



JFM Environmental Limited

318 Neptune Crescent, Unit No. 1, London ON N6M 1A1 CANADA

Tel: +1 519 951 9191 • Fax: +1 519 488 0711

E-mail: info@jfmel.com

August 25, 2020

Project 20-2-1832-64-A.1

AGM Plan Survey Engineer
3514 White Oak Road,
London, ON N6E 2Z9

Attention: Mr. Dan Wade,
Manager of Engineering Services
dan@agm.on.ca

Dear Mr. Wade,

RE: Response to Email - Review of Previous Hydrogeological Work
Poplar Woods Development - Phase 2
Part of Lots 5 & 6, Concession 8 (Lobo), Ontario

Introduction

The following letter is JFM Environmental Ltd (JFMEL)'s response to the request of Dan Wade of AGM (the Client) with respect to outstanding issues related to the Poplar Woods proposed subdivision in Poplar Woods, Ontario. The Client sent an email on May 26, 2020 to Frank Colozza of JFMEL (Email) (Reference 1), requesting assistance with respect to specific issues as contained in a letter dated, July 9, 2018 from Erica Ogden and Sarah Hodgkiss of the St. Clair Region Conservation Authority (SCRCA) to Durk Vanderwerff, at the County of Middlesex (Letter) (Reference 2). The Letter was attached to the Email.

The Client stated in the May 26, 2020 email the following:

"Generally, the items we are looking for confirmation on is the Aquifer Separation and Restriction on Road Salts." Also The Client had highlighted specific points, some with JFM marked next to the highlighted sections, in the copy of the Letter attached to the email as follows:

- 1) "The restriction of road salt within the development has been proposed as a mitigation measure in the JFM addendum dated April 20, 2018. Further details regarding the implementation within the plan of subdivision is required."; and,
- 2) "The Municipality must determine if the information provided to date is sufficient to address the potential risk associated with the provision of services with regards to the separation between the upper and lower aquifer."; and,
- 3) "The addendum report by JFM Environment, dated April 20, 2018 discusses the disposal of grey water, please confirm the report also addresses black water.

The report also addresses an issue with the installation of Well # 1, which has mixing between the upper and lower aquifer. The well construction should be repaired, as recommended by JFM Environment."

JFMEL had been involved in the Poplar Woods subdivision as a hydrogeological consultant for the previous owner (JFMEL's previous Client). To address the above noted concerns we have reviewed JFMEL reports, added information and JFMEL's responses of further information as requested from SCRCA, all completed on behalf of JFMEL's previous Client (JFMEL previous work).

The focus of this letter has been on more recent work completed by JFMEL including the report, Hydrogeological Assessment Part of Lots 5 & 6, Concession 8 (LOBO), Municipality of Middlesex Centre, Ontario (JFMEL Report, January 15, 2018) (Reference 3) and JFMEL's April 20, 2018 response to Meeting Notes of February 7, 2018 - Hydrogeological Assessment (JFMEL Response, April 20, 2018) (Reference 4). Figures referenced in this letter and attached to this letter are taken from Reference 3 and have not been updated. JFMEL's project number as seen on the title block for these figures is 17-2-1384-24.

Restriction on Road Salt

On Page 4, under the heading of Cross Contamination Between the Two Aquifers in the JFMEL Response, April 20, 2018 the following is noted. "Since 2015, the concentration of sodium in the shallow groundwater measured at MW1, MW2 and MW3 has substantially decreased. For example, in 2015, the sodium concentration at MW3, located next to Ilderton Road was 95,600 mg/L ; in 2017, the sodium concentration in the groundwater at that well was reported to be 73.6 mg/L. These concentrations suggest that between 2015 and 2017, the amount of road salt applied had dropped significantly. This assumes that the sodium concentration at MW3 are mostly from the application of road salt. MW3 is located near the roadside ditch which will convey stormwater that seeps into the ground and presumably into the shallow groundwater (upper aquifer)." Figure 9 shows well locations.

Continuing on Page 4 in the JFMEL Response, April 20, 2018, "The sodium concentration in the shallow groundwater based on the 2015 work suggests that it decreases in an easterly direction. At MW1, located east of MW3 approximately mid way to the tree-line, the sodium concentration was 31,200 mg/L, and farther to the east at MW2 (within the woodlot) the sodium concentration was 2,210 mg/L. Chloride concentrations showed the same decrease in an easterly direction (hydraulically downgradient from the road).

