This analysis was prepared by Jim Bennett, Groundwater Geologist in the County Department of Planning and Development Services on May 7, 2013 and Updated on May 13, 2013.

Groundwater General Comments

The County has approved one wind energy project with large wind turbines, the Tule Wind project. The County approved the Tule Wind project in August 2012. This project provides a good example of groundwater demand for wind energy projects. The portion of the Tule Wind project in the County's land use jurisdiction includes five large wind turbines. The project will require up to 56 acre feet of groundwater, mostly for dust suppression during construction of all 67 wind turbines over a nine month period. Once the project becomes operational, the groundwater demand drops significantly. The project would need approximately 2,500 gallons per business day (about two acre feet per year) for the operations and maintenance building and support staff. This amount can be furnished by one groundwater well pumping at a rate of about two gallons per minute. The Major Use Permit for the Tule Wind Project was conditioned to include a Groundwater Monitoring and Management Plan (GMMP) that requires a maximum amount of groundwater that can be pumped from each well and includes a water level threshold at which groundwater production would be required to cease.

Future wind projects will each require a relatively large amount of water for the construction phase of the project. This water would come from one or more of the following sources: (1) on-site groundwater resources, (2) imported water from nearby groundwater-dependent water entities, or (3) imported recycled water from a CWA member agency if the member agency will allow the trucking and use of water outside its boundaries. The use of on-site groundwater resources would require a groundwater investigation and likely a groundwater monitoring and management plan (GMMP) to ensure that impacts to groundwater resources would remain less than significant as a result of the project. With the required groundwater investigation and GMMP, if needed, impacts to on-site groundwater resources from future wind energy projects would be less than significant. Additionally, for some projects, on-site groundwater resources may not be adequate for construction water demand. These projects would rely on a mixed portfolio of on-site groundwater and/or imported water from other sources.

It is also important to note that projects requiring a Major Use Permit must prepare a groundwater investigation pursuant to the County Groundwater Ordinance, County Code section 67.222.B. For projects proposing to use greater than 20 acre-feet of groundwater per year, the purpose of the groundwater investigation is to ensure that there is sufficient groundwater to serve the proposed use, as well as buildout of the General Plan in that particular water basin. Consequently, the groundwater investigation serves to preclude these types of projects from causing significant impacts to groundwater resources. Pursuant to the County Zoning Ordinance, large wind turbine projects require a Major Use Permit. The construction phase of these projects is likely to exceed 20-acre feet of groundwater per year, and thus would trigger the need

to prepare a groundwater investigation that addresses cumulative impacts to the project's groundwater basin at maximum buildout of the General Plan.

This informal response is provided to address the report titled Cumulative Impacts on Water Resources of Large-Scale Energy Projects in Boulevard and Surrounding Communities, San Diego County, California, by Victor M. Ponce dated April 30, 2013 and provided to the County on May 3, 2013.

Water Sustainability: The report indicates that the County's approach to evaluating sustainability has been widely discredited over the past 15 years and cites several studies. The report states that enlightened water resources management now seeks to determine sustainable yield as a suitable fraction of recharge. The report makes several references to exploiting groundwater resources that would dry up all groundwater and surface water resources if groundwater resources are used at rates up to the average annual groundwater recharge for a given basin.

Contrary to what the report asserts, the County evaluates sustainable yield in the manner that Dr. Ponce suggests is in accordance with what he terms enlightened water resources management. When the County originally prepared the County Guidelines for Determining Significance – Groundwater Resources in 2007 (Groundwater Guidelines), which contain the methodology for how the County evaluates sustainable yield for projects, Professor Ponce provided comments very similar to the April 30, 2013 report. The County along with four individuals on the County Groundwater Technical Advisory Committee provided responses to Dr. Ponce's comments. Those comments and responses are attached to this analysis for reference. In conclusion, the limitation of sustainable yield that the County applies is exactly what Dr. Ponce suggests for enlightened water resources management, i.e., "a fraction of the 'recharge' amount, the fraction to be established after detailed conjunctive surface-water and ground-water studies."

Section 3.1 Existing Water Demand: The report overestimates the amount of existing groundwater demand for the Boulevard Border Patrol Station and the McCain Valley Conservation Camp by utilizing an unsubstantiated estimation of 250 gallons per day per person for these uses. The United States Environmental Protection Agency Onsite Wastewater Treatment Systems Manual (EPA Manual) dated February 2002 contains typical wastewater flow rates from commercial, institutional, and recreational facilities. For the Boulevard Border Patrol Station, which is an office use, the EPA Manual estimates a wastewater flow rate of 6 to 16 gallons per employee with a typical amount of 13 gallons per day per employee. For the McCain Conservation Camp, the EPA Manual estimates a wastewater flow rate of 80 to 150 gallons per day per prisoner with a typical amount of 120 gallons per day per prisoner.

