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January 2, 2008 **Reference: 004 - 012**

To: **Mr. Ron Versteegen, Planner**
County of Oxford – Community and Strategic Planning

Copy: **Deborah Goudreau, P.Eng.**
Manager of Water Services – Public Works

Subject: **Category 1 - Class A Pit Below Water License Application**
Banner Road Pit, Thames Valley Aggregates Inc.

Introduction

As requested by the County of Oxford, I have undertaken a review of the hydrogeology and groundwater-related information submitted to the County in support of an application for a license to extract aggregate (sand and gravel) above and below the water table at a property (proposed Banner Road Pit) in Part Lot 20, Concession 1, Township of Zorra.

The information submitted to the County of Oxford and provided to ARL Groundwater Resources Ltd. (ARL) for review included (a) a Summary Statement document with a set of site plans (prepared by William Bradshaw, P.Eng. and dated September 2007), and (b) a hydrogeological report (Updated Level 1 and 2 Hydrogeological Assessment, Proposed Gravel Pit, Thames Valley Aggregates Inc., prepared by Golder Associates, June 12, 2007). The Summary Statement and the site plans incorporate hydrogeological information and recommendations from the hydrogeological report.

Hydrogeological Report (Golder, June 2007)

The hydrogeological assessment undertaken to support the license application covers a period of approximately four years, beginning in August 2003 and ending in June 2007. Background information including water well records obtained from the Ministry of the Environment (MOE) were reviewed in the early stages. In August 2003, a series of test holes were drilled and monitoring wells constructed at seven locations (Boreholes 1 – 7) within or on the periphery of the property. Groundwater samples from these monitoring wells were collected and tested for a number of water quality parameters in August 2003. Two additional monitoring wells (Boreholes 8 – 9) were constructed in January 2005. I observed a number of the monitoring wells during a visit to the site on November 23, 2007.

Staff gauges were installed at three locations in the existing municipal drain (Humphrey Drain) that passes through the property. The drain enters on the north side, continues south to the centre of the property where it bends to the southwest and continues to an exit point on the southwest boundary. One staff gauge was located where the drain enters the property, one staff gauge was in the central part of the property near the bend, and the third staff gauge was located on the

southwest edge where the drain exits the property. The staff gauges were used to record surface water level elevations in the drain.

Water levels in the monitoring wells were measured periodically beginning in August 2003 and continuing until April 2007. Approximately 12 sets of water level measurements at the monitoring wells are presented in Table II of he report. Six sets of surface water level measurements at the staff gauges are presented in Table II. The measurements occurred on an irregular schedule and the rationale for this is not explained.

The data collected from the field investigations were interpreted by Golder and presented as a series of figures that include hydrogeologic cross-sections and maps of the water table surface. The borehole logs and interpretations indicate that the aggregate deposit (sand, sand and gravel) extends to depths that range from approximately 4 – 11 m below surface. The sand and gravel deposit is underlain by a till; the on-site boreholes extended approximately 0.5 – 1.5 m into the till.

Golder notes that the data indicate that the water table occurred at depths ranging from approximately 0.5 – 7 m below surface, corresponding to an elevation range from 278.1 – 280.2 m ASL. The data in Table II supports their observation that seasonal variations in the water levels recorded at the individual monitoring wells ranged from about 1.4 – 1.8 m. The hydraulic gradients evident from the water table surface interpretations indicate that groundwater flow is predominantly to the southeast. A groundwater divide is shown to occur in the west half of the property, resulting in a westerly component of groundwater flow in that part of the property during certain times of the year.

Golder observed that the presence of surface water in the drain was intermittent, appearing to occur mainly in the spring. It was noted that surface water elevations recorded in the drain in the central and north parts of the site were higher than the groundwater elevations recorded at monitoring wells located in those areas, indicating that groundwater discharge to the drain was not occurring. Golder infers that water in the drain in those areas is inferred to be acting as a source of recharge to the upper aquifer. In the downstream portion of the site where the drain exits the property on the west side, surface water elevations were below the nearest measured groundwater elevations, indicating that there may be some groundwater flow into the drain in that part of the property.

