San Pasqual Valley Groundwater Sustainability Plan
Technical Peer Review Meetings - Groundwater Modeling Comments
Comment Tracking Table

Commenter Name	Commenter Organization	Comment Received	Subject	Line #s or Figure #	Comment	Modeling Team Response
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP084 serves two residences in this location. Add #29 Desigantion. See pipeline sketch	Well SP084 will be incorporated to represent domestic pumping only for Parcel #29. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP084 Domestic Only	Well SP084 will be incorporated to represent domestic pumping only for Parcel #29. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP043 Agriculture and domestic	Well SP043 was assigned to Parcel #8 for domestic pumping and Parcel #19 for agricultural pumping. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP065 Agcriculture only	Well SP065 was assigned to Parcel #26 for agricultural pumping. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP043 Provides to residences here. Add #8 designation. See pipeline sketch.	Well SP043 was assigned to Parcel #8 for domestic pumping and Parcel #19 for agricultural pumping. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP011 Agricultural and domestic	Well SP011 was assigned to Parcel #26 for agricultural and domestic pumping. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP013 does not service parcel #14. SP013 services a 10 acre parcel. Not shown. See approx. parcel boundary drawn in.	A new parcel (Parcel #46) was added based on the provided boundary with well SP013 assigned for agricultural pumping for this parcel. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP001 is inactive	Well SP001 assumed to be inactive during historical simulation period and under current/future conditions. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP076 & SP079 agriculture only	Wells SP076 and SP079 provides agricultural pumping for Parcel #1. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Frank Konyn	Konyn Dairy	7/8/2020	Comments on Handout #2	Handout #2 Modeling Maps	SP002 agriculture & domestic	Well SP002 provides agricultural pumping for Parcel #1. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Peter Quinlan	Dudek, Rancho Guejito	7/16/2020	Information Request by Jacobs Engineering about land use changes		The floor of Rockwood Canyon was used for nursery operations from 2004 to 2009. In 2010 the use transitioned from nursery to citrus. Approximately half the valley was planted in citrus by August 2010 and all of it by the end of 2010 to the best of our recollection.	Transitioning of land use conditions is not explicitly required in the model due to the continuous nature of CalETa data used to inform consumptive use estimates. Transitions from nursery to citrus, or other similar transitions, would be reflected in the processing of Aleta data for this parcel.
Peter Quinlan	Dudek, Rancho Guejito	7/16/2020	Information Request by Jacobs Engineering about land use changes		The following wells were used between 2004 and 2019. As new wells came on line, older wells were idled as indicated in the table below. (Please see the memo send for full map: Information requested for San Pasqual Model 7-16 edit.pdf) Rancho Guejito Wells Used in Rockwood Well ID / start / last year used / Well Completion Report Number Well 3 / 2004 / 2019 / WCR1991-018980 Well 4 / 2004 / 2011 / Well 5 / 2004 / 2019 / Well 6 / 2004 / 2016 / WCR1976-005011 RK-8 / 2015 / 2019 / WCR2018-000598 RK-9 / 2016 / 2019 / RK-10 / 2017 / 2019 / WCR2014-012001 RK-Dom (Domestic) / 2004 / 2015 / WCR1989-018199 RK-Dom 2 (Domestic) / 2016 / 2019 / WCR2015-001438	Annual well activity, as noted in the comment, was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Carole Burkhard	Landowner	7/14/2020	Comments on Handout #2	Handout #2 Modeling Maps	(1) It appears this parcel (36 on the map), lumps together two or more parcels as one parcel. We (me and my husband, Charlie Burkhard) believe that possibly three separate parcels have been lumped together in this space on this map. We own 8 acres and when comparing the size of the purple parcel to our neighbor across the street (Rancho Guiejto with 20k+ acres), the purple area may include more than one parcel because a minuscule 8 acres would be a smaller spot on this map.	Worked with City staff to delineate the parcels as described and to locate wells associated with these parcels. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Carole Burkhard	Landowner	7/14/2020	Comments on Handout #3	Handout #2 Modeling Maps	(2) We are guessing that the well numbered SP108 is our well, but it could, instead, be our neighbor's.	Worked with City staff to identify approximate locations of SP108 and the two neighboring wells. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Carole Burkhard	Landowner	7/14/2020	Comments on Handout #4	Handout #2 Modeling Maps	(3) To the east of our property line is our neighbor, Tyson Short. He, too, has an 8-acre parcel and he has a separate well. His property may be the land to the east of the purple area labeled 36 that is designated in red and labeled "Rural Landscape." If so (if that is his correct parcel on this map), his well does not appear to be identified on this map.	Worked with City staff to identify neighbor's well. Parcel designated as Rural Landscape in 2018 land use dataset. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.

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Carole Burkhard	Landowner	7/14/2020	Comments on Handout #5	Handout #2 Modeling Maps	(4) To the west of our property line is our neighbor, the San Dieguito River Valley Conservancy (Trish Boaz on this committee) and they have 23 acres and they, too, have their own well. Their 23-acre parcel may be part of the area identified as "Riparian" on this map, however, if so, there is no well identified on this map for them. Their well is very near the south side of our property line, very near our own well. When you visited our property many months ago, I pointed out their well to you. Their well was drilled sometime after December 2008 (I don't remember exactly, but they would know).	Worked with City staff to identify location of the Conservancy's well. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Carole Burkhard	Landowner	7/14/2020	Comments on Handout #6	Handout #2 Modeling Maps	(5) As respects the map called "Preliminary Working Draft, 2005 Land Use," the purple designation (Truck Crops), was correct in 2005 but is not correct for today (so is not correct on the "Preliminary Working Draft, 2018 Land Use"). In 2005, the land was owned by the estate of Justine Fenton and was leased to a small farmer who raised cantaloupe and watermelon. In late September 2007, we purchased 8 acres of the 40-acre parcel from the estate. On October 22, 2007 (less than a month later), we lost that home in the Witch Fire. We rebuilt our home (the one standing today) and moved back to the property in mid-December 2008. At that time (continuing to this day), our homeowner's insurance carrier will not allow us to raise crops nor lease our land to others to raise crops. So, there have been no "Truck Crops" on this property since late 2007. As such, using the Legend on the map, our parcel and Tyson Short's parcel should be reclassified as "Rural Landscape."	Parcel reclassified to Rural Landscape in the 2018 Land Use dataset. Comment was incorporated into Handout 5 distributed as part of the October 8th TPR meeting.
Carole Burkhard	Landowner	7/14/2020	Comments on Handout #7	Handout #2 Modeling Maps	(6) As I have stated in earlier emails, I do not know the other small private landowners in our valley, so I can't provide any information as respects their wells.	Thank you for your input.
Peter Quinlan	Dudek, Rancho Guejito	1/24/2020 email	TPR Meeting #2	Pages 8-15	Land use maps aren't accurate. Some orchards are mapped as field crops. See area to west of Rockwood Canyon which is irrigated from wells in the alluvial basin. Before estimating historical pumping from land use, these maps should be verified by using Google Earth at a minimum, or requesting verification by the farmers through the Advisory Group.	The modeling team reviewed SANDAG, SANGIS, DWR County, and LandIQ datasets and found them to be incomplete or inaccurate for modeling purposes. Ultimately, the land use maps used for the modeling effort are based on mapping established during the development of the Salt and Nutrient Management Plan (SNMP), with the aid of 2018 aerial imagery from Google Earth. The modeling team requested stakeholder review of the 2005 and 2018 land use maps and have incorporated stakeholder feedback (subject of the July-2020 TPR meeting). It is our understanding that there are no further comments on the land use maps.