For the Golden Acorn Casino, the Groundwater Supply Evaluation: Campo Kumeyaay Nation, Proposed Golden Acorn Hotel and Amenities Project dated March 28, 2007 and revised May 27, 2008 prepared by Environmental Navigation Services indicates the Golden Acorn Casino has an existing water demand of approximately 22.4 acre-feet per

year. This amount is substantially lower than the 168 acre-feet per year in the report based on the size of the on-site wastewater treatment system.

Section 3.2 Cumulative Water Demand of Energy Projects: For the cumulative water demand, the report includes only construction water demand for each of the projects. Construction water demand is a temporary use, which in some cases may be up to 18 months in duration, but then the demand for water for on-going operations drops significantly because a relatively limited amount of water is needed for ongoing operations. In Table 4 of the report, the construction water demand for the future energy projects is labeled as future water demand and is added to the existing water use in the Boulevard area. If read at face value, the table would indicate that groundwater demand in the study area will effectively double as a result of the future energy projects. What the report does not disclose is the reality that once the construction phase of these projects is over, the ongoing water use associated with each project will be less than 5% of the construction water demand. This significant decrease in water demand is shown on the table below. The table is a list of energy projects with the estimated water demand for construction and the estimated water demand for ongoing operations.

Construction Water	**Ongoing Water**
Tule Wind: 56 Acre-feet in 9 months	2 acre-feet per year
Soitec Rugged Solar: 90.7 acre-feet in 12 months	5.33 acre-feet per year
Soitec Tierra Del Sol Solar: 79.7 acre-feet in 11 months	3.9 acre-feet per year
Soitec LanWest Solar: 12.84 acre-feet in 6 months	0.23 acre-feet per year
Total: 239 acre-feet	Total: 11.5

Therefore, assuming that Table 4 in the report showing construction water demand of 509.6 acre-feet applies to all potential renewable energy projects in the study area, it is reasonable to assume that water demand for ongoing operations after construction would be roughly 5% of this value, or about 26 acre-feet per year. Given the fact that these projects are spread over various sub-basins in the region and are on relatively large plots of land, the cumulative impacts from the water demand for ongoing operations are very likely to be less than significant.

Section 6 Analysis: Using a capture-to-recharge percentage, the report evaluates impacts from the water demand for the proposed renewable energy projects in the Boulevard area. It takes the construction water demand for all of the potential renewable energy projects and concludes that the capture-to-recharge percentage would increase from an existing value of 13.96% to 29.31%. The report then compares this result to a capture-to-recharge average for the continential United States. Based on a brief review of the report, this analysis misses several important factors that would be necessary to evaluate impacts to groundwater resources accurately. The following is a list of the deficiencies with the analysis in the report.

1. The future water demand that is evaluated in the study is only the temporary construction water demand that will last on the order of 6 to 18 months. Because this demand would be temporary, there would not be an effective doubling of ongoing groundwater use in Boulevard.
2. The future construction water demand for these projects is temporary and will not occur all at the same time, and combining the construction water demand for all future projects into one demand and then evaluating potential impacts is not accurate because all of the these projects will not be approved at the same time or constructed at the same time.
3. The water demand was lumped into a single groundwater demand and impacts were evaluated over a single study area defined by political boundaries (the Boulevard Community Planning Area). However, groundwater demand will be spread over various sub-basins within the Planning Area, and evaluation of sustainable yield utilizing political boundaries is inappropriate because groundwater basins do not follow political boundaries on the surface. Therefore, the boundaries for cumulative projects would more appropriately be drawn to conform to the various sub-basins from which each project would withdraw groundwater.
4. The future demand for ongoing operations is not discussed. As indicated above, water demand for ongoing operations for all potential renewable energy projects, if all were approved, would be roughly 5% of the construction water demand. Therefore, once the projects have been constructed, they would likely use less than 30 acre-feet per year from groundwater wells spread over multiple project sites in separate sub-basins.
5. The methodology employed does not provide thresholds for determining a potentially significant impact to groundwater resources.
6. Using continental and global averages to compare to localized impacts to groundwater resources is not appropriate because each individual water basin contains unique parameters that must be evaluated on a local basis to obtain meaningful results.

Section 8 & 9 Conclusions and Recommendations: The conclusions indicate the following:

1. *Intensive development in a desert region such as Boulevard poses significant challenges in sustainability due to increased water demands, while the supply remains essentially unchanged.*

   The County wholeheartedly agrees and is requiring each project in its jurisdiction to perform site-specific hydrogeologic investigations to evaluate potential impacts to groundwater resources and to propose mitigation measures as needed to avoid potentially significant impacts.

