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REPORT

April 2021

TOWN OF Barnstable MASSACHUSETTS

Source Exploration Report (Volume I)



Brune W. Colon





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April 26, 2021

Mr. Hans Keijser Supervisor Barnstable Water Supply Division Department of Public Works 47 Old Yarmouth Rd. Hyannis, MA 02601

Re: Study for New Public Drinking Sources for the Barnstable Water System New Source Exploration Report

Dear Mr. Keijser:

We are pleased to submit to the Town of Barnstable, Barnstable Water Supply Division the attached New Source Exploration Report. This document presents the results of the test well drilling conducted for the Hyannis Water System, focusing on alternatives to obtain additional water supply.

We wish to acknowledge the assistance of Mr. Michael Gorenstein, Project Manager, who assisted the project team in gathering and evaluating background information for this project. Bruce Adams, PE and Kevin MacKinnon, PG, PHg of Weston & Sampson worked on the project. We thank you for this opportunity to be of assistance.

Very truly yours,

WESTON & SAMPSON,

Kevin MacKinnon, PG, CG, PHg Senior Technical Leader, Water Resources

EXECUTIVE SUMMARY

Weston & Sampson, on behalf of the Hyannis Water System, has completed a preliminary test well investigation to locate new water supply sources to resolve water production and water quality deficiencies identified in the March 2019 New Sources Alternatives Evaluation Report. The previous evaluation concluded that the current supply deficit of 1.87 million gallon per day (MGD) in 2020 is expected to grow to 3.23 MGD in 20 years (2040). In following with the recommendations of that report, Weston & Sampson initiated a groundwater supply investigation at the seven highest ranked sites.

After the construction of a total of nine test wells across the seven sites, six of those wells were deemed hydrogeologically favorable for additional testing, which included 4-hour pumping tests. These short-term pumping tests were designed to evaluate potential yield and identify any water quality concerns. The results of the short-term pumping tests served to identify four locations capable of providing at least 500 gpm (0.72 MGD) with a single production well installed. One site (Site E) however was dropped from further consideration due to the shallow nature of the deposits and concern relative to the long-term yield and vulnerability to potential contamination and drought(s). This leaves Sites C, B and D for further consideration. Site C is located north of Route 6 within the Bridge Street Conservation Area, Site B is located north of Route 6 west off Old Jail Lane, while Site D is located within the West Barnstable Conservation Area.

The conceptual costs to develop each of the sites for a 1500 gpm (2.16 MGD) water supply were described in the 2019 New Sources Evaluation Report. These costs are now further refined based on the yield, quality, and location information provided in this study. Each site is unique and probable costs were estimated based on the conceptual potential of each site. The significant unknown is whether each site could support multiple wells to produce a total of 2.16 MGD. Further hydrogeological investigation is required to answer this question. Estimated costs to develop Sites C, B and D are \$25.4, \$19.6 and \$22.2 million dollars, respectively. Cost estimates provided include wells, pump stations, treatment facilities, connection mains, transmission mains, engineering design, as well as contingency.

Weston & Sampson recommends conducting additional test well drilling at Site C. Once two to three locations within Site C are identified, these withdrawals should be permitted with sources approximating 500 to 750 gpm each for a total of 1,500 gpm (2.16 MGD). It is our expectation that the permitting and construction of a source capable of supplying an additional 2.16 MGD of treated groundwater will cost approximately \$25.4 M and be complete by 2026. Weston & Sampson also recommends that the HWS should conduct additional test well drilling at Site B to better understand the withdrawal potential of that large parcel. If favorable for the remaining future water supply deficit (1.07 MGD), the HWS should consider purchasing the necessary land area (including required Zone I's) to preserve it for future development.

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1.0 INTRODUCTION

In March of 2019, Weston & Sampson submitted the New Sources Alternatives Evaluation Report to the Town of Barnstable (the Town) summarizing findings with regard to an evaluation of water supply and treatment options for sources located within the Hyannis Water System (HWS). The evaluation provided in the report concluded that the current supply deficit of 1.87 MGD in 2020 will grow to 3.23 MGD in 20 years (2040). The final report recommended that the Town initiate an investigation and development of additional sources of groundwater supply in concert with currently planned water system improvements. Seven locations, shown in Figure 1 below, were identified to be favorable at the conclusion of a GIS-based site screening and ranking process. These seven locations were subsequently chosen to be the subject of a preliminary test well investigation program. The hydrogeologic and water quality results of that test well program are summarized in this report followed by a revised cost evaluation for source development.

In following with the recommendations of the March 2019 report, Weston & Sampson and associated drilling subcontractors initiated a groundwater supply investigation at the seven sites located in Barnstable (Figure 1). The sites, designated as Site A through Site G, were accessed and investigated over a four-month period that began on January 23, 2020 and ended on May 19, 2020. During this time, Weston & Sampson oversaw the drilling and installation of eleven (11) borings, nine (9) test wells and two (2) observation wells. Seven (7) of the test wells were constructed within borings advanced using sonic drilling methods, while the remaining test wells and observation wells were advanced and constructed within borings using drive-and-wash drilling methods. If a test well was found to be favorable, a 4-hour pumping test was conducted and evaluated for yield and water quality. This was completed on six of the test wells that were constructed. This report describes the test well drilling effort, the results obtained, the analyses of the data collected, and provides recommendations for the next steps with respect to infrastructure and required permitting.



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2.0 WORK PERFORMED

Due to the limitations of traditional test well drilling and testing used in New England, two methods of drilling were employed. At sites where the groundwater depth was relatively shallow (<28 feet), 2 $\frac{1}{2}$ - inch diameter drive and wash drilling methods were used. In areas where groundwater levels were greater than 28 feet, the 4 $\frac{1}{4}$ -inch diameter sonic drilling method was used. The primary limitation was the ability to employ suction lift when pumping the test well. At sites where groundwater was shallow, centrifugal pumps were used to lift the water on suction. At sites with a deeper groundwater table, submersible pumps were temporarily installed into the larger diameter casing and pumped to the surface. Sites E and C were drilled using the 2 $\frac{1}{2}$ -inch drive and wash methodology while sites A, B, D, F, and G were evaluated with the 4 1/4 – inch sonic method.

2.1 Test Well Drilling (Site E and Site C)

On January 23, 2020, the Denis L. Maher Company mobilized a test well drilling rig to Site E (Figure 2, Attachments) to advance one boring. Site E is located within the boundaries of the Barnstable Fire District and was accessed through 45 Phinney's Lane. Subsurface conditions were investigated at this location by advancing a 2.5-inch test boring using the drive and wash drilling method. Once the COVID-19 restrictions had lifted, a second boring and test well was advanced and constructed on Site C (Figure 3, Attachments) using this drilling methodology between May 13, 2020 and May 19, 2020. Site C is located within the village of West Barnstable and the West Barnstable Fire District and was accessed through Hinckleys Lane, between 230 and 240 Church Street. Generalized descriptions of the materials observed in the borings advanced on Site E and Site C are provided below. Table 1 provides the well construction detail. Boring logs are provided in Appendix A.

Site E (Hathaway's Pond): Test Well TW-1E-20

TW-1E-20 (Figure 2, Attachments) was advanced to refusal at a depth of 76 feet below ground surface (ft bgs). The materials encountered are as follows:

- 0 28' light brown fine to coarse SAND, little fine gravel, trace silt
- 28 35' light brown fine to coarse SAND, trace fine gravel
- 35 49' light brown and gray very fine to medium SAND, little to some silt
- 49 56' gray poorly graded very fine to fine SAND, trace silt
- 56 76' gray very fine SAND and silt
- 76' refusal (bent casing)

Materials within the upper 35 feet of the test well boring consisted primarily of fine to coarse sand. As the boring progressed below 35 feet, percentages of fine sands and silts increased. To maximize saturated thickness and available drawdown to a production well in this location, a 12-foot screen was set from 28 to 40 ft bgs and exposed by pulling back on the 2.5-inch casing. Once the well was constructed, the well was developed using a diaphragm pump for a period of two hours and then rated using a centrifugal pump, pumping the discharged water to waste.

To rate TW-1E-20, a short-duration test was conducted, and drawdown during this test was estimated with a vacuum gauge that was installed prior to the test on top of the casing. Units on the vacuum gauge are in inches of mercury (in. Hg). When the vacuum pressure on the test well is measured where

the gauge is installed, an estimate of drawdown is made. The conversion for one inch of mercury is approximately 1.13 feet of water.

During the 15-minute short-duration test, TW-1E-20 pumped at approximately 75 gallons per minute (gpm) with a vacuum pressure reading of 25 in. Hg. This corresponds to a drawdown of approximately 15.25 feet, considering a casing stick-up of 3.0 feet and a static water level of 10.0 feet from the top of the well casing (ft toc). The specific capacity of the test well is therefore 4.92 gpm/ft of drawdown (75 gpm/15.25 ft). This specific capacity value is generally considered low because this well-rating method often overestimates drawdown and underestimates the specific capacity. The subsequent 4-hour pumping test provides additional data to evaluate potential yield at this location and will be discussed in a subsequent section of this report.

Site C (Bridge Street Conservation Area): Test Well TW-1C-20

TW-1C-20 (Figure 3, Attachments) was advanced to refusal at a depth of 85 ft bgs. The materials encountered are as follows:

- 0 14' gray CLAY, trace Sand, trace Gravel
- 14 21' brown, fine to medium SAND, some gray Clay, little f-c Gravel, trace Silt
- 21 35' brown, medium to coarse SAND, trace Gravel, trace Silt, trace Clay
- 35 42' brown, medium to coarse SAND, trace fine Gravel, trace Silt
- 42 85' brown, coarse SAND, trace fine Gravel, trace Silt

Materials from 0 to 14 ft bgs consisted primarily of clay. From 14 to 21 ft bgs, percentages of sand increased, and percentages of clay decreased. From 21 to 42 ft bgs, materials consisted of medium to coarse sand, and from 42 to 85 ft bgs, materials consisted of coarse sand. To maximize saturated thickness and available drawdown to a production well in this location, a 12-foot screen was set from 73 to 85 ft bgs and exposed by pulling back on the 2.5-inch casing. Once the well was constructed, the well was developed using a diaphragm pump for a period of two hours and then rated using a centrifugal pump, pumping the discharged water to waste.

To rate TW-1C-20, a short-duration test was conducted, and drawdown during this test was estimated with a vacuum gauge that was installed prior to the test on top of the casing. Units on the vacuum gauge are in inches of mercury (in. Hg). When the vacuum pressure on the test well is measured where the gauge is installed, an estimate of drawdown is made. The conversion for one inch of mercury is approximately 1.13 feet of water.

During the 15-minute short-duration test, TW-1C-20 pumped at approximately 75 gpm with a vacuum pressure reading of 17 in. Hg. This corresponds to a drawdown of approximately 15.05 feet, considering a casing stick-up of 2.33 feet and a static water level of 1.83 ft toc. The specific capacity of the test well is therefore 4.98 gpm/ft of drawdown (75 gpm/15.05 ft). This specific capacity value is generally considered low because this well-rating method often overestimates drawdown and underestimates the specific capacity. The subsequent 4-hour pumping test provides additional data to evaluate potential yield at this location. This test will be discussed in a subsequent section of this report.

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2.2 Test Well Sonic Drilling (Site A, Site B, Site D, Site F and Site G)

Between February 18, 2020 and March 12, 2020, Cascade Drilling assisted Weston & Sampson with subsurface investigations at five (5) sites throughout Barnstable, Massachusetts by advancing seven 6-inch test borings using the sonic drilling methodology. A total of seven (7) test wells with 4.25-inch PVC casings were constructed in these borings. Figures showing each site and the locations of the test wells are attached to this letter report, and descriptions for each boring are provided below and presented according to the date on which they were advanced. The first of the subsurface investigations using sonic drilling methods was initiated on Site D, on February 18, 2020. The last of the subsurface investigations using sonic drilling methods was initiated on Site G, on March 12, 2020. Table 1 summarizes the test wells constructed in these borings, and drilling logs showing the composition of the materials observed in each of the borings are available in Appendix A.

Site D (West Barnstable Conservation Area): Test Well TW-2D-20

TW-2D-20 (Figure 4, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 1' dark brown TOPSOIL
- 1 3' brown very fine SAND and Silt
- 3 6' brown very fine to coarse SAND and Gravel, trace Silt
- 6 12' brown poorly graded very fine to fine SAND and Silt, trace Gravel
- 12 19' brown moderately graded very fine to fine SAND, trace Silt
- 19 30' gray to brown very fine SAND and Silt, little cobbles, trace clay
- 30 48' brown moderately graded fine SAND, trace Gravel
- 48 83' brown poorly graded very fine to fine SAND and Silt, trace Gravel
- 83 100' brown fine to coarse SAND, trace Gravel
- 100' End of Boring

Materials within the upper 80 feet of the TW-2D-20 boring consisted mostly of fine sand and silt. From 80 to 100 feet, materials were primarily composed of well graded fine to coarse sand. To maximize saturated thickness and available drawdown to a production well in this location, a 10-foot screen was set from 90 to 100 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site D (West Barnstable Conservation Area): Test Well TW-1D-20

TW-1D-20 (Figure 4, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 1' dark brown TOPSOIL
- 1 3' orange brown very fine SAND and Silt, trace Gravel
- 3 7' dense, brown SILT, little Clay
- 7 8' COBBLES
- 8 20' dense, brown, well graded very fine to fine SAND, little Silt, occasional Cobbles
- 20 26' dense, brown, very fine to fine SAND and Silt, little Gravel and Cobbles
- 26 30' dense, brown, well graded v. f. to f. SAND, little Gravel, trace Silt, trace Clay
- 30 32' dense, gray to brown, fine to coarse SAND and Silt, trace Gravel, trace Clay



- 32 57' very dense, brown, well graded, v. f. to f. SAND, little Silt, little Gravel, trace Clay
- 57 80' dense, brown, moderately graded, very fine to fine SAND, little Gravel, little Silt
- 80 90' dense, brown, moderately graded, v. f. to f. SAND, trace Gravel, trace Silt
- 90 100' brown, moderately graded, fine to coarse SAND, trace Gravel
- 100' End of Boring

Materials within the top 20 feet of the boring consisted of alternating layers of fine sand and silt. From 20 to 90 feet, materials consisted of alternating layers of dense to very dense sand with concentrations of silt varying from 1% to 50% and percentages of gravel varying from 1% to 20%. Materials from 90 to 100 feet consisted of moderately graded, fine to coarse sand with trace amounts of gravel and silt. In an effort to maximize saturated thickness and available drawdown to a production well in this location, a 10-foot screen was set from 90 to 100 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site F (County Farm): Test Well TW-1F-20

TW-1F-20 (Figure 5, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 74' light brown and grayish brown SILT and very fine Sand, trace Gravel
- 74 89' light brown, moderately graded, fine to medium SAND, trace Silt
- 89 90' dense, gray SILT and Clay
- 90 100' light brown, moderately graded, very fine to fine SAND, trace Silt
- 100' End of Boring

Materials from 0 to 74 feet consisted primarily of silt and very fine to fine sand, and from 74 to 89 feet materials consisted of fine to medium sand. At 89 feet, a one-foot thick interval of dense silt and clay was observed, and from 90 to 100 feet very fine to fine sand was observed. To maximize saturated thickness and available drawdown to a production well in this location, a 6-foot screen was set from 72 to 78 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site B (North of Rt. 6): Test Well TW-1B-20

TW-1B-20 (Figure 6, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 62' grayish brown and light brown SILT and very fine SAND
- 62 70' light brown very fine to fine SAND, trace Silt
- 70 100' dense, grayish brown SILT and very fine SAND, trace Gravel
- 100' End of Boring

Materials from 0 to 62 feet consisted of silt and very fine sand. From 62 to 70 feet, materials consisted of very fine to fine sand, and from 70 to 100 feet, materials consisted of silt and very fine sand. To maximize saturated thickness and available drawdown to a production well in this location, a 6-foot screen was set from 66 to 72 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site B (North of Rt. 6): Test Well TW-2B-20

TW-2B-20 (Figure 6, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 49' brown SILT and very fine SAND
- 49 58' brown medium to coarse SAND
- 58 89' dense, brown, very fine to fine SAND and SILT
- 89 100' light brown medium to coarse SAND
- 100' End of Boring

Materials from 0 to 49 feet consisted of silt and very fine sand. From 49 to 58 feet, materials consisted of medium to coarse sand, and from 58 to 89 feet, materials consisted of fine sand and silt. From 89 to 100 feet, materials consisted of medium to coarse sand. To maximize saturated thickness and available drawdown to a production well in this location, a 10-foot screen was set from 90 to 100 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site A (Rt 132/Rt 6): Test Well TW-1A-20

TW-1A-20 (Figure 7, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 10' brown very fine SAND and SILT
- 10 70' brown very fine to medium SAND, trace to little Silt, trace Gravel
- 70 86' brown fine to coarse SAND, trace to little Gravel, trace Silt
- 86 90' dense brown SILT and moderately graded very fine SAND, trace Gravel
- 90 100' no recovery
- 100' End of Boring

Materials from 0 to 10 feet consisted of fine sand and silt, and from 10 to 70 feet, materials consisted of fine to medium sand with trace to little concentrations of silt. From 70 to 86 feet, observed sediments consisted of fine to coarse sands and trace to little concentrations of gravel, and from 86 to 90 feet, materials consisted of silt and fine sand. Materials were not recovered from 90 to 100 feet. To maximize saturated thickness and available drawdown to a production well in this location, a 10-foot screen was set from 80 to 90 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site G (Fish & Wildlife): Test Well TW-1G-20

TW-1G-20 (Figure 8, Attachments) was advanced to a depth of 100 ft bgs. The materials encountered are as follows:

- 0 30' brown and gray fine to medium SAND, trace to little Silt, trace to little gravel
- 30 63' light brown, well graded, f to c SAND, trace fine to coarse gravel, trace silt
- 63 65' light brown SILT, little f. to m. SAND, trace fine to coarse gravel, trace silt
- 65 70' light brown, well graded f. to c. SAND, trace fine to coarse gravel, trace silt
- 70 78' gray, mostly SILT, trace fine sand



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- 78 83' gray, poorly graded m. to c. SAND, little silt, trace fine to medium gravel
 - 83 85' gray, poorly graded fine SAND, some silt, little fine to coarse gravel, little clay
 - 85 100' brown, well graded fine to coarse SAND, little silt, trace fine to coarse gravel
- 100' End of Boring

Materials from 0 to 70 feet consisted of alternating layers of fine to medium and fine to coarse sand with trace to little concentrations of silt and trace to little concentrations of gravel. A layer of silt was observed from 70 to 78 feet. From 78 to 100 feet, alternating layers of poorly graded and well graded fine to coarse sands were observed. To maximize saturated thickness and available drawdown to a production well in this location, a 10-foot screen was set from 90 to 100 ft bgs and exposed by pulling back on the 6-inch override casing. Once the well was constructed, the well was developed for a period of two hours to remove fine materials from the coarser sediments around the well screen.