Groundwater samples from the three monitoring wells had sodium concentrations in November 2017 of 40.0 mg/L at MW1, 2.82 mg/L at MW2 and 73.6 mg/L at MW3. These concentrations suggest the following:

- a) The sodium concentration is greatest near the road suggesting this is likely a contributing source of the sodium, probably from the road salt.
- b) The sodium concentration gradient decreases easterly (hydraulically downgradient) indicating the groundwater is attenuating the sodium (diluting it as the groundwater migrates easterly).
- c) The concentration of sodium in the deeper groundwater from the three test water supply wells (Well#1, Well#2 and Well#3) in 2017 is less than that of the shallow groundwater because there is less interaction of water in the deeper aquifer compared to the shallow aquifer, which is influenced by precipitation and less road salt contaminated surface water (since 2015).

The three deep wells were installed in 2017 and sodium concentrations in the deep wells from the November 2017 water samples were 21.1 mg/L in Well #1; 52.3 mg/L in Well #2 and 65.2 mg/L in Well #3. Water in the lower aquifer is migrating easterly (based on the groundwater elevations from the three deep wells) and likely originates from areas to the west beyond the Site, most of which have been under agricultural use for decades.

At the Site, surface water impacted with fertilizers and road salt is more likely to directly impact the upper aquifer's quality than that of the lower aquifer. The reason being is the upper aquifer is not protected from surface derived sources of contaminants, unlike the lower aquifer which has the aquitard and its positive hydraulic pressure to mitigate (not eliminates) seepage of surface derived contaminants into its water. It is possible through chemical diffusion, for some surface derived contaminants to migrate through the aquitard. "

On Page 5, under the heading of Mitigation of the Proposed Development in the JFMEL Response, April 20, 2018 the discussion is with respect to road salt. "As discussed previously, sodium levels in the shallow groundwater have likely been impacted primarily from the use of road salt. I understand that the municipality is now using a sand-salt mixture (80% sand to 20% salt) for road applications. This should continue to mitigate the impact of road salt to the shallow groundwater. It is recommended that LID techniques implemented should include restrictions on the use of road salt within the development. " LID is low intensity development.

Separation of the Upper and Lower Aquifer

In the JFMEL January 15, 2018 report, the stratigraphy of the overburden of the Site was described based on water well records within 500 m of the Site from the Ministry of the Environment, Conservation and Parks (MECP), or at the time of the completion of the report, The Ministry of the Environment and Climate Change (MECC) database and from on-Site drilling of monitoring wells (stratigraphy logged by JFMEL personnel) and water wells (with stratigraphy as recorded by the water well drillers at the time of installation of the wells). For the JFMEL January 15, 2018 report, which is JFMEL's most recent hydrogeological report, 204 water well records were reviewed. The following descriptions of the Site stratigraphy and interpretation of the on-Site hydrogeology were included in this report. The interpreted stratigraphy is shown in the cross-sections, Figures 9A and 9B from Reference 3. Figure 9 shows the locations of the lines of cross-section in Plan view.

- " i. Shallow Aquifer: The shallow aquifer is interpreted to consist of a layer of sand and gravel to silty sand. The shallow aquifer was interpreted to be unconfined and have a maximum depth ranging from approximately 4.57 to 7.01 metres below ground surface.
- ii. Upper Confining Layer: The upper confining layer consists of a layer of clay to silty clay. This layer was reported to have an upper depth ranging from approximately 4.57 to 7.32 metres below ground surface and a lower depth ranging from approximately 19.8 to 21.0 metres below ground surface.
- iii. Deep Aquifer: The deep aquifer is interpreted to consist of a layer of black sand, described as having a fine grain texture and a layered appearance. This layer was reported to have been encountered in each of the test wells. The layer was reported to have an upper depth ranging from approximately 19.8 to 21.0 metres below ground surface and a lower depth ranging from approximately 24.7 to 27.7 metres below ground surface.
- iv. Lower Confining Layer: The lower confining layer, encountered at the base of each test well, was reported to consist of a layer of grey silty clay to silt. The layer was reported to extend to the maximum depth explored and start at a depth ranging from approximately 24.7 to 27.7 metres below ground surface."

On page 2 of the JFMEL Response, April 20, 2018, in Section, Comment # 2 (Page 1 of 2), it was stated, "From the pool of well records within approximately 500 metres of the Site, 35 well records were selected based on their

location and depths. Also, "Wells whose boreholes intercepted the deeper clay underlying the deeper sand aquifer were selected."

