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Technical Memorandum

To	North Kent 1 LP	Page	1
CC	Mark Van der Woerd (AECOM), Jody Law (Pattern), Joshua Vaidhyan (Samsung)		
Subject	**North Kent Wind 1 (Chatham-Kent, ON)** **Well Water Impact Complaint Investigation** **[redacted] – PIN 007450074, [redacted] (Dresden, ON)**		
From	Jason Murchison, P.Geo.		
Date	March 22nd, 2018	Project No.	60343599

1. Introduction and Background

AECOM Canada Ltd. (AECOM) has been retained by North Kent Wind 1 LP (NKW1) to provide hydrogeological services pursuant to *Condition G* of Renewable Energy Approval (REA) No. 5272-A9FHRL.

The purpose of this Technical Memorandum (TM) is to present a response to a water well interference complaint that was received by NKW1 via the Project's toll-free telephone line on 13-December-2017. Upon receipt of the complaint, email notification was provided by NKW1 (c/o Mr. Joshua Vaidhyan) to Ms. Deb Jacobs, Environmental Officer, with the Ministry of the Environment and Climate Change (MOECC), Windsor Area Office that same day. In his correspondence, Mr. Vaidhyan provided a summary narrative of the well interference complaint that was received from the property owners of [redacted] (Dresden, ON).

In brief, Mr. Vaidhyan describes the well interference complaint, as follows:

> *We received a complaint through our Project's toll-free line, below. Please note that there has been no piling activity for over a month (November 8th), and there are no turbines operating. Under these circumstances, it is our belief that this should not be considered as an official complaint. Please advise.*
>
> ***PIN:*** *00745-0074*
>
> ***Address:*** [redacted]
>
> ***Owner:*** [redacted]
>
> ***Phone:*** [redacted]
>
> ***Report:*** *No water and water is black.* [redacted] *frantic to get water to her animals.*
>
> ***Closest Turbine:*** *T6 approx. 900m N.*
>
> ***Other Turbines:*** *T38 (SW 1,000m) & T31 (NE ~1,400m).*

In reply, Ms. Jacobs provided the following:

> *I also received a call from* [redacted] *this morning. It is the Ministry's position that this should be considered an official complaint. That said, it is understood that there is no vibration monitoring going on right now and so site investigation would be by AECOM alone that this point. You have the main details of the complaint below and the complainant did indicate that he was providing permission to*

us to pass the information on to you. I pointed out to the complainant that there had not been pile driving for about a month, and their response back to me was that there was lots of construction going on at nearby sites and heavy equipment driving around the piles which go down to the bedrock. Please note: I am not saying that I agree or disagree with this assertion, simply that that was the explanation put forth by the complainant. You may wish to see if Golder can provide an opinion on the plausibility of this in the complaint report.

One thing [redacted] told me this morning was that he indicated that he had experienced a short-term issue back in August or September where he couldn't get water, but that the situation resolved itself without follow up. [redacted] indicated that he spoke with Pat Murray by Telephone at that time to advise the company of the matter. I can find no record of a report to the Ministry of this contact / complaint. Please enquire with your staff and advise on this.

A copy of the correspondence described above is provided herein as **Attachment A**.

2. REA Condition Response

Table 1 provides a summary of action(s) taken pursuant to REA Condition G5 in response to the current well interference complaint.

TABLE 1: REA CONDITIONS AND RESPONSE SUMMARY

REA CONDITIONS	ACTION(S) TAKEN
G5. Should the Company receive a complaint about wells or well water from an owner of an active water well (i) within the Project Study Area; or (ii) outside of the Project Study area and located within 1 km from each individual Equipment and meteorological tower, the microwave tower, and the operations & maintenance building, the Company shall retain a qualified expert (P.Eng or P.Geo) to immediately undertake the following: (1) collect a water well sample at the complainant's water well, prior to any treatment systems ("raw"), after allowing the distribution system to flow for approximately 5 minutes and submit the water sample to a qualified laboratory for an analysis of the general chemistry suite of water quality parameters identified in Condition G3; (2) compare the results of the analysis of the water sample noted in Condition G5(1) to the pre-construction water sampling analysis results noted in Condition G3 for the subject well (if a pre-construction water sample at the subject well was taken); and, (3) provide a detailed written opinion as to whether the water sampling analysis results demonstrate that the construction, operation or decommissioning of the Facility caused or may have caused an adverse effect to the well's water supply.	Steps undertaken to satisfy the requirements of Condition G5 are summarized, as follows: (1) AECOM was retained by NKW1 to investigate a Well Interference Complaint received directly from the property owners on 13-December-2017. (2) AECOM arranged directly with the property owners an appointment to visit the property at 1:00pm on 18-December-2017, based on the availability of the property owner. (3) Tasks completed by AECOM during the well interference complaint site visit included: i) interview with the property owner regarding their reported well interference issue(s); ii) collection of a raw (untreated) groundwater sample for analytical laboratory testing; and, iii) digital photographs of pertinent site features (eg. well, pumping system, etc.). (4) Information obtained during the site visit has been compiled and is summarized within this technical memorandum. An opinion regarding potential association of the well interference complaint with local construction activities as part of the NKW1 Project is provided and potential remedial options are presented, as appropriate.