Site Name	Well ID	Start Date	Finish Date	Depth of Boring (ft bgs)	Screen Top (ft bgs)	Screen Bottom (ft bgs)	Slot Size	Depth to Ground water (ft bgs)
Hathaway's Pond	TW-1E-20	1/23/20	1/27/20	76	28	40	30/60	7
Bridge St Conservation Area	TW-1C-20	5/13/20	5/19/20	85	73	85	30	-0.5
W Barnstable Conservation Area	TW-2D-20	2/18/20	2/19/20	100	90	100	40	47
W Barristable Conservation Area	TW-1D-20	2/20/20	2/24/20	100	90	100	30	48
County Farm	TW-1F-20	2/24/20	2/26/20	100	72	78	40	47.6
North of Rt. 6	TW-1B-20	2/27/20	2/28/20	100	66	72	30	47.9
	TW-2B-20	3/2/20	3/3/20	100	90	100	40	33.13
Rt 132 / Rt 6	TW-1A-20	3/4/20	3/5/20	100	80	90	40	41.89
Fish & Wildlife	TW-1G-20	3/11/20	3/12/20	100	90	100	30	31.93

Table 1: Test Well Details

2.3 4-Hour Pumping Tests

Of the nine (9) test wells constructed during this investigation, six (6) test wells were deemed favorable enough to administer 4-hour pumping tests, including: TW-2D-20, TW-1F-20, TW-2B-20, TW-1G-20, TW-1C-20 and TW-1E-20. Materials found within the borings of the remaining three test wells were found to be unsuitable for further testing. Water levels during the tests were measured and recorded by hand with a Solinst water level meter. Pumping tests conducted on wells constructed with 2.5-inch steel casings were pumped with a centrifugal pump, and pumping tests conducted on wells constructed with 4.25-inch PVC casings were pumped with a 3-inch submersible pump. Table 2 below shows test wells with dates on which pumping tests were conducted, the diameters of the wells and the pumps that were used during pumping tests.

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Site Name	Well ID	Date of Pumping Test	Casing Diameter (inches)	Model/Type of Pump Used
W Barnstable Conservation Area	TW-2D-20	2/19/2020	4.25 PVC	3-inch submersible
County Farm	TW-1F-20	2/26/2020	4.25 PVC	3-inch submersible
North of Rt. 6	TW-2B-20	3/3/2020	4.25 PVC	3-inch submersible
Fish & Wildlife	TW-1G-20	3/12/2020	4.25 PVC	3-inch submersible
Bridge St Conservation Area	TW-1C-20	5/19/2020	2.5 Steel	Centrifugal
Hathaway's Pond	TW-1E-20	6/5/2020	2.5 Steel	Centrifugal

Table 2: Test Well Diameters and Rating Test Details

Static water levels were measured and recorded in all the test wells prior to initiating 4-hour pumping tests. All test wells were rated during the 4-hour pumping tests. Pumping water levels were measured and recorded within the test wells during the 4-hour pumping tests every minute for the first ten minutes, every ten minutes for the remainder of the first hour and then every thirty minutes for the remainder of the tests. Water level data recorded during the pumping tests are attached in Appendix B.

Prior to the shutdown of each 4-hour pumping test, water quality samples were collected. The water quality samples were submitted to a Massachusetts certified laboratory for analysis of secondary contaminants (turbidity, TDS, color, odor, pH, alkalinity, sulfate, chloride, hardness, calcium, magnesium, aluminum, potassium, iron, manganese, silver, copper, and zinc), coliform bacteria, lead, 1,4-dioxane, nitrate/nitrite, inorganic compounds, perchlorate, volatile organic compounds (VOCs), synthetic organic compounds (SOCs), radionuclides and PFAS. A summary of the water quality results is shown in Table 6 and discussed below. A full summary of water quality results is attached to this letter report in Appendix C. Detailed water quality results from the laboratory are also attached to this letter report in Appendix D (Volume II).

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3.0 RESULTS

3.1 Theoretical Yield of Test Well Locations

As described in the work performed section above, 4-hour pumping tests were conducted on the six test wells listed in Table 2. Pumping water levels were recorded throughout the pumping tests, and evaluations of aquifer parameters were determined such that estimates of potential yields for final production wells at these locations could be calculated. Water level data was measured with an electronic water level meter, and recorded water level data is attached in Appendix B. Water quality results are subsequently summarized, and full water quality laboratory reports received by Weston & Sampson are attached in Appendix C.

Initial yield ratings of test well locations that did not undergo 4-hour pumping tests are listed in Table 3 below. 4-hour pumping tests at these locations were not conducted, because initial yields were calculated to be insufficient for further consideration. Results at locations where 4-hour pumping tests were conducted are also detailed in Table 3 and described immediately below.

Site ID	Well ID	Pumping Rate (gpm)	Static (ft TOC)	Maximum Drawdown ¹ (ft)	S.C. ² (gpm/ft)	Well Depth (ft bgs)	Available Water ³ (ft)	Potential Yield⁴ (gpm)
Site A	TW-1A-20	26	44.84	31.00	0.84	90	33.11	28
Site C	TW-1C-20	75	1.83	1.01	74.26	85.00	68.5	5087
Site E	TW-1E-20	75	11.54	1.92	39.06	40.00	14.46	565
Site D	TW-2D-20	26	47	2.00	13.00	100	40.7	529
Site D	TW-1D-20	16	48	50.00	0.32	100	39.52	13
Site F	TW-1F-20	26	47.6	15.00	1.73	78	22.35	39
Site B	TW-2B-20	26	35.83	2.60	10.00	100	51.87	519
Site B	TW-1B-20	26	47.9	20.00	1.30	72	15.83	21
Site G	TW-1G-20	27	34.68	17.89	1.49	100	53.07	79

Table 3: Potential Yield Estimations

Notes: 1. Drawdown = Maximum Pumping Level - Static Water Level

2. Specific Capacity = Pumping Rate/Drawdown

3. Available Water = Well Depth - (Static - Stickup) - Screen Length - 5 Foot Safety Factor

4. Potential Yield = Specific Capacity * Available Water

5. Gray highlight = the test well was found not to be suitable for a 4-hour pumping test due to the low potential yield.

4-Hour Pumping Test at TW-1C-20

The 4-hour pumping test on TW-1C-20 was conducted at an approximate pumping rate of 75 gpm. The maximum drawdown observed in the observation well located 2 feet away during the test was 1.01 feet and was measured just prior to shutdown (minute 240). Specific capacity and available water were calculated to be 74.26 gpm/ft and 68.5 ft. Potential yield calculated from the specific capacity and available water is 5,087 gpm at this test well location. A summary of these calculations is provided in Table 3.

4-Hour Pumping Test at TW-1E-20

The 4-hour pumping test on TW-1E-20 was conducted at an approximate pumping rate of 75 gpm. The maximum drawdown observed in the observation well located 2 feet away during the test was 1.92 feet. This measurement was first observed at minute 90 during the test, and the pumping level stabilized at this level for the remainder of the test. Specific capacity and available water were calculated to be 39.06 gpm/ft and 14.46 ft. Potential yield calculated from the specific capacity and available water is 565 gpm at this test well location. A summary of these calculations is provided in Table 3.

4-hour Pumping Tests on 4-Inch Test Wells

With pumping water levels and pumping rates measured and recorded during the 4-hour pumping tests, evaluations of aquifer parameters and potential yields for each 4.25-inch test well were made. Pumping rates on all the 4.25-inch test wells were consistently observed and recorded at 26 to 27 gpm. Static water levels in each of the 4.25-inch wells were greater than 30 feet deep from the top of each well's casing (ft TOC), with the minimum static water level measured in TW-1G-20 at 34.68 ft TOC, and the maximum static water level measured in TW-1F-20 at 47.6 ft TOC. Drawdowns from the 4-hour pumping tests were calculated by subtracting static water levels from pumping water levels recorded throughout the pumping tests. Maximum drawdowns during the 4-hour pumping tests consistently occurred immediately prior to the shutdowns of the pumping tests. By dividing pumping rates by maximum drawdowns, the specific capacities of each test well were calculated. Available water in each well was then calculated by subtracting static water levels, screen lengths and a 5-foot safety factor from the depths of each well. After these calculations were made, potential yields were calculated by multiplying the specific capacities by the available water in each well. Results are presented in Table 3. Hand data measured and recorded during the 4-hour pumping tests are attached in Appendix B.

Capacity Summary

Table 4 below summarizes the sites investigated and identified as possessing a potential yield suitable for the development of a public drinking water supply source for the HWS. As shown in the table, test well TW-1C-20 has the greatest potential yield at 5,087 gpm, followed by TW-1E-20 at 565 gpm, TW-2D-20 at 529 gpm, and finally TW-2B-20 at 519 gpm.

Site ID / Location	Well ID	Potential Yield (gpm)
Bridge St. Conservation Area (Site C)	TW-1C-20	5,087
Hathaway's Pond (Site E)	TW-1E-20	565
West Barnstable Conservation Area (Site D)	TW-2D-20	529
North of Rt. 6 (Site B)	TW-2B-20	519

Table 4: Highest Ranked Sites by Yield

3.2 Water Quality

Table 5 below provides a summary of the water quality results from samples collected just prior to the shutdowns of the 4-hour pumping tests conducted on six test wells during this test well investigation. As mentioned in the Work Performed section above, all water quality samples collected were submitted to a Massachusetts certified laboratory and analyzed for secondary contaminants (turbidity, TDS, color, odor, pH, alkalinity, sulfate, chloride, hardness, calcium, magnesium, aluminum, potassium, iron, manganese, silver, copper, and zinc), coliform bacteria, lead, 1,4-dioxane, nitrate/nitrite, inorganic

compounds, perchlorate, volatile organic compounds (VOCs), synthetic organic compounds (SOCs), radionuclides and PFOS/PFOA. A table summarizing all the water quality results from laboratory reports that Weston & Sampson received are attached in Appendix C.

Analyte	TW-2B-20 3/3/20	TW-1C-20 5/19/20	TW-2D-20 2/19/20	TW-1E-20 1/27/20	TW-1F-20 2/26/20 ⁷	TW-1G-20 3/12/20 ⁷	Max. Contaminant Level (MCL)
Total Fe (mg/L)	0.078	0.131	0.054	ND ¹	0.194	ND	0.3 mg/L
Total Mn (mg/L)	ND	ND	0.041	ND	0.028	ND	0.05 mg/L
рН	6	5.8	6.2	5.7	5.6	6	6.5 - 8.5
Total Pb (mg/L)	ND	ND	0.0078	ND	ND	ND	TT ² 0.015 mg/L
Perchlorate (mg/L)	0.000088	0.000082	0.000077	0.000054	0.000084	ND	0.002 mg/L
Chloroform (mg/L)	0.00053	0.00077	0.0016	0.001	0.0059	0.0022	0.07
PFAS 6 ³ (ng/L)	ND	11.23 ⁴	ND	ND	ND	ND	20 ppt
Other PFAS (NEtFOSAA ⁵) (ng/L)	1.86	ND	ND	ND	ND	ND	N/L ⁶

Table 5: Water Quality Results Summary

Notes: 1) ND = Not Detected

2) TT = Treatment Technique. If > 10% of tap water samples tested exceed the action level of 0.015 mg/L, additional steps must be taken for water treatment.

3) The sum concentration of the six PFAS compounds regulated by the current MassDEP MCL including PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA).

4) Three of six PFAS compounds proposed by MassDEP for regulation were detected: PFHxS, PFOA, PFOS

5) NEtFOSAA = N-Methyl Perfluorooctanesulfonamidoacetic Acid

6) N/L = Not Listed

r) Sites sampled for completeness, however not favorable for development due to limited yield potential

Of the analytes shown in Table 5, pH is the only analyte that falls outside established MCLs in Massachusetts. pH is listed in Massachusetts as a secondary contaminant and has a listed secondary maximum contaminant level (SMCL) range, where results from analyses should not fall outside 6.5 – 8.5. Results from water quality samples collected at each site show pH levels below the established SMCL range for Massachusetts. Manganese, lead, perchlorate, chloroform, PFAS and N-Methyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA) are analytes detected in some of the analyses shown in Table 5, but all of the results are below SMCL, MCL and proposed standards. Results for perchlorate were detectable in all the wells where water quality samples were collected and analyzed, but all the results are below the Massachusetts MCL of 0.002 mg/L. Chloroform, the only volatile organic compound that was detected throughout the investigation, showed results in all of the wells, but the results are below the established federal MCL and the Massachusetts Office of Research and Standards Guidelines (ORSG) of 0.07 mg/L. Of the 19 per- and polyfluoroalkyl substances (PFAS) analyzed for during this investigation, four (4) PFAS compounds were detected: NEtFOSAA, PFHxS, PFOA, and PFOS. NEtFOSAA was detected in TW-2B-20 at 1.86 parts per trillion (ppt) and PFHxS, PFOA and PFOS were detected in TW-1C-20 at 2.24 ppt, 2.21 ppt and 9.11 ppt. The sum concentration of PFAS compounds detected in TW-1C-20 is 11.23 ppt, 8.77 ppt below the Massachusetts Total PFAS Maximum Contaminant Level of 20 ppt. Massachusetts has recently enacted the Total PFAS MCL of 20 ppt be applied to six PFAS contaminants: PFOS, PFOA, PFHxS, PFNA, PFHpA and PFDA. DEP Policy also states that any detection of PFAS

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would require re-sampling, as well as quarterly sampling to verify compliance. If an upward trend in concentration is identified, treatment would be the next step.

Summary of Water Quality

After review of the extensive water quality samples collected and tested for the six test wells evaluated, Sites B and D would rank the highest, followed by Sites C, and E. Based on criteria set by HWS, Site E will be eliminated for further consideration at this time due to the shallow nature of the deposits. Shallow sites like this (<40 ft) are more vulnerable to drought, potential contamination sources and are often require additional treatment as they are deemed under the influence of surface water.

Due to the increasing threat and treatment expense of the emerging contaminant known as PFAS in drinking water within the Sagamore Lens, the Barnstable Water Supply Division (HWS) recently commissioned Sole Source Consulting to evaluate the distribution of PFAS within Barnstable. Using surface water bodies as a surrogate for groundwater, 21 samples were collected from surface water bodies in the summer of 2020. PFAS compounds were present in every surface water body tested. Total detected PFAS concentrations in these surface water bodies ranged from 252 ng/l to 2.5 ng/l. This range is quite similar to the source well testing conducted in 2019, in which PFAS-6 concentrations in groundwater from WSD public drinking water supply wells ranged from 525 ng/l to 50 ng/l. Overlay mapping of the two studies' sample results present a clear picture and correlation that high concentration areas in surface water and groundwater results translate to high concentration of PFAS in pumping wells.

It is recommended that these two studies (Sole Source Consulting, Barnstable Water Supply Division) be used in conjunction with the results of this study to assess the potential risk in further developing a new source of supply for the WSD. The studies suggest that background concentrations likely due to septic systems as well as potential atmospheric deposition are as high as 10 ng/L in Barnstable. Higher concentrations of PFAS in the aquifer are thought to be from point sources, which include the Barnstable County Fire Training Facility, the Municipal Airport, and the Town's Water Pollution Control Facility in Hyannis. These point sources have contributed to PFAS exceedances at the Mary Dunn Wellfield, Airport Wells, Maher Wells, Straightway Wells, as well as the Barnstable Fire District Wells.

Upon review of the Sole Source Consulting study results, it is generally understood that any source developed in Barnstable has a risk of detection of PFAS. Given that fact, Site C will remain a potential alternative for water supply development with consideration given to the potential costs related to treatment of PFAS. Sites B and D represent lower risk areas for further development of a groundwater supply source. These two sites are located in areas that are represented in the previous studies as having background level concentrations of PFAS in the aquifer. Sites C represents a higher risk area given its location relative to the plumes identified and discussed above.

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4.0 COST ANALYSIS

In March 2019, the Town of Barnstable received the New Sources Alternatives Evaluation Report from Weston & Sampson that included an overview of cost estimates for the development of new groundwater sources. Cost estimates were originally presented for six sites, Site A through Site F. A seventh site (Site G) was subsequently added and included in the current well exploration program described in this report. Four of the seven sites from this test well investigation produced favorable results with respect to yield, and two of those sites ranked highest with respect to water quality results as well as possessing a lower risk for future PFAS contamination. Three sites total (Sites B, D, and C) will ultimately be recommended for further analysis and are compared in this section from a cost perspective. Since the capacity of Sites B and D are different from Site C, they will be discussed separately below.

As previously discussed, the current supply deficit is approximately 1.87 mgd, or 1,300 gpm. Based on test well pumping data and analysis, the expected well capacity of a single well at Sites B and D is expected to be approximately 500 gpm. To provide sufficient supply to meet the deficit, at least three wells would be needed at those sites. Each of the wells would be required to provide at least 433 gpm on a continuous basis to satisfy the supply deficit. For planning purposes, we recommend that the initial site be developed to provide at least 2.2 mgd (1,500 gpm) from at least three wells that would be operated a maximum of 85% of the time to satisfy the current deficit of 1.87 mgd.

Based on the preliminary data thus far (2 ½-inch test well drilling), the expected capacity of Site C is approximately 5,000 gpm. Practically speaking, given the grain size of the materials observed in the expected screened interval for TW-1C-20, a final single production well constructed at this location could be expected to produce approximately 1,000 gpm. To provide sufficient supply to meet the deficit, at least two wells would be needed at this site. Each of the wells would be required to provide at least 650 gpm on a continuous basis to satisfy the supply deficit. For planning purposes, we recommend that the initial site be developed to provide at least 2.2 mgd (1,500 gpm) from at least two wells that would be operated a maximum of 85% of the time to satisfy the current deficit of 1.87 mgd. To stay ahead of the increasing demands in future years, it would be prudent to provide for greater well and treatment capacity if the next round of hydrogeological investigation indicates additional water is available from the selected site.

