LAFCO *of Monterey County*

LOCAL AGENCY FORMATION COMMISSION OF MONTEREY COUNTY

LOCAL AGENCY FORMATION COMMISSION
P.O. Box 1369 | 132 W. Gabilan Street, Suite 102
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Kate McKenna, AICP
Executive Officer

MEMORANDUM

DATE: February 25, 2022

TO: Chair and Members of the Formation Commission

FROM: Kate McKenna, Executive Officer, AICP

SUBJECT: **Supplemental Memorandum #1 Transmitting Information regarding February 28, 2022 LAFCO Meeting Agenda Item No. 10 – Monterey Peninsula Water Management District – Reconsideration of Resolution #22-01 disapproving the District's proposed activation of latent powers to provide and maintain potable water production and distribution services for retail customers.**

Since distributing the agenda packet for the February 28 LAFCO meeting, staff would like to bring two items to the Commission's attention.

First is a correction to a staff report reference to a MPWMD meeting date. The Monterey Peninsula Water Management District Board of Directors considered and adopted a resolution last night – not next month as stated on pages three and four of the staff report.

Second, our office has received additional correspondence since the meeting packet was published this week. Those letters and emails are attached to this memorandum. We anticipate further correspondence and will share it at the February 28 meeting.

Attachment: Correspondence from February 24 to February 25, 2022 regarding Agenda Item No. 10 on the February 28, 2022 Regular LAFCO Meeting Agenda.

From: Renee Franken <rbfranken@aol.com>
Sent: Thursday, February 24, 2022 7:59:53 AM
To: McKenna, Kate x5016 <McKennaK@monterey.lafco.ca.gov>
Subject: Letter to LAFCO commission members and staff on Water District Application for Reconsideration

Dear Ms. McKenna,

I would appreciate your sharing my letter (attached) with the members and the staff of LAFCO. Should you have any questions, feel free to contact me.

Thank you.

Renee

February 22, 2022   For Distribution to the Members and Staff of LAFCO

K. McKenna, Executive Director
LAFCO of Monterey County
c/o Clerk to the Commission
132 W. Gabilan Street, Ste. 102
Salinas Ca 93901

Re: LAFCO Reconsideration of Water Management District application

Chair Lopez and Commission Members:

With respect, I ask the Commission to reconsider its vote on the Water Management District's application to activate its latent powers, and I ask that Commission members Leffel and Gourley recuse themselves from the vote.

Commissioner Leffel voted against the wishes of her constituency expressed by the adoption of Measure J in 2018 and voted against the thoroughly researched LAFCO staff recommendation on this issue. She used loss of tax revenues by various special districts as her reason. I wish she was as concerned about Cal-Am ratepayers as she is about the special districts she mentions. Tax revenues will be marginally impacted by having the Water Management District purchase Cal-Am. The District has already indicated that it would work to minimize those losses, as Commissioner Leffel well knows. Further, the school district's losses will be made up by the State.

Commissioner Gourley rather cavalierly stated that he thought public agencies never did things as well as the private sector. While he is entitled to his viewpoint, he is not entitled to use his opinion – unsupported by the evidence on this LAFCO matter – as the reason for his vote. Frankly, his bias against public agencies should disqualify him from serving on one. Again, he also voted against the LAFCO staff's recommendation.

As to the remaining members of LAFCO, I suggest that if you focused your attention on the legitimate role that LAFCO has, and followed the evidence, you would come to the same conclusion as that of your staff and its recommendation to conditionally support the District's application to activate its latent powers.

I thank you for your consideration.

Sincerely,

Renee Franken
Monterey, CA

From: Myrleen Fisher myrfisher@comcast.net
Sent: Thursday, February 24, 2022 9:29 AM
To: Maluki, Safarina x5109 MalukiS@monterey.lafco.ca.gov
Subject: Re: LAFCO Reconsideration of Water Management District application

LAFCO of Monterey County
c/o Clerk to the Commission
132 W. Gabilan Street, Ste. 102
Salinas, CA 93901

Re: LAFCO Reconsideration of Water Management District application

Chair Lopez and Commission Members:

It is disturbing to me that a commission as venerable and important as LAFCO appears unable to meet its obligation to the people of Monterey County in an unbiased way. We are seeing now that private concerns of some commissioners carry more weight than the best interests of the public as a whole.

In particular I find the views of Matt Gourley, a Public Member LAFCO Commissioner, very disturbing. He has publicly stated, *"The government can't run anything efficiently."* And, *"I'm definitely from the private sector."* How can his vote on the Monterey Peninsula Water Management District's request for activation of its latent powers to manage a water system, (wresting it from a private purveyor, Cal Am), ever be considered unbiased? Might his statements have influenced the votes of other commissioners?

I also find it odd, given Mr. Gourley's apparent contempt for government agencies, that he has spent his last two decades or more in various governmental positions, including as mayor of Gonzales, as president of AMBAG, and as an alternate or regular member of LAFCO. What has motivated Mr. Gourley to devote so much time to governmental agencies when he espouses such a blatantly negative view of them? One wonders if Mr. Gourley is the reason a government agency like LAFCO isn't working.

He should recuse himself from voting on this matter that affects the latent powers needed by a public agency to carry out the voter-mandated buyout of Cal Am. If he respects his oath of office, he will recuse himself.

Respectfully,

Myrleen Fisher
Carmel, CA

From: Troy Ishikawa ishikawatroy@yahoo.com
Sent: Thursday, February 24, 2022 9:47 AM
To: McKenna, Kate x5016 McKennaK@monterey.lafco.ca.gov
Cc: Maluki, Safarina x5109 MalukiS@monterey.lafco.ca.gov
Subject: Agenda Item #10 - LAFCO Regular meeting Feb. 28, 2022

Dear Ms. McKenna,

Enclosed is my public written comment on Agenda item #10 to LAFCO Regular Meeting Feb. 28, 2022.

Thank You.
Troy Ishikawa

Dear Ms. Kate McKenna, LAFCO Executive Officer
Dear Ms. Safarina Maluki, LAFCO Clerk to the Commissioners/Office Administrator

TO: LAFCO Commissioners – Chair Lopez, Root Askew, Craig, Olgesby, Poitras, Gourley, and Vice Chair Leffel,

This letter is in regards to Agenda item 10 of your Feb. 28, 2022 regular meeting.

Monterey County Assessor, Steve Vagnini clearly stated at the Monterey County special districts association quarterly meeting of Jan. 18, 2022 example-after-example of private properties bought by non-profit organizations and local government (e.g., Monterey Bay Aquarium, Rancho Cañada golf course, Middlebury Institute of International Studies, Monterey County purchase of the Capitol One property, The Pebble Beach Company donating 100 acres to the city of Monterey to reduce paying property taxes, etc.) who stopped paying property taxes, who never offered to pay the county a tax sharing agreement for a specified number of years which special districts would benefit from, and not one single opposition was ever uttered and/or questioned by any member of LAFCO.

To your members who have voted against the Monterey Peninsula Water Management District (MPWMD) request to reinstitute their latent powers to sell retail water, LAFCO's reasons are not caused by reduced property taxes or the possibility of Cal-Am raising rates in Chualar. Chualar is a disadvantaged community defined by the California Public Utilities Commission (CPUC) and rates are therefore capped at the rate of inflation. Voting against reconsideration has everything to do about special interest (e.g., Cal-Am, Salinas Valley agriculture, Monterey Business Council, and any thing not profit driven).

MPWMD reconsideration is your last chance to stop preventing a lawsuit against LAFCO.

I strongly urge your "Yes" vote for reconsideration. Measure J (2018) passed by the 24,000 voters on the Monterey Peninsula. Stop obstructing justice.

Sincerely,
Troy Ishikawa
Carmel, CA

Water Plus

24 February 2022

Kate McKenna
Executive Officer
Monterey LAFCO

Dear Ms. McKenna:

Please include the three attachments, along with this message, in support of LAFCO's grant of latent powers to MPWMD. If LAFCO does not do that, the ensuing court action could cost both ratepayers and taxpayers a good deal of unnecessary expense. It's too bad that the commissioners who are causing that court action, along with Cal Am shareholders, are not bearing that expense. They should.

The attachments are new to this decision process. The first shows that Cal Am' s proposed MPWSP would have the same deleterious effect on the Salinas River that the company's over-pumping has had on the Carmel River. The second is a report by a renowned hydrogeologist that supports the first attachment. The third is an article by me published last November by the American Statistical Association journal *Chance* that shows that the EIR for the MPWSP is statistical garbage tantamount to fraud. Cal Am supports the fraud. The choice is between Cal Am and MPWMD. The correct choice is clear.

Most respectfully,

Ron Weitzman
President, Water Ratepayers Association of the Monterey Peninsula (aka Water Plus)

Attachment 1

Guest commentary

Desal impact on Salinas River

While protecting the Carmel River, the MPWSP would endanger the Salinas River.

By Ron Weitzman

The time has come for the Monterey One Water board to proceed with the extension of its recycling project, currently opposed by Salinas Valley members of the board. Perhaps those board members will end their opposition when they realize that Cal Am's project, while protecting the Carmel River, would have the opposite impact on the Salinas River.

What is that impact? A little tutorial is necessary to answer that question.

Particularly affecting the freshwater Dune Sand aquifers underlying the Salinas River, the impact is twofold: a drop in water levels and seawater intrusion, which occurs when the water level in an aquifer falls below sea level. In the model used in the Monterey Peninsula Water Supply Project's environmental impact report to estimate that impact — which is "Water Level = Estimate + Error" — the estimate is a weighted sum of observable variables that can vary in value over time and from zone to zone in a checkerboard of zones covering the North Marina area surrounding the CEMEX site of the MPWSP.

The variables include, among others, vertical water flow rate to or from an aquifer, horizontal water flow rate in an aquifer, rate of well pumping, and availability of surface water such as rain and river water. The weights are constants that do not vary over zones or with time. Computer programs determine the weights in a so-called "inversion" process in which the weights become the variables and the erstwhile variables, together with the actual water levels, become the constants. The determined weights are the ones that minimize the variation of the errors around the estimates in all zones and time periods.

A calibrated model is a model created by an inversion process and then modified by altering questionable values of some of its variables to reduce the error variation even further. The North Marina model used to estimate the impact of the MPWSP on water levels and seawater intrusion in Salinas Valley aquifers is a calibrated model.

The Water Ratepayers Association of the Monterey Peninsula (WRAMP) hired a hydrogeologist who is an expert in modeling to evaluate the modeling in the EIR. Here are excerpts of what she had to say in her 28-page report to WRAMP about the impact of the MPWSP on streams in the Salinas Valley, including the Salinas River.

"The uppermost layer [Dune Sand aquifers] has expectedly the most (if not all) interaction with . . . stream gains and losses, precipitation recharge and other deep percolation" (p. 8).

"The extremely low [vertical water flow rate] applied [in calibration] to the Dune Sand . . . unit, and particularly in the underlying [aquitard] . . . seems unreasonable" (p. 17).

"Because the [predicted] stream-aquifer interaction along the Salinas River may be affected by the erroneous model values, <u>and because stream gain-loss data were not presented for the calibration</u>, the predicted impact to the River from slant well pumping is unreliable" (p. 13).

"The uncertain MPSWP predicted impacts to the streams may exceed allowable limits of established minimum streamflow standards" (p. 23).

The MPWSP modeling is incorrect, according to that hydrogeologist [and according to reality]. Water in the freshwater Dune Sand aquifers flows downward to the sea [even during drought years]. The water in the aquifers must come from somewhere. Where other more than from the Salinas River?

