Peer Review Report

2026 SECURE West-Wide Assessment Technical Memorandums

Date

May 26, 2026

Originating Office

Bureau of Reclamation, Water Resources and Planning Office

Reclamation Roles

Director or delegated manager: Sheri Looper, Acting Water Resource and Planning Office Manager, National Programs, Bureau of Reclamation

Peer Review Lead: Stephanie Hellekson, Civil Engineer, Water Resources and Planning Office, National Programs, Bureau of Reclamation

Date Peer Review

A peer review kick-off meeting was held on June 10, 2025, with a peer review window for the 2026 West-Wide Assessment occurring from June 10 through July 3, 2025.

Subject and Purpose

The 2026 West-Wide Assessment (WWA) is organized into three distinct Technical Memorandums, each developed to fulfill the statutory reporting requirements outlined in Section 9503(c) of the SECURE Water Act. The assessment evaluates historical and projected changes in precipitation and temperature using multiple datasets, providing water managers with insights into which datasets are most appropriate for various types of historical and future planning analyses.

In addition to climate trends, the WWA includes a comprehensive analysis of historical and projected changes in snow water equivalent across the western United States. It also examines historical evaporation rates at major Reclamation reservoirs. Furthermore, the assessment features a literature review that explores the complexities involved in evaluating both historical and projected streamflow conditions.

The WWA includes the following analyses:

- Analysis of hydroclimate projections for the eight major Reclamation river basins, plus the Arkansas River Basin, Texas Gulf Region, and Great Basin;
- Historical climate data analysis;
- Projected future climate data analysis;
- Change in snowpack, historical and future,
- Analysis of historical and projected evaporation rates and significant trends at approximately 247 Reclamation reservoirs;
- Literature review of hydrologic Modeling, uncertainty and change;
- Evaluation of the risk to water deliveries and other listed resources under 9503(b)(3) using climate projections as applicable.

Peer Review Scope

Peer reviewers were asked to evaluate three technical memorandums and provide input on whether these analyses are well supported and clearly described. The memorandums include:

Technical Memorandum – Climate and Streamflow Analysis (TM No. ENV-2025-003): Hydroclimate analysis and western streamflow.

Technical Memorandum – Snow Analysis (TM No. ENV-2025-001): West-wide snow analysis and significant trends.

Technical Memorandum – Reservoir Evaporation Analysis (TM No. ENV-2025-002): Evaporation rates and significant trends at Reclamation Reservoirs

Reviewers were also asked whether the memorandums provide useful information to support water managers in understanding which datasets are useful for different types of historical and future planning analyses. In addition, reviewers provided feedback on the following two questions.

Question 1. For the purpose of producing a high-level characterization of water reliability across the Western United States, are the data and methods employed appropriate and consistent with practices in the field?

Question 2. Are the findings presented in the technical memorandums consistent with findings documented in contemporary peer-reviewed scientific publications that you are familiar with?

The scope of this review did not include the CMIP6 archive, LOCA2 downscaling method; datasets used in downscaling methods; methods for development of snowpack datasets used in the WWA; and the Daily Lake Evaporation Model as all of these items have been sufficiently reviewed and documented in peer-reviewed scientific publications.

Peer Reviewers

Peer reviewers were selected to provide expertise in climate science, climate science applications, and/or the associated hydrologic impacts and water management. The selected reviewers are listed below.

Name	Title and Location	Climate & Streamflow Analysis	Snow Analysis	Reservoir Evaporation Analysis
Allan, Genevieve	Supervisory Natural Resource Management Specialist, Reclamation - ALB	X		X
Bearup, Lindsey	Civil Engineer, Reclamation - TSC		X	
Becker, Paige	Hydrologist, Reclamation - UCB	X	X	
Clarkin, Tim	Hydraulic Engineer, Reclamation - TSC		X	
Felstul, David	Supervisory Interdisciplinary, Reclamation - CGB - KBAO		X	X
Ferguson, Ian	Civil Engineer, Reclamation - TSC	X		
Fitts, Ally	Physical Scientist, Reclamation - TSC		X	
Frans, Chris	Civil Engineer, Reclamation - R&D	X	X	X
Gangopadhyay, Subrendu	Supervisory Civil Engineer, Reclamation - TSC		X	X
Holland, Melanie	Hydraulic Engineer, Reclamation - TSC			X
House, Brandon	Civil Engineer, Reclamation - TSC	X		
Kabir, Jobaid	Branch Chief, Reclamation – CGB			X
McGuire, Marketa	Civil Engineer, Reclamation - TSC		X	
Mikkelson, Kristin	Civil Engineer, Reclamation - TSC			X
Pederson, Gregory	Research Ecologist, USGS	X		
Ramakrishnan, Balaji	Civil Engineer, Reclamation - LCB			X
Smith, Rebecca	Civil Engineer, Reclamation - LCB	X		
Tighi, Shana	Hydrologist, Reclamation, LCB	X		
Walker, Kent	Program Manager, Reclamation, DSO	X		
Wilderotter, Sophie	Civil Engineer, Reclamation - CPN	X	X	
Woodson, David	Civil Engineer, Reclamation - TSC	X		X

Summary of Reviewer Comments

Reviewer comments regarding the two questions identified above for the peer review scope (reviewers do not directly correspond to the list above for anonymity with respect to their comments) are summarized below.

Overall, reviewer feedback across the three technical memorandums consistently emphasized the need for improved clarity in explanations, greater consistency in terminology and structure, and more transparent communication of data sources, statistical methods, and uncertainties. Reviewers also highlighted opportunities to strengthen visual elements including figures, maps, and legends to better support interpretation, and encouraged clearer articulation of methodological assumptions, dataset limitations, and management implications. Collectively, these comments enhance the readability and practical usefulness of the assessment.

Technical Memorandum – Climate Analysis (TM No. ENV-2026-003)

Key Themes in the Comments

Clarity

- Audience Understanding: Emphasis on making the document accessible to practitioners who may not be familiar with specialized climate or hydrology concepts.

Consistency and Style

- Terminology Consistency: Recommendations to use consistent terms (e.g., “gage” vs. “gauge,” “naturalized” vs. “natural” streamflow).
- Sentence Structure: Suggestions to simplify complex or awkward sentences, reduce parenthetical clauses, and improve readability.

Data and Methodology

- Dataset Selection and Justification: Requests for clearer rationale behind choosing specific datasets (e.g., Livneh vs. PRISM).
- Statistical Methods: Suggestions to explain hypothesis testing, significance levels, confidence intervals, and statistical distributions.
- Uncertainty and Bias: Emphasis on discussing uncertainties in climate models, data biases (e.g., elevation-related biases), and limitations of datasets.

Climate and Hydrology Concepts

- Climate Variability vs. Climate Change: Clarifications on the distinction and appropriate usage of these terms.

- Forcings and Variability Drivers: Requests to elaborate on internal and external climate forcings, and their role in variability and change.
- Runoff and Streamflow Dynamics: Comments on the influence of soil moisture, temperature, and precipitation on runoff efficiency and streamflow.

Document Structure and Organization

- Section Reorganization: Proposals to restructure sections (e.g., combining historical and future analyses by basin).
- Reducing Redundancy: Suggestions to consolidate repetitive content and move detailed methods to appendices.
- Improving Navigation: Comments on making the document easier to follow, especially for readers focused on specific basins.

Technical Memorandum – Snow Analysis (TM No. ENV-2026-001)

Key Themes in the Comments

Data Accuracy and Methodological Transparency

- Numerous comments ask for clarification on data sources, statistical methods, and assumptions.
- Emphasis on clearly stating whether trends are statistically significant, including p-values and confidence intervals.

Scientific Rigor and Citations

- Many comments request citations for claims or data sources.
- Suggestions include references to relevant literature, datasets, and methodologies.

Visualization and Figure Improvements

- Feedback on improving figure resolution, color schemes, and legends.
- Requests to add explanatory notes, clarify axes, and ensure figures match the text.

Geographic and Spatial Clarifications

- Requests to clarify spatial coverage and implications for snowpack and runoff analysis.

Technical Precision

- Attention to detail in statistical methods (e.g., Mann-Kendall test, autocorrelation).

- Suggestions to verify calculations, check decimal precision, and ensure reproducibility.