2.1 Property Owner Statements Regarding Well Interference Complaint

During AECOM's 18-December-2017 site visit to the subject property, a series of seven (7) standard questions were raised with the property owner [redacted] for the purposes of obtaining further details regarding their reported well water supply issue(s). The questions raised with the property

owner were as detailed on *Form B: Well Complaint Procedure for Site Investigation*, included as part of MOECC's approved *Well Interference Protocol* (AECOM, 2017) for the NKW1 project.

TABLE 2: PROPERTY OWNER QUESTIONNAIRE RESPONSE SUMMARY

QUESTION	PROPERTY OWNER RESPONSE
"Please explain the type of problem you are having"	• Changed from original complaint; originally did not have any water coming out of the well. Now water supply is constant, but he has particles within the water from his well. • Homeowner also is concerned about the quality of water being consumed by his animals.
"What do you think is the cause?"	• Cannot say 100% sure. The only change is the turbine across the street.
"When did you first notice the problem (Date/Time)?"	• The issue was first noticed in August 2017, and Pat Murray was contacted at that time. • Most recently, it was noticed on the evening of 12-December-2017.
"Is the problem still occurring?"	• Still slow and discoloured with black sand.
"Do you have an alternate source of potable water (i.e. municipal water)?"	• No.
"Were you provided a temporary supply of potable water?"	• Yes, but only using drinking water provided, waiting for the storage tank to be winterized. • Well water is still being used for showering and for the animals on the property.
"Did you participate in the Detailed Well Assessment program prior to construction?"	• No.

Upon completion of the questionnaire, both the property owner ([redacted]) and his representative of Water Wells First (Mr. Kevin Jakubec) were provided an opportunity to review the responses detailed in **Table 2** to ensure their accuracy.

3. Operational Activities and Vibration Monitoring

Within a one (1) month timeframe preceding the property owner's reported outset of recent well impact (12-December-2017), no pile driving activities for foundation construction as part of the NKW1 project were completed within a 9 km radius of [redacted]. Similarly, no turbines reportedly were operating within the area during that same period.

The following three (3) turbines represent the closest foundation construction locations to [redacted]

- T6 – last pile completed on 31-July-2017 @ 962 m North-Northwest
- T38 – last pile completed on 24-October-2017 @ 1,083 m Southwest
- T31 – last pile completed on 18-July-2017 @ 1,473 m East-Northeast

The following two (2) turbines represent the closest foundation construction locations to [redacted] where construction was occurring in November / December 2017:

- T73 – last pile completed on 1-November-2017 @ 5,756 m Southwest
- T34 – last pile completed on 8-November-2017 @ 9,423 m Northwest

Construction timeframes, along with approximate directions and distances away from the subject property are provided for reference purposes. As can be observed, T6 represents the nearest turbine location to the subject property. Pile driving for foundation construction at T6 was completed exclusively on 31-July-2017, more than four (4) months prior to the reported outset of recent well interference impact(s) at the subject property.

Monitoring of vibration effects during pile driving at each of the above-noted turbine locations was completed by Golder Associates Ltd. (GAL) on behalf of NKW1 in accordance with *Condition H* of the REA. The monitoring program developed and implemented by GAL (and as approved by MOECC) comprised the measurement of particle velocities at locations in close proximity to the piles, as well as at local private water well supplies.

A site-specific vibration assessment pertaining to the subject property was completed by GAL, the results of which are presented in a technical letter, dated 9-January-2018. The conclusions of GAL's site-specific assessment are summarized, as follows:

> *Given the elapsed time between the last pile driven for the Project and the complaint date, the transient nature of pile driving vibrations, proximity of pile driving earlier in the year and dates on which the work was completed, and the distances between the well and turbine locations, it is our opinion that the reported conditions are entirely unrelated to pile driving for turbine foundations.*

A copy of the GAL site-specific assessment letter is included herein as **Attachment B**.

4. Well Construction Details

Table 3 provides a summary of available construction details for the existing water well located at [redacted], based on details provided to AECOM by [redacted] during the well interference complaint site visit on 18-December-2017.

