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## Info Item No. 2

August 15, 2013  
File:1049385/121510734

Brunello Estates Inc.  
2000 Barrington Street  
Suite 202  
Halifax, NS B3J 3K1

**Attention: Andrew Giles, P. Eng.**

Dear Mr. Giles:

**Reference: Construction Monitoring Report Year 2 – Q4**

Brunello Estates has a proposed 18-hole golf course and residential development between Lakeside and Timberlea in Halifax, Nova Scotia, currently under construction. The property is bordered by Highways 3 and 103 (Figure 1). Further information regarding the development can be found at [www.brunelloestates.com](http://www.brunelloestates.com). All watercourses within the project area are identified and the associated fish habitat is described in the Aquatic Assessment report titled "Brunello Estates – Stream Assessments in Preparation for an Application for Watercourse Alteration" (Stantec 2009a). This report also includes baseline data on *in-situ* water quality and physical characteristics.

The Brunello Estates water quality monitoring plan was accepted by the Halifax Area Watershed Advisory Board (HWAB) in February 2012. The plan was based on information contained within the "Halifax Regional Municipality's Water Quality Monitoring Functional Plan" (Stantec 2009b). The Water Quality Monitoring Functional Plan (WQMFP) is one of a series of diverse functional plans mandated by the "HRM Regional Municipal Planning Strategy" (HRM 2006). Functional Plans are considered to be management guides considering the detailed elements of policy programming. Recognizing that "environmental features within a watershed all are connected and land-use activities in one part of the watershed can adversely affect quality and quantity of water in another", the Regional Municipal Planning Strategy (RMPS) in Policy E-18 identifies the need for the WQMFP to assist in the sustainable management land use and water resources.

### **SURVEY METHODOLOGY**

The water quality monitoring was carried out according to the monitoring plan illustrated in the *Brunello Estates Water Quality Monitoring Plan* (Stantec 2011).

Sample locations were chosen based on the proximity of construction activities surrounding the watercourses, the identified habitat described in the aquatic assessment report (Stantec 2009a) and the connectivity of the watercourses to larger systems. In total six locations were chosen to be monitored all of which are streams or brooks (*i.e.* Lotic systems). Three of the watercourses in the monitoring program drain into Governors Lake (WC 1, 2 and 6), with two located along the western extent of the property flowing into Nine Mile River (WC-11 and WC-13). The remaining two watercourses (WC-4 and WC-7) are predominantly overland drainage connecting wetlands. Figure 1 illustrates the locations of the water quality monitoring stations on each stream.

**Reference: Construction Monitoring Report Fourth Quarter– Year 2**

## **LOCATION AND DATES OF SAMPLING**

Construction activities in this quarter have been limited to the central portion of the development and as such interaction of the development with the freshwater environment was limited to the area upstream of WC-7 and WC-6. Water chemistry sampling continued at both stations on each of the dates below:

- April 17, 2013
- May 9, 2013
- June 7, 2013

Supplemental to the water chemistry samples taken, the following water quality parameters were measured in the field at each location.

- Date and time
- pH
- Conductivity
- Dissolved oxygen
- Air temperature
- Water temperature
- Ice depth (Winter)
- Incidental wildlife sightings,
- Observations on water clarity and odour

## **RESULTS**

Monitoring events were chosen to correspond with periods of weather typical to the season in which the monitoring occurred with periods of elevated rainfall and drought conditions avoided (if possible). Meteorological conditions observed prior to sample collection were as follows:

- April 17, 2013: Mainly Clear, 8°C, 1 mm in the previous 48 hrs.
- May 9, 2013: Cloudy, 12°C, trace precipitation in the previous 48 hrs.
- June 7, 2013: Overcast/ light rain, 11°C, 0 mm in the previous 48 hrs.

The water in WC-7 at the time of the sample collection was observed to be tea-stained during all sampling events with no unusual odours observed during any event. In addition, no sedimentation was visible during any of the site visits. The water in WC-6 was observed to be clear with no unusual odours and no visible sedimentation during any of the three site visits.

It should be noted that during the April 17, 2013 monitoring event, field staff observed that additional surge material had been placed at the western side (up-gradient side) of the temporary bridge at WC-6.