The future (2040) supply deficit is projected to be 3.23 mgd (2,245 gpm), or an additional 1.36 mgd (945 gpm). This is about 75% of the current supply deficit. In the future, assuming demands increase as projected, an additional site should be developed in a similar fashion to the current plan with multiple wells, as further described below.

A qualitative summary of the two sites and the test well locations that produced these results is shown in Table 6. Water quality concerns are also noted.



Location	Site ID	Test Well ID	Potential Yield (gpm)	Depth (feet)	Water Quality Concerns
North of Rt. 6	Site B	TW-2B-20	519	100	None
W. Barnstable Conservation Area	Site D	TW-2D-20	529	100	Manganese
Bridge St. Conservation Area	Site C	TW-1C-20	5,087	85	PFAS

Table 6: General and Qualitative Summary of Well Exploration Program

The conceptual costs to develop each of the various sites for a 2.5 million gallon per day (mgd) water supply was described in the 2019 New Sources Evaluation Report. These costs are now further refined based on known factors, including the location of the test well site(s), estimated well yield(s) and treatment needs. Each site is unique and probable costs were estimated based on the conceptual potential of each site. The significant unknown is whether each site could support multiple wells to produce a total of at least 2.2 mgd. Further hydrogeological investigation is required to answer this question. As a result, the well spacing and yields discussed for each site are for planning purposes only. Based on the anticipated yield and water quality concern(s) summarized in Table 6, Site D, B, and C show the most promise for development. It is likely that multiple wells located on a combination of sites will be required to achieve the minimum 2.2 mgd capacity goal. Although, further hydrogeological investigation is required to finalize source capacity estimates for each site, it should be noted that the probability of identifying a high yield site is highest at Site C.

4.1 Wells

The number of wells is based on producing a total of 2.2 mgd supply without redundancy. As discussed above, further hydrogeological investigation is required to determine the capacity of each Site. As discussed, we recommend that the initial site be developed to provide at least 2.2 mgd (1,500 gpm) from at least two to three wells (depending on the site) that would be operated a maximum of 85% of the time to satisfy the current deficit of 1.87 mgd. For comparison we evaluated potential well spacing within Sites B and D, to support up to five wells. Site B could fit five wells with 1,000 foot spacing. Site D is the largest and could fit five wells with over 1,500 foot spacing. Spacing for three wells could be greater, but actual groundwater availability could push the wells closer together. Site C would only require two wells, located approximately 1,000 feet apart.

4.2 Well Pump Station, Access Roads and Water Mains

Each well would include a small building to house the pump controls and pumping equipment. A gravel roadway, 8" raw water connecting main, and power cables would be necessary from each well to the centrally located treatment facility. A paved access road and treated water connecting water main will also need to be constructed to bring water from the treatment facility to the main road and a 12" transmission main from the facility to the nearest road.

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4-2



Site ID	Test Well ID	Wells (No.)	Depth (feet)	Well Costs	Well Pump Station Costs	Road & Site Water Main Costs	Total Cost (Ea)
Site B	TW-2B-20	3	100	\$1,200,000	\$900,000	\$600,000	\$2,700,000
Site D	TW-2D-20	3	100	\$1,200,000	\$900,000	\$600,000	\$2,700,000
Site C	TW-1C-20	2	85	\$700,000	\$600,000	\$400,000	\$1,700,000

Table 7: New Well, Pump Station, Roadway and Water Main Probable Cost- 2.5 mgd

4.3 Treatment Station

Base level chemical treatment, is assumed to be implemented for any new groundwater source within the HWS and accounts for pH adjustment, sequestration, corrosion control and disinfection. A centrally located treatment station would provide for the above chemical treatment. The probable cost to construct a base level chemical treatment station with a capacity of 2.2 mgd is \$2,200,000.

4.4 Filtration Plant

As discussed in the previous report, additional levels of treatment/filtration may be required depending on constituents found in the water. Iron and manganese are typically treated with greensand pressure filtration. We have assumed that iron and manganese concentrations above 0.06 mg/l and 0.02 mg/l, respectively, will be treated. PFAS would require GAC or resin filtration. We have assumed that PFAS concentrations above 10 ug/l, which is half of the current regulatory limit, will be treated. Additionally, removal of iron and manganese should precede GAC filtration for PFAS removal.

The probable cost to construct a 2.2 mgd greensand pressure filtration/treatment addition to the chemical treatment facility is \$7,000,000. The concentrations of combined iron and manganese are 0.8, 0, and 0.131 mg/L for well sites B, D, and C respectively. The chance that the final production wells will have elevated levels of these two constituents initially or in later years is significant. We recommend that the cost of an iron and manganese removal greens and pressure filtration plant be included for both sites.

Level of Treatment	Cost @ 2.2 mgd Design Flow
Treatment Station	\$2.2M
Filtration Plant	\$7.0M

The cost summary is presented below in Table 9. Engineering and contingency amounts are included as a percentage of construction costs. The table assumes that each site is developed individually and can yield 2.2 mgd. As additional exploration of suitable sites is conducted and additional water quality analyses become available, the sites of wells, water mains, and the treatment facility can be determined, and the probable costs can be refined.



All three sites include the probable cost for treatment of iron and manganese with greensand pressure filtration. This will provide for similar treated water quality compared to other HWS sources which are scheduled to receive similar greensand pressure filtration treatment in the near future. Due to the high yield, lower cost, and proximity to the existing HWS system, we suggest that the next phase of hydrogeologic investigation be conducted on Site C. If Site C does not yield the required 2.2 mgd, then additional investigation at site B could be necessary.

Site ID	Wells & Pump Stations	Treatment Facilities	Transmission Mains ¹	Engineering 18%	Contingency 15%	Total Cost ¹
Site C	\$1,700,000	\$12,700,000	\$4,300,000	\$3,400,000	\$3,300,000	\$25,400,000
Site B	\$2,700,000	\$9,200,000	\$2,500,000	\$2,600,000	\$2,600,000	\$19,600,000
Site D	\$2,700,000	\$9,200,000	\$4,400,000	\$3,000,000	\$2,900,000	\$22,200,000

Table 9: Supply Development Cost Estimate – 2.5 mgd

Notes: 1) Transmission main costs provided include cost to construct the water main in the roadways from the site to the treatment plant (assumed to be near Site B) and includes construction and paving.

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5.0 CONCLUSIONS / RECOMMENDATIONS

Preliminary hydrogeological investigations were performed at seven sites across Barnstable. Four of those sites proved to be hydrogeologically favorable with sufficient yield (> 500 gpm). After review of the yield expectations, water quality results, and recent PFAS sampling conducted by others (Sole Source Consulting), three sites are recommended for further study and development. Those three sites include Site C, referred to in this report as the Bridge Street Conservation Area, Site B, referred to as the site 'north of Rt. 6' and the West Barnstable Conservation Area (Site D). In an effort to advance into the permitting phase for a new source approval at one or both sites, further test well drilling, aquifer and water quality testing is recommended in an effort to 1) identify the most favorable location on those properties for the development of multiple groundwater supply wells, and 2) collect additional hydrogeologic information required to initiate the new source approval permitting process with MassDEP.

Due to the highly favorable yield expectations and the expectation that PFAS treatment may ultimately be required at all sites developed within the study area, Weston & Sampson recommends conducting additional test well drilling at Site C. Once two locations within Site C are identified, these withdrawals should be permitted with sources approximating 750 gpm each for a total of 1,500 gpm (2.16 MGD). It is our expectation that the permitting and construction of a source capable of supplying an additional 2.16 MGD of treated groundwater will cost approximately \$25.4 M and be complete by 2026.

Weston & Sampson also recommends that the HWS should conduct additional test well drilling at Site C and B to better understand the additional withdrawal potential at those two sites. If favorable for the remaining future water supply deficit (1.07 MGD), the HWS should consider purchasing the necessary land area (including required Zone I's) to preserve it for future development.

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FIGURES

















APPENDIX A BORING LOGS



Weston & Sampson							New Source Exploration Study Barnstable, MA			REPORT OF BORING No. SHEET Project No. CHKD BY		TW-1E-20 1 OF 3 2170766		
BORIN			Denis	L. Maher Co	ompany			ING LOCA					615.91833	
							OUND SURF E START	-ACE ELE	EV. (ft) <u>43.89</u> 1/23/20	DA DATE		NAD83/NAVD88 1/27/20		
SAMPL	ER:	Drive a	and wash				-		GF	ROUNDWATER O	BSER	/ATIO	NS	
	<u> </u>		ata al again	-			DATE TIME WATER AT (ft bgs) 05/14/20 8.28				CASING AT STABILIZATION TIME			
CASING:		Driver	steel casing				-	05/14/20		0.20				
CASING	G SIZE:	2.5" IC)				PID							
DEPTH (feet)	CASING (blows/ft)	No.	SAMPLE No. REC/PEN (in) DEPTH (ft) BLOWS/6"					SAMPLE DESCRIPTION NOTES STR					RATUM DESCRIPTION	
0 5- 10-														
15 - 20 -							Light brown, very fine to coarse SAND, little fine Gravel, trace Silt					SAND, little Gravel		
25 –														
30 -							Grav		e to coarse	e SAND, trace fine			SAND	
	GRANU	LAR SO		1	IVE SOILS	NOT		ation and ar	ound ourf	aco alovation four	d uning			
(4 1(3(WS/FT)-4 -10)-30)-50 · 50	L M. E	TW LOOSE OOSE DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Set 1	1⁄4-ino		n from 28	ace elevation foun				
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											BORIN	G No.	TW-1E-20	

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Weston & Sampson						Exp	PROJECT REF New Source Exploration Study Project Name			REPORT OF BORING No. SHEET Project No. CHKD BY		TW-1E-20 2 OF 3 2170766	
BORIN			Denis	L. Maher Co	ompany			ING LOCA				2712615.91833	
	FOREMAN Joe Boyle GROUND SURFACE ELEV. (ft) 43.89 WSE REPRESENTATIVE: Jesse Schwalbaum DATE START 1/23/20										DATUM NAD83/NAVD88 DATE END 1/27/20		
SAMPLER: Drive and wash DATE TH								GF	ROUNDWATER OB WATER AT (ft bgs)		ATIONS		
CASIN	G:	Steel of	casing				-	05/14/20		8.28	CASI		
							-						
CASING		2.5" ID					-						
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	IPLE DESCI	RIPTION	NOTES	STRATUM DESCRIPTION	
35													
								brown to g D, little Silt	ray, very f	ine to medium			
40 -							SAN	D, IIIIe Siii					
												SAND, Silt	
45 —							Grav	verv fine t	o medium	SAND, some Silt			
							Clay	, vory mile t	o moulain				
50 —													
							Gray, poorly graded very fine to fine SAND, trace silt					SAND	
												SAND	
55 -													
60 —													
							Gray, very fine SAND and silt					SAND and Silt	
05													
65 —													
				001150									
RI O	GRANU WS/FT			COHES BLOWS/FT	IVE SOILS DENSITY	NOT Borin		ation and or	ound surf	ace elevation found	usina (GIS and LiDAR	
)-4		LOOSE	0-2	V. SOFT					-40 ft bgs, exposed			
	-10		OOSE	2-4	SOFT	hours	s, Q =	75 gpm @	25 "Hg.				
)-30)-50		M. DENSE 4-8 M. STIFF DENSE 8-15 STIFF										
30-50 DENSE 8-15 STIFF > 50 V. DENSE 15-30 V. STIFF													
				> 30	HARD								
GENERA	L NOTES:									TRANSITIONS MAY BE GR		6	
										THOSE PRESENT AT THE		<u>.</u>	
		MEAS	SUREMENTS AR	E MADE.							r		
											BORIN	IG No. TW-1E-20	

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Weston & Sampson						New Source			REPORT OF BORING No. SHEET		TW-1E-20 3 OF 3			
							Exploration StudyProject No.Project NameCHKD BY					2170766 Kevin MacKinnon		
BORIN	G Co		Denis	L. Maher C	ompany		BORING LOCATION (ft) 981090.296402, 2712615.9							
				Joe Boyle				UND SURF				TUM NAD83/NAVD88		
					e Schwalbaur	n		E START		1/23/20	DATE END 1/27/20			
SAMPLER: Drive and wash			and wash							ROUNDWATER OF	1			
CASING:		Steel casing					-	DATE 05/14/20	TIME	WATER AT (ft bgs) 8.28	CASIN	NG AT STABILIZATION TIME		
CASINO DEPTH	SIZE:	2.5" IC		SAMPLE		PID								
(feet)	(blows/ft)	No.	REC/PEN (in)		BLOWS/6"	(ppm)		SAN	IPLE DESCH	RIPTION	NOTES	STRATUM DESCRIPTION		
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							,							
75-										70		Defined @ 70		
								I	Refusal @	76		Refusal @ 76'		
80 -														
85 —														
90 —														
						-								
95 —														
						-								
100-														
100-														
						-								
	GRANU	LAR SC	DILS	COHES	SIVE SOILS	NOT								
	WS/FT		DENSITY	BLOWS/FT	DENSITY					ce elevation found				
)-4 -10		LOOSE LOOSE	0-2 2-4	V. SOFT SOFT			n ss screei 75 gpm @		40 ft bgs, exposed 2	28-40 ft	bgs, developed 2		
10)-30	M.	DENSE	4-8	M. STIFF		., .	3P @	i ig.					
	0-50	DENSE 8-15 STIFF												
> 50 V. DENSE 15-30 > 30					V. STIFF HARD									
GENERA	L NOTES:									TRANSITIONS MAY BE GR				
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			SUREMENTS AR											
											BORIN	IG No. TW-1E-20		

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	We	sto	n <mark>&</mark> S	Sampe	son	Ex	olorati	<u>JECT</u> Source on Study ble, MA	_	OF BORING No. SHEET Project No. CHKD BY	1	2	TW-2D-20 OF 3 170766 MacKinnon
						De		,		-			
BORIN FORE			С	ascade Drill Rob Maille				ING LOCA		959592.4 V. (ft) 84.64			60.33138 NAD83/NAVD88
WSE R			Jes	se Schwalb				E START	ACE ELE	2/18/20	DATE		2/19/20
							-		01				
SAMPL	ER:		Core Barrel drilling meth	od			-	DATE	GE	ROUNDWATER OF WATER AT (ft bqs)			NS STABILIZATION TIME
CASIN	G:		casing	lou			-	02/19/20		47	CASIN	IG AT	STABILIZATION TIME
							-						
CASING	G SIZE:	6.0" II)				-						
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	IPLE DESCF	RIPTION	NOTES	STR	ATUM DESCRIPTION
0							Dark	brown tops	soil				TOPSOIL
							Brow	n, very fine	SAND an	d Silt		Fir	ne SAND and Silt
5 -							Brow trace		to coarse	SAND and Gravel,		s	AND and Gravel
10-								n, poorly gr Silt, trace G		/ fine to fine SAND		Fii	ne SAND and Silt
15– 20–								n, very fine D, trace Silt		derately graded			Fine SAND
25 30								to brown, v les, trace cl		AND and Silt, little		Fir	ne SAND and Silt
30-							Grav	•	ely graded	, fine SAND, trace			Fine SAND
	GRANU	LAR SO			IVE SOILS	NOT							
(4 1(3(WS/FT -4 -10 -30 -50 -50	L M.	TW LOOSE OOSE DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Set 4	.25-in			ace elevation found 0-100 ft bgs, expos			
GENERA	AL NOTES:	ii) WATE FLUC	ER LEVEL READ	LINES REPRES INGS HAVE BEE HE LEVEL OF GF	ENT THE APPROX N MADE IN THE D	RILL HO	LES AT	TIMES AND UN	DER CONDITI	TRANSITIONS MAY BE GF ONS STATED ON THIS BC THOSE PRESENT AT THE	RING LOO TIME		
											BORIN	G No.	TW-2D-20

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	We	stor	n <mark>&</mark> 8	Samps	son	Exp	olorati	<u>JECT</u> Source on Study Name	_	OF BORING No. SHEET Project No. CHKD BY	2	2	TW-2D-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Dril	ling		BOR	ING LOCA	TION (ft)	959592.4	30603,	27141	60.33138
FORE				Rob Maille	t			UND SURF	ACE ELE			-	NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:	Jess	e Schwalbaun	n	DATI	E START		2/18/20	DATE	END .	2/19/20
SAMPL	ER:	4.75" (Core Barrel						GF	ROUNDWATER OF	BSERV	ATION	IS
		Sonic	drilling meth	nod			-	DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT	STABILIZATION TIME
CASIN	G:	Steel of	casing				-	02/19/20		47			
		0.0110					-						
CASING	-	6.0" ID)			-	-						
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	IPLE DESCF	RIPTION	NOTES	STR	ATUM DESCRIPTION
35	(010W3/11)	INO.			BLOWG/0	(ppin)							
00													
40 -													
									ely graded	, fine SAND, trace			Fine SAND
							Grav	el					
45 —													
50-													
50													
55 -													
55-													
							Brow	n noorly ar	nav hahe	/ fine to fine SAND			
								Silt. trace G				Fin	e SAND and Silt
60 -													
		I				<u> </u>							
65 -						1	1						
							1						
						<u> </u>							
							1						
	GRANU	LAR SC	DILS	COHES	IVE SOILS	NOT	ES:					1	
BLO	WS/FT		ENSITY	BLOWS/FT	DENSITY			ation and gr	ound surfa	ace elevation found	using (GIS an	d LiDAR.
()-4	۷.	LOOSE	0-2	V. SOFT					0-100 ft bgs, expos			
	-10		OOSE	2-4	SOFT	hours	s, Q =	26 gpm.					
)-30		DENSE	4-8	M. STIFF	1							
)-50 · 50		DENSE DENSE	8-15 15-30	STIFF V. STIFF	1							
	50	v.	DENGE	> 30	HARD								
GENERA	L NOTES:	i) THE S	TRATIFICATION			IMATE B	OUNDA	RY BETWEEN S	SOIL TYPES.	TRANSITIONS MAY BE GR	RADUAL.		
										ONS STATED ON THIS BO		G.	
					ROUNDWATER M	AY OCCL	JR DUE	TO OTHER FAC	TORS THAN	THOSE PRESENT AT THE	TIME		
		MEAS	SUREMENTS AF	RE MADE.							DODIN		
											BORIN	G No.	TW-2D-20