Peter Quinlan	Dudek, Rancho Guejito	1/24/2020 email	TPR Meeting #2	Pages 16-17	These maps show 22 wells in the section containing Rockwood Canyon, not counting the 4 monitoring wells. At least 6 of the wells are laterally outside of the basin and 5 of the wells are constructed to isolate them from the alluvium and residuum. Others are abandoned.	Please refer to Handout 5 distributed as part of the October 8th TPR meeting, which contains the inventory of pumping wells.

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Peter Quinlan	Dudek, Rancho Guejito	1/24/2020 email	Numerical Model Discussion	Slides 7-10	SGMA Emergency Regulations repeatedly call for addressing uncertainty. In the context of minimum thresholds , they raise the issue of uncertainty including model uncertainty:"§ 354.28. Minimum Thresholds (a) Each Agency in its Plan shall establish minimum thresholds that quantify groundwater conditions for each applicable sustainability indicator at each monitoring site or representative monitoring site established pursuant to Section 354.36. The numeric value used to define minimum thresholds shall represent a point in the basin that, if exceeded, may cause undesirable results as described in Section 354.26. (b) The description of minimum thresholds shall include the following: (1) The information and criteria relied upon to establish and justify the minimum thresholds for each sustainability indicator. The justification for the minimum threshold shall be supported by information provided in the basin setting, and other data or models as appropriate, and qualified by uncertainty in the understanding of the basin setting." Quantifying uncertainty in model predictions is important for providing context to management decisions. If the model-estimated sustainable yield that avoids undesirable results is less than current groundwater production, it may require unnecessary reductions in pumping and have negative economic consequences for groundwater users. The GSA should be aware of the confidence interval bounding the estimated sustainable yield before acting to limit production beyond what I necessary, so as to avoid unnecessary economic disruption. Uncertainty associated with numerical models can be addressed a number of ways. ASTM D5447-04 (2010) specifies validation or verification against historical observations held back from the data used for calibration: "6.6.5 Calibration of a groundwater flow model to a single set of field measurements does not guarantee a unique solution. In order to reduce the problem of nonuniqueness, the model calculations may be compared to another set of field observations that represent a different set of boundary conditions or stresses. This process is referred to in the groundwater modeling literature as either validation (1) or verification (14, 15). The term verification is adopted in this guide. In model verification, the calibrated model is used to simulate a different set of aquifer stresses for which field measurements have been made. The model results are then compared to the field measurements to assess the degree of correspondence. If the comparison is not favorable, additional calibration or data collection is required. Successful verification of the groundwater flow model results in a higher degree of confidence in model predictions."	We appreciate the comments and agree that qualifying the uncertainty in the understanding of the basin setting and model projections will be important to provide context for management decisions. Confidence intervals around the estimated sustainable yield is desirable information. However, the scope of the GSP-related modeling work includes deterministic-style modeling, rather than stochastic (probabilistic) modeling. To be able to provide confidence intervals on model projections to the degree the comment is suggesting, stochastic modeling would be required and involve calibrating multiple models (e.g., dozens to hundreds), making projections with each of the calibrated models, and then conducting a statistical evaluation of the projections. This would require a level of effort far beyond what is required for the GSP. Although GSP Guidelines indicate that uncertainty must be addressed in the GSPs, they do not dictate the means and methods for addressing uncertainty (e.g., conducting verification or developing confidence intervals). As pointed out, there are some guidelines (e.g., ASTM standards) that describe potential ways uncertainty can be evaluated with numerical groundwater models. However, it is the opinion of the modeling team that the value of conducting model verification during the calibration effort is overstated. This opinion has also been shared by others in the scientific literature (e.g., Oreskes et al., 1994*). Ultimately calibration is an exercise of history matching, regardless of whether the historical simulation period is split into a "calibration period" versus a "verification period". At the end of the calibration effort, the modeling team must demonstrate an adequate match to historical observations over at least the last 10 years with consideration of climatic variability and water-use conditions. Our team analyzed historical data and provided a basis for the planned history-matching period during the May- and July-2020 TPR meetings.
					Verification enables quantitative assessment of model error / uncertainty. Uncertainty can also be characterized qualitatively through sensitivity analyses. Again from ASTM D5447-04 (2010): "A calibrated but unverified model may still be used to perform predictive simulations when coupled with a careful sensitivity analysis (15). 6.7 Sensitivity analysis is a quantitative method of determining the effect of parameter variation on model results. The purpose of a sensitivity analysis is to quantify the uncertainty in the calibrated model caused by uncertainty in the estimates of aquifer parameters, stresses, and boundary conditions (6). It is a means to identify the model inputs that have the most influence on model calibration and predictions (1). Perform sensitivity analysis to provide users with an understanding of the level of confidence in model results and to identify data deficiencies (16). 6.7.1 Sensitivity analysis is performed during model calibration and during predictive analyses. Model sensitivity provides a means of determining the key parameters and boundary conditions to be adjusted during model calibration. Sensitivity analysis is used in conjunction with predictive simulations to assess the effect of parameter uncertainty on model results."	The GSP modeling team favors a more practical approach of conducting sensitivity analyses that focus on selected projection simulations. Focusing such analyses on the forecasts rather than the hindcasts will provide much more value for decision making associated with the sustainable management criteria. Identifying the model inputs that have the most influence on model projections will also help inform decisions related to data gaps and the monitoring network. *Oreskes, N., K.Shrader-Frechette, and K.Belitz. 1994. Verification, Validation, and Confirmation of Numerical Models in the Earth Sciences. Science, v.263, pp. 641-646.
Matt Wiedlin	Weidlin & Assoc.	1/21/20 email	TPR Handout #3	Figure 1-7 & 8	Big change in ag use from field crops to intensive ag between 1990 and 1995 This will require follow up.	The modeling team reviewed SANDAG, SANGIS, DWR County, and LandIQ datasets and found them to be incomplete or inaccurate for modeling purposes. Ultimately, the land use maps used for the modeling effort are based on mapping established during the development of the Salt and Nutrient Management Plan (SNMP), with the aid of 2018 aerial imagery from Google Earth. The modeling team requested stakeholder review of the 2005 and 2018 land use maps and have incorporated stakeholder feedback (subject of the July-2020 TPR meeting). It is our understanding that there are no further comments on the land use maps.
Matt Wiedlin	Weidlin & Assoc.	1/21/20 email	TPR Handout #3	Figure 1-12	Comparing 2013 Land Use Map to Google Earth Images for the same time frame shows error in classification where undeveloped areas are classified as field crops, orchards classified as field crops, former poultry ops, abandoned decades ago, classified as intensive agriculture. See attached Figure 1-12, with annotations.	The modeling team reviewed SANDAG, SANGIS, DWR County, and LandIQ datasets and found them to be incomplete or inaccurate for modeling purposes. Ultimately, the land use maps used for the modeling effort are based on mapping established during the development of the Salt and Nutrient Management Plan (SNMP), with the aid of 2018 aerial imagery from Google Earth. The modeling team requested stakeholder review of the 2005 and 2018 land use maps and have incorporated stakeholder feedback (subject of the July-2020 TPR meeting). It is our understanding that there are no further comments on the land use maps.

