Agenda Correspondence received by the Basin Management Committee prior to the 6/15/2022 Meeting

LOSG Recommended Revisions for the 2021 Draft Annual Monitoring Report (AMR), with BMC staff responses, and LOSG replies to responses (6-14-22)

Key:		
LOSG Recommended revisions	BMC staff responses	LOSG replies to responses

Page 1—The goals of the monitoring program should quote the "Immediate Goals" of the Basin Plan. The goals statement mentions only one "immediate goal" and it misstates it (e.g., the first immediate goal of the Basin Plan is not the "prevention of seawater intrusion"—it's too late for that).

Misstatement corrected

Page 2—The "Seawater intrusion front" status (in brief) report is misleading and incomplete. Whenever the status is reported, it should include the caveat that it likely reflects localized conditions at LA10. We note that signs seawater intrusion retreat are also based on LA31, which is a mixed aquifer Zone C/D well, that is not likely accurate for Zone D. Further, the assertion that Zone E intrusion advanced toward LA12 is not supported by data. As this draft and the 2019 and 2020 ARMs acknowledge, not enough data points exist to know what is happening in Zone E (see further comments for Page 57).

Caveat added. Advance toward LA12? Text says LA11. The data (Appendix K) shows increasing chlorides at LA11 over time – an indicator of seawater intrusion.

We were likely thinking of the 2019 Adaptive Management TM's statement that seawater intrusion advancing toward LA11 could impact Well LA 12 "through upconing (rising into Zone D during pumping)" (Page 8). Our concern, as we state in our comment for Pages 57 and 58 below, is that Well LA12 is the only well identified in BMC documents as threatened by Zone E intrusion. In fact, all lower aquifer production wells are threatened.

Page 2—The "Basin Yield Metric" status statement is incorrect and misleading based on changes in the sustainable yield definition and value last year. Although the BMC approved the changed sustainable yield value for 2022, the BMC did not find at the time that the old sustainable yield and estimated BYM of 2760 AFY were correct and still in effect. This status statement should report the new definition and value and state that the metric has not met LOBP goals since 2016. It would more accurately represent and the status of the Basin and actual sustainable yield and BYM to agencies and other stakeholders receiving the report.

The old SY value is correct per the original methodology and remains in effect until 2022. The upcoming change is mentioned.

We continue to say the statement is incorrect and misleading. The BMC determined that the original methodology was not consistent with the Stipulated Judgment, the sustainable yield value of 2760 AFY had not been approved, and the sustainable yield definition was not consistent with accepted definitions—and the BMC revised all three. The BMC would report Basin conditions based on a methodology and metric value that were not approved, or a sustainable yield definition in consistent with accepted definitions.

Page 2—The "Water Level Metric" status statement and metric value require corrections and qualifying statements for at least three reasons, e.g., 1) the metric data, like other water level data, does not appear to be back-dated based on resurveyed reference points.

Metric graph and hydrographs are backdated.

Page 72 of the draft indicates that metric data has been adjusted stating that the survey "resulted in a slight decline the Water Level Metric well elevations of 0.014." This would have to be explained since the survey resulted in water levels at LA16 increasing by almost 2', which would mean a .4' average increase in data from 2016 to 2020,

The former elevation for LA16 was 106.82 in NGVD 29, which is 109.62 in NAVD88. The new surveyed elevation is 108.74 in NAVD88, so there was a decline of 0.88 feet for that well. The resulting decline in average Water Lever Metric well elevations is 0.14 feet (47.473 average Metric elevation prior to correction, 47.329 with correction). The 0.014 in the report text is a typo, should be 0.14 (corrected).

and 2) the elevation reference point and data at Well LA3, like LA3 data in the 2020 draft, are not consistent with data in Table 5. We explain (see "Page 57" comment) why we think the metric overstates values and does not represent an improvement over 2020.

LA3 elevation needs to be corrected in table text, but the correct elevation was used for WaterLevel Metric Calculation (also see "Page 57 comment")

We understand how the backdating was done, but still have concerns about LA3 (why the raising of the elevation point was reported in 2015 but didn't happen apparently until 2018, and why data tables continue to report the reference point incorrectly. The errors we highlight support the need for a formal quality control program with third party review (other than by the LOSG). (Also see comment for Page 21).

The status statement should also report how much the metric has improved toward the target since 2015—since a purpose of the AMR is to report progress toward goals.

Progress in the metric over time is discussed and shown in main text of the AMR, will consider expanding summary for 2022.

What is not shown or explained, but should be, is that the Water Level Metric has risen from .6' to 2.1' in six years (2015 to 2021), and at that rate would not reach the 8' target until sometime around 2040. This timeframe supports use of the revised sustainable yield and BYM 80 (1904 AFY) to report conditions. The revised BYM 80 would indicate that Basin-wide production has not yet been reduced to below the BYM 80. The Basin Plan estimates that water levels will rise to 8' within about 10 years of production falling to below the BYM 80 (Page 108).

Page 2—The "Chloride Metric" status statement, like the seawater intrusion front statement, should include the caveat that it likely reflects localized conditions at LA10. Clearly, the statement should not report "an improvement." The 3 mg/l per liter of chlorides change since 2020 is well within a margin of error, given the significant problems with LA10 data acknowledged in the Annual Reports. Again, improvements in the metric result since 2015 and progress toward target should be stated.

In lieu of caveats on the metrics, a footnote in Table ES-2 was inserted to note the upcoming revisions to the Water Level, Chloride, and Nitrate Metrics. The assignment of "improvement" or "deterioration" is a simple indicator to let the reader know the implications of the direction of metric movement. Progress in the metrics are discussed and shown in the main text.

Our point is that the Chloride Metric is not accurate enough to identify a significant change in conditions, let alone a minor change in conditions. Further, the metric is not accurate or reliable enough for a reader to draw conclusions about future conditions or the direction of the metric (i.e., it does not "let the reader know the implications of the direction of the metric").

Page 2—The summary of "recommendations for improving the quality and availability of data" should include mention improvements to the Chloride and Water Level Metrics and the addition and modification of wells. These improvements are more relevant to the monitoring report than an update of the "Maximum Sustainable Yield" and Basin model mentioned.