While protecting the Carmel River, the MPWSP would endanger the Salinas River and could seriously diminish the capacity of the river's rubber dam supplying irrigation water to valley growers

Ron Weitzman is president of the Water Ratepayers Association of the Monterey Peninsula.

Attachment 2

Evaluation of the Ground Water Modeling for the Cal Am Monterey Peninsula Water Supply Project

Prepared for Dr. Ron Weitzman, President
of the
Water Ratepayers Association of the Monterey Peninsula

Prepared by Barbara Ford, PE*, GeoHydroScience llc

August 10, 2019

*CO

1.0 Introduction

1.1 GeoHydroScience Objective

Modeling is essential for accurate prediction of the environmental impact of proposed slant well pumping in the California-American Water Company (Cal Am) Monterey Peninsula Water Supply Project (MPWSP). That project underwent two draft environmental impact reports (EIRs), one in 2015 and one in 2017.[1] Each report contained an appendix on modeling identified as Appendix E2. The first was prepared by Geoscience Support Services, Inc. (Geoscience) and the second by HydroFocus Inc. (HydroFocus), collectively referred to as the consultants. I have been informed by Dr. Weitzman of the following:[2]

> The second (H-E2) was created at least partly in response to critical comments on the first (G-E2) by Dr. Ron Weitzman, president of Water Plus, a party to the proceeding on MPWSP. The final project EIR contained H-E2 and a chapter (Chapter 6) consisting of responses to critical comments on the second draft, including comments by Dr. Weitzman on H-E2. According to Dr. Weitzman, the California Public Utilities Commission has not held any evidentiary hearings on the second draft or the Chapter 6 responses in the final EIR. Because Dr. Weitzman considers the EIR modeling to be seriously inadequate, as well as professionally uncontested, he has filed a lawsuit challenging the usefulness of the EIR to determine the environmental impact of MPWSP.

Under these circumstances, for assistance in that suit, Dr. Ron Weitzman has hired Barbara Ford, PE[3] of GeoHydroScience llc, as an expert in hydrogeology and modeling to review both G-E2 and H-E2, and write a report.

1.2 Information Reviewed

Because of the short timeframe as a consequence of Dr. Weitzman's communicated difficulty in acquiring assistance in California as a consequence of conflicts of interest, my review was necessarily limited to only the documents identified below:

- Water Ratepayers Association of the Monterey Peninsula and the State of California Amended Complaint for Damages and Civil Penalty and Demand for Jury Trial, Case No.:16CV001561, Draft April 12, 2019.

[1] Communication with Dr. Weitzman on August 8, 2019.
[2] Ibid.
[3] Barbara Ford, author of this report is a licensed Professional Engineer in Colorado and Arizona.

- Geoscience Support Services, Inc. April 17, 2015. Appendix E2 Monterey Peninsula Water Supply Project Groundwater Modeling and Analysis. Prepared for California American Water and Environmental Science Associates. It includes Appendix A - Luhdorff and Scalmanini, Consulting Engineers, March 2015. Monterey Peninsula Water Supply Project Using the Salinas Valley Integrated Ground and Surface Water Model. Prepared for Geoscience.
- HydroFocus, Inc., August 31, 2017. Appendix E2 North Marina Groundwater Model Review,Revision, and Implementation for Slant Well Pumping Scenarios. Prepared for Cal Am Monterey Peninsula Water Supply Project.

1.3 Information Not Reviewed

Of significance to this review, there is additional information that has not been reviewed for the reason stated. The following is a partial list of items not reviewed.

- Data and data analysis reports
- Source data
- Model files
- CEMEX model report and files
- Responses to Comments to the Final Environmental Impact Report

Accordingly, my report can only assess the model based on the information reviewed, and weighing that information across the reports and against standard modeling practice as appropriate.

The last item in the list, Responses to Comments was made available to me on July 26, late in my review and only just prior to report preparation. While time did not allow for sufficient review of that document, I was able to identify that some concerns by other reviewers similar to my own were addressed to an unknown extent by the consultants (because of my limited time not allowing for a comprehensive review). To the extent that the consultants comments have not adequately addressed, mitigated or corrected each of the items described in this report, my opinions on that particular item remain relevant.

2.0 Model

2.1 Reliance on Salinas Valley Integrated Ground and Surface Water model (SVIGSM)

The Geoscience modeling relied on an updated calibration of the SVIGSM model by its subcontractor, Luhdorff and Scalmanani, Consulting Engineers (LSCE). Geoscience extracted a portion of the area of the SVIGSM model to construct the North Marina Ground Water Model (NMGWM) and adapted it to estimate the drawdown impacts to the aquifer system resulting from proposed slant well pumping along the coast at the CEMEX site and the Potrero Road site. HydroFocus adopted the Geoscience model, adjusted parameter values among other revisions to produce a calibrated model, concluded that the NMGWM boundary conditions, pumping and recharge were in error and instead relied on superposition to predict drawdown from proposed slant well pumping.

The LSCE focus was as follows (excerpt from LSCE, p.1):

> This report focuses on documenting the extension and recalibration of the SVIGSM along with the predictive scenario results of the MPWSP generated by the SVIGSM with a focus on the influence the MPWSP has on Salinas River streamflow and interaction with underlying groundwater aquifers in the Pressure and East Side subareas of the Salinas Valley.

2.2 Limitations in SVIGSM Calibration

LSCE identified the methodology employed to update the SVIGSM calibration. Of significance, primarily because of the subsequent reliance on SVIGSM water levels for assignment of boundary conditions in NMGWM, the LSCE calibration was necessarily limited to only revising and updating system stresses including aquifer recharge and discharge, but excluded updating of the aquifer properties[4] because elements of the existing SVIGSM were inaccessible (see excerpt below, LSCE pg.2):

> The intent of the recalibration effort was to retain the existing model framework and aquifer properties as originally conceptualized by Water Resource and Information Management Engineering, Inc. (WRIME) and MCWRA due to the inability to obtain the SVIGSM source modeling code.

Also from LSCE (pg. 11; underline added for emphasis):

[4] such as hydraulic conductivity (K)/transmissivity(T), and specific storage(Ss)/storage coefficient (S); T and S reflect the K and Ss across the aquifer thickness.

> The intent of the model extension and recalibration effort was to retain the existing modeling framework and aquifer properties and <u>any adjustments that were necessary to recalibrate the model focused on recharge and discharge input values</u>.

Presumably LSCE would have chosen to update aquifer properties to capitalize on the new data available since the last SVIGSM calibration. LSCE provided the following SVIGSM output for the NMGWM model (excerpt, pg. 13):

> SVIGSM calibration outputs were provided to Geosciences for incorporation into the NMGWM. These outputs included monthly output of groundwater levels at SVIGSM nodes located along the edge of the NMGWM domain, groundwater pumping by element, deep percolation by element, and streambed infiltration by stream node. These data were incorporated into the NMGWM for use in model calibration.

LSCE modified the pumping in each model layer based on observed water level data, as described in the following excerpt (LSCE pg. 11):

> During the model calibration, the vertical distribution of groundwater pumping was adjusted to more closely simulate the observed conditions within all three (3) model layers based on water levels at calibration wells. Groundwater levels in each calibration well individually reflect conditions in distinct depth intervals corresponding with different model layers. Accordingly, the hydrographs of simulated and observed water levels for calibration wells were used as guidance in making adjustments to the vertical distribution of pumping for different time periods during the updated model calibration period.

While much of the LSCE data preparation for the model update was reasonable, this re-allocation of pumping during the calibration is problematic. It is not clear that this practice was done model-wide or only for select wells as the report did not provide sufficient information. If the justification for this application was for only wells which spanned multiple aquifers (multi-completion wells), a more defensible approach would have been to employ an equivalent method as that available in the Modflow multimode package which dynamically allocates pumping depending on the layer water level (head), the transmissivity and the storage characteristics (if a transient model). Reallocation by using only the observed water level, presumes the aquifer properties are known and correct in the model. If not, the pumping reallocation based on the observed water level as the guidance, is incorrect. Because the NMGWM calibration would subsequently revise aquifer properties, while retaining the SVIGSM pumping allocation, but also in accordance with the observed water levels, the pumping allocation would be erroneous. Not only that, the calibrated aquifer properties would also be potentially erroneous, because of their dependence on the erroneous stress.

LSCE presented no stream gain-loss data in its report to support its estimation of the streambed infiltration used in the calibrated model, but like the pumping, it was a calibration parameter. But because stream gain-loss data was not presented, it is indeterminate if the calibrated recharge distribution was accurate. Sensitivity analysis of calibrated values was not presented, so the uncertainty is unquantified.

2.3 SVIGSM and NMGWM Inconsistencies

NMGWM is reliant on the recharge and discharge distributions from the updated SVIGSM calibration. Geoscience explicitly states adoption of those stresses, consistent with the LSCE report as follows (excerpt from Geoscience report pg. 27):

> Monthly data for deep percolation from precipitation, stream recharge and groundwater pumping in the NMGWM area as well as the water levels assigned for the general head boundaries during the calibration period were obtained from the SVIGSM.

Geoscience describes the following calibration process (excerpt pg. 28):

> The calibration process involved adjusting model parameters until the model provided a reasonable match between the simulated and measured parameters. These aquifer parameters included horizontal hydraulic conductivity, vertical hydraulic conductivity, effective porosity, and the storage coefficient.

A side-by-side comparison of the aquifer properties in the two models (SVIGSM and NMGWM) is not presented by Geoscience or HydroFocus and because LSCE did not present the aquifer properties in SVIGSM, I am unable to identify and evaluate the differences.

The properties are presumably different between SVIGSM and NMGWM as a consequence of subsequent parameter revisions during calibration by Geoscience and HydroFocus. Because of inadequate documentation in the Geoscience report however, the extent to which a feedback loop between Geoscience and LSCE existed is not evident. It is possible that such feedback was used and the water levels assigned at the NMGWM boundaries were consistent with the SVIGSM output, but if employed, that process may have led to other errors, potentially of great relevance to the reliability of the model results. Only because HydroFocus included water level data in the southern area of the model (south of the Salinas River), was a major discrepancy revealed between the SVIGSM calculated water level elevations and those assigned by Geoscience along the boundary condition. HydroFocus identified the error but did not correct it, and chose instead to abandon use of the calibrated head model for predictions of drawdown from slant well pumping, and employ superposition in its place.

2.3.1 Boundary Conditions

The consultants relied on the updated SVIGSM model-calculated water level distributions associated with an unknown set[5] of SVIGSM aquifer property values in order to assign the water level elevations along the general head boundaries (GHB) in the NMGWM model.

The GHB includes assignment of water levels and conductance terms to perimeter boundary cells and its function is simulation of a head distribution and prevailing gradient at the NMGWM model boundary. Accurate representation of the GHB ensures that the water level elevations in the aquifer layers are equivalent between the parent SVIGSM and NMGWM models at the boundaries. But the consultants do not report the water level elevations at the GHB. LSCE included figures of the simulated potentiometric surface showing contours of the model-calculated spatial water level elevation in the 180-ft aquifer and the 400-ft aquifer, but did not include the Dune Sand/A Aquifer/Salinas Valley aquitard potentiometric surface (SVIGSM model layer 1a). Geoscience and HydroFocus included no figures of the interpreted or simulated potentiometric surfaces for any aquifer in NMGWM so the head assigned along the boundaries could not be determined. The failure to include these interpretations is contrary to standard model (conceptual and numerical) reporting.[6] Also contrary to standard model reporting was the absence of a conceptual water budget, how well the model adhered to that budget, and definition of the method used to calculate the GHB conductance terms.