Within the JFMEL Response, April 20, 2018, page 3, in section, "Comment # 2 Cross-Contamination Between the Two Aquifers," it is noted, "The low permeability characteristics of the silty clay layer, estimated to have a thickness of 12 metres to 16 metres (refer to the same figures previously referenced) presents an aquitard of 12-16 metres thick." (ii above) (These are Figures 9A and 9B of Reference 3 and attached to this letter). Continuing in this section "This aquitard mitigates the downward seepage of water located within the water-table shallow aquifer from reaching the next soil layer underlying the aquitard, being the lower aquifer." Also, it was concluded, "Since it is protected from the upper aquifer, it is the favourable source for potable water." The 'it' referred to is the lower aquifer (iii above). Similar conclusions were made in JFMEL previous work. The protection for the lower aquifer is the Upper Confining Layer (ii above). Also, continuing in this section, the following statement was made, "Well records previously discussed suggest that the upper aquifer, upper aquitard and lower aquifer are continuous within the Site boundaries and beyond. The lower aquitard is likely regionally expansive." As noted previously, these statements and conclusions are based on the reviewing of water well records within 500 m of the Site, the descriptions of the soils encountered during drilling of the water wells by the drillers and JFMEL personnel's observations of soils encountered during the drilling of the monitoring wells. The monitoring wells were completed in the silty clay layer and did not intercept the lower aquifer.

With respect to water levels, continuing on page 3, in Section, Cross-Contamination Between the Two Aquifers, JFMEL Response, April 20, 2018, it is stated, "Groundwater elevations measured and presented in Figure 14B clearly identify a separation between the deep aquifer levels (238.00 metres above sea level (MASL)) and those of the shallow aquifer (242.00 MASL and 245.00 MASL)." These differences in the elevations of the water levels between the two aquifers indicate a separation between the two aquifers, with the upper aquifer being a perched aquifer, on the aquitard and the lower aquifer underlying this aquitard.

Disposal of Grey Water and Black Water

The concern as contained in the Letter with respect to the disposal of black water was whether black water was addressed in the JFMEL Response, April 20, 2018. On Page 5, under the heading of Disposal of Septic Unit Disposal in the JFMEL Response, April 20, 2018 the discussion is with respect to grey water. Although black water is not mentioned, the black water (e.g. from toilets, laundry, dishwashers, etc.) within the proposed residences will be directed to individual septic treatment systems. "It is our understanding that the proposed development will utilize individual private septic systems with tertiary treatment." The black water enters the septic treatment system with the resultant "treated" water being considered grey water due to the treatment in the septic system. As noted in the same section, "Grey water is allowed to seep (or leach) into the soil and from there into the soil and from there into the groundwater, where it is assimilated." The discussion in the above noted section addresses the grey water exiting the septic system by way of a tile bed system and its entrance into the upper unsaturated soil and eventually into the groundwater of the upper aquifer. Although black water is not mentioned in Reference 4, the purpose for the proposed septic systems for the proposed residences for the development is for the treatment of black water and the disposal of the resultant grey water discharged from the individual septic systems.

Well No. 1

A licensed drinking water well driller installed the drinking water wells. JFMEL was not present at the Site during their installation. The well log for "Well No. 1", indicates that the sand pack around the casing and the screen intercepts the lower aquifer, the aquitard and the lower part of the upper aquifer. The bentonite seal is terminated in the upper aquifer. Thus it will be necessary to repair Well No. 1, by ensuring that the bentonite seal extends further, into the silty clay layer (aquitard) and that the upper elevation of the sand pack is below the elevation of the lower extent of the upper aquifer and in the aquitard. This bridging of the sand pack between the upper aquifer and the aquitard has been noted in JFMEL previous work.

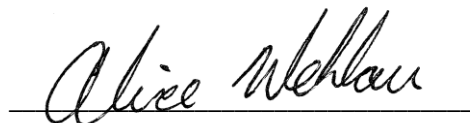
It was noted in the Email in which the Client included an excerpt, as credited to JFMEL's previous Client from a recent correspondence between the Client and JFMEL's previous Client, the following, "With respect to the one well that may need some repair work, we undertook to do that work when/if the well was to be actually used in servicing a home."

Conclusion

The intention of this letter is to address the concerns raised in the Letter (Reference 2) as requested by the Client in the Email (Reference 1). Any further questions or concerns of the Client with respect to this response should be forwarded or communicated to JFMEL. Thank-you for this opportunity to assist you in addressing these concerns through our review of previous work completed for the previous owner of the property (JFMEL's previous Client).