Recommendations added. The update to the Maximum Sustainable Yield is an important task that would revise the estimated benefits to Basin yield for each of the LOBP programs (using the new methodology). This task would support decisions to make any changes in infrastructure planning (adding a third Program C well, for example).

Page 3—Table ES-2 should be modified per comments for Page 2 above, e.g., the Basin Yield Metric should be reported using the revised sustainable yield definition and BYM values.

The revision does not affect 2021 SY/BYM estimates. Comments of the upcoming change are provided

We disagree. Revisions to the SY/BYM would result in a BYM value of 84 (2000 AFY current production /2380 AFY revised sustainable yield).

Pages 8 & 10—The purpose and basic elements of the monitoring program as stated are too narrow and limited. They should, for instance, state that the purpose of the program is to provide and constantly improve an understanding of the Basin setting in order to better inform decision making. This section should also provide information on the "three main" water supply aquifers (Zones C, D, and E) rather than considering Zones D and E one aquifer. It should also provide information on surface water interconnections, e.g., with Los Osos Creek. Also, the programs should be used to set and verified measurable objectives to address undesirable conditions and the threat of undesirable conditions throughout the Basin.

Expanded language will be considered for the 2022 AMR.

To clarify, what we are recommending is that the purpose and objectives of the monitoring program are expanded consistent with SGMA. The change would include the development and addition of measurable objectives for all sustainability indicators consistent with SGMA and Special Conditions 5 & 6 of the LOWWP CDP, e.g., measurable objectives for water in storage Basin wide, and water levels and water quality Basin wide and/or within management areas such as the new pumping center in the lower aquifers (the commercial area east to the creek). The monitoring program would be upgraded to quantify and conclusively verify achievement of objectives.

Page 10--The two paragraphs above section "2.2.1 Water Level Monitoring" should explain that many more dedicated monitoring wells are needed to improve the system—e.g., adequately track water levels and water quality Basin wide. The paragraphs should further explain that use of municipal wells and private wells have significant limitations, including limited access (private wells) and mixed aquifer screening and pumping interference (municipal wells). When use of private wells are mentioned, the limitations should be mentioned, including the number of private wells with restricted data or collection access.

Expanded language will be considered for the 2022 AMR.

Page 14—The last paragraph should state that Zones D and E are two separate aquifers, which may have some communication (since conditions are different in each aquifer). This paragraph should also recognize the fact that at least two major supply wells including LA 20, LA21, and the new expansion well being installed by the LOCSD, will be screened partly in Zone E. Also, the immediate goals of the Basin Plan should be cited as the goal rather than a modified version ("to halt, slow, and/or reverse intrusion"). This sounds as though the goal may now be to only "slow" seawater intrusion when the BYM target of 80 is intended to reverse it in both lower aquifers to the estuary.

Expanded language will be considered for the 2022 AMR.

Page 17—Constituents of Emerging Concern should include the class of chemicals referred to as PFAS and any other CEC's that threaten to reduce beneficial uses of the Basin or cause harm to people or the environment.

Modification of CEC's to be considered with BMC Staff input for 2022 AMR.

Pages 19 & 20—The list of "Additional Basin Studies" should include the evaluation the BMC authorized to review sites and add additional wells.

Included (part of well modification study).

Page 21—The Field Methods section should explain that BMC management does not have a quality control program or procedures in place that ensure monitoring methods and protocols are followed and data is reviewed for accuracy. The section should also explain how the BMC's monitoring and data control protocols and related practices compare to SGMA requirements or another set of respected protocols and accepted practices. Looking over the data, we've come across several obvious errors in the past, in addition to anomalies and inconsistencies that raise questions about data accuracy and indicate a need for better quality control.

BMC Staff has not requested a formal quality control program to date. Monitoring methods and protocols for the BMC program (Appendix E) are from authoritative sources (USGS and DWR) and comparable to County practices and methods submitted in local Groundwater Sustainability Plans. SGMA legislation does not require specific quality control procedures. CHG staff are experienced and perform quality assurance procedures during fieldwork and quality control during report preparations, including independent review of data entry. Not all “errors” pointed out by LOSG comments are, in fact, errors.

SGMA legislation (23 CCR Section 352.2 “Monitoring Protocols”) requires monitoring protocols to be reviewed by a Groundwater Sustainability Agency (GSA) “at least every five years as part of the periodic evaluation of the Plan and modified as necessary.” SGMA legislation (23CCR Section 352.6. “Data Management System”) and related BMPs call for “a description of the quality assurance and quality control checks performed on the data being entered.” As we understand the SGMA process, the protocols and data management system would be reviewed by the DWR as part of the five-year reviews.

The BMC should implement formal quality assurance and control procedures, and the procedures and protocols should be reviewed periodically by a third party. We’ve identified quite a few errors this year and last, some of which we are reporting for the first time in these replies to staff responses. For instance, data for LA3 in fall of 2018 are anomalous (i.e., water levels more than 5’ above all other data for the well are unlikely), and the LA4 fall 2021 data are also anomalous. The elevation reference point for LA39 in Appendix C doesn’t match the reference point data in the 2020 Annual Report (e.g., Table 8).

In general, we are concerned that the BMC monitoring program produces poor data quality for multiple reasons, e.g., wells with mixed aquifer screening, human error, and bias. For instance, adjusting data at LA10 due to an uptick in pumping does not inspire confidence. It raises the question of how many other production wells had an uptick in production but weren’t adjusted. SGMA BMPs state that municipal supply wells should be replaced with dedicated monitoring wells and that mixed aquifer wells should be “avoided.” About half of the lower aquifer water level monitoring wells are production wells (mostly municipal supply wells), about a third are mixed aquifer wells and/or have well-bore leakage. Additionally, about a third are in localized mounding areas, which can also adversely affect water level and/or chloride data. As mentioned, water levels may also be unreliable due to seawater intrusion.

Page 21— The “Elevation Datum” section should explain that historic data was not updated and has been incorrect since 2015 by on average about 2’ per well. Water level data should be backdated to provide a better understanding of water level trends, problem areas, and any problems with data (e.g., questionable reference point survey results—see Pages 45-52 comment).