Subsequent to boundary assignment using the SVIGSM results, Geoscience and HydroFocus[7] revised the aquifer properties inside of the model area, including along the boundaries. This likely resulted in a disparity between the water level elevation assigned at the boundary per SVIGSM, and that inside of the NMGWM. But the disparity at the boundary would result in erroneous flow rates at the boundaries and to an unquantified extent, erroneous water levels inside the boundary. HydroFocus concluded the error was significant, and rather than correct the erroneous boundaries, abandoned the NMGWM physically-based head model in favor of a superposition

[5] not included in the LSCE report appended to the Geoscience report
[6] Anderson, MP, WW Woessner and RJ Hunt 2015. Applied Groundwater Modeling Simulation of Flow and Advective Transport. Elsevier/Academic Press.
[7] It is assumed Geoscience altered the parameter values after importing the SVIGSM boundary water levels because the report does not distinguish otherwise. HydroFocus did alter the Geoscience NMGWM parameter values.

model, where only the change to the water level (not the water level elevation or head) is calculated. The predictive modeling is described in Section 4.0 of this report.

Pumping

The errors in pumping introduced during SVIGSM calibration described in the previous section, were compounded in the Geoscience and HydroFocus calibrations.

Recharge

In order to accurately quantify the impacts during predictive modeling, there must first be an understanding of the stream-aquifer interaction for the conceptual model based on gain-loss data, followed by estimation of the stream-aquifer parameter values during calibration using that data, and finally, quantification of the uncertainty in the calibrated parameter values based on sensitivity analysis. But the consultants do not present this data and analysis.

Stream gain-loss estimates were not presented in the Geoscience or HydroFocus reports. The reports do not present adequate information for the conceptual model pertaining to the stream aquifer interaction, nor where or how SVIGSM stream infiltration is assigned in the NMGWM model, and how well the NMGWM represents that relationship.

It appears[8] that historic gaged flow data along the Salinas River within the SVIGSM and NMGWM areas is available, but an explanation as why gain-loss estimates have not been estimated and utilized in calibration of the respective ground water models was not provided. If such data are available, it is of high value because it reduces uncertainty in the estimated parameter values and reduces the non-uniqueness commonly confounding optimization. Nonuniqueness occurs when different combinations of parameter values match the observations equally well.[9] Furthermore, the predictions of drawdown from slant well pumping and the impact to the stream gain-loss is of critical interest as identified in both the Geoscience and HydroFocus reports. The Geoscience and HydroFocus reports did not include a demonstration that the models accurately simulate the stream-aquifer interaction.

2.3.2 Model Layering

[8] on only a cursory review of USGS online data

[9] Hill, MC and CR Tiedeman 2007. Effective Groundwater Model Calibration. John Wiley & Sons, Inc.

NMGWM includes a layer for the Dune Sand/Aquifer A aquifer[10] (layer 2), and a layer (layer 3) representing the Salinas Valley aquitard, where present. In contrast, SVIGSM combines the typically highly transmissive Dune Sand/Aquifer A unit and the very low permeability aquitard into only one layer (1a), even where both occur vertically in the project area. Because LSCE did not present the aquifer properties of this lumped layer, the disparity in the SVIGSM and NMGWM cannot be evaluated.[11] Accurate representation of this uppermost aquifer layer including the Dune Sand/A Aquifer unit is critical to the calibration and predictions made using the model, including subsequent superposition modeling. The uppermost layer has expectedly the most (if not all) interaction with the recharge stresses, including stream gains and losses, precipitation recharge and other deep percolation.[12] Because SVIGSM revised the recharge distribution in its calibration, it is not evident that the inconsistent representation of the uppermost aquifer unit did not result in inaccurate representation of the recharge distribution. This may be another reason HydroFocus concluded the recharge distribution was erroneous, but this was not specified in its conclusion.

Geoscience and LSCE presented no calibration data for the Dune Sand/A Aquifer unit, although Geoscience was apparently aware of the existence of this data as shown in its Figure 96. Because Geoscience and LSCE did not include any calibration data in the Dune Sand/A Aquifer unit, the level of error remains unquantified.

3.0 Model Calibration

The description of the methodology employed for model calibration in the Geoscience and HydroFocus reports is incomplete. It is not possible to determine if Modflow 2000 was used for parameter estimation using inverse techniques, or was instead used deterministically. Parameter estimation using inverse techniques includes minimization of the objective function, representing the sum of the squared residual values in order to optimize the independent variables, the parameters. The residual is the difference between the observed and calculated value.

[10] Layer 2 also houses Perched Aquifer, the Perched "A" Aquifer, the 35-ft Aquifer and the -2 ft Aquifer (HydroFocus report pg. 9) but in this report I will refer to the "Dune Sand/A Aquifer unit" for simplicity.
[11] LSCE presented no information on the aquifer property values in the SVIGSM model so that a comparison could be made with that presented in the Geoscience and HydroFocus reports.
[12] Based on HydroFocus figures, however, there may be stream infiltration to the 180-ft aquifer, although there was inadequate information in the report to make a conclusion.

Modflow 2000 can be used for either approach. Parameter estimation is the calibration process which adjusts aquifer and stress variables (typically including the aquifer hydraulic conductivity, transmissivity, storage properties and recharge, among others) within reasonable ranges, to minimize the residuals in the observed and calculated response variables (i.e. the water level, also referred to as the head, and flux/flow). Industry standard calibration was historically done deterministically but, for approximately the past 15 years, inverse techniques have become more commonly employed because of the benefits of the inverse methodology, including quantification of the parameter uncertainty and sensitivities (coefficients calculated during parameter estimation to reduce the difference between the observed and calculated values[13]) , as well as quantification of the uncertainty in predictions, among other documented benefits.[14]

Neither consultant states which of the two, or whether a combination of the two was used to calibrate the models, critical to my review. It would have been assumed that the models were calibrated using inverse techniques in that the model is expectedly amenable to inversion.[15] The absence of enormous amounts of information generated by inverse modeling from the reports suggests that perhaps only deterministic methods were employed, sacrificing a valuable opportunity to better define the system through parameter optimization and uncertainty analysis. At a minimum, the identification of which calibration method was employed, and if not employed, a legitimate reason for not using inverse methods should have been included in the report.

The objective of the NMGWM model stated in the Geoscience report (pg.8) was to "evaluate the impacts of the proposed MPWSP on the Salinas Valley Groundwater Basin. Groundwater modeling was conducted to assess the impacts of MPWSP on the groundwater levels and the seawater intrusion".

Geoscience identified the following tasks to be completed in its scope of work (pg. 8):

- Collecting and analyzing historical geohydrologic data,
- Updating and recalibrating the North Marina Groundwater Model (NMGWM), including data gathered during the exploratory borehole work (GEOSCIENCE, 2014),
- Updating and recalibrating the Salinas Valley Integrated Ground and Surface Water Model (SVIGSM; see Appendix A)
- Developing a focused CEMEX Model for the CEMEX Site,
- Developing and running various MPWSP scenarios, and

[13] Doherty, J. 2015. PEST Calibration and Uncertainty Analysis for Complex Environmental Models, pg. 62.
[14] Hill, MC and CR Tiedeman 2007. Effective Groundwater Model Calibration. John Wiley & Sons, Inc.
[15] Dry cells in modeling can present difficulties for inverse modeling, but this model expectedly did not incur this difficulty to the extent that inverse methods would have been rejected *a priori*.

- Preparing the modeling report.

3.1 Data Deficiencies and Exclusion

While additional data collection was part of the task, Geoscience included no water level data for the Dune Sand/A Aquifer unit across the entire model area. But the Dune Sand/A Aquifer unit is one of the two primary units intended for pumping in the MPWSP. Geoscience did identify the existence of well data at Fort Ord (Figure 96), but excluded it from the calibration results in the model report. Because the expanse of this unit as represented in model layer 2 excluded water level data, the Geoscience NMGWM calibration for the Dune Sand/A Aquifer unit is associated with significant uncertainty, and predictions relying on the Geoscience calibrated model are concluded to be unreliable. Model bias is also evident in the 180-ft aquifer. Only when HydroFocus included the water level data (but only in the Fort Ord area south of the Salinas River), a poor calibration was revealed. But the calibration may be poor across other areas of the model where no water level data was available to inform the calibration. HydroFocus is correct in its assertion that the model in its current condition was unacceptable for its intended objective.

Geoscience described the CEMEX modeling in its report (April 17, 2015) but monitoring and testing of the CEMEX wells was initiated at nearly the same time as the report in early to mid-April 2015. It is unfortunate that the Geoscience CEMEX modeling was not delayed until after the testing which presumably would provide significantly better data for the model.[16] Because this data was not yet available, Geoscience relied on lower quality information from sediment texture curves, which included significant and untested assumptions, to derive the aquifer parameter starting values for calibration. But equipped with no water level data and no stream gain-loss data for calibration, the model representation of the Dune Sand/A Aquifer unit remained uncalibrated, so the presumably highly uncertain values used as initial values reasonably remained equivalent or nearly so to the final values.

HydroFocus presented calibration results using the CEMEX testing in which observed and calculated drawdown were presented for its model, the Geoscience model and the CEMEX model. But HydroFocus did not report the CEMEX test estimates of hydraulic conductivity (K); horizontal (Kh) or vertical (Kv)) or the estimated specific yield/storage estimate (sy/S), or that the model used those values.[17] The model K and S values for

[16] I am unfamiliar with potential constraints on the project schedule but the nearly contemporaneous report submittal and data acquisition is noted.
[17] See Figure 3.3d

either the HydroFocus model or the Geoscience model are not compared with the valuable test-derived estimates. Of the three models, the CEMEX model most accurately simulated the test drawdown, which HydroFocus attributed to the better resolution in the CEMEX model.

The source data was not included in the reports. Neither consultant posted actual K or storage values from testing in their parameter zone maps. While HydroFocus did prepare a list of sources for its basis in the model parameter zone values, those sources are most often other modeling efforts. It is not known if the source K values are model-estimated or estimates from testing. Model-derived estimates of K through calibration, for instance, are of less reliability than a hydraulic conductivity (K) value derived from pumping tests. The consultants require that the reviewer must gather and review all source documents to extract the information that should be reported in the model report. Standard model reporting includes a description of the method used to estimate each aquifer parameter[18], which is absent in the reports.

3.2 Parameter Adjustment During Calibration

HydroFocus and Geoscience adjusted parameter values to minimize the difference between the observed and model-calculated water levels during calibration. This minimization of the objective function (water level or head residuals (errors)) is but one measure of many in determination of the calibration quality and whether the model is a sufficiently accurate representation of the aquifer system. Calibration quality assessing only the error in the water level residuals, considers only a portion of the error information, and in this case likely a small portion of the error information. The NMGWM objective function is dependent on the water level data available, and as described in previous sections, insufficient data was acquired, utilized and presented for the NMGWM model calibrations. Furthermore, the calibration process must only adjust parameters within reasonable ranges based on available data, and quantify the uncertainty in those parameter estimates during the sensitivity analysis.

But the NMGWM calibration is concluded to have significant errors besides those already presented, and they include unreasonable parameter values, insufficient data, and inadequate sensitivity analysis.

[18] Anderson, MP, WW Woessner and RJ Hunt 2015. Applied Groundwater Modeling Simulation of Flow and Advective Transport. Elsevier/Academic Press.

Because of these errors, the model is not concluded to be representative of the aquifer system. The model will be unreliable for predictions of impacts from slant well pumping, regardless of its ability to minimize the objective function.