## **Water Quality**

The following two Tables summarize the water quality measured in WC-6 and WC-7 during the fourth quarter of Year 2 of construction monitoring. Samples collected during each of the three monitoring events were submitted for laboratory analysis of E.Coli, Total Phosphorous, TSS, Turbidity, and Colour; additionally, the April 17, 2013 samples were analyzed for general chemistry and total metals. All chemical analysis and field measurements not summarized below are included as an attachment with the relevant guidelines.

## Reference: Construction Monitoring Report Fourth Quarter– Year 2

Table 1 Brunello Estates – Year 2 Second Quarter WC-7 Construction Monitoring Results

Watercourse 7	April 17, 2013	May 9, 2013	June 7, 2013	Baseline Mean	Year 2 – Q2 Mean
pH <sup>2</sup> (pH units)	6.35	5.74	5.52	4.59	5.87
Specific Conductivity <sup>2</sup> (µS/cm)	172.2	45.2	41.7	55	86.4
Total Phosphorous (µg/L)	18	33	43	16	31
Total Suspended Solids (mg/L)	3.4	2.1	13.2	1	6.2
Dissolved Oxygen <sup>2</sup> (mg/L)	9.8	7.8	7.3	7.20	8.3
Dissolved Oxygen <sup>2</sup> (%)	76	70	-	62.0	73
<i>E. coli</i> (CFU/100ml)	ND	3	ND	ND	1.3

<sup>1</sup> One half RDL value used for calculation of average where one or more samples were reported as non-detectable.

<sup>2</sup> Measured In-situ

<sup>3</sup> "-" = parameter not measured during this field event

Table 2 Brunello Estates – Year 2 fourth Quarter WC-6 Construction Monitoring Results

Watercourse 6	April 17, 2013	May 9, 2013	June 7, 2013	Baseline Mean	Year 2 – Q2 Mean
pH <sup>2</sup> (pH units)	6.35	7.35	6.48	6.44	6.73
Specific Conductivity <sup>2</sup> (µS/cm)	1182.0	214.8	183.2	240	526.7
Total Phosphorous (µg/L)	21	21	37	23	27
Total Suspended Solids (mg/L)	2.8	ND	2.6	2	2.0
Dissolved Oxygen <sup>2</sup> (mg/L)	11.6	8.4	9.7	8.95	9.9
Dissolved Oxygen <sup>2</sup> (%)	89	76	-	73.6	82.5
<i>E. coli</i> (CFU/100ml)	13	ND	6	13	6.5

<sup>1</sup> One half RDL value used for calculation of average where one or more samples were reported as non-detectable.

<sup>2</sup> Measured In-situ

<sup>3</sup> "-" = parameter not measured during this field event

## Discussion

The results of the water chemistry sampling and *in-situ* water quality measurements are discussed below in comparison to the relevant Canadian Council of the Ministers of the Environment (CCME) Guidelines for the Protection of Freshwater Aquatic Life (CCME FAL) and Recreational Water Quality Guidelines (RWQG).

The mean pH for WC-6 (6.73) falls within the range recommended for the protection of aquatic life. For WC-7, the pH ranges in the acidic with a mean of 5.87; however, this is similar to conditions observed during the baseline sampling events and elsewhere within Nova Scotia. CCME FAL recommends a pH range of 6.5 to 9.5 pH units to maintain fish health. Low pH values reduce the ability of certain species to spawn and hinder

**Reference: Construction Monitoring Report Fourth Quarter– Year 2**

tissue development in juveniles (CCME 2006). During baseline fish habitat assessments it was determined that no fish habitat was present within WC-6 or WC-7 and therefore the recommended CCME FAL pH range is utilized as a reference value. It should be noted that viable fish communities in Nova Scotia have been observed by Stantec personnel in pH levels similar to or more acidic than those measured in the watercourses of Brunello Estates.

Levels of nutrients found in WC-7 and WC-6 were elevated as compared to the baseline results. Accumulation will become evident initially through increased nutrient levels in measured water quality and subsequently through in-stream vegetation growth. In general, nutrients remain elevated for a greater period of time in lentic (still water) systems than for lotic (moving water) systems based on the reduced flushing rates of the former.