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Matt Wiedlin	Weidlin & Assoc.	5/29/2020	TPR-05-14-20 Handout 1		As part of the 2nd TPR meeting it was evident that the initial compilation of landuse mapping was inadequate. Will Woodard-Curran be providing an update on how they are characterizing landuse?	The modeling team reviewed SANDAG, SANGIS, DWR County, and LandIQ datasets and found them to be incomplete or inaccurate for modeling purposes. Ultimately, the land use maps used for the modeling effort are based on mapping established during the development of the Salt and Nutrient Management Plan (SNMP), with the aid of 2018 aerial imagery from Google Earth. The modeling team requested stakeholder review of the 2005 and 2018 land use maps and have incorporated stakeholder feedback (subject of the July-2020 TPR meeting). It is our understanding that there are no further comments on the land use maps.
Will Halligan	LSCE	7/16/2020	Attachment 2		On the Well to Parcel memo and map I am concerned that you may have situations where you have a well that serves a very small parcel (and hence a likely low discharge simulated by MFOWHM) to wells that end up serving a large area/parcel(s) which will likely result in a very large pumping rate by the numerical model. I realize that metered pumping was only recently implemented, however, are there historical utility pump efficiency tests that include useful well yield data that are available to cross check this well to parcel approach and related pumping amounts that the model will eventually simulate?	The modeling team does not have pump efficiency test information. We will evaluate model output to inform the need to look into further constraining pumping rates at the parcel level.
Will Halligan	LSCE	7/24/2020	Presentation	Slide 14	Which version of One Water is being used?Version 1 is full of bugs so hopefully you have access to the most recent version released in April 2020 by Boyce et al. (MF-OWHM2).	We are using MF-OWHM2 with the fourth version of the Farm Process based on the April 2020 release.
Will Halligan	LSCE	7/24/2020	Presentation	Slide 16	As mentioned in the meeting, plesae account for any water demands/applications that are not related to ET. This is important since the Farm Process functions primarily on water demands associated with ET only and not other farming cultural practices.. Also when you show us land surface and groundwater budgets let us know if you have the Farm Process "magic water" activiated or not. I am hoping that you will provide historical land and gw budgets for review at some point to the TPR.	The modeling team has not been provided water use data for activities not related to irrigation (e.g., frost protection). Thus, we are moving forward under the assumption that any water-budget errors introduced in the model by omitting such water use would be negligible. We also set the "Deficiency Scenario Option" in the FMP package to "Deficit Irrigation", which means any applied water demand not met during a given month will be left unmet in the model.
Will Halligan	LSCE	7/24/2020	Presentation	Slide 18	As mentioned in my comments on Handout 2, grapevines needs to be evaluated and segrated further as some grapevine water demands are much higher than others. Also, an understanding of defict irrigation practices (someone else mentioned this in the meeting) needs to be accounted for in the Farm Process.	The manner with which the CalETa consumptive-use data are processed accounts for variability in consumptive use for different grape types. The “Grapevine” classification makes up only about 43 acres (0.16%) of the model domain in 2005 to 55 acres (0.20%) of the model domain in 2018. Thus, tracking down table grapes versus vineyards would not likely be a worthwhile effort. Therefore, we do not plan at this time to further segregate the Grapevine classification. The modeling team has not been provided information on deficit irrigation practices. However, we have the "Deficiency Scenario Option" in the FMP package set to "Deficit Irrigation", which means any applied water demand not met during a given month will be left unmet.
Will Halligan	LSCE	7/24/2020	Presentation	Slide 21	If you will be transitioning from 2005 to 2018 land use between the 2010 and 2011 water year, are you expecting a large difference in water demands in some areas of the basin that is supported by observations of changes in gw elevations? Or is the gw elevation data not of high enouth spatial resolution in teh basin to get a sense of whether transitioning between the two land uses for modeling purposes is supported by observed changes in gw elevations?	Based on the land use datasets developed, there are very minor changes in land use from 2005 to 2018. Also, the manner with which consumptive use data are processed accounts for changes in water use at the field level. Thus, even if our crop designation from year-to-year is not 100% accurate, the consumptive use estimates will reflect changes in cropping within a given year. Information received from stakeholders has been incorporated into the process and they confirmed that land use conditions have not changed much during the 15-year calibration period.
Will Halligan	LSCE	7/24/2020	Presentation	Slide 22	The root water uptake aspect of the Farm Process can have a large influence on what may be needed from groundwater pumping. Please provide crop rooting depths that you will be using in the Farm Process. This is an important component especially in the western half of the basin where gw levels are often shallow and close to the land surface at times. Rooting depth values may be a sensitive parameter and it may be helpful to get a sense of the sensitivity of that parameter if that is in your budget/scope.	The modeling team will provide a table of rooting depths used in the model at the December 17th TPR meeting.

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Peter Quinlan	Dudek, Rancho Guejito		Modeling approach	pages 13-15 of the 7/9/2020 TRP meeting power point presentation	Jacobs proposes using BCM to compute stream and groundwater inflows to GSP flow model domain from watershed areas tributary to GSP flow model domain. This area is approximately 4 to 5 times larger than the One-Water/MODFLOW domain. Stream gauge data are available for about 80% of the area that BCM is proposed for. It would be reasonable to just use the gauge data to estimate surface water inflow to the basin. The BCM does not calculate stream flow. The "runoff" calculated by BCM is the water balance remaining after estimated evapotranspiration, soil moisture deficit (based uncertain soil thicknesses), and estimated infiltration into bedrock (based on uncertain bedrock permeability) are subtracted from precipitation. The authors wrote the following in *Fine-scale hydrologic modeling for regional landscape applications: the California Basin Characterization Model development and performance* , Flint et al. 2013. (underline emphasis added). "A highly valuable application of the BCM beyond the estimates of spatially distributed recharge and runoff would be to estimate basin discharge for ungaged basins. We attempted to correlate equation coefficients (scaling factors and exponents in Equations 1 to 7) developed in gaged basins to landscape variables such as geology, soil properties, slope, basin area, or aridity to provide an empirical basis for estimating discharge in ungaged basins. <u>This endeavor was unsuccessful on a statistically significant basis across all calibration basins, possibly due to potential errors in the soils or geology maps, or in the PRISM climate data, or due to human activities that are affecting basin hydrology at the watershed scale.</u>" <u>"The estimate of spatially distributed runoff does not equal basin discharge as measured at a streamgage without post-processing to determine the components of runoff and recharge that contribute to stream channel gains and losses, which must be done using some measured data for a given basin.</u> The resultant parameters corresponding to the gains and losses generally reflect climatic conditions and geologic setting, but at the scale of California have not been determined to a degree that allows for the direct extrapolation of basin discharge to all ungaged basins."	This comment was addressed with Handout 4a for the October TPR meeting. This handout describes the process implemented by the modeling team to bias-correct the runoff estimates provided by BCM so they provide defensible stream inflows into the model domain when and where measured stream inflows are not available.