Technical Memorandum – Reservoir Evaporation Analysis (TM No. ENV-2026-002)

Key Themes in the Comments

Visualization and Figure Improvements

- Many figures need clearer labels, units, captions, and consistent legends.
- Some maps and plots need clean-up (remove gridlines, clarify color bars, fix missing months).
- Standardize and clean up all graphics.

Units, Terminology & Consistency

- Confusion between rate vs total, inconsistencies like in/yr, in/dec, ft, etc.
- Condensation labeling is unclear (negative vs positive).
- Establish one consistent unit/style and apply it everywhere.

Statistical Methods & Hypothesis Testing

- Must clearly state null hypotheses, show p-values, and clarify which trend test is used in each figure.
- Consider using Seasonal Mann-Kendall for monthly/seasonal results.
- Strengthen statistical clarity and consistency.

Data Sources & Biases

- Clarify biases in gridMET, RTMA adjustment, solar/wind issues, and dataset availability.
- Add a short section clearly explaining data limitations and known biases.

Methodology & Model Clarifications

- Need clearer explanation of DLEM, heat storage, ice treatment, surface area changes, equations.
- Add a concise, complete methods overview.

References & Citation Management

- Need clearer explanation of DLEM, heat storage, ice treatment, surface area changes, equations.
- Add a concise, complete methods overview.

Operational / Management Relevance

- Emphasize volumes, %/decade changes, and implications for water management.
- Link findings more explicitly to manager decisions.

Analytical Enhancements & Additional Analyses

- Consider multiple linear regression (elevation + latitude) to predict rates; add time series plots; analyze surface area trends and link to volumetric changes.
- Compare CRLE vs DLEM over overlapping periods; explain why DLEM is an improvement (daily timestep, heat storage, fetch/wind, improved forcing).

Conclusion

Overall, the peer review process proved to be a valuable and constructive exercise, offering thoughtful and independent perspectives that strengthened the quality of the technical memorandums. The reviewers' insights helped clarify methods, refine data interpretation, and improve the presentation of complex climate, snowpack, and reservoir evaporation analyses. Incorporating this feedback has resulted in clearer, more rigorous, and more useful technical reports that better support water managers and stakeholders in understanding the datasets and methods most appropriate for future planning and decision-making.

List of Attachments

Attachment A: Comments to Technical Memorandum – Climate and Streamflow Analysis (TM No. ENV-2026-003)

Attachment B: Comments to Technical Memorandum – Snow Analysis (TM No. ENV-2026-001)

Attachment C: Comments to Technical Memorandum – Reservoir Evaporation Analysis (TM No. ENV-2026-002)

Attachment A: Comments to Technical Memorandum – Climate and Streamflow Analysis (TM No. ENV-2026-003)

Comment	Page	Section	Text	Comment	Response to Comments
1	22	1 Introduction	authorizes	When I read the Act, it appears more than “authorizes” but actually “requires”. I quote:“(b) REQUIRED ELEMENTS.- In carrying out the program described in subsection (a), the Secretary shall -”…	Accepted.
2	22	1 Introduction	authorizes	Same comment as above. Suggest change “authorizes” to “requires”	Accepted.
3	24	1.3 The 2026 SECURE Water Act Report	this one	Fix	Accepted.
4	24	1.3 The 2026 SECURE Water Act Report	this one	Agreed. It appears this was copied from the Evap report and needs to be edited to refer to the climate analysis report	Accepted.
5	24	1.3 The 2026 SECURE Water Act Report	helps Western water managers understand what historical conditions and aid their consideration ofto consider potential future variability within managementthose decisions	Incomplete/grammatically funky sentence, needs clarification	Accepted.
6	24	1.4 Objectives of Climate and Streamflow Analysis	applying	Application of	Accepted.
7	25	1.4 Objectives of Climate and Streamflow Analysis	contrasts	Is it really about providing a contrast, or just including both levels of info?	Accepted.
8	25	1.4 Objectives of Climate and Streamflow Analysis	unregulated streamflow, gaged streamflow, and simulated historical streamflow.	Is the intended audience of this report (water managers?) familiar with the definitions of these 3 types of flow? I would like to assume so, but not sure if there is a need to define them further (here or later in the report?)	Accepted. We added definitions.
9	25	1.4 Objectives of Climate and Streamflow Analysis	unregulated streamflow, gaged streamflow, and simulated historical streamflow.	Is simulated historical streamflow natural flow?	We added clarification.
10	25	1.4 Objectives of Climate and Streamflow Analysis	unregulated streamflow, gaged streamflow, and simulated historical streamflow.	I think this is an important function of the memo so it’s worth stating clearly what it’s trying to do	Accepted

Comment	Page	Section	Text	Comment	Response to Comments
11	25	2.1 Weather versus Climate	Weather versus Climate	some of this section seems repetitive and the point the authors are tyring to make gets lost in the sauce. Instead of highlighting multiple definitions of both you could instead say "there are varying definitions, but ultimately weather is the day to day changes typically measured in precip, temp, humidity, etc. Climate is considered the average of these on a seasonal to yearly scale. For the purpose of this study we define them as X,y,z." Then give examples like "Colorado in January typically sees highs of x and lows y and z precipitation (climate), but the day to day varies with one day being a high of a, low of b, and c precip (weather)." Then talk about numerical models used for both and how IPCC use climate models, then talk about key sources of uncertainty.	We reworked and reduced this section
12	25	2.1 Weather versus Climate	many	Could you be more specific? 30 yrs?	We added 30 years as an example.
13	25	2.1 Weather versus Climate	accumulation	Accumulation makes me think additive rather than the "typical" weather seen	We changed the wording.
14	25	2.1 Weather versus Climate	accumulation	Summary? Generalization?	We changed the wording.
15	26	2.1 Weather versus Climate	Weather varies on timescales ranging from seconds to days. Conversely, climate represents the slowly varying aspects of the atmosphere-hydrosphere-land surface system (AMS 2024).	Seems odd to define both again, when the above paragraph does that as well.	We reworked and reduced this section
16	26	2.1 Weather versus Climate	Bryson 1997)	Open parens?	Accepted.
17	26	2.1 Weather versus Climate	initial value problem and climate projections a boundary value problem. Others, however, suggest that weather and climate prediction are both initial value problems (Palmer 1999; R. Pielke Sr 1998).	Definition of “initial value problem” vs “boundary value problem”?Is this level of academia valuable to the target audience?	We reworked and reduced this section
18	27	2.1 Weather versus Climate	earth’s	uppercase	Accepted
19	27	2.1 Weather versus Climate	For instance, initial conditions are an enormous source of uncertainty for short-term weather forecasts, as weather forecasts intend to predict the actual evolution of the atmosphere using the best guess of the current state	It's possible I'm misunderstanding but I would think initial conditions are the least uncertain for short-term weather forecasts because are they not the same as current conditions? Why is there a "best guess" of the current state when I can know what the temperature is currently?	We reworked and reduced this section

Comment	Page	Section	Text	Comment	Response to Comments
20	27	2.1 Weather versus Climate	For instance, initial conditions are an enormous source of uncertainty for short-term weather forecasts, as weather forecasts intend to predict the actual evolution of the atmosphere using the best guess of the current state	[General comment echoing Paige's confusion]	We reworked and reduced this section
21	27	2.1 Weather versus Climate	In the case of climate projections, these simulations clearly depend on initial conditions (Deser, Phillips, et al. 2012) , yet the intent is to estimate the response of the climate system to external forcings (Palmer 1999; Phillips et al. 2004; Werndl 2019).	I also am not understanding this sentence and how uncertainty in initial conditions relate to external forcings	We reworked and reduced this section
22	27	2.1 Weather versus Climate	sea surface temperatures	Not scenario based	Thank you. Accepted.
23	27	2.1 Weather versus Climate	External forcings are usually fixed for weather forecasts but are highly uncertain in century long climate simulations. Internal variability of the climate system, natural fluctuations within the Earth's climate system driven by interactions among the atmosphere, oceans, and land, is considered less relevant to weather forecasts. However, on decadal and longer time scales, internal variability is a major source of uncertainty (Deser et al. 2010; 2014).	This should be moved to follow the sentence that first mentions external forcings. Also giving an example of what external forcings are would be helpful.	We reworked and reduced this section

