HANSON VAN VLEET
est. 2004
Hydrogeologic Consultants, PLLC

February 6, 2025

Town of Cairo Planning Board
C/O Mr. Joseph Hasenkopf, Chairman
PO Box 728
Cairo, New York 12413

**RE: Hydrogeologic Review**
**Water Supply Hydrogeologic Report**
**Blackhead Mountain Lodge Project**
**Cairo, New York**

Dear Mr. Hasenkopf:

At the request of Town of Cairo Planning Board, Hanson Van Vleet, PLLC (HVV) has conducted a review of the hydrogeologic evaluation report submitted in support of water supply development for the proposed Blackhead Mountain Lodge Project, located in the Town of Cairo, Greene County, NY. This review assumes that the revised Water Supply Hydrogeologic Report for Blackhead Mountain Lodge (report), dated November 19, 2024 and revised on January 17, 2025, and February 5, 2025 prepared by Sterling Environmental Engineering, P.C. (Sterling) is intended for submission for New York State Department of Health (NYSDOH) and New York State Department of Environmental Conservation (NYSDEC) public water supply and water withdrawal permitting.

The criteria set forth in the NYCRR Part 5, Subpart 5-1, Public Water Systems - Appendix 5D, and the NYSDEC Procedures for Pumping Tests for Water Supply Withdrawal Applications were compared to the methods of testing, analysis, and conclusions of the report. HVV has reviewed the report to determine if an adequate water supply for the proposed project has been established, and to review the potential for long term adverse effects to the local aquifer and normal use of nearby privately-owned wells by the proposed project water system.

**BACKGROUND**

HVV's review consisted of the report and data prepared by Sterling titled, Water Supply Hydrogeologic Report for Blackhead Mountain Lodge, dated November 19, 2024 and revised on January 17, 2025, and February 5, 2025. To provide a professional opinion on the reported safe yield of the proposed project water supply wells. HVV reviewed the report's methods of analysis used to support the reported available safe yield in accordance with the New York State Environmental Quality Review Act (SEQR), and NYSDOH and NYSDEC requirements.

The report states that the maximum daily demand for the project would be 46,212 gallons per day (gpd) or 32 gallons per minute (gpm). The maximum daily demand of 46,212 gallons per day was reportedly calculated using design flow rates from the New York State Design Standards for Intermediate Sized Wastewater Treatment Systems, at the maximum

occupancy of the project. Method 1 of the New York State Design Standards for Intermediate Sized Wastewater Treatment Systems, states that maximum occupancy is an acceptable design flow rate for septic tank or subsurface absorption systems.

Drinking water source capacity is required to meet or exceed the maximum daily waste water design flow, and it is the responsibility of the design engineer to demonstrate the water system's ability to meet the project demands for public water system approval. HVV has not been provided correspondence regarding DOH approval of the design flow calculations and or minimum required source capacity for the project. For the purposes of this review, HVV assumes that the proposed calculated maximum daily demand of 46,212 gpd as stated in the report will be acceptable to the NYSDOH, NYSDEC and the Town of Cairo's consulting Engineer for the project.

The Recommended Standards for Water Works, from which NYSDOH bases their public water supply requirements, states that the total developed groundwater source capacity, unless otherwise specified by the reviewing authority, shall equal or exceed the design maximum day demand with the largest producing well out of service. Based on the information provided in the report, in order to meet NYSDOH requirements for source capacity, both Well-4 and Well-5 must have a demonstrated safe yield of at least 32 gpm. Constant, 24-hour a day pumping of at least 32.09 gpm would be required at Well-4 or Well-5 to accommodate the maximum daily demand of 46,212 gallons per day.

## METHODS OF DATA COLLECTION

The report describes appropriate methods utilized during the 72-hour pumping tests of the proposed production wells Well-4 and Well-5 to collect water level data during back ground, testing, and recovery periods at the onsite and offsite wells.

## DATA ANALYSIS AND CONCLUSIONS

Based HVV's review of the Well-4 and Well-5 72 hour pumping test data, the proposed safe yields of 32 gpm for both Well-4 and Well-5 respectively are in question due to concerns of long-term impacts to the available water column height in nearby privately owned wells that exhibit a significant hydraulic connection to the proposed production wells Well-4 and Well-5.

