L Poly	H2SO4
12	140803	Yes	N/A	Yes	250 mL Poly	NP
12	140823	Yes	N/A	Yes	250 mL Amber	NP
12	140834	Yes	N/A	Yes	VOA Vial	HCl
12	140835	Yes	N/A	Yes	VOA Vial	HCl
13	140766	Yes	N/A	Yes	1L Poly	NP
13	140785	Yes	N/A	Yes	1L Poly	H2SO4
13	140804	Yes	N/A	Yes	250 mL Poly	NP
13	140824	Yes	N/A	Yes	250 mL Amber	NP
13	140836	Yes	N/A	Yes	VOA Vial	HCl
13	140837	Yes	N/A	Yes	VOA Vial	HCl
14	140767	Yes	N/A	Yes	1L Poly	NP
14	140786	Yes	N/A	Yes	1L Poly	H2SO4
14	140805	Yes	N/A	Yes	250 mL Poly	NP
15	140768	Yes	N/A	Yes	1L Poly	NP
15	140787	Yes	N/A	Yes	1L Poly	H2SO4
15	140806	Yes	N/A	Yes	250 mL Poly	NP

ESS Laboratory Sample and Cooler Receipt Checklist

Client: AECOM Environment - ENSR - KPB

ESS Project ID: 21C0217
Date Received: 3/4/2021

16	140769	Yes	N/A	Yes	1L Poly	NP
16	140788	Yes	N/A	Yes	1L Poly	H2SO4
16	140807	Yes	N/A	Yes	250 mL Poly	NP
17	140770	Yes	N/A	Yes	1L Poly	NP
17	140789	Yes	N/A	Yes	1L Poly	H2SO4
17	140808	Yes	N/A	Yes	250 mL Poly	NP
17	140825	Yes	N/A	Yes	250 mL Amber	NP
18	140771	Yes	N/A	Yes	1L Poly	NP
18	140790	Yes	N/A	Yes	1L Poly	H2SO4
18	140809	Yes	N/A	Yes	250 mL Poly	NP
18	140826	Yes	N/A	Yes	250 mL Amber	NP
19	140772	Yes	N/A	Yes	1L Poly	NP
19	140791	Yes	N/A	Yes	1L Poly	H2SO4
19	140810	Yes	N/A	Yes	250 mL Poly	NP
19	140827	Yes	N/A	Yes	250 mL Amber	NP

2nd Review

Were all containers scanned into storage/lab? Initials AG
Yes / No

Are barcode labels on correct containers? Yes / No / NA
Are all Flashpoint stickers attached/container ID # circled? Yes / No / NA
Are all Hex Chrome stickers attached? Yes / No / NA
Are all QC stickers attached? Yes / No / NA
Are VOA stickers attached if bubbles noted? Yes / No / NA

Completed By: Amber Garcia Date & Time: 3/4/21 19:32

Reviewed By: [signature] Date & Time: 3/4/21 1937

m 3/4/21

CHAIN OF CUSTODY

ESS Lab # ~~210127~~ 210227

ESS Laboratory
Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

Turn Time	5	Days
Regulatory State	Massachusetts	
Reporting Limits		

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Electonic Deliverables: ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

Address	City	State	Zip Code	PO #
250 Apollo Dr	Chelmsford	MA	01824	

Telephone Number	FAX Number	Email Address
978-905-2419		julianne.marrion@aecom.com

Julianne Marrion

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
1	03/04/21	0935	Grab	Ground Water	MW-B12C	X	X	X		X		X
2	03/04/21	1025	Grab	Ground Water	MW-B107SB	X	X	X		X		X
3	03/04/21	1105	Grab	Ground Water	MW-B105OA	X	X	X		X		X
4	03/04/21	1130	Grab	Ground Water	MW-B105OB	X	X	X		X	X	X
5	03/04/21	1225	Grab	Ground Water	MW-B105OC	X	X	X		X		X
6	03/04/21	1315	Grab	Ground Water	MW-BM05OA	X	X	X		X		X
7	03/04/21	1340	Grab	Ground Water	MW-BM05OB	X	X	X		X		X
8	03/04/21	1410	Grab	Ground Water	MW-BM05OC	X	X	X		X		X
9	03/04/21	1030	Grab	Ground Water	MW-B101OC	X	X	X		X	X	X
10	03/04/21	1110	Grab	Ground Water	MW-B102OB	X	X	X		X		X
					Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial	P	P	P	P	P	V	AG
					Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*	6	6	6	3	3	7	3
					Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-Methanol 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*	1	1	3	1	1	2	1
					Number of Containers per Sample:	1	1	1	1	1	2	1

