November 27. 2018

Derek Marshall, PE, LEED AP, Associate
Dewberry
4805 Lake Brook Drive, Suite 200
Glen Allen, VA 23060

RE: HYDROGEOLOGICAL REVIEW OF SPOTSYLVANIA COUNTY SPECIAL USE PERMIT SUP18-0001, 2, 3

Dear Mr. Marshall:

Golder has reviewed the Hydrogeologic Investigation Report for the proposed Spotsylvania Solar Energy Center in Spotsylvania County, Virginia dated September 26, 2018, including Appendix D Fracture Trace Analysis and Geophysical Survey Report dated May 29, 2018. We have also reviewed the Geotechnical Engineering Report, the Hydrologic Soil Group Study, the Stormwater Management Report and Generalized Development Plan Narratives for the three subject Special Use Permit (SUP) cases (SUP18-0001, 2, and 3). The purpose of this subject matter expert review is to provide comment on whether the hydrogeology documentation meets industry standards, to recommend document changes, and provide recommendation SUP conditions for approval that ensure protection of the aquifers and wells that may be impacted by the proposed sPower Solar Facility.

Recommended Document Changes

The hydrogeologic review, although thorough and purposeful, does not meet industry standards for evaluating potential impacts of the proposed sPower Solar Facility on existing groundwater conditions and groundwater users. The following changes and additions to the hydrogeologic documentation are recommended:

- Conduct a water budget and groundwater recharge analysis to document how the proposed facility may impact and alter infiltration and recharge rates to the aquifers underlying the property. This analysis should include a discussion of pre-development and post-development groundwater recharge rates, including an evaluation of whether modified land cover from mostly forested woodland to grassland and impervious cover increases runoff and decreases groundwater recharge. Briefly describe the nature and occurrence of groundwater and how it flows through the aquifer system from recharge to discharge.
- Provide a narrative and graphical illustration of potential groundwater flow directions indicating areas that are upgradient and downgradient of the proposed facility and what impacts, if any, may occur to existing groundwater users (i.e., private and public wells and springs). Provide a specific assessment of how land use/land cover changes may impact Fawn Lake, a spring-fed lake northeast of the proposed facility.
- Estimate water use during construction including a narrative of the typical daily and maximum monthly water usage along with the duration of the construction water usage. Discuss how this water usage compares with

groundwater recharge estimates. Also, revise the existing drawdown impact and area of influence (AOI) analysis using average and maximum water use rates.

- Conduct a more detailed search and inventory of private and public water wells within the identified radius of influence of the construction or a minimum of 2,000-foot radius of the property boundary using publicly available data from the Virginia Department of Health (VDH) and the Virginia Department of Environmental Quality (DEQ, see example below) and by performing a windshield survey. Assess the potential water quantity and water quality impacts to the identified wells.