3.2.1 Hydraulic Conductivity

Sensitivity analysis and confidence intervals for the calibrated parameter values are not reported in the consultants reports. The uncertainty in the calibrated parameter estimates is not quantified.

Geoscience updated the CEMEX model subsequently in 2016, prior to the HydroFocus NMGWM calibration (2017), and presumably reflective of the high quality data from the pumping test performed in April 2015.[19] But HydroFocus did not identify the CEMEX aquifer test estimates of the horizontal (Kh) and vertical hydraulic conductivity (Kv) values in the report, and instead relied on other (often older) reports which appear to include predominantly modeling estimates of Kh and Kv.[20] The CEMEX monitoring well network for the test appears to have been particularly well suited for determination of Kh and Kv values.

In the CEMEX and Potrero Road sites, the Geoscience initial estimates of Kh and Kv were based on an assumed relationship between sediment texture and horizontal and vertical hydraulic conductivity. The method assumptions were not subsequently validated with the CEMEX aquifer test parameter estimates. Had the assumptions been subsequently validated, an opportunity would have existed to extend that demonstrated correlative relationship to other areas of the model. HydroFocus did not provide a post-audit of the validity of the approach and assumptions, or appear to rely on that method.

In the model area primarily east, south and southeast of CEMEX, the Kh and Kv values in the Geoscience and HydroFocus models are substantially different for the Dune Sand/A Aquifer unit, the Salinas Valley aquitard (SVA), and the 180-ft aquifer. The Kv changes include up to seven orders of magnitude reduction in the newly-interpreted low conductivity material in the HydroFocus model in layer 3.

The mapped SVA (Salinas Valley aquitard) north of the Salinas River has a Kv value five orders of magnitude larger than this anomalous low Kv zone south of the river. Because this change was not associated with a defined lithologic reinterpretation in the HydroFocus report, the value appears to be unreasonable. The Kh and Kv of the Dune Sand/A Aquifer unit are also generally lower in this anomalous zone, although the Kh

[19] The pumping test at CEMEX is concluded to have been performed in April 2015 based on the hydrographs presented in the HydroFocus report.
[20] See Figure 3.3d

value is identical between the Dune Sand unit and the low conductivity zone, also potentially reflecting an unreasonable Kh value if it is permeable material.

This area is partially traversed and bordered by the Salinas River.[21] The low Kh and Kv will limit the hydrologic connection between the river and the aquifer. Because the stream-aquifer interaction along the Salinas River may be affected by the erroneous model values, and because stream gain-loss data were not presented for the calibration, the predicted impact to the River from slant well pumping is unreliable. HydroFocus excluded explicit representation of a portion of the Salinas River in this area of the model in its predictive modeling as will be described in Section 4.0.

The Kh and Kv values in the 180-ft aquifer were also revised between the Geoscience and HydroFocus models significantly south of the Salinas River and near the southern boundary. The Geoscience Kh of 160 feet per day (ft/d) was revised to 50 ft/d (western half) and 425 ft/d (eastern half) so that a much higher Kh value is assigned inland as compared to the coast. The Kv was increased more than an order of magnitude above the Geoscience model values. HydroFocus did not post/identify the specific K values used to support this set of values, so it is not possible to make a conclusion about its accuracy.

HydroFocus incorporated more water level data along the southern boundary than Geoscience which allowed for better calibration in this area of the model. However, calibration must also reflect reasonable aquifer properties, while also minimizing the residuals between observed and calculated water levels. Some of the significant parameter changes made in the HydroFocus model may have been to compensate for anomalous boundary and initial water levels prior to the evident conclusion that the water levels were erroneous and disregarded in subsequent superposition modeling.

3.2.2 Storage Values

Only a cursory review of the model storage properties has been accomplished. I did not identify any source data values in the reports to which I can compare the model values. HydroFocus referred primarily to SVIGSM, but the LSCE model report did not include S estimates. HydroFocus had not included estimates from the CEMEX aquifer test so a comparison with model values could be made.[22]

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[21] Because Geoscience and HydroFocus do not show the Salinas River on its respective parameter zone maps, I can only estimate based on a comparison across multiple figures.

[22] It is unknown whether the CEMEX testing yielded an estimate of specific yield and storage coefficient because the CEMEX report was not reviewed, and HydroFocus did not identify the values in its model report.

Accurate representation of the specific yield (effective porosity) and the storage coefficient is required for accurate predictions of the drawdown distribution and seawater intrusion. The HydroFocus values of specific storage (representing the storage coefficient divided by the aquifer thickness) as presented in Figure 3.3c appear to indicate an average model value of 0.001/ft which seems high for a confined aquifer where that exists.[23] Without any independent estimates made available by the consultants, it is not possible to conclude that the model storage values are reasonable. The model reports did not present interpreted or calculated potentiometric surface maps so areas where aquifers are confined or unconfined could not be distinguished and weighed against the storage estimates. The potentiometric surface is an imaginary surface passing through all points to which water will rise in wells penetrating a confined aquifer, and the surface is described by a series of contour lines along which the potential head is equal. The ground water flow direction is perpendicular to the contours. For an unconfined aquifer, the potentiometric surface is referred to as the water table, which defines the surface upon which the water pressure is equal to atmospheric pressure[24]. Definition of the potentiometric surface/water table is integral to understanding the hydrogeologic system.

3.2.3 Model Budget

The NMGSM hydrographs show that the initial model heads and heads at the boundaries were inaccurate for a significant portion of the simulation period.[25] The HydroFocus model flow budget presented in Figure 4.5 is inaccurate because it appears to use an average based on the inaccurate heads, as well as the erroneous pumping and recharge components. The model flow budget represents the model balance of each flow component simulated explicitly in the model, with some of the components positive (water into model area), precipitation recharge for example, and the others negative (water out of model area), including pumping as an example. Modflow numerically balances the positive and negative components with a balanced model showing a near zero difference between the two. Unbalanced or excessive flow budget error would be an indication that the flow components are not balanced, and the model is not concluded to be numerically precise. A model flow budget for the Geoscience model calibration is not included in the report. It is standard modeling practice to compare the model budget with that estimated independently depending on available

[23] Without review of source data, it is indeterminate whether 0.001/ft is an accurate value for the aquifer specific storage.
[24] McWhorter, DB and DK Sunada 1977. Ground-Water Hydrology and Hydraulics. Water Resources Publications, LLC.
[25] See HydroFocus Figure 4.1A layer 2 hydrographs.

historic data. LSCE had provided a detailed basis for some components, but the consultants did not incorporate this as part of the model calibration evaluation.

3.3 Sensitivity Analysis

HydroFocus stated the objective of its sensitivity analysis (pg. 42):

> The objective of the sensitivity analysis is to address the question: "If the assumptions adopted in developing the model were changed, would the model predictions change so as to change the conclusions regarding proposed slant well operation?"

For its sensitivity analysis, the HydroFocus report included an evaluation of the changes in drawdown in the predictive scenarios with alteration of five of nearly 50 conductivity model parameter zones.[26,27] Evaluation of the predictive uncertainty is valuable but not without an evaluation of the uncertainty in the parameter values estimated in calibration, upon which predictive uncertainty also depends. Standard reporting includes reporting the parameter sensitivity for all parameters, not only 10 percent, and from the calibration, not only from the predictive scenarios. While it was not made clear in either report whether inverse modeling was used for parameter estimation, Modflow 2000 allows for calculation of the sensitivities, as do other freely-available, coupled softwares to Modflow. Corroboration of the methodology and software is not possible without more information.

3.4 Analysis of the Residual Error

Geoscience and HydroFocus presented various report figures describing the residual error between the observed and model-calculated water level (head) values. The following observations are made based on my review of the report figures.

Dune Sand/A Aquifer unit

Of the eight wells, seven show that the model underestimates the observed water levels in the Dune Sand/A Aquifer unit. The model shows a biased low water level distribution.

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[26] HydroFocus report Figure 6.1.

[27] Sensitivity is defined as the change in the model calculated response variable (for NMGWM, the water level, or derived drawdown) associated with the change in the parameter value (i.e. K; Anderson, MP, WW Woessner and RJ Hunt 2015. Applied Groundwater Modeling Simulation of Flow and Advective Transport. Elsevier/Academic Press.). Although typically in inverse modeling, perturbation of the parameter value over a small range more accurately reflects the parameter sensitivity because the parameter sensitivity is not always linear (Hill, MC and CR Tiedeman 2007. Effective Groundwater Model Calibration. John Wiley & Sons, Inc.). HydroFocus changes to the parameter values were large, assuming linearity, and done to demonstrate only the change in extent of drawdown away from the slant pumping.

Four of the wells[28] show that the starting head in the model was as great as 70 to 80 ft in error, as compared to the observed values. While there is convergence of the observed and simulated water levels late in the simulation period at three of the wells, it is not evident that error magnitude is not increasing with time,[29] or that application of an extremely low and likely unreasonable Kv is justified and has not been applied to specifically to reduce the residuals.

At monitoring wells MW-OU2-29-A and MW-BW-01-A, the erroneous starting head is shown to rise more than 70 ft during the simulation period at the (latter) well farther in from the boundary, and 35 ft at the (former) well more proximal to the boundary, possibly distinguishing error contributions.[30] Despite the significant rise in model water levels, concluded in the report to be erroneous, the observed water levels range similarly between the wells over a 10-15-ft interval. Rather than a localized perched condition as HydroFocus concludes without presentation of adequate data[31], the four wells collectively support instead a laterally extensive (of a few miles at least) saturated unit possibly above the Dune Sand/A Aquifer unit. It is possible that an additional aquifer above or within the Dune Sand/A Aquifer unit is present south of the Salinas River and is not the seemingly insignificant localized perched zone HydroFocus concludes. Additional data should have been collected to determine if this apparent upper aquifer unit is in hydrologic connection to the Dune Sand/A Aquifer unit. If it is, the evident vertical gradient warranted better vertical resolution (increased layering). This, among other expanses of model layer2 where the absence of water level data could not allow for similar revelation, may be an indication that the layering is too coarse for accurate representation of the uppermost aquifer units, including the Dune Sand/A Aquifer unit, thereby preventing evaluation of the full impacts from slant well pumping. Because the consultants provided no interpretation of the potentiometric surface, or the model-simulated potentiometric surface for any aquifer in their reports, contrary to model reporting standards, the extent to which this area may be in hydrologic communication with the Dune Sand unit at CEMEX has not been investigated

[28] MW-OU2-07-A, MW-BW-31-A, MW-OU2-29-A and MW-BW-01-A

[29] MW-OU2-07-A hydrograph Figure 4.1a shows an approximate 90% increase in the error between the beginning and end of the correlated portion of the record. MW-BW-31-A observed values show an anomalous step in the record which prevents a determination of the change in errors before the simulation period ends in Sept 2011.

[30] Errors in starting head and errors in the boundary conditions represent different error impacts in the model.

[31] Review of lithologic logs and interpretation of the potentiometric surface would have helped to distinguish whether the area may be in hydrologic communication with the aquifer or is perched, but Geoscience excluded the water level data, and HydroFocus concluded, in my opinion without adequate analysis completed, that the area was likely perched and that Modflow limitations prevented accurate representation of the water levels. Both consultants failed to adequately characterize this area, among others in NMGWM as a consequence of not collecting additional data in the uppermost unit.

or described by the consultants. The model does not allow for this communication as evidenced in the calibration results.

The extremely low Kv applied to the Dune Sand/A Aquifer unit, and particularly in the underlying layer 3[32] appears to have resulted in eventually reducing the residual at three of the wells. The extremely low Kv was applied to reduce the residuals at the wells, but because the value seems unreasonable, its use as a mechanism (prop up the head in layer 2) to improve the appearance of the calibration, instead reduces the confidence in the calibration.