Laboratory Use Only

Cooler Present: Yes ○Drop Off
Seals Intact: ○Pickup
Cooler Temperature: 2.9 °C

Sampled by: Briley Bama AECOM Briley Bama

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
Briley Bama 03/04/21 1735	3-4-21 17:33	3-4-21 17:46	3/4/21 1746
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

ESS Laboratory

Division of Thielsch Engineering, Inc.
185 Frances Avenue, Cranston RI 02910
Tel. (401) 461-7181 Fax (401) 461-4486
www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 21C0217

Turn Time	5	Days
Regulatory State	Massachusetts	

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Reporting Limits

Electonic Deliverables: ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

Contact Person	Address
Julianne Marrion	250 Apollo Dr

City	State	Zip Code	PO #
Chelmsford	MA	01824	

Telephone Number	FAX Number	Email Address
978-905-2419		julianne.marrion@aecom.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3, SO4, Cl	TN, Ammonia	Lab Filter Dissolved Fe, Mn	DOC	Lab Filtered Dissolved Arsenic	Methane
11	03/04/21	1155	Grab	Ground Water	MW-B102OC	X	X	X	X	X	X
12	03/04/21	1315	Grab	Ground Water	MW-BX1B	X	X	X	X		
13	03/04/21	1240	Grab	Ground Water	MW-BX1C	X	X	X	X		
14	03/04/21	1435	Grab	Ground Water	MW-BX2A	X	X	X			
15	03/04/21	1520	Grab	Ground Water	MW-BX2B	X	X	X			
16	03/04/21	1400	Grab	Ground Water	MW-BX2C	X	X	X			
17	03/04/21	1450	Grab	Ground Water	MW-BNIA	X	X	X	X		
18	03/04/20	1515	GRAB	GW	MW-BNIB	X	X	X	X		
19	03/04/21	1550	GRAB	GW	MW-BNIC	X	X	X	X		

BR

Container Type:	P	P	P	AG	P	V
Container Volume:	6	6	3	3	3	1
Preservation Code:	1	3	1	1	1	2
Number of Containers per Sample:	1	1	1	1	1	2

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-MeOH 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Laboratory Use Only

Cooler Present: Yes ○Drop Off
Seals Intact: ○Pickup
Cooler Temperature: 2.9 °C

Sampled by: Briley Bara AECOM

Comments: Please specify "Other" preservative and containers types in this space
MW-BX1B + MW-BX1C DO NOT include SO4 + Cl

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
Briley Bara 03/04/21 1735	3-4-21 17:33	3-4-21 17:33	Taylor Davis 3/4/21 1733
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

m 3/4/21

ESS Laboratory

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # ~~210127~~ 210227

Turn Time	5	Days
Regulatory State	Massachusetts	

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Reporting Limits

Electonic Deliverables ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

Address			
Julianne Marrion	250 Apollo Dr		
City	State	Zip Code	PO #
Chelmsford	MA	01824	
Telephone Number	FAX Number	Email Address	
978-905-2419		julianne.marrion@aecom.com	

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3	SO4, Cl	TN, Ammonia	Lab Filter Dissolved Arsenic	Lab Filter Dissolve Fe, Mn	Methane	DOC
1	03/04/21	0935	Grab	Ground Water	MW-B12C	X	X	X		X		X
2	03/04/21	1025	Grab	Ground Water	MW-B107SB	X	X	X		X		X
3	03/04/21	1105	Grab	Ground Water	MW-B105OA	X	X	X		X		X
4	03/04/21	1130	Grab	Ground Water	MW-B105OB	X	X	X		X	X	X
5	03/04/21	1225	Grab	Ground Water	MW-B105OC	X	X	X		X		X
6	03/04/21	1315	Grab	Ground Water	MW-BM05OA	X	X	X		X		X
7	03/04/21	1340	Grab	Ground Water	MW-BM05OB	X	X	X		X		X
8	03/04/21	1410	Grab	Ground Water	MW-BM05OC	X	X	X		X		X
9	03/04/21	1030	Grab	Ground Water	MW-B101OC	X	X	X		X	X	X
10	03/04/21	1110	Grab	Ground Water	MW-B102OB	X	X	X		X		X