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	We	stor	n <mark>&</mark> S	Samps	son	Exp	olorati	J <u>ECT</u> Source on Study Name		OF BORING No. SHEET Project No. CHKD BY	3	2	TW-2D-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Drill	ing			ING LOCA		959592.4			
FORE				Rob Maille		-			ACE ELE				NAD83/NAVD88
	EPRESE			Jesse	e Schwalbaun	1	DATI	E START		2/18/20	DATE		2/19/20
SAMPL	ER:		Core Barrel				-			ROUNDWATER OF		1	
CASIN	C.	Sonic Steel o	drilling meth	od			-	DATE 02/19/20	TIME	WATER AT (ft bgs) 47	CASIN	IG AT	STABILIZATION TIME
CASIN	0.	Oleen	asing				-	02/13/20		+1			
CASING	G SIZE:	6.0" ID)				-						
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	PLE DESCR	RIPTION	NOTES	STR	ATUM DESCRIPTION
(ieet) 70	(010W5/11)	INU.	REC/FEN (III)		BLOWS/0	(ppm)							
75-							Brow	n, poorly gr	aded verv	fine to fine SAND			
80-								Silt, trace G				Fin	e SAND and Silt
							 						
85 —													
90 —							Brow	n, fine to co	oarse SAN	D, trace Gravel			SAND
95 —												1	
100-									-nd of Por	ing			End of Poring
								ſ	End of Bor	ing			End of Boring
	GRANU	1			IVE SOILS	NOT							
(4 1(3(WS/FT D-4 10 D-30 D-50 50	V. L M. C	ENSITY LOOSE OOSE DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Set 4	.25-in			ace elevation found 0-100 ft bgs, expos			
GENERA	AL NOTES:	ii) WATE FLUC	R LEVEL READ	NGS HAVE BEE HE LEVEL OF GI	N MADE IN THE D	RILL HO	LES AT	TIMES AND UNI	DER CONDITI	TRANSITIONS MAY BE GI ONS STATED ON THIS BO THOSE PRESENT AT THE	ORING LO		
											BORIN	G No.	TW-2D-20

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	We	sto	n <mark>&</mark> S	Samps	Som	Exp	New S plorati	<u>JECT</u> Source on Study ble, MA	REPORT	OF BORING No. SHEET Project No. CHKD BY	1	21	TW-1D-20 DF <u>3</u> 70766 MacKinnon
BORIN			С	ascade Drill				ING LOCA		958593.0			
FOREN WSE R				Rob Maille sse Schwalb				UND SURF E START	ACE ELE	V. (ft) 85.47 2/20/20	DA DATE		AD83/NAVD88 2/24/20
-				Se Scriwait	aum		DAT	E START				-	
SAMPL	_ER:		Core Barrel drilling meth	od			-	DATE	GF TIME	ROUNDWATER OI WATER AT (ft bgs)			S STABILIZATION TIME
CASIN	G:		Casing	iou			-	05/14/20		45.1	CASIN	NG AT	STABILIZATION TIME
							-						
CASING	G SIZE:	6.0" IE)										
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	PLE DESCR	RIPTION	NOTES	STRA	TUM DESCRIPTION
0		110.		, <u>DEI III (II)</u>	BEOMOIO	(ppm)	Dark	brown tops	oil				TOPSOIL
									very fine S	AND and Silt,		S	AND and Silt
							trace	Gravel			-		
_								- h 0	UT 1944	I			011 T
5-							Dens	se, brown S	IL I , IITTIE C	lay			SILT
							COR	BLES			-		COBBLES
							COB	DLLJ					COBBLES
10-							1						
-													
										l, very fine to fine		S	AND, little Silt
15 -							SAN	D, little Silt,	occasiona	al cobbles			
20-													
												0.4.4	ID and Olt little
						-		ittle gravel a		fine SAND and		SAN	ID and Silt, little Gravel
25 -							Unt, I	ittio graver (Clavol
23-													
			-			-	Dens	e. brown. w	ell graded	l, very fine to fine			
										Silt, trace Clay		SAN	ND, little Gravel
30-									<i>.</i> .	04115			
								e, gray to bro ace Gravel, t		coarse SAND and		S	AND and Silt
							Very	dense, browr	, well grade	ed, very fine to fine		Fine S/	AND, little Silt, little
						-	SAND	D, little Silt, lit	tle Gravel,	trace Clay			Gravel
	GRANU	LAR SO	DILS	COHES	IVE SOILS	NOT	ES:						
	WS/FT		TW	BLOWS/FT	DENSITY		•	0		ace elevation found	0		
)-4 -10		LOOSE .OOSE	0-2 2-4	V. SOFT SOFT			ch pvc scre 16 gpm.	en from 9	0-100 ft bgs, expos	sed 90-7	100 ft bộ	gs, developed 2
	D-30		DENSE	4-8	M. STIFF	noura	s, u –	ro gpin.					
	0-50		DENSE	8-15	STIFF								
>	· 50	V.	DENSE	15-30	V. STIFF								
GENER	NOTES:	i) THE S		> 30	HARD					TRANSITIONS MAY BE GI			
SENER/										ONS STATED ON THIS B		G.	
					ROUNDWATER MA	AY OCCL	JR DUE	TO OTHER FAC	TORS THAN	THOSE PRESENT AT THE	TIME		
		MEA	SUREMENTS AR	E MADE.							BORIN	G No	TW-1D-20
											DOMIN	J NU.	1010 20

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	We	stor	n <mark>&</mark> 8	Samps	son	۱ Exp	plorati	<u>JECT</u> Source on Study Name	-	OF BORING No. SHEET Project No. CHKD BY			TW-1D-20 OF 3 170766 MacKinnon
BORIN		-	(Cascade Drill				ING LOCA		958593.0 ²			
FOREN	/IAN EPRESE			Rob Maille	t e Schwalbaum			UND SURF E START	ACE ELE	V. (ft) 85.47 2/20/20	DA DATE		NAD83/NAVD88 2/24/20
-	-				3 SCHWaibaun	<u> </u>	DAI				-		
SAMPL	EK:		Core Barrel drilling met				-	DATE	GF	ROUNDWATER OF WATER AT (ft bgs)			NS STABILIZATION TIME
CASIN	G:	Steel					-	05/14/20		45.1	0,.0		
							_						
CASINO DEPTH		6.0" IC)	SAMPLE		PID							
(feet)	(blows/ft)	No.	REC/PEN (ir		BLOWS/6"	(ppm)		SAN	PLE DESCR		NOTES	STR	ATUM DESCRIPTION
35													
						┼──							
						+							
40-]						
						—							
			1	++									
							1						
45 —						╂──	Verv	dense, bro	wn well ar	aded, very fine to			
										Gravel, trace Clay			
							1						
						╂──	Į						
50 —				+ +		+							
							1					Fine	SAND, little Silt, little
							ł						Gravel
55 -				<u>+</u>		†							
55-						\square	1						
						┼──	┣──				-		
				<u> </u>									
60 -						\square	1						
						┼──	ł						
				<u> </u>			Done	o brown n	andorately	graded, very fine			
						\square		e SAND, lit					
65 —						╂──		,	,				
						\square]						
				+		+							
	GRANU	LAR SC	DILS	COHES	IVE SOILS	NOT							
	WS/FT		ENSITY	BLOWS/FT	DENSITY					ace elevation found			
)-4 -10		LOOSE .OOSE	0-2 2-4	V. SOFT SOFT			cn pvc scre 16 gpm.	en from 9	0-100 ft bgs, expos	sea 90-	100 ft	bgs, developed 2
	0-30		DENSE	4-8	M. STIFF	noure	,, u –	ro gpini					
	0-50		DENSE	8-15	STIFF								
>	50	V.	DENSE	15-30 > 30	V. STIFF HARD								
GENERA	L NOTES:	i) THE S	TRATIFICATION			IMATE B	OUNDA	RY BETWEEN S	SOIL TYPES.	TRANSITIONS MAY BE GI	RADUAL.		
										ONS STATED ON THIS BO		G.	
			SUREMENTS A		ROUNDWATER MA	AY OCCU	JR DUE	TO OTHER FAC	TORS THAN	THOSE PRESENT AT THE	TIME		
											BORIN	G No.	TW-1D-20

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	We	ston	6	Samps	son	l Exp	olorati	JECT Source on Study Name	-	OF BORING No. SHEET Project No. CHKD BY			TW-1D-20 OF 3 170766 MacKinnon
BORIN			С	ascade Dril				ING LOCA		958593.07			
FOREN WSE R	MAN E PRESE	NTATIV	E:	Rob Maille Jesse	et e Schwalbaun	<u>ו</u>		UND SURF E START	ACE ELE	V. (ft) 85.47 2/20/20	DA DATE		NAD83/NAVD88 2/24/20
SAMPI	FR	4 75" Co	ore Barrel			-	-		GE				
0, 1011			rilling meth	od			-	DATE	TIME	WATER AT (ft bgs)	CASI		STABILIZATION TIME
CASIN	G:	Steel Ca	asing				-	05/14/20		45.1			
CASING	G SIZE:	6.0" ID					-						
DEPTH				SAMPLE		PID	Ī	S A M			NOTES	стг	
(feet)	(blows/ft)	No. F	REC/PEN (in)) DEPTH (ft)	BLOWS/6"	(ppm)		SAM	PLE DESCR	IP HON	NOTES	SIR	RATUM DESCRIPTION
70													
							Dens	e brown n	noderatelt	graded, very fine		Fine	SAND, little Silt, little
75 -								e SAND, lit		•		1 1110	Gravel
80 -													
00													
								e, brown, n D. trace Silt		graded, fine			
							SANI	D, trace Slit	, trace Gra	avei			
85 -													Fine SAND
							Dons	e brown n	oderately	graded very fine			
								e SAND, tra					
90 -													
									ely graded	medium SAND,			
							trace	Gravel					
95 —								(0 A N				Fin	e to coarse SAND
							Brow	n fine SAN	5				
									ely graded	, fine to coarse			
							SANI	D					
100 -									End of Bor	ing			End of Boring
		┝──┼										1	
			-		_								
	GRANU WS/FT			1	IVE SOILS	NOT		tion and ar	ound ourfo	ce elevation found	uning		
)-4		OOSE	BLOWS/FT 0-2	DENSITY V. SOFT					0-100 ft bgs, expos			
	-10		DOSE	2-4	SOFT	hours	s, Q =	16 gpm.		0 1			
	0-30			4-8	M. STIFF								
	0-50 · 50		ENSE DENSE	8-15 15-30	STIFF V. STIFF								
				> 30	HARD								
GENERA	AL NOTES:									TRANSITIONS MAY BE GI			
		·								ONS STATED ON THIS BO THOSE PRESENT AT THE		в.	
			JREMENTS AR										
											BORIN	IG No.	TW-1D-20

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	We	sto	n <mark>&</mark> S	Bamps	SON	Exp	Vew S plorati	<u>JECT</u> Source on Study ble, MA		OF BORING No. SHEET Project No. CHKD BY			TW-1F-20 OF 3 170766 MacKinnon
BORIN	G Co.		С	ascade Dril	ling		BOR	ING LOCA	TION (ft)	988504.9	52335.	27151	169.45091
FORE				Rob Maille	t		GRC	UND SURF		V. (ft) 72.66	DA	TUM	NAD83/NAVD88
WSE R	EP:		Jes	sse Schwalb	aum		DAT	E START		2/24/20	DATE	END	2/26/20
SAMPL	ER:		Core Barrel				-			ROUNDWATER OF			
CASIN	c.		drilling meth Casing	nod			-	DATE 05/14/20	TIME	WATER AT (ft bgs) 44.06	CASI	IG AT	STABILIZATION TIME
CASIN	6.	Sleer	Jasing				-	03/14/20		44.00			
CASING	G SIZE:	6.0" IE)				-						
DEPTH				SAMPLE		PID		SAM	IPLE DESCR		NOTES	STE	RATUM DESCRIPTION
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)	Dress				NOTEO		
0							BLOW	n TOPSOIL	-				TOPSOIL
5-						-			Γ and very	fine Sand, trace			
							Grav	el					
							1						
						-							
10-													
15-							Dens	e, light brov	wn, moder	ately graded very			
15-							fine \$	SAND and S	Silt, trace C	Gravel			
												SILT	and very fine Sand
20-													
25 -													
							Dens	e light brow	wn SII T av	nd moderatly			
								ed very fine					
								-					
30-													
	GRANU	LAR SO			SIVE SOILS	NOT			ff			010 -	
	WS/FT)-4	V.	TW	BLOWS/FT 0-2	DENSITY V. SOFT					ce elevation found 2-78 ft bgs, expose			
	-10		.OOSE	2-4	SOFT			26 gpm.		ege, expeed		, it 29	o, dorolopod <u>-</u>
	0-30		DENSE	4-8	M. STIFF								
	0-50 ∙ 50		DENSE DENSE	8-15 15-30	STIFF V. STIFF								
	00	v.	DENOL	> 30	HARD								
GENERA	L NOTES:	i) THE S	TRATIFICATION	LINES REPRES	ENT THE APPROX	IMATE B	OUNDA	RY BETWEEN S	SOIL TYPES.	TRANSITIONS MAY BE GR	RADUAL.		
										ONS STATED ON THIS BO		G.	
			SUREMENTS AF		ROUNDWATER M		IK DUE	IO UTHER FAC	IUKS IHAN	THOSE PRESENT AT THE			
											BORIN	G No.	TW-1F-20

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	We	stor	n <mark>&</mark> S	Samps	son	Exp	olorati	<u>JECT</u> Source on Study Name	REPORT	OF BORING No. SHEET Project No. CHKD BY	2		TW-1F-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Dril	lina		BOR	ING LOCA	TION (ft)	988504.9	52335.	27151	69.45091
FORE				Rob Maille				UND SURF					NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:	Jess	e Schwalbaun	า	DATI	E START		2/24/20	DATE	END	2/26/20
SAMPL	ER:	4.75" (Core Barrel						GF	ROUNDWATER OF	BSERV	IOITA	NS
_			drilling meth	od			•	DATE	TIME	WATER AT (ft bgs)	CASI		STABILIZATION TIME
CASIN	G:	Steel of	casing					05/14/20		44.06			
		0.01110											
CASING		6.0" ID											
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		SAM	IPLE DESCF	RIPTION	NOTES	STR	ATUM DESCRIPTION
35								e, light browr ine Sand, tra		moderately graded		SILT	and very fine Sand
										arse SAND and	-	s	AND and Gravel
40-							Grav	el, trace Sil	t				
40-													
45-													
-10													
50-													
00													
55 -									orown SILT	Γ and very fine		SII T	and very fine Sand
							Sand					0	
60 -													
65 -													
						-							
						NOT	<u>.</u>						
- PLO	GRANU WS/FT	1	DILS	BLOWS/FT	DENSITY	NOT		ation and an	ound surfa	ce elevation found	usina (219 ar	
)-4		LOOSE	0-2	V. SOFT					2-78 ft bgs, expose			
4	-10	L	.OOSE	2-4	SOFT			26 gpm.		0 1		0	•
	0-30		DENSE	4-8	M. STIFF								
)-50			8-15	STIFF								
	50	v.	DENSE	15-30 > 30	V. STIFF HARD								
GENERA	L NOTES:	i) THE S	TRATIFICATION			IMATE B	OUNDA	RY BETWEEN S	SOIL TYPES.	TRANSITIONS MAY BE GR	RADUAL.		
	0.									ONS STATED ON THIS BC		Э.	
		FLUC	TUATIONS IN TH	HE LEVEL OF G	ROUNDWATER MA	AY OCCL	IR DUE	TO OTHER FAC	TORS THAN	THOSE PRESENT AT THE	TIME		
		MEAS	SUREMENTS AR	E MADE.							DODIN		
											BORIN	G INO.	TW-1F-20

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	We	stor	n <mark>&</mark> S	Samps	son ̃	۱ Exp	PROJE New Sc ploratio Project I	ource n Study	REPORT C	F BORING No. SHEET Project No. CHKD BY		2	TW-1F-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Dril	lina		BORIN	NG LOCA	TION (ft)	988504.9	52335.	27151	69,45091
FORE			0	Rob Maille							,		NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:		e Schwalbaun	า		START		2/24/20	DATE		2/26/20
SAMPL	FR:	4.75" (Core Barrel				Ī		GR	OUNDWATER OB	SFRVA		S
C /			drilling meth	od			• •	DATE	TIME	WATER AT (ft bgs)		NG AT	STABILIZATION TIME
CASIN	G:	Steel 0	Casing					05/14/20		44.06			
							.						
CASING		6.0" ID											
DEPTH		NI-	T	SAMPLE	DL OMO/OI	PID		SAI	MPLE DESCRI	PTION	NOTES	STR	ATUM DESCRIPTION
(feet) 70	(blows/ft)	No.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	(ppm)						<u> </u>	
10									- · · -				
							Dense	e, grayish t	prown SILT	and very fine Sand		SILT	and very fine Sand
75 -													
							Light b	prown fine	to medium	SAND, trace Silt			
80 -													
												Ve	ry fine to medium
							Light b	prown, mo	derately gra	ded very fine to			SAND
								AND, trace		, , ,			
85 -													
							-		derately gra	ded fine SAND,			
							trace S	Silt					
90 -							Dense	e, gray SIL	T and Clay				SILT and Clay
95 -										ded, very fine to			Fine SAND
00							fine S/	AND, trace	e Silt				
100-													
100									End of Bori	ng			End of Boring
					ļ		1						
	GRANU				IVE SOILS	NOTI							
	WS/FT		LOOSE	BLOWS/FT 0-2	DENSITY V. SOFT					e elevation found u 78 ft bgs, exposed			
			.OOSE	2-4	SOFT			26 gpm.		76 lt bys, exposed	12-10	n bys,	developed 2
	0-30		DENSE	4-8	M. STIFF	noure	, u – 1	o gpiii.					
30	0-50	0	DENSE	8-15	STIFF								
>	• 50	۷.	DENSE	15-30	V. STIFF								
051-55				> 30	HARD	<u> </u>							
GENERA	AL NOTES:									RANSITIONS MAY BE GRA		2	
										HOSE PRESENT AT THE			
			SUREMENTS AF										
											BORIN	G No.	TW-1F-20