The trophic state of a body of water is a general measure of the nutrient accumulation within. The CCME *Canadian Guidance Framework for the Management of Freshwater Systems* has developed trophic levels based on ranges of phosphorous concentrations. A body of water is usually classified as being in one of four possible classes (*oligotrophic*, *mesotrophic*, *meso-eutrophic* or *eutrophic*) ranging from low to high trophic status. Watercourses with extreme trophic indices may also be considered *hyperoligotrophic* or *hypereutrophic*. Based on the fourth quarter mean total phosphorous results, WC-6 and WC-7 can both be classified as Meso-eutrophic. A Meso-eutrophic stream is one in which the water is approaching the limit for nutrient input. The water is usually turbid with beds of submerged aquatic macrophytes; algae can be present in the late summer leading to increased water turbidity.

Water clarity and transparency of the streams in Brunello Estates were measured by observations and the concentrations of total suspended solids (TSS) in the water samples. TSS is a direct measure of the weight of solids in the water; this parameter is predominantly used as a method to indicate the quantity of sediment in the water column. TSS in the baseline samples of both WC-6 and WC-7 were low (WC-6 mean = 2 mg/L, WC-7 mean = 1 mg/L) and continues to be low during the fourth quarter of year two (WC-6 mean = 2 mg/L, WC-7 mean = 6.2 mg/L); these levels of sediment in the water column indicate aquatic environments with little sedimentation through erosion or other anthropogenic effects. CCME FAL recommend a maximum TSS increase of 5 mg/L over background levels for effects lasting longer than 30 days, this leads to an interpreted guideline concentration for Brunello Estates of 7 mg/L for WC-6 and 6 mg/L for WC-7. TSS levels at WC-6 are below the interpreted guideline and similar to results noted during the baseline assessment. TSS levels at WC-7 were slightly above the interpreted guideline, due to elevated (more than 2 times the guideline) results from the June 7, 2013 monitoring event.

*E.coli* is a type of faecal bacteria commonly found in the intestinal tract of warm-blooded animals and is used as an assessment tool to identify fecal contamination. During the baseline monitoring *E.coli* concentrations within the streams of Brunello Estates development were low with detectable results measured solely in the streams adjacent to existing residential units (WC-1, WC-4, and WC-6). The source of the *E.coli* measured in the three streams cannot be determined but could be attributed to wildlife, pets, or humans. As bacterial contamination has little effect on aquatic habitats the primary reason for monitoring is related to human health. *E. coli* was detected in two of three samples of WC-6 during the fourth quarter of year two, with reported concentrations of 13 CFU/100ml and 6 CFU/100ml. WC-7 reported detectable concentrations of *E. coli* during only one of the three sampling events this quarter, with a concentration of 3 CFU/100m. All reported detections were well below the CCME recreational guidelines for freshwater set at 200 CFU/100ml.

**SUMMARY**

The results provided in this report represent the findings of the fourth quarter of Year 2 for the construction monitoring program which occurred between April and June 2013. During this period, water quality generally remained similar to values observed during the baseline monitoring program. Total phosphorous remains

**Reference: Construction Monitoring Report Fourth Quarter– Year 2**

elevated over the baseline results in WC-7; however, results are generally consistent with those observed during Q2 and Q3 of year 2, and are lower than those observed during Q1 – year 2. The elevated total phosphorous levels, as compared to baseline results, may be due to natural variation through weather patterns and seasonality differences between the two monitoring periods. This data report was created to provide Brunello Estates a brief overview of the water quality observed during the previous quarter as compared to the baseline results.

**References**

Clair, T.A., Dennis, I.F., Scruton, D.A., Gilliss, M. *Freshwater acidification research in Atlantic Canada: a review of results and predictions for the future*. Accessed in May 2011, at <http://www.nrcresearchpress.com/toc/er/15/NA>

Canadian Council of Ministers of the Environment, 2004. *Canadian Water Quality Guidelines for the Protection of Aquatic Life*.

Canadian Council of Ministers of the Environment, 2004. *Phosphorous: Canadian Guidance Framework for the Management of Freshwater Systems*

Halifax Regional Municipality, 2011. *Seasonal Water Quality Sampling Program*. As accessed in May 2011 at: <http://www.halifax.ca/environment/lakesanddrivers.html#SeasonalSampling>

Nova Scotia Environment, 2011. *Water Quality Dataset*.

**CLOSING**

We trust that this report meets the requirements pertaining to the development agreement between Nine Mile River Investments and HRM for the project known as Brunello Estates. Stantec is open to comments and suggestions regarding this study, and appreciates any feedback from local watershed advisory boards.