The elevations have not been incorrect as described above. The wells were simply surveyed in two different datums historically, which were listed for each well in prior AMRs. From 2015 through 2020, adjustments to the NGVD 29 elevations were made before contouring and storage calculations. Water level hydrographs are backdated.

This response is incorrect—water levels have been incorrect since 2015. Appendix E of the 2020 Annual Report and Appendix C of the 2021 Annual Report show how much the 2020 and 2021 surveys changed reference points. Past data is incorrect by an equal amount if the original data were expressed in NAVD 88, and it was incorrect by an amount greater than or less than 2.8' (the amount subtracted from NAVD values to find NGVD 29 values) if the original data were expressed in NGVD 29. We were incorrect in saying the changes averaged about 2.' The average error is closer to 1,' which is significant, given that the Water Level Metric has increased relative to its 8' target by1.5' in six years).

Pages 26 & 28—Tables 5 and 8 should have the elevation reference point for LA3 listed as 19.47' changes to 23.89.' If 19.47' is accurate, the Water Level Metric is not accurate and if 23.89' is accurate, then the elevation reference point for years 2016 through 2018 should be corrected or clarified, as well as the footnote on the 2016 data tables (also see Pages 57 & 58 comment).

23.89' is correct beginning in 2019 (wellhead raised). This update is applied to the County database every year and was missed in the draft text this year – the metric calculation uses correct elevation.

This does not explain the footnote in the 2016 Annual Report, which indicates that the County raised the wellhead that year, or why the same error appears in this year's draft (i.e., why the update was not added to the BMC's database). The error argues for a quality control program. Also see our reply to Page 21 comment above. As mentioned, fall 2018 data for LA3 is also anomalous suggesting an error.

Pages 33 & 34—Tables 10 and 11 show nitrate levels for LA10 to be 2.1 mg/l. According to the Appendix J of the 2018 AMR (Pages 3 and 4), 2.1 mg/l indicates well-bore leakage. To calculate the spring 2020 chloride metric value, a chloride value of 320 mg/l with nitrates of 2.1 was replaced with 250 mg/l of chlorides with 2.0 mg/l of nitrates (see 2020 AMR, Page 71). The substitution produced results inconsistent with expected results (less upper aquifer influence is assumed in Appendix J to result in higher chloride levels). However, our point is that 2.1 of nitrates resulted in a substitution. Our more basic point, which we further explain in the Page 57 comment below, is that Well LA10 data and the Chloride Metric are unreliable with or without consistent use of the methodology (e.g., since nitrate data is variable relative to chlorides).

The spring 2020 substitution was an effort to mitigate a localized spike in chloride due to increased pumping prior to the sampling event. The 250 mg/l value was considered more representative of spring 2020 conditions (with nitrates at 2.0 mg/L)

This response reinforces our basic point that data substitution for LA10 does not follow a methodology and is unreliable because the decision on what and when data is substituted rely too heavily on the discretion of the person substituting data.

Page 35—Table 12 should include the class of chemicals referred to as PFAS.

Pending BMC consideration for 2022

Page 36—The last paragraph should also say whether the sucralose concentrations at FW6 prevent or reduce beneficial use of the water in the area including for ESHA.

Text added with respect to drinking water regulations.

Page 37—The Geophysics section should discuss all limitations and potential error of the logs. For instance, the logs are provided triennially and do not "correspond to the 250 mg/l chloride concentration isopleth." Therefore, they are apparently not effective for early detection of intrusion or for setting and confirming seawater intrusion objectives. We note that logs provided in an appendix include disclaimers suggest the logs have substantial uncertainties and margins of error (see 2021 Draft AMR, pdf Page 253).

Expanded language will be considered for the 2022 AMR.

Page 38—The discussion of water use should point out that purveyor use shows no overall reduction since Basin operations began in 2015, despite conservation being a key program. Of course, this poor showing was because neither the County nor BMC followed through on the Basin Plan proposed Basin-wide program and related commitments and requirements (e.g., Special Condition 6 of the LOWWP). The discussion of water use should also point out that the only decline in overall use has been due to estimated declines in private well use—i.e., declines on paper rather than declines verified by data.

The text already notes that purveyor use declined through 2016, and has fluctuated since then. Text has been added indicating declines since 2015 are from estimated production values, not metered production.

The text should be specific that purveyor pumping has not declined since 2015 and has gone up in the Western Area since a key reason for publishing the Annual Monitoring Report is to update the Court and other stakeholders on the results of BMC actions and the implementation of the Basin Plan.

Page 39—If unmetered water use is 50% of water use, then uncertainty is much greater than 5%. The estimated reduction in ag use alone is 5% (see related LOSG comments for the 2020 draft AMR).

The LOBP compared the uncertainty in unmetered production (given as +/- 10 percent) to 5 percent of the sustainable yield in 2012. The reduction in ag use was due to a reduction in irrigated acreage. Nevertheless, we can update the LOBP statement for 2022 AMR

(BMC staff review needed).

It should be added to this year's draft.

Page 39 and 40—The discussion of groundwater production should point out that pumping of the lower aquifers has gone down only slightly less than 100 AFY on average in the past five years (since 2017) and that lower aquifer pumping in the Western Area has gone up slightly since 2017.

Text added.

Pages 42 & 43—Los Osos Landfill annual rainfall data should be used for the model at a minimum. The record at the official County station in the area is over 15 years long and the average annual rainfall at is 15.97," more than an inch below the annual rainfall assumed in the Basin model. The statement that the Los Osos Landfill record can be used once it "becomes more representative of long-term climatic conditions" represents a mode of planning that become obsolete with climate change. Last year, despite worsening drought conditions, the BMC reduced the assumed rainfall for the model from 17.5 inches/year to 17.3 inches/year showing that it places a greater priority on maximizing extractions from the Basin protecting the resource. A more precautionary approach is justified and essential for a Basin suffering from 40 years of severe overdraft.

The model does use the Los Osos landfill data – it correlates the data to the long-term record at Morro Bay. We have been through more cycles of drought in the last 15 years than normal. Global climate model outcomes do not show less average rainfall on the central coast at mid or late century.