A review of the MOECC on-line database did not reveal a water well record for the subject property.

Measurement of well details (i.e., including total depth, water level, etc.) was not completed by AECOM during our 18-December-2017 site visit due to the wellhead being buried below grade within a pumphouse located to the rear of the residence. A photograph of the reported well location is provided herein as **Photo 1**.

TABLE 3: REPORTED PRIVATE WELL CONSTRUCTION DETAILS

DETAILS	[redacted] (PIN 007450074)
Well Tag #	*Unknown*
Well ID	*Unknown*
Installation Date	*Unknown*
Well Location	*Unknown*
Contractor	*Unknown*
Contractor No.	*Unknown*
Construction Method	*Unknown*
Total Depth	*Unknown*
Target Formation	*Unknown*
Casing Length	*Unknown*

DETAILS	[redacted] (PIN 007450074)
Casing Diameter	*Unknown*
Casing Material	*Unknown*
Casing Stick-Up	*Unknown*
Annular Seal	*Unknown*
Sealant Type	*Unknown*
Well Screen Installed?	*Unknown*
Well Screen Details	*Unknown*
Well Screen Interval	*Unknown*
Well Cover Type	*Unknown*
Pump Intake Depth	*Unknown*
Pumping Rate	11.5 L/min (3.0 USgpm) based on testing results obtained by AECOM on 18-December-2017
Well Pump Type	Jet Pump (as observed by AECOM)
Well Pump Size	½ hp (as observed by AECOM)
Static Level	*Unknown*
Pumping Level	*Unknown*

NOTE: mBGS - meters below ground surface; L/min – litres per minute; USgpm – US gallons per minute.



PHOTO 1: REPORTED WELL LOCATION (BELOW PUMPHOUSE FLOOR)

4.1 Limited Well Flow Rate Testing and Pumping System Assessment

During AECOM's well interference complaint investigation site visit on 18-December-2017, a limited flow rate test was completed to assess the current pumping capacity of the ½ hp jet pump connected to the well (Goulds® J5SH). Testing was completed using a yard hydrant installed within a barn structure located at the rear of the subject property.

For the test, the water system was permitted to flush continuously for a period of approximately fifteen (15) minutes. During pumping, the discharge rate was assessed by AECOM on three (3) separate occasions by timing the collection of 12 L of water into a calibrated pail. Measurement results indicated an average discharge rate of approximately 11.5 L/min (3.0 USgpm) for the jet pump that currently is connected to the well.

No variation in flow rate (including increasing or decreasing trends) was observed during testing. Similarly, no detectable changes in the quality of the water discharge stream (eg. colour, odour, dissolved gas, sediment, etc.) were identified. The water pumped from the well was odourless, clear and colourless, with a small amount of sediment being observed within the calibrated pail at the conclusion of each flow rate test (**Photo 2**).



PHOTO 2: SEDIMENT WITHIN FLOW SAMPLING PAIL

5. Water Quality Data

Table 4 provides a summary of available groundwater quality data for the site well. Laboratory Certificates of Analysis are included as **Attachment C**.

TABLE 4: PRIVATE WELL SAMPLING SUMMARY

LOCATION	SAMPLED BY	DATE	TYPE	PURPOSE
[redacted]	--	--	--	Baseline – Did not Participate
	AECOM	18-December-2017	Raw (Untreated)	Complaint Investigation

5.1 Discussion

Available raw (untreated) groundwater quality data for the site well is provided in **Table 5**, which includes analysis results from AECOM's 18-December-2017 site visit pertaining to the property owner's current interference complaint. It is noted that the property owners declined to participate in the NKW1 water well survey and baseline sampling programs.

