From:	Bennett, Jim
To:	Trey Driscoll (tdriscoll@dudek.com)
Cc:	Gungle, Ashley; Patrick Brown (patrick.brown@soitec.com); Steve Dickey (sdickey@dudek.com)
Subject:	Tierra Del Sol Groundwater Production Cap Issue
Date:	Tuesday, September 03, 2013 12:53:00 PM
Attachments:	PDS2012-3600-12-005-PDS-PLN-Misc-Correspondence-External.pdf

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Trey,

Please find attached a response letter to your Memorandum dated August 20, 2013.

Thanks,

Jim Bennett, P.G. #7707, CHG#854
Groundwater Geologist

County of San Diego
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5510 Overland Avenue, Suite 110, San Diego, CA 92123
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September 3, 2013

Mr. Trey Driscoll
Senior Hydrogeologist
Dudek
605 Third Street
Encinitas, CA 92024

Subject: Groundwater Production Cap – Tierra Del Sol Solar Farm

Dear Mr. Driscoll,

This letter is being written in response to the Letter of Memorandum dated August 20, 2013 regarding the groundwater production cap for the Tierra Del Sol Solar Farm which is attached for your reference. The requests made in your letter were discussed internally in a meeting with Planning & Development Services (PDS) management where it was agreed that any additional groundwater analysis that is proposed for this project must be conducted prior to public review. The following responses were formulated based on decisions made from the meeting.

Guidelines for Determining Significance – Five Year Projection of Drawdown: The first issue brought up in your letter was in regard to the County modifying the five year period of analysis down to a one year period. As primary author of the well interference guideline, the intent of the five year projection of drawdown was to cover projects that have continual ongoing water uses which remain static over time which historically has been the case for the vast majority of groundwater dependent projects processed by PDS. In recent years, alternative energy projects have been proposing a relatively large amount of water during a short period of time which could potentially cause direct well interference impacts from concentrated water demand in these short periods. Therefore, applying the five-year projection of drawdown would be inappropriate to evaluate impacts from short-term construction demand. As stated within the Explanation Section of the Guidelines on page i, "These Guidelines…do not substitute for the use of independent judgment to determine significance or the evaluation of the evidence in the record." Therefore, County staff has utilized independent judgment and has requested all projects with large construction demands including the approved Tule Wind Project (P09-019) to separately evaluate well interference impacts from the period it will occur rather than the inappropriate usage of a 5-year projection of drawdown.

Reportedly Conservative Assumptions of Well Interference Calculations: It is stated that two conservative assumptions were made regarding well interference which included using a storage co-efficient of 0.001 and assumption that the deep aquifer is connected to the shallow aquifer. In both cases, the assertion that these two assumptions are conservative does not appear to be valid. There is no empirical evidence through actual site-specific data to prove or disprove that either assumption is conservative. In the case of the storage co-efficient, it is indicated in the Memorandum that the aquifer is composed of fractured rock, residuum, and alluvium. And that due to these characteristics, Dudek proposes to change the storage co-efficient to 0.002 to take into account no drawdown observed in the nearest residential well located 784 feet away from the pumped well during the 72-hour well test. In response, PDS only allows for changes to be made to the assumed storage co-efficient for a project if there is empirical evidence through site-specific data from aquifer tests to estimate the actual value for the storage co-efficient. It is not justified to change the storage co-efficient due to a lack of response in a short-term well test. It is often the case in short-term aquifer tests in fractured rock aquifers to not see a response in nearby wells during aquifer testing. It would not be prudent to assume that the lack of response is due to the storage coefficient being artificially low since there are other explanations plausible such as the heterogeneity within the fractured rock aquifer. In addition, Dudek is performing a groundwater investigation for the Rugged Solar project north of this project site in an environment that has substantially more alluvium in which wells were installed and tested. The two aquifer tests from wells for the Rugged Solar project both had significantly higher calculated transmissivity than this project and the tests indicated storage co-efficients of 0.00104 and 0.0011 on average. This is right within the range of 0.001 being used this project.

Secondly, it is indicated that the results conservatively assume that the deep and shallow aquifer are connected. The following is asserted within the memorandum: “we have no evidence to prove or disprove the assumption that the shallow and deep aquifers are connected.” Since there is no evidence to prove or disprove whether the shallow and deep aquifers are connected, it is not conservative to assume they are connected.