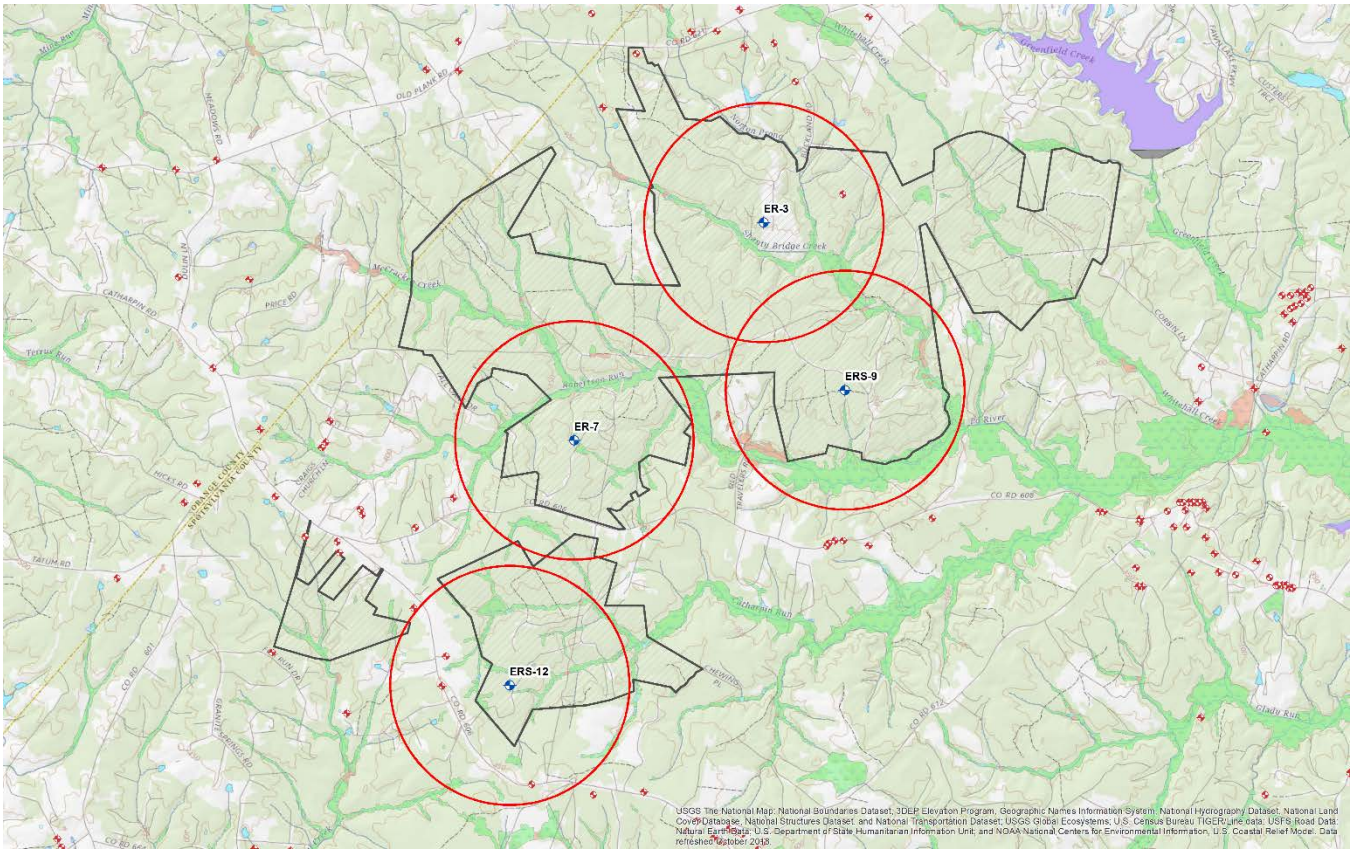


Figure 1 - Map illustrating inventory of groundwater wells (red) and 4,500-ft radius of influence surrounding construction water supply wells (blue). Well geodatabase provided by the DEQ.

Recommended Special Use Permit Conditions

The following SUP conditions are recommended to be considered for approval to ensure protection of the aquifers and wells that may be impacted by the proposed sPower Solar Facility:

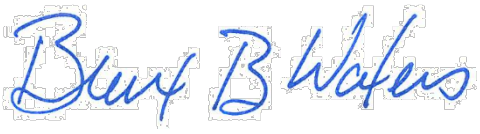
- If the determined area of influence, AOI, extends beyond the property, develop a Groundwater Mitigation Plan to mitigate all adverse impacts on existing groundwater users resulting from the withdrawal.

- Develop a Groundwater Monitoring Plan that establishes a minimum of 4 monitoring wells, one located upgradient and three located downgradient of the proposed facility. The downgradient monitoring wells should be situated between the solar facility and existing groundwater users. Groundwater withdrawal during construction shall be monitored using instantaneous and totalizing flow meters from each water supply well. The hours and the total gallons pumped on a daily basis will be recorded. Daily water withdrawal data will be summarized on a monthly basis.
- Groundwater levels from all monitoring wells will be measured and recorded on a monthly basis during the construction period and semi-annually thereafter. Measurements shall be made from a reference mark on the top of the inner well casing. Care shall be taken to verify the readings during each water level measurement period. The manually collected water level data will be input into an excel spreadsheet so that trends can be displayed graphically. Any significant changes in water level will be noted by comparing the more recent measurement with past measurements.
- Water quality samples shall be collected from the site monitoring well network before operations begin to document background conditions, and then will be collected annually thereafter. The water samples shall be measured for turbidity, temperature, pH, and specific conductivity. The resultant data will be input into an excel spreadsheet so that trends can be displayed graphically. Any significant changes in water quality will be noted by comparing to the base line measurements.

