HYDROGEOLOGIC REVIEW OF INLAND WETLANDS AND WATERCOURSE APPLICATION THE PRESERVE, OLD SAYBROOK, CT

Prepared For:

Town of Old Saybrook

October 2005

Prepared By:

LEGGETTE, BRASHEARS & GRAHAM, INC.
Professional Ground-Water and Environmental Engineering Services
126 Monroe Turnpike
Trumbull, Connecticut 06611

HYDROGEOLOGIC REVIEW OF INLAND WETLANDS AND WATERCOURSE APPLICATION THE PRESERVE, OLD SAYBROOK, CT

INTRODUCTION

LBG has completed a review of the hydrogeological report, "Yield and Environmental Impact Analysis, Irrigation Water Supply Systems" by BL Companies, September 2005, submitted as part of the Inlands Wetlands and Watercourse Application for The Preserve development in Old Saybrook, Connecticut. The purpose of the review is to provide an assessment of the Applicant's water-supply and impact assessment information. Specifically, LBG considered potential impacts to wetlands and watercourses as a result of pumping ground water for irrigation of the golf course. It is noted that LBG performed a review of the previous application for The Preserve in 2000, for which irrigation water was to be obtained from public water supply.

LBG has also reviewed the "Integrated Turf and Pest Management Program (ITPMP)/Ground and Surface Water Monitoring Program", by BL Companies, August 11, 2005, specifically Appendix A, detailing the ground-water monitoring protocols. LBG has issued a separate review memo on this subject and the report is being reviewed in its entirety by the Town's IPM consultant, Dr. Martin Petrovic.

The proposed development on nearly 1,000 acres includes residential villages and single-family homes for a total of 221 residential units and an 18-hole golf course with associated clubhouse and maintenance facilities. Potable water to the residences and clubhouse will be provided by a connection to public water and therefore will not be derived from onsite ground-water resources. A single community septic system with two separate leachate fields will treat all wastewater at the development. The golf course will be irrigated by ground water from onsite wells that will be pumped into two lined irrigation ponds.

REVIEW COMMENTS

Irrigation Water Demand

The Applicant's estimates of irrigation water demand are provided in table 2 of the report. The water demand is calculated for 90 irrigated acres, of which there are 9.4 acres of tees and greens. The Town's golf course architect consultant, Mary Armstrong, notes that this is an unusually high percentage of green and tees for an 18-hole golf course, and that fairways are not separated out of the calculation. Nonetheless, the estimates for total water usage are consistent with other 18-hole golf courses in the state. Under average rainfall conditions, the golf course is expected to use 27 mgy (million gallons per year) between the months of April through October with a peak daily demand of 0.221 mgd (million gallons per day) in July. This is equivalent to a delivery rate of 153 gpm (gallons per minute) over a 24-hour period. During drought periods, the total golf course demand is 40.6 mgy during the irrigation season with a peak daily demand of 0.345 mgd, equivalent to a delivery rate of 240 gpm in 24 hours. The peak daily demands are generally consistent with our experience but the total seasonal demands are higher than is typical for this region.

We concur with the Applicant that the wells should meet the peak daily demand during an average rainfall year; however, the Applicant did not address the inadequacy of ground-water supplies during a drought year. The pumping test results indicate that the three wells can produce a sustainable yield of 170 gpm, which is equivalent to 0.245 mgd. A Water Diversion Permit issued by the Connecticut Department of Environmental Protection (CTDEP) will be required since the peak daily withdrawal exceeds 50,000 gpd (gallons per day). Assuming no other issues with the application, CTDEP will typically issue a diversion permit limited to the tested yield of the wells, in this case a maximum of 0.245 mgd. During periods of drought, the peak daily demand in July and August exceeds the tested rate of the wells, and apparently the shortage will be derived from water storage in the lined irrigation ponds.

The Applicant did not perform a ground-water balance study. A water balance involves comparing the estimated ground-water recharge to proposed withdrawals from a given area. A positive water balance (i.e., recharge to ground water exceeds the amount of pumping) is useful in providing a first-order estimate of the ability of the onsite aquifers to support the water demand, without "mining" ground water from the aquifer. Typically, the water balance is

assessed by calculating recharge to the watershed area that is upgradient of the ground-water withdrawal points or able to be captured by them. Considering the relatively small watershed area upstream of the wells, the water balance may be positive during normal rainfall years, but may be negative during drought years.