This response reinforces our point—the methodology used to calibrate the model for rainfall is out-of-date since climate change represents a new "normal." By the time the 12.3" average is realized (sometime after mid-century if then) the damaging effects on the Basin will be irreversible--if the BMC continues to base key decisions primarily on best-case modeling projections rather sufficient good-quality monitoring data and physically measurable objectives.

Pages 45-52—The Water Level Contour mapping and water in storage discussions should point out that there are not nearly enough water level monitoring wells to reliably track lower aquifer water levels in the Western and Centrals Areas of the Basin, especially in the northern part of the Basin and the western part of the Central Area. For instance, on Figure 11, spring lower aquifer water levels for the entire northern Basin inland from the estuary appear to be based on one or two data points. Even along the estuary, where the Basin is most vulnerable to seawater intrusion, there are only three data points. There are also no data points to the south of Los Osos Valley Road along the historic intrusion pathway or through the entire commercial area, and just one data point between the commercial area and Los Osos Creek.

There is a need for more monitoring locations in Los Osos, and additional sites will be recommended.

Keep in mind, however, that the density of water level monitoring data points per square mile in the Los Osos Basin far exceeds that of other basins. The BMC monitoring program has close to 90 wells in a basin that covers about 10 square miles. By comparison, the Paso Robles Basin uses around 40 wells to contour water levels over an area of close to 680 square miles. The USGS recently proposed targeting a network of 30 wells to monitor water levels in the Adelaida Area of SLO County that covers about 230 square miles. The BMC network has two orders of magnitude more wells per square mile than the above examples.

We appreciate that the BMC staff is recommending additional monitoring sites. Several staff responses indicate that staff sees the need for the upgrades and also understands why sustainable management of the Los Osos Basin requires more wells (producing high-quality data) than larger Basins not experiencing serious seawater intrusion, water quality degradation, and other impacts. Nevertheless, we are including a brief response to the examples staff provided of monitoring programs in larger basins.

One reason the Los Osos Basin requires many more monitoring wells, including many new wells, is that it's a small Basin undergoing multiple changes and facing multiple threats simultaneously. The changes include the impacts from management actions, the installation of the LOWWP, and climate change. Some of the major changes resulting from management actions and the LOWWP are shifts in pumping inland and to the upper aquifer and the shift from dispersed recharge from septic systems to recycled water dispensed primarily in one location, at Broderson leach fields. The multiple climate change impacts include higher temperatures, less rainfall, less soil moisture, and rising sea levels. Additionally, the Basin is experiencing serious on-going seawater intrusion due to 40 years of severe overdraft, degradation of the upper and lower aquifers by nitrates, and chronically low water levels in some parts of the Basin. There is the real possibility that critically low water levels, seawater intrusion, and serious degradation exist in parts of the Basin that are not being monitored due to overdraft, climate change or management actions. All of these factors pose threats and create dynamic conditions that require more monitoring than larger basins because—especially in combination--they can result in greater and more rapid irreversible harm to the resource.

Eugene Yates, in his review of the Basin Plan, indicates that many more wells are needed for the monitoring program and metrics to track changing conditions (see 2014 Yates' Review, Pages 8-9). SGMA require monitoring programs to be capable of tracking dynamic changes, the effects of management actions, and potential adverse impacts on beneficial uses. It also requires monitoring networks capable of assessing all identified undesirable conditions and setting, and tracking progress toward, measurable objectives that quantify desired conditions. The six categories of undesirable conditions identified in SGMA (referred to as sustainability indicators) include "chronic lowering of water levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletion of surface waters" (see "BMP Monitoring Networks and Identification of Data Gaps" e.g., Page 6, on the DWR website).

A few of SGMC BMPs for water level monitoring include

- *Data must be sufficient for mapping groundwater depressions, recharge areas, and along margins of basins where groundwater flow is known to enter or leave a basin.*
- *Well density must be adequate to determine changes in storage.*
- *Data must be able to demonstrate the interconnectivity between shallow groundwater and surface water bodies, where appropriate.*
- *Data must be able to characterize conditions and monitor adverse impacts as they may affect the beneficial uses and users identified within the basin.* (See "BMP Monitoring Networks and Identification of Data Gaps" e.g., Page 6, on the DWR website).

Although the LOSG believes a change in Basin management to SGMA jurisdiction from its adjudicated status may be necessary to achieve Basin sustainability, it is the LOSG's position that minimum SGMA standards would have to be exceeded for a GSA to sustainability manage the Basin and meet the requirements of Special Conditions 5 & 6 of the LOWWP CDP. The density and distribution of monitoring data to monitor seawater intrusion is one area where minimum requirements may need to be exceeded, and setting objectives that reverse seawater intrusion and nitrate contamination is another area. (These two examples are not intended to be a complete list.) (Also see our letter of July 16, 2021 to the BMC for ways the BMC can align Basin management operations with SGMA and Special Conditions 5 & 6).

Pages 45-52-- Also some of the data points on contour maps Figures 11 & 14 appear to be incorrect. For instance, LA22 near South Bay Blvd. is shown in data Table 5 to be about -11.4' (NAVD 88), but in Figure 11 it is shown as "0." Similarly, Table 8 shows LA22 at -42' in the fall, but the water level is shown as 0' on Figure 14.

None of the data points noted are incorrect. LA22 is immediately adjacent to an active production well and water levels are significantly affected by localized pumping, so data from that well is not representative of basin static conditions and is not used in the water level contours.

We disagree. The contour map doesn't accurately show conditions. It should show lower water levels around LA22. The dramatic effects of a nearby private well on LA22 (lowering water levels to 42' below msl) represents present conditions would reasonably result in relatively general effects. The decision to ignore this data appears to be a significant change in past practice that should have been vetted. We see several problems with the practices of simply eliminating data points: 1) it leaves too much discretion to staff and/or managers and is susceptible to bias, 2) it would arguably eliminate most of the wells in the lower aquifer water level monitoring program (all the production wells and nearby observation wells), and 3) based on staff's response, the effects of private wells on the Basin, are, not being adequately tracked and they must be for sustainable management of the Basin.

