MEMO

TO: Gary Tomlinson, MOE Senior Environmental Officer

FROM: Darin Burr, Dillon Consulting Limited.

DATE: June 20, 2014

SUBJECT: Risk Assessment Analysis of Groundwater Contamination at Transmission Line Poles

OUR FILE: 13 8287

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This memorandum presents a risk analysis of the potential for groundwater impacts from transmission pole foundations associated with the Dufferin Wind Farm project. The assessed concern relates to whether the foundations will act as a preferential pathway for surface water to enter into the subsurface, and impact local aquifers. The assessment was based on a pole foundation construction information provided to Dillon from Dufferin Wind Power, information on the local geology, available MOE water well records and the local land use.

Transmission Line Foundation Construction

There are two types of pole foundations for the project: Wooden pole foundations and larger concrete foundations for steel poles constructed at corners and turns of the transmission line. Details on the construction of both types of poles are presented below.

Wood Pole Foundations

Based on information provided to Dillon from Dufferin Wind Power, wood pole foundation construction involves augering, and then placing a 1.06 to 1.21 m diameter steel sleeve extending 6 to 9 m into the ground, depending upon location. The steel sleeve is left in place during installation of the pole. Following pole placement, the space between the pole and the steel sleeve is backfilled with granular material and compacted. Where possible, the steel sleeve is driven into the ground, and therefore, no space exists between the outside of the steel sleeve and the adjacent ground. For situations where the steel sleeve cannot be driven because of soil conditions (e.g., rocky soils), the auger hole is slightly over bored, leaving an approximately 0.05 to 0.10 m space between the outside of the steel sleeve and the adjacent ground. This narrow space is backfilled with aggregate and compacted. The backfilled steel sleeve (which now forms a caisson) is buried below grade, and is covered with approximately 0.15 to 0.30 m of native fill material (i.e., subsurface clay based material and topsoil). The distance between the transmission poles average between 100 m to 150 m.

Steel Pole Foundations

Foundations for the 53 steel poles that will be located at corners and turns along the transmission line will follow a similar installation concept as the standard wood pole foundations. For the concrete caissons, a larger (up to 2.44 m) diameter hole is augered out, a steel sleeve is inserted to maintain the integrity of the hole. A steel rebar bolt cage is then inserted in the hole to a max depth of 12.19 m (average 9.14 m). The steel sleeve is then filled with concrete (forming a concrete caisson). The top of the concrete caisson will be approximately 0.15 m above grade and a standard graded backfill cap with an approximate depth of 0.15 to 0.30 m of native fill material will be installed around the concrete caisson.

Land Use

Land use along the transmission line is primarily a mixture of a former railway easement, rural/agricultural fields and vegetated areas such as woodland and wetlands. The majority of the overhead transmission line alignment is >150 m away from homes and farmsteads thus providing a buffer area to local wells.

Hydrogeology

The dominant aquifer in the vicinity of the transmission line is dolostone (Guelph and Amabel bedrock Formations), which is overlain by clay, clay to silty sand till and/or sand; however sand and gravel aquifers are present in some areas, particularly in the south. In general, the depth of bedrock along the transmission line alignment varies from approximately 3 to 7 m (east of Corbetton), 7 to 15 m (between Corbetton and Shelburne), 15 to 50 m (between Shelburne and Orangeville). Potable water for the rural homes and farms in the vicinity of the transmission line is supplied by individual private water wells. Based on a review of the MOE Water Well Records, the majority of wells along the transmission alignment are completed in the bedrock aquifer; however, overburden wells are present in some areas where sand and gravel aquifers occur.

Risk of Surface Water Impacts to Aquifer

The risk of surface water migrating into aquifers via the pole foundations and impairing groundwater quality to nearby receptors such as potable water wells is considered low. This conclusion is based on the following considerations:

a) The transmission line foundations are located in a largely rural area, and the surrounding land uses do not pose untypical risks for surface/ground water contamination in rural areas.

b) The near ground surface cross-sectional area of the wood transmission pole foundations (minus the pole area) is relatively small (0.4 to 0.7 m^2), limiting the area of the caisson that could potentially vertically transmit surface water into the subsurface.

c) The near ground surface cross-sectional area of the steel transmission pole foundations is larger (~9m^2), however the concrete caissons are completely filled with concrete and will be installed approximately 6" above grade. The concrete will act as an impermeable plug preventing vertical groundwater flow. Because the outside steel sleeve is pressed into the ground at the time of drilling, there is no significant gap between the metal casing and the surrounding soil therefore a pathway for vertical groundwater movement along the casing sides is not expected.

d) The spatial density of these wood and steel pole foundations is low (one pole per 100 to 150 linear metres). Considering the small foot print of the wood pole foundations, the elevation and density of the concrete caissons, the low spatial density of the poles, and that any water seeping out of the base of the foundation would be of such low volume and frequency that it would be mixed/dispersed with the ambient groundwater in the area, effects (if any) to groundwater chemistry are expected to be marginal and localized around the pole.

e) Further, the top of the wood pole foundations are covered with clay and native material, which is placed sloping away from the pole, providing positive drainage away from the pole and inhibiting surface water runoff from entering into the caissons. In addition, unlike a well situation, the caisson is filled with compacted aggregate, which provide additional vertical resistance to groundwater movement. Both the wood and steel pole foundation will also be lined with a steel sleeve which will prevent shallow groundwater in the adjacent soils from entering into the backfill inside the caisson and migrating vertically into aquifers.

f) Lastly, the method of transmission line pole installation used in this project is common elsewhere in Ontario. Near the project area, large transmission poles have been previously built for the TransAlta wind farm, west of Shelburne and we are not aware of any reported situations where groundwater impacts to aquifers have resulted from transmission line poles acting as preferential pathways for groundwater movement.

Additional Mitigation Actions

While the potential for impacts to aquifers from the pole foundations is considered low, the following mitigation actions are recommended for construction of the remaining pole foundations for further risk reduction purposes.

a) For areas where the bottom of the foundation is anticipated to be within 2.5 m of the top of the local aquifer used as a potable water source (i.e, top of the bedrock surface or overburden aquifer), the wood pole foundation caissons will be sealed near the surface with bentonite clay. For cases where aggregate has been used between the caisson walls and the adjacent ground, the top of the annular space will be filled with bentonite clay.

b) Wood pole foundations located in areas of surface water features/wetlands will have the steel sleeve used to form the caisson extend above the water level. Furthermore, the aggregate on the inside of the steel sleeve will be capped with bentonite clay. For cases where aggregate has been used between the steel sleeve and the adjacent ground, the top of the annular space will be filled with bentonite clay.

Respectfully submitted

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