TABLE 5: RAW (UNTREATED) GROUNDWATER SAMPLING RESULTS

PARAMETER	ODWQS CRITERIA	ODWQS TYPE	BASELINE	COMPLAINT INVESTIGATION (18-December-2017)
Escherichia coli	0 CFU/100mL	MAC	*Did not Participate*	Non detection
Total Coliforms	0 CFU/100mL	MAC	--	Non detection
Electrical Conductivity	--	--	--	726 µS/cm
pH	6.5 – 8.5	OG	--	8.43
Total Hardness (as $CaCO_3$)	80 – 100 mg/L	OG	--	**21.4 mg/L**
Total Dissolved Solids	500 mg/L	AO	--	440 mg/L
Total Suspended Solids	--	--	--	<10 mg/L
Alkalinity (as $CaCO_3$)	30 – 500 mg/L	OG	--	343 mg/L
Fluoride	1.5	MAC	--	1.48 mg/L
Chloride	250	AO	--	58.4 mg/L
Nitrate as N	10	MAC	--	<0.05 mg/L
Nitrite as N	1	MAC	--	<0.05 mg/L
Bromide	--	--	--	0.16 mg/L
Sulphate	500 mg/L	AO	--	<0.10 mg/L
Ammonia as N	--	--	--	0.18 mg/L
Dissolved Organic Carbon	5 mg/L	AO	--	2.5 mg/L
Colour	5 TCU	AO	--	**6 TCU**
Turbidity	5 NTU	AO	--	1.1 NTU
Calcium	--	--	--	5.49 mg/L
Magnesium	--	--	--	1.86 mg/L
Sodium	200 mg/L	AO	--	163 mg/L
Potassium	--	--	--	1.21 mg/L
Iron	0.300 mg/L	AO	--	0.287 mg/L
Manganese	0.050 mg/L	AO	--	0.003 mg/L

NOTE: MAC – maximum acceptable concentration (health-related); AO – Aesthetic Objective (non health-related); Operational Guideline (non health-related).

At the time of AECOM's well interference complaint investigation site visit on 18-December-2017, no water treatment devices were observed or reported by [redacted] to be installed at the subject property.

Raw (untreated) groundwater sample collection during AECOM's 18-December-2017 site visit was completed using the same yard hydrant in the barn as was utilized during flow rate testing (**Photo 3**). Prior to sampling, the faucet was permitted to flush thoroughly with the pumped water being collected within a pail. Prior to sample collection, the faucet orifice was disinfected (using chlorine) and flushed. Clean nitrile gloves were worn by AECOM staff during sample collection.

The groundwater sample was examined by AECOM in the field for any visual or olfactory evidence of impact and then immediately placed in laboratory-supplied sample bottles prepared in advance with the appropriate preservatives, sealed, labeled and stored on ice to maintain a sample temperature of

10°C or lower during transportation under chain of custody documentation to a CALA-accredited environmental analytical laboratory within the specified sample analyte holding times.



PHOTO 3: SAMPLING AND FLOW RATE TESTING LOCATION (WITHIN BARN)

At the time of sample collection, the raw (untreated) groundwater pumped from the well was observed to be clear and colourless, with a minor amount of sediment observed at the base of the sample bottles. No apparent odour(s) or entrained gas was detected.

No exceedances of bacteriological (E.coli / Total Coliforms) or inorganic (Fluoride, Nitrate [as N], Nitrite [as N]) health-related parameters of the Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWQS) included in the analytical suite were detected in the 18-December-2017 raw (untreated) groundwater sample.

Turbidity is an Aesthetic Objective (AO) of the ODWQS. In this regard, a value of 5 Nephelometric Turbidity Units (NTU) has been established by MOECC. The MOECC's *Technical Support Document for Ontario Drinking Water Standards, Objectives and Guidelines* (June 2003; revised June 2006) makes a clear distinction between turbidity related to organic constituents and inorganic constituents stating: "Raw water supply which is ground water with very low organic content may contain inorganic-based turbidity, which may not seriously hinder disinfection. For such waters, an Operational Guideline for turbidity is not established". Further guidance is provided by MOECC regarding the relationship between turbidity and its organic and inorganic components, the disinfection processes, and as a measure of the water supply filtration and treatment efficiency. The technical explanations also note that while organic turbidity is an important measure as related to health concerns, the AO value is an aesthetic component which is set for all waters at the point of consumption (i.e., not at the source). At the site well, a turbidity value of 1.1 NTU was reported by the laboratory for the 18-December-2017 raw (untreated) groundwater sample, which was well below the ODWQS AO value of 5 NTU.

Total suspended solids (TSS) within the 18-December-2017 raw (untreated) groundwater sample was reported as being below the laboratory's Reported Detection Limit (RDL) of 10 mg/L, indicating the

presence of a low sediment load in the groundwater source pumped from the well. An ODWQS criteria limit has not been established for this parameter.

The potential for groundwater quality impact(s) associated with pile driving is both time-dependent and related to the intensity and propagation of ground-borne vibration. In this instance, no pile driving activities were completed for the project (within a 9 km radius) during a period of one (1) month prior to the reported outset of recent well impacts (12-December-2017). As such, no vibrations attributable to pile driving activities as part of the NKW1 project would have been present in proximity to the site well within a month prior to or on the date of outset of impact, as reported by the property owners.