SGMA BMPs state that municipal supply and Ag wells (presumably all production wells) should be replaced with dedicated monitoring wells and the BMPs recommend analyzing monitoring wells for influence from nearby wells (see "BMP Monitoring Networks and Identification of Data Gaps," Pages 9 & 10, on the DWR website). Overall, staff 's response highlights the need for more dedicated monitoring wells and a more intentional, well-planned monitoring program. SGMA requires GSAs to set monitoring program objectives and to carefully evaluate monitoring wells and plan networks to quantify and achieve objectives (see "BMP Monitoring Networks and Identification of Data Gaps," e.g., Pages 4, 7, and 8-10, on the DWR website).

LA15 is shown at -12.5' on Table 5 in the spring but appears as -5 in Figure 11.

There is actually another contour interval shown around LA15 on Figure 11 (the -10 contour) but it's too small to support a label.

The small contour interval around LA15 in spring of 2021 should be labeled, also the -15' interval around LA 39, which may also be present but too mall to label (LA39 appears in inside a -10' interval). These omissions, and the elimination of LA22 and possibly LA25 as data points--tend to minimize low water levels in the Basin. (We assume LA25 data are eliminated since the 2020 fall contour map shows the well within a small -30' interval and the fall 2021 map shows it within a larger -10 contour line.) (Also see the response above)

After further review of contour maps, we are also concerned that the fall 2021 lower aquifer map shows an uncharacteristic general improvement over spring levels. The significant apparent improvements should be reviewed for accuracy and explained since they are not consistent with low rainfall conditions or the increase in lower aquifer pumping in the Western Area in 2021.

LA12 also appears within a "0" contour line in Figure 11, but is -11.7' according to Table 5.

LA12 has a labeled -10-foot contour around it on Figure 11 (see LA12 location on Figure 4).

Further, LA6 appears to be incorrect, possibly due to problems with the elevation point survey, which raised levels by 6 feet. LA6 is shown as being an island of high water levels (about 10') surrounded by water levels about 5'. Historical data at LA6 shows it shut down between 2009 and 2014 due to seawater intrusion. Why it would be experiencing significant localized mounding--if it is—must be explained.

The old survey elevation was NGVD29, so the survey effectively raised the wellhead elevation by 3.8 feet. LA6 and LA16 actually have similar Spring 2021 water levels (LA6 was 1.4 feet higher) and are both downgradient of the Broderson site, which may provide some mounding influence (pressure transducers are now installed to help with this determination). There may also be some minor mounding effects from Upper Aquifer wellbore leakage.

This response doesn't explain the questionable LA6 data and, instead, reinforces the need for a quality control program. LA6 data is footnoted on data tables prior to 2020 with the caveat: "estimated elevation (assume NAVD 88)." Thus, LA6 data were assumed to be NAVD 28 not NGVD 29 from 2015 to 2019. This supports our point that the reference point (RP) may be incorrect since it effectively raises water levels at the well by 6' (actually 6.58'), about 5' above nearby well LA5. Our point is supported by a comparison of the 2019 and 2020 fall data for LA6 (3.5' and 10.6' respectively) and by a comparison of contour maps (Figures 14) in 2019 and 2020. The point is also supported by the fact that the RP survey raised water levels at LA5 by only .87' (LA5 has the same footnote on pre-2020 data tables). The staff response compares the questionable LA6 data to LA16 data. However, LA 16 is some distance away and the comparison doesn't explain why LA6 levels are 5' higher than LA5's. The comparison does point out that LA16 water levels are also higher than nearby wells. However, levels have been relatively high since 2016, which could be due to well-bore leakage (as staff suggests). Based on historical data (e.g., the 2005 Seawater Intrusion Assessment), LA16 is much more likely to have mounding due to well-bore leakage than LA6 since nitrates (NO3-N) at LA6 were under 3 mg/l and nitrates at LA16 were 10.36 mg/l. Thus, staff's response reinforces a general point we make in comments that water level data (and the Water Level Metric) are unreliable. The response also supports out point that not all contour lines are accurate on contour maps. Figure 11 should probably show LA16 within a 10' interval (although the data is questionable). Further, Broderson leach fields are not likely the source of mounding at LA6, LA16 or any of the wells in the area, since 2015 contour maps show that inflows from the south were present before the LOWWP went on line in 2016.

Page 52—As we suggested last year, the source of the groundwater moving into the Basin from the south should be explained, including its effects on water level and chloride data reliability--and also on water quality, especially if the water is flowing in from Cabrillo Estates since Cabrillo is still on septic systems.

Sources of groundwater inflow along the southern Basin boundary include percolation from the Broderson Site wastewater disposal site (since late 2016), return flows from Cabrillo Estates, percolation of precipitation, potential range-front recharge, and Los Osos Creek, all of which can contribute to a rising hydraulic gradient approaching the Basin boundary. Contouring software also tends to follow established patterns (gradients) toward boundaries. The Broderson site is a location that will be recommended for a lower aquifer monitoring well, and will help define local conditions. Water quality with respect to return flows from Cabrillo Estates is a topic that S&T is currently investigating.

The adverse effects on the Basin and beneficial uses of rising nitrates in the lower aquifers should be discussed in this Annual Report and evaluated and addressed in this Annual Report, also the adverse effects of localized mounding on water level and chloride data.

Page 52—Anther recommendation/request we submitted last year is that all water level metrics and other measures based on water data are expressed in the same datum and we suggested NGVD 29 since "0" is very near sea level. Currently, the Water Level Metric is expressed in NGVD29 and the contour maps are in NAVD 88. This is confusing to stakeholders and can be misleading. For instance, people looking at Figure 11, the spring lower aquifer water level contour map, might think no part of the lower aquifers in the Western and Central Area have water levels below mean sea level. In fact, the very large areas within "0" contour lines are about -2.8' (2.8 feet below sea level) and all other contours are 2.8 feet lower that the number that appears relative to sea level.

We can possibly contour the 0 elevation for NGVD29 in red, or switch the metrics to NGVD 88 as part of the current review process. Will consult with BMC staff for the 2022 AMR.

This should be done this year.

Page 52—The discussion of water levels on Page 52 states (at the ends of the first three paragraphs) that average seasonal water level declines are "followed by full water level recovery in the spring." This phrase should be removed or reworded since some wells have pumping depressions below sea level year-round, resulting in chronically low levels near the wells and extending out from the wells. For instance, water levels at community supply wells LA12, LA15, LA20, LA22, and LA39 never get above from about -2' to about -15' depending on the well. Further, the lower aquifers continue to have no water in storage above sea-level though water above sea level is an indicator of Basin health.