Comment	Page	Section	Text	Comment	Response to Comments
24	27	2.1 Weather versus Climate	Weather forecasts and climate projections differ on key sources of uncertainty. For instance, initial conditions are an enormous source of uncertainty for short-term weather forecasts, as weather forecasts intend to predict the actual evolution of the atmosphere using the best guess of the current state (Werndl 2019). In the case of climate projections, these simulations clearly depend on initial conditions (Deser, Phillips, et al. 2012) , yet the intent is to estimate the response of the climate system to external forcings (Palmer 1999; Phillips et al. 2004; Werndl 2019). Model physics are important for weather forecasts, particularly for clouds and convection, but are critical for long-term simulations (Hawkins and Sutton 2009). Small errors in climate model physics can negatively impact long-term trends (Giorgi 2019). Boundary conditions, such as land use, land cover, and sea surface temperatures, are generally well characterized for weather forecast time scales, but these variables can be scenario-based for long term climate simulations. External forcings are usually fixed for weather forecasts but are highly uncertain in century long climate simulations. Internal variability of the climate system, natural fluctuations within the Earth's climate system driven by interactions among the atmosphere, oceans, and land, is considered less	Much of this paragraph is confusing, particularly the before and after the comma. The ideas are not connecting in a clear way. For example, the sentence about initial conditions then external forcings. I don't understand the connection, and ask myself "so what? what does the external forcing have to do with initial conditions?"	We reworked and reduced this section
25	28	2.2 Climate Variability and Change	period,	Seemed like the important concept was minimized in between commas here.	We reworked and reduced this section

Comment	Page	Section	Text	Comment	Response to Comments
26	29	2.2 Climate Variability and Change	Hawkins and Sutton (2016) list common qualities used to decide on a historical reference period (also called observational reference period), including being representative of the most recent conditions yet long enough not to be overly influenced by random fluctuations, to be relatable from the public perspective, to not need constant updating, to be simple to calculate, and to maximize number and quality of observations. Using global-mean air temperature as an example, Hawkins and Sutton (2016) demonstrate how anomalies (defined as deviations from a climatological mean) in this variable depend on reference time period selection under historical and projected conditions. Moving forward, some authors encourage broader transparency in the development and definition of reference periods (Puig et al. 2013; Hawkins et al. 2017). Others recommend an investigation of conclusions and the robustness of those conclusions to the selection of historical reference period (Hawkins and Sutton 2016).	I wish there was a concluding sentence here that tells the reader what historical reference period was used for this study.	Accepted. We added this.
27	29	2.2 Climate Variability and Change	Attribution studies	what is this?	We added explanation.
28	29	2.2 Climate Variability and Change	detection results	define	We added explanation.
29	29	2.2 Climate Variability and Change	(Bindoff et al. 2014; Hegerl et al. 2010)	There has been a lot of recent work on specific events: World Weather Attribution – Exploring the contribution of climate change to extreme weather events	We added explanation.
30	29	2.2 Climate Variability and Change	hi	Doesn’t seem like these need to be contrasted - both due to warming	Accepted.
31	29	2.3 Dataset Considerations	Dataset Considerations	I think much of this section could be condensed into about 2 paragraphs and instead have a table that summarizes the datasets instead. Similar to what the snow report has which shoes temporal and spatial resolution of the products, limitations, if it's observation vs reanlaysis, etc.	We did this - thanks for the suggestion.
32	29	2.3 Dataset Considerations	Dataset Considerations	I concur, and would add that Section 2.2 can be consolidated as well.	We did this - thanks for the suggestion.

Comment	Page	Section	Text	Comment	Response to Comments
33	29	2.3 Dataset Considerations	Dataset Considerations	Perhaps subheadings for each of these considerations could make this more easily navigable	Accepted.
34	30	2.3 Dataset Considerations	under catch	Might be worth defining	We changed the wording to improve understanding.
35	30	2.3 Dataset Considerations	Despite their significance, point observations can be limited by period of record and spatial representativeness.	Can remove as this point is made above	Accepted.
36	31	2.3 Dataset Considerations	As	This paragraph does not appear to have a logical tie-in to this section. You started talking about types of datasets - point vs gridded, but now you jumped to climate models to be used for evaluating climate change impacts and I'm not sure why. Are you trying to discuss observed data vs model data? If so I think you need more transitional text so the reader can follow the story/logic here.	We removed this.
37	31	2.3 Dataset Considerations	The	I'm struggling to see the tie-in of this entire paragraph to the topic of Datasets. It's a bit of a red herring and I don't think it makes much sense in the context of this section and all the text preceding it. I would delete it altogether, or at a minimum move it out of the Dataset Considerations section and into the introductory text.	Thanks for this suggestion. We made this change and it works much better.
38	31	2.3 Dataset Considerations	The	Or possibly lead off section 2 with this, then make the rest of the section a concise definition of the terminology/concepts. There were a lot of areas in this section that were repeated elsewhere in the section.	We reworked and reduced this section
39	31	3.1 How climate drives streamflow	How climate drives streamflow	Also worth noting how climate has impact on soil moisture conditions which then influence how much water is streamflow vs infiltrates into the subsurface	Accepted.
40	31	3.1 How climate drives streamflow	—the water flowing in rivers and streams—	Probably don't need this	Accepted.
41	31	3.1 How climate drives streamflow	direct	Seemed to strong. Lots of things affect streamflow that are not a direct result of climate	Accepted.
42	31	3.1 How climate drives streamflow	direct	Also are you talking about natural flow? If not, some flow in a stream shows up b/c humans transferred it there somehow. True that it still comes from rain and snow, but transferred water is not necessarily tied (certainly not directly) to climate. If you're talking about it being stored in lakes, that implies reservoirs in this region. Just need some clarity on what "streamflow" you're trying to connect to	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
43	32	3.1 How climate drives streamflow	As an example, increased temperatures can boost streamflow at certain times of the year by speeding snowmelt and transitioning precipitation to fall as rain instead of snow. In other times of the year, increased temperatures can reduce streamflow when snow melts earlier in the season (meaning streamflow declines later in the year)	This is worded better than how it's described in the snow report and think you should add this to the snow report as well.	Thank you. We conveyed the comment.
44	32	3.2 Streamflow Variability	Generally, streamflow varies depending on when and how much it rains or snows and when snow melts.	I think it's important to emphasize that not all streams are influenced by snow. I read this as all streams are influenced by snowmelt which isn't necessarily the case	Good point, we clarified. It now reads: "Generally, natural streamflow varies depending on when and how much it rains or snows and, in the locations that receive snow, when the snow melts. However, depending on location, actual measured streamflow"
45	32	3.2 Streamflow Variability	streamflow varies depending on when and how much it rains or snows and when snow melts. However, depending on location, streamflow	I think some clarification could be added by specifying that generally, natural streamflow varies depending on rain/snow, etc, however actual/measured/gaged streamflow variability can be influenced by management decisions, etc.	Good point, added clarity.
46	32	3.2 Streamflow Variability	streamflow varies depending on when and how much it rains or snows and when snow melts. However, depending on location, streamflow	Mind meld	yes
47	32	3.2 Streamflow Variability	. It also varies depending on landscape features such as vegetation and soil types and can be impacted considerably by wildfires.	Would it be useful to mention the impact of antecedent soil moisture conditions on the amount of runoff actually reaching a river or stream/contributing to streamflow?	Good idea, added: For example, soils, especially those that hold more water, can change the amount of water in streams. If it has been dry, rain will first infiltrate and increase soil moisture before becoming streamflow. Depending on the location and soil moisture conditions, the runoff efficiency (amount of water that goes into the stream for a given amount of precipitation) can vary considerably.