Yours very truly,

JFM ENVIRONMENTAL LIMITED



Alice Wehlau, P.Eng., Q.P.(ESA)*
Environmental Engineer
E-mail: alice.wehlau@jfmel.com



Frank C. Colozza, M.Sc., P.Geo., Q.P.(ESA)*
Principal & Senior Hydrogeologist
E-mail: frank.colozza@jfmel.com

* "Qualified Person" under O.Reg. 153 / 04

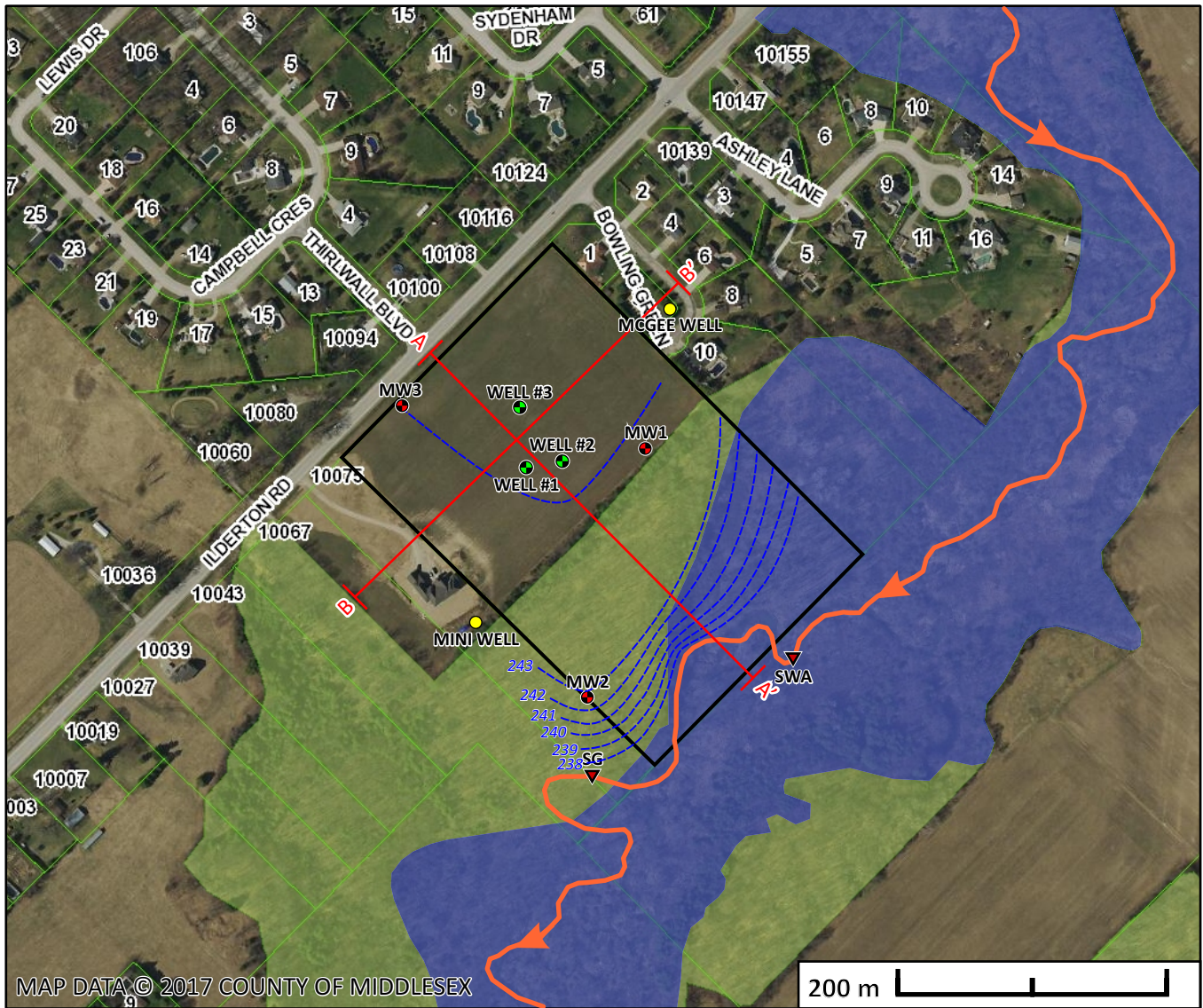
FCC/aew;

Attachments: Figure 9 – Cross Section Configuration (January 2028)
Figure 9A – Interpreted Stratigraphic Cross Section A-A' (January 2028)
Figure 9B – Interpreted Stratigraphic Cross Section B-B' (January 2028)
Figure 14B – Water Level Hydrographs, 2017 Precipitation Data / Transducer Data Comparison