Reworded phrase.

Page 57—A discussion of seawater intrusion influence on all lower aquifer wells in the Western Area and even the Central Area should be included, including its effect on the reliability and accuracy of water level data. It is clear from transducer data that seawater influences Wells LA11, LA40, and LA41. Further, the Basin Plan indicates that wells LA11, LA14, and LA16 have been influenced by seawater intrusion in the past (see Pages 100 and 101). We note that these three Water Level Metric wells located in the Western Area. The other two, LA2 and LA3, are on the sand spit.

As explained in the AMR (page 57) the transducer data shows pressure loading and unloading from tidal action in the bay at LA11, LA40, and LA41. This is not "seawater influence" as normally associated with water quality impacts.

This avoids the issue. Our question—like the Basin Plan (Pages 100 and 101)--clearly refers to seawater intrusion influence on water levels in the lower aquifers. Based on the staff response, we assume BMC staff is not able to provide clear evidence that seawater intrusion doesn't affect water levels in the Basin. This and the Basin Plan further support a conclusion that water level data are not accurate or reliable indicators of seawater intrusion conditions—and, instead, may provide inaccurate or misleading information (e.g., rising water levels may indicate worsening condition rather than improving conditions).

Page 57—Regarding Zone D seawater intrusion contour mapping, how the addition of LA41 resulted in "a more westerly (improved) position" for the Zone D contour map (Figure 18) as compared to the 2020 contour map, would have to be further explained and justified. The contour is based mainly on LA10 data, which is acknowledged to have significant variability and not be representative of "broad intrusion front movement." The "refinement" may also be based on data from LA31. Based on the cross-section map, LA31, like LA10 is unreliable for Zone D, because it is a mixed aquifer well. (LA10 is a Zone D/E well and LA31 appears to be a Zone C/D well). Any estimated improvement in the contour is likely more than offset by the potential error in the data. Besides variability and mixed aquifer screening adversely affecting data, it is impossible to know if the fall chloride data for LA10 (from a sample with 2.1 of nitrates) is affected by well bore leakage. The multiple factors adversely affecting data—and the potential for the map to not accurately represent Zone D intrusion--should be further discussed and the review of the metric. Also, the need for more wells to better delineate Zone D intrusion should be mentioned in the discussion.

The westerly movement of the intrusion front resulting from the addition of LA41 to the contour data set has nothing to do with LA10 or LA31. The recommendation for additional monitoring locations to better delineate seawater intrusion in Zones D and E was mentioned.

Our main point is that an "improvement" should not be claimed due to the uncertainty of the metric and multiple factors adversely affecting data quality.

Pages 57 & 58—Regarding Zone E intrusion, BMC staff agreed with the LOSG in May of 2021 that Zone E intrusion "is a significant threat to basin sustainability and has been for decades" (see 5-19-21 BMC agenda packet, pdf Page 39, Item 1). This threat should be discussed, including the potential for wells in the commercial area to pull seawater further into the Basin and for the intrusion to upcone into Zone D wells (e.g., as indicated in the 2019 Adaptive Management TM and the LOCSD Program C Update TM, e.g., Pages 3 and 4). Due to the lack of sufficient wells to monitor Zone E, the discussion should point out that the direction and extent of Zone E is not known, but that the substantial increases in chloride levels at LA40 indicate substantial inflow that is degrading a substantial portion of the aquifer.

Text added with respect to LA40, along with statement regarding seawater intrusion threat to Zone E. Recommendations for additional wells are mentioned.

Thank you.

Suggesting that the intrusion is moving only toward Well LA12 (also see second Page 2 comment) based on rising chlorides at LA11 downplays the seriousness. The statement that the intrusion is "interpreted to be laterally pervasive in the Western Area…(and)…rising chlorides at LA40 and LA11 indicates worsening conditions over time" also tends to downplay the seriousness by suggesting the intrusion is not an urgent problem. Zone E intrusion could be moving in any direction or several directions. Without adequate monitoring, the movement of Zone E intrusion can't be assessed. The acknowledged threat to LA12 points out that it can threaten any or all Zone D wells. Based on increasing chlorides at LA40, it is more logical that the intrusion is moving in along the syncline than toward LA12, e.g., toward or along the historic pathway. The potential increased influence of Zone E on LA10 data could be a sign that intrusion in Zone E has intruded to the top of the aquifer adversely influencing use of the well. The statement that "There has been no evidence of further movement west of Palisades Avenue…based on the latest geophysics at LA14 and on… Zone E monitoring well LA32… "ignores the potential that seawater in Zone E is intruding to higher levels in the aquifer and could be moving under LA16 and/or to the south of LA16, LA15, and LA18 into the commercial area. It may even be moving into Well LA14, which is monitored with geophysics. Based on the discussion in the Geophysics section, the method is not sensitive to the 250 mg/l threshold for intrusion or intrusion precursors—100 to 250 mg/l. We're not sure why the BMC has not included LA5, LA6, LA13, LA14, and LA16 in the water-quality monitoring program since the wells are accessible and already part of the water level monitoring program. Though some of these wells have well-bore leakage and others have mixed aquifer screening, like LA10 they could provide information on seawater intrusion conditions in the Basin. These wells should be added to the water quality program in the short-term, and several new wells should be installed a.s.a.p.

As mentioned above, text added with respect to LA40 and threat to Zone E. Intrusion is already interpreted to have reached the top of Zone E near LA10 (Figures 19 and 20). LA32 is along the Basin syncline and would be directly in the pathway of Zone E intrusion between Palisades and the commercial area.

Eugene Yates, in his 2014 review of the Basin Plan, states that seawater intrusion can move around wells and he provides an example (see Yates' 2014 Review, Pages 8 & 9). Regarding the three-dimensional depiction of Zone E, the cross-sectional map is only speculation absent adequate monitoring. Having new wells in the pathway (e.g., near LA 16, LA15 and LA18), and to the north and south of the pathway, especially if the new well(s) include geophysics, could avoid a disaster by providing early detection and needed verification of Zone E movement.