					For example the total water flowing by the Guejito Creek gauge in 2005 was 2,648 AF. "Runoff" from the BCM for the Guejito Creek watershed calculated by BCM was approximately 9,710 AF. All of the BCM runoff occurred in January and February, whereas there was flow at the gauge all months except July, August, and September. Extensive post-processing including applying a routing package to the entire model grid and accounting for subsurface lateral flow will be necessary to modify/calibrate the BCM output. Application of the BCM model is unlikely to reduce uncertainty regarding surface water inflows to the basin. Given how much of the watershed is covered by actual gauge data, I question whether the effort is worthwhile.	
Peter Quinlan	Dudek, Rancho Guejito		Modeling approach	pages 13-15 of the 7/9/2020 TRP meeting power point presentation	Recharge in the BCM is also uncertain and may also be overstated. For precipitation that fell in January and February 2005, the BCM partitioned 65% of the available water to runoff and recharge. Recharge for the Guejito Creek watershed is based on an assumed hydraulic conductivity of 1.5 mm/d (1.7E-06 cm/s) for the granite. The BCM output for recharge in the Guejito watershed for 2011 was a mean of 42.6 mm per cell or 2,000 AF. Water levels in observation wells completed in the granite on Rancho Guejito located 5 to 7 miles north of the SPB only rose approximately 8 feet in response to rainfall between November 2010 and March 2011. Dividing 42.6 mm (0.14 ft) by 8 feet yields an estimated specific storage coefficient of 0.0175. This is well outside the expected 2.1e-05 to 1e-06 range for jointed rock (Batu, V., 1998. *Aquifer Hydraulics: A Comprehensive Guide to Hydrogeologic Data Analysis* , John Wiley & Sons, New York, 727p.). This example indicates that the BCM likely overestimates recharge to bedrock in the vicinity of the San Pasqual Basin. Again, application of the BCM to estimate recharge to granitic bedrock outside the domain of the MODFLOW model is not likely to reduce uncertainty regarding groundwater inflow into the model domain. As is the case for runoff, BCM calculated recharge also does not represent subsurface discharge from a watershed. Relying on the BCM for recharge to the granite does not decrease uncertainty regarding subsurface inflow to the basin. Finally, the BCM output that we have located on line only extends through 2016.	The recharge estimates from BCM are not being used by the modeling team. Groundwater recharge within the model domain is computed via the FMP package.
Peter Quinlan	Dudek, Rancho Guejito		Modeling approach	pages 13-15 of the 7/9/2020 TRP meeting power point presentation	As is the case for runoff, BCM calculated recharge also does not represent subsurface discharge from a watershed. Relying on the BCM for recharge to the granite does not decrease uncertainty regarding subsurface inflow to the basin.	The recharge estimates from BCM are not being used by the modeling team. Groundwater recharge within the model domain is computed via the FMP package.

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Peter Quinlan	Dudek, Rancho Guejito		Modeling approach	pages 13-15 of the 7/9/2020 TRP meeting power point presentation	Using OWHM may not reduce uncertainty about surface water inflows either. In Guidance for determining applicability of the USGS GSFLOW and OWHM models for hydrologic simulation and analysis, the USGS describes the capabilities of One Water Hydrologic Model (OWHM) for estimating surface runoff. The ability of OWHM to do this is limited (again, highlighted emphasis added): "Both models have limitations in how they simulate real-world hydrologic systems, but the watershed-simulation processes and daily time-step discretization available in GSFLOW make it possible to simulate hydrologic processes such as overland runoff, snowpack dynamics, soil-zone processes, recharge, surface-depression storage, and streamflow more comprehensively and in a more physically-based manner than those available in OWHM. Because of this, GSFLOW is more appropriate for application to environmental-flow, streamflow-generation, and other watershed-process issues than is OWHM. • Both codes have been applied to field settings. GSFLOW has been applied to several types of hydrologic-process and water-management studies, including irrigated agriculture, in a range of climate and hydrogeologic settings. A benefit of GSFLOW is that both headwater and valley settings can be simulated simultaneously, so that flows throughout a watershed can be simulated comprehensively. OWHM also has been applied to a similar range of climate and hydrogeologic settings, but more typically in the lower watershed areas of arid to semi-arid settings where agricultural processes associated with alluvial-aquifer systems are relatively important and natural rates of runoff and snowmelt are small or nonexistent. Flows from headwaters to the lower valleys can be simulated externally from OWHM…."	We are using MF-OWHM2 with the fourth version of the Farm Process based on the April 2020 release. Use of this code is especially helpful in basins like the San Pasqual Valley, in which continuous reliable records of ag pumping are not available. Pairing CalETa data with OWHM2 allows more defensible estimates of ag pumping than GSFLOW.
Peter Quinlan	Dudek, Rancho Guejito	10/23/2020	Future Climate Scenarios	Handout 2	The precipitation and other climate change projections used in the modeling predict that there will be prolonged drought in the basin. The projections do not reflect past climate patterns or precipitation and have been characterized as unlikely to occur. Using them could result in unnecessary restrictions on groundwater use. Being conservative does not require using scenarios that are characterized as unlikely to occur. From: CLIMATE, DROUGHT, AND SEA LEVEL RISE SCENARIOS FOR CALIFORNIA'S FOURTH CLIMATE CHANGE ASSESSMENT Page 1 "One requirement of the climate simulations and scenarios provided to the Fourth Assessment is to enable investigation of extreme, highly damaging climate changes that are possible but unlikely—e.g., low probability, high consequence outcomes. Two examples are provided, exploring extreme drought and high sea level rise. To explore extreme drought in a warmer future, two 20-year drought scenarios were produced from the downscaled meteorological and hydrological simulations: one for the earlier part of the 21st century, and one for the latter part." No decisions about management actions or potential projects should be made based on the results of model simulations without factoring in how unlikely it is that the theoretical results will occur. Management actions and projects will have actual costs. They should be based on observed data, not model simulations of unlikely future conditions.	The longest-projected drought with the selected GCM (i.e., HadGEM2-ES, RCP 8.5) is 7 years in duration (WY 2062 thru WY 2068). The next longest-projected drought is 4 years in duration (WY 2029 thru WY 2032 and WY 2040 thru WY 2043). These durations are within the ranges of historical California droughts. I mention this to provide context for the assertion that the projections include prolonged droughts. Additionally, the mean annual precipitation (MAP) of the selected GCM is 14 inches over the 50-year GSP planning period (i.e., WY 2020 thru WY 2069), as compared with the MAP of the most recent (1981-2010) precipitation normal of 14.4 inches. So overall, the MAP of the selected GCM is only 0.4 inches lower than the MAP of the most recent precipitation normal for the area. I am not aware of any indications from climate experts that the selected GCM is unlikely to occur. Avoidance of groundwater-use restrictions will require avoidance of undesirable results, as defined by sustainable management criteria (SMC). Thus, annual reporting of measured data and the SMC definitions, as opposed to modeling results, will be relied upon by DWR to render decisions regarding basin sustainability and groundwater use restrictions. Ultimately, the need to implement projects and management actions will be decided based on annual reporting of measured data against their respective SMC, as opposed to models. By selecting a GCM that plots within the range of the ensemble, but on the drier side of the four California-specific GCMs makes sense for a water-supply planning effort. In this case the MAP of the selected GCM is only 0.4 inches lower than the MAP of the most recent (1981-2010) precipitation normal.