References

1. Email Communication from Dan Wade, Vice President and Manager of Engineering Services, AGM Engineering with Frank Colozza, Principal & Senior Hydrogeologist, JFM Environmental Limited. May 26, 2020.
2. Letter Communication from Erica C. Ogden, Planner and Sarah Hodgkiss, Planning Ecologist, St. Clair Region Conservation Authority to Durk Vanderwerff, Planner, County of Middlesex, Ontario. July 18, 2018.
3. JFM Environmental Limited, 'Hydrogeological Assessment, Part of Lots 5 & 6, Concession 8 (LOBO) Municipality of Middlesex Centre, Ontario.' January 15, 2018.
4. Letter Communication of Frank Colozza, Principal & Senior Hydrogeologist, JFM Environmental Limited, 'Reply to Meeting Notes of February 7, 2018 – Hydrogeological Assessment Poplar Woods Development – Phase 2 Part of Lots 5 & 6, Concession 8 (LOBO), Ontario. April 20, 2018.

Figures



LEGEND

- | | | |
|------------------------|--|--|
| - THE SITE | - SC 8 WETLAND COMPLEX | - APPROXIMATE STAFF GAUGE LOCATION |
| - LOT BOUNDARY | - WOODLAND AREA | - APPROXIMATE PRIVATE WELL LOCATION |
| - EAST SYDENHAM RIVER | - APPROXIMATE MONITORING WELL LOCATION | - APPROXIMATE TEST WELL LOCATION |
| - RIVER FLOW DIRECTION | - CROSS-SECTIONAL LINE | - INTERPRETED SHALLOW GROUNDWATER ELEVATION CONTOUR (MASL) |

CROSS-SECTION CONFIGURATION



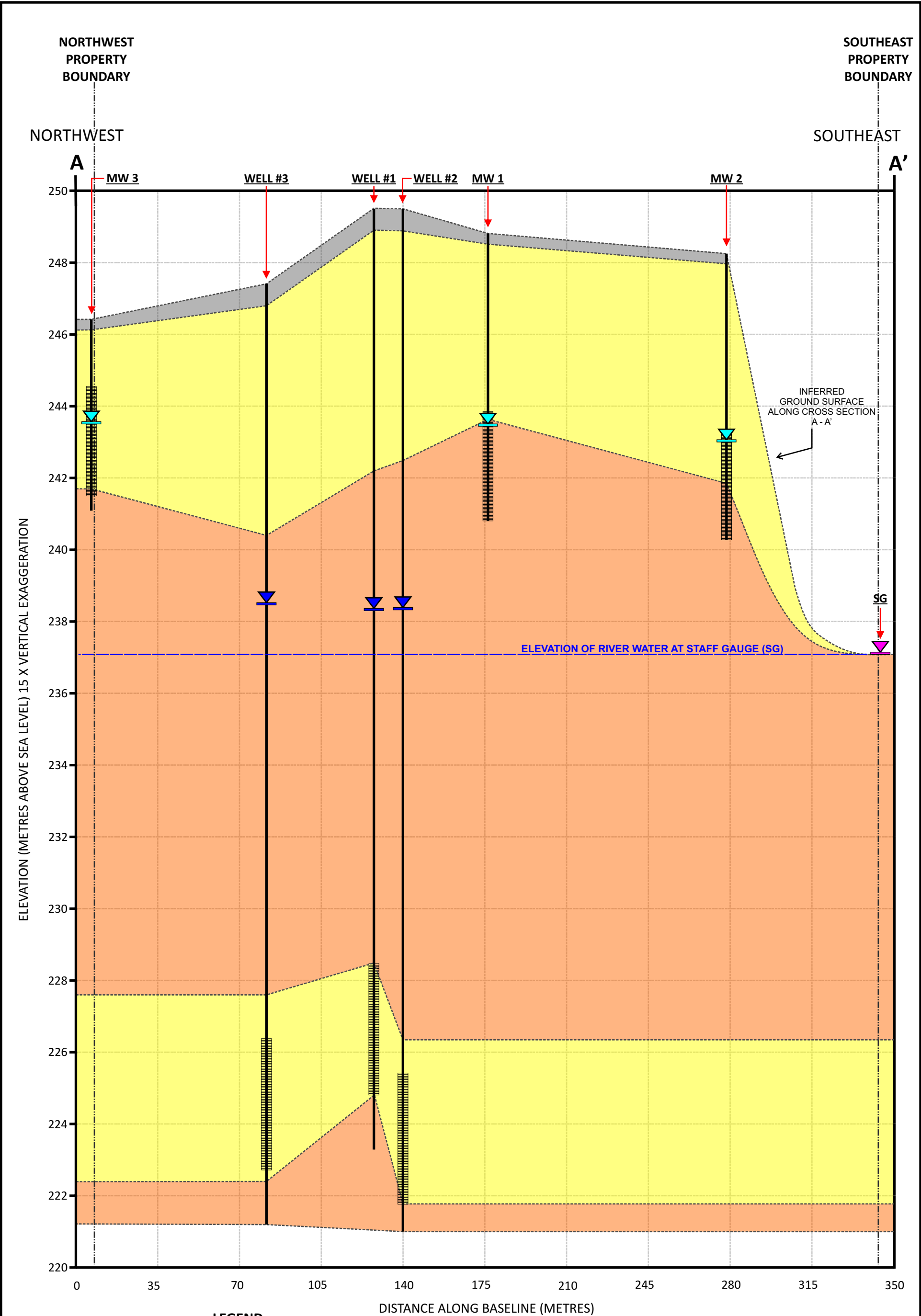
SITE ASSESSMENTS
REMEDATION
www.jfmeal.com