Comment	Page	Section	Text	Comment	Response to Comments
48	32	3.2 Streamflow Variability	. It also varies depending on landscape features such as vegetation and soil types and can be impacted considerably by wildfires.	The concept of runoff efficiency would fit well in this section.	Yes, included (see comment 47).
49	32	3.2 Streamflow Variability	ften streamflow is thought of as a combination of direct runoff, water that flows into the stream in close proximity to an event (e.g., rain storm) which is not absorbed by the land, and base flow,	and snowmelt	Yes, added snowmelt as another example
50	32	3.3 Dataset Considerations	memo	Recommend spelling out the whole word	Accepted.
51	32	3.3 Dataset Considerations	this important measure of resilience	What is this referring to?	We removed this and reworked this section.
52	32	3.3 Dataset Considerations	Gaged streamflow	Is it valid to use gage streamflow below significant human activity in trend analysis?	Revised to clarify that we are sharing the way streamflow is estimated. Re: whether gaged data is useful for trend analysis (good question!), it depends - you can still detect trends, but the trends you're detecting are now influenced by a lot of things - whether or not whatever the trends are are meaningful is something this effort is exploring. This is discussed below.
53	33	3.3 Dataset Considerations	adds back in	In some cases subtracts out water (ie irrgation return flows and wastewater returns)	Yes! Now reads: Creating these naturalized flows, often requires a careful reconstruction process which adds back in water removed because of human activities including diversions and consumptive uses, subtracts out water from irrigation return flows and wastewater returns, and adjusts for the effects of reservoir storage.
54	33	3.3 Dataset Considerations	consumptive uses	And removed the effects of reservoir storage	Yes, see addtions in comment 53.
55	33	3.3 Dataset Considerations	gaged	Hopefully unimpaired gages...	unsure where this comment is within the document

Comment	Page	Section	Text	Comment	Response to Comments
56	34	4 Climate Data	Data	In the Climate background in Section 2 above, you have an entire Data Considerations section. Then you also have this entire climate data section. I wonder if you could make report more concise and less repetitive by incorporating a bit of the information from section 2.3 here in section 4 and omitting the subsection above?	Accepted.
57	34	4 Climate Data	Water managers primarily rely on quantifications of streamflow (e.g. historical and/or forecasted streamflow over days to months; projected seasonal and annual streamflow for future decades) to meet Reclamation's mission for supplying water and power to Western US communities.	Seems odd to start a section about climate data by talking about how streamflow is the primary variable of interest. I think you could omit this and start with the following statement to introduce climate data as being important because it is the fundamental driver of our understanding of the hydrologic cycle, streamflow, etc.	Accepted.
58	34	4 Climate Data	Precipitation and temperature data at various time- and spatial scales are often used as inputs in analysis and modeling studies	including the inputs for the models used by RFCs that Reclmation uses	Accepted.
59	34	4 Climate Data	Reclamation does support climate data collection for its Hydromet network and for other site-specific applications	?	Modified.
60	34	4 Climate Data	Reclamation does support climate data collection for its Hydromet network and for other site-specific applications, water managers, scientists, and engineers commonly rely on existing climate data collection networks, interpolated gridded climate data products based on observations, and modeled climate data products to support design and management decisions, and dam safety risk determination.	Seems unnecessary to include	Modified.

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61	34	4 Climate Data	conditions. This	This paragraph seems to merge 2 topics. The first sentence is background explanatory information. But then you switch gears and introduce the objective of the report. And then in the next paragraph you go back to a somewhat repetitive topic of observation data for analysis. The big-picture organization/structure of this section 4 could be better organized. (This might also be an opportunity for improved conciseness, per the ask in the peer reviewer email?) Perhaps a suggestion might be to move the second half of this paragraph to the very beginning of this section to introduce the objective of this section? That way it's not kind of thrown in almost random-like.	We reworked and reduced this section
62	36	4 Climate Data	CMIP5 RMJOC-II	RMJOC-II is a study that used downscaled projections. The BCSD product is listed below in the table. The other climate projection product was MACA - MACA Statistical Downscaling Method	Accepted.
63	37	4.1 Historical datasets	Two historical datasets, the observational GHCNd dataset and the gridded Livneh et al. (2015), are analyzed across multiple time periods to show temporal variations in metrics and associated trends. The various time periods for which metrics and trends are calculated are summarized in Table 3.	Why were those two selected? E.g., Resource constraints for using 2 and wanted one gridded and one point? Given pervasive use of some of the others with PRISM and gridMET leading in use in applications, moving toward the question of "which history to use" would involve an intercomparison of these gridded datasets. I recommend providing some context for dataset selection for the report.	We added explanation.
64	37	4.1 Historical datasets	POR	Undefined acronym	Thanks.
65	37	4.1 Historical datasets	Start for Livneh et al. (2015) and greatest period of record of GHCNd	?	Modified.
66	37	4.1 Historical datasets	Historical reference period for CMIP5 climate projections	I don't understand this column	We clarified this table
67	37	4.1 Historical datasets	Historical reference period for CMIP5 climate projections	Is this the historical reference period chosen for this study? This is confused with the CMIP5 historical reference period with starts in 1950. I am not sure what the value of this short period is for the analyses	We clarified this table
68	37	4.1.1 Global Historical Climatology Network daily dataset	Global Historical Climatology Network daily (GHCNd)	This should be defined above, the first time you use it in section 4.0	Accepted.
69	38	4.1.1 Global Historical Climatology Network daily dataset		The outlines make it hard to see the colors. Is it possible to mike them thinner? Or get rid of them completely? Or will these plots be blown up to a full landscape page?	Accepted.
70	38	4.1.1 Global Historical Climatology Network daily dataset	/	The panel on the left wiht widnow length should not be in black and white especially if the circles have a border. It's really hard to tell interpret them	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
71	39	4.1.1 Global Historical Climatology Network daily dataset	minimum temperature stations.	This reads like the station is specifically for minimum temperature rather than just average annual minimum temperature and window lengths	Accepted.
72	40	4.1.1 Global Historical Climatology Network daily dataset	minimum	Maximum	Accepted
73	40	4.1.2 Historical gridded climate dataset	climate	Meteorological?	Modified.
74	43	4.2.1 CMIP6 LOCA2 dataset	method	Some of the content in this paragraph is repetitive with 4.1.2. You could make the report more concise by putting in either 4.1.2 or here.	Thank you. We accepted this suggestion.
75	43	4.2.1 CMIP6 LOCA2 dataset	ensemble members	describe what this means	Accepted.
76	44	4.2.2 RMJOC-II dataset	RMJOC-II dataset	This is a locally developed regional dataset. It seems that other regions have similar resources that have been applied. Is there a reason CRB doesn't have a dataset featured (William Currier VIC work, Cal-DWR projections used by CGB?)	We added some clarifications here.
77	45	4.2.2 RMJOC-II dataset	2018	The RMJOC agencies applied these data products in reservoir modeling analyses to project changes and resource impacts in the reservoir system (RMJOC-II Part 2, Climate and hydrology datasets for RMJOC long-term planning studies: Second edition (RMJOC-II), part II: Columbia River reservoir regulation and operations—modeling and analyses - Technical Reports - USACE Digital Library	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
78	45	4.2.2 RMJOC-II dataset	Chegwidden et al. (2019) found that the emissions scenario (Representative Concentration Pathway [RCP]) and choice of global climate model explain the most variance of the spread of projected shifts in snowmelt streamflow timing and annual volumes, respectively. The hydrologic model explains the most variance of projected spread in low streamflow. These results can help inform the design of future studies directed at a particular impact of interest.In this SECURE West-Wide Assessment - Climate and Streamflow Analysis report, the focus of analysis is on precipitation and temperature as they are estimated by different future projection datasets. Development of simulated streamflow based on CMIP6 LOCA2 projections is in progress at the time of this report, so streamflow analysis focuses not on GCM-based streamflow estimates, but instead on understanding changes in historical unregulated and gaged streamflow.	I get that you wanted to state how this dataset is currently used by Reclamation, but I think you switched gears a bit too much and started talking too much about streamflow in these last 2 paragraphs.	Accepted.
79	45	4.2.2 RMJOC-II dataset	In this SECURE West-Wide Assessment - Climate and Streamflow Analysis report, the focus of analysis is on precipitation and temperature as they are estimated by different future projection datasets. Development of simulated streamflow based on CMIP6 LOCA2 projections is in progress at the time of this report, so streamflow analysis focuses not on GCM-based streamflow estimates, but instead on understanding changes in historical unregulated and gaged streamflow.	This paragraph doesn't fit in this section	Accepted.
80	46	4.2.2 RMJOC-II dataset	/	I'm confused why this figure is here	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
81	47	5 Climate Analysis Methodology	When seeking climate information to use in analysis and/or to answer design or water management questions, users are faced with common challenges including the selection of appropriate dataset, identification of metrics of interest (for example, 3-day annual peak precipitation), and processing the data to quantify the metrics of interest at the appropriate time and spatial scale	I think you can remove this	Accepted.
82	48	5.1 Climate Metrics	The calculated metrics were identified from four major sources, including:the Environmental Protection Agency (EPA) Climate Change Indicators (https://www.epa.gov/climate-indicators)the U.S. Geological Survey (USGS) CMIP5-LOCA2 threshold and extreme event metric projections (Jay R Alder, 2024); https://www.sciencebase.gov/catalog/item/65cd1ff2d34ef4b119cb3d07), the Fifth National Climate Assessment (NCA5, Marvel et al. 2023); https://nca2023.globalchange.gov/chapter/2/), and Reclamation's West-Wide Climate Risk Assessment team	Is this level of detail and background meaningful, relevant, and useful for the target audience? If not this section could be reduced and made more concise.	Accepted and we did this.
83	48	5.1 Climate Metrics	understanding how extreme values or values relative to a threshold may be even more meaningful	This is not a complete sentence	Accepted.
84	48	5.1.1 Precipitation Metrics	Precipitation metrics that we include in evaluation in this report as a demonstration of summarized data and trends.	Not a complete sentence	Accepted.
85	48	5.1.1 Precipitation Metrics	Much more is available, and we aim to expand evaluations as resources allow.	Is this just a place holder for the authors? Seems like you could omit this from the final report. By then it will be too late for inclusion.	Thanks. We removed this.
86	48	5.1.1 Precipitation Metrics	inches	maybe the units can be placed at the beginning. EX. Annual 3-Day Maximum Precipitation (inches) -	We revised the definitions and made more concise.
87	48	5.1.1 Precipitation Metrics	(right)	???	We revised the definitions and made more concise.
88	48	5.1.1 Precipitation Metrics	(right) i	Is this referirng to a figure?	No, but we clarified the sentence.