2. *Existing water demand in Boulevard and surrounding communities is calculated at 14% of the recharge, a value that is nearly double the Continental United States value of 8.7%.* The report does not explain the relevance of this comparison, particularly given that fact that the continental United States has widely varying conditions including large tracts of undeveloped open land. See also item 6 above.
3. *With the implementation of the proposed energy projects, future water demand is likely to increase to 29%. Effectively, the future water demand will more than double the existing water demand.* As previously discussed, this statement is incorrect because construction water demand is a one-time, temporary water use and construction demand will be staggered occurring at different locations and different times given the fact that all future renewable energy projects in the Boulevard area will not be approved or constructed at the same time. The construction phase of groundwater demand for each project is anticipated to last up to 18 months, and the water demand for ongoing operations following construction is anticipated to be roughly 5% of construction water demand.

The study concludes with a recommendation to import water into Boulevard from other areas so that the recharge-to-capture percentage remains within reasonable bounds. In response, the County has a comprehensive process for evaluating potential impacts to groundwater resources contained within the County Guidelines for Determining Significance – Groundwater Resources and the County Groundwater Ordinance. As previously discussed, the County will evaluate the potential impacts to groundwater resources through site-specific groundwater investigations. It is particularly important that the temporary impacts from construction water demand at the front end of each of these projects be thoroughly analyzed. Groundwater monitoring and management plans will be required in most cases and will include a maximum amount of groundwater that can be pumped from individual wells and also water level thresholds at which groundwater extraction would have to cease to ensure impacts to off-site groundwater users remain less than significant. Imported water from several sources will be required to provide construction water to augment local groundwater supply for some of the projects. Any imported water sources utilizing groundwater resources will also be analyzed to evaluate potential impacts to off-site groundwater resources.

From: donnatisdale [donnatisdale@hughes.net]
Sent: Friday, January 26, 2007 8:57 AM
To: Jacob, Dianne
Cc: Covic, Mario; Bennett, Jim; Bev Esry; Larry Johnson; thometz@ltsp.com
Subject: Det. Significance/Dr. Ponce

San Diego State University
Department of Civil and Environmental Engineering
College of Engineering
5500 Campanile Drive
San Diego, CA 92182-1324

January 25, 2007

Supervisor Dianne Jacob
County of San Diego

Dear Supervisor Jacob:

This letter provides comments in reference to the DRAFT document entitled **"Guidelines for Determining Significance and Report Format and Content Requirements--Groundwater Resources,"** prepared by the Land Use and Environment Group, and circulated for public review January 11-February 9, 2007.

B-1 The document defines sustainable yield as "the amount of groundwater that can be withdrawn [from a basin] annually without producing an undesirable result" (page 6). The reference for this statement is the authoritative book by Todd (1959). However, later in the same paragraph, it states that "the sustainable yield of a basin is often considered to be the annual average recharge for the basin." This statement implies that current practice is to equate sustainable yield with annual recharge, a concept which is flawed and has been widely discredited (see, for instance, M. Sophocleous: "From safe yield to sustainable development of water resources--The Kansas experience," *Journal of Hydrology,* 235, 2000). Significantly, Sophocleous argues that the sustainable yield of an aquifer must be considerably less than recharge if adequate amounts of water are to be available to sustain both the quantity and quality of streams, springs, wetlands, and ground-water dependent ecosystems.

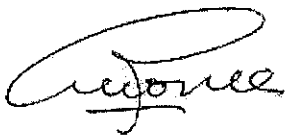
B-2 The proposed 50% storage-volume policy stated in Section 4.1 of the Guidelines (page 22) is ill-conceived, patently out-of-date, and contrary to the stated definition of sustainable yield (page 6). We note that using 50% of aquifer storage volume as a basis for measuring groundwater exploitation defies every concept of sustainability painstakingly developed in the past two decades on a global reach. The terms "volume" and "recharge" should not be confused. If pumping annual recharge amounts can negatively affect local ecosystems and established surface-water rights, the pumping to a 50% aquifer storage-volume limit (that is, the mining of groundwater) will be even more negative.

The proposed 50% storage-volume policy should be repealed outright, and replaced with a more sensible policy that is in accordance with the times. There is a growing body of evidence that shows that sustainable yield should be taken as a fraction of the "recharge" amount, the fraction to be established after detailed conjunctive surface-water and ground-water studies (see, for instance, Hahn et al., in *Environmental Geology,* 33(1), December 1997). Caution is recommended when dealing with this issue, since the negative effects of groundwater mining can be long ranging and long lasting. At risk are the surface water itself, and the ecosystems and people who are relying solely on the local groundwater resources.

B-3 For further clarification on this issue, please refer to the authoritative U.S. Government report entitled "Sustainability of Ground-Water Resources" by Alley et al., U.S. Geological Survey Circular 1186 (1999). This report defines "safe yield" as the maximum pumpage for which the consequences are considered acceptable.