HYDROGEOLOGICAL ASSESSMENT
PART OF LOTS 5 & 6, CONCESSION 8 (LOBO)
MUNICIPALITY OF MIDDLESEX CENTRE, ONTARIO

PROJECT #17-2-1384-24


JANUARY 2018

FIGURE 9



- LEGEND**

 - TOPSOIL
 - SAND / SILTY SAND / GRAVEL AQUIFER
 - SILTY CLAY / CLAY AQUITARD
 - SCREENED INTERVAL
 - SHALLOW GROUNDWATER SURFACE (NOVEMBER 27, 2017)
 - DEEP GROUNDWATER SURFACE (NOVEMBER 27, 2017)
 - SURFACE WATER LEVEL (NOVEMBER 27, 2017)



SITE ASSESSMENTS
REMEDiation
www.jfmeal.com

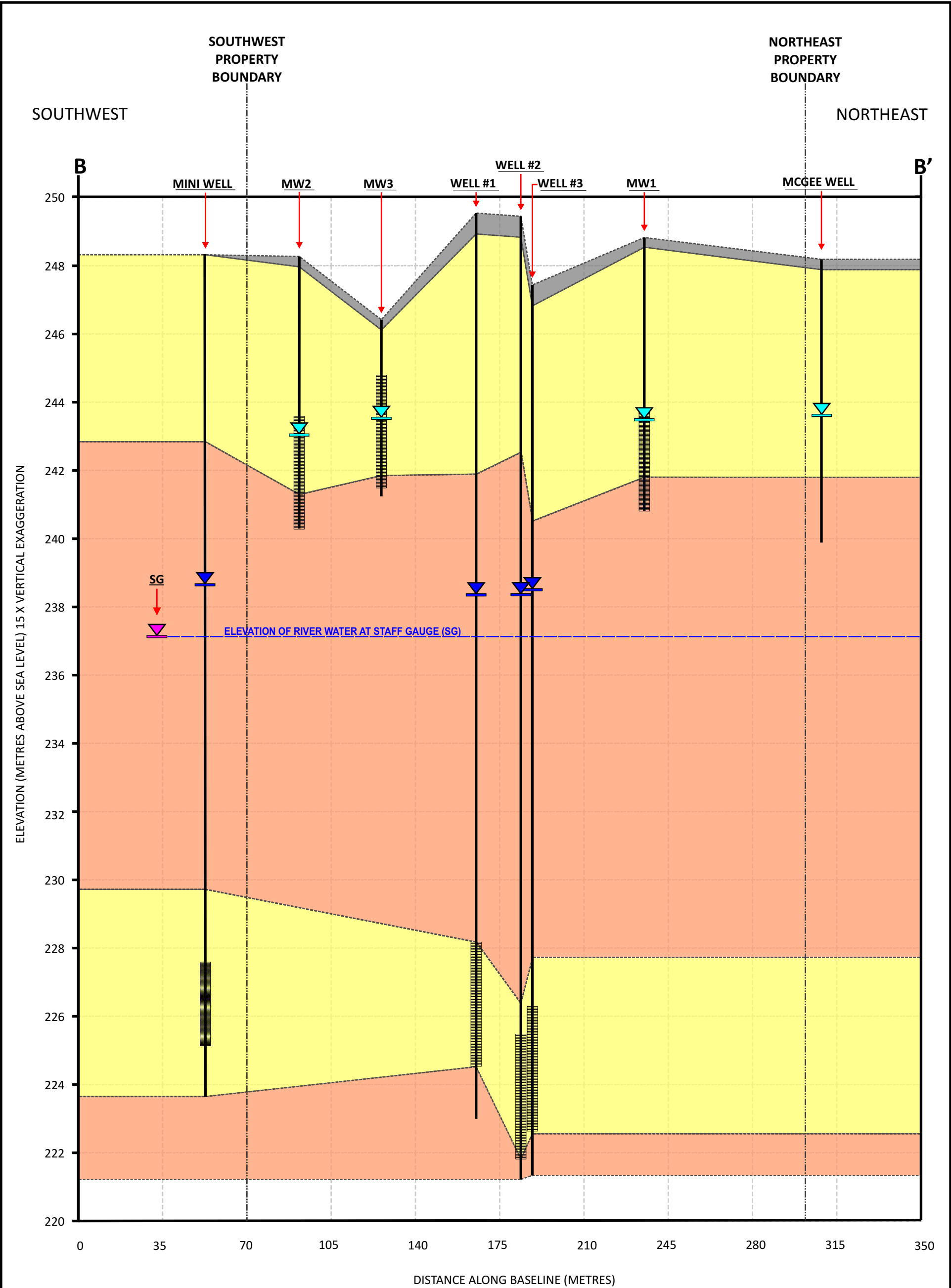
**INTERPRETED STRATIGRAPHIC
CROSS SECTION (A-A')**

**HYDROGEOLOGICAL ASSESSMENT
PART OF LOTS 5 & 6, CONCESSION 8 (LOBO)
MUNICIPALITY OF MIDDLESEX CENTRE, ONTARIO**

PROJECT #17-2-1384-24








JANUARY 2018