Geoscience included no data for calibration of this unit. Because of the errors revealed in the HydroFocus calibration and report, the Geoscience calibration is expectedly also poor, as likely would have been concluded had the data been included.

For the CEMEX modeling as presented in Figure 4.2, the comparison between the observed and model-calculated values indicates low error in the water level residuals. However, the basis provided by HydroFocus on its improvement to well MS-5S[33] consists of the changes made to the SVA Kv. The Kv changes are described above and are considered unreasonable but applied as a mechanism to prop up the head in the model. An acceptable calibration achieves low magnitude, spatially and temporally random error, using reasonable parameter values. Because a sensitivity analysis of the calibrated parameter values was not presented in the report, the influence of the low Kv on the CEMEX area model-calculated water levels is unknown. The extent to which the model water level distribution in the Dune Sand/A-Aquifer unit in the CEMEX area depends on the seemingly unreasonable low Kv value of the nearby underlying SVA has not been assessed due to the consultants not including a sensitivity analysis of the calibrated parameter values.

The calibration is poor for the Dune Sand/A Aquifer unit and is affected to an unquantified extent by erroneous boundary conditions, erroneous starting heads, unreasonable parameter values and insufficient data. Based on the reports, the interpretation is also insufficient and fails to characterize the impact of these errors on the accuracy of the calibrated parameter values. Model predictions relying on a model with these errors are unreliable.

180-ft Aquifer

[32] as described in Section 3.2.1

[33] The CEMEX test was simulated in the Geoscience and HydroFocus NMGWM, but MW-5S available for monitoring and calibration during the slant well testing was excluded from Figure 4.6 without explanation.

The HydroFocus calibration included 10 wells with time-series data. The match between the observed and calibrated water levels at six of the wells is excellent in both timing and magnitude. However, five of the six wells are proximal to rivers (streams slough, etc; unlabeled in the HydroFocus report). It cannot be concluded that aquifer property values are accurate because the good fit between observed and calculated values may be a consequence of the unreported streamflow infiltration values provided by SVIGSM. It is not even clear from the reports if streamflow infiltration is applied in layer 3. Furthermore, because a sensitivity analysis was not presented for the calibrated parameter values, the sensitivity of these observations to recharge is unknown.

Two of the model-calculated water level hydrographs exhibit too much variability in the model response as compared to the observed response, and the remaining two show too little variability in the magnitude as compared to the observed values. But the extent to which this is significant depends on the problematic LSCE treatment of pumping in its calibration as described in Section 2.2 of this report. The LSCE calibration included allocation of pumping rates vertically across the aquifers based on observed water level data; water level data also used in the subsequent Geoscience and HydroFocus calibrations.[34] The LSCE practice resulted in what may be considered a contamination of the independence of the water level dataset because of the explicit correlation made between water levels and pumping in SVIGSM. If the pumping is inaccurate (as concluded by HydroFocus and this review), but a reasonable fit between observed and calculated water levels has been achieved due to parameter (K,S) adjustment, as is shown to be the case to an extent in the consultants respective calibrations, then the aquifer properties are likely inaccurate also. Use of the observed water levels to allocate pumping results in lower confidence in the aquifer parameter values.

The calibration results indicating low error are not an indication that the underlying parameter values are reasonable, only that they have compensated for unquantified error in pumping, recharge, boundary conditions and initial heads. The extremely low Kv values are a demonstration of exactly this. The confidence in the calibrated model is low, and reliable predictions of drawdown cannot be calculated.

Geoscience presented only four hydrographs for the 180-ft aquifer, and nine for the 400-ft aquifer, even though the 180-ft aquifer is of prime interest, and more data was available. LSCE presented seven hydrographs for the 180-ft aquifer. HydroFocus presented 10 hydrographs. Why the available data was excluded was not addressed in

[34] Approximately the same datasets, as Geoscience only presented four of the wells in its report with its appended LSCE report showing only seven as compared to HydroFocus presenting 10 hydrographs.

the Geoscience report. The Geoscience 180-ft aquifer residuals range from low magnitude to as high as approximately 18 ft. The two remaining wells show an acceptable match to observations, but this statement is qualified in the preceding paragraphs. Even where low residuals have been calculated, there is low confidence in the calibrated aquifer parameters.

The CEMEX modeling based on the Geoscience and HydroFocus calibrated models, shows low magnitude error but a bias in the model-calculated water levels indicating that the model cannot reproduce the variability exhibited in the observed values. HydroFocus did not provide an explanation for this effect.[35]

Another anomaly in the HydroFocus and Geoscience calibrations was the ambiguous placement of observation well 14S/2E-14L01 which according to the Monterey County Water Resources Agency is a 180-ft aquifer monitoring well. But because of seemingly similar water levels, was instead placed in the 400-ft aquifer layer. Sufficient information was not presented to discern that the consultants assigned the well to the correct aquifer. The well construction details were apparently not reviewed although that review may have resolved the ambiguous placement with more confidence. HydroFocus did not identify that Geoscience undertook this effort either.[36]

400-ft Aquifer

The HydroFocus model generally underestimates the observed response in this aquifer, and generally simulates too high a head compared to the observations. The Geoscience model achieved a poor calibration over most of the 400-ft aquifer with the largest residuals calculated along the eastern and northern boundaries. Residuals of greater than 50 ft are prevalent in proximity to the eastern boundary. This result shows that the eastern boundary water levels were significantly erroneous and influenced the water level distribution inside the model, including expectedly, the predictions of drawdown made by Geoscience from slant well pumping. No observations near the southern boundary were included so the extent to which the southern boundary water levels were erroneous cannot be determined.

For the CEMEX modeling as presented in Figure 4.2, evident bias is shown for the 400-ft aquifer with all simulated water levels higher than the corresponding observed values. This indicates that the model underestimated the impact to the 400-ft aquifer during

[35] Although the report does identify that pumping and recharge changed after September 2011, but also identified that hydrologic conditions have not likely changed substantially between the model timeframe and the water level data period.

[36] Geoscience prepared a communication for HydroFocus on the matter but I have not reviewed that document.

CEMEX pumping from the overlying aquifers. It is not evident from the report, if the calibration sought to resolve this. If not, the predicted impact to this aquifer will be underestimated for the MPWSP.

900-ft Aquifer

During half of the simulated period, the observed water level response at all of the monitoring wells varies over a narrow range of approximately two feet. The model simulates a 10-ft range.

3.5 Analysis of the Model Error

Insufficient data was used for model calibration as described. The error evaluated by the consultants only reflects as much error as the calibration dataset allows, which is limited most notably in the Dune Sand/A Aquifer unit, a primary aquifer targeted for slant well pumping, as well as by the absence of stream gain-loss data. Error along model boundaries is largely unquantified owing to limited data in those areas. The impact of this error on calculated water levels across the model is unquantified. Because sensitivity analysis of the calibrated values and parameter uncertainty analysis were not performed, the model error has not been thoroughly evaluated for calibration or prediction.

The structural error due to elements including layering and zonation has not been evaluated. It is possible that an additional aquifer above or within the Dune Sand/A Aquifer unit is present south of the Salinas River and is not the (insignificant) localized perched zone HydroFocus concludes. This, among other expanses of model layer2 where the absence of water level data could not allow for similar revelation, may be an indication that the layering is too coarse for accurate representation of the upper aquifer unit, thereby preventing evaluation of the full impacts from slant well pumping.

But model error in the form of bias is evident in the calibration results. Model error is reflected in the non-randomness of the residuals as demonstrated by the correlation between residual error and calculated water levels, and non-randomness in space, and to the extent it could be determined, unreasonable parameter values.[37] Sensitivity analysis of calibrated parameter values, and of the SVIGSM-adopted errors in pumping and recharge was not accomplished. Without this, the uncertainty in the parameter values is unknown.

[37] Because specific values of K and S from aquifer testing were not reported, the extent to which the model values adhered to reasonable values as determined independently of the model cannot be determined. In some cases however, the calibrated values do not appear to be reasonable based on other indicators.

Rather than rectify the model bias error, HydroFocus employed superposition to predict the drawdown associated with proposed slant well pumping. But the model error, the revelation of which was limited by the dataset, was inherent in the calibration, and superposition relied on the calibrated parameter values. So the error was transferred and potentially compounded for the superposition modeling.

Geoscience and HydroFocus present other error measures in their respective reports including the relative error, concluded by HydroFocus to be acceptable based on the following excerpt (pg. E-1):

> The relative error calculated from the standard deviation of the model errors and range of measured water levels in the model meets calibration criteria and ensures that model errors are only a small part of the overall model response.
>
> The results provide confidence that the model calculations are reliable estimates of the groundwater response to pumping, which was confirmed by simulating measured drawdown during test slant well pumping.

The statements are ambiguous, but importantly, HydroFocus correctly concludes that other model measures, including the identified bias, renders the calibrated head model unacceptable for use in predictions of drawdown from slant well pumping. This set of conclusions, that the residual error is low, but the model bias is significant and the calibrated model cannot accomplish what it was designed for, is a good demonstration that an acceptable calibration must consider bias as an integral measure of model utility. Geoscience did not include sufficient data or analysis to make the correct conclusion that HydroFocus was able to make. The model was not calibrated to an acceptable standard, but instead of improving the calibration, admittedly not a simple undertaking in this case, HydroFocus employed superposition for predictive modeling.

4.0 Predictive Modeling

4.1 Uncertainty in Calibrated Parameter Values

HydroFocus and Geoscience did not evaluate the uncertainty in the calibrated parameter estimates, and its impact on the calculated water levels. HydroFocus evaluated only the sensitivity of a few parameters near CEMEX and Potrero Road sites during predictive modeling. From its limited sensitivity analysis for predictions, HydroFocus concluded (pg. 42):

> Increasing the anisotropy (increasing horizontal conductivity and decreasing vertical conductivity) minimizes the area of the cone of depression. Conversely, decreasing the anisotropy (decreasing horizontal conductivity and increasing vertical conductivity) maximizes the area of the cone of depression.”.[38]

Hydraulic conductivity often exhibits characteristic anisotropy, meaning that it is directionally dependent[39] and in the NMGWM, anisotropy is used to reflect that Kh is not equal to Kv.[40] The HydroFocus conclusion stated above regarding the effect of anisotropy on the drawdown cone extent is counterintuitive to the expected result. For clarification, higher anisotropy indicates that the Kh is *much* larger than the Kv. For such a situation, among other variables[41], one would expect a laterally extensive drawdown in the horizontal direction (high Kh) and limited drawdown vertically (low Kv). The conclusion HydroFocus derived based on its modeling does not make sense.[42] Reducing the anisotropy (making Kh and Kv less dissimilar, or more equivalent in magnitude), and allowing for increased vertical flow should result in a cone of depression that is less laterally extensive. The HydroFocus model calibration included apparently unreasonable values of Kh and Kv east and south of the CEMEX site, and the remainder of the model includes parameter values of unquantified uncertainty because of inadequate sensitivity analysis.

HydroFocus presented three scenarios varying the pumping allocation between the Dune Sand/A Aquifer unit and the 180-ft aquifer. However, HydroFocus elects to present results for the scenario which is apparently not based on the most likely allocation between the two aquifers. Based on the CEMEX model calibration, more of the pumping is derived from the Dune Sand as opposed to the 180-ft aquifer (worse-case scenario?). While it is unclear why HydroFocus presented the results of this apparently less likely scenario, it may be that increased pumping from Dune Sand would have calculated a greater drawdown extent and increased leakage from the Salinas River and other modeled surface water drainages.[43]

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[38] Pg 42 in HydroFocus report

[39] Anisotropy is defined as a property that varies with direction (Driscoll, FG 1986. Groundwater and Wells. Johnson Filtration Systems, Inc.)