This report was undertaken exclusively for the purpose outlined herein and was limited to the scope and purpose specifically expressed in this report and the referenced documents. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a fourth party, or any reliance on decisions made based upon it, are the responsibility of such fourth parties. Stantec Consulting, Ltd. (Stantec) accepts no responsibility for damages, if any, suffered by any fourth party as a result of decisions made or actions taken based on this report.

Stantec makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report were assumed by Stantec to be accurate. Conclusions presented in this report should not be construed as legal advice.

This report represents the best professional judgment of Stantec personnel available at the time of its preparation. Stantec reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

August 15, 2013

Andrew Giles

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**Reference: Construction Monitoring Report Fourth Quarter– Year 2**

This report was prepared by W. Luke Miller and reviewed by Elizabeth Kennedy. Should you have any questions, please do not hesitate to contact Elizabeth Kennedy at (902) 468-7777.

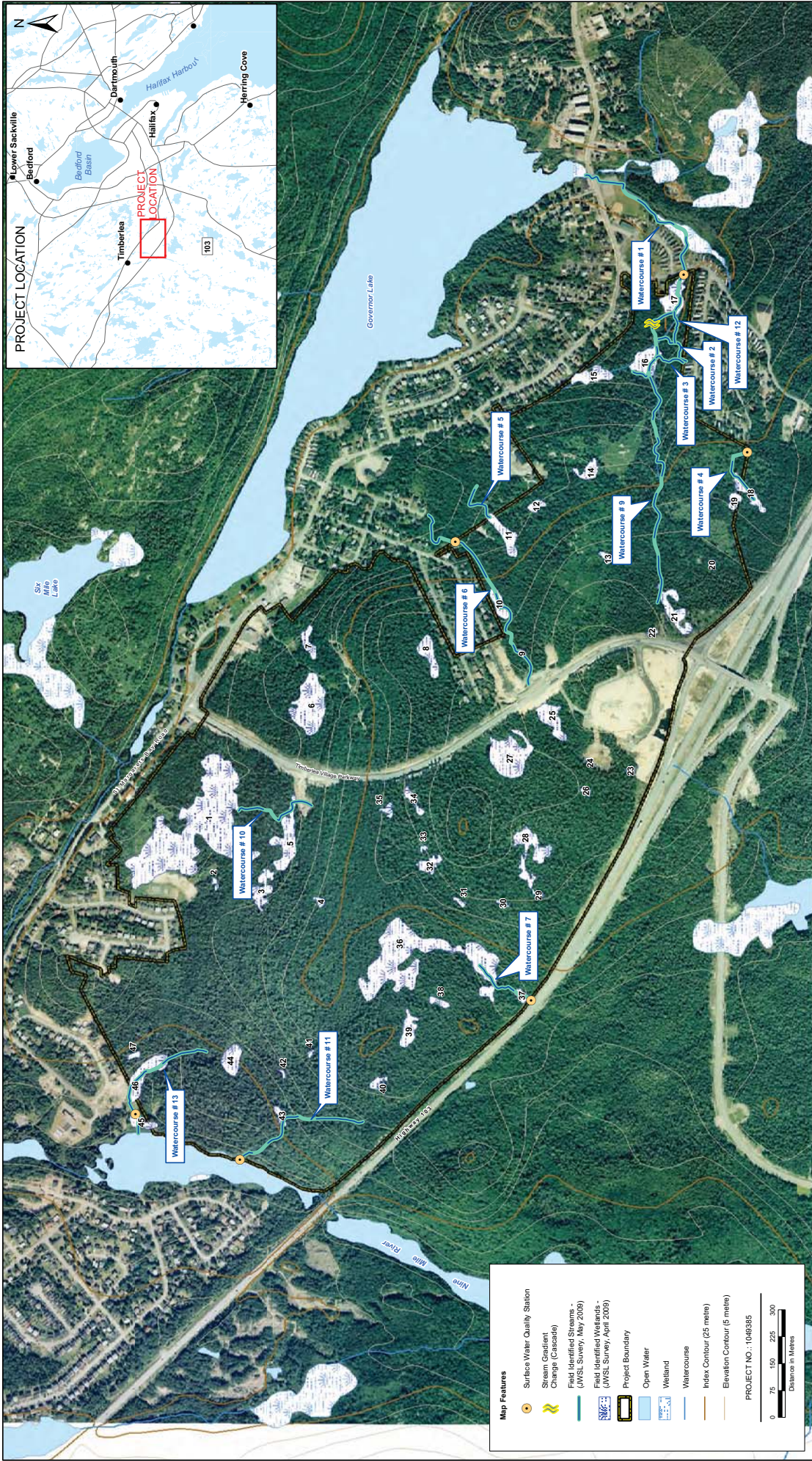
Sincerely,

**STANTEC CONSULTING LIMITED**

Original Signed

W. Luke Miller B.Sc., EPT.  
Environmental Scientist

Attachment: Figure 1 – Water Quality Monitoring Locations  
Water Quality Results and Relevant Guidelines



AUTHOR: C.Shupe APPROVED BY: H.Aubrey		DATE: January 27, 2010 SCALE: 1:10,000	
		COORDINATE SYSTEM: UTM NAD 83 ZONE 18	
<b>Figure 2</b> Brunello Estates <b>Sampling Locations for Brunello Estates Water Quality Monitoring Plan.</b>			
		PROJECT NO.: 1049385	

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Table 2: Brunello Estates Water Chemistry (Metals)

RESULTS OF ANALYSES OF WATER		Watercourse #6												CCME	FWAL			
Sampling Period	Date	Calculated Parameters	Units	mm/dd/yyyy	Year 2 - First Quarter			Year 2 - Second Quarter			Year 2 - Third Quarter			Year 2 - Forth Quarter			Guidelines	
					6/25/2012	7/18/2012	8/23/2012	9/25/2012	10/31/2012	11/23/2012	12/11/2012	1/xx/2013	3/18/2013	4/17/2013	5/9/2013	6/7/2013		