Request to Provide Further Groundwater Analysis After Project Approval: A request is made within the Memorandum based upon the conservative nature of well interference calculation, the unknown amount of actual storage in the Well B aquifer, and the lack of certainty as to whether deeper fractures in Well B encounter the shallow aquifer system, to adopt additional criteria for the GMMP that would permit additional analysis of the aquifer and allow additional project pumping if project pumping could be realized without exceeding the drawdown criteria set for off-site wells. This would include an updated groundwater analysis to be prepared after the first 60 days of production at the site. In response, analysis of groundwater resources must be conducted prior to approval of a project. This has and continues to be practice of PDS for all projects. The local residents surrounding this project are reliant upon groundwater resources for their everyday existence. By providing all analysis up front prior to project approval, this provides a level of certainty for both the public and the decision makers. For the uncertainties within the project that have been brought up in this Memorandum, the applicant has the ability to further analyze groundwater resources prior to taking the project forward to the decision makers. However, without further analysis, PDS will be conditioning the project to not exceed established thresholds during the construction phase of this project. This will include a cap in production during the first three months and the remainder of the one year construction period.

If you have any questions regarding this letter, please contact me at 858-694-3820 or jim.bennett@sdcounty.ca.gov.

Sincerely,

Jim Bennett, Groundwater Geologist
Project Planning

e-mail cc: Ashley Gungle, Project Manager

Attachment

DUDEK

MEMORANDUM

To: James Bennett, County Groundwater Geologist
From: Trey Driscoll, Senior Hydrogeologist
Subject: Groundwater Production Cap – Tierra del Sol Solar Farm
Date: August 20, 2013
cc: Ashley Gungle, Project Manager County of San Diego

The County of San Diego is proposing to set a groundwater production cap of 18.5 acre-feet for the supply well (Well B) over the approximately thirteen (13) month construction period of the Tierra del Sol Solar Farm (Project). This production cap is based on the County's well interference threshold for determining significance, and calculation of projected well interference using the Cooper-Jacob approximation of the Theis non-equilibrium flow equation.

In relevant part, the County's well interference threshold for determining significance is as follows:

> "As an initial screening tool, offsite well interference will be considered a significant impact if after a five year projection of drawdown, the results indicate a decrease in water level of 20 feet or more in the off-site wells. If site-specific data indicates water bearing fractures exist which substantiate an interval of more than 400 feet between the static water level in each offsite well and the deepest major water bearing fracture in the well(s), a decrease in saturated thickness of 5% or more in the offsite wells would be considered a significant impact."

Guidelines for Determining Significance and Report Format and Content Requirements, at 26 (Mar. 19, 2007).

For the Project, however, the County proposes to amend the threshold to apply it over the Project's one year construction period, rather than the five year period explicitly stated in the guideline. The County proposes using a one year projection of drawdown instead of a five year projection because the bulk of the Project's water use from Well B will occur during the Project's short-term construction period, which is expected to last approximately thirteen (13) months. During the short-term construction period, the Project would propose to withdraw 27

acre-feet. During operations, however, the Project would propose to withdraw only 5.56 acre-feet per year (afy).[1] Due to the small amount of water withdrawn during operations, the only period in which the Project poses the potential to exceed the well interference threshold at off-site wells is during construction.

Using the County's screening guideline, as amended by the County above, the calculation of well interference using the Cooper-Jacob approximation of the Theis non-equilibrium flow equation indicates that ground water production from Well B above 18.5 acre-feet over a one year period would induce greater than 20 feet of drawdown in the nearest residential well located 784 feet from Well B. This calculation is based on two conservative assumptions: (1) using a conservative estimate of water storage in the aquifer; and (2) assuming that the shallow aquifer at the nearest residential well is connected to the deep aquifer accessed by Well B. This memorandum discusses why these are conservative assumptions in turn.

First, the County proposes to use a storage co-efficient of 0.001 (1×10^{-3}), which is the storage co-efficient used when an aquifer is composed entirely of fractured rock. Here, however, the aquifer is composed of fractured rock, residuum and alluvium.[2] Furthermore, the conservative water storage coefficient of 0.001 (1×10^{-3}) is demonstrably incorrect when applying it to estimate drawdown at the nearest residential well because it contradicts the observed behavior of the aquifer during actual testing. The calculation of well interference using the conservative 0.001 (1×10^{-3}) storage coefficient estimates 2.4 feet of drawdown at the nearest residential well after 72 hours of pumping Well B, but during the 72 hour pump test performed at well B, no drawdown was observed in the nearest residential well. A sensitivity analysis indicates that 0.002 (2×10^{-3}) is the smallest value of the storage co-efficient that results in no drawdown at the nearest residential pumping well. Using a storage coefficient of 0.002 (2×10^{-3}) results in drawdown of less than 20 feet in the nearest residential well after 1 year of Project pumping at a volume of 22.6 acre-feet.

Second, this analysis assumes that the shallow aquifer accessed by the nearest residential well is connected to the deep aquifer accessed by Well B. Well B is drilled to a depth of 1,311 feet, with a steel casing from ground surface to 1,000 feet below ground surface that limits it from drawing water from the shallow aquifer, while the nearest residential well is only 147 feet deep. At this time, we have no evidence to prove or disprove the assumption that the shallow and deep aquifers are connected.