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	We	stoi	n <mark>&)</mark> S	Samps	son	Ex	olorati	ource on Study	REPORT C	DF BORING No. SHEET Project No.	1		TW-1B-20 OF 3 170766
			\bigcirc			Ba	arnsta	ble, MA		CHKD BY		Kevin	MacKinnon
BORIN	G Co.		C	ascade Dril	ling		BOR	ING LOCAT	ΓΙΟΝ (ft)	978401.97	7868, 2	27167	99.79412
FOREN	/IAN			Rob Maille	t		GRO	UND SURF	ACE ELEV	. (ft) 66.10	DA	TUM	NAD83/NAVD88
WSE R	EP:		Je	sse Schwalb	baum		DATI	START		2/27/20	DATE	END	2/28/20
SAMPL	ER:	4.75" (Core Barrel						GF	ROUNDWATER OB	SERVA	TION	S
_			drilling meth	nod			-	DATE	TIME	WATER AT (ft bgs)	CASIN		STABILIZATION TIME
CASIN	G:	Steel (Casing					05/14/20		39.49			
							_						
CASING	S SIZE:	6.0" ID)				-						
DEPTH	CASING		1	SAMPLE		PID		SAI	MPLE DESCR	IPTION	NOTES	STR	ATUM DESCRIPTION
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)		TODOOU					
0							Brow	n TOPSOIL	-		- 1		TOPSOIL
							Dens	e light brov	wn SII T and	d very fine Sand,			
							little (-		a rong milo cana,		SI	LT and fine Sand
5-													
5													
							Dens	e, gray and	l grayish bro	own SILT and Clay			SILT and Clay
10													
10 -													
									wn SILT and	d very fine Sand,			
							trace	Clay					
15 —													
20 -													
							Dens	e, grayish b	orown, mod	erately graded very		0	
							fine S	SAND and S	Silt, trace G	ravel		SIL	_T and fine SAND
25 -													
30 -													
						┨───							
							Dens	e aravish k	orown SILT	and very fine Sand,			
			1	1	L	1		Gravel		and very fine odilu,			
	GRANU	LAR SO			SIVE SOILS	NOT							
	WS/FT		TW	BLOWS/FT	DENSITY					e elevation found u			
)-4 -10		LOOSE .OOSE	0-2 2-4	V. SOFT SOFT			•	en from 66	-72 ft bgs, exposed	66-72 f	i bgs,	developed 2
)-30		DENSE	4-8	M. STIFF	nours	s, Q =	26 gpm.					
)-50		DENSE	8-15	STIFF								
	50		DENSE	15-30	V. STIFF								
				> 30	HARD								
GENERA	L NOTES:	,								RANSITIONS MAY BE GRA			
1										ONS STATED ON THIS BOR			
			CTUATIONS IN T SUREMENTS AF		KOUNDWATER M	AY OCC	UR DUE	10 OTHER FA	CTORS THAN T	HOSE PRESENT AT THE T	IME		
		WEA	JUREIVIEN I S AI								BORIN	G No.	TW-1B-20
L											1		

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	We	stor	n <mark>&</mark> 8	Samps	son	Exp	New S plorati	<u>JECT</u> Source on Study Name	REPORT	OF BORING No. SHEET Project No. CHKD BY		TW-1B-20 2 OF 3 2170766 Kevin MacKinnon
BORIN			C	ascade Dril	ling			ING LOCA			7868,	2716799.79412
FORE				Rob Maille				UND SUR	FACE ELE			TUM NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:	Jess	e Schwalbaun	1	DAT	E START		2/27/20	DATE	END 2/28/20
SAMPL	ER:		Core Barrel						G	ROUNDWATER OB	SERV	ATIONS
			drilling meth	nod				DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT STABILIZATION TIME
CASIN	G:	Steel	casing				-	05/14/20		39.49		
CASING		6.0" ID)				•					
DEPTH	CASING	0.0 12	,	SAMPLE		DID						
(feet)	(blows/ft)	No.	REC/PEN (in	-	BLOWS/6"	PID (ppm)		SAN	IPLE DESC	RIPTION	NOTES	STRATUM DESCRIPTION
35	(,		(, ()		MT 7						
40 —												
45 —												
							D			a duara fire o Ora d		
								e, grayisn bro Gravel	own SILT a	nd very fine Sand,		SILT and fine Sand
50 -							11000	Clavel				
55 -												
55-												
60												
60 -												
65 —				1			liaht	brown	, fina ta fin	e SAND, trace Silt		Fine SAND
							Light	biowii very		I JAND, LACE SIL		I THE SAIND
						<u> </u>						
	GRANU	LAR SO	DILS	COHES	SIVE SOILS	NOT	ES:					
BLO	WS/FT		DENSITY	BLOWS/FT	DENSITY			ation and gr	ound surfa	ace elevation found	using G	GIS and LiDAR.
()-4		LOOSE	0-2	V. SOFT	Set 4	.25-in	ch pvc scre	en from 6	6-72 ft bgs, exposed	d 66-72	ft bgs, developed 2
	-10		OOSE	2-4	SOFT	hours	s, Q =	26 gpm.				
)-30)-50		DENSE DENSE	4-8 8-15	M. STIFF STIFF							
	50		DENSE	15-30	V. STIFF							
		v.	DENOL	> 30	HARD							
GENERA	L NOTES:	i) THE S	TRATIFICATION			IMATE B	OUNDA	RY BETWEEN	SOIL TYPES.	TRANSITIONS MAY BE GR	ADUAL.	
		ii) WATE	R LEVEL READ	INGS HAVE BEE	N MADE IN THE D	RILL HO	ES AT	TIMES AND UN	DER CONDITI	ONS STATED ON THIS BO	RING LOO	Э.
					ROUNDWATER M	AY OCCL	IR DUE	TO OTHER FAC	CTORS THAN	THOSE PRESENT AT THE	TIME	
		MEAS	SUREMENTS AF	KE MADË.							BORIN	IG No. TW-1B-20
											BURIN	

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	We	stoi	n <mark>&</mark> 8	Samps	son	l Exp			REPORT C	DF BORING No. SHEET Project No. CHKD BY			TW-1B-20 OF 3 170766 MacKinnon
BORIN	G Co.		C	ascade Drill	ing		BOR	NG LOCA	TION (ft)	978401.97	7868,	27167	99.79412
FORE	/AN			Rob Maille					ACE ELEV				NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:	Jesse	e Schwalbaun	า	DATE	START		2/27/20	DATE		2/28/20
SAMPL	ER:	4.75"	Core Barrel				_		GF	ROUNDWATER OB	SERVA	TION	 S
_			drilling meth	nod			-	DATE	TIME	WATER AT (ft bgs)	CASI		STABILIZATION TIME
CASIN	G:	Steel	Casing					05/14/20		39.49			
		0.011											
CASING	-	6.0" IE)			-							
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in	SAMPLE) DEPTH (ft)	BLOWS/6"	PID (ppm)		SA	MPLE DESCR	IPTION	NOTES	STR	ATUM DESCRIPTION
70 75 80 85 90 95								e, grayish I Gravel	brown SILT	and very fine Sand,		SI	LT and fine Sand
100 -									End of Bor	ing			End of Boring
										5			3
	GRANU				IVE SOILS	NOT						<u> </u>	
(4 1(3(WS/FT)-4 -10)-30)-50 -50	V. L M.	DENSITY LOOSE .OOSE . DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Set 4	.25-in			e elevation found u -72 ft bgs, exposed			
GENER#	AL NOTES:	ii) WATE FLUC	ER LEVEL READ CTUATIONS IN T	I LINES REPRES DINGS HAVE BEE THE LEVEL OF G	ENT THE APPRO	RILL HC	DLES AT	TIMES AND UN	NDER CONDITIC	RANSITIONS MAY BE GRA DNS STATED ON THIS BOR HOSE PRESENT AT THE T	RING LOG		
		MEA	SUREMENTS AI	KE MADE.							BORIN	IG No.	TW-1B-20

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	We	stor	n <mark>&</mark> S	Samps	SON	Exp			REPORT (DF BORING No. SHEET Project No. CHKD BY	1	2	TW-2B-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		C	Cascade Dril	ling		BOR	NG LOCAT	FION (ft)	976745.98	30434,	27153	346.16666
FORE	ЛAN			Rob Maille	t		GRO	UND SURF	ACE ELEV				NAD83/NAVD88
WSE R	EP:		Je	sse Schwalk	aum		DATE	START		3/2/20	DATE	END	3/3/20
SAMPL	ER:		Core Barrel						GR	OUNDWATER OB	SERVA	TION	IS
	_		drilling met	hod			_	DATE	TIME	WATER AT (ft bgs)	CASI	IG AT	STABILIZATION TIME
CASIN	G:	Steel (Casing				-	05/14/20		32.95			
CASING	SIZE.	6.0" ID)				-						
DEPTH				SAMPLE		PID							
(feet)	(blows/ft)	No.	REC/PEN (in	1	BLOWS/6"	(ppm)		SAN	MPLE DESCR	IPTION	NOTES	STR	ATUM DESCRIPTION
0							Dark	brown TOF	PSOIL				TOPSOIL
_													
5-													
							Brow	n SILT and	very fine S	and			
10													
10 -													
45													
15 —													
												SILT	and very fine SAND
20													
20 -													
							Brow	n very fine	SAND and	Silt			
25 -													
25-													
30-													
00													
							Dens	e brown SI	LT and very	y fine Sand			
												L	
DI O	GRANU	LAR SC			IVE SOILS	NOT		tion and ar	ound ourfor	a alguetian found i	uning C	10 00	
	WS/FT)-4	V.	TW LOOSE	BLOWS/FT 0-2	DENSITY V. SOFT					ce elevation found ι -100 ft bgs, expose			
	-10		OOSE	2-4	SOFT			26 gpm.			a 00 ii		90, 001010p00 2
)-30		DENSE	4-8	M. STIFF								
)-50		DENSE	8-15	STIFF								
>	50	V.	DENSE	15-30 > 30	V. STIFF HARD	1							
GENERA	AL NOTES:	i) THE S	TRATIFICATION			XIMATE I	BOUNDA	RY BETWEEN	SOIL TYPES. 1	TRANSITIONS MAY BE GR	ADUAL.		
										ONS STATED ON THIS BO		Э.	
					ROUNDWATER	IAY OCC	UR DUE	TO OTHER FA	CTORS THAN T	THOSE PRESENT AT THE	TIME		
		MEAS	SUREMENTS A	KE MADE.							BORIN	G No	TW-2B-20
											- Solution	5 110.	

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V	/este	or	n <mark>&</mark> S	ampa	son	Exp	New S olorati	<u>JECT</u> Source on Study Name	REPOR	T OF BORING No. SHEET Project No. CHKD BY			TW-2B-20 OF <u>3</u> 170766 MacKinnon
BORING Co			Ca	ascade Drilli				ING LOCA			80434,	27153	346.16666
FOREMAN WSE REPRI			/E:	Rob Maille Jesse	t e Schwalbaum	1		UND SURI E START	FACE EL	EV. (ft) 66.17 3/2/20	DA DATE		NAD83/NAVD88 3/3/20
SAMPLER:	4.7	5" C	Core Barrel				-		G	ROUNDWATER O	BSER	/ATIC	NS
	Sor	nic d	drilling meth	od			-	DATE	TIME	WATER AT (ft bgs)	1	IG AT	STABILIZATION TIME
CASING:	Ste	elc	asing				-	05/14/20		32.95			
CASING SIZE	: 6.0	" ID					-						
DEPTH CAS				SAMPLE		PID		SAM	PLE DESC	RIPTION	NOTES	STF	ATUM DESCRIPTION
(feet) (blow 35	s/ft) N	0.	REC/PEN (in)	DEPTH (ft)	BLOWS/6"	(ppm)		-					
00													
40													
							Dens	se brown SI	LT and v	ery fine Sand		SILT	and very fine SAND
45													
50											-		
50													
							Brow	n medium	to coarse	SAND			SAND
55													
	_										-		
60	_												
00													
								se, brown, v	ery fine t	o fine SAND and		Fi	ne SAND and Silt
65							Silt						
GRA BLOWS/FT	NULAR		NLS ENSITY	COHES BLOWS/FT	IVE SOILS DENSITY	NOT		ation and ar		face elevation four			and LiDAR
0-4			LOOSE	0-2	V. SOFT					90-100 ft bgs, expo			
4-10			OOSE	2-4	SOFT	2 hou	urs, Q	= 26 gpm.					
10-30 30-50			DENSE ENSE	4-8 8-15	M. STIFF STIFF								
> 50			DENSE	15-30	V. STIFF								
	FS: i) TL	15 07		> 30	HARD					S. TRANSITIONS MAY B		ΙΔΙ	
SENERAL NOT	,									DITIONS STATED ON THIS			
					ROUNDWATER M	AY OCC	UR DUE	TO OTHER FA	CTORS TH	AN THOSE PRESENT AT	THE TIME		
	N	леаs	UREMENTS AR	E MADÉ.							BORIN	IG No.	TW-2B-20

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	We	ston	<mark>&</mark> S	Samps	son	۱ Exp	loratio	I <u>ECT</u> ource on Study Name	REPORT C	DF BORING No. SHEET Project No. CHKD BY	3	2	TW-2B-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Drill	ling		BOR	NG LOCA	TION (ft)	976745.9	80434,	27153	346.16666
FORE				Rob Maille					FACE ÉLEV				NAD83/NAVD88
WSE R	EPRESE	NTATIVE		Jesse	e Schwalbaum	۱	DATE	START		3/2/20	DATE	END	3/3/20
SAMPL	FR·	4 75" Co	ore Barrel						GR	OUNDWATER OB	SERVA		IS
0,			illing meth	nod				DATE	TIME	WATER AT (ft bgs)	CASIN		STABILIZATION TIME
CASIN	G:	Steel Ca						05/14/20		32.95			
CASING	G SIZE:	6.0" ID											
DEPTH	CASING			SAMPLE		PID		SAN	MPLE DESCRI		NOTES	STR	ATUM DESCRIPTION
(feet)	(blows/ft)	No. R	EC/PEN (in)	DEPTH (ft)	BLOWS/6"	(ppm)		0/AN			NOTED		
70													
75 -													
							_						
80 -							Dens	e, brown, v	ery fine to f	ine SAND and Silt		Fir	ne SAND and Silt
05													
85 —													
90 -													
95 —							Light	brown med	dium to coar	rse SAND			SAND
100													
100-									End of Bori	ng			End of Boring
I		┣──┼											
I		┣──┼											
		┢──┼											
<u> </u>	GRANU	AR SOIL	S	COHES	IVE SOILS	NOTI	S:						
BLO	WS/FT		NSITY	BLOWS/FT	DENSITY			tion and gr	ound surfac	e elevation found	using G	SIS an	d LiDAR.
(0-4	V. L0	DOSE	0-2	V. SOFT					100 ft bgs, exposed			
	-10		OSE	2-4	SOFT	hours	, Q =	26 gpm.					
	0-30		ENSE	4-8	M. STIFF								
-	0-50		NSE	8-15	STIFF								
>	• 50	V. D	ENSE	15-30	V. STIFF								
OFNES				> 30	HARD	<u> </u>							
GENER	AL NOTES:									RANSITIONS MAY BE GR		c	
										ONS STATED ON THIS BO THOSE PRESENT AT THE		э.	
			REMENTS AF										
											BORIN	G No.	TW-2B-20

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	We	stoi	n <mark>&</mark> S	Samps	SON	l Exp	olorati	J <u>ECT</u> ource on Study ble, MA	REPORT C	DF BORING No. SHEET Project No. CHKD BY			TW-1A-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Dril	ling	•	BOR	NG LOCAT	ΓΙΟΝ (ft)	975350.7	51307,	2713	092.90178
FORE				Rob Maille					ACE ELEV				NAD83/NAVD88
WSE R	EP:		Jes	sse Schwalt	aum		DATE	START		3/4/20	DATE	END	3/5/20
SAMPL	ER:		Core Barrel						GR	OUNDWATER OB	SERV	ATION	IS
	0.		drilling meth	nod				DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT	STABILIZATION TIME
CASIN	G:	Steel (Jasing				•	05/14/20		38.39			
CASING	SIZE:	6.0" IC)				•						
DEPTH	CASING			SAMPLE		PID						075	
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)		SAN	IPLE DESCRI	PTION	NOTES	STR	ATUM DESCRIPTION
0 5 –							Brow	n, very fine	SAND and	Silt		Very	fine SAND and Silt
10-													
15 —									ely graded, trace Grave				
20 - 25 -									very fine SA	ND, little Silt, trace			√ery fine SAND
30-							Grav	el					
							Silt	e, brown, v	ery fine to f	ine SAND, trace			
	GRANU	LAR SC		÷	IVE SOILS	NOT		tion and cr		o olovation formed			
(4 1(3(<u>WS/FT</u>)-4 -10)-30)-50 ↓50	L M. E	TW LOOSE OOSE DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Set 4	.25-in			e elevation found of 90 ft bgs, exposed			
GENERA	AL NOTES:	ii) WATE FLUC	R LEVEL READ	INGS HAVE BEI HE LEVEL OF G	EN MADE IN THE D	ORILL HC	LES AT	TIMES AND UN	NDER CONDITIO	RANSITIONS MAY BE GR DNS STATED ON THIS BC HOSE PRESENT AT THE	RING LO		TW-1A-20
											DUKIN	UNU.	100-174-20