			RDL															
Total Aluminum (Al)	ug/L	5.0		-	-	-	-	-	-	-	-	-	-	-	693	-	-	100
Total Antimony (Sb)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Arsenic (As)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	5
Total Barium (Ba)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	20.4	-	-	
Total Beryllium (Be)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Bismuth (Bi)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Boron (B)	ug/L	50		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Cadmium (Cd)	ug/L	0.017		-	-	-	-	-	-	-	-	-	-	-	0.031	-	-	0.017
Total Calcium (Ca)	ug/L	100		-	-	-	-	-	-	7180	-	-	-	-	8230	-	-	
Total Chromium (Cr)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Cobalt (Co)	ug/L	0.40		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Copper (Cu)	ug/L	2.0		-	-	-	-	-	-	ND	-	-	-	-	ND	-	-	2
Total Iron (Fe)	ug/L	50		-	-	-	-	-	-	393	-	-	-	-	697	-	-	300
Total Lead (Pb)	ug/L	0.50		-	-	-	-	-	-	-	-	-	-	-	0.56	-	-	1
Total Magnesium (Mg)	ug/L	100		-	-	-	-	-	-	1950	-	-	-	-	2460	-	-	
Total Manganese (Mn)	ug/L	2.0		-	-	-	-	-	-	8.4	-	-	-	-	36.1	-	-	
Total Molybdenum (Mo)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Nickel (Ni)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	25
Total Phosphorus (P)	ug/L	100		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Potassium (K)	ug/L	100		-	-	-	-	-	-	1480	-	-	-	-	2090	-	-	
Total Selenium (Se)	ug/L	1.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	1
Total Silver (Ag)	ug/L	0.10		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	0.1
Total Sodium (Na)	ug/L	100		-	-	-	-	-	-	19900	-	-	-	-	42200	-	-	
Total Strontium (Sr)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	33.1	-	-	
Total Thallium (Tl)	ug/L	0.10		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	0.8
Total Tin (Sn)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Titanium (Ti)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	18.1	-	-	
Total Uranium (U)	ug/L	0.10		-	-	-	-	-	-	-	-	-	-	-	0.54	-	-	
Total Vanadium (V)	ug/L	2.0		-	-	-	-	-	-	-	-	-	-	-	ND	-	-	
Total Zinc (Zn)	ug/L	5.0		-	-	-	-	-	-	ND	-	-	-	-	7.4	-	-	30

Values in bold exceed CCME/FAL guidelines