



— BUREAU OF —
RECLAMATION

Peer Review Report – Implementation Effects of New Area and Capacity Surveys for Lake Mohave and Lake Havasu

Originating Office

Bureau of Reclamation, Lower Colorado Basin Region, Boulder Canyon Operations Office, PO BOX 61470, LC-4600, Boulder City, NV 89006-1470

Reclamation Roles

Director or delegated manager: Genevieve R. Johnson, Acting Regional Director, Lower Colorado Basin Region.

Peer Review Lead: Erin Orozco-Whitaker, Hydrologist, Lower Colorado Basin Region, Boulder Canyon Operations Office, River Operations Group.

Peer Review Scope

Reviewers will consider the methods used to perform the sensitivity analysis in the technical memorandum and whether any further analysis needs to be performed. Reviewers will also consider the sensitivity analysis results and if they represent a thorough understanding of impacts to Reclamation’s models. The following questions should be considered by reviewers:

1. Was the sensitivity analysis performed by Reclamation a thorough investigation to understand the impact to projections?
2. Are the conclusions of the sensitivity analysis reasonable and valid, given the analysis and results provided in the report?

Reviewers were asked to provide comments solely on the scientific information being reviewed and not on any agency decision or policy.

Peer Reviewers

Peer reviewers were selected based on having at least 3-years of experience with expertise in hydrology, natural sciences, engineering, or water/reservoir management. Reviewers also had to be part of Reclamation but situated outside of the Lower Colorado Basin Region.

Selected reviewers had general knowledge regarding Colorado River Basin operations and guidelines and were not involved with the study. The public was not asked to participate in the peer reviewer selection process. The three selected reviewers are listed below:

- Genevieve Allan, Albuquerque Area Office, Water Management Division
- Amanda Becker, Upper Colorado Basin Region, River Operations Group
- Michael Callahan, Upper Colorado Basin Region, River Operations Group

Summary of Reviewer Comments

Reviewers 1 and 3 directly answered the questions identified above for the peer review scope. The summary of input from the other reviewer is noted below. Reviewer numbers do not directly correspond to the reviewer list above in order to retain anonymity with respect to their comments.

Reviewer 1 Response:

1. The analyses, using the variety of modeling tools and timeframes that Reclamation employs, is a thorough investigation to understand the impacts of updating the ACAPs tables.
2. The conclusion that these updates show minimal impacts is supported and this report is an important step to providing accurate and reliable hydrologic data for modeling and decision-making.

Reviewer 2 General Response:

Reviewer 2 provided constructive feedback which allowed for better explanation regarding the Lower Colorado Basin Region's (LCBR) operations model. The feedback also allowed for more clarification on certain findings in the report.

Reviewer 3 Response:

1. I think there is room to investigate more CRMMS-ESP and 24-MS runs in extreme years. I would also like to know of any impacts to daily model results. Pending the response to some of my questions about the number of models and years chosen, this additional analysis may not be necessary.
2. Yes, the conclusions are reasonable and valid given the analysis and results provided in the report.