B-4 The burden of proof regarding groundwater sustainability is on the government, which should determine, based on basin-specific studies, if the consequences of pumping are acceptable.

Sincerely yours,



Victor M. Ponce
Professor of Civil and Environmental Engineering

cc: Mario Covic, DPLU

GARY L. PRYOR
DIRECTOR

County of San Diego

DEPARTMENT OF PLANNING AND LAND USE

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March 19, 2007

RE: RESPONSES TO COMMENTS RECEIVED ON THE GUIDELINES FOR DETERMINING SIGNIFICANCE AND REPORT FORMAT AND CONTENT REQUIREMENTS – GROUNDWATER RESOURCES

The following are staff's responses to comments received during the public review period for the Guidelines for Determining Significance (Guidelines) and Report Format and Content Requirements (Report Format) for Groundwater Resources. The draft Guidelines and Report Format were circulated for public review from January 11, 2007 to February 26, 2007. Comments were received that require changes to the Guidelines and Report Format.

Response to comments received from T&B Planning:

A-1 The County acknowledges and appreciates this comment. Comment noted and revisions made to the Guidelines in the Introduction section on page 1.

A-2 The County acknowledges and appreciates this comment. The suggestion is a good one and the County already asks the applicant to answer this question in the County's Application for Environmental Initial Study (AEIS). Therefore, since the question is already asked in the AEIS, it does not need to be repeated in the Initial Study.

Response to comments received from Dr. Ponce, San Diego State University:

The County acknowledges and appreciates comments received from Dr. Ponce. Based on review of Dr. Ponce's comments that provide the basis for the recommendation of repealing the 50% Reduction of Groundwater in Storage guideline and questions the overall approach the County is taking in calculating sustainable yield, there appear to be misunderstandings that require clarification. Revisions have been made to Section

4.0 of the Guidelines to provide a clear description to the reader of how the County determines sustainable yield for a given project, which includes using the 50% Reduction of Groundwater in Storage Guideline. Dr. David Huntley, Professor of Geological Sciences (Groundwater Hydrology) at San Diego State University, has written a response letter to Dr. Ponce's comments, which demonstrates that the approaches taken by the County on calculations of sustainable yield are consistent with suggestions made in the papers Dr. Ponce references. It should be noted that Dr. Huntley is renowned for his expertise in fractured rock hydrology, with over 30 years of academic and site-specific groundwater investigation experience. In addition, response letters to Dr. Ponce's comments were received from three other members of the County DPLU Groundwater Technical Advisory Committee (GTAC), which provide further clarification to portions of the Guidelines that Dr. Ponce questions. These letters are included with the public review comments for Dr. Ponce's review.

Below is the response to specific comments by Dr. Ponce.

B-1 The County acknowledges and appreciates this comment. To prevent confusion to the reader, the following statement has been removed from the Guidelines: *"For practical purposes, the sustainable yield of a basin is often considered to be the annual average recharge for the basin. Pumping in excess of this value is defined as overdraft."* While the limit of sustainable yield might theoretically be annual recharge, the County concurs that using average groundwater recharge as the basis for development is flawed. This is especially so for most fractured rock basins, as using average annual recharge would cause groundwater in storage to be nearly or completely depleted during extended drought periods. It is easy to understand how the above statement could imply that the County equates sustainable yield with annual recharge. However, the methods and procedures discussed throughout the Guidelines provide guidance, which when applied, conservatively limit maximum groundwater extraction for a basin to a level that is a fraction of average annual recharge (well below average groundwater recharge).

B-2 The County acknowledges and appreciates this comment. The Guidelines have been revised to include clarification language of the 50% Reduction of Groundwater in Storage guideline, as well as how the Guidelines are used to estimate groundwater sustainability which are entirely consistent with the suggestions Dr. Ponce makes in his comment letter.

Dr. Ponce states *"If pumping annual recharge amounts can negatively affect local ecosystems and established surface-water rights, the pumping to a 50% aquifer storage-volume limit (that is, the mining of groundwater) will be even*

more negative." Dr. Ponce appears to be saying that using the 50% Reduction in Storage guideline would allow for groundwater extraction at rates even greater

than the average annual recharge of a given basin, which is not the case. Because of the limited storage capacity in the fractured rock environment, the sustainable yield is limited to a rate much less than average annual recharge for a given basin when using the 50% reduction in storage guideline. If a 30 year water budget used an extraction rate equal to the annual average recharge for a given fractured rock basin, in most cases, during the extended drought periods, groundwater in storage would be depleted to nearly 0% of the available storage capacity. Furthermore, the guideline does not limit annual production in a basin to 50% of the storage capacity. Groundwater impacts are considered significant if at any time over a minimum 30-year period, groundwater in storage is reduced to a level of 50% or less as a result of extraction. Dr. Huntley points out in his response to Dr. Ponce's comments that the actual limitation to sustainable yield is exactly what Dr. Ponce suggests, "a fraction of the 'recharge' amount, the fraction to be established after detailed conjunctive surface-water and ground-water studies."