As an alternate consideration, to have the potential to impact the subject well vibration impacts in the immediate vicinity of a pile driving (turbine) location would have needed to result in: i) the suspension of settled particles within the groundwater system; ii) the particles remaining in suspension for a prolonged period of time; and, iii) the water well being situated in a position hydraulically downgradient of and/or within the radius of pumping influence relative to the pile driving location. Factors (ii) and (iii) above are not considered plausible in the context of the local hydrogeological setting (ie. potential hydraulic gradient and groundwater travel times), vibration monitoring data collected by GAL during the course of project construction, and recent sampling results.

6. Conclusions

Based on a review and interpretation of information gathered during AECOM's well interference complaint investigation, as presented herein, it is our opinion that the groundwater quality issue currently reported by the property owners at [redacted] (PIN 007450074) is *not* as a result of NKW1 turbine construction or operations.

The water well interference impact(s) reported by the property owners appear to be related to local water system and/or well construction / condition issues versus an area-wide impact to the local groundwater system. It is recommended that the property owners consult with a qualified water well contractor regarding the current condition of their on-site well supply and pumping system.

This interpretation and opinions presented in this technical memorandum are based on information available as of the date the document was prepared. Should additional information become available at a future date, AECOM reserves the right to review and potentially reconsider the findings of our current assessment through the issuance of addenda to this technical memorandum.

-- End of Memorandum --

Attachments

Attachment A

Correspondence

From: Jacobs, Deb (MOECC) [mailto:deb.jacobs@ontario.ca]
Sent: Wednesday, December 13, 2017 10:15 AM
To: Joshua Vaidyan; Jody Law (jody.law@patternenergy.com)
Cc: Gilbert, Teri (MOECC); Smith, Mark (MOECC); Harman, Bruce (MOECC); Thuss, Simon (MOECC); Moroney, Michael (MOECC); Lehouillier, Jason (MOECC); McDonald, Dan (MOECC)
Subject: RE: New Complaint - [redacted])_North Kent 1

Hi Josh,

I also received a call from [redacted] this morning. It is the Ministry's position that this should be considered an official complaint. That said, it is understood that there is no vibration monitoring going on right now and so site investigation would be by AECOM alone that this point. You have the main details of the complaint below and the complainant did indicate that he was providing permission to us to pass the information on to you. I pointed out to the complainant that there had not been pile driving for about a month, and their response back to me was that there was lots of construction going on at nearby sites and heavy equipment driving around the piles which go down to the bedrock. Please note: I am not saying that I agree or disagree with this assertion, simply that that was the explanation put forth by the complainant. You may wish to see if Golder can provide an opinion on the plausibility of this in the complaint report.

One thing [redacted] told me this morning was that he indicated that he had experienced a short-term issue back in August or September where he couldn't get water, but that the situation resolved itself without follow up. [redacted] indicated that he spoke with Pat Murray by Telephone at that time to advised the company of the matter. I can find no record of a report to the Ministry of this contact / complaint. Please enquire with your staff and advise on this.

Thank you

Deb Jacobs
Environmental Officer / Agente de l'environnement
Telephone: 519-948-4148
deb.jacobs@ontario.ca

From: Joshua Vaidyan [mailto:j.vaidhyan@samsung.com]
Sent: December 13, 2017 9:55 AM
To: Jacobs, Deb (MOECC)
Cc: Gilbert, Teri (MOECC); Smith, Mark (MOECC); Harman, Bruce (MOECC); Thuss, Simon (MOECC); Moroney, Michael (MOECC); Lehouillier, Jason (MOECC); McDonald, Dan (MOECC); 'Pat Murray'; 'Murchison, Jason'; 'Sre.Bop'; 'Boone, Storer'; Colella, Nick (MOECC); Keyvani, Mohsen (MOECC); 'Jody Law'; mark.vanderwoerd@aecom.com
Subject: New Complaint - [redacted] ([redacted])_North Kent 1

Hi Deb,

We received a complaint through our Project's toll-free line, below.
Please note that there has been no piling activity for over a month (November 8th), and there are no turbines operating. Under these circumstances, it is our belief that this should not be considered as an official complaint. Please advise.

PIN: 00745-0074
Address: [redacted]
Owner: [redacted]
[redacted]
Report: No water and water is black. [redacted] is frantic to get water to her animals.
Closest Turbine: T6 approx. 900m N.
Other Turbines: T38 (sw 1000m) & T31 (ne about 1400 m)



Regards,
Josh

AECOM

Attachment B

Vibration Monitoring Data (Golder Associates Ltd.)