Drawdown greater than 15-feet and 20-feet was identified at the privately owned E. Massman and R. Green wells respectively during the 72-hour pumping tests of Well-4 and Well-5, of which approximately 85% of the residual drawdown remained at the E. Massman and R. Green wells after 24-hours of pumping inactivity at the project wells, and full recovery to pre- test levels took greater than 10-days. The lack of recovery to pre-test static water levels at the offsite wells after significant periods of pumping inactivity at the proposed production wells may indicate that the withdrawal rate of 32 gpm at wells 4 and 5 may be too high relative to the available groundwater recharge in the aquifer intercepted at wells 4 and 5 and the E. Massman and R. Greene wells.

A fractured bedrock aquifer as reported to be utilized by all wells included in the scope of the report, is defined as one or more secondary porosity features in the low-permeability bedrock such as joints, fractures, and bedding planes that yield a usable quantity of water to an intercepting borehole. A fractured bedrock aquifer is characteristically variable and often discontinuous regionally, with wells installed in a given area exhibiting varying degrees of

hydraulic connection often not directly related to their distance from one another. Hydraulic connection and potential pumping influence in fractured bedrock aquifers also is not easily predictable based on the respective well's depth of installation.

The report presents water level observations illustrated in Figure 5 to describe the presence of an upper and lower aquifer in the study area. Variations in the static piezometric surface (static water levels) in the wells monitored is provided as evidence of an upper and lower aquifer in the study area. HVV agrees that there are likely two differentiated aquifer zones identified by the study area wells. Based on the data provided, an aquifer zone was identified that results in a deeper static water level as observed at Well-5, Well-4, Well-2, the E. Maassmann well, and the R. Green well. A significantly shallower static water level indicative of a differentiated aquifer was observed in the project well Well-1, and the wells owned by D. Palka, R. Yanashusky, P. Maassmann, and M, Helene.

The pumping test data from the test of Well-4 and Well-5 shows drawdown correlated with the 72-hour pumping period at the E. Maassmann and R. Green wells in excess of 15-feet and 20-feet respectively. As described in the report, based on the observed drawdown, inferred orientation of bedrock fracturing, and similar static water levels, the E. Maassmann and R. Greene wells appear to have a substantial hydraulic connection to the project wells 4 and 5. None of the other offsite wells monitored during the testing of Well-4 and Well-5 showed drawdown in excess of 3-feet during the 72-hour tests of Well-4 and Well-5, and based on their location relative to the inferred predominant fracture orientation, significantly varying static water levels, and lack of substantial drawdown observed during the testing, the D. Palka, R. Yanashusky, P. Maassmann, and M, Helene wells do not appear to have a substantial hydraulic connection to Well-4 or Well-5, and based on the data collected during the pumping tests, HVV concurs with the report that the normal use of these wells is not likely to be disrupted by the project water system as proposed.

The report provides the hypothesis that a stratified upper and lower aquifer with a lower yielding upper aquifer zone is the cause for the delay in recovery of the water levels to pre-test conditions at Well-5, Well-4, the E. Maassmann well, and the R. Green well following the pumping tests. The report provides the conclusion that the dewatering of the upper aquifer zone that persists for greater than 10-days days following the pumping tests, does not pose a threat to the viability of the wells because the "lower" aquifer is contributing the majority of the useable yield for the wells, and therefore the water levels in the aquifer will not be permanently lowered. It is the opinion of HVV that this conclusion is not well supported by the pumping test data and is a risky assumption based on the rate of recovery observed, the limited pumping duration provided during 72-hour testing, and the need to run the production wells in a 24-hour a day pumping scenario to meet the project's maximum design water demands.

The differentiated aquifer zones identified as upper and lower in the report, are the result of the elevation and porosity of the water-bearing features encountered in each respective well. Although the "upper and lower" aquifers may be identified in respective wells in the area, nothing in the data provided clearly indicates that these zones were encountered at all of the study-area wells. Based on the information provided, it appears that Well-5, Well-4, Well-2, the E. Maassmann well, and the R. Green wells intercept similar secondary porosity features that are not as directly connected to the fractures intercepted in the other study-area wells that were monitored. The data does not clearly indicate that both the "upper and lower"

aquifer zones were intercepted by Well-5, Well-4, the E. Maassmann well, and the R. Green wells.