Comment	Page	Section	Text	Comment	Response to Comments
89	48	5.1.1 Precipitation Metrics	Daily Precipitation Intensity	I don't think this is how daily precipitation intensity is normally calculated	Accepted.
90	48	5.1.1 Precipitation Metrics	Daily Precipitation Intensity	Agree - this is confused with annual max 24-hr duration precip intensity. Maybe drop “daily” or call this “precipitation intensity index”	Accepted.
91	48	5.1.1 Precipitation Metrics	trace precipitation	define	Accepted.
92	49	5.1.2 Temperature Metrics	Temperature metrics that we include in evaluation in this report as a demonstration of summarized data and trends. Much more is available and we aim to expand evaluations as resources allow.	Same comments as in the intro to 5.1.1. First sentence is not a complete sentence. And 2nd sentence seems more like a placeholder that should be omitted from the final report.	Accepted.
93	49	5.1.2 Temperature Metrics	Annual average daily average temperature	Does this mean for each day of the year you have an average daily temperature ? e.g. an average temp for Oct 1, Oct2, etc?	We revised the definitions and made more concise.
94	49	5.1.2 Temperature Metrics	(inches)	Celsius?	Accepted.
95	49	5.1.2 Temperature Metrics	(inches)	Update units	Accepted.
96	49	5.1.2 Temperature Metrics	(inches)	Update units	Accepted.
97	49	5.1.2 Temperature Metrics	Annual daily average temperature less than 32°F	This sounds like you're calculating a temperature and not a count of days just from the bold text. Maybe reword it as "Number of days annual daily average temp is less than 32F"	We revised the definitions and made more concise.
98	49	5.1.2 Temperature Metrics	Tmin, Tmax	don't need Tmin/Tmax/Tavg here if you don't include them in the metrics immediately above	We revised the definitions and made more concise.
99	49	5.1.2 Temperature Metrics	Growing degree days (base 50°F)	I'm confused by what this metric is. Is it a trend of how often the daily average is above or below 50F?	We revised the definitions and made more concise.
100	50	5.2 Methods for Historical Analysis	Methods for Historical Analysis	The document is at page 50 and hasn't gotten to the presentation of any results yet. Consider putting dataset descriptions and methods into appendices where folks looking for that detail can find it. An additional consideration is that the many of the methods and dataset descriptions are the same across the three memos. To reduce duplication and make the memos more focused on results, can the common background information be provided and referenced in a different memo or common appendices to reference?	Accepted. Thanks and we are keeping this in mind.
101	50	5.2.1 Trends and Statistical Significance	random	are they really random variables though?	Modified.
102	50	5.2.1 Trends and Statistical Significance	random	Yes - this is a statistical definition - please see link below: https://training.weather.gov/pds/climate/pcu2/statistics/Stats/part1/CTS_random.htm	Modified.

Comment	Page	Section	Text	Comment	Response to Comments
103	51	5.2.1 Trends and Statistical Significance	There is an emerging school of thought that seeks to move away from the traditional, significance level-based hypothesis testing. Some of these approaches are described by McBride et al. (2014), (Hirsch, Archfield, and De Cicco 2015), and (G. B. McBride 2019). Quintessentially, these approaches seek to adhere to the American Statistical Association principles (Wasserstein and Lazar 2016) of not solely relying on whether a p-value passes a given threshold to make scientific conclusions, policy, or business decisions, because p-values do not, by themselves, give enough evidence regarding a hypothesis or model. Instead, phenomena likes trends could be expressed in terms of 'highly likely' or 'equally likely', etc.	This seems a little out of place here.	We reworked this section
104	51	5.2.1 Trends and Statistical Significance	Two different trend techniques are selected for elucidation of temporal changes in the various evaporation metrics: (1) Sen's slope estimator, also known as the Theil-Sen estimator, and (2) the Mann-Kendall trend test.	I thought you were only looking at temperature and precip. Was this erroneously copied from the evap report?	Oops. Thanks.
105	56	5.3 Methods for Projected Future Analysis	025	p25?	Oops. Thanks.
106	57	6 Climate Analysis Results and Discussion	Climate Analysis Results and Discussion	Much of this section has repeated phrases for each of the basins, like mentioning the bias correcting. Then the results are all rather lengthy and repeated. I think this section could be greatly condensed if you talked about one basin, the Columbia River in detail, then just have figures and tables for all the other basins. Especially because there is very little "discussion" that happens regarding the implications of the results. I'm not convinced the questions you list in this paragraph are answered in a clear manner. I get having the results broken down by basin but instead I would rather the sections be the answers to each of these questions and results to back those up. So much gets lost in the sauce in this section that I forget what the point of this section is.	We revised the definitions and made more concise.

Comment	Page	Section	Text	Comment	Response to Comments
107	57	6.1 Historical Analysis	temperature have occurred and what datasets are useful for different types of historical analyses, this section explores the changes have occurred	Grammatically funky	Accepted.
108	57	6.1.1.1 Precipitation – GHCN, Livneh, comparison	However, before comparing	This introductory paragraph is organized oddly. Seems like you could simplify and shorten by saying first we analyzed the point data for trends. Then we analyzed the gridded data. Then we compared the 2 datasets.	We revised the definitions and made more concise.
109	57	6.1.1.1 Precipitation – GHCN, Livneh, comparison	Focusing	Everything from here to the end of this paragraph evaluation/conclusions. I wonder if it belongs in this introductory paragraph? Seems like it should be a separate paragraph at a very minimum, and really should be in a conclusions section elsewhere.	Accepted.
110	59	6.1.1.1 Precipitation – GHCN, Livneh, comparison	in/dec	define	Accepted.
111	59	6.1.1.1 Precipitation – GHCN, Livneh, comparison	mean trend (-0.24 in/dec)	do we care about mean trend? the rest of the paragraph, only median is called out.	Accepted.
112	60	6.1.1.1 Precipitation – GHCN, Livneh, comparison	70 stations had an increasing trend, 22 of which were statistically significant at 95% confidence. 36	Don't start a sentence with a numeric number. Spell it out.	Accepted.
113	61	6.1.1.1 Precipitation – GHCN, Livneh, comparison	/	Either a different color scheme or different scale I think would help this figure because the light blues and browns are hard to see.	Accepted.
114	61	6.1.1.1 Precipitation – GHCN, Livneh, comparison	not unexpected	are expected	Accepted.
115	61	6.1.1.1 Precipitation – GHCN, Livneh, comparison	respective median trends were -1.09 in/dec and -0.2 in/dec – showing a dramatic regime shift.	I think a figure like Figure 10 below but for these two basins would be beneficial to better show the dramatic regime shifts	Accepted.
116	62	6.1.1.1 Precipitation – GHCN, Livneh, comparison	significant	You use this term in this section, including the graphic in Figure 10. But you don't define what you mean by "significant sites" until we read the fine print under the Figure description. Suggest defining "significant sites" here or earlier.	Accepted.
117	63	6.1.1.1 Precipitation – GHCN, Livneh, comparison	/	This is a good example on why 30-year periods are too short for trend analysis i.e. spurious trends. Could use this to support that or consider not including 30-year trend results. An alternative period to consider may be 1970s-now which with the 1970s serving as a breakpoint in many variables where anthropogenic effects start to be more evident	True, but we continue to show 30-year trends and discuss nuances.