Golder Associates

January 9, 2018

Project No. 1668031-2000-L27

Mr. Jody Law
c/o North Kent Wind 1 LP
355 Adelaide Street West, Suite 1000
Toronto, ON M5V 1S2

WATER WELL COMPLAINT 17
NORTH KENT WIND 1 PROJECT
CHATHAM-KENT, ONTARIO

Dear Mr. Law:

This letter is provided to address vibration concerns associated with Well Complaint 17, dated December 12, 2017, related to the well located at [redacted] in Dresden, Ontario. The complaint and the water quality and quantity issues were noted and reported on December 12, 2017, some 34 days after the last single pile was driven at Turbine T34 on November 8, 2017. This pile was driven more than 9 km from the residence at [redacted] The most recent dates of construction of foundations for other turbines in the area of the residence, and their distances from the residence, are summarized below in chronological order:

- Turbine T31: Last pile driven July 18, 2017, about 1,473 m from [redacted]
- Turbine T6: Last pile driven July 31, 2017, about 962 m from [redacted]
- Turbine T38: Last pile driven October 24, 2017, about 1,083 m from [redacted]
- Turbine T73: Last pile driven November 1, 2017, about 5,756 m from [redacted]; and
- Turbine T34: Last pile driven November 8, 2017, about 9,423 m from [redacted]

Given the elapsed time between the last pile driven for the Project and the complaint date, the transient nature of pile driving vibrations, proximity of pile driving earlier in the year and dates on which this work was completed, and the distances between the well and turbine locations, it is our opinion that the reported conditions are entirely unrelated to pile driving for turbine foundations.

CANADA'S BEST MANAGED COMPANIES Platinum member

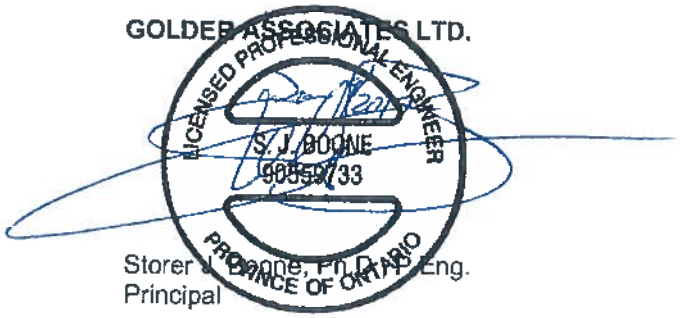
Golder Associates Ltd.
309 Exeter Road, Unit #1, London, Ontario, Canada N6L 1C1
Tel: +1 (519) 652 0099 Fax: +1 (519) 652 6299 www.golder.com
Golder Associates: Operations in Africa, Asia, Australasia, Europe, North America and South America

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We trust that this letter is adequate for your present requirements. If any point requires further clarification, please contact this office.

Yours truly,

GOLDER ASSOCIATES LTD.



Storer J. Boone, Ph.D., P.Eng.
Principal

SJB/MAS/nb

CC: J. Vaidyan, Samsung

\\golder.gds\gal\london\active\2016\3 proj\1668031 pattern_north kent vib monit_chatham-kent\ph 2000-vib monit field work\2-correspondence\3-ltrs\l27\1668031-2000-l27 jan 9 18 (draft) water well complaint 17.docx

Attachment C

Water Quality Data

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

CLIENT NAME: AECOM CANADA LTD
55 WYNDHAM STREET NORTH SUITE 215
GUELPH, ON N1H7T8
(519) 840-2251

ATTENTION TO: Brian Holden

PROJECT: 60343599

AGAT WORK ORDER: 17T296358

MICROBIOLOGY ANALYSIS REVIEWED BY: Inesa Alizarchyk, Inorganic Lab Supervisor

WATER ANALYSIS REVIEWED BY: Nivine Basily, Inorganics Report Writer

DATE REPORTED: Dec 20, 2017

PAGES (INCLUDING COVER): 8

VERSION*: 1

Should you require any information regarding this analysis please contact your client services representative at (905) 712-5100

*NOTES

All samples will be disposed of within 30 days following analysis. Please contact the lab if you require additional sample storage time.

Member of: Association of Professional Engineers and Geoscientists of Alberta (APEGA)
Western Enviro-Agricultural Laboratory Association (WEALA)
Environmental Services Association of Alberta (ESAA)

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

Results relate only to the items tested and to all the items tested
All reportable information as specified by ISO 17025:2005 is available from AGAT Laboratories upon request

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 17T296358

PROJECT: 60343599

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Brian Holden

SAMPLING SITE:

SAMPLED BY:

North Kent - Microbiological Analysis (water)

DATE RECEIVED: 2017-12-19

DATE REPORTED: 2017-12-20

			SAMPLE DESCRIPTION:	**007450074[redacted]**
			SAMPLE TYPE:	**Water**
			DATE SAMPLED:	**2017-12-18**
Parameter	**Unit**	**G / S**	**RDL**	**8984575**
Escherichia coli	CFU/100mL	0	**1**	ND
Total Coliforms	CFU/100mL	0	**1**	ND

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: Refers to SDWA - Microbiology
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

8984575 ND - Not Detected.
The water aliquot has been sub-sampled from the non-sterile container. Review data with discretion.