Specific reviewer comments and LCBR responses are listed in the following table.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
1	1	V		Throughout the document, the border with Mexico is referred to as "the Southern Border", "the Southerly Boundary", and the "Northerly Boundary". Can these be made consistent? (executive summary 1st para., pg. 2 line 40, and pg. 5 line 37)	We double checked the borders reference with Mexico and updated when appropriate.
2	1	V		In the second to last paragraph, consider using consistent hyphens and spaces between year groups	Double checked for consistency. Second to last paragraph was deleted between peer review and final draft.
3	1	2	8	Should basin (near the end of the line) be capitalized?	Consistency applied throughout the document.
4	1	3	9	Correct NAV88 to NAVD88 for consistency	Updated.
5	1	5	10-11	Equation 1 is defined above as the RPVD Davis. Suggest making this Equation 3	Updated.
6	1	5	11-26	Equation 2 is defined above as the RPVD Parker. Suggest making this Equation 4	Updated.
7	1	5	50	This section describes the inputs and the regulations used but could benefit from explicitly noting that operations are manually input, as it is referenced in the sections before and after.	Acknowledged. No change made due to manually input operations being referenced in 2.2.3.
8	1	6	27	Figure 4, as described here, seems to be missing. If a new figure is added, please note that later figures will need to be renumbered, as figure 4 is redefined in section 3.1.	Did some arrangement in the document to fix this.
9	1	7	13	There doesn't seem to be a (Reclamation, 2020) in the References section on pg. 25	Reference added.
10	1	7	13	Should this be "gaging" stations?	Updated.
11	1	8	13	Suggest moving the sentence about surface area to the next paragraph with the rest of the surface area information. Also please note this sentence indicates a surface area of 29,590 acres, while line 19 and Table 3 indicate 29,600 acres with no reason for the discrepancy.	Misplaced sentenced. Updated.
12	1	8	16	Consider defining NA	Updated.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
13	1	8-11		Suggest structuring section 3.1 and 3.2 more similarly. For example [capacity paragraph] [capacity table][area paragraph][area table][chart], or whatever order makes sense.	Restructured for consistency.
14	1	9	14	Suggest moving the sentence about surface area to the next paragraph with the rest of the surface area information. Also please note this sentence indicates a surface area of 17,160 acres (at el 454.98), while pg. 10 line 8 and Table 5 indicate 20,690 (at el. 455.0) acres with no reason for the discrepancy. While the elevation is slightly different, table 5 makes it seem this number may be incorrect.	Misplaced sentenced. Updated.
15	1	13	5	Suggest writing as "three most recent"	Updated.
16	1	13	15	Add a blank line between paragraphs	Updated.
17	1	13	15	Replace LCB with Basin or define and add to acronym list	Replaced LCB with "basin".
18	1	13	30	The "-" seems to have been input as a "-"	Fixed.
19	1	15	1	Likely a rounding difference, but note that 2022 Mead difference is different than what one would get based solely on this table	Updated.
20	1	15	4	Likely a rounding difference, but note that 2024 Mohave difference is different than what one would get based solely on this table	Updated.
21	1	16	12	"kaf" should be defined here as it is the first time it is used	Updated
22	1	17	10	I think these should now refer to "Figure 10 and Figure 11"	Updated. Figures are correctly numbered.
23	1	18	2	Suggest space between 10% and 50%. Should this be "End of Month" rather than "EOCY"? Also suggest using a different color for the vertical lines as it is very similar to the "old" in the legend and may cause unnecessary confusion	Space added. Title changed.
24	1	19	2	Suggest space between 10% and 50%. Should this be "End of Month" rather than "EOCY"? Also suggest using a different color for the vertical lines as it is very similar to the "old" in the legend and may cause unnecessary confusion	Space added. Title changed.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
25	1	20	5	If I'm reading the paragraph above correctly, this is just the "intervening" natural flow. It may be helpful to explicitly state that in this label	Updated.
26	1	21	4	If I'm reading the paragraph above correctly, this is just the "intervening" natural flow. It may be helpful to explicitly state that in this label	Updated.
27	1	21	7-10	While labeling Figures 12 and 13 may help address this, putting an idea of magnitude/percent change in this paragraph may help with clarity.	Updated.
28	1	21	14	Suggest using "NFM" as it has been defined.	Updated.
29	1	21	21	I think that "Final Environmental Impact Statement" should be capitalized, as it is the title of a document	Updated.
30	1	21	3	I think these should now refer to "Figure 14 and Figure 15"	Updated. Figures are correctly numbered.
31	1	23	7	Update to "Figure 16"	Updated. Figures are correctly numbered.
32	1	25	12	Capitalize "Mead"	Updated.
33	1	25	15	This seems to be referenced in a different style than the others	Updated.
34	2	iii	N/A	UC should be labelled as the "River Operations Group"	Updated.
35	2	vi	N/A	There is a blank space in the navigation pane here	Fixed.
36	2	vii	N/A	Is the font change on Figure 4 purposeful?	Font has been updated
37	2	3	17	Is this correct, seems like something was missing based on the statement below.	Removed averages.
38	2	8 -11	N/A	Table and figure order are flipped between 3.1 vs 3.2. Suggest moving figure 5 to the bottom of section 3.2 for consistency.	Reviewer #1 had the same comment. Restructured.
39	2	22	10	Why does it seem that the runs stabilize somewhat? I know the report talks of commutative effects but why are those effects making the runs generally smoother. Maybe worth exploring or explaining.	Explanation added.
40	3	vi	N/A	Could it be useful to define live and dead storage for a less technical audience?	Added definition of dead and live storage.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
