Review Comments on EBR#010-5426

I have been requested by EcoJustice to provide a review of a Permit Application posted under EBR# 010-5426. From my analysis I have found this Application to be seriously lacking. This application contains numerous unsubstantiated assumptions which are used as a basis for arguments to indicate nil or limited impact of water taking on the Leitrim PSW. In the Technical Study in Support of this PTTW Application, there is inadequate in-depth analysis of the borehole monitoring data to support the conclusions pertaining to the potential impact of pumping on the groundwater levels in the Leitrim PSW.

Specific Comments

1. Page 2, Golder Associates submission Letter of December 10, 2008: The letter states ". . . *in view of the uncertainty regarding timing of issuance of the Future Stages PTTW, the Applicant cannot wait until the permit is issued to proceed with its construction.*" This is a specious argument on which to base the current application. The comments submitted in response to the Future Stages PTTW Applications gave substantial evidence against granting the permit posted under EBR#010-4134 and the following amendment posted under EBR#010-4670. It is apparent that those same inadequacies are present in the current application.

2. On page 3 of the PTTW Application (Section 7) the applicant claims to be unaware of complaints or impacts resulting from water takings at the site. Complaints in relation to all previous PsTTW at this site have been submitted.

3. Page 4 of the Technical Study in support of a Category 3 PTTW Application , Findlay Creek Village Subdivision (Attachment 2, hereafter referred to as Technical Study) states "*Groundwater control requirements in trenches completed in overburden have typically been much smaller and have not required a PTTW.*" The comments provided by me on EBR#010-4670 concerning the huge drawdown of borehole water levels in the PSW in 2007 demonstrate that the applicants should have had PsTTW for overburden construction to assure protection of the wetland, particularly during such overburden activity as caused the devastating drawdown of water levels in 2007. In addition, this claim does not support the applicant's statement that " *Groundwater control . . . has not been shown to cause adverse effects to the long-term groundwater levels within the PSW, . . . (Golder Associates 2008a)*"

4. Technical Study, Table 2 and page 7. Table 2 is listed as "*Drawdowns Observed in July 2006*". Following Table 2 is a description for how the calculation of maximum drawdown was performed. These results are unreliable as a prediction tool as used in Sections 4.2 and 4.3 for two reasons. Firstly, the Applicants use of "*six (6) or seven (7) pumps were operational*" as a quantitative specification of boundary or initial conditions for the drawdown observation is woefully inadequate quantification. This leaves unanswered such questions as, at what rate was water being removed from the pumping centroid for how long? Actual numbers giving the pumping rate have not been specified

quantitatively. Secondly, precipitation during the periods in 2005 and 2006 considered to have an influence on summer groundwater levels and/or drawdowns were 12% and 20% above normal, respectively. As precipitation and pumping rates are the factors exhibiting major influence on well levels and drawdown, the lack of quantification of both of these factors make the drawdown data in Table 2 invalid as a predictive instrument as used in this Technical Study.

5. Section 4.2 in Technical Study

(A). Section 4.2, Figure 5 in Technical Study: The latter part of the first paragraph of Section 4.2 draws conclusions about groundwater drawdown at distances from the pumping centroid. Regrettably, those predictions are unreliable. Even the author claimed only "*fairly accurate representation*" for the Figure 5 prediction tool. As Table 2 is unreliable, any derivations therefrom are also unreliable, including Figure 5 and all predictions based on it.

(B). The last paragraph of Section 4.2 commits an unforgivable error in modeling and prediction methods. Apart from the fact that Figure 5 uses data from Table 2 that are invalid, Figure 5 is an empirical representation of the complex drawdown process. One uses empirical representations or equations when the processes are not understood well enough to allow use of a physical model. One should respect rigorous restrictions on the use of empirical models for predictive purposes. At least two of those restrictions have been ignored by the authors of this Technical Study. The authors refer to data from monitors BH03-7A, BH03-7B and BH03-9B as if those data were "*significantly*" separate from the curve of Fig. 5B, which is referenced as a prediction. In fact, data from these boreholes are among the data set used to generate Figures 5A and 5B! The deviations of data points from the empirical representation of those data are the measure of error or uncertainty inherent in the empirical representation and are, by definition, not significantly different from the curve unless shown to be outliers. There is no reference to a statistical significance test. Thus the authors are actually using data uncertainty as predictive of groundwater levels, a universally unacceptable practice.

(C). Although the latter part of the last paragraph in Section 4.2 describes poorly a so-called "*worst-case scenario*", one may read this as an additional prediction based on Figure 5. If so, the authors have used an empirical equation as a predictive tool under conditions which were not in-place for the data used to generate the equation. This is a blatant abuse of the restrictions governing the use of empirical models. Thus the "*expected temporary drawdown . . . conservatively based on a worst case scenario*" is useless because of the doubly erroneous use of empirical modeling.

6. Section 4.3, Technical Study: Figure 5B is again used as a predictive tool to generate Table 3 from a scenario apparently relevant to Stage 2 Phase 3 construction. As described above empirical models cannot be used as predictive tools under altered boundary and initial conditions. In addition, the authors have used again the 2006 data from BH03-7A and BH03-7B as being "*significantly*" different from the "*predicted drawdown*", even though these data are part of the prediction curve. Thus Table 3, like Table 2, has two

levels of error – incorrect use of empirical model and using part of the modeling data as if an independent prediction of the model, making this Table useless. As Section 4.3 makes extensive use of Table 3, a Table of faulted data, the whole Section draws unsubstantiated conclusions.

7. Section 4.3, last sentence paragraph 2: "*. . . , similar pumping for servicing construction during June 2008 did not cause a measurable change in the groundwater elevation in the PSW monitors (refer to Figures 6 to 12).*" The evidence in Figures 6 to 12, in so far as can be made out, does not substantiate but actually negates the above claim. BH03-1, BH03-3, BH03-5, BH03-6, BH03-7a, BH03-8a, BH03-9a, BH03-9b, BH03-10a, BH03-10b, BH97-2a and BH97-2b all recorded BH levels which dropped measurably from June through the remainder of the summer, in a year of near normal precipitation. Of those numerous boreholes there were many which dropped to or below the listed trigger level, such as, BH03-1, BH03-5, BH03-6, BH03-7a, BH03-8a, BH03-9b and BH03-10b. Thus the author's statement is made on the basis of their wish that pumping not be injurious to the PSW and not on a reasoned analysis of their own data taking into account precipitation conditions. They do not acknowledge that recovery response of the borehole groundwater levels is seldom immediate in its entirety.

8. Section 6.2: This section refers initially back to Section 4.3 which has been shown above to be entirely faulty. Thus the first sentence cannot be treated as valid. No evidence is given to validate the claims in sentences 3 and 4 that "*Because the proposed groundwater taking regime is similar to historical groundwater duration and rates, it is anticipated that the proposed pumping will not impact the function of the Leitrim PSW. If water taking is required within the overburden or to control surface water, they are not expected to impact the function of the PSW.*" Much of the groundwater monitoring data show strong evidence that the function of the PSW has been impacted by the historical pumping and construction activity which has gone on both with and without permit. In response to ERB#010-4670, I provided results of a limited analysis of borehole water levels with time which showed that groundwater levels and response patterns within the PSW have changed over the years of construction. In recent years the Golder measured groundwater levels are more frequently dropping below trigger levels well within the PSW than was occurring three years earlier. Thus the above claims made by the authors cannot be accepted.

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