Certified By:



Results relate only to the items tested and to all the items tested

AGAT Laboratories

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Certificate of Analysis

AGAT WORK ORDER: 17T296358

PROJECT: 60343599

CLIENT NAME: AECOM CANADA LTD

ATTENTION TO: Brian Holden

SAMPLING SITE:

SAMPLED BY:

North Kent - Groundwater Samples

DATE RECEIVED: 2017-12-19

DATE REPORTED: 2017-12-20

				SAMPLE DESCRIPTION:	**007450074 [redacted]**
				SAMPLE TYPE:	**Water**
				DATE SAMPLED:	**2017-12-18**
Parameter	**Unit**	**G / S: A**	**G / S: B**	**RDL**	**8984575**
Electrical Conductivity	uS/cm			2	726
pH	pH Units		6.5-8.5	NA	8.43
Total Hardness (as CaCO3)	mg/L		80-100	0.5	21.4
Total Dissolved Solids	mg/L		500	20	440[<B]
Total Suspended Solids	mg/L			10	<10
Alkalinity (as CaCO3)	mg/L		30-500	5	343
Fluoride	mg/L	1.5		0.05	1.48[<A]
Chloride	mg/L		250	0.10	58.4[<B]
Nitrate as N	mg/L	10.0		0.05	<0.05
Nitrite as N	mg/L	1.0		0.05	<0.05
Bromide	mg/L			0.05	0.16
Sulphate	mg/L		500	0.10	<0.10
Ammonia as N	mg/L			0.02	0.18
Dissolved Organic Carbon	mg/L		5	0.5	2.5[<B]
Colour	Apparent CU		5	5	6[>B]
Turbidity	NTU		5	0.5	1.1[<B]
Calcium	mg/L			0.05	5.49
Magnesium	mg/L			0.05	1.86
Sodium	mg/L	20	200	0.05	163[A-B]
Potassium	mg/L			0.05	1.21
Iron	mg/L		0.3	0.010	0.287[<B]
Manganese	mg/L		0.05	0.002	0.003[<B]

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard: A Refers to Ontario Drinking Water Quality Standards. Na value is derived from O. Reg. 248, B Refers to Ontario Drinking Water Quality Standards - Aesthetic Objectives and Operational Guidelines
Guideline values are for general reference only. The guidelines provided may or may not be relevant for the intended use. Refer directly to the applicable standard for regulatory interpretation.

Certified By: Divine Basily

Results relate only to the items tested and to all the items tested

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Guideline Violation

AGAT WORK ORDER: 17T296358

PROJECT: 60343599

CLIENT NAME: AECOM CANADA LTD

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SAMPLEID	SAMPLE TITLE	GUIDELINE	ANALYSIS PACKAGE	PARAMETER	UNIT	GUIDEVALUE	RESULT
8984575	007450074 [redacted]	O.Reg. 169(mg/L)AO&OG	North Kent - Groundwater Samples	Colour	Apparent CU	5	6
8984575	007450074 [redacted]	O.Reg. 169(mg/L)AO&OG	North Kent - Groundwater Samples	Total Hardness (as CaCO3)	mg/L	80-100	21.4
8984575	007450074 [redacted]	O.Reg.169/03(mg/L)	North Kent - Groundwater Samples	Sodium	mg/L	20	163

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 17T296358

PROJECT: 60343599

ATTENTION TO: Brian Holden

SAMPLING SITE:

SAMPLED BY:

Microbiology Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
North Kent - Microbiological Analysis (water)															
Escherichia coli	8984476		ND	ND	NA	< 1									
Total Coliforms	8984476		ND	ND	NA	< 1									

Comments: ND – Not detected; NA - % RPD Not Applicable

Certified By:

AGAT Laboratories is accredited to ISO/IEC 17025 by the Canadian Association for Laboratory Accreditation Inc. (CALA) and/or Standards Council of Canada (SCC) for specific tests listed on the scope of accreditation. AGAT Laboratories (Mississauga) is also accredited by the Canadian Association for Laboratory Accreditation Inc. (CALA) for specific drinking water tests. Accreditations are location and parameter specific. A complete listing of parameters for each location is available from www.cala.ca and/or www.scc.ca. The tests in this report may not necessarily be included in the scope of accreditation.