Regarding the "groundwater mining" comments including *"negative effects of groundwater mining can be long ranging and long lasting",* the 50% storage concept is not about allowing the mining of 50% of groundwater in storage. Its intent is to ensure that storage does not fall below acceptable levels over at least a 30-year period in basins where the volume of water fluctuates significantly seasonally and during periods of drought, due to low storage capacity. The term "groundwater mining" typically refers to a prolonged and progressive decrease in the amount of water stored in a ground-water system at rates that are not sustainable. By limiting groundwater in storage in fractured rock basins to 50%, such a scenario is not possible.

B-3 The County acknowledges and appreciates this comment. The definition of safe yield that Dr. Ponce quotes, "the maximum pumpage for which consequences are considered acceptable" is very similar to what the County considers to be sustainable yield, which has been clarified in the document to be "the amount of groundwater that can be withdrawn annually without producing an undesirable result" (Todd, 1959). The differences in definition are a matter of semantics.

B-4 The County acknowledges and appreciates this comment. The County agrees that the burden of proof regarding groundwater sustainability is on the government and this is achieved through applying CEQA and the County Groundwater Ordinance. Dr. Ponce's suggestion that basin-specific studies be performed to determine if the consequences of pumping are acceptable is precisely what the County requires through site-specific groundwater

investigations. Site-specific groundwater studies (elements of such a study are outlined in the Report Format and Content Requirements) determine whether the consequences of pumping are acceptable.

Responses provided by the Groundwater Resources Technical Committee Members (Huntley, Wiedlin, Wunderly, and Peterson) regarding the comments of Dr. Victor M. Ponce, Professor of Civil and Environmental Engineering, dated January 25, 2007

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February 11, 2007

Mr. Jim Bennett
Groundwater Geologist
County of San Diego, Department of Planning and Land Use
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Dear Mr. Bennett:

I would like to take the opportunity to respond to Dr. Ponce's comments on the draft document entitled "Guidelines for Determining Significance and Report Format and Content Requirements--Groundwater Resources" (referred to hereafter as the "Significance" document). It is my understanding that Dr. Ponce refused to meet with the Technical Advisory committee that was very active in the revision of the San Diego County Groundwater Ordinance and provided substantial review of the above "Significance" document. It is disappointing that Dr. Ponce refused such a meeting, as his comments seem to me to be a result of both a misunderstanding of a portion of the document and inexperience in conducting site-specific groundwater investigations in San Diego County.

Dr. Ponce takes issue with two statements in the "Significance" document, (1) the statement that sustained yield is considered to be the annual recharge for the basin, and (2) the limitation of groundwater depletion to 50% of the available storage. Both issues are tied to each other, and are related to the relation between sustained yield and annual recharge in an environment where recharge varies greatly as a result of variations in precipitation.

Dr. Ponce's reaction to the limitation of depletion to 50% of the storage seems to be based on a misunderstanding of the text of the "Significance" document. As I read his comment, particularly based on his warning about confusing storage and recharge, Dr. Ponce seems to interpret that section as stating that annual groundwater withdrawal is limited to 50% of the basin storage. This reading of the document could not be further from the truth – there is no confusion between storage and recharge amongst the Technical Advisory Committee, consisting of two Ph.D.s and four holders of Master's degrees, all specialists in groundwater hydrology. The document is actually quite explicit about the reason for the limitation of ***cumulative*** storage depletion to 50% and the relation to recharge. In particular, we have recognized for decades that recharge is quite variable (in time) in the fractured rock terrain of San Diego County, varying between years in which there is no groundwater recharge to years in which recharge is so high that basins are filled to beyond capacity. The sustainable yield of a basin cannot be based on average recharge, or some percentage of average recharge. The sustainable yield also cannot be based on the minimum recharge that would occur in any one year, as that would be zero and would limit development based on groundwater use to zero.

Calculation of groundwater recharge on a year-by-year basis shows that our climate is characterized by periods of drought, during which groundwater recharge is below average (or zero), and periods of above-average recharge when the basins become replenished, sometimes to the point where additional recharge is rejected because of limited storage capacity.

The "Significance" document does not limit annual production in a basin to 50% of the storage capacity (as implied by Dr. Ponce's comments), it states

> "groundwater impacts will be considered significant if a soil moisture balance, or equivalent analysis, conducted using a minimum of 30 years of precipitation data, including drought periods, concludes that ***at any time groundwater in storage is reduced to a level of 50% or less as a result of groundwater extraction***."