We understand that purging Wells LA5, LA6, LA13, LA14, and LA16 to monitor water quality (e.g., chlorides) wastes precious water. We recommend that all water from purging any well in the monitoring program is collected in a tanker truck and reused. This should also be done for testing of hydrants. Another idea we had—through we're not sure it's feasible—is to install a small diameter pipe in one or more of the above wells to use for sampling, which may also remedy contamination from well bore leakage at some wells.

Pages 62-65—The considerable uncertainties of groundwater in storage estimates should be discussed, and the need for more monitoring to measure actual water levels throughout the Basin, especially the lower aquifers in the Western and Central Areas, should be stressed. The lack of sufficient wells and fact water is storage estimates are based on contour lines, makes the estimates highly uncertain, and it appears to us arbitrary (e.g., where contour lines are drawn). Several other issues relative to groundwater in storage should also be stressed: 1) that there is no water in storage above sea level which makes the Basin vulnerable to seawater intrusion and future droughts, climate change impacts, and even management actions such as moving wells, 2) that water in storage above sea level is an indicator of a Basin's health and sustainability, 3) that water in storage above sea level in the Upper Aquifer may be needed to stop seawater intrusion and is likely to take time to develop, 4) that setting a measurable objective to reverse seawater intrusion in the lower aquifers in necessary for Basin sustainability, and 5) that setting objectives to reverse seawater intrusion in the Western area would also build reserves (water in storage) that could be used during droughts, etc., while providing a freshwater barrier to preserve beneficial uses, e.g., all supply wells.

A groundwater storage sensitivity analysis was performed for the 2017 AMR (Appendix J). Even under pre-development conditions and pressures that mitigate seawater intrusion, there would be little groundwater storage above sea level in the Lower Aquifer. To be sustainable, water pumped from the Lower Aquifer in the Western and Central areas needs to be replenished by an equal amount of leakage through the Upper Aquifer, boundary inflows, or inflow from the Eastern area. Expanded discussion with graphics with respect to storage above sea level is planned for AMR 2022.

The response seems contradictory. Raising water levels in the Western Area to reverse seawater intrusion requires raising water levels to above mean seal level, which increases water in storage in the Western Area—although along the seawater interface, freshwater would also be flowing out when levels are high enough. Your point seems to be that water levels wouldn't have to be raised to above sea level in lower aquifers inland to reverse seawater intrusion. Our point is that having water in storage above sea level Basin wide is needed to reverse seawater intrusion in both aquifers, avoid salt build up, and provide a buffer against climate change—i.e., sustainable Basin management. Consistent with SGMA, an objective therefore should be set to increase water in storage Basin wide. Water in storage above sea level in the Upper Aquifer should not be assumed to be surplus water or water available for development, but should be used to help bring up levels in the lower aquifer (e.g., by offsetting outdoor use), ensure adequate outflows, and provide a buffer against climate change-- also to provide flows to habitat.

Page 66—The second paragraph under "Basin Metrics" discusses the changes in the Basin sustainable yield definition and value that the BMC approved in 2021. As stated, these changes, including the revised yield of 2,380 and BYM 80 target of 1904 AFY, should be applied in the 2021 report since they represent a sustainable yield value and definition, and a pumping target, more consistent with accepted practice. As we have pointed out, the revised sustainable yield would continue result in undesirable effects (continuing threats of Zone E to wells and the Basin), and the BYM 80 should be set as the "sustainable yield" as a starting point (until sufficient high-quality data is available to accurately assess seawater intrusion conditions and the effects of management actions). The discussion explains that the methodology sets "...a condition that no further inland advance (of intrusion) is allowed from threshold lines drawn parallel to the coast that represent the current (2021) position of the seawater intrusion front in the Lower Aquifer." As we have pointed out, there are not enough wells producing good quality data now to establish the locations of fronts in Zones D and E or to set and confirm measurable objectives that would verify the management actions are achieving the objectives. These issues should be discussed.

Changes in the sustainable yield methodology were adopted for 2022, and mention of this is made throughout the annual report, including the likelihood that the BYM would fall below 80. The need for additional monitoring wells has been stated.

A point we've made in comments to the BMC, we'll repeat again--the BYM 80 should be the sustainable yield. Eugene Yates points out in his 2014 review of the Basin that pumping at the BYM 80 is necessary to raise water levels in Zone E high enough to result in outflows from the Basin and to avoid salt build up. He states that it is also needed to stop seawater intrusion in Zone E at the lowest levels, and he and the Basin Plan state that the BYM 80, based on the model, would reverse seawater intrusion in Zones E to under the estuary removing its threat to wells (see Pages 110 & 111). We'll also point out that drawing straight lines to represent the present location of seawater intrusion fronts, which the BMC refers to as "minimum thresholds" for seawater intrusion, still allow seawater to move into the Basin laterally, causing loss of the Basin (i.e., undesirable effects).

Page 69—The second paragraph mentions that the peer review in 2010 indicates that the model "would benefit from updates as more data is collected" and the Stipulated Judgment requires a peer review every 10 years. However, the 2021 draft also continues to use modeling projections without the 2021 updates and the 2021 draft recommends that the peer review is not completed until after the model is upgraded to a transient model. The LOSG has pointed out that the transient model is not likely to significantly improve the model as a planning tool unless there are many new monitoring wells to better understand basin conditions (e.g., water levels, the movement of groundwater, and Basin structure) and the effects of management actions. We have also pointed out that the model is being relied on too heavily now for key decisions (e.g., deferring programs) that are not supported by sufficient data. We have suggested that BMC priorities should be on implementing Program C and a strong conservation program for the current population as proposed in the Basin Plan, in addition to improving the monitoring system, and implementing measurable objectives based on improved monitoring. The need for better data relative to modeling and measurable objectives should be discussed.

Comment noted. Transient modeling will benefit from data collected since implementation of the wastewater project, such as Broderson mound development and the continued rise on Lower Aquifer water levels.