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Quality Assurance

CLIENT NAME: AECOM CANADA LTD

AGAT WORK ORDER: 17T296358

PROJECT: 60343599

ATTENTION TO: Brian Holden

SAMPLING SITE:

SAMPLED BY:

Water Analysis

RPT Date:			DUPLICATE				REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD	Method Blank	Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
North Kent - Groundwater Samples															
Electrical Conductivity	8983037		621	621	0.0%	< 2	97%	80%	120%						
pH	8983037		8.29	8.29	0.0%	NA	99%	90%	110%						
Total Dissolved Solids	8976940		622	636	2.2%	< 20	98%	80%	120%						
Total Suspended Solids	8981578		26	27	NA	< 10	98%	80%	120%						
Alkalinity (as CaCO3)	8983037		99	99	0.0%	< 5	107%	80%	120%						
Fluoride	8982589		<0.05	<0.05	NA	< 0.05	107%	90%	110%	99%	90%	110%	117%	80%	120%
Chloride	8982589		27.0	27.0	0.1%	< 0.10	95%	90%	110%	103%	90%	110%	102%	80%	120%
Nitrate as N	8982589		0.08	0.09	NA	< 0.05	94%	90%	110%	99%	90%	110%	90%	80%	120%
Nitrite as N	8982589		0.05	0.05	NA	< 0.05	NA	90%	110%	94%	90%	110%	88%	80%	120%
Bromide	8982589		<0.05	<0.05	NA	< 0.05	106%	90%	110%	106%	90%	110%	108%	80%	120%
Sulphate	8982589		5.74	6.01	4.6%	< 0.10	96%	90%	110%	101%	90%	110%	82%	80%	120%
Ammonia as N	8984575	8984575	0.13	0.12	NA	< 0.02	103%	90%	110%	105%	90%	110%	97%	80%	120%
Dissolved Organic Carbon	8984575	8984575	2.5	2.6	0.8%	< 0.5	103%	90%	110%	103%	90%	110%	100%	80%	120%
Colour	8984575	8984575	6	6	NA	< 5	108%	90%	110%						
Turbidity	8984575	8984575	1.1	1.0	NA	< 0.5	99%	90%	110%						
Calcium	8979600		135	135	0.6%	< 0.05	93%	90%	110%	94%	90%	110%	94%	70%	130%
Magnesium	8979600		12.7	13.0	2.8%	< 0.05	93%	90%	110%	93%	90%	110%	92%	70%	130%
Sodium	8979600		37.5	37.7	0.6%	< 0.05	94%	90%	110%	95%	90%	110%	94%	70%	130%
Potassium	8979600		1.77	1.86	4.8%	< 0.05	97%	90%	110%	98%	90%	110%	95%	70%	130%
Iron	8984575	8984575	0.287	0.308	7.1%	< 0.010	97%	90%	110%	97%	90%	110%	96%	70%	130%
Manganese	8984575	8984575	0.003	0.003	NA	< 0.002	98%	90%	110%	101%	90%	110%	98%	70%	130%

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Nivine Basily

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Method Summary

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PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Microbiology Analysis			
Escherichia coli	MIC-93-7010	EPA 1604	Membrane Filtration
Total Coliforms	MIC-93-7010	EPA 1604	Membrane Filtration
Water Analysis			
Electrical Conductivity	INOR-93-6000	SM 2510 B	PC TITRATE
pH	INOR-93-6000	SM 4500-H+ B	PC TITRATE
Total Hardness (as CaCO3)	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Total Dissolved Solids	INOR-93-6028	SM 2540 C	BALANCE
Total Suspended Solids	INOR-93-6028	SM 2540 D	BALANCE
Alkalinity (as CaCO3)	INOR-93-6000	SM 2320 B	PC TITRATE
Fluoride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Chloride	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrate as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Nitrite as N	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Bromide	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Sulphate	INOR-93-6004	SM 4110 B	ION CHROMATOGRAPH
Ammonia as N	INOR-93-6002	AMM-002-A & SM 4500 NH3-G	DISCRETE ANALYZER
Dissolved Organic Carbon	INOR-93-6049	EPA 415.1 & SM 5310 B	SHIMADZU CARBON ANALYZER
Colour	INOR-93-6046	SM 2120 C	SPECTROPHOTOMETER
Turbidity	INOR-93-6044	SM 2130 B	NEPHELOMETER
Calcium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Magnesium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Sodium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Potassium	MET-93-6105	EPA SW-846 6010C & 200.7	ICP/OES
Iron	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS
Manganese	MET-93-6103	EPA SW-846 6020A & 200.8	ICP-MS

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AECOM