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	We	ston 🔕)Samps	sonँ	۱ Exp	olorati	<u>JECT</u> ource on Study Name	REPORT C	DF BORING No. SHEET Project No. CHKD BY	2	2	TW-1A-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		Cascade Dril	ling		BOR	NG LOCAT	TION (ft)	975350.7	51307,	2713	092.90178
FORE			Rob Maille					FACE ÉLEV	7. (ft) 72.74	DA	TUM	NAD83/NAVD88
WSE R	EPRESE	NTATIVE:	Jess	e Schwalbaum	١	DAT	START		3/4/20	DATE	END	3/5/20
SAMPL	FR:	4.75" Core Ba	rrel					GR	OUNDWATER OB	SFRV		IS
		Sonic drilling r					DATE	TIME	WATER AT (ft bgs)	CASIN		STABILIZATION TIME
CASIN	G:	Steel casing					05/14/20		38.39			
CASING	G SIZE:	6.0" ID										
DEPTH	CASING		SAMPLE		PID		SAN	IPLE DESCRI		NOTES	STR	ATUM DESCRIPTION
(feet)	(blows/ft)	No. REC/PE	N (in) DEPTH (ft)	BLOWS/6"	(ppm)		0/10			NOTES	511	ATOM DESCRIPTION
35												
											1	
						Dense	e, brown, ver	ry fine to fine	SAND, trace Silt		1	
											1	
40 -										-	1	
											1	
											1	
											1	
45 -								ely graded,			1	
_						medi	um SAND,	trace Grave	el, trace Silt		1	
											1	
											1	
50											1	
50 -											1	
											Very	/ fine to fine SAND
											1	
55 —											1	
											1	
											1	
											1	
60 -									very fine to fine		1	
						SANI	D, little Silt,	trace Grave	el		1	
											1	
											1	
05											1	
65 -	1										I.	
											I.	
											I.	
I					<u> </u>						I.	
<u> </u>	GRANU	LAR SOILS	COHES	SIVE SOILS	NOT	-S.						
BLO	WS/FT	DENSITY	BLOWS/FT	DENSITY	-	-	tion and ar	ound surfac	e elevation found	usina G	SIS an	d LiDAR.
	0-4	V. LOOSE		V. SOFT		0	0		-90 ft bgs, exposed	0		
4	-10	LOOSE	2-4	SOFT			26 gpm.		0 1		Ũ	•
10	0-30	M. DENSE	4-8	M. STIFF								
	0-50	DENSE	8-15	STIFF								
>	• 50	V. DENSE		V. STIFF								
			> 30	HARD	<u> </u>							
GÉNER/	AL NOTES:								RANSITIONS MAY BE GR		0	
									ONS STATED ON THIS BO THOSE PRESENT AT THE		J.	
		MEASUREMEN		MOUNDWATER M		UC DUE	10 UNTER PA		HOOL FILLGENT AT THE			
										BORIN	G No.	TW-1A-20

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	We	stor	n <mark>&</mark> S	Samps	son	l Exp	New S plorati	<u>JECT</u> Source on Study Name	REPORT	OF BORING No. SHEET Project No. CHKD BY	3	21	TW-1A-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		С	ascade Drill	ing		BOR	ING LOCA	TION (ft)	975350.75	51307,	271309	92.90178
FOREN				Rob Maille			GRO	UND SURF			DA	TUM	NAD83/NAVD88
WSE R	EPRESE	NTATI	VE:	Jesse	e Schwalbaun	า	DAT	E START		3/4/20	DATE	END	3/5/20
SAMPL	ER:	4.75" (Core Barrel						GF	ROUNDWATER OF	BSERV	ATION	S
_			drilling meth	od			•	DATE	TIME	WATER AT (ft bgs)	CASIN		STABILIZATION TIME
CASIN	G:	Steel 0						05/14/20		38.39			
CASING	SIZE:	6.0" ID)										
DEPTH			1	SAMPLE		PID		SAM	IPLE DESCF	RIPTION	NOTES	STRA	ATUM DESCRIPTION
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)				-		-	
70													
75-							Brow	n, fine to m	edium SAI	ND, trace Silt, trace			
75-							Grav	el					
												Fine	e to coarse SAND
80 —													
							_						
								,	barse SAN	D, little Gravel,			
							trace	Silt					
85 —													
								e, brown S fine Sand, t		oderately graded		SILT	and very fine Sand
							very	nne Ganu, t		51			
90 —													
95 —								1	No Recvov	ery			No Recovery
		L				<u> </u>							
100-							<u> </u>		End of Bor	ina			End of Boring
						-				"'Y			
						1							
				001150									
	GRANU				SIVE SOILS	NOT		tion and an		an algorithm found	uning (
	WS/FT)-4			BLOWS/FT 0-2	DENSITY V. SOFT					ce elevation found 0-90 ft bgs, expose			
	-10		.OOSE	2-4	SOFT			26 gpm.			00 00	/ n bgo	
10)-30	М.	DENSE	4-8	M. STIFF		,	- 51					
30)-50		DENSE	8-15	STIFF								
>	50	V.	DENSE	15-30	V. STIFF								
	L NOTES			> 30	HARD	<u> </u>							
GENERA	L NOTES:									TRANSITIONS MAY BE GR		2	
										ONS STATED ON THIS BO THOSE PRESENT AT THE			
			SUREMENTS AF			2000							
											BORIN	IG No.	TW-1A-20

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	We	sto	n <mark>&</mark> S	Samps	son	l Exp	olorati	<u>JECT</u> Source on Study ble, MA	-	OF BORING No. SHEET Project No. CHKD BY	1		TW-1G-20 OF 3 170766 MacKinnon
BORIN	G Co		0	ascade Drill	lina		BOR	ING LOCA		002638.8	56626	27129	377.86163
FORE			0	Rob Maille				UND SURF					NAD83/NAVD88
WSE R	REP:	1	N	athaniel Par	ker		DATI	E START		3/11/20	DATE	END	3/12/20
SAMPL	ER:	4.75"	Core Barrel						GR	OUNDWATER OF	BSERV		NS
		Sonic	drilling meth	lod			-	DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT	STABILIZATION TIME
CASIN	G:	Steel	Casing				-	03/12/20		31.93			
CASING	2 8175	6.0" ID)				-						
DEPTH		0.0 1	,	SAMPLE		PID							
(feet)	(blows/ft)	No.	REC/PEN (in)		BLOWS/6"	(ppm)		SAM	PLE DESCR	IPTION	NOTES	STR	ATUM DESCRIPTION
0 5 –													
10-								n fine to me el, trace Co		D, trace Silt, trace			
												Fire	
15 -												FINE	e to medium SAND
20-								, poorly gra Gravel	ded fine SA	AND, little Silt,			
								, poorly gra Silt, trace (AND, little Gravel,			
25 –								um SAND,		ly graded fine to tle fine to coarse			
30 —										ne to coarse Gravel, trace Silt		Fin	e to coarse SAND
	GRANU	LAR SO	DILS	COHES	IVE SOILS	NOT	ES:				1		
(4 1(3(GRANULAR SOILS COHESIVE SOII BLOWS/FT TW BLOWS/FT DENSI 0-4 V. LOOSE 0-2 V. SO 4-10 LOOSE 2-4 SOF 10-30 M. DENSE 4-8 M. ST 30-50 DENSE 8-15 STIF > 50 V. DENSE 15-30 V. ST > 30 HAR GENERAL NOTES: i) THE STRATIFICATION LINES REPRESENT THE AF									ce elevation found)-100 ft bgs, expos			
GENER#	AL NOTES:	ii) WATE FLUC	ER LEVEL READ	INGS HAVE BEE HE LEVEL OF GI	N MADE IN THE D	RILL HO	LES AT	TIMES AND UNI	DER CONDITIC	RANSITIONS MAY BE GR DNS STATED ON THIS BC HOSE PRESENT AT THE	RING LO	Э.	
											BORIN	G No.	TW-1G-20

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	We	stor	n <mark>&</mark> S	Samps	son	ا Exp	olorati	J <u>ECT</u> ource on Study Name	REPORT (DF BORING No. SHEET Project No. CHKD BY		2	TW-1G-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		C	ascade Dril	ling		BOR	NG LOCA	TION (ft)	992638.8	56626,	27128	377.86163
FORE				Rob Maille					FACE ÉLEV	/. (ft) 56.84	DA	TUM	NAD83/NAVD88
WSE R	EPRESE	NTATI	/E:	Nat	haniel Parker		DAT	E START		3/11/20	DATE	END	3/12/20
SAMPL	ER:	4.75" (Core Barrel						GR	OUNDWATER OB	SERV	ATION	IS
		1	drilling meth	nod				DATE	TIME	WATER AT (ft bgs)	CASIN		STABILIZATION TIME
CASIN	G:	Steel c	asing					03/12/20		31.93			
CASING		6.0" ID					1						
DEPTH	CASING			SAMPLE		PID		SAM	MPLE DESCR	IPTION	NOTES	STR	ATUM DESCRIPTION
(feet) 35	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)							
- 35													
40 -													
45 -													
40-													
							l iaht	brown, wel	I graded fin	e to coarse SAND,			
									rse Gravel.			Fin	e to coarse SAND
50 -													
55 -													
60 -													
							Light	brown SIL ⁻	T, little fine	to medium Sand			SILT
65 -							<u> </u>		-				
				1	L					e to coarse SAND,		Fin	e to coarse SAND
							uace	ine to coa	rse Gravel,	II ACE SIIL			
L						NOT						L	
	GRANU WS/FT	1	DILS ENSITY	COHES BLOWS/FT	DENSITY	NOT		tion and ar	ound ourfor	ce elevation found	icina (210 00	
	0-4		LOOSE	0-2	V. SOFT		0			-100 ft bgs, expose			
	-10		OOSE	2-4	SOFT			27 gpm.				00 11 0	90, developed 2
	0-30		DENSE	4-8	M. STIFF		,	51					
	0-50		ENSE	8-15	STIFF								
>	• 50	۷.	DENSE	15-30	V. STIFF								
OFNES				> 30	HARD	L							
GENER	AL NOTES:									TRANSITIONS MAY BE GF ONS STATED ON THIS BC		G	
										THOSE PRESENT AT THE		0.	
			UREMENTS AF										
											BORIN	G No.	TW-1G-20

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	We	stor	1 <u>&</u> S	Samps	son	۱ Exp	olorati	<u>JECT</u> ource on Study Name	REPORT (DF BORING No. SHEET Project No. CHKD BY			TW-1G-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		C	ascade Dril	lina		BOR	NG LOCAT	FION (ft)	992638.8	56626.	27128	377.86163
FORE				Rob Maille					ACE ELEV		,		NAD83/NAVD88
WSE R	EPRESE	NTATIV	/E:	Nat	haniel Parker		DATE	E START		3/11/20	DATE		3/12/20
SAMPI	ER:	1	ore Barrel						GR	OUNDWATER OB	SERV		IS
			drilling meth	nod				DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT	STABILIZATION TIME
CASIN	G:	Steel C	Casing					03/12/20		31.93			
CASING	G SIZE:	6.0" ID											
DEPTH	CASING			SAMPLE		PID		544	IPLE DESCR		NOTES	етр	ATUM DESCRIPTION
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)		SAN	IPLE DESCR	IFTION	NUTES	318	ATOM DESCRIPTION
70													
				-			Gray	mostly SIL	T, trace fin	e Sand			SILT
75 -													
80 -							Grav	poorly gra	ded mediur	n to coarse SAND,			
00-									ne to mediu			Medi	um to coarse SAND
								,		O laroi			
							Crow	noorly grade	d fine CANE), some Silt, little			
									vel, little Cla			Fin	e SAND, some Silt
85 -										y			
90 -													
										oarse SAND, little		Fin	e to coarse SAND
							Silt, t	race fine to	coarse Gra	avel			
05													
95 -													
100-									End of Bori	na			End of Boring
		┢──┤											Lind of Borning
L													
	GRANU	7			SIVE SOILS	NOTI							
	WS/FT		ENSITY	BLOWS/FT	DENSITY		0			ce elevation found			
	0-4 ⊦-10		LOOSE DOSE	0-2 2-4	V. SOFT SOFT				en from 90	-100 ft bgs, expose	a 90-1	00 π c	igs, developed 2
	0-30		DENSE	2-4 4-8	M. STIFF	nours	s, Q =	27 gpm.					
	0-50 0-50		ENSE	8-15	STIFF								
	• 50		DENSE	15-30	V. STIFF								
			-	> 30	HARD								
GENER	AL NOTES:	i) THE ST	RATIFICATION	LINES REPRES	SENT THE APPROX	IMATE E	BOUNDA	RY BETWEEN	SOIL TYPES.	FRANSITIONS MAY BE GF	ADUAL.		
		ii) WATEF	R LEVEL READ	INGS HAVE BEI	EN MADE IN THE D	RILL HO	LES AT	TIMES AND UN	DER CONDITIO	ONS STATED ON THIS BO	RING LO	G.	
					ROUNDWATER M	AY OCCI	JR DUE	TO OTHER FA	CTORS THAN 1	HOSE PRESENT AT THE	TIME		
		MEAS	UREMENTS A	RE MADE.									TM 40 00
											BORIN	G No.	TW-1G-20

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	We	stoi	n <mark>&</mark> S	Samps	son ≊™	l Exp			REPORT (DF BORING No. SHEET Project No. CHKD BY	1		TW-1C-20 OF <u>3</u> 170766 MacKinnon
BORIN	G Co.		Denis	L. Maher Co	ompany		BOR	NG LOCAT	TION (ft)	964474.0	38718,	2717 [.]	175.2048
FORE				Joe Boyle					ACE ELEV				NAD83/NAVD88
WSE R	EP:		N	athaniel Par	ker		DATE	START		5/13/20	DATE	END	5/19/20
SAMPL	ER:	Drive	and wash				-			ROUNDWATER OB			
CASIN	<u> </u>	Driver	ata al again	~			-	DATE 05/19/20	TIME	WATER AT (ft bgs) -0.5	CASIN	IG AT	STABILIZATION TIME
CASIN	G.	Diivei	n steel casin	y			-	03/19/20		-0.5			
CASING	G SIZE:	2.5" IC)										
DEPTH	CASING			SAMPLE		PID		SAI	MPLE DESCR	RIPTION	NOTES	STR	ATUM DESCRIPTION
(feet)	(blows/ft)	No.	REC/PEN (in) DEPTH (ft)	BLOWS/6"	(ppm)							
5-													
							Gray	CLAY, trac	e Sand, tra	ce Gravel			CLAY
10-													
15 -							Brow	n fine to m	edium SAN	D, some gray Clay,		Fine	to Medium SAND,
20-									se Gravel, t				e Clay, little Gravel
20-													
25 -													
								n, medium Silt, trace (AND, trace Gravel,		Medi	um to Coarse SAND
30-													
	GRANU	LAR SO	DILS	COHES	IVE SOILS	NOT	ES:				1	1	
(4 1(3(0.500000000000000000000000000000000000	V. L M.	TW LOOSE OOSE DENSE DENSE DENSE	BLOWS/FT 0-2 2-4 4-8 8-15 15-30 > 30	DENSITY V. SOFT SOFT M. STIFF STIFF V. STIFF HARD	Borin Set 1	g loca ¼-inc		n from 73-8	e elevation found u 5 ft bgs, exposed 73			
GENER	AL NOTES:	ii) WATE FLUC	ER LEVEL READ	INGS HAVE BEE HE LEVEL OF G	IN MADE IN THE D	ORILL HC	LES AT	TIMES AND UN	NDER CONDITIO	TRANSITIONS MAY BE GRA DNS STATED ON THIS BOR HOSE PRESENT AT THE T	ING LOG		
											BORIN	G No.	TW-1C-20

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	We	sto	n&S	Samps	son	١		I <u>ECT</u> ource on Study	REPORT O	F BORING No. SHEET Project No.		2 2	TW-1C-20 OF 3 170766
								Name		CHKD BY			MacKinnon
BORIN			Denis	L. Maher Co				ING LOCA		964474.03	,		
FORE				Joe Boyle					FACE ELEV				NAD83/NAVD88
	EPRESE	NIAI	IVE:	Natr	naniel Parker		DAT	E START		5/13/20	DATE		5/19/20
SAMPI	ER:	Drive	and wash				-			ROUNDWATER OBS	1		
CASIN	C.	Stool	casing				-	DATE 05/19/20	TIME	WATER AT (ft bgs) -0.5	CASI	NG AT	STABILIZATION TIME
CASIN	0.	Sieer	casing				-	03/13/20		-0.0			
CASING	G SIZE:	2.5" II	D				-						
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in)	SAMPLE DEPTH (ft)	BLOWS/6"	PID (ppm)		S	SAMPLE DESC	RIPTION	NOTES	STR	ATUM DESCRIPTION
35													
										SAND, trace fine		Medi	um to coarse SAND
40							Grav	el, trace S	lit				
40-													
												┣━ ━ •	
45 -													
			-										
		-											
50 -			-										
55 -							Brow	n coarse	SAND trace	fine Gravel, trace			
							Silt						Coarse SAND
			-										
60 -		-											
65 –							1						
						<u> </u>							
	GRANU	AR S	OILS	COHES	IVE SOILS	NOT							
-	WS/FT		DENSITY	BLOWS/FT	DENSITY					ce elevation found us			
)-4 -10		LOOSE	0-2 2-4	V. SOFT SOFT			n @ 17 "H		5 ft bgs, exposed 73-	90 TI C8	js, dev	velopea z nours,
)-30		. DENSE	4-8	M. STIFF	~ '	- 9Pi		J.				
	0-50		DENSE	8-15	STIFF								
>	50	V.	DENSE	15-30	V. STIFF								
GENER	NOTES.	i) ТНЕ 9	STRATIFICATION	> 30	HARD			RY BETWEEN	SOIL TYPES T	RANSITIONS MAY BE GRADU	ΔΙ		
		,								NS STATED ON THIS BORING			
		FLU	CTUATIONS IN T	HE LEVEL OF G	ROUNDWATER M	AY OCCI	JR DUE	TO OTHER FA	CTORS THAN T	HOSE PRESENT AT THE TIME	E		
		MEA	SUREMENTS AR	E MADE.							DODI		TW/ 40 20
											BORIN	UG NO.	TW-1C-20