Peter Quinlan	Dudek, Rancho Guejito	10/23/2020	Calibration	Power Point page 15	The quantitative calibration should include the vertical gradients. Nate Brown indicated that water levels in the alluvium will be quantified using standard statistics, but that the vertical gradients among the alluvium, residuum, and non-weathered granitic rock (as measured in the 3 USGS observation well clusters) will only be used as a qualitative check on model calibration. Under this approach, it will not be possible to draw conclusions about the degree of hydraulic connection if the model development does include quantitative assessment of model error in reproducing the vertical gradient observed in the nested observation wells with.	We are evaluating residuals of heads and vertical head differences (VHDs) at the three USGS observation well clusters. So, one will be able to draw conclusions regarding the model's ability to replicate target heads and VHDs in the model. We do not plan on computing calibration summary statistics for VHDs, because there are no industry standards to provide guidance for acceptable ranges of values. Not computing calibration summary statistics is the only reason we are referring to them as qualitative targets. Qualitative targets should not be viewed as not important.

Commenter Name	Commenter Organization	Comment Received	Subject	Line #s or Figure #	Comment	Modeling Team Response
Peter Quinlan	Dudek, Rancho Guejito	10/23/2020	Model	Power Point page 29	It is unclear whether Jacobs intends to simulate pumping from the layers of the model that represent the un-weathered granitic rock. The table showed parcel 42 as irrigated by water from Rancho Guejito wells 3, 4, and 5 which extract water from the granite beneath the basin, but showed parcel 43 as not irrigated although it is irrigated by wells extracting water from the granite laterally outside the basin boundaries, but within the model domain. If pumping from the un-weathered granitic rocks is simulated, all pumping within the domain must be simulated for the result to be valid.	The modeling team includes bedrock pumping in and near the groundwater basin. We also plan to rely on CalETa datasets and the FMP package to estimate monthly pumping in Parcel 43. Because we have not been provided any pumping locations, we will infer two or three locations with the aid of Google Earth and assign the pumping rate to the model layer representing bedrock in Parcel 43. The assertion that information for all bedrock wells throughout the entire model domain would be needed for the model results to be valid is overstated. For example, bedrock wells located distal from the groundwater basin will have negligible effects on the basin water budget.
Peter Quinlan	Dudek, Rancho Guejito	10/23/2020	Model		I am concerned about the proposed use of the external boundary of the model as a no flow boundary. During the meeting, Nate Brown stated that the external boundary of the model domain would be treated as a no flow boundary. This is likely to cause the model to generate unreliable results if pumping from the non-weathered granitic rock is simulated in the calibration period and future scenarios.	The model domain boundaries were purposely selected to coincide with subcatchment boundaries located sufficiently far from the groundwater basin boundary or with reliable stream gage locations. It is common practice to assume that the surface-water divides along the subcatchment boundaries are also largely groundwater divides in the absence of substantial groundwater pumping near the subcatchment boundaries. Thus, any conceptual errors associated with the no-flow assumption at the distal model boundaries are expected to have negligible impacts on the historical and future water budgets being developed to support development of the GSP.
Peter Quinlan	Dudek, Rancho Guejito	10/23/2020			The fractures in the non-weathered granitic rock occur within and outside of the model domain. Fractures connected to areas outside the domain provide recharge to the non-weathered granitic rock within the domain. It is not clear whether Jacobs intends to simulate pumping outside of the DWR Bulletin 118 basin boundaries in the model layers representing the non-weathered granitic rock. If Jacobs does simulate pumping from the non-weathered granitic rock, they must do it for all wells within the model domain in order for the model results to be valid.	The modeling team does not have much information on pumping locations from bedrock wells outside of the groundwater basin and to our knowledge no reliable information is available regarding locations of interconnected fractures. However, we do have CalETa data, which provides estimates of actual consumptive use. This information combined with land use mapping helps guide the understanding of irrigated areas throughout the model domain (including in bedrock areas outside the groundwater basin). Areas that are inferred to be irrigated are provided sources of water (i.e., local wells or imported water) and the FMP package provides estimates of groundwater pumping that would be needed for each month of the simulation period to satisfy the consumptive demand. The assertion that information for all bedrock wells would be needed for the model results to be valid is overstated. For example, low-yielding bedrock wells located distal from the groundwater basin will have negligible effects on the basin water budget.
Will Halligan	LSCE	11/6/2020	Handout 3	Pages 1 and 2	The climaate change memo is somewhat confusing as it does not mention the DWR climate chage guidance document and does not differentiate between the transient approach and the DWR historical period approach in the background portion of the memo. Is this memo planned on being included as an Appendix to the GSP? If so, then it needs to summarize the DWR approach and tool versus the approach recommended by Jacobs. The projected time frame of 2020 through 2069 seems more appropriate for a GSP submittal in January 2020 versus this one which is Januaryt 2022. Why sin't the projected water budget through 2072? Most critically overdrafted basins GSPs have projected water budgets through 2070. The memo does not clearly articulate why the preferred approach is better than the DWR approach, even with hteh pros and cons summarized in teh Table later in teh memo. The memo does not describe how the preferred method incorporates variations in climate change (2030 and 2070 DWR approaches) that is in the DWR BMP. The DWR BMP has a 2030 climate change model and three different 2070 models. Are these the same four GCMs that the Jacobs preferred approach is using? If so then is seems as if you are comparig apples to organges by commingling the 2030 climate change model with the three 2070 GCMs.	The modeling report will describe the approach implemented to address climate change with enough detail to demonstrate that the approach complies with the intent of the GSP Regs. The modeling report will be included in the GSP as an appendix. In terms of the projection period, because the GCMs project climate conditions out to the year 2100, it would easy to expand the projection period to include 2072. The DWR climate change approach uses the same underlying GCM information. Their approach differs in that one must select a historical period and assemble the monthly precipitation and reference ET data, upload the datasets into the DWR tool to compute perturbation factors, and then download the climate-adjusted values for 2030 and 2070 conditions. One would then also need to come up with an independent way to compute runoff from contributing catchments. The "transient" approach undertaken by the modeling team allows us to make use of rainfall, reference ET, and runoff data from climate experts and we simply bias-correct it to customize it to our local model domain.
Will Halligan	LSCE	11/6/2020	Handout 3	Table 1	The table conveys that DWR will ensorse the recommended approach. Has the local DWR representaive been informed of this approach and have they provided a preliminary "endorsement"? In my experience, it is very difficult to get any DWR representative to provide such an endorsement for an approach which is not consistent with DWR best management practices. The decision not to develop a 50 year historical period of record to be used in the projection based on the fact that there is not 50 years worth of data should not present a large hurdle or a lot of extra work. Many basins have this same issue and have developed a 50 year record using a repeat of wet, dry, and average years during the time frame data is available in which to populate the years where data is not available.	We did engage a DWR representative as part of a GSP project in Northern California where we are implementing a similar approach. Their response was as follows: "If GSAs determine that other methods or approaches, which vary from the GSP Regulations, are the best for a given situation then it would be appropriate for the GSA to explain why that decision was made and how the proposed approach substantially complies with the Regulations." In this case, we feel our approach makes use of the best available science, is more defensible than us selecting a historical period and applying climate factors, and complies with the intent of the GSP Regs to incorporate a meaningful climate-change approach. We are relying on projections made by climate experts and tailoring them to our local modeling domain in this region of California. In addition to having defensible climate change projections, it also turns out that our approach is also more efficient in preparing historical and projected precipitation, reference ET, and runoff estimates, as compared with having to develop, implement, and defend independent approaches.