This statement is based on the above observations of limited recharge during droughts and excess recharge during wet periods. Specifically, what we find when we do site specific investigations of groundwater resources in San Diego County is that, because of limited storage capacity in the fractured crystalline rock environment, the sustainable yield is much less than the average annual recharge. If, for example, we did a year-by-year mass balance (or water budget) using an extraction rate equal to the annual average recharge, we would find in every basin in the county that, during our extended droughts, groundwater in storage would be completely depleted (to nearly 0% of the available storage capacity). In most cases, limiting depletion of the storage to 50% of the available capacity, limits annual groundwater extraction to well below 50% of the average annual groundwater recharge rate. However, rather than simply defining sustainable yield as some arbitrary percentage of average annual recharge, the county requires that site specific investigations be done that (1) calculates groundwater recharge on a yearly basis over a 30 year time period, (2) compares that recharge with proposed extraction for each of those years and calculates the depletion of storage during those years when extraction exceeds recharge, (3) tracks cumulative depletion of storage during successive years of storage depletion, and (4) determines that extraction is in excess of sustained yield if the cumulative depletion of storage exceeds 50% of the capacity of the basin. Such a groundwater study incorporates the reality of climate variability and assures us that groundwater use, even during periods of limited recharge during extended drought, does not produce a negative impact to groundwater users or habitats dependent upon groundwater.

As a result, the approach taken by the San Diego County Groundwater Ordinance, which governs the requirements of groundwater investigations in San Diego County, and the "Significance" document, is much more conservative than Dr. Ponce is aware. In practice, while the upper limit of the sustained yield might theoretically be annual recharge (in a basin with large storage capacity, minimally varying recharge with time, and minimal groundwater discharge to streams or wetland habitats), the actual limitation to sustained yield is exactly what Dr. Ponce suggests, "a fraction of the "recharge" amount, the fraction to be established after detailed conjunctive surface-water and ground-water studies". This is exactly what is prescribed by the document, in combination with the County Groundwater Ordinance. Site specific studies are required for approval of projects, and those studies take into account the temporal variability of recharge and the storage capacity of the basin necessary to absorb the effects of groundwater production during years of below average recharge, resulting in sustainable yields that are a fraction of the average annual recharge.

Again, it is disappointing that Dr. Ponce refused to meet with the Technical Advisory Committee to exchange ideas. I don't think that Dr. Ponce realized the need to read the "Significance" document in the context of the County Groundwater Ordinance (referenced as part of the applicable regulatory framework in the "Significance" document). I think that his reservations about the document could have been resolved quickly and easily, as the approaches taken to evaluate sustained yield in San Diego County are entirely consistent with his suggestions, and the results of calculations of sustained yield are consistent with those in the papers he references. At the same time, documents can always be improved and/or clarified, and the Technical Advisory Committee would welcome any opportunity to clarify portions of the document that confuse readers.

Dr. David Huntley

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February 13, 2007

Mr. Jim Bennett
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Subject: Comments Regarding Professor Ponce's Concerns on the Draft *Guidelines for Determining Significance and Report Format and Content Requirements--Groundwater Resources*

Dear Mr. Bennett:

I've reviewed Professor Ponce's letter which commented on the draft *Guidelines for Determining Significance and Report Format and Content Requirements--Groundwater Resources* (draft Guidelines) prepared by the Department of Planning and Land Use (DPLU). I have also read Professor David Huntley's letter to you that addressed Professor Ponce's concerns. Professor Huntley's letter discussed technical issues pertaining to groundwater storage, groundwater recharge, water balance calculations, and sustainable yield. My professional experience conducting groundwater resource studies in southern California are consistent with Professor Huntley's comments and I am in full concurrence with his observations. Rather than reiterate those comments, the following is intended to provide additional perspective to the process the County has developed to assess groundwater resources.

In addition to the water balance analysis, the county requires an analysis of well interference with off site wells and has a criterion for groundwater drawdown for groundwater dependent habitat. The well interference analysis is described in the draft Guidelines it is my understanding that the criterion for drawdown beneath groundwater dependent habitat has been established by DPLU in a similar draft document that addresses Guidelines for Determining Significance for Biological Resources.

The water balance analysis provides a study area wide assessment of groundwater resources. The resultant sustainable yield is further constrained by applying the findings of the water balance analysis toward assessment of well interference and drawdown at groundwater dependent habitat. This is achieved by calculating drawdown based on the on-site groundwater extraction rate derived from the water balance analysis.