41	3	vi	N/A	Should this just be top of dam since Parker is a gravity arch dam rather than an earthen one like Davis? Same comment throughout text	This is correct, they are not "earthen dams." Updated.
42	3	vi	N/A	Should this be reservoir rather than dam elevation?	Clarified the use of project datum for elevation conversions.
43	3	vi	N/A	I know that they aren't operational tier reservoirs but it might help to mention how Mohave and Havasu projected conditions changed (didn't change) in this section?	Clarified impacts of Lake Mead and Powell compared to Mohave and Havasu.
44	3	vi	N/A	Not a dealbreaker but might be good to do more than one ESP run?	Since we only ran one CRSS, we ran one parallel CRMMS run to mirror that analysis. Additionally, multiple ESP runs do not add value to the overall analysis and conclusions.
45	3	vi	N/A	Do you also want to add what the hydrologic record years are for CRMMS? There are numbers for elevation changes in the CRSS results in this exec summary but not for the 24-MS or CRMMS-ESP. Arguably I would say that the 24-MS numbers would be the most important.	Executive Summary was made more succinct to preserve detailed findings in the main report.
46	3	vi	N/A	Average monthly elevation differences or average EOWY or EOCY differences?	Removed due to updates.
47	3	2	9	A general comment throughout...I tend to see runoff mostly used to refer to snowpack runoff rather than runoff from precip. I like the term tributary inflows. Technically yes though, it is all runoff	Acknowledged. No change made.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
48	3	4	8	Did you look at the Daily Model to see if there were any impacts? If so did you rerun the 24-MS with the updated BHOPS?	We did not perform a sensitivity analysis on the daily model. At the daily timestep, operations can be adjusted in real time to accommodate the change in storage due to the new ACAPs.
49	3	5	4	I wonder if dam seepage contributes to the gain/loss values?	Dam seepage is not based on elevation-area or volume tables, it is the same regardless.
50	3	5	47	Consider mentioning the timestep for each of the models run	Timesteps for each model are mentioned in their respective sections.
51	3	6	16	Want to mention how the side inflows are used in these scenarios?	Acknowledged. No change made.
52	3	6	32	I think that the SEIS should be a footnote or citation in this. Same w/ Min 323	Added citations.
53	3	9	10	Is this the Little Colorado River?	Clarified in text.
54	3	13	6	Did you take a look at any other extreme years or studies where we were very close between two different operational decisions? Or where reservoir levels were "high. Was this because there have been so many policy changes over the past 3 years?	The analysis covers years with varying hydrology and are representative of where the reservoirs have been over the past 20 years.
55	3	13	12	Maybe explicitly say at some point that it isn't valuable to look at changes in Mohave and Havasu projected elevations because they adhere to the guide curve after the first month or two.	Clarified in text.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
56	3	13	20	Did you look at year 2 in the 24-MS at all. Might be interesting to evaluate a full CY or WY.	Yes, we looked at year 2, however, since there is no decision made for year 2, we did not include those results in this report.
57	3	13	30	Did you evaluate any model runs using just one of the new ACAPs tables to see the influence that each has? This is more of a curiosity, rather than a suggestion because I know that this is really just examining how both of these together impact operations.	Not for the purpose of this report; as mentioned, the purpose of this report is to look at the combined impacts.
58	3	14	4	I know it isn't a big difference relative the outflow volume, but it is a pretty big difference compared to the other differences? Any thoughts on this? Perhaps it wouldn't look like such an outlier if there were more studies?	Refer to page 16 for explanation. The large relative difference is due to the shift in Lake Powell balancing operations.
59	3	16	11	Might be good to specify in summary sections throughout the text that there would be small operational changes (change in release volumes) with the ACAPs but no indication of changes to operational tiers in decision-making runs.	Acknowledged. No change made.
60	3	17	6	Did you see whether it was the same trace that changed operating tier year to year or different ones? Are multiple traces changing and zeroing each other out in the frequencies?	Yes, but this level of detail is not warranted in this report.
61	3	21	9	Since intervening flows are used interchangeably in certain contexts throughout the text. Might help to explicitly state that at the beginning.	Section 2.2.1 states how these terms are interchangeable.
62	3	21	21	Ensure citations of footnotes for all operational documents throughout text	Added citations.

Comment Number	Reviewer	Page Number	Line Number	Reviewer Comment	Response
63	3	21	24	Would suggest that this be moved to the CRMMS section	Clarified in text.
64	3	24	5	Some suggestions for consideration. How far back are you planning on recalculating storage and surface area in HDB? How frequently are y'all planning for surveys in the future? I also wonder if it is important to discuss any impacts that this could/or that it doesn't have on parties that use this data? Also a general statement that despite this changing components of the mass balance there is no additional physical water entering/leaving the system? Are there any potential changes to sediment entering the system on these reaches that you are aware of that may impact the amount of sediment entering the reservoirs? In the Rio Grande we are seeing additional sedimentation in our reservoirs due to runoff from monsoon events hitting wildfire scars and less vegetation holding on to soil during these events. It is pretty barren on these reaches in the Lower Basin, but I'm curious if this is something worth exploring.	Acknowledged. Out of scope.