In the same way that a positive water balance does not definitively rule out impacts to wetland areas, a negative water balance does not definitively demonstrate impacts. A pumping test under controlled conditions with monitoring of sensitive areas is critical to evaluating potential impacts. And although a pumping test under ideal conditions provides a good indication of potential impacts to wetland areas, long-term operation of the wells may result in impacts that were not detected during the pumping test, even when the test was conducted under ideal conditions.

Pumping Test Procedures

Overall, the setup and pumping test methodology was good, but the test was not conducted under ideal conditions due to a large rainfall event that occurred at the beginning of the test. To compensate for the rainfall event, the test was run for eight days in September 2004, an extension of three days beyond what is required according to Level A mapping requirements of the CTDEP, which is the requirement that has been applied recently to golf course applications. This rain event, the remnant of one of several former hurricanes that made landfall in September 2004, occurred during the first 24 hours of the test and totaled over 2 inches at the site. Most of the hydrographs for the monitoring points in wetland areas were dominated by this rain event, showing a rise in water levels during the storm followed by a corresponding period of water level decline that lasted several days or more. In some monitoring points, water-level recovery from this event was still seen after shut-down, seven days after the rain event. LBG is concerned that potential drawdown impacts from pumping may have been obscured by the large rain event.

Of an original six test wells, three bedrock wells (TW-2, TW-3 and TW-4) were identified as having sufficient preliminary yields to be included in a long-term pumping test as potential irrigation wells. Test wells TW-2, TW-3 and TW-4 sustained pumping rates of 80, 27, and 40 gpm, respectively, although the Applicant calculated a sustainable yield from a reconstructed TW-3 of 50 gpm, for a total of 170 gpm from all three wells. The borehole for

TW-3 was originally drilled to 320 feet, although it was not possible to install the pump deeper than 57 feet bgs (below ground surface). It was reported that major water-bearing fractures were encountered at 40 and 55 feet bgs in TW-3 and the borehole likely collapsed at the depth of the water-bearing fractures. Therefore, the pumping rate from TW-3 was reduced to avoid drawing down the water below the level of the pump.

No information on recovery of the wells was provided in the report. Recovery monitoring identifies the rate that the water in the well returns to pre-pumping (static) conditions and how long it takes for the well to fully recover from pumping. This information would be useful for evaluating well performance and the wetland monitoring data.

The Applicant did not indicate where the pumped water was discharged. If the wells discharged into or near a wetland area, potential drawdown to the wetlands caused by pumping could be masked by the input of the discharged water. Ideally, sufficient piping would be connected to the wells to direct discharge away from any potentially-impacted wetland areas.

Potential Impacts to Onsite Wetland Areas

A total of 58 wetlands monitoring points were installed and monitored during the test. These are identified in the report as deep monitoring points, streambed minipiezometers, minipiezometers, and stream weirs. No boring logs or information on monitoring point construction were provided in the report. Some additional information on the monitoring points was provided by the Applicant's consultant when requested by LBG. The minipiezometers were installed to monitor shallow ground water in wetland areas and were driven manually to a depth of 2 feet below grade. Deep monitoring points are monitoring wells that were installed in the overburden to the depth of refusal on bedrock (with the exception of DMP-5 where no refusal was encountered), with 5 feet of screen installed at the base of the well.

The Town's wetland consultants have identified vernal pools on the property as a primary concern for impacts as a result of pumping ground water because of the seasonal habitats provided for amphibians. There are several vernal pools in Wetland #19 in the vicinity of TW-2 and TW-3. LBG identified impacts from pumping in Wetland #19, which is not an unexpected result as this is the extensive wetland in the immediate vicinity of the pumping wells. Wetland #19 comprises 44.17 acres and includes Pequot Swamp and represents headwaters that drain to the west and empty into Trout Brook to the west of the site along State Route 153.

Although monitoring points were not installed in all the vernal pools in Wetland #19 (e.g., VP #8, VP #13, VP #28 and VP #32), overall there was good coverage in the wetland system during the test (including VP #12 and VP #9) and results from these monitoring points can be projected to the vernal pools of concern.

The data indicate that pumping caused drawdown in shallow ground-water levels at some monitoring points in Wetlands #19. The Applicant did not address the implications of this ground-water drawdown on the surface water levels in the wetland areas, particularly the vernal pools. Impacts to ground-water levels were seen at monitoring points installed in VP #7, VP #9 and VP #12, all part of Wetland #19. DMP-5, identified as an overburden monitoring point with a screened interval from 27 to 32 ft bgs, showed a drawdown of over 16 feet during the test. Although two other shallow monitoring points located in the vicinity of DMP-5 (SW-4 and SMP-6) showed no drawdown, the Applicant did not provide an analysis of the significance of the data from DMP-5. Most of these monitoring points show a strong response to the rainfall event at the start of the test, and there is a potential that larger impacts would have been seen in these monitoring points in a rainless period. The Applicant did not identify which well or wells caused the most impact to the shallow ground-water levels in the wetland areas. The Applicant did not monitor surface water levels any monitoring point (with the exception of the one point in Pequot Swamp and the six stream weirs) although it is likely that some locations were wet for some or all of the testing period.