Hence, the water balance analysis provides an assessment of the resource on the scale of hundreds or thousands of acres and the drawdown analyses for well interference and groundwater dependent habitat provides a near-field assessment of potentially undesirable effects from pumping at the proposed project site. Findings from the drawdown analyses can result in a revision of well locations to reduce undesirable effects or a further constraint on groundwater extraction rates. This tiered evaluation process provides the opportunity to further constrain the sustainable yield estimate. It is worth noting that the drawdown calculation is frequently conducted using analytical solutions that do not take into account groundwater recharge. In this regard, analytical calculations provide an over estimate of potential drawdown; though because

of it's relative simplicity may under estimate or over estimate drawdown with respect to other site specific factors.

To provide further perspective, few counties have groundwater resource policies and even fewer, if any; have technical criteria as rigorous as those stated in San Diego County's draft or existing guidelines. Because the subject is relatively complex, there will always be opportunity to improve County policy as additional understanding of the groundwater resource is developed. To that end constructive criticism and open dialogue should of course, always be welcome.

In pursuit of providing a better understanding of the County's fractured rock resources, I would also add that County funding for further hydrologic measurements may be the most effective way to improve groundwater resource assessments. In particular the need to better understand the relationship between surface water runoff and groundwater recharge would greatly enhance the professional community's ability to assess groundwater resources. Accordingly, establishing surface water flow measurement stations in selected watersheds is recommended to augment the limited number of stations run by the United States Geological Survey.

Respectfully Submitted,

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February 16, 2007

Jim Bennett
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RE: RESPONSE TO PROFESSOR PONCE'S LETTER TO SUPERVISOR DIANNE JACOB DATED JANUARY 25TH, 2007 REGARDING PROPOSED GUIDELINES OF SIGNIFICANCE FOR GROUNDWATER

Dear Mr. Bennett:

This letter is written in response to Professor Ponce's letter to Supervisor Dianne Jacob, dated January 25th, 2007 which provides his comments on the draft *Guidelines for Determining Significance and Report Format and Content Requirements* (Guidelines) prepared by the Land Use and Environmental Group at the County of San Diego. After reading Dr. Ponce's comments it is apparent that he is misinterpreting a few of the fundamental concepts outlined in the guidance.

In the first paragraph of Professor Ponce's letter, he takes issue with a statement in the Guidelines regarding sustainable yield. The Guidelines state that the sustainable yield for a basin "is the amount of groundwater that can be withdrawn from it annually without producing an undesirable result (Todd, 1959)". However later in the same paragraph, it states that "for practical purposes, the sustainable yield of a basin is often considered to be the annual average recharge for the basin". It is this latter statement that Professor Ponce takes issue with and he goes on to say that the concept is flawed and has been widely discredited. After reviewing the Guidance document, it is easy to understand how Professor Ponce misinterpreted this statement to imply that the County also assumes sustainable yield to be the average annual recharge for the basin. This is not the case and the statement should be removed from the document to prevent further confusion. The Guidance document assumes the definition by Todd, stated above, to be the appropriate definition for sustainable yield. The assumption by Professor Ponce that the Guidance document assumes that sustainable yield is simply the average annual recharge is inconsistent with the methods and procedures discussed throughout the entire Guidance document.

Dr. Ponce also takes issue with the 50% storage concept outlined in the Guidance. If is clear from his comments about mining of groundwater that he is misinterpreting the concept. The 50% storage concept is not about allowing the mining of 50% of groundwater in storage, it is about ensuring that storage does not fall below acceptable levels in basins where the volume of water in storage fluctuates significantly seasonally and during periods of drought.

In the last paragraph of Professor Ponce's letter he states that "The burden of proof regarding groundwater sustainability is on the government, which should determine, based on basin-specific studies, if the consequences of pumping are acceptable." This is precisely what the County does. In fact, the latter portion of the Guidance document outlines the Report Format and Content Requirements for these studies. Once the studies are completed, the challenge is to determine whether the "consequences of pumping are acceptable". The Guidance document is meant to establish the basis for determining whether the "consequences of pumping are acceptable".

It is unfortunate that Professor Ponce refused to meet with the Technical Advisory Committee to discuss his comments and have an open discussion about the concepts outlined in the Guidance document. The members of the Technical Advisory Committee collectively have decades of experience studying the County's complex groundwater system. Each of the members is well aware of the strengths and limitations of the Guidance document and would welcome any constructive criticism or new ideas that would help improve the document and the methodology by which groundwater resources within the County are evaluated.

Respectfully,

Terra Pacific Group Incorporated

Murray Wunderly PG (7132), CHG (713)

Principal Hydrogeologist

February 12, 2007

Jim Bennett, County Groundwater Geologist
Department of Planning and Land Use
5201 Ruffin Road Suite B-1
San Diego Ca. 92123-1666

Subject: Review and Comment on Dr. Victor Ponce Letter Regarding the Groundwater Guidelines and Report Format.