CLOSURE

We appreciate the opportunity to work with you on this project. These activities will be performed and invoiced in accordance with the terms and conditions set forth in the attached Dewberry-Golder Subconsultant Agreement for Professional Services effective as of October 29, 2018 and referenced as 50107768 – Spotsylvania Solar Energy Services for On-Call Multiple tasks (fee to be determined by each task assignment).

Golder Associates Inc.



Brent B. Waters, PG
Principal Hydrogeologist

BBW/et

TECHNICAL MEMORANDUM

DATE November 27, 2018 **Project No.** 18111754

TO Derek Marshall, PE, LEED AP, Associate
Dewberry

CC

FROM Brent B. Waters, Principal Hydrogeologist, Golder **EMAIL bwaters@golder.com**

RE: PRELIMINARY HYDROGEOLOGIC EVALUATION OF POTENTIAL IMPACTS FROM PROPOSED SOLAR FACILITY - SPECIAL USE PERMIT SUP18-0001, 2, AND 3

The following memo partially addresses a series of questions provided by Spotsylvania County representatives regarding our review of hydrogeologic documents as stated in our proposal dated October 30, 2018.

County Comment

Examine Hydrogeology Summary Report (also containing Appendix D - Fracture Trace Report and Well info), and Water Use Plan and report on any missing information needed to confirm sufficient protection of aquifers and wells which may be impacted from the sPower Solar Facility. Report what amount of groundwater withdraw via well could safely be accommodated. Can 100,000 gallons per day (gpd) be withdrawn sustainably without harming the aquifer? 50,000? 200,000? The neighboring Fawn Lake is a large man-made spring fed lake to the east of Site A; would a 100,000 gpd withdraw have a foreseeable impact on the Lake? 50,000gpd? 200,000 gpd? (24 hours).

Golder Response

Sustainable yield from a property is a function of the amount of recharge and the characteristics of the aquifer. Groundwater is continually replenished by recharge from precipitation. For this region, approximately 70 percent of total precipitation is typically lost to evapotranspiration, 7 percent is lost as surface water runoff, and the remaining 23 percent recharges the groundwater system. Using an average annual precipitation of 43 inches per year, the approximate recharge rate is 10 inches per year. This is equal to approximately 744 gpd of recharge per acre on an average annual basis. Based on these recharge values, it is estimated that the entire 6,335 acre property likely receives approximately 4.7 million gallons of recharge per day on an annual average basis. Infiltrating groundwater is stored in the underlying regolith (soil, alluvium, and saprolite) and bedrock and flows through this aquifer material to eventually discharge to local and regional surface water bodies. Figure 1 illustrates approximate groundwater flow directions under natural, static or non-pumping conditions based on the location of groundwater recharge and discharge areas and local topography. As shown groundwater flow is primarily to the southeast across the subject property discharging into tributary creeks to the Cartharpin Run. The

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site is not directly upgradient of Fawn Lake and is beyond the estimated area of influence for the site water supply wells and therefore should not have any adverse impacts to the springs that feed Fawn Lake.

The actual amount of groundwater that can be developed from a particular property will be a small percent of this total recharge amount and typically is more a function of individual well yield and the number of wells that can be feasibly developed within the study area without impact on each other or existing groundwater users. We estimate that a minimum of 470,000 gpd, or 10% of the total recharge amount, can be sustainably withdrawn from the property without regional impact to the aquifer system. This is more than the 100,000 gpd to 400,000 gpd estimated by sPower that would be required during construction. After construction is complete and normal operational water use decreases substantially, aquifer water levels and water quality should fully recover to pre-construction conditions.