Well drilling logs provided in the report do not show shallow fractures or defined and continuous confining layers encountered by the boreholes at Well-4 or Well-5 that would support the notion of separate upper and lower aquifers in these wells, nor do the pumping test data drawdown or recovery graphs illustrate distinct inflection points in the plotted rate of drawdown or recovery that would support the presence of varying rates of recharge contributed by multiple aquifers intercepted by the wells.

Based on the above, the aquifer intercepted by Well-5, Well-4, the E. Maassmann well, and the R. Green well appears to be the "lower aquifer" only. Following the 72-hour pumping tests of Well-4 and Well-5, this aquifer did not recover in such a manner that would indicate that the proposed safe yields of 32 gpm for Well-4 and Well-5 are sustainable in the long term.

A significant concern is identified by the pumping test data that over-pumping of the aquifer at 32 gpm from Well-4 and or Well-5 during long-term use would result in a reduced static water level at the E. Maassmann and R. Greene wells after each pumping cycle of the project production wells, because the proposed use of the wells would not allow adequate recovery to be achieved between pumping cycles of the project wells. For example, during the 72-hour test of Well-4, 15.84 feet of drawdown was observed at E. Massman Well after 72-hours of pumping. After 24-hours from cessation of pumping at Well-4, 13.39' of residual drawdown remained at the E. Maassmann well. After 4-days from cessation of the 72-hour test of Well-4, the residual drawdown in the E. Massman Well remained 6.56-feet below the pre-test static water level. Based on the project demand relative to the proposed safe yield of 32 gpm, it is not reasonable to expect 4 or more days of pumping inactivity between pumping cycles of the project wells that would appear to be necessary to allow a reasonable percentage of recovery of the water levels in the E. Maassmann and R. Greene wells. Slightly more drawdown and a similar delayed rate of recovery was identified at the R. Greene well as described above.

The report refers to 180-day semi-logarithmic projection of the pumping test data to support the safe yield of 32 gpm for Well-4 and Well-5 respectively. NYSDOH Part 5 Appendix 5-D states that *if the well does not recover to 90% of the initial water level within 24 hours after cessation of pumping, a thorough evaluation of the expected sustained performance of the well during seasonal or multi-year dry periods shall be prepared. This evaluation may involve additional hydrogeologic investigation. Such evaluation may be used in lieu of satisfying the objectives of subdivision (c) of this section only at the discretion of the reviewing agency(ies) having jurisdiction.*

180-day projections are not considered to be an adequate method of evaluation in this case because they rely solely on graphical projection of the drawdown data collected during the 72-hour pumping test, and do not take into account the rate of recovery after pumping is discontinued, which in this case does not appear to match the proposed rate of withdrawal. The report provides a hydrogeologic evaluation mostly focused on the presence of an upper and lower aquifer to address the concerns of over pumping. It is the opinion of HVV that additional analysis would be needed to support the conclusions of the report.

HVV recommends a reduced safe yield for Well-4 and Well-5 respectively that would allow 90% recovery in 24-hours in accordance with NYSDOH guidelines, and that would not result in a potential impact to offsite privately-owned wells.

If the project demand cannot be met by a reduced safe yield that allows adequate recovery at private wells drawdown during the 72-hour pumping tests of Well-4 and Well-5, additional testing should be completed that incorporates the other existing project wells in a combined pumping scenario that may prove to better distribute the drawdown of the aquifers present, and allow the rate of withdrawal to be better accommodated by the available groundwater recharge to the wells.

**PROPOSED MITIGATION**

In accordance with The New York State Environmental Quality Review Act (SEQR), as the lead agency, the Town of Cairo Planning Board must review if the potential for impacts to the pre-existing use of offsite privately owned wells as described herein represents the possibility of no or small impact, or a or potential for a moderate to large impact.

Based on the data provided by Sterling and reviewed by HVV, in regards to Full EAF items Part 2, Section 4, b; the proposed water supply for the project without mitigation measures has the potential to result in a moderate to large impact due to the potential that the water supply demand from the proposed action may exceed safe and sustainable withdrawal capacity rate of the local supply or aquifer.

If the project maximum daily demand is not proposed to be reduced to accommodate the sustainable withdrawal rate of the local aquifer, proposed mitigation measures provided in section 3.0 of the report, may serve to alleviate the potential for a large to moderate impact to the local aquifer. The potential for a large to moderate impact is evidenced by drawdown without adequate recovery at the E. Massmann and R. Green wells during the pumping tests.