[40] Kh can also be directionally dependent along the x and y tensors. But NMGWM does not reflect this particular anisotropy.

[41] Storage characteristics, transmissivity values, well completion, initial head and head differences across layers, boundary effects, etc.

[42] Because I do not have access to the model files, I cannot confirm that this is accurate. It is possible that sufficient numerical precision was not achieved, or the flow budget was associated with excess error. Or it is possible that the statement is correct but not intuitive.

[43] However, this can only be surmised without access to the model files.

HydroFocus adapted the NMGWM superposition model to include explicit representation of a portion of the Salinas River and Tembladero Slough/Reclamation Ditch using the Modflow river package so that the stream-aquifer interaction along these drainages is represented in order to quantify the impacts from slant well pumping. A large reach of the Salinas River and several other streams are not included in the analysis. No explanation for this is provided.

Because the calibration does not incorporate evaluation of stream gain-loss data, and the conceptual model does not include adequate information or analysis of the stream-aquifer interaction, the superposition model-predicted depletion impacts to the surface water system are concluded to be unreliable. The uncertain MPSWP predicted impacts to the streams may exceed allowable limits of established minimum streamflow standards. The results did not address this possibility.

4.2 Superposition

HydroFocus abandoned use of the calibrated head model, and instead relied on superposition to quantify the drawdown impacts from slant well pumping. But superposition relied on a set of calibrated parameter values which are concluded to also range from unreasonable to exhibiting significant but unquantified uncertainty. As a consequence, the superposition modeling produced unreliable predictions of drawdown from slant well pumping.

Superposition requires that the model be linear[44], or nearly so. But the degree of potential nonlinearity was not investigated by HydroFocus. It is not concluded that the thinning and unconfined Dune Sand/A Aquifer, or the reduction in transmissivity from slant well pumping or the boundary conditions did not present significant nonlinearities in the system causing the application of superposition to calculate erroneous drawdown values. This same criticism may be applicable to the Salinas Valley Aquitard where it may become unconfined during predictive simulations.

Superposition, as applied in the HydroFocus work, did not include dynamic updating of the boundaries which may have incurred drawdown, although the presentation style of reporting only drawdown greater than one foot does not show the full drawdown extent.[45] The zero/near zero drawdown contour should have been included in the Geoscience and HydroFocus analyses and figures to identify areas where the boundaries affected the model-calculated drawdown extent. The boundary inflow with and without

[44] Reilly TE, OL Franke, and GD Bennett, 1984. The Principle of Superposition and its Application in Ground-Water Hydraulics, U. S. Geological Survey Open-File Report 84-459.
[45] This was the presentation form in both the Geoscience and HydroFocus reports.

slant well pumping should have been presented to discern any changes in inflow mitigating drawdown. A prevailing gradient is simulated at the General Head Boundary (GHB). If pumping inside the model results in drawdown reaching the GHB, inflow at the boundary will continue at a biased high rate resulting in an erroneous calculation of the drawdown extent. Insufficient analysis and reporting does not demonstrate that this was not a factor.

Application of superposition to isolate the impact from only the slant well pumping may be inconsistent with the model purpose as defined by Geoscience (pg. 8):

> The purpose of this study was to evaluate the impacts of the proposed MPWSP on the Salinas Valley Groundwater Basin. Groundwater modeling was conducted to assess the impacts of MPWSP on the groundwater levels and the seawater intrusion.

The Salinas Groundwater Basin includes multiple complex variables (recharge and discharge) changing in time and space which affect the groundwater levels and rate and extent of seawater intrusion. The success of the slant well pumping to expectedly not exceed seawater intrusion thresholds, among other measures, is dependent on the effects from these other complex and dynamic stresses. In the superposition analysis, these other relevant stresses are omitted, thereby making system response predictions unreliable. It is insufficient to predict only slant well pumping impacts in a dynamic system integrally defined by many other complex impacts which in turn, affect the slant well pumping.

The application of superposition, intended by HydroFocus to diminish the error and uncertainty in many aspects of the calibrated head model, did not alleviate the errors or quantitatively demonstrate a reduction in error, and possibly introduced new and different errors in that aspects of the superposition model were not calibrated (i.e. stream gain-loss; boundary inflow, etc.).

4.3 Slant Wells Designed to Replace Freshwater with Saltwater

Dr. Weitzman indicated that according to his understanding of the project objective, that the slant wells would not cause additional seawater intrusion and requested that if available, I include information from the consultants reports which did not support this understanding.

Review of the consultants reports identifies that seawater intrusion would increase. The increase in inland extent due to creation of a cone of depression from pumping was not reliably determined in the consultants model. But the slant well pumping is designed to replace freshwater in the Dune Sand/A Aquifer unit and 180-ft aquifer with seawater over some unreliably quantified aquifer volume and timeframe based on the HydroFocus report excerpt presented below (pg. 36):

> A capture zone refers to the three-dimensional volume of aquifer that contributes the water extracted by the wells. When the pumps are turned on, the wells initially extract the existing ambient mix of native groundwater in storage, but as pumping continues the wells extract increasing proportions of infiltrating recharge from the ocean. The ocean recharge gradually replaces the ambient water within the capture zone, and moves within the capture zone toward the well but does not spread beyond the capture zone. In map view, the capture zone is a 2-dimensional surface that delineates the underlying aquifer volume where ocean water replaces ambient groundwater and ultimately becomes the primary water source to the wells.

Because the slant well pumping is designed to replace aquifer freshwater with seawater, the pumping necessarily results in an increase in seawater intrusion into aquifer areas still containing freshwater.

5.0 Conclusions

The MPWSP proposes slant well pumping to replace freshwater aquifers with seawater as a supply for the desalination plant. A calibrated model was needed to make accurate predictions of drawdown and seawater intrusion resulting from slant well pumping. To accomplish this, the existing SVIGSM model was updated. The model results were adapted for use in the better resolution NMGWM. Geoscience calibrated the NMGWM as described in its 2015 report. HydroFocus provided an alternate calibration starting with the Geoscience model as described in its 2016 report, and used superposition for its predictions of drawdown.

Based on my review of the reports, it is concluded that:

- Insufficient data was collected/evaluated for the model calibrations:
    - including, but not limited to, inadequate (to no) water level data in particular for the Dune Sand/A Aquifer unit, one of two primary units targeted for slant well pumping,
    - and stream gain-loss data which would have improved the model and aided in parameter optimization.

- SVIGSM produced unreliable estimates of the pumping, recharge and initial water levels for use in NMGWM.

- NMGWM calibration included adjustment of model parameters based on unreliable values from SVIGSM.
- Geoscience was aware of Dune Sand/A Aquifer unit data but excluded it from the calibration without explanation. Geoscience also excluded water level data available for the 180-ft aquifer, also without explanation.
- Inadequate information was presented in the reports contrary to standard model report documentation and included:
    - Interpretations of the potentiometric surface for each aquifer in the NMGWM area were not included in the reports.[46] Recall that the potentiometric surface is described by a series of contour lines along which the potential head is equal. The ground water flow direction is perpendicular to the contours. Standard model reporting includes representation of the interpreted and model-simulated surfaces to show that the model is consistent with the hydrogeologic understanding of head and flow directions derived from the conceptual model. No such demonstration was made in either consultant's report for the NMGWM area.
    - Simulated potentiometric surface maps from the NMGWM area were not presented in the consultants' reports.
        - It is possible that an additional aquifer above or within the Dune Sand/A Aquifer unit is present south of the Salinas River and is not the (insignificant) localized perched zone HydroFocus concluded. This, among other expanses of model layer2 where the absence of water level data could not allow for similar revelation, may be an indication that the layering is too coarse for accurate representation of the uppermost aquifer units, including the Dune Sand/A Aquifer unit, thereby preventing evaluation of the full impacts from slant well pumping. Because the consultants provided no interpretation of the potentiometric surface, or the model-simulated potentiometric surface for any aquifer in their reports, contrary to model reporting standards, the extent to which this area may be in hydrologic communication with the Dune Sand unit at CEMEX, for example, has not been adequately investigated or described by the consultants. The model does not allow for this communication as evidenced in the calibration results.

[46] although the Geoscience model report did append the LSCE interpretations and simulations from SVIGSM of the 180-ft and 400-ft aquifers

- Inadequate specific information was reported for the source data including K and S values that were relied upon for parameter adjustment.
- Inadequate explanation was provided for the recharge distribution, including the characteristics associated with streamflow infiltration rates along unnamed rivers in NMGWM.
- HydroFocus did not report the K and S values estimated from the CEMEX testing and, without explanation, did not rely on those for calibration of NMGWM (Figure 3.3d).
- The Geoscience model report did not include an interpreted model water budget or a simulated water budget. HydroFocus presented a simulated budget but it is concluded to be incorrect for many reasons described in this report.
- A comparison between the SVIGSM aquifer properties and model calculated heads upon which NMGWM relied was not presented in the Geoscience model report. Evaluation of evident model bias was not included in the report, and therefore could not be used to improve the model. Because of this, erroneous initial heads and erroneous heads along the boundaries were not revealed until the HydroFocus report, which included data for the Dune Sand/A Aquifer unit and additional data in the 180-ft aquifer. The Geoscience model was considered a poorly calibrated model despite the calibration results presented which showed a low error in the residuals.
- The HydroFocus report revealed the existence of unacceptable error from model pumping, model recharge, initial model heads, and model boundary heads, but failed to provide detailed information to support its conclusions. Instead of correcting these errors (probably a major undertaking), HydroFocus subsequently relied on superposition for prediction of drawdown impacts from slant well pumping so that some of the identified error was eliminated to improve accuracy in the predictions.
- HydroFocus simulated stream-aquifer interaction with the Modflow river package but did not provide an explanation why some NMGWM area streams/rivers were excluded from the predictive analysis.
- HydroFocus did not present a comparison of model-calculated gain-loss estimates against estimated values and therefore did not demonstrate that their assumptions and assigned properties were accurate.

- It was indeterminate whether the model calibration was accomplished using inverse methods, considered an industry standard at this time[47], or was accomplished deterministically. At a minimum, an explanation for not using inverse techniques should have been included in the report.
- HydroFocus and Geoscience did not include the NMGWM calibrated parameter sensitivity and parameter uncertainty. Sensitivity analysis is considered an industry standard. If inverse modeling was done, enormous information generated by that process was excluded from the reports, including among other output:
  - Sensitivity of parameters
  - Sensitivity of water level observations
  - Sensitivity of boundaries
  - Parameter correlation
  - Parameter confidence intervals
  - Degree of nonlinearity

- Because of inadequate data, analysis, reporting and the use of parameter values ranging from unreasonable to unquantified uncertainty, and known and unknown error, the NMGWM is concluded to be poorly calibrated and not representative of the aquifer system.
- HydroFocus, in recognition of some of these elements, rejected use of the NMGWM head model and instead used superposition based on NMGWM calibrated parameter values to predict drawdown from slant well pumping.
- Because superposition relies on parameters from a poorly calibrated model with known and unknown/unquantified errors, the error in the parameter estimates contributes unquantified error to the predictions.
- Superposition did not produce reliable estimates of drawdown from slant well pumping, and is not concluded to have been the appropriate methodology to employ to meet the Project goals.