Dear Mr. Bennett:

I have reviewed Dr. Ponce letter to Supervisor Jacob (January 25, 2007) and also his report called *Groundwater Utilization and Sustainability* that he completed at the request of some local back county residents. In response to these documents I would offer the comments.

In my 25 years of experience as a Professional Geologist (#3713) and a Certified Hydrogeologist (#90) working in the County of San Diego I have always used the saying "Groundwater Levels Don't Lie". Frequently we have had differing professional opinions on the status of local groundwater resources on many issues. As an example we had an "expert" present testimony at the Board of Supervisors that he questioned if a groundwater overdraft condition exists in Borrego Valley. However in the review of well hydrographs for Borrego Valley it becomes absolutely clear that such a condition exists and is without question. The proof for groundwater models and calculations comes from the review of direct evidence, which for us in San Diego County is the 25 year record of groundwater levels from wells located throughout the County. I believe that this monitoring record supports the technical conclusions that are contained within the Guidelines.

Within the first paragraph of Dr. Ponce letter (January 25, 2007) he discusses the concept and definition of "sustainable yield". I agree with the conclusion that frequently sustainable yield of an aquifer must be considerable less than recharge. This is especially true here in San Diego County. However definition of sustainable yield is nebulas and frequently differs from author to author.

Within the second paragraph of his letter he states that the proposed limit of 50% is "ill-conceived, patently out-of-date, and contrary to the stated definition of sustainable yield". I strongly differ with this statement. San Diego County is complex mix of aquifers resulting from the size and complexity of the local geologic and hydrological conditions. All aquifers are not the same and they must be treated differently based on the characteristics on the geological materials and local hydrology. It is correct to state that

this threshold would not be adequate to protect the Borrego Valley aquifer. The Borrego Valley aquifer operates differently due to its significant storage capacity and limited recharge due to very low precipitation.

However the fractured rock aquifers of the central portion of the County operate under a different set of limitations. Generally the primary limitation is not recharge rather the very limited groundwater storage of the aquifer. Hydrographs for wells within these aquifers has shown us many years with zero groundwater recharge and then total and complete recovery of drawdown from one good rainfall year. The very high rate of recovery within the aquifer results directly from the low amount of storage within the aquifer.

Dr. Ponce appears to have looked at the County as having one type of aquifer and ignoring the unique hydrogeological characteristics of the different aquifers. As an example within his paper *Groundwater Utilization and Sustainability* (page 20) he states that "The effects of groundwater development trend to become apparent gradually, with time often measured in decades". As given above this would relate to Borrego Valley but not to the fractured rock aquifers of San Diego County. Following the statement "Groundwater levels don't lie" we have hydrographs that show declines of 35 feet in a week with a yearly decline of greater than 300 feet (Ballena Valley Fire Station Well). Due to the limited groundwater storage within fracture rock aquifers groundwater recovery and decline frequently happen very quickly and his statement is not correct for these types of aquifers.

Dr. Ponce proposes to use the equation of $\mathbf{Y = 0.02\ A\ P}$ (equation 4, page 21 of his report) to calculate sustainable yield. This equation uses the assumption that sustainable yield is 2% of an average yearly rainfall times the surface area. This approach states that groundwater recharge occurs each and very year. Using the approach would not take into consideration the limitations of localized drought conditions where little or no groundwater recharge occurs for many years (as documented within local hydrographs). I believe such an approach is over simplistic and treats all aquifers the same. It appears that Dr. Ponce is using this approach to all aquifer systems throughout the world. Although the proposed approach (using a significance standard of 50% of total storage) treats all fracture rock aquifers the same, this approach is specific to the localized geological and hydrological conditions of San Diego County. This approach should not be applied to dissimilar aquifer systems.

Dr. Ponce also expresses his concerns regarding impacts to local ecosystems and established surface-water rights. Such impacts would be considered significant by the existing Ordinances and Codes (including the California Environmental Quality Act). It should be pointed out that these issues are site specific issues and are not addressed within the proposed groundwater threshold of 50%. In fact (Dr. Ponce apparently is not aware of this) the threshold to riparian habitats from groundwater withdrawals is 3 feet below historical low groundwater levels. This is a much higher standard that the 50% value.

In summary Dr. Ponce appears not to take into consideration the differing groundwater systems within the County. As given before "Groundwater levels don't lie" the hydrograph record within the County support the technical conclusions of the Groundwater Technical Advisory Committee. Also I would be happy to meet with Dr. Ponce to discuss these issues. Frequently technical disagreements can be resolved with communication and discussion. I was sorry to hear that Dr. Ponce refused to meet with the Technical Committee.

Please contact me if have any questions on the above.

Sincerely

John Peterson
PG #3713, CHG #90

Cc: Eric Gibson, Deputy Director, Department of Planning and Land Use