FIGURE 9A



NOTE: A WELL RECORD FOR THE MCGEE WELL WAS NOT AVAILABLE TO JFMEL. TOTAL WELL DEPTH AND WATER LEVEL WERE FIELD MEASURED.

LEGEND

- | | |
|--|---|
|  - TOPSOIL |  - SHALLOW GROUNDWATER SURFACE (NOVEMBER 27, 2017) |
|  - SAND / SILTY SAND / GRAVEL AQUIFER |  - DEEP GROUNDWATER SURFACE (NOVEMBER 27, 2017) |
|  - SILTY CLAY / CLAY AQUITARD |  - SURFACE WATER LEVEL (NOVEMBER 27, 2017) |
|  - SCREENED INTERVAL | |


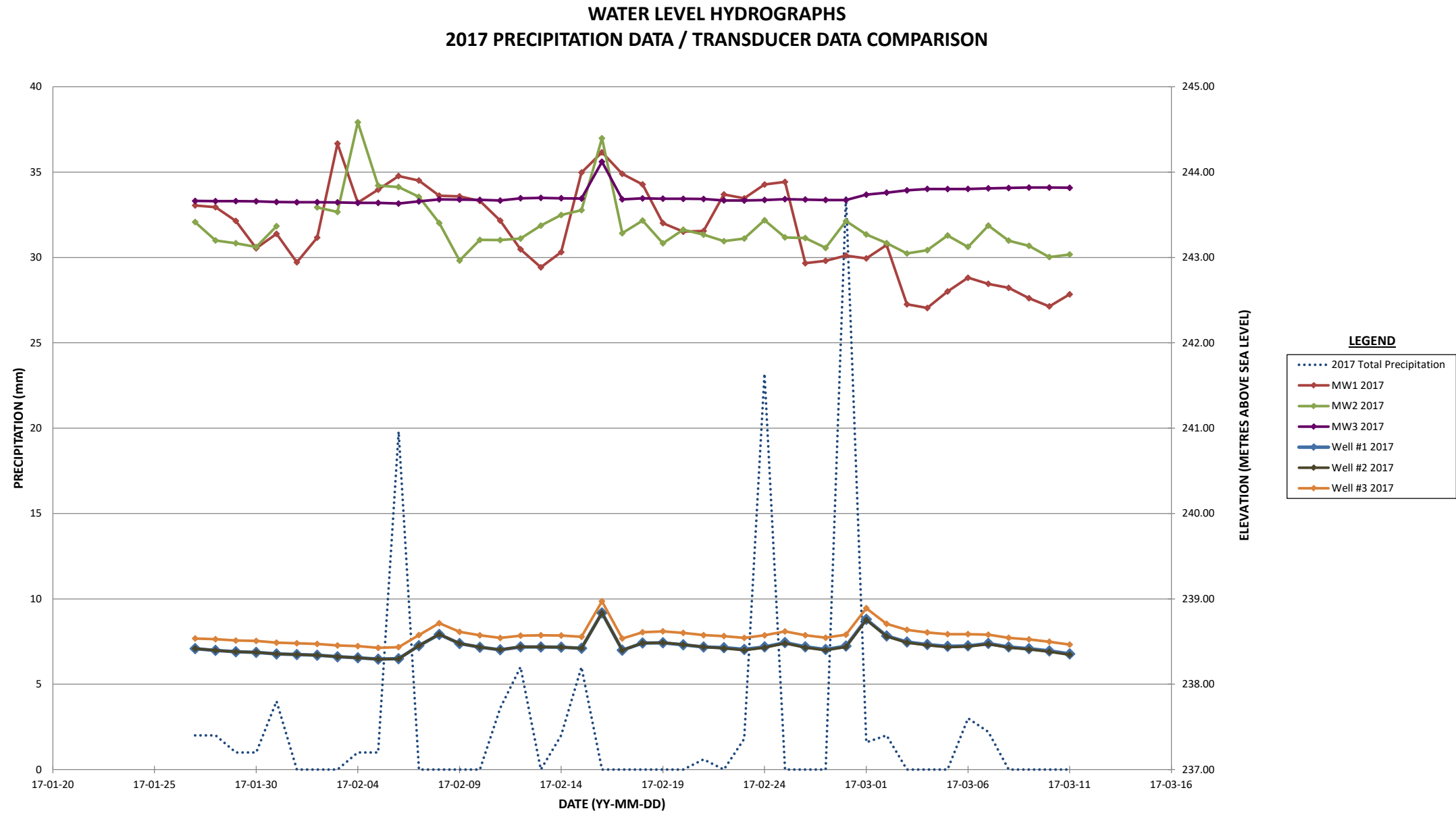
INTERPRETED STRATIGRAPHIC CROSS SECTION (B-B')		
HYDROGEOLOGICAL ASSESSMENT PART OF LOTS 5 & 6, CONCESSION 8 (LOBO) MUNICIPALITY OF MIDDLESEX CENTRE, ONTARIO		
 SITE ASSESSMENTS REMEDiation www.jfmel.com	PROJECT #17-2-1384-24	FIGURE 9B
	JANUARY 2018	