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	We	stor	n <mark>&</mark> S	amps	:ON	N Exp	loratio	<u>ECT</u> ource on Study Name	REPORT O	F BORING No. SHEET Project No. CHKD BY			TW-1C-20 OF 3 170766 MacKinnon
BORIN	IG Co.		Denis	L. Maher Co	ompany		BOR	NG LOCA	TION (ft)	964474.03	38718,	27171	175.2048
FORE				Joe Boyle					FACE ELEV	'. (ft) 15.51	DA	TUM	NAD83/NAVD88
WSE F	REPRESE	NTATI	VE:	Nath	naniel Parker		DATE	E START		5/13/20	DATE	END	5/19/20
SAMPI	_ER:	Drive a	and wash						GF	ROUNDWATER OB	SERVA		S
								DATE	TIME	WATER AT (ft bgs)	CASIN	IG AT	STABILIZATION TIME
CASIN	G:	Steel of	casing					05/19/20		-0.5			
		0 5 1 10	<u>, </u>										
CASING		2.5" ID											
DEPTH (feet)	CASING (blows/ft)	No.	REC/PEN (in	SAMPLE) DEPTH (ft)	BLOWS/6"	PID (ppm)		S	AMPLE DESCR	RIPTION	NOTES	STR	ATUM DESCRIPTION
(ieet) 70	(010W3/11)	INO.			BLOW 5/0	(ppiii)							
75-													
							_					1	
							Brow Silt	n, coarse	SAND, trace	fine Gravel, trace		1	Coarse SAND
							SIIL					1	
80-												1	
												1	
												1	
												1	
85 -													
00									End of Bor	ring		1	End of Boring
												1	
90 -												1	
50												1	
												1	
												1	
95 —												1	
95-												1	
												1	
												1	
400													
100 -	1												
	GRANU	AR SC	DILS	COHES	IVE SOILS	NOT	S:						
BLC	WS/FT		ENSITY	BLOWS/FT	DENSITY	Borin	g loca	ition and g	round surfac	ce elevation found u	sing GI	S and	LiDAR.
	0-4		LOOSE	0-2	V. SOFT					5 ft bgs, exposed 73	3-85 ft b	ogs, de	eveloped 2 hours,
	-10		OOSE	2-4	SOFT	Q = 7	'5 gpn	n @ 17 "H	g.				
	0-30 0-50		DENSE DENSE	4-8 8-15	M. STIFF STIFF								
	J-50 ∙ 50		DENSE	15-30	V. STIFF								
	50	v.		> 30	HARD								
GENER/	AL NOTES:	i) THE S	TRATIFICATION			IMATE B	OUNDA	RY BETWEEN	I SOIL TYPES. TH	RANSITIONS MAY BE GRAD	UAL.		
		ii) WATE	R LEVEL READ	INGS HAVE BEE	N MADE IN THE DI	RILL HOL	ES AT	TIMES AND UI	NDER CONDITION	NS STATED ON THIS BORIN	NG LOG.		
					ROUNDWATER MA	AY OCCL	IR DUE	TO OTHER F	ACTORS THAN TH	HOSE PRESENT AT THE TIM	ИE		
		MEAS	SUREMENTS AF	RE MADE.							BORIN		TW-1C-20
L											DUKIN	G INO.	100-20

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APPENDIX B WATER LEVEL DATA



		1 00-20-	20	
Date	Elapsed Minutes	Water Level	Drawdown (ft)	Pumping Rate (gpm)
2/19/2020	0	47.05	0	
2/19/2020	1	48.92	1.87	
2/19/2020	2	48.96	1.91	
2/19/2020	3	48.97	1.92	
2/19/2020	4	48.97	1.92	
2/19/2020	5	48.98	1.93	
2/19/2020	6	48.98	1.93	
2/19/2020	7	48.98	1.93	
2/19/2020	8	48.98	1.93	
2/19/2020	9	48.98	1.93	
2/19/2020	10	48.98	1.93	26
2/19/2020	20	48.99	1.94	
2/19/2020	30	49	1.95	
2/19/2020	40	49.01	1.96	
2/19/2020	50	49.01	1.96	
2/19/2020	60	49.01	1.96	
2/19/2020	90	49.02	1.97	
2/19/2020	120	49.04	1.99	
2/19/2020	150	49.05	2	
2/19/2020	180	49.06	2.01	+
2/19/2020	240	49.07	2.02	SHUTDOWN

TW-2D-20

		IW-1F-/	20	
Date	Elapsed Minutes	Water Level	Drawdown (ft)	Pumping Rate (gpm)
2/26/2020	0	47.63	0	
2/26/2020	1	62	14.37	
2/26/2020	2	62.99	15.36	
2/26/2020	3	63.1	15.47	
2/26/2020	4	63.13	15.5	
2/26/2020	5	63.15	15.52	
2/26/2020	6	63.17	15.54	
2/26/2020	7	63.17	15.54	
2/26/2020	8	63.17	15.54	
2/26/2020	9	63.17	15.54	
2/26/2020	10	63.17	15.54	26
2/26/2020	20	63.19	15.56	
2/26/2020	30	63.2	15.57	
2/26/2020	40	63.2	15.57	
2/26/2020	50	63.21	15.58	
2/26/2020	60	63.22	15.59	
2/26/2020	90	63.24	15.61	
2/26/2020	120	63.25	15.62	
2/26/2020	150	63.26	15.63	
2/26/2020	180	63.27	15.64	*
2/26/2020	240	63.3	15.67	SHUTDOWN
2/26/2020	241	48.15	0.52	
2/26/2020	242	47.91	0.28	
2/26/2020	243	47.88	0.25	
2/26/2020	244	47.86	0.23	
2/26/2020	245	47.85	0.22	
2/26/2020	246	47.85	0.22	
2/26/2020	247	47.85	0.22	

TW-1F-20

		IW-2B-	20	
Date	Elapsed Minutes	Water Level	Drawdown (ft)	Pumping Rate (gpm)
3/3/2020	0	33.25	0	
3/3/2020	1	35.51	2.26	
3/3/2020	2	35.62	2.37	
3/3/2020	3	35.66	2.41	
3/3/2020	4	35.68	2.43	
3/3/2020	5	35.69	2.44	
3/3/2020	6	35.7	2.45	
3/3/2020	7	35.71	2.46	
3/3/2020	8	35.72	2.47	
3/3/2020	9	35.72	2.47	
3/3/2020	10	35.73	2.48	26.5
3/3/2020	20	35.77	2.52	
3/3/2020	30	35.79	2.54	
3/3/2020	40	35.81	2.56	
3/3/2020	50	35.82	2.57	
3/3/2020	60	35.83	2.58	
3/3/2020	90	35.83	2.58	
3/3/2020	120	35.85	2.6	
3/3/2020	150	35.87	2.62	
3/3/2020	180	35.86	2.61	*
3/3/2020	240	35.88	2.63	SHUTDOWN
3/3/2020	241	33.65	0.4	
3/3/2020	242	33.51	0.26	
3/3/2020	243	33.46	0.21	
3/3/2020	244	33.44	0.19	
3/3/2020	245	33.43	0.18	

TW-2B-20

Date 3/12/2020		Elapsed Time	Material and (ft TOC)	D 1 (0)	
2/12/2020		-	water Level (ft TOC)	Drawdown (ft)	Pumping Rate (gpm)
3/12/2020	11:00	0	34.68	0	
3/12/2020	11:01	1	50.6	15.92	
3/12/2020 2	11:02	2	52	17.32	
3/12/2020	11:03	3	52.18	17.5	
3/12/2020 2	11:04	4	52.21	17.53	
3/12/2020 2	11:05	5	52.22	17.54	
3/12/2020	11:06	6	52.24	17.56	
3/12/2020	11:07	7	52.25	17.57	
3/12/2020 2	11:08	8	52.27	17.59	
3/12/2020	11:09	9	52.28	17.6	
3/12/2020 2	11:10	10	52.29	17.61	26.64
3/12/2020 2	11:20	20	52.32	17.64	20.04
3/12/2020 2	11:30	30	52.38	17.7	
3/12/2020 2	11:40	40	52.41	17.73	
3/12/2020 2	11:50	50	52.42	17.74	
3/12/2020 2	12:00	60	52.41	17.73	
3/12/2020	12:30	90	52.43	17.75	
3/12/2020 2	13:00	120	52.46	17.78	
3/12/2020 2	13:30	150	52.47	17.79	
3/12/2020 2	14:00	180	52.5	17.82	
3/12/2020	14:30	210	52.56	17.88	•
3/12/2020 2	15:00	240	52.57	17.89	SHUTDOWN
3/12/2020	15:01	241	35.2	0.52	
3/12/2020 2	15:02	242	34.75	0.07	
3/12/2020 2	15:03	243	34.72	0.04	
3/12/2020 2	15:04	244	34.71	0.03	
3/12/2020 2	15:05	245	34.7	0.02	

TW-1G-20

			IW-1C-20		
Date	Time	Elapsed Time	Water Level (ft TOC)	Drawdown (ft)	Pumping Rate (gpm)
5/19/2020	13:45	0	2.28	0	
5/19/2020	13:46	1	2.76	0.48	
5/19/2020	13:47	2	2.81	0.53	
5/19/2020	13:48	3	2.85	0.57	
5/19/2020	13:49	4	2.87	0.59	
5/19/2020	13:50	5	2.89	0.61	
5/19/2020	13:51	6	2.91	0.63	
5/19/2020	13:52	7	2.92	0.64	
5/19/2020	13:53	8	2.93	0.65	
5/19/2020	13:54	9	2.94	0.66	
5/19/2020	13:55	10	2.95	0.67	75
5/19/2020	14:05	20	3.03	0.75	75
5/19/2020	14:15	30	3.07	0.79	
5/19/2020	14:25	40	3.11	0.83	
5/19/2020	14:35	50	3.13	0.85	
5/19/2020	14:45	60	3.15	0.87	
5/19/2020	15:15	90	3.19	0.91	
5/19/2020	15:45	120	3.23	0.95	
5/19/2020	16:15	150	3.25	0.97	
5/19/2020	16:45	180	3.27	0.99	
5/19/2020	17:15	210	3.28	1	+
5/19/2020	17:45	240	3.29	1.01	SHUTDOWN
5/19/2020	17:46	241	2.85	0.57	
5/19/2020	17:47	242	2.8	0.52	
5/19/2020	17:48	243	2.76	0.48	
5/19/2020	17:49	244	2.74	0.46	

TW-1C-20

Date Time Elapsed Time Water Level (ft TOC) Drawdown (ft) Pumping Rate (gpm) 6/5/2020 11:00 0 10.23 0 6/5/2020 11:01 1 11:1 0.87 6/5/2020 11:02 2 11:9 1.67 6/5/2020 11:03 3 11:95 1.72 6/5/2020 11:05 5 12:01 1.78 6/5/2020 11:06 6 12:02 1.79 6/5/2020 11:07 7 12:03 1.8 6/5/2020 11:09 9 12:05 1.82 6/5/2020 11:10 10 12:05 1.82 6/5/2020 11:30 30 12:11 1.88 6/5/2020 11:30 30 12:11 1.88 6/5/2020 11:30 30 12:11 1.88 6/5/2020 11:30 30 12:11 1.89 6/5/2020 11:30 10:0 12:15 1.92 </th <th></th> <th></th> <th></th> <th>TW-1E-20</th> <th></th> <th></th>				TW-1E-20		
6/s/2020 11:01 1 11.1 0.87 6/s/2020 11:02 2 11.9 1.67 6/s/2020 11:03 3 11.95 1.72 6/s/2020 11:04 4 11.99 1.76 6/s/2020 11:05 5 12.01 1.78 6/s/2020 11:06 6 12.02 1.79 6/s/2020 11:07 7 12.03 1.8 6/s/2020 11:08 8 12.04 1.81 6/s/2020 11:09 9 12.05 1.82 6/s/2020 11:10 10 12.05 1.82 6/s/2020 11:30 30 12.11 1.88 6/s/2020 11:30 30 12.13 1.9 6/s/2020 11:30 30 12.15 1.92 6/s/2020 13:30 150 12.15 1.92 6/s/2020 13:30 150 12.15 1.92 6/s/2020 15:01	Date	Time	Elapsed Time	Water Level (ft TOC)	Drawdown (ft)	Pumping Rate (gpm)
6/s/2020 11:02 2 11.9 1.67 6/s/2020 11:03 3 11.95 1.72 6/s/2020 11:04 4 11.99 1.76 6/s/2020 11:05 5 12.01 1.78 6/s/2020 11:07 7 12.03 1.8 6/s/2020 11:07 7 12.03 1.8 6/s/2020 11:07 7 12.05 1.82 6/s/2020 11:00 9 12.05 1.82 6/s/2020 11:01 10 12.05 1.82 6/s/2020 11:02 20 12.09 1.86 6/s/2020 11:30 30 12.11 1.88 6/s/2020 11:30 30 12.13 1.9 6/s/2020 11:30 90 12.15 1.92 6/s/2020 13:30 150 12.15 1.92 6/s/2020 14:30 210 12.15 1.92 6/s/2020 15:01	6/5/2020	11:00	0	10.23	0	▲
6/5/2020 11:03 3 11.95 1.72 6/5/2020 11:04 4 11.99 1.76 6/5/2020 11:05 5 12.01 1.78 6/5/2020 11:07 7 12.03 1.8 6/5/2020 11:07 7 12.03 1.82 6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:00 10 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:30 30 12.13 1.9 6/5/2020 11:30 30 12.13 1.9 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:02 <td>6/5/2020</td> <td>11:01</td> <td>1</td> <td>11.1</td> <td>0.87</td> <td></td>	6/5/2020	11:01	1	11.1	0.87	
6/s/2020 11:04 4 11.99 1.76 6/s/2020 11:05 5 12.01 1.78 6/s/2020 11:06 6 12.02 1.79 6/s/2020 11:07 7 12.03 1.8 6/s/2020 11:09 9 12.05 1.82 6/s/2020 11:10 10 12.05 1.82 6/s/2020 11:10 10 12.05 1.82 6/s/2020 11:30 30 12.11 1.88 6/s/2020 11:30 30 12.11 1.88 6/s/2020 11:30 30 12.13 1.9 6/s/2020 12:00 60 12.13 1.9 6/s/2020 13:30 150 12.15 1.92 6/s/2020 14:00 180 12.15 1.92 6/s/2020 15:00 240 12.15 1.92 6/s/2020 15:03 243 10.38 0.15 6/s/2020 15:03<	6/5/2020	11:02	2	11.9	1.67	
6/5/2020 11:05 5 12.01 1.78 6/5/2020 11:06 6 12.02 1.79 6/5/2020 11:07 7 12.03 1.8 6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.82 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:30 30 12.11 1.89 6/5/2020 11:30 30 12.13 1.9 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:	6/5/2020	11:03	3	11.95	1.72	
6/5/2020 11:06 6 12.02 1.79 6/5/2020 11:07 7 12.03 1.8 6/5/2020 11:08 8 12.04 1.81 6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:30 30 12.13 1.9 6/5/2020 11:50 50 12.13 1.9 6/5/2020 13:30 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:03 243 10.33 0.15 6/5/2020 15:	6/5/2020	11:04	4	11.99	1.76	
6/5/2020 11:07 7 12.03 1.8 6/5/2020 11:08 8 12.04 1.81 6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:03 243 10.33 0.1 6/5/2020 15	6/5/2020	11:05	5	12.01	1.78	
6/5/2020 11:08 8 12.04 1.81 6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:03 243 10.33 0.15 6/5/2020 <td< td=""><td>6/5/2020</td><td>11:06</td><td>6</td><td>12.02</td><td>1.79</td><td></td></td<>	6/5/2020	11:06	6	12.02	1.79	
6/5/2020 11:09 9 12.05 1.82 6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:00 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:05 245 10.33 0.1 6/5/2020	6/5/2020	11:07	7	12.03	1.8	
6/5/2020 11:10 10 12.05 1.82 6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:05 245 10.33 0.1 6/5/2020 <t< td=""><td>6/5/2020</td><td>11:08</td><td>8</td><td>12.04</td><td>1.81</td><td></td></t<>	6/5/2020	11:08	8	12.04	1.81	
6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 <	6/5/2020	11:09	9	12.05	1.82	
6/5/2020 11:20 20 12.09 1.86 6/5/2020 11:30 30 12.11 1.88 6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:06 246 10.31 0.08 6/5/2020 15:09	6/5/2020	11:10	10	12.05	1.82	75
6/5/2020 11:40 40 12.12 1.89 6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10	6/5/2020	11:20	20	12.09	1.86	/5
6/5/2020 11:50 50 12.13 1.9 6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10	6/5/2020	11:30	30	12.11	1.88	
6/5/2020 12:00 60 12.13 1.9 6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10	6/5/2020	11:40	40	12.12	1.89	
6/5/2020 12:30 90 12.15 1.92 6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:06 246 10.31 0.08 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10	6/5/2020	11:50	50	12.13	1.9	
6/5/2020 13:00 120 12.15 1.92 6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:06 246 10.31 0.08 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10 250 10.3 0.07 6/5/2020 15:20	6/5/2020	12:00	60	12.13	1.9	
6/5/2020 13:30 150 12.15 1.92 6/5/2020 14:00 180 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:06 246 10.31 0.08 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10 250 10.3 0.07 6/5/2020 15:20 260 10.26 0.03	6/5/2020	12:30	90	12.15	1.92	
6/5/202014:0018012.151.926/5/202014:3021012.151.926/5/202015:0024012.151.926/5/202015:0124110.480.256/5/202015:0224210.40.176/5/202015:0324310.380.156/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	13:00	120	12.15	1.92	
6/5/2020 14:30 210 12.15 1.92 6/5/2020 15:00 240 12.15 1.92 6/5/2020 15:01 241 10.48 0.25 6/5/2020 15:02 242 10.4 0.17 6/5/2020 15:03 243 10.38 0.15 6/5/2020 15:04 244 10.36 0.13 6/5/2020 15:05 245 10.33 0.1 6/5/2020 15:06 246 10.31 0.08 6/5/2020 15:07 247 10.32 0.09 6/5/2020 15:08 248 10.31 0.08 6/5/2020 15:09 249 10.3 0.07 6/5/2020 15:10 250 10.3 0.07 6/5/2020 15:10 250 10.3 0.07 6/5/2020 15:20 260 10.26 0.03	6/5/2020	13:30	150	12.15	1.92	
6/5/202015:0024012.151.92SHUTDOWN6/5/202015:0124110.480.256/5/202015:0224210.40.176/5/202015:0324310.380.156/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	14:00	180	12.15	1.92	
6/5/202015:0124110.480.256/5/202015:0224210.40.176/5/202015:0324310.380.156/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	14:30	210	12.15	1.92	↓ ↓
6/5/202015:0224210.40.176/5/202015:0324310.380.156/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:00	240	12.15	1.92	SHUTDOWN
6/5/202015:0324310.380.156/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:01	241	10.48	0.25	
6/5/202015:0424410.360.136/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:02	242	10.4	0.17	
6/5/202015:0524510.330.16/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:03	243	10.38	0.15	
6/5/202015:0624610.310.086/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:04	244	10.36	0.13	
6/5/202015:0724710.320.096/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:05	245	10.33	0.1	
6/5/202015:0824810.310.086/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:06	246	10.31	0.08	
6/5/202015:0924910.30.076/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:07	247	10.32	0.09	
6/5/202015:1025010.30.076/5/202015:2026010.260.03	6/5/2020	15:08	248	10.31	0.08	
6/5/2020 15:20 260 10.26 0.03	6/5/2020	15:09	249	10.3	0.07	
	6/5/2020	15:10	250	10.3	0.07	
6/5/2020 15:30 270 10.24 0.01	6/5/2020	15:20	260	10.26	0.03	
	6/5/2020	15:30	270	10.24	0.01	