Comment	Page	Section	Text	Comment	Response to Comments
118	65	6.1.1.1 Precipitation – GHCN, Livneh, comparison	57%	Don't start a sentence with a number %	Accepted.
119	66	6.1.1.1 Precipitation – GHCN, Livneh, comparison	bimodal	Is there a reason why trends display this bimodal distribution - there seems to be a clear cut off. I would expect at least some sites with low variability display some low magnitude trends. Is the processing somehow screening out low magnitude sens slopes?	Accepted.
120	69	6.1.1.2 Temperature – GHCN, Livneh, comparison	Temperature – GHCN, Livneh, comparison	Because this is a comparison, I wish the figures had side by side plots. Like the mean temps of Livneh vs the GHCN. And the trend plots so I could better compare them. Additionally, i understand Livneh doesn't totally align timeframe wise (ie only until 2015) but is there a reason the data cannot be broken up into time spans like GHCN for the livneh data for a better ocmparison	Accepted.
121	69	6.1.1.2 Temperature – GHCN, Livneh, comparison	Other than elevation, there is a strong latitudinal gradient in temperature due to increasing solar insolation with proximity to the equator. Mild differences between Pacific coast stations and further inland areas such as California's Central Valley can be seen due to oceanic influences.	below when looking at the Livneh data you say "like the GHCN, there are orographic trends" but you don't discuss the orographic effects here	Accepted.
122	69	6.1.1.2 Temperature – GHCN, Livneh, comparison	Other than elevation, there is a strong latitudinal gradient in temperature due to increasing solar insolation with proximity to the equator. Mild differences between Pacific coast stations and further inland areas such as California's Central Valley can be seen due to oceanic influences.	Also though, there seems to be less orographic effect on temperatures here compared to Livneh. Looking at the sierra Nevadas specifically and the western ridge of the Colorado River basin	Accepted.
123	72	6.1.1.2 Temperature – GHCN, Livneh, comparison	Figure 18	Same as comment earlier, the lights are really hard to see over a white background. I think a different color scheme might be better	Accepted.
124	72	6.1.1.2 Temperature – GHCN, Livneh, comparison	Figure 18	I'll echo this for the other tech memos	Accepted.
125	73	6.1.1.2 Temperature – GHCN, Livneh, comparison	Figure 19	I'm curious why trends are described as being per decade rather than per year or over the total time period looked at. It's an interesting way to normalize the data but still doesn't seem equal since not all periods have the same number of decades in them.	Consistency across TMs.

Comment	Page	Section	Text	Comment	Response to Comments
126	75	6.1.1.2 Temperature – GHCN, Livneh, comparison	River	Remove river. Is this just discussing the Upper Rio Grande Basin or the entire Basin?	Accepted.
127	76	6.1.1.2 Temperature – GHCN, Livneh, comparison	(Pan et al. 2004)	Its been awhile since I have read this paper, or maybe the more recent work has proven this wrong, but I recall increasing irrigation being a factor in the "warming hole"	We revised the discussion
128	76	6.1.1.2 Temperature – GHCN, Livneh, comparison	Figure 22—Trend	Is there a reason you don't have a bar graph like for the GHCN showing the distribution of trends (Figure 19)?	We added this.
129	77	6.1.1.2 Temperature – GHCN, Livneh, comparison	diurnal temperature range (DTR)	is this dialy max minus daily min?	Accepted.
130	77	6.1.1.2 Temperature – GHCN, Livneh, comparison	53%	This is the 3rd instance in this paragraph alone of starting a sentence with a numeric percent.	Accepted.
131	78	6.1.1.2 Temperature – GHCN, Livneh, comparison	/	Same as comment above regarding bi-modal pattern. Are there no trends less than ~0.2 or is that a product of clipping/precision of the processing?	We revised these figures for better illustration
132	78	6.1.1.2 Temperature – GHCN, Livneh, comparison	/	Why are the significant trends points over a boxplot but then all sites are just a box plot? At this point just do a violin plot	We revised these figures for better illustration
133	81	6.1.2 Arkansas River Basin	20	Twenty	Accepted.
134	82	6.1.2 Arkansas River Basin	Temperature trends in the Arkansas River Basin (Figure 28) show conflicting patterns when comparing the Livneh data (cooling) and the GHCN data (warming). Across the 16 GHCN stations with valid coverage over 1951-2013, median average annual daily mean temperature was 57.8 °F and the median trend was 0.16 °F/dec. 14 stations had an increasing trend, 6 of which were statistically significant, while the remaining two stations had a significant decreasing trend.	Can you tell me the number of sites/ basins that have different trends between the two	Accepted.
135	84	6.1.2 Arkansas River Basin	For maximum (minimum)	what does this mean?	Clarified.