Commenter Name	Commenter Organization	Comment Received	Subject	Line #s or Figure #	Comment	Modeling Team Response
Will Halligan	LSCE	11/6/2020	Handout 4a	PDF Page 3 and Table 1 on PDF Page 4	I had assumed from the text on page 3 that the ratios were developed for each month of the simulation period, however, you used a single ratio value for every January, the same ratio value for every February, etc. How much variability is there within the same month (different years) and does this approach produce its own bias? This approach also seems to mute the highs and lows that may occur during wet and dry periods, therebyinfluencing the groundwater model's ability to simulate wet period gw level highs and drought period gw level lows. There are not that many months in the simulation period. Why not have a ratio calucaluted for each month in the entire simulation period versus using the average approach?	It is not evident in the corrected datasets that our approach systematically over- or under-estimates measured highs and lows. Showing the comparison of average monthly, annual, and cumulative results speak for themselves in terms of showing good correlations between bias-corrected and measured values. The modeling team developed the monthly and annual water-year type correction factors so a consistent workflow approach could be implemented for the historical and projection periods. Developing custom correction factors for past months would not be useful for future periods where measured streamflows are not available.
Will Halligan	LSCE	11/6/2020	Handout 4a	PDF Page 3 and Table 2	The water year adjustment factor (step 2) is somewhat confusing and the text would benefit from a better explanation of why this is necessary. Rather, the hreader is left to interpret the numbers on Table 2 to get a sense of the fact that the BCM does not represent critical year types well at all. I am assuming that there is likely little to no flow in these streams in critical years (which his why the factors are close to zero). The factors for teh other year types seem to result in most year types (except for above normal) to need to have increased amounts of runoff to be representative of observed flows. All of this need for a two step process to manipulate the BCM output casts doubt on why use that tool in the first place versus developing relationships in observed runoff between different watersheds in order to fill in months and years where there is a lack of observed data in some of the streams.	Monthly adjustment factors bias-correct BCM runoff estimates, so they better align with the measured timing of streamflow. This step provides the largest corrections to the data, as evidenced by the difference between the blue and gray lines relative to the black points and lines. Annual bias-correction factors are then implemented to improve the fit with water year types, annual, and cumulative measured streamflows. Use of BCM allows the modeling team to build off of USGS work products in a more efficient manner than independently developing and implementing our own rainfall-runoff calculation techniques. BCM incorporates a comprehensive energy balance approach at a regional scale and we're implementing monthly and annual bias corrections to make the BCM runoff estimates more consistent with measured streamflow data at the local scale.
Will Halligan	LSCE	11/6/2020	Handout 4a	Exhibit 2	What is the explanation for why you are using calendar years and water years intermixed in Exhibits 2, 3, and 4? Also, what is the explanation of why the "final" adjusted value and the observed values for the "wet" years of 2005 and 2011 being different. As in one wet year has the observed being higher than the final and the other wet year shows teh opposite relationship. This does not show up on the other two streams. Also, the portion of the three exhibits that show the monthly relationship is onfusing in that it does not explain what year type is being shown, nor is there an explanation of the year in which the observed data is obtained from (unless the observed data is a monthly average?). It wouild be more informative to see monthly results for all year types for each stream to see how well this approach works in all year types in the three watersheds shown.	Because the cumulative streamflow plots accumulative continuous monthly data, the choice for displaying calendar or water years is not particularly important. Had we accumulated annual data, then the year type would have mattered. The purpose of the plot is to demonstrate that the modeled monthly values when accumulated through time, better match measured accumulated values after the bias corrections are implemented. For Guejito Creek, the 2005 and 2011 measured annual inflows are similar; however, the BCM original values are quite different. Furthermore, the BCM original values matched the 2011 measured values fairly well, whereas the 2005 BCM original values strongly overestimate streamflows, as compared with 2005 measured streamflows. Because the same wet-year correction factor is being applied to the BCM original dataset, some years are overcorrected and other years are undercorrected. The good comparison of the cumulative streamflows shows that the overestimates and underestimates balance out, which is important for long-term water supply planning. The 2005 and 2011 datasets for the other two creeks indicate that BCM overestimates the runoff as compared with measured. So when applying the wet-year correction factor for those other creeks, the final BCM annual adjusted values are more consistently in line with the measured values. Monthly plots show the average of each individual month for the simulation period, the plotted values are not tied to any individual year or water year type. The y axis correctly states the values presented are monthly average inflows for the displayed month.
Will Halligan	LSCE	11/6/2020	Handout 5	Well Parcel Map	Very busy map. I was not able to locate parcel no. 35 as it may be hidden behind other labels. Does this include ALL wells that supply water to lands within the basin? Regardless of whether those wells penetrate the fractured bedrock or bedrock. I want to make sure because if the wells that are represented do not represent the soucrce of all water used in the basin then that discrepancy impacts how the basin is currently (or historically) operated. For those half dozen or so parcels classified as "not irrigated", does that mean just in the "current" time (2020) or historicallyy as well?	Parcel 35 is located south of the SP113 red label near the western end of the basin. Yes, stakeholders have provided the well information on this map and it is our understanding that this includes wells that supply water to lands within the basin (bedrock and alluvium/residuum wells). Parcels listed as "not irrigated" have been assumed to be not irrigated throughout the calibration period. However, the modeling team is re-evaluating these assumptions for some parcels based on CalETa data and Google Earth imagery.
Will Halligan	LSCE	11/6/2020	Handout 5	Land Use Maps	Is that large parcel bordering the east boundary of the basin near Guejito an avocado land use? If so, does the model simulate that land use and the sources of water that are used to irrigate it? I did not see that parcel in the well/parcel map. Does the existence of that irrigated parcel influence groundwater and surface water conditions within the basin?	Yes, that parcel is mapped as avocado. We plan to rely on CalETa datasets and the FMP package to estimate monthly pumping in Parcel 43. Because we have not been provided any pumping locations, we will infer two or three locations with the aid of Google Earth and assign the pumping rate to the model layer representing bedrock in Parcel 43. Because of the proximity of Parcel 43 to Rockwood Canyon, there will likely be some influence on conditions in Rockwood Canyon.

San Pasqual Valley Groundwater Sustainability Plan
Technical Peer Review Meetings - Groundwater Modeling Comments
Comment Tracking Table

Commenter Name	Commenter Organization	Comment Received	Subject	Line #s or Figure #	Comment	Modeling Team Response
Will Halligan	LSCE	11/6/2020	Presentation	Slide 13	As mentioned in the meeting, the vertical exageration conveyed with the model layering in this figure gives the impression that the actual model layering has very steep slopes which can result in numerical convergence and other issues. This cross section figure couild benefit from showing the model domain extent and how the domain boundary is simulated (no flow boundary?) I know that may be a sensitive topic, however,it will be a comment that will likely be provided at some point in teh GSP review process.	Updated profiles of the model layering will be provided at the December 17th TPR meeting.