The results from the surface water monitoring point at the southern end of Pequot Swamp Pond show sudden fluctuations on the order of 0.5 foot in the pond level during and following the testing period. The report offers no explanation or speculation on the cause of these fluctuations, yet concludes that the pond levels were not affected by pumping. It is not possible to verify this conclusion without more information on the potential causes of the pond level fluctuations.

The Applicant did not provide a full analysis of the stream monitoring results. Hydrographs showing measurements at six stream weir monitoring points are shown on Chart 39 and the data is included in table 3 of the report. The Applicant's analysis indicates, "*There was no observed increase in stream flow when the wells were turned off.*" (page 35). LBG concurs with this observation; however, the stream weirs showed a large response to the September 18 rain event and stream flows were still declining when the test was shut down on September 25.

Therefore, the difference in the flow rate at separate stations should be compared for readings at different times, to separate out any changes as a result of precipitation from those due to pumping. LBG's evaluation of the data collected at three stream weir stations in Wetland #19 (SW-5, SW-4 and SW-1) indicates that the flow through the system may have been reduced during by the pumping test. This result is consistent with the ground-water monitoring data that show that the shallow ground-water zone associated with Wetland #19 is in hydraulic connection with the bedrock aquifer.

Potential Impacts to the Bedock Aquifer (Offsite)

A total of 50 offsite residential wells were monitored during the test. Presumably these wells are completed in the bedrock aquifer because of the lack of significant overburden aquifer material in the area. Ultimately, monitoring water levels during pumping is the only way to determine if two bedrock wells are in hydraulically connection due to the nature of bedrock aquifers in which water travels through interconnected networks of openings and fractures. The offsite monitoring network was adequate to provide representative coverage in all directions and to get an indication of the likelihood of potential offsite impacts. As with any test of this size, complete coverage of all offsite wells within the targeted radii from the pumping wells is usually not feasible because of the preference of some private wells owners to not participate and the inaccessibility of some wells.

As identified by the Applicant, two wells located at 9 and 11 Deer Run Road were impacted by the test pumping. TW-4 is located about 400 feet from the two wells that showed drawdown impacts and is likely the well that caused the drawdown in these wells. These two wells each showed a drawdown of around 12 feet due to pumping. Even with the pumping impacts, the wells have available drawdowns of 121 and 141 feet, respectively. Although the available information indicates there is sufficient available drawdown to allow normal operation of each of these wells, the potential for significant drawdown impacts over the long term in the bedrock aquifer in this area cannot be ruled out. The significance of this observed drawdown in the bedrock aquifer to onsite wetlands was not discussed in the Applicant's report.

On advice of Town Counsel, the issue of impacts to offsite drinking water wells does not reside with the Inlands Wetlands and Watercourses Commission. This issue will almost certainly be addressed by the DEP as a part of the diversion permit application process.

Conclusions

1. The Applicant has not identified a source of water to meet drought season irrigation water supply.
2. The Applicant has not shown that seasonal use of ground water derived from onsite bedrock wells, a consumptive use of water by definition, will not adversely reduce surface water outflows from the site, both in the short and long term.
3. The Applicant has not shown that the use of ground water derived from onsite bedrock wells will avoid impacts to vernal pools during critical parts of the amphibian life cycle. The Applicant should demonstrate that the wells will not impact these areas, or should explain how usage of TW-2 and TW-3 can be managed to avoid undesirable impacts.
4. The Applicant has not performed an analysis of the feasible and prudent alternatives to the use of ground water derived from the three bedrock test wells for irrigation. In accordance with the Criteria for Decision, Section 10.2.B of the Inland Wetlands and Watercourses Regulations of the Town of Old Saybrook, "*Such alternatives should include, but not necessarily be limited to, requiring actions of different nature which would provide similar benefits with different location for the activity.*"

LEGGETTE, BRASHEARS & GRAHAM, INC.

Juliet M. McKenna
Senior Hydrogeologist

Reviewed by:

R. G. Slayback, CPG, LEP
Principal

ng
October 19, 2005
H:\OLDSAYBR\LBG HYDRO REVIEW FINAL.DOC