Comment	Page	Section	Text	Comment	Response to Comments
136	85	6.1.2 Arkansas River Basin	Average temperature increased in 25.3% of the area (significant in 3.4%) and decreased in 51.4% (significant in 19.9%).Maximum temperature increased in 13.3% of the basin (0% significant) and decreased in 47.2% (39.5% significant).Minimum temperature increased in 38.9% of the basin (25.5% significant) and decreased in 27.3% (8.3% significant).Diurnal temperature range increased in 6.5% of the basin (0.9% significant) and decreased in 33.1% (59.4% significant).	I love bullet summaries like this and wish there were more like this in the previous results	Accepted. We changed this throughout.
137	85	6.1.2 Arkansas River Basin	Average temperature increased in 25.3% of the area (significant in 3.4%) and decreased in 51.4% (significant in 19.9%).Maximum temperature increased in 13.3% of the basin (0% significant) and decreased in 47.2% (39.5% significant).Minimum temperature increased in 38.9% of the basin (25.5% significant) and decreased in 27.3% (8.3% significant).Diurnal temperature range increased in 6.5% of the basin (0.9% significant) and decreased in 33.1% (59.4% significant).	Great idea! Would add clarity and conciseness	Accepted. We changed this throughout.
138	95	6.1.4 Columbia River Basin	52.8	The bars in Fig 39b look different from whatt is stated here. same with Fig 40b.	Revisited.
139	97	6.1.4 Columbia River Basin	44.0% of the area (significant in 48.0%) and decreased in 8.0%	so the remaining areas had a 0 trend?	no significant trends, not trend is zero
140	107	6.1.6 Klamath River Basin	In the Klamath River Basin, the 1991-2020 average was much greater than the 1976-2005 average. There is a single station that meets the criteria over WY 1991-2020 that records temperature and a different station that meets the criteria over WY1976-2005. The location of the station has great influence on the daily average temperature.	Might be helpful or interesting to see where the 2 distinct stations are located to get an understanding of the differences. Maybe in Figure 48 (mean temp figure)?	Accepted.
141	109	6.1.6 Klamath River Basin	/	For all of these it would be helpful to say the number of significant HUC8s vs the number of all the HUC8s	Accepted.
142	118	6.1.8 Rio Grande	River	Remove River	Accepted.
143	118	6.1.8 Rio Grande	River	This will need to be done throughout the text for all Rio Grande Basin references	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
144	118	6.1.8 Rio Grande	northernmost headwaters	Would it be helpful to note that this is the predominant water supply for the Basin?	Accepted.
145	136	6.1.11 Truckee-Carson River Basins	Only one GHCN station (located in Reno, NV) had valid coverage over 1951-2013	With only one valid station for 1951-2013, would it have made sense to look at some of the other time intervals?	Yes, we did.
146	142	6.2 Projected Future Analysis	Columbia River Basin	What is the reasoning for selecting this basin?	Consensus dataset for comparison.
147	142	6.2 Projected Future Analysis	Columbia River Basin	By the time I get to this part of the report, I have forgotten the mention of the Columbia Basin at the beginning and why you chose it. I think it's worth bringing those figures back to this point or refreshing us because it's a long report and a lot to ingest	Consensus dataset for comparison. And we understand and reworked this.
148	143	6.2 Projected Future Analysis	are presented	Repeated in the sentence	Accepted.
149	143	6.2 Projected Future Analysis	What are fundamental questions about historical climate data that Reclamation staff commonly ask and how may these analyses answer those questions? For example, GCMs provide historical information in additional to projected future climate information – how do we consider this information compared with historical climate observations?	I'm not getting the connection between the question asked and example given here.	Accepted.
150	143	6.2 Projected Future Analysis	What are fundamental questions about historical climate data that Reclamation staff commonly ask and how may these analyses answer those questions? For example, GCMs provide historical information in additional to projected future climate information – how do we consider this information compared with historical climate observations?	Also not sure how appropriate/fitting it is to discuss this question in a section about future projections. Seems a bit off-topic and perhaps should move into the historical data section, if you think it is such an important topic to cover	Accepted.
151	144	6.2.1 West-wide overview	Rio Grande	Basin	Accepted.
152	144	6.2.1 West-wide overview	declining precipitation	I think we could argue that increasing precipitation also requires potential shifts to water management	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
153	144	6.2.1 West-wide overview	The Missouri River Basin, Great Basin, and Columbia River Basin are projected to experience the most warming, reaching increases in median annual average temperature of 8.4°F, 7.8°F, and 7.8°F by late century, respectively. In contrast, the Sacramento and San-Joaquin River Basin and Texas Gulf Region are projected to warm the least, though still significantly, with late century increases of 6.6°F and 6.8°F, respectively	Rio Grande temp trend?	Accepted.
154	144	6.2.1 West-wide overview	Figure 77—LOCA2 projected changes in precipitation (%) and temperature (F) by WWA Basin.	I'm guessing the lines are temperature and precip is the bars but there isn't a legend or caption to confirm this	Accepted.
155	144	6.2.1 West-wide overview	Figure 77—LOCA2 projected changes in precipitation (%) and temperature (F) by WWA Basin.	Change in annual precipitation? Agree with adding a legend or caption to clarify which is precip and which is temp	Accepted.
156	145	6.2.2 Arkansas River Basin	temperature	Difficult to see the yellow line. Might need to rethink the color selection for this chart.	Accepted.
157	145	6.2.2 Arkansas River Basin	(1985–2014)	This is not the same period of record used for the analysis in the Historical Data Analysis. Should it have been? Vs 1951-2013?	Added clarification.
158	149	6.2.3 Colorado River Basin	–0.1%	This is negative but the data cited above is an increase (+ 0.1%)	We revisted the numbers.
159	152	6.2.3 Colorado River Basin	Mean monthly temperature is projected to increase in all months and increasingly so from early century to late century. However, largest increases are projected during fall and winter and more so when considering only SSP 5-8.5 projections.	It might be discussed later on but here I think it's important to talk about the impacts of this. For example, warming temps in winter months suggests more precip will come as rain instead of snow, or we'll see earlier snow melt	Accepted.
160	153	6.2.3 Colorado River Basin	The Colorado Headwaters HUC8 subbasin is a focus in the Upper Colorado River Basin while the Black HUC8 subbasin is a focus in the Lower Colorado River Basin. The median change in total annual precipitation is positive (wetter) in the future for the Colorado Headwaters and negative (drier) in the future in the Black subbasin,	By the time I get to this point in the report, I have forgotten where the sites are and referring to Figure 7 is a bit of a pain with the length of this report. It might be worth moving that figure down to this section.	Accepted. And we reworked the organization later on.
161	155	6.2.4 Columbia River Basin	Columbia River Basin	I get you're listing these alphabetically, but because there is extra analysis done here, it makes sense to list this before the other basins or at the end.	We kept the order as is.

Comment	Page	Section	Text	Comment	Response to Comments
162	160	6.2.4 Columbia River Basin	CMIP5 projections than CMIP6 projections is different from broad comparisons made between these datasets in other publications, for example Reclamation (2025) and Lukas and Vano (2024), that state CMIP6 projections have generally greater increases on annual precipitation than CMIP5 projections	Consider adding more context here - it isn't really a CMIP6 vs CMIP5 comparison because the two datasets used different downscaling methods, different training data, different GCM ensemble members etc which are perhaps more influential than CMIP version on precipitation.	Accepted.
163	161	6.2.4 Columbia River Basin	Lower Boise: 26 – 13 fewer days, early century 47 – 31 fewer days, late centuryUmatilla:20 – 9 fewer days, early century 35 – 23 fewer days, late centuryUpper Owyhee: 30 – 16 fewer days, early century 64 – 39 fewer days, late centuryUpper Yakima: 32 – 18 fewer days, early century 63 – 41 fewer days, late century	Tables like this are useful and I think the other basins should have the results condensed into tables as well.	Accepted.
164	168	6.2.6 Klamath River Basin	This steady warming trend underscores the significant shifts expected in regional climate, with implications for snowpack, evapotranspiration, and overall water availability in the basin.	Expand on this. What are the implications?	Accepted.
165	169	6.2.6 Klamath River Basin	These projections suggest a future Klamath Basin that is prone to large swings in annual precipitation—continuing the risk of both dry spells and episodic wet years—while experiencing unequivocal warming throughout the twenty-first century.	These implications aren't mentioned in the previous basins and I wish they were	Accepted.
166	193	6.2.10 Texas Gulf Region	Higher scenarios (SSP3-7.0 and especially SSP5-8.5) show a similar pattern of year-to-year swings but with somewhat larger positive excursions later in the century, indicating an increased likelihood of wetter years—even as dry extremes remain possible.	I'm seeing the opposite in the figure below. It looks like it more consistently has negative precip anomaly for the extreme situations.	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
167	198	6.2.11 Truckee-Carson River Basins	Future projections under SSP2-4.5, SSP3-7.0, and SSP5-8.5 (2015–2100) exhibit only modest shifts in the mean precipitation anomaly (often within ±1 inch/year) but a noticeable widening of extremes (95th percentile values occasionally exceeding +10 inches under the highest-emissions scenario).	Also looks like SSP8-8.5 is projecting overall wetter shifts	Accepted.
168	198	6.2.11 Truckee-Carson River Basins	Future projections under SSP2-4.5, SSP3-7.0, and SSP5-8.5 (2015–2100) exhibit only modest shifts in the mean precipitation anomaly (often within ±1 inch/year) but a noticeable widening of extremes (95th percentile values occasionally exceeding +10 inches under the highest-emissions scenario).	at least between 2075 and 2100	Accepted.
169	198	6.2.11 Truckee-Carson River Basins	Future projections under SSP2-4.5, SSP3-7.0, and SSP5-8.5 (2015–2100) exhibit only modest shifts in the mean precipitation anomaly (often within ±1 inch/year) but a noticeable widening of extremes (95th percentile values occasionally exceeding +10 inches under the highest-emissions scenario).	Same with ssp3-7.0	Accepted.
170	202	7 Streamflow Analysis and Literature Review	across locations	I think this sentence would be more clear if you just said “west-wide”, similar/parallel as in the analysis above. For example “ We first highlight insights west-wide (Section 7.1) and then provide more (insights/context/detail/whatever word you like) for individual basins (Section 7.2)	I like the suggestion. We revised to say: "We first highlight insights across all nine west-wide locations (Section 7.1) and then provide more detailed insights for each location (Section 7.2)." Note, this is a pilot, so I feel it would be misleading to just say west-wide.
171	202	7 Streamflow Analysis and Literature Review	We first highlight insights across locations (Section 7.1) and then provide more context for each location (Section 7.2)	What is the difference between insights and context in this case and why are they separated into two sections?	Reworded. Sorry for the confusion - context is now just "more detailed insights".
172	203	7 Streamflow Analysis and Literature Review		It's weird that there is no mention of the two different streamflow sources in this paragraph. Or discussion about what the two different flows mean. Either just use one method or have discussion on the two in this paragraph.	The caption now references where the multiple sources come from (section 7.2 provided details for all 9 of the locations).