[47] My opinion stating that inverse modeling is the industry standard for approximately 15 years now is based on the techniques in model calibration presented at the Colorado School of Mines Integrated Ground Water Modeling Center's biannual conference (over the past 20 years) with inverse modeling being the most common approach among modelers presenting at the conference. Also at least three public domain codes are available for use. All models are not necessarily amenable to inverse modeling if dry cells are calculated but because NMGWM did not incur this effect according to the absence of information in the reports, it should have been calibrated using this standard technique.

Attachment 3

CHANCE

Volume 34, 2021 - Issue 4

From Divining Rods to Statistics: A Forensic Analysis of the Misuse of Statistics in the Estimation of Environmental Impact

R. A. Weitzman

Abstract

Shortly after my retirement, I became involved in local water issues and learned that I could be of especial use in work on those issues because of my background in statistics. What I am reporting here is a minimally-technical account of the experience I had using statistics as a forensic tool to unearth what appears to have been a misuse of statistics in the modeling of the environmental impact of a proposed desalination project to provide water for the community where I reside. Of potential interest to statisticians is how statistics can be useful in detective work.

From Divining Rods to Statistics: A Forensic Analysis of the Misuse of Statistics in the Estimation of Environmental Impact

R. A. Weitzman

Most experts who search for underground water no longer use divining rods—they use statistics to estimate the water levels in aquifers below specific sites on the ground. Unfortunately, users of statistics can also misuse them, sometimes with costly consequences. This is the story of how statistics were applied as a forensic tool to identify misuse in estimating the impact of a proposed public project on groundwater levels.

The Monterey Peninsula in California has been over-drafting the Carmel River groundwater basin for years. In 2012, after two decades of fits and starts seeking water elsewhere, all faithfully documented in the *Monterey Herald* newspaper, the Monterey district of the privately owned water utility California-American Water filed an application with the California Public Utilities Commission (CPUC) to build a desalination plant on the coastline of the Monterey Bay in the city of Marina, about eight miles north of the Monterey Peninsula.

A number of parties joined the proceeding on the application, which also included recycling and storage components, in a total package called the Monterey Peninsula Water Supply Project (MPWSP). The Water Ratepayers Association of the Monterey Peninsula (Water Plus) was one of those parties. The proceeding lasted six years, until 2018, when the CPUC certified the project and the Environmental Impact Report (EIR) on its desalination component, which is the focus of this story.

A critical part of the EIR was modeling the impact of the operation of the project's coastal wells on nearby groundwater levels and seawater intrusion, which occurs when groundwater levels go below sea level. Stochastic and linear modeling being one of my strongest interests in statistics, that aspect of the project particularly caught my attention. What I learned and reported to the CPUC about the EIR's treatment of modeling had not only great interest for me, but also substantial impact on the fate of the project.

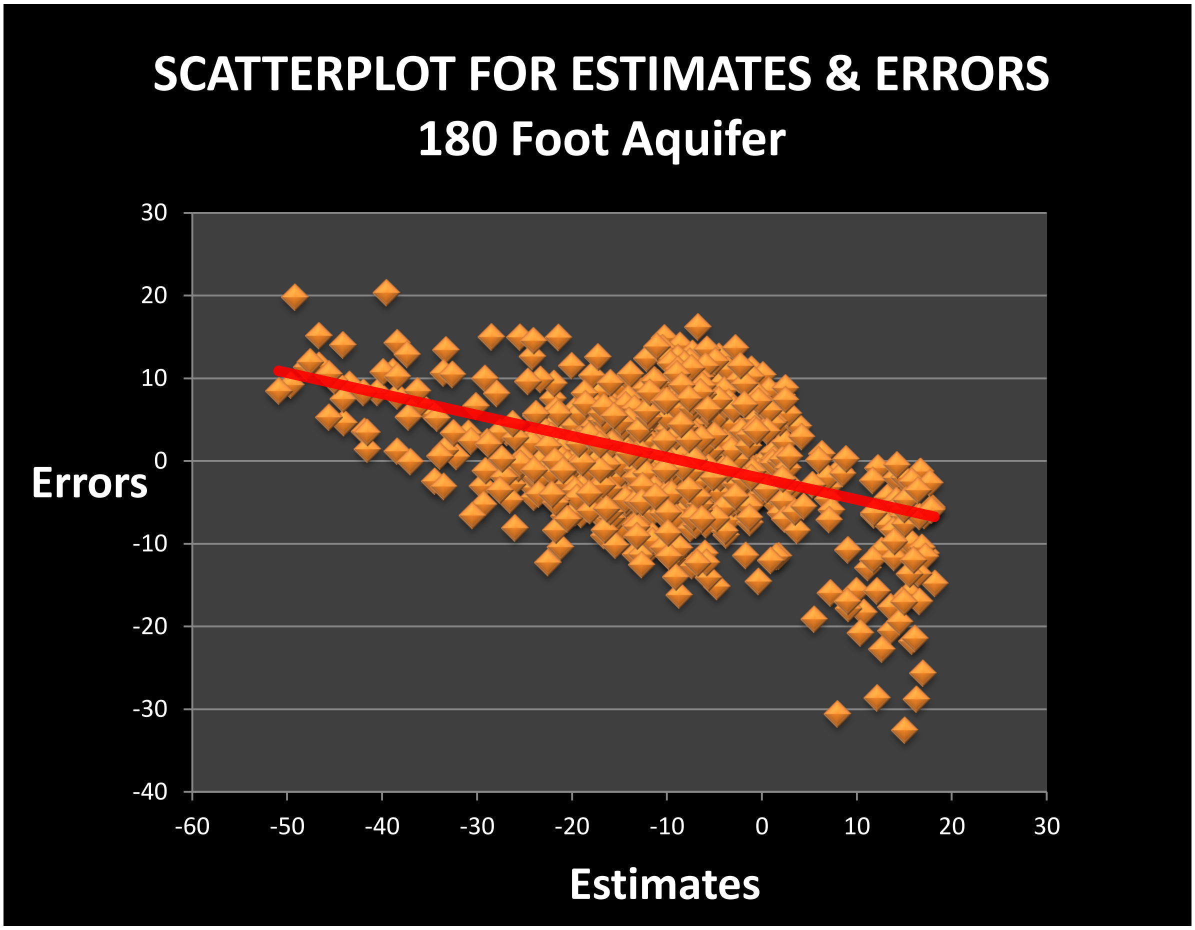
Modeling Groundwater Levels

The CPUC circulated three versions of the EIR: a first draft in 2015, a second draft in 2017, and a final version in 2018. Expert 1, the modeling consultant for the first draft, used a linear model to estimate groundwater levels over time in a checkerboard of zones covering an inland region around the proposed project wells. The model divided each water-level measurement into two components: an estimate and an error component. The estimate component was a weighted sum of independent variables that could vary in value over time and zones.

To evaluate the model's accuracy, Expert 1 used a statistic called "the relative error" that measured the extent to which the error components varied from zero: the smaller the variation, the more accurate the model. In hydrogeology, the relative error, expressed as a percent, is equal to 100 times the decimal fraction, consisting of the standard deviation of errors divided by the range of observed measurements; in this case, water levels.

Considering a model to have satisfactory accuracy if its relative error was below 10.0 percent, Expert 1 computed the relative error of the model applied to combined data from three aquifers and, finding the relative error to be 9.5%, concluded that the model's accuracy was satisfactory. That result might have marked the successful end of the proceeding on the project if not for a number of events that occurred at the time.

Figure 1. Graph of data showing highly negative correlation, equal to −0.45, in slope of straight red trend line.



One of those events was the result of my curiosity. The project was to draw its water from two aquifers, but only one of them—the 180-foot aquifer—was among the three to which Expert 1 applied the model in testing it.

Because I wondered what the results might be if the model were applied only to the 180-foot aquifer, I requested and received data from the CPUC to find out. What I found out and reported in filed comments on the first draft EIR is that the relative error for the 180-foot aquifer was 11.2%, indicating a less-than-satisfactory evaluation of the model when applied to data for that aquifer.

Snooping around further, I also found and reported for that particular data set, consisting of 993 water-level observations, that errors and estimates were highly correlated: Estimates above average tended to have errors below average (zero) and vice versa. See Fig. 1. That is a no-no in modeling and made me wonder what might be the cause of it..

That is the kind of slope likely to describe the relationship between estimates of water elevation in a well and the well's pumping activity, with high estimates corresponding to low pumping activity, but not between estimates and errors. Water elevation should be predictable from pumping activity but, by definition, errors are unpredictable. Prediction of errors is an oxymoron. The straight trend line describing the relationship between estimates and errors should be horizontal to reflect unpredictability, with a zero correlation between them. Any other straight-line trend indicates data that have somehow become corrupted.

The CPUC managed these events by replacing Expert 1 with Expert 2 to respond to the Water Plus critique of the modeling by Expert 1 that supported the project. In the resulting second draft EIR, Expert 2 confirmed that the relative error for the 180-foot aquifer was larger than 10.0% and that the correlation of errors with estimates was far from zero—but provided different interpretations of those numbers to help support the project.

For the relative error, Expert 2 raised the threshold for a satisfactory model from 10.0% to 15.0% despite that for a normal distribution having a practical range of six standard deviations, 15.0 is 90% of the highest possible value for the statistic—16.7% (one-sixth of the range), representing a model having virtually zero predictive power.

No less questionably, Expert 2 attributed the non-zero correlation between errors and estimates to model "bias" due to other non-zero correlations with error that Expert 2 discovered, including one in which errors moved up (from negative to positive) while estimates moved down over time.

Finding these biases intractable, Expert 2 replaced the model, which had not done well on its tests, with an untested one that applied the replaced model (with the same weights and independent-variable values), to estimate periodic changes in water levels and, by adding the estimated changes over time, to predict the project's impact on aquifer water levels and seawater intrusion. The untested application of a model developed to predict one thing to predict something else, with no known relationship between the two, can only produce results that have zero credibility. The final version of the EIR made no further modeling changes.

The data for the 180-foot aquifer were, no doubt, corrupted. The question was whether the cause of the corruption was inherent model bias in the estimation of water levels, as Expert 2 claimed without verification, or something perhaps more sinister had occurred, such as manipulation of the data. The evidence supports the second answer.

Common practice among hydrogeologists in model "calibration" is to "adjust" values of unreliably measured independent variables (such as directional groundwater flow rates) in the estimation equation to reduce the relative error. Reducing the relative error by this means not only moves errors toward zero, but also moves estimates equally in the opposite direction to avoid altering the sum of each estimate and error, which is equal to an observed water level.

The movement of errors and estimates in opposite directions is what created the negative correlation between them that I observed as a sign of data tampering. The model itself, having been developed to have minimal error variation with zero estimate-error correlation, was not responsible for that bias; by tampering with data in their model calibration, Expert 1 and Expert 2 were sufficiently, if not solely, responsible. As Pogo observed, “We have met the enemy and he is us.”

Neither was the model itself responsible for other biases observed by Expert 2. Errors went up as estimates went down over time, for example, because during that time, water levels were going down. When they go down, estimates follow them down while, being negatively correlated with estimates, error go up. Other biases observed by Expert 2 were likely also due to the negative correlation between errors and estimates caused by model calibration.

Model calibration may be acceptable in hydrogeology if the altered data are subjected to a weight-estimating process like the one that created the model in the first place and produced water-elevation estimates that were uncorrelated with errors. Subjecting the altered data to that process probably would have erased the biases that led Expert 2 to replace a tested and improvable model with one having implausible and untested applicability to make predictions of project impacts. Inexplicably and unfortunately, both Expert 1 and Expert 2 failed to do that, although that process today constitutes standard practice in hydrogeological modeling.