Container Type:	AC-Air Cassette	AG-Amber Glass	B-BOD Bottle	C-Cubitainer	J-Jar	O-Other	P-Poly	S-Sterile	V-Vial	P	P	P	P	P	V	AG
Container Volume:	1-100 mL	2-2.5 gal	3-250 mL	4-300 mL	5-500 mL	6-1L	7-VOA	8-2 oz	9-4 oz	10-8 oz	11-Other*	6	6	6	3	3	7	3
Preservation Code:	1-Non Preserved	2-HCl	3-H2SO4	4-HNO3	5-NaOH	6-Methanol	7-Na2S2O3	8-ZnAce, NaOH	9-NH4Cl	10-DI H2O	11-Other*	1	1	3	1	1	2	1
											Number of Containers per Sample:	1	1	1	1	1	2	1

Laboratory Use Only

Cooler Present: Yes ○Drop Off
Seals Intact: ○Pickup
Cooler Temperature: 2.9 °C

Sampled by: Briley Bama AECOM Briley Bama

Comments: Please specify "Other" preservative and containers types in this space

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
Briley Bama 03/04/21 1735	3-4-21 17:33	3-4-21 17:46	3/4/21 1746
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)

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www.esslaboratory.com

CHAIN OF CUSTODY

ESS Lab # 21C0217

Turn Time	5	Days
Regulatory State	Massachusetts	

Is this project for any of the following?: ○CT RCP ○MA MCP ○RGP

Reporting Limits

Electonic Deliverables ☐Data Checker ☐Excel ☐Other (Please Specify →)

Company Name	Project #	Project Name
AECOM	60476644	Orleans PRB

Contact Person	Address
Julianne Marrion	250 Apollo Dr

City	State	Zip Code	PO #
Chelmsford	MA	01824	

Telephone Number	FAX Number	Email Address
978-905-2419		julianne.marrion@aecom.com

ESS Lab ID	Collection Date	Collection Time	Sample Type	Sample Matrix	Sample ID	Analysis: NO2, NO3, SO4, Cl	TN, Ammonia	Lab Filter Dissolved Fe, Mn	DOC	Lab Filtered Dissolved Arsenic	Methane
11	03/04/21	1155	Grab	Ground Water	MW-B102OC	X	X	X	X	X	X
12	03/04/21	1315	Grab	Ground Water	MW-BX1B	X	X	X	X		
13	03/04/21	1240	Grab	Ground Water	MW-BX1C	X	X	X	X		
14	03/04/21	1435	Grab	Ground Water	MW-BX2A	X	X	X			
15	03/04/21	1520	Grab	Ground Water	MW-BX2B	X	X	X			
16	03/04/21	1400	Grab	Ground Water	MW-BX2C	X	X	X			
17	03/04/21	1450	Grab	Ground Water	MW-BNIA	X	X	X	X		
18	03/04/20	1515	GRAB	GW	MW-BNIB	X	X	X	X		
19	03/04/21	1550	GRAB	GW	MW-BNIC	X	X	X	X		

BR

Container Type:	P	P	P	AG	P	V
Container Volume:	6	6	3	3	3	1
Preservation Code:	i	3	1	1	1	2
Number of Containers per Sample:	1	1	1	1	1	2

Container Type: AC-Air Cassette AG-Amber Glass B-BOD Bottle C-Cubitainer J-Jar O-Other P-Poly S-Sterile V-Vial

Container Volume: 1-100 mL 2-2.5 gal 3-250 mL 4-300 mL 5-500 mL 6-1L 7-VOA 8-2 oz 9-4 oz 10-8 oz 11-Other*

Preservation Code: 1-Non Preserved 2-HCl 3-H2SO4 4-HNO3 5-NaOH 6-MeOH 7-Na2S2O3 8-ZnAce, NaOH 9-NH4Cl 10-DI H2O 11-Other*

Laboratory Use Only

Cooler Present: Yes ○Drop Off

Seals Intact: ○Pickup

Cooler Temperature: 2.9 °C

Sampled by: Briley Bara AECOM

Comments: Please specify "Other" preservative and containers types in this space

MW-BX1B + MW-BX1C DO NOT include SO4 + Cl

Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)
Briley Bara 03/04/21 1735	3-4-21 17:33	3-4-21 17:33	Taylor Davis 3/4/21 1733
Relinquished by: (Signature, Date & Time)	Received By: (Signature, Date & Time)	Relinquished By: (Signature, Date & Time)	Received By: (Signature, Date & Time)