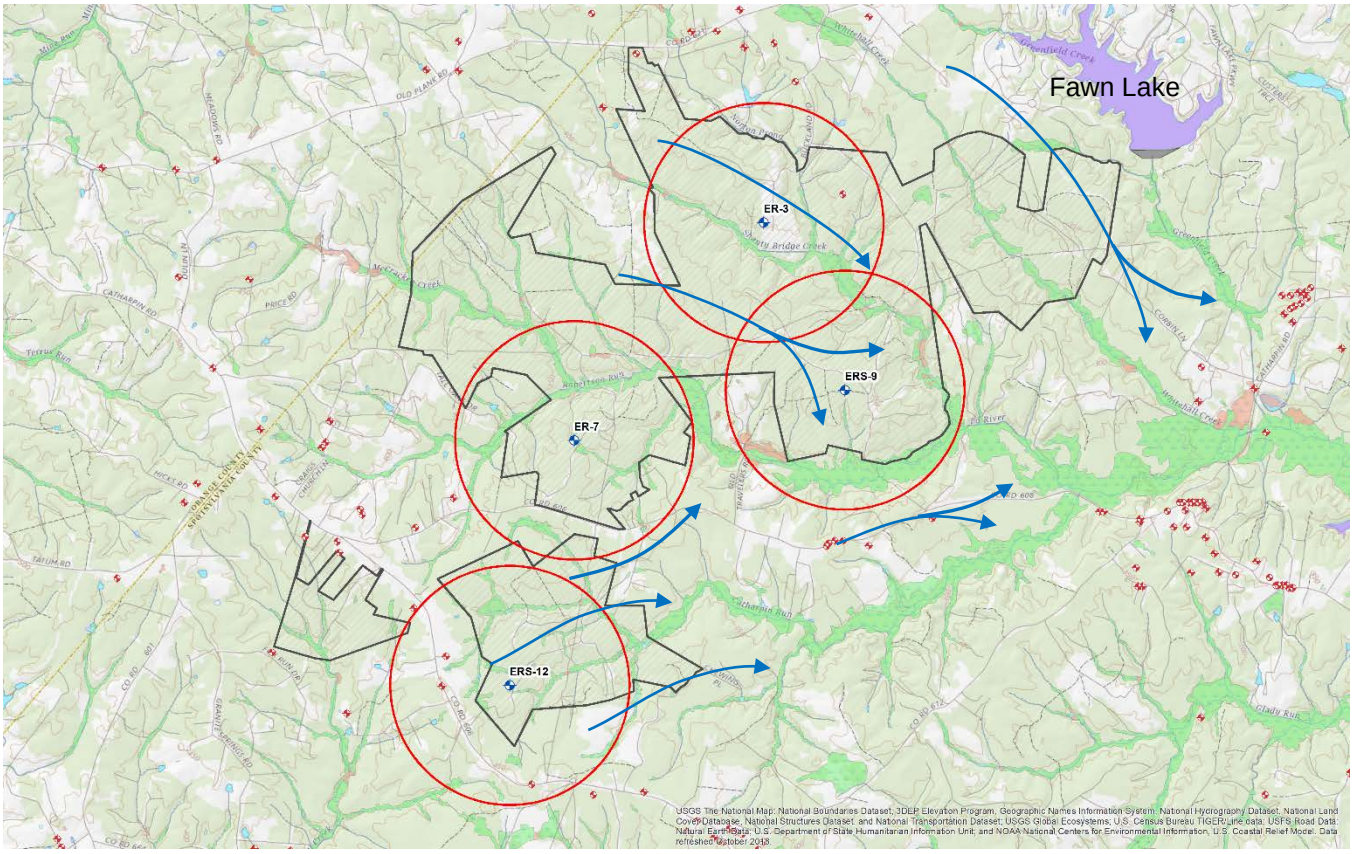

Figure 1 - Map illustrating approximate groundwater flow directions (arrows), the estimated area of influence from site production wells and other wells in the vicinity of the site (north is up).

County Comment

Provide a ball park estimate of anticipated construction water use (regardless of source) to develop the projects using industry standards. Note that the Hydrology Report document states that 400,000 gallons of water per day for “construction and operation and maintenance” of the SUP18-0001 site. However, the more recent Water Use

Plan commits to using public water (max. 100,000 gpd) but allows for use of wells for no more than 50,000 gpd during construction only. This is also significantly reduced from an originally submitted GDP narrative which stated that an estimated 756 acre-feet of water (246,343,680 Gallons) would be used during construction (24 hours).

Golder Response

The water usage during construction for dust control and other non-potable uses is highly variable based on the amount of soil exposed during the various phases of construction, the type of soil, climatic conditions, the type of treatment additives for dust control, etc. A technical estimate of water supply needs, including the average daily, maximum monthly and anticipated duration of the construction should be completed by sPower or their consultants. Their estimate should include a description of available water sources, water conservation measures, and how the quantities of water will be monitored and reported.

We hope that the results of this study provide valuable insight into the subsurface conditions at the subject site and look forward to continued work on this important project. Please do not hesitate to contact us if you have any questions or would like to discuss our findings in more detail.

Brent B. Waters, CPG
Principal Hydrogeologist

BBW/et

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