Comment	Page	Section	Text	Comment	Response to Comments
173	203	7 Streamflow Analysis and Literature Review	/	Is the Missouri data correct? Observed is substantially higher than naturalized	Yes, we noted that too. We aren't sure why and will inquire further with those who created the Missouri naturalized flow data. We do discuss this later in the text: "... in the Missouri at Omaha where USGS gage values are higher than naturalized flows. Three other locations also have gage flows that are slightly higher intermittently and on average than naturalized flows during the overlapping period. This difference could be a combination of water from diversions that are added (not taken away), or that the gage location is not positioned precisely where naturalized flows were estimated, or it could have something to do with how the naturalized flows were calculated. In future analyses, these nuances could be investigated; however, because trends are based on relative differences, trends can still be informative regardless of overall magnitudes."
174	203	7 Streamflow Analysis and Literature Review	/	it would be easier to read if it was KAF	will change to MAF
175	203	7 Streamflow Analysis and Literature Review	Figure 122—	Why would you not use the same sites as the Precip and Temperature sites in section 6?	The sites here are streamflow gage locations which differ from T and P stations or HUCs. Added text to explain: Although, while specified at a specific location, streamflow is the accumulation of all upstream climate conditions, meaning precipitation or temperature, e.g., at weather stations, are not directly comparable.

Comment	Page	Section	Text	Comment	Response to Comments
176	205	7.1 West-wide streamflow trends	Trends in the historical gage records include changes in how the system is managed	This style of presenting results is very helpful and section 6 should match	Glad it was helpful. This section is a bit different than earlier sections because its a preliminary analysis and not as involved as section 6.
177	206	7.1 West-wide streamflow trends	three larger rivers	which locations?	added names of three locations
178	206	7.1 West-wide streamflow trends	five of nine	which?	now reference the 5 as panels in two figures
179	206	7.1 West-wide streamflow trends	see	Again name them	added names
180	207	7.2 Location-specific streamflow trends	Location-specific streamflow trends	I wish the figures above the streamflow were broken down by site and presented here isntead	This is a preliminary analysis, so we wanted to show patterns across sites instead of focusing too much on any individual location. In future analysis we can provide more site specific analysis.
181	208	7.2 Location-specific streamflow trends	Both gaged and naturalized streamflow have statistically significant declines	For context here, there have been management changes to the operation of Glan Canyon Dam - in particular changes to the determination of annual release volumes following implementation of the 2007 interim guidelines. Prior to 2007, the annual release was always 8.23 maf per year, unless Lake Powell was getting too full. So very little variability in annual outflow the vast majority of the time prior to 2007. Annual release volumes are now tied directly to reservoir elevation. With lower inflow into the reservoir, we might see lower elevations and therefore lower annual releases. With higher inflow into the reservoir, you might see higher elevations and therefore higher annual releases. The increase in frequency of lower release volumes (< 8.23 maf) between 2007 and now is the indication of climate related impacts to gaged flow at the downstream gage at Lees Ferry, because it indicates a higher frequency of low Lake Powell elevations due to lower inflows.	Thank you for this context. Have update the text to provide a bit more detail: Both gaged and naturalized streamflow have statistically significant annual declines. Trend values (Figure 124, column c) also indicate a shift in seasonality. For gaged streamflow, trends are due to a number of factors including water availability (since 2007 annual release volumes are tied directly to reservoir elevation) and energy demands (e.g., higher hydropower generation needs in the cold winter and hot summer). For naturalized streamflow, seasonal trends are likely due to warming temperatures, with streamflow increases in the winter (less snow, earlier snowmelt) and subsequent declines in May-September streamflow later in the year.

Comment	Page	Section	Text	Comment	Response to Comments
182	208	7.2 Location-specific streamflow trends	. Trend values (Figure 124, column c) also indicate a shift in seasonality with winter (DJF) streamflow increases, likely due to warming temperatures, with subsequent statistically significant declines in May-July (gaged)	WRT seasonal changes - Increases in winter gaged flows are due to reservoir management, particularly higher hydropower generation needs in the cold winter months. Nothing to do with temperature for gaged flows. Since the annual volume of Lake Powell releases is more-or-less set on a year-to-year basis, that means less water available to be released in the low energy-demand months of late spring/early summer. Flows are then increased in the hot, high energy demand months of Aug-Sep.Your conclusions about changes in timing of naturalized flows being tied to climate are valid.	Added a mention of this, see comment 181
183	208	7.2 Location-specific streamflow trends	above Imperial Dam	Not sure why you reference future changes at Imperial but not Lees Ferry. Was Lees Ferry not analyzed in the 2021 assessment? If that is the case, you might want to mention that. Otherwise this information about Imperial Dam appears kind of random and thrown in for no obvious reason.	Yes. Lees Ferry was not analyzed. The text now says this.
184	209	7.2 Location-specific streamflow trends	SimulatioTimes New Romanns	Typo	Thank you for catching this. Fixed.
185	212	8.2 Uncertainty in projected future climate dataset selection and analysis	9	Want to provide a more direct reference	Accepted.
186	212	8.2 Uncertainty in projected future climate dataset selection and analysis	a report	Can we hyperlink things?	Accepted.
187	213	8.2 Uncertainty in projected future climate dataset selection and analysis	Lukas and Vano (2024) provide additional answers to many of the frequently asked questions around CMIP6 projections. Their work, which is a valuable resource to accompany this report.	Is there a handful (<10) bulleted takeaways on certainty that can be summarized here?	Accepted.
188	213	8.3 Uncertainty in historical streamflow analysis	unregulated	I do not recollect seeing any analysis of unregulated inflow. I think it was only gaged and naturalized?	Corrected. Yes, this should be naturalized (inadvertantly switched).
189	215	9.1 Historical Analysis - findings	drying in the Klamath River Basin and increasingly challenging water management conditions. Conversely, high increases in annual total precipitation in the Texas Gulf Region, Arkansas	Is this a good place to mention that trend analysis is different in different areas of the country and highlight the importance of updating this document regularly?	Accepted.

Comment	Page	Section	Text	Comment	Response to Comments
190	215	9.1 Historical Analysis - findings	What history do we use? – as you might expect, there is not single answer for all applications and studies. However, this report highlights decision points that are important to consider when deciding what history to use. One decision point is the historical climate trend and how it may differ depending on time period. Another decision point is the appropriateness of the dataset selected to establish “history”. Generally, point observations are appropriate for trend analysis, but gridded datasets may not be appropriate.	This is oddly positioned here. I think the question remains largely unanswered	Accepted.
191	216	9.2 Projected Future Analysis - findings	below freezing.	If the Ark and Texas regions list the number of days, should the Klamath and Truckee be listed as well?	Accepted.
192	216	9.2 Projected Future Analysis - findings	this work supports the concept of vulnerability assessment and evaluation of what are the conditions that make a system or facility vulnerable	This report presents exposure - it does not include any elements of vulnerability or risk. I would state that the report presents plausible future conditions that can be considered in assessments vulnerability	Accepted.
193	218	9.3 Streamflow Analysis	Table 9—	what do the colors mean?	Accepted.
194	218	9.3 Streamflow Analysis	future changes	Are these median deltas across all scenarios?	Accepted.
195	221	9.4 Future Work	The exploratory streamflow analysis may be expanded in the future by expanding locations of analysis. A comprehensive analysis of historical streamflow trends – gaged streamflow and naturalized streamflow – has not been completed or documented and may be useful for context building and broad understanding of historical changes.	It might be helpful to also suggest that Reclamation (or USACE?) personnel with operational knowledge of each gaging station be involved in any analysis of gaged flow because those are the people with the expertise to understand what is happening upstream of those gage locations. (i.e. what upstream reservoir management