The first proposed mitigation measure consists of the developer retaining a well drilling contractor to deepen the total depth and pump setting at the E. Massmann and R. Green wells, to accommodate the projected 180-day drawdown at each well as calculated from the pumping test data. The semi-logarithmic graphical projection of the pumping test data utilized for 180-day projections may be unreliable due to the analysis not incorporating the rate of recovery after pumping is discontinued, which in this case does not appear to match the proposed rate of withdrawal. Mitigation by deepening the wells identified with the potential for long term impacts would require an agreement and with the property owner and, would need to be verified to be effective by additional testing after the well and pump are deepened.

The second option for mitigation proposed in this report is presented as follows:

*Connect to Public Water Supply: Alternatively, the E. Maassmann and R. Green wells are immediately adjacent to the project site and could feasibly be incorporated into the project water supply system. Single-family dwellings have a design water demand of 110 gallons per bedroom per day (i.e., 330 gpd for a three bedroom dwelling and 440 gpd for a four bedroom dwelling). Using a residential demand of 500 gpd per dwelling would require an allocation of 1,000 gpd (0.7 gpm) from the design demand flow for the project.*

*If connection to the project water supply were implemented, the project density would be reduced in size to accommodate the addition of the two dwellings such that the maximum daily demand of the*

*project system remains at 32 gpm.* HVV finds this approach to be reasonable, if such an agreement can be reached with the property owners in question as it incorporates the additional demand of the private residences and proposed to reduce the project density to accommodate.

The third mitigation measure proposed is provided as follows to address the lack of 90% recovery in 24-hours at the proposed project production wells Well-4 and Well-5:

*The observed groundwater recovery less than 90% within 24 hours of pumping for Well 4 and Well 5 is attributed to the stratified bedrock aquifer system and not that the aquifer is being depleted. The 90% recovery target is a benchmark that indicates an aquifer is capable of accommodating a sustained pumping rate without the need for a more detailed analysis. As documented in this report, additional analysis was performed to demonstrate that the aquifer can accommodate the sustained target pumping rate of 32 gpm. Nevertheless, the following mitigation is readily available if deemed necessary to alleviate potential concerns related to observed recovery:*

*Phased Construction: The development is planned to be constructed over 8 phases with phases 1 through 3 consisting of site infrastructure. Phases 4 through 6 continue the infrastructure buildout and includes the construction of lodging structures with 43 available bedrooms. Phase 7A includes the construction of an additional 47 bedrooms and the 300-seat restaurant. This report conservatively uses tabulated hydraulic loading rates that may overestimate actual water demand. As an example, the United States Geological Survey*

*Blackhead Mountain Lodge Page 20 Water Supply Hydrogeologic Report – 2/5/2025 #2024-59 © 2025, Sterling Environmental Engineering, P.C.*

*per capita water use in New York State of 71 gallons per day compared to the tabulated 110 gallons per day used in this report. The NYS Design Standards for Intermediate Sized Wastewater Treatment Systems allows for design flow rates to be obtained using actual metered daily water use flow rates.*

*Actual water use can be determined after the completion of Phase 7A (i.e., at approximately 56% of the full buildout water use) to refine the actual maximum daily demand at full buildout and to obtain drawdown and recovery data under operating conditions for a duration longer than 72 hours.*

*The actual water use and longer-term drawdown and recovery data will be incorporated into a subsequent hydrogeologic report to confirm the findings of this report that the aquifer can accommodate the sustained pumping from the project at full buildout of the remaining Phases 7B, 7C, 8A, 8B, and 8C, which collectively include lodging structures for the remaining 176 bedrooms. Therefore, the project design allows for monitoring actual levels of predicted impacts at an intermediate point of construction that is likely significantly less than water demand assessed in this report.*

HVV does not agree that that additional analysis was performed that demonstrates that the aquifer can accommodate the sustained target pumping rate of 32 gpm. The above proposed analysis of actual water use during the phased project buildout may be a reasonable approach to provide a more-detailed long-term hydrogeologic analysis of the sustainability of the proposed water system. If this approach is pursued, the applicant's consultants should provide a detailed work plan of how the analysis would be completed, including details of long-term water-level monitoring of the E. Massman and R. Green wells.

If you have any questions, please contact me at (518) 371-7940, ext. 129 or jgironda@hansonvanvleet.com.

Very truly yours,
Hanson Van Vleet, PLLC

James Gironda, P.G.
Senior Hydrogeologist