Will Halligan	LSCE	11/6/2020	Presentation	Slide 15	The qualitative calibration part of the slide seems pretty quantitative to me if you are using observed heads from the multiple completion wells to evaluate vertical gradients. Is it qualititative bacause you are just going to "eye ball it" or are you going to actually calculate vertical gradienits from teh measured data and compare to the model data? Also, will there be any streamflow calibration to gages located in the basin? Seems as if that would be a good idea in order to dial in streamflow.	We are evaluating residuals of heads and vertical head differences (VHDs) at the three USGS observation well clusters. We do not plan on computing calibration summary statistics for VHDs, because there are no industry standards to provide guidance for acceptable ranges of values. Not computing calibration summary statistics is the only reason we are referring to them as qualitative targets. Qualitative targets should not be viewed as not important. We have no streamflow targets for calibration, because there are no stream gages within the basin.
Will Halligan	LSCE	11/6/2020	Presentation	Slide 17	Is there a water budget component that covers surface water outflow from the basin? I do not see it on the "example" water budget chart. I am assuming these example charts include all the budget components you are planning to show in the GSP (correct?). I am not a fan of stacked bar charts in general because it can be challenging to get a sense of trends on individual budget omponents over time. However, if you do use them, it is helpful to have budget components that are adjacent to each other to have contrasting colors rather than use the rainbow approach that is being used.	Yes, it is labelled Stream Outflow to Lake Hodges in Slide 17. These and other plots will be provided to comply with GSP Regs. We appreciate and agree with your feedback regarding improving color contrasts between the bars on the chart.
Will Halligan	LSCE	11/6/2020	Presentation	Slide 21	If the historical water budget period is 2005 through 2019 water year, then what is your current water budget year: 2020? If it is 2020, then the land use used for the baseline projected water budget should be the current water budget land use not the last year of the histroical water budget. In any case, why have a different year for land use than for groiundwater pumping (2019 and 2020)? that does not make sense and is not explained as to the reason for that difference. Depending on the increase in consumptive use due to climate change in the future along with your "freezing" of the number of wells, how do you know that the existing footprint of wells can all handle the increase in discharge that is required to handle the increase in consumptive use? It will be interesting to see if you potential have a wetting/drying situation going on with the Farm Process with your wells needing to pump more and how that relates to teh well construction and model layer distribution.	This comment can be discussed further during the December 17th TPR meeting.
Will Halligan	LSCE	11/6/2020	Presentation	Slide 24	by assigning Lake Hodges to the GHB, will you run into issues when reporting your land surface budget and/or surface water budgets? Or will you do a zone budget approach and parse out that data for water budget output purposes? An explanation of how the general head can simulate groundwater/surface water interaction on the sides and bottom of Lake Hodges is requested. I am curious as to how you will be able to have leakage from Lake Hodges in layer 1 to the underlying layer 2 using the GHB approach versus using the River package os imiilar surface water package where you can readily isolate the budget terms and prepsent gw/sw interaction on all sides.	We are using a combination of tools to prepare the surface water, land, and groundwater budgets and zone budget is among the tools we will use. Lake Hodges is located outside of the model domain. The GHB boundary condition is only intended to be a gradient boundary that relates stages in Lake Hodges to aquifer heads near the exit point of the basin. So, we are not proposing to model groundwater/surface-water interaction on the bottom of Lake Hodges per se, but rather implement a boundary condition that captures the general hydraulic relationship between Lake Hodges and the basin aquifer near the exit point. To be clear, the GHB is only included for subsurface exchange with the area downgradient from the model domain. Surface water flows from the basin are handled separately via the SFR assigned to San Dieguito River.
Will Halligan	LSCE	11/6/2020	Presentation	Slide 27	The CU posted on the chart for the various crops seems pretty low in general. Will you be providing Kc and Etref values for review. I would have thought the CU for pasture grass should essentially equal Etref as the Kc should be close to 1. The majority of the crops are around 2 af/year which seems generally low .	Yes, Kc and reference ET values will be provided in the model documentation.

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Will Halligan	LSCE	12/3/2020	Bedrock Wells	In response to Peter Quinlan's comment on 1/24/2020.	Page 2, Peter Quinlan, last comment on page: Peter uses the word "isolate" in reference to well construction features that "isolate" the well from pumping from the alluvium and rediduum. It is important to understand what well construction features he considers he is referencing that provides "isolation". If the wells he is referencing are constructed with sanitary seals (cement type goruts) that extend from the ground surface downward through the alluvium and residuum at a minimum, then that would lead to some degree of isolation of the well pumping groundwater from the alluvium and residuum. However, if the well construction only includes the well casing that extends through the alluvium and residuum and the underlying perforations (well screen) spans a depth interval below the residuum, then that alone would not prevent that well from drawing water from the overlying alluvium and residuum, unless the sanitary seal extends through those overlying units. Bottom line is that it is important to understand more of the details of the well construction features than what Peter mentioned in his comment before concluding any sort of isolation.	The modeling team agrees. Having a better understanding of well construction throughout the model domain would help reduce uncertainty in modeled groundwater conditions and degree of connection between the bedrock and overlying aquifer materials.
Will Halligan	LSCE	12/3/2020	Land Use	In response to Matt Wiedlin's comment on 5/29/2020.	Page 4, first comment. With the revisions to land use that the modeling team had to conduct due to incompleteness and inaccuracies from published datasets, will those revised/updated land use datasets be provided for review at some point?	The 2005 and 2018 land use maps were included for review in Handout 5 of the October 2020 TPR meeting materials.
Will Halligan	LSCE	12/3/2020	Pumping Rates	In response to Will Halligan's comment on 7/16/2020.	Page 4, second comment. With the absence of pump test or pump efficiency testing data, anecdotal information from AC members, etc. can be used to get a sense of what pumping rates may be for large capacity wells in the basin. This information can be used to see if the discharge volumes expected from such wells that serve large parcels is sufficient to meet the parcels water demands. That could be a form of a cross check proposed by Matt that could be utilized by the modeling team.	In the Modeling Team's experience on other projects, comparisons of modeled pumping rates with pumping rates of unknown reliability estimated from landowners have mixed results. Given the limited time and budget remaining on the current contract, we plan on moving forward with modeled estimates of pumping rates. Stakeholders will have the opportunity to review and comment on the modeling report and the various input assumptions. As knowledge of the physical system and groundwater use evolves during GSP implementation, it will be important to periodically update the model with such information.
Peter Quinlan	Dudek, Rancho Guejito	12/4/2020	No Flow Boundary	In response to Modeling Team responses to Peter Quinlan's comment on 10/23/2020.	The current model boundary does coincide with the location of reliable stream gauges. However, where the boundary aligns with the gauge locations, the boundary does not correspond with the watershed boundaries and associated groundwater divides. There are approximately 14,000 acres of watershed upstream of the gauge on Guejito Creek. The watershed divide is approximately 10 miles north of the gauge. None of this area will receive recharge through the FMP package in the model, nor will the recharge to the granitic rocks in this area be represented in the model because of the no-flow boundary located at the gauge. There is a much greater watershed (8 to 10 times the area of the Guejito Creek watershed) upstream of the gauge on Santa Isabel Creek that is similarly excluded from the model domain. Excluding this recharge to the layers of the model representing the granitic rock will impact the validity of model results. I am not suggesting that the model domain be extended to include these areas of the watershed, rather I suggest that some alternative to the no-flow boundary be adopted to incorporate the recharge to the granitic rock that occurs in these areas and migrates into the basin.	The Modeling Team will consider exploring additional subsurface inflow into the GSP Model domain from contributing catchments as part of the sensitivity analysis.