Prior to initiating aggregate extraction, the proponents intend to relocate the Humphrey Drain to the north and west perimeter of the site. Golder does not anticipate any significant changes to the surface water or ground conditions to result from the drain re-alignment.

The proposed excavation of aggregate below the water table is expected to result in a large pond extending over the mined out area. Golder does not expect the pond to alter the general groundwater flow patterns and predicts that there will be no overall reduction in the average groundwater elevation or the recharge rate. Unacceptable or adverse impacts on groundwater are not anticipated.

Golder concludes that the proposed aggregate extraction plan and re-alignment of the drain will have no adverse impact on existing water wells. This conclusion appears to have been based on the water well record information received from MOE. The study reports do not include a field inventory to confirm details on private well locations and use in the vicinity of the site.

Recommendations provided in the Golder report are summarized as follows:

- Best management practice (BMP) plans and a contingency plan should be put in place to deal with spills, and the handling and use of petroleum hydrocarbons and hazardous materials
- Maintain the existing monitoring wells and implement a program of quarterly water level groundwater level monitoring
- Establish staff gauges at three locations in the realigned drain and initiate quarterly monitoring of surface water levels
- After extraction begins, review the water level data on an annual basis for evidence of any significant impacts from the aggregate extraction; it is noted that the water level data will provide a basis for assessing subsequent claims of groundwater interference resulting from the aggregate extraction.

Summary Statement and Site Plans (William Bradshaw, P.Eng., September 2007)

The summary statement document includes the Hydrogeological Assessment Report by Golder as an Appendix and notes three important conclusions from the report.

Page 2 (Operational Plan) of the site plans includes a general 'Spills Plan' for accidental spills of petroleum products.

Page 3 (Consultant Recommendations) of the site plans includes the hydrogeologic recommendations from the Golder report.

Page 4 (Progressive Rehabilitation and Final Rehabilitation Plans) indicates that most of the existing site area will become a large pond with an average surface water elevation of 278.5 m.

Additional Comments

Well Head Protection Areas (WHPA)

I note that the site is approximately 1 km to the south of the Well Head Protection Areas that have been delineated for the Thamesford municipal wells. The proposed plan for aggregate extraction at the property appears to present little, if any, risk to the municipal groundwater supply in Thamesford.

Private Wells

The reports indicate that a field inventory of private water wells in the vicinity of the property has not been completed.

A water well record is identified for the property located at the intersection of Banner Road and Township Road 66 (Well No. 28 in Golder Figure 2), which is downgradient of the property. Information provided in Table I of the Golder report indicates that this well is completed in gravel to a depth of approximately 20 m, and is overlain by approximately 9 m of till.

A building appearing to be a residence exists near the southwest corner of the property. No

information on the existing well supply at this location is provided. Although this location may appear to be upgradient of the site based on the water surface interpretations in the Golder report, a well supply at the location could potentially be impacted by the proposal.

Summary

The Golder (2003) report provides detailed information on the hydrogeology and groundwater conditions in the upper sand and gravel deposit at the proposed Banner Road pit site. Information is also provided on surface water conditions in the existing municipal drain passing through the property. Based on that information, Golder concludes that potential adverse impacts to the existing groundwater and surface water systems resulting from the proposed municipal drain re-alignment and aggregate extraction plan are unlikely.

Based on the information presented in their report, I am in general agreement with Golder's conclusion as it relates to the groundwater system, with the exception of private wells in the vicinity of the site. It is my opinion that confirmation of existing private well supplies located within at least 100 m of the property is required to ensure that the nature of these supplies are thoroughly understood, and that appropriate measures can be considered to ensure their protection from potential adverse effects that may result from the aggregate extraction operation.

The impact assessment and proposed monitoring program should be re-evaluated once the results of well inventory are available.

ARL Groundwater Resources Ltd.

Original Signed and Sealed

A.R. (Tony) Lotimer, M.Sc., P.Geo.
Hydrogeologist, Principal