FIGURE 14B
HYDROGEOLOGICAL ASSESSMENT
PART OF LOTS 5 6, CONCESSION 8 (LOBO)
MUNICIPALITY OF MIDDLESEX CENTRE, ONTARIO



Limitations



JFM Environmental Limited

LIMITATIONS FOR INTRUSIVE INVESTIGATIONS / ASSESSMENTS

1. The work performed in this report was carried out in accordance with the Terms of Conditions made part of our contract. The conclusions presented herein are based solely upon the scope of services and time and budgetary limitations described our contract. No scope of work, no matter how exhaustive, can identify all contaminants or all conditions above or below ground.
2. The report has been prepared in accordance with generally accepted environmental study and / or geoscientific and / or engineering practices. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our contract and included in this report.
3. The services performed and outlined in this report were based, in part, upon visual observations of the property being studied (referred to as the "Site") and attendant structures (referred to as the "Site buildings"). Our opinion cannot be extended to portions of the Site that were unavailable for direct observation, reasonably beyond the control of JFM Environmental Limited. Also note that conditions between test holes (if applicable) may differ from those encountered in the investigation and observed or measured conditions may change with time. The work conducted therefore cannot warranty that all conditions on or off the Site are presented by those identified at specific locations.
4. The objective of this report was to assess the environmental conditions at the Site, given the context of our contract, with respect to existing environmental regulations within the province of Ontario. Standards, guidelines and / or objectives related to environmental assessments and investigations may change with time. Those which are applied at the time of this investigation may be obsolete or unacceptable at a later date.
5. The Site history research performed herein relies on information supplied by others, such as local, provincial, and federal agencies as well as plant personnel. No attempt has been made to independently verify the accuracy of such information, unless specifically noted in our report.
6. Our visual observations relating to potential contaminant materials in the environment at the Site are described in this report. Where testing was performed, it was executed accordance with our contract for these services. It should be noted that other compounds or material might be present in the Site environment.
7. The conclusions of this report are based in part, on the information provided by others. The possibility remains that unexpected environmental conditions may be encountered at the Site in locations not specifically investigated. Should such an event occur, JFM Environmental Limited must be notified in order that we may determine if modifications to our conclusions are necessary.
8. The utilization of JFM Environmental Limited's services during the implementation of any remedial measures will allow JFM Environmental Limited to observe compliance with the conclusions and recommendations contained herein. It will also provide for changes as necessary to suit field conditions as they are encountered.
9. Any use or any reliance on or decisions to be made of this report by a third party without the written consent of JFM Environmental Limited, is the sole responsibility of such third parties. JFM Environmental Limited accepts no responsibility for damages, if any, suffered by any third party because of decisions made or actions taken based on the unauthorized use of this report.