TW-1E-20

APPENDIX C WATER QUALITY RESULTS (SUMMARY)



	Analytes	EPA (mg/L)	ORSG (mg/L)	SMCL/MMCL (mg/L)	TW-2B-20 3/3/2020	TW-1C-20 5/19/2020	TW-2D-20 2/19/2020	TW-1E-20 1/27/2020	TW-1F-20 2/26/2020	TW-1G-2 3/12/202
	Dichlorodifluoromethane		1.4		ND	ND	ND	ND	ND	ND
	Chloromethane	0.003			ND	ND	ND	ND	ND	ND
	Vinyl chloride	0.002		0.002	ND	ND	ND	ND	ND	ND
	Bromomethane		0.01		ND	ND	ND	ND	ND	ND
	Chloroethane				ND	ND	ND	ND	ND	ND
	Trichlorofluoromethane				ND	ND	ND	ND	ND	ND
	1,1-Dichloroethene	0.007		0.007	ND	ND	ND	ND	ND	ND
	Methylene chloride	0.005			ND	ND	ND	ND	ND	ND
	Methyl tert butyl ether			0.02 - 0.04	ND	ND	ND	ND	ND	ND
	trans-1,2-Dichloroethene	0.1		0.1	ND	ND	ND	ND	ND	ND
	1,1-Dichloroethane			0.07	ND	ND	ND	ND	ND	ND
	2,2-Dichloropropane				ND	ND	ND	ND	ND	ND
	cis-1,2-Dichloroethene	0.07		0.07	ND	ND	ND	ND	ND	ND
	Chloroform	0.07	0.07		0.00053	0.00077	0.0016	0.001	0.0059	0.0022
	Bromochloromethane				ND	ND	ND	ND	ND	ND
	1,1,1-Trichloroethane	0.2		0.2	ND	ND	ND	ND	ND	ND
	1,1-Dichloropropene				ND	ND	ND	ND	ND	ND
	Carbon tetrachloride	0.005		0.005	ND	ND	ND	ND	ND	ND
	1,2-Dichloroethane	0.005		0.005	ND	ND	ND	ND	ND	ND
	Benzene	0.005		0.005	ND	ND	ND	ND	ND	ND
	Trichloroethene				ND	ND	ND	ND	ND	ND
	1,2-Dichloropropane	0.005		0.005	ND	ND	ND	ND	ND	ND
	Bromodichloromethane				ND	ND	ND	ND	ND	ND
	Dibromomethane				ND	ND	ND	ND	ND	ND
	cis-1,3-Dichloropropene		0.0004		ND	ND	ND	ND	ND	ND
	Toluene	1		1	ND	ND	ND	ND	ND	ND
	trans-1,3-Dichloropropene		0.0004		ND	ND	ND	ND	ND	ND
	1,1,2-Trichloroethane	0.005		0.005	ND	ND	ND	ND	ND	ND
	1,3-Dichloropropane				ND	ND	ND	ND	ND	ND
	Tetrachloroethene				ND	ND	ND	ND	ND	ND
Volatile Organics	Dibromochloromethane				ND	ND	ND	ND	ND	ND
0	1,2-Dibromoethane				ND	ND	ND	ND	ND	ND
	Chlorobenzene	0.1		0.1	ND	ND	ND	ND	ND	ND
	1,1,1,2-Tetrachloroethane				ND	ND	ND	ND	ND	ND
	Ethylbenzene	0.7		0.7	ND	ND	ND	ND	ND	ND
	p/m-Xylene				ND	ND	ND	ND	ND	ND
	o-Xylene				ND	ND	ND	ND	ND	ND
	Styrene	0.1		0.1	ND	ND	ND	ND	ND	ND
	Isopropylbenzene				ND	ND	ND	ND	ND	ND
	Bromoform				ND	ND	ND	ND	ND	ND
	1,1,2,2-Tetrachloroethane				ND	ND	ND	ND	ND	ND
	1,2,3-Trichloropropane				ND	ND	ND	ND	ND	ND
	Xylenes, Total ¹			10	ND	ND	ND	ND	ND	ND
	n-Propylbenzene			10	ND	ND	ND	ND	ND	ND
	Bromobenzene				ND	ND	ND	ND	ND	ND
	1,3,5-Trimethylbenzene	1	<u>├</u>		ND	ND	ND	ND	ND	ND
	o-Chlorotoluene	1	1		ND	ND	ND	ND	ND	ND
	p-Chlorotoluene	1	<u>t</u>		ND	ND	ND	ND	ND	ND
	tert-Butylbenzene	1	1		ND	ND	ND	ND	ND	ND
	1,2,4-Trimethylbenzene	1			ND	ND	ND	ND	ND	ND
	sec-Butylbenzene	1			ND	ND	ND	ND	ND	ND
	p-Isopropyltoluene	1	1		ND	ND	ND	ND	ND	ND
	1,3-Dichlorobenzene	1	1		ND	ND	ND	ND	ND	ND
	1,4-Dichlorobenzene	1	1	0.005	ND	ND	ND	ND	ND	ND
	n-Butylbenzene	1	<u>├</u>	0.000	ND	ND	ND	ND	ND	ND
	1,2-Dichlorobenzene			0.6	ND	ND	ND	ND	ND	ND
	1,2-Dibromo-3-chloropropane	0.0002	+ +	0.0002	ND	ND	ND	ND	ND	ND
	1,2,4-Trichlorobenzene	0.0002	+ +	0.002	ND	ND	ND	ND	ND	ND
	Hexachlorobutadiene	0.07	┼ ┼	0.07	-					ND
	Naphthalene	<u> </u>	0.14		ND ND	ND ND	ND ND	ND ND	ND ND	ND
	1,2,3-Trichlorobenzene		0.14	0.07	ND	ND	ND	ND	ND	ND

Water Quality Summary Barnstable New Source Exploration Study Phase 3 - Well Exploration Program

	Analytes	EPA (mg/L)	ORSG (mg/L)	SMCL/MMCL (mg/L)	TW-2B-20 3/3/2020	TW-1C-20 5/19/2020	TW-2D-20 2/19/2020	TW-1E-20 1/27/2020	TW-1F-20 2/26/2020	TW-1G-20 3/12/2020
	1,4-Dioxane		0.0003		ND	ND	ND	ND	ND	ND
	Aluminum, Total	0.05 to 0.2		0.05 to 0.2	ND	ND	ND	ND	ND	ND
-	Antimony, Total	0.006		0.006	ND	ND	ND	ND	ND	ND
-	Arsenic, Total	0.01		0.01	ND	ND	ND	ND	ND	ND
-	Barium, Total	2		2	0.0011	0.0104	ND	0.0045	0.004	0.0014
-	Beryllium, Total	0.004		0.004	ND	ND	ND	ND	ND	ND
-	Cadmium, Total	0.005		0.005	ND 2.33	ND	ND 3.83	ND 2.02	ND 1.FC	ND 2.4
-	Calcium, Total	0.1		0.1		18.6	3.83 ND	2.03	1.56	
-	Chromium, Total	0.1 TT ¹ 1.3		0.1 TT 1.3	ND ND	ND ND	0.021	ND ND	ND ND	ND ND
-	Copper, Total Iron, Total	0.3		0.3	ND	0.131	0.021	ND	0.194	ND
-	Lead, Total	0.5 TT 0.015		TT 0.015	ND	ND	0.0078	ND	ND	ND
Total Metals	Magnesium, Total	11 0.015		11 0.015	1.45	8.6	1.55	1.54	1.48	1.47
-	Manganese, Total	0.05	0.3	0.05	ND	ND	0.041	ND	0.028	ND
-	Mercury, Total	0.002	0.0	0.002	ND	ND	ND	ND	ND	ND
-	Nickel, Total	0.002	0.1	0.002	ND	ND	ND	ND	ND	ND
-	Potassium, Total		0.1		ND	ND	ND	ND	ND	ND
-	Selenium, Total	0.05		0.05	ND	ND	ND	ND	ND	ND
-	Silver, Total	0.05		0.1	ND	ND	ND	ND	ND	ND
-	Sodium, Total		20		8.98	74.6	9.88	9.17	11.6	9.12
-	Thallium, Total	0.002		0.002	ND	ND	ND	ND	ND	ND
-	Zinc, Total			5	ND	ND	ND	ND	ND	ND
-	Hardness			-	11.8	81.8	15.9	11.4	10	12
	Perchlorate			0.002	0.000088	0.000082	0.000077	0.000054	0.000084	ND
	Turbidity			TT	ND	ND	0.45	ND	ND	0.24
-	Odor @ 60 C			3 threshold odor numbers	ND	ND	ND	ND	ND	ND
	Color, Apparent	15 color units		15 color units	ND	8	ND	ND	ND	ND
-	Alkalinity, Total				6.9	26.3	10.8	4.5	4.4	10.2
	Solids, Total Dissolved			500	34	320	66	43	25	29
General Chemistry	Cyanide, Total	0.2		0.2	ND	ND	ND	ND	ND	ND
-	Fluoride	4		4	ND	ND	ND	ND	ND	ND
	pH (H)			6.5-8.5	6	5.8	6.2	5.7	5.6	6
	Nitrogen, Nitrite			1	ND	ND	ND	ND	ND	ND
	Nitrogen, Nitrate			10	ND	1.4	ND	ND	ND	ND
Bacteria	Coliform, Total	5% ²	N/A	N/A	Negative	Negative	Negative	Negative	Negative	Negative
	comorni, rotai	370-	1,1,7,1		INCEALINC					
Dacteria	Escherichia Coli	5%	N/A	N/A	Negative	Negative	Negative	Negative	Negative	Negative
					•	-	_	-	_	Negative 13.1
Anions	Escherichia Coli	5%		N/A	Negative	Negative	Negative	Negative	Negative	_
	Escherichia Coli Chloride	5% 250		N/A 250	Negative 14.5	Negative 167	Negative 14.3	Negative 16	Negative 18.1	13.1
	Escherichia Coli Chloride Sulfate	5% 250		N/A 250 250	Negative 14.5 3.44	Negative 167 5.76	Negative 14.3 6.52	Negative 16 6.09	Negative 18.1 4.94	13.1 6.61
	Escherichia Coli Chloride Sulfate Radon (pCi/L)	5% 250 250	N/A	N/A 250 250 10000	Negative 14.5 3.44 236	Negative 167 5.76 376	Negative 14.3 6.52 280	Negative 16 6.09 402	Negative 18.1 4.94 207	13.1 6.61 224
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L)	5% 250 250 15	N/A _	N/A 250 250 10000 15	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <3	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L)	5% 250 250 15 5	N/A 	N/A 250 250 10000 15 5	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <3	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L)	5% 250 250 15 5 5	N/A 	N/A 250 250 10000 15 5 5	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <3	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l	5% 250 250 15 5 5 30	N/A 	N/A 250 250 10000 15 5 5 30	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <3	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <1
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor	5% 250 250 15 5 5 30 0.002	N/A 	N/A 250 250 10000 15 5 5 5 30 0.002	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <1 <0.0001
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine	5% 250 250 15 5 5 30 0.002 0.003	N/A 	N/A 250 250 10000 15 5 5 30 0.002 0.003	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <1 <0.0001 <0.0001
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran	5% 250 250 15 5 30 0.002 0.003 0.04	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04	Negative 14.5 3.44 236 <3	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <1 <0.0001 <0.0001 <0.0009
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 228 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane	5% 250 250 15 5 30 0.002 0.003 0.04	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <1 <1 <0.0001 <0.0001 <0.0009 <0.0002 <0.0002 <0.001
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin	5% 250 250 15 5 30 0.002 0.003 0.04 0.002	N/A 	N/A 250 250 10000 15 5 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.007 0.002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.001 <0.0001
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.07 0.002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0009 <0.0002 <0.001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0001 <0.0002 <0.0002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0001 <0.0002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000002 <0.00002 <0.00002 <0.00002 <0.00002 <0.0000
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.07 0.002 0.002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.0002 0.0002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.0002 0.0002 0.00002 0.00002 0.00002 0.00002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <1 <1 <0.0001 <0.0001 <0.0009 <0.0002 <0.0002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.00002 <0.0002 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000004 <0.000004 <0.000004 <0.000004 <0.000004 <0.000004 <0.00004 <0.00004 <0.000004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.00004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004 <0.0004
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.07 0.002 0.002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.004 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.0001 <0.0001 <0.0001 <0.00002 <0.00002 <0.0001 <0.0001 <0.00002 <0.00002 <0.0001 <0.00002 <0.0001 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000002 <0.00001 <0.00001 <0.00001 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.0000002 <0.000002 <0.000002 <0.000002 <0.0000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000000002 <0.00002 <0.000000000000 <0
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor epoxide Lindane	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.0002 0.0004 0.0002 0.0002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.004 0.002 0.002 0.002 0.007 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002 0.0002 0.0002 0.0002 0.0002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.0001 <0.0001 <0.00002 <0.00002 <0.00004 <0.00004 <0.00006 <0.00007
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Lindane Methoxychlor	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.002 0.0004 0.0004 0.0002 0.0002 0.004	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002 0.0002 0.0004 0.0002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.0001 <0.0001 <0.00002 <0.00004 <0.00004 <0.00006 <0.00007 <0.00007 <0.0001
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.0002 0.0004 0.0002 0.0002	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.007 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002 0.0002 0.004 0.002 0.004 0.002 0.04	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.00002 <0.00002 <0.00004 <0.00004 <0.00007 <0.00001 <0.00001 <0.00001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.00002 <0.000002 <0.000002 <0.000002 <0.00002 <0.00002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.000002 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0
Anions	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachloropepane Chlordane	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.00	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.004 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0004 0.0002 0.0002 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.001 0.003	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachloroppenol Toxaphene 2,4,5-TP	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.0002 0.0004 0.0002 0.0002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0004 0.0002 0.0002 0.0002 0.0002 0.001 0.003 0.003 0.003 0.05	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.004 0.007 0.002 0.007 0.002 0.002 0.004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.0002	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.001 0.003 0.05 0.0002	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.005 0.05	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.004 0.001 0.003 0.05 0.0002 0.2	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.0002 0.0002 0.0002 0.0002 0.004 0.0002 0.005	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.003 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.0002 0.0002 0.001 0.003 0.05 0.0002 0.2 0.4	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.0002	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.004 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.001 0.003 0.05 0.0002 0.2 0.4 0.006	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3 <0.1 <1 <0.0001 <0.0001 <0.0002 <0.0002 <0.00002 <0.00002 <0.00004 <0.00001 <0.00001 <0.00001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.00002 <0.00001 <0.00002 <0.00001 <0.00002 <0.00001 <0.00002 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00002 <0.00001 <0.00001 <0.00001 <0.00001 <0.00002 <0.000002 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00002 <0.00002 <0.00002 <0.000002 <0.000001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.00001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate Diloseb	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.007 0.002 0.007 0.0002 0.000	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.004 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.0002 0.001 0.003 0.05 0.0002 0.2 0.4 0.006 0.007	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 226 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate Di(2-ethylhexyl) phthalate	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.07 0.002 0.007 0.002 0.0002	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.004 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0004 0.0002 0.004 0.0002 0.004 0.0002 0.004 0.001 0.003 0.05 0.0002 0.2 0.4 0.006	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate Diloseb Hexachloropceneal	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.003 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.007 0.005 0.007 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.005 0.007 0.005	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.0002 0.001 0.003 0.05 0.0002 0.2 0.4 0.001 0.005 0.007 0.001 0.005	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate Dinoseb Hexachlorobenzene Hexachloroyclopentadiene Oxamyl (Vydate)	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.004 0.002 0.007 0.002 0.004 0.0002 0.0004 0.0002 0.0002 0.0004 0.0002 0.0002 0.001 0.003 0.05 0.2 0.2	N/A 	N/A 250 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.004 0.0002 0.004 0.0002 0.001 0.003 0.005 0.006 0.007 0.006 0.007 0.001 0.005 0.001 0.005 0.2	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3
Anions -	Escherichia Coli Chloride Sulfate Radon (pCi/L) Gross Alpha Activity (pCi/L) Radium 226 (pCi/L) Radium 228 (pCi/L) Uranium ug/l Alachlor Atrazine Carbofuran Chlordane Dibromochloropropane 2,4-D Endrin Ethylene dibromide Heptachlor Heptachlor Heptachlor Pentachlorophenol Toxaphene 2,4,5-TP Benzo(a)pyrene Dalapon Di(2-ethylhexyl) adipate Diloseb Hexachloropceneal	5% 250 250 15 5 30 0.002 0.003 0.04 0.002 0.003 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.007 0.005 0.007 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.007 0.005 0.005 0.007 0.005	N/A 	N/A 250 250 10000 15 5 30 0.002 0.003 0.04 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.002 0.0002 0.0002 0.0002 0.0002 0.001 0.003 0.05 0.0002 0.2 0.4 0.001 0.005 0.007 0.001 0.005	Negative 14.5 3.44 236 <1	Negative 167 5.76 376 <1	Negative 14.3 6.52 280 <3	Negative 16 6.09 402 0.92 0.37 0.4 <1	Negative 18.1 4.94 207 <3	13.1 6.61 224 <3

Water Quality Summary Barnstable New Source Exploration Study Phase 3 - Well Exploration Program