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Peter Quinlan	Dudek, Rancho Guejito	12/4/2020	Uncertainty	In response to Modeling Team responses to Peter Quinlan's comment on 1/24/2020.	The modeling team has highlighted the fact that, in general, earth system models are inherently difficult or impossible to verify (Oreskes et al, 1994). In the context of groundwater modeling, this is largely due to the fact that the hydrogeological environment is of unknowable complexity and that natural and anthropogenic stresses interact non-linearly across the system. The modeling team's assessment of calibration as a historical matching exercise is appropriate. However, incorporating the entire historical record into the calibration efforts can introduce systematic biases that may impact projections (e.g. Oreskes and Belitz, 2001; Hunt et al., 2019). The incorporation of a validation period provides a direct method of how the calibrated parameter distribution may bias predictions moving into the future. In addition to demonstrating an adequate match to historical observations over at least the last 10 years, I recommend that the modeling team assess and characterize how biases in the model calibration process may impact projected water levels and historical estimates of sustainable yield. The stochastic methods suggested by the modeling team to generate uncertainty bounds on estimates of sustainable yield are robust, but (as noted) expensive. I do not suggest that the modeling team pursues the development of dozens to hundreds of calibrated model realizations. Instead, the modeling team may consider using simpler methods, such as linear uncertainty propagation (e.g. see PEST ++) or stochastic methods that do not rely on calibrated models to generate an ensemble of sustainable yield estimates. Non-calibrated model results can be weighted using calibration statistics, such as RMSE, to assess confidence in the model's estimates of groundwater storage change and predicted water levels. I believe that this uncertainty quantification effort supports the modeling team's proposed sensitivity analyses that will identify the locations, processes, and parameters that are the dominant influence of model predictions.	The Modeling Team appreciates the suggestions and will take them under advisement.
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020	Model Documentation report		The GSP should include a report documenting the model development, calibration, and complete parameterization as an appendix. This report should the pumping assigned to each well through time. Zone budgets showing inflows and out flows from each model layer would be helpful in understanding the results of the model simulations.	Modeling documentation will be provided as an appendix to the GSP. We will take your suggestions under advisement when pulling the information together.
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020	No Flow Boundaries in Layers 3 and 4	Slide 18 from 17-Dec TPR Meeting	I would like to reiterate that the use of no flow boundaries in these layers eliminates subsurface groundwater inflow resulting from recharge to the granitic rock in large catchments upstream of the stream gauges on Santa Isabel, Guejito, and Santa Maria Creeks, and to a lesser extent catchments above the gauges on Sycamore and Cloverdale Creeks. By incorporating pumping in Layers 3 and 4, but cutting off horizontal inflows from the larger catchments, the model construction will force all the water pumped in layers 3 and 4 to be recharged from Layer 1. As a result the model will not be suitable for evaluating vertical flow in the basin.	The degree to which bedrock pumping induces groundwater flow from overlying aquifers versus laterally from adjacent bedrock areas is not known with certainty. We respectfully disagree that the model is not suitable for evaluating vertical flow in the Basin. The SPV GSP Model is the best tool we have to explore different conceptual models for groundwater flow. Depending on the nature of fracturing in the vicinity of the bedrock pumping wells, it is quite possible that bedrock pumping induces vertical groundwater flow downward from the alluvial aquifer. The conceptual model can be refined as additional field data are collected and rolled into the 5-year GSP updates during the implementation of the GSP.
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020	No Flow Boundaries in Layers 3 and 4	Slide 18 from 17-Dec TPR Meeting	Rather than addressing this subsurface flow in a sensitivity analysis, I urge the team to try to incorporate subsurface inflow as a specified flux based on the recharge calculated by the Basin Characterization Model (BCM) during calibration.	As described in Handout #4 of the 14-Jan-2021 TPR meeting materials, the modeling team has conducted a sensitivity analysis by evaluating five different simulations with different assumed percentages of BCM-derived recharge from catchments potentially contributing subsurface inflow from the northern, eastern, and southern subcatchments upgradient from the SPV GSP Model domain. The subsurface inflows were incorporated as monthly specified fluxes across the associated boundaries of the SPV GSP Model domain in Model Layers 3 and 4 (deeper rock layers). Although adding subsurface inflow slightly compromises global calibration statistics, there are some local benefits in the eastern Santa Ysabel Creek area and with outflows to Lake Hodges. Considering the balance between achieving localized benefits versus having slightly worse global calibration statistic versus addressing your concerns, the modeling team has opted to move forward with including 25% of the BCM-derived recharge as subsurface inflow to the northern, eastern, and southern SPV GSP Model domain boundaries.
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020	Parameterization	Slide 41 from 17-Dec TPR Meeting	The hydraulic conductivity assigned to the residuum 10E-03 cm/sec seems high given the amount of pedogenic clay that was reported as being encopuntered in the residuum in logs from Rockwood Canyon.	Aquifer tests at RK-8 and RK-9 indicate bulk Kh values ranging from 1E-3 to 1E-2 cm/s. Although, it is acknowledged that these pumping wells are screened in alluvium, residuum, and bedrock, so these K values are not isolated residuum values. A Kh value of 1E-3 cm/s is in the mid range of a silty sand and upper end of a silt, which is not necessarily too high, depending on the clay fraction.

San Pasqual Valley Groundwater Sustainability Plan
Technical Peer Review Meetings - Groundwater Modeling Comments
Comment Tracking Table

Commenter Name	Commenter Organization	Comment Received	Subject	Line #s or Figure #	Comment	Modeling Team Response
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020	Layers	Slide 51 from 17-Dec TPR Meeting	The stratigraphic column indicating that within the SPV Basin boundaries model Layers 1 and 2 are within the basin and that model Layers 3 and 4 is a helpful reminder that The Bulleting 118 basin does not include the rock underlying the Residuum. This clarification should be made in future presentations of the model to avoid confusion about the extent of the Basin, the location of Basin boundaries and the purpose of this analysis.	Comment noted.
Peter Quinlan	Dudek, Rancho Guejito	12/22/2020		Slides 26-32 from 17-Dec TPR Meeting	The presentation on the 17th included a number of statements about the relationship between head differentials, groundwater flow and pumping from wells screened in granite underlying the Basin. There is insufficient evidence at this point to draw any conclusions about the volume of water flowing between the Basin and the underlying formations and/or the cause of such flow. Additional review and comparison of USGS work on regional flow through granite in the San Diego region may be helpful to this analysis, as would additional research into the relationship to water levels in Lake Hodges.	The SPV GSP Model provides estimates, rather than conclusions, of the volume of water flowing between the Basin and underlying/adjacent formations. It is understood that these estimates are uncertain. However, these estimates provide a good starting point for discussions around the hydraulic interaction between the Basin and the surrounding and underlying rock, as needed. We have also reviewed the regional USGS study and independent estimates of inflows to Lake Hodges. Based on these reviews, we are opting to include 25% BCM recharge as specified fluxes into the SPV GSP Model domain as subsurface inflow, as described in Handout 5 of the 14-Jan-2021 TPR meeting materials.