Epilogue

In addition to CPUC certification, the MPWSP needs a number of permits enabling its development. The most critical of these is a coastal development permit from the California Coastal Commission. In 2019, aware of project problems identified by Water Plus and others, including their own hydrogeological consultant, commission staff members recommended that it reject the utility’s application for the permit. Commission action remains pending.

This story is only an example. Statistics may have widespread use as a forensic tool, even in the legal world itself, where an amateur sleuth like me might turn out to be an actual one.

Additional information

Notes on contributors

R. A. Weitzman

Ron Weitzman received his BA and MA from Stanford and his PhD from Princeton. He has received a Stanford Honors Fellowship; Psychometric Fellowship of Princeton and the Educational Testing Service; and two post-

doctoral fellowships, from the National Science Foundation and the United States Public Health Service. He has served on university faculties in the United States, the United Kingdom, and Israel. His specialty areas are mental tests and survey statistics, and he has dozens of publications and two patents in those fields (one patent in each). He is a United States Army veteran.

From: susan schiavone s.schiavone@sbcglobal.net
Sent: Thursday, February 24, 2022 8:44 PM
To: Maluki, Safarina x5109 MalukiS@monterey.lafco.ca.gov
Subject: Public Comment to Commission - February 28 meeting

Please find attached my public comment letter to the Commission in regard to the Monterey Peninsula Water Managment District application, item number 10 on the agenda. Please include this in the Commission's packet for the meeting. Thank you!

February 24, 2022

Dear Chair Lopez and Commissioners:

The decision to deny Monterey Peninsula Water Management District's latent powers application violates premises for which LAFCO exists and promotes a disturbing decision-making process that has no place in governmental agencies that purport to make objective evaluations. Your biases and lack of rational decisions are several but I want to focus on only two.

Page 23 of your Policies and Procedures state, "…standards may be met by any of the factors enumerated in Section 566668 as follows." ***Section 56668(n) "Any information or comments from the landowner or owners, others, or residents of the affected territory"***

These criteria are misrepresented in your decision making. You pointedly chose to include in your written decision, *after the fact* of your biased verbal vote, only those letters which conformed to your decision. You focused on each one's possible concern. They were a minority of voices; 19 private citizen comments, along with some private organizations. Where is the fact checking, especially related to finances? Yet, you hold them up as truth. Your own consultants and staff determinations, along with honest participation by a public agency, were tossed aside. The Monterey Peninsula Taxpayers Association, Monterey Farm Bureau, the Chamber of Commerce, SAGE, or Salinas Valley Water Alliance, are private or pro-business organizations. **Most of these organizations/individuals are not "…residents of the affected territory" which is the service area for Cal Am**. Yet, they were given priority.

Nonetheless, the district clearly made an effort to mitigate any concerning losses they presented and provided information showing that even without the water supply charge funds, purchase was feasible; there was sufficient source water; and there would be no increase in costs to ratepayers in Cal Am's other satellite systems due to spreading costs throughout their rate base per their own CPUC driven policy. You ignored this.

Members of the public **that *are* residents of the affected territory (the service area for Cal Am)** clearly provided both comments and presented factual information as well. Over 130 personally written supportive comments were sent to the Commission, many with information, and from organizations, in support of the proposal. Letters to the Editor were also sent. All of these letters were simply awarded a one sentence mention and disregarded completely!

Members of the public **who are residents of the affected territory (the service area for Cal Am)** overwhelmingly showed up to participate in these hearings. Despite having their public comment time shrunken to only 60 seconds, they made their voices clear to the commission that they overwhelmingly supported approval, and why. Very few spoke against it. LAFCO must consider the interests of the voters who overwhelmingly approved Measure J and the residents in the affected territory. This fact is significant as compared to isolated comments from select local agency or business officials as this is the mandate of "voters, or residents of the affected territory."

The issue is simply whether to grant an agency its latent powers to move forward on a voter mandated action. It neither approves nor disapproves a buyout. This was not an election, not a judicial review of the law, or whether measure J should be enacted. Whether or not you personally opposed Measure J, it is a fact, and must be recognized and respected as local policy. The district has met all criteria and has offered to mitigate losses for those agencies who will be affected. This should be an adequate solution. The proposal should be conditionally approved so it can be moved to the appropriate judicial process for decision. I will point out, again, that in the **Cortese Knox Hertzberg Act: Section 56325.1. While serving on the commission, all commission members shall exercise their independent judgment** ***on behalf of the interests of residents, property owners, and the public as a whole in furthering the purposes of this division. Any member appointed on behalf of local governments shall represent the interests of the public as a whole and not solely the interests of the appointing authority.*** **This section does not require the abstention of any member on any matter, nor does it create a right of action in any person.**

Those commissioners voting no, and their stated reasons, went outside LAFCO's scope with issues unrelated to approving latent powers. Clear biases influenced the vote from anti-government sentiment to impromptu water policy comments, to untrue statements, many now codified in your final document, at the cost of the public good.

LAFCO is supposed to represent the good of the whole county. The 1% tax loss of a special district, which can be mitigated, should not override the greater good of the 91,717 residents (39,777 customer accounts) under Cal Am who pay those taxes, and also currently pay the highest water bills in the country. Please reconsider your decision.

Sincerely,
Susan L. Schiavone
Seaside

From: Marli Melton marlimelton@yahoo.com
Sent: Thursday, February 24, 2022 9:53 PM
To: Maluki, Safarina x5109 MalukiS@monterey.lafco.ca.gov
Subject: Reconsideration of MPWMD Application

February 24, 2022

To: LAFCO Commissioners and Staff c/o the Clerk of the Board

Re: Reconsideration of MPWMD Application

The following questions remain unanswered and cast doubt on the wisdom of LAFCO's vote to deny conditional approval of the Monterey Peninsula Water Management District's application:

1. Commission Chair Lopez said one of the main reasons for his denial of the District's application was to protect the people of Chualar. Did LAFCO seriously consider the needs of poor people in Seaside and elsewhere on the Monterey Peninsula? Chualar has a population of about 1,512 people, of whom approximately 350 live in poverty. All of the people in Chualar are currently (and rightfully) receiving very low water rates that are strongly protected on an ongoing basis by the Public Utilities Commission, a very powerful state agency.

Seaside has a population of 33,646 people, with 4,475 living in poverty. **Why should those in poverty in Seaside (more than 12 times as many as in Chualar) continue to pay the highest water rates in the nation?** LAFCO should not require poor people on the Monterey Peninsula to continue to suffer in order to further protect people in Chualar or the other outlying districts. People in Chualar are already protected, and Dave Stoldt's letter shows there are much better ways to keep rates affordable in outlying districts.

2. LAFCO Commissioners seem to be unaware that water system assets do NOT appreciate in value the same way that commercial and residential properties often do, so tax losses from a public takeover would NOT increase over time. **Are LAFCO Commissioners also aware that Monterey County Assessor Stephen Vagnini recently provided new information that residential and commercial properties have increased in value so much (unlike the water system), that districts' tax receipts are likely to increase by $10 million annually -- far more than what's needed to offset a worst-case annual tax loss of $1.7 million?**

3. **Why did LAFCO claim the power to prevent MPWMD's Board members from fulfilling their legal roles and responsibilities?** MPWMD is one of Monterey County's most successful, award-winning, and respected public districts. LAFCO did not present any credible evidence, documents, or findings of board bias or incompetence. **Willingness to engage in a voter-mandated process is not bias.** The District's board members are quite capable of the critical thinking and due diligence needed to determine if a buyout is financially and operationally feasible and also will benefit the public. MPWMD's board can only proceed with a buyout if those conditions are met and well documented.

Sincerely,

Marli Melton, Carmel Valley

From: Rosa Salcedo <RSalcedo@ci.seaside.ca.us>
Sent: Friday, February 25, 2022 8:51:58 AM
To: McKenna, Kate x5016 <McKennaK@monterey.lafco.ca.gov>
Cc: Roberta Greathouse <Rgreathouse@ci.seaside.ca.us>
Subject: Letter of Support

Good morning,

Please find attached letter of support for reconsideration of Resolution No. 2022-01 from City of Seaside.

Thank you,
Rosa

OFFICE OF THE CITY MANAGER
440 Harcourt Avenue
Seaside, CA 93955
www.ci.seaside.ca.us
Telephone 831-899-6701
Fax 831-624-5839

February 24, 2022

Ms. Kate McKenna
Executive Officer, LAFCO of Monterey County
132 W. Gabilan St., Suite 102
Salinas, CA 93901
E-mail: mckennak@monterey.lafco.ca.gov

Re: February 28, 2022 LAFCO Meeting: Reconsideration of LAFCO Resolution No. 2022-01 Disapproving MPWMD's Proposed Activation of Latent Powers (LAFCO File #21-01)

Dear Ms. McKenna:

The purpose of this letter is to notify LAFCO that City of Seaside supports the reconsideration of Resolution 22-01 as it relates to the activation of the Monterey Peninsula Water Management District's (MPWMD's) exercise of its latent powers authority for the purpose of proceeding with acquisition of Cal-Am's Monterey Main Water System through negotiation or a condemnation proceeding in accordance with the provisions of Measure J passed by the electorate in 2018.

In accordance with the District's December 28, 2021, letter to the City of Seaside and the Seaside County Sanitation District, we look forward to completing negotiations with the MPWMD regarding tax loss impacts following the conclusion of LAFCO's decision on the reconsideration.

Sincerely,

Roberta Greathouse
Acting City Manager

From: bdmoore100@aol.com <bdmoore100@aol.com>
Sent: Friday, February 25, 2022 10:23:50 AM
To: McKenna, Kate x5016 <McKennaK@monterey.lafco.ca.gov>
Subject: reconsideration of vote on granting latent powers of MPWMD

Dear Ms. McKenna,

Please share my email with all of the LAFCO commission members.

I urge each commissioner who voted against approving the latent powers of the MPWMD to freshly reconsider their vote as is the appropriate course of action when voting on a motion to reconsider. I hope the comments submitted since the previous action will cause each member to rethink their previous vote and to approach their vote on reconsideration to keep in mind the specific responsibilities and duties they have as members of LAFCO. Those are what should control and guide their votes now.

I join others who have said that Mr. Gourley has shown he cannot fulfill his duties because he has a personal bias against public agencies that makes his vote against MPWMD tainted by him acting on the basis of his personal opinion rather than the facts.

Similarly, the issue of minor tax losses is not an reasonable basis for not approving the District's latent powers both because the District has said it will minimize or eliminate these losses and also because they pale in comparison to the negative impact of denying the District these powers.

Commissioner Lopez based his negative vote on his concern for water rates in Chualar, but those lower rates are protected by the CPUC. Moreover, the burden of the exorbitant rates Cal Am imposes on so many of its residential ratepayers is unconscionable. Pursuant to Measure J, if it is financially feasible, the MPWMD is bound to pursue a buyout of Cal Am. It is wrong for LAFCO members to thwart this measure that has such strong pubic support by misusing their position to deny the District's request.

The additional study of financial feasibility previously demanded by LAFCO, which resulted in unnecessary costs to the public, confirmed the previous study finding of financial feasibility. The LAFCO staff report recommended approving the District's latent powers in a well-reasoned analysis of the facts and the law. The refusal of those members who voted against the MPWMD have unreasonably ignored both of these and based their negative votes on inappropriate bases.

Please reconsider and vote to approve the latent powers. It seems inevitable that the public buyout will end up in court where the cost of the buyout will be determined and this is the proper forum. LAFCO has no business throwing up the roadblock it has by its previous negative vote.

Barbara Moore
Monterey