Page 70-72—The Water Level Metric has several issues that make the metric unreliable and/or inaccurate (not representative of conditions in the intrusion-impacted Western Area of the Basin). These include 1) too few wells, 2) inadequate well distribution and density, 3) wells producing poor quality data, and 4) problems with the data as presented. The metric includes one well in the northern Basin (LA11), two wells in the historic pathway (LA14 and LA16) and two wells on the sand spit (LA2 and LA3). This leaves significant gaps in coverage where water levels effects on water levels could differ substantially from the effects on metric wells. Furthermore, Wells LA14 and LA16 are mixed aquifer wells, so the data is not reliable for Zones D or E leaving a major gap in the pathway in both Zones D and E, and the only aquifer-specific metric well is LA11, a Zone E north of the pathway. LA11, and likely LA2 and LA3, are unreliable due to seawater intrusion influence. In fact, all of the wells in the Western and even some in the Central Area may be unreliable due to seawater influence since the Basin Plan cites LA11, LA14, and LA16 as being influenced by seawater intrusion historically (see Pages 100 and 101).

A revised Water Level Metric with more wells and better distribution is under review by

BMC staff.

Further, the data presented for LA3 will need to be explained. Last year, we pointed out what we believed to be an error in the metric based on spring water level data in the draft report, and we received the following reply:

The 2020 water level metric is correct (1.8 feet). San Luis Obispo County raised the wellhead at LA3 by 4.42 feet, and the updated RP elevation will be reflected in Table 5 of the 2021 report. All the calculations and contours use the correct elevation.

Subsequently, the elevation reference point for LA3 was changed in the final 2020 AMR from 19.47' to 23.89'. This year, there is either the same error in Table 20 (i.e., a number inconsistent with water level data on Table 5.) or the data on Table 5 is the correct data and Table 20 overstates the elevation at LA3. The reason we think the data and reference point in Table 5 of the current draft are correct, is that the 2016, 2017, and 2018 AMR final drafts have the same elevation reference point and the footnote on the table in 2016 indicates that data accounts for the County's "adjustment for raising (the) wellhead." Further, the other well the footnote applies to, LA1, has no later changes in the elevation reference point. The LA3 reference point is changed in 2019 and 2020 to 23.89.' LA3 water levels in 2016-2918 are also based on the elevation reference point of 19.47. Therefore, if 19.47' is incorrect, LA3 values and related metric values would apparently have to be backdated, in addition to all line graphs and analyses. This inconsistencies with this data will have to be explained, and documentation of what has happened at the well should be provided.

The wellhead at LA3 was raised in February 2019 from 19.47' to 23.89'. This update is applied to the County database every year and was missed in the draft text this year – the metric calculation uses correct elevation.

See related responses to Page 2 and Pages 26 & 27 comments above.

Pages 72 & 73—The Chloride Metric also has several issues that make the results unreliable and/or inaccurate. One of these is the insufficient number of wells and larges gaps in the metric, especially for Zone E, due in part to poor quality data. We discussed some quality issues in comments on water contour mapping above, most of which AMRs also acknowledged (variability and related unreliability for monitoring general conditions, well-bore leakage, and mixed aquifer screening)—mainly stemming from problems with LA10. Further, it is not possible to eliminate the problems at LA10 with a data substitution method as implemented in 2017, 2018 and 2020, or with a pumping/collection protocol as implemented apparently in 2019 through 2021. These measures have their own limitations and unreliability/inaccuracy issues, including that nitrate data has considerable variability relative to chloride data, so substituting data based on nitrate levels is unreliable. The pumping/collection protocol results in unreliability due to variability in operator schedules and needs, as shown by the decision to substitute data in 2020 due to too much pumping prior to the spring sampling. The protocol also undermines the basic strategy for reversing seawater intrusion—the reduction of pumping in the Western Area. Thus, to state that a 3 mg/l improvement in the metric, indicates "an overall improvement during 2021" is not supportable and it is misleading (e.g., it does not reflect that seawater intrusion conditions in Zone E are worsening).

A revised Chloride Metric with more wells and better distribution is currently under review by BMC staff.

Page 74—The Nitrate Metric highlights a shortcoming of all the monitoring metrics. The Chloride, Water Level, and Nitrate Metrics all provide average values, which provide limited information about conditions and can be misleading. The Nitrate metric has improved, but this is almost entirely due to improvements at one well. SGMA requires water level and water quality objectives to be based on quantified minimum thresholds at each well in a series of wells. The SGMA metric requirement better represents conditions in management areas and Basin wide. This shortcoming of the metrics should be discussed for all the monitoring metrics. Also, it would be helpful for planning purposes if timelines for improvements in water quality in specific parts of the Upper Aquifer and Basin in general were estimated using the model to make management of the upper aquifer more effective and to determine the best use of recycled water. Currently, most if it is being discharged at Broderson leach fields. Offsetting potable water use or blending some upper aquifer water for injection and replacing the groundwater with recycled water via leach fields may be a more effective use of recycled water.

A revised Nitrate Metric with more wells and better distribution is currently under review by BMC staff.

Conclusion: We did not have time to complete a full review of the AMR draft and reviewed only to Page 74. The LOSG is providing this input to explain some ways the Annual Report can provide stakeholders more accurate, complete, and useful information regarding the status of the Basin to aid in a fuller understanding of conditions and options. We do not intend to imply that by making some or all of the changes we suggest that the BMC will correct all of the problems we see with the present Basin Plan, Stipulated Judgment, and BMC practices and policies. In general we believe that, for Basin management to stop and reverse seawater intrusion and make other necessary improvements for a sustainable Basin, the management approach would have to be much more data-driven and outcome-based consistent with SGMA and with the Coastal Commission's requirements (e.g., that County must show with "conclusive evidence" that additional development can be supported by the Basin before it is approved. The BMC process now primarily a model-driven approach, in which key decision-making is based on theoretical future outcomes (e.g., that certain programs, mainly infrastructure programs, will increase the sustainable yield). We support substantial upgrades to the monitoring program, the development of measurable objectives based on high-quality data that address all undesirable effects on beneficial uses of the Basin, and a focus on maximizing conservation, recycled water use, and the most cost-effective infrastructure programs Basin wide, with costs and participation in programs spread Basin wide. To obtain grant funding and achieve these goals and Basin sustainability, Basin management may have to be shifted to SGMA jurisdiction.