[1] An additional 1.56 afy is now included in the operational water demand for the landscape vegetative screen.
[2] Due to these characteristics, Dudek proposed using a water storage co-efficient of 2×10^{-3} to account for the lack of drawdown observed in the nearest residential well.

Accordingly, as actual storage in fractured rock aquifers can differ substantially from estimated values (sometimes spanning several orders of magnitude), and a connection has yet to be established between the deeper fractures encountered in Well B and the shallow aquifer system, a ground water level monitoring network consisting of six (6) on-site wells and eleven (11) off-site wells has been established to monitor water levels on a daily basis during pumping operations from Well B. The purpose of this ground water level monitoring network is two-fold: (1) to develop more data about the actual characteristics of the aquifer that Well B draws from, and (2) to identify and avoid potential impacts to off-site wells during actual pumping from Well B.

The monitoring network, monitoring plan, and mitigation measures to avoid impacts to off-site wells are discussed in the Draft Groundwater Monitoring and Mitigation Plan (GMMP) being developed for the Project. To protect off-site wells during pumping operations from Well B, the following criterion has been developed as part of the Draft GMMP:

- If the groundwater levels at off-site wells located within 0.5 miles of Well B (Wells RM-1, RM-3 or RSD-1) drops 10 feet below the baseline water levels, groundwater pumping at Well B will cease until the water level at the well that experienced the threshold exceedance has increased above the threshold and remained there for at least 30 continuous days.[3] Additionally, written permission from the County Planning and Development Services (PDS) must be obtained before production from Well B may be resumed.

As this ground water monitoring criterion recognizes, only Project pumping will provide actual evidence whether drawdown in off-site wells will be observed in the monitoring well network.

In recognition of the conservative nature of the County's screening tool employed above, the unknown amount of actual storage in the Well B aquifer, and the lack of certainty as to whether deeper fractures encountered in Well B intercept the shallow aquifer system, the Project applicant requests that the County adopt additional criteria for the Draft GMMP that would permit the applicant to submit site-specific data collected during Project pumping if the applicant believes additional Project pumping could be realized without exceeding the drawdown threshold set for off-site wells. These criteria would establish a tiered production cap, which initially tiers production at 18.5 acre-feet (the cap set by using the uncorroborated storage co-efficient 1 x 10^{-3}), but permits the applicant to demonstrate that additional production is possible without off-site well interference:

[3] Note: the use of a 10 foot-drop as included in the Draft GMMP rather than the County standard of 20 feet provides a measure conservatism beyond that set in the County standard.

- Tiered Production Cap: Production at Well B is capped at 18.5 acre-feet during the construction period. If less than ten (10) feet of drawdown below static baseline conditions in the off-site monitoring wells (Wells RM-1, RM-3 or RSD-1) has been observed when the Project has pumped 18.5 acre-feet from Well B, then the Project applicant may request the authority for additional production above the initial 18.5 acre-foot cap.[5] The County shall approve such additional production unless there is evidence that additional pumping will induce greater than ten (10) feet of drawdown in the nearest residential well. If additional production is permitted, the Project shall continue to monitor ground water levels at all on-site and off-site monitoring wells. If ground water levels at any off-site monitoring wells drop by ten (10) feet or more below baseline conditions, production will immediately cease and not resume until the next production year. In no instance shall the total production of Well B exceed 27 acre-feet over the construction period.

- An updated groundwater analysis will be prepared after the first 60 days of production. During this period up to 14 acre-feet of water is expected to be extracted from Well B. The groundwater analysis will document impacts, if any to off-site wells and determine whether Project pumping is projected to exceed well interference thresholds at the tired production rates of 18.5 acre-feet and 27 acre-feet.

This conservative approach preserves two competing values, both of which are important to the County, the Project applicant, and the community. First, it preserves the integrity of off-site wells by terminating production from Well B if off-site well interference exceeds 10 feet, a conservative ground water level drawdown threshold, which is itself more conservative than the drawdown threshold of 20 feet set by the County.

Second, it allows the applicant to use on-site ground water resources to avoid environmental impacts associated with trucking in imported water, including air quality, greenhouse gas, noise, and traffic impacts, as well as to avoid the cost of importing construction water to the Project. Dudek estimates that 27 acre-feet of on-site water supply could be withdrawn from Well B for the construction portion of the Project without causing interference to off-site wells. If Well B's production is capped at 18.5 acre-feet, however, an additional 8.5 acre-feet from off-site sources would need to be imported. This would result in an additional 462 truck trips using 6,000-gallon water trucks.

[5] Note: static baseline conditions take into account water levels fluctuations resulting from seasonal variation and off-site well production.

The tiered cap measure proposed above would be at the discretion of the County of San Diego at the time the initial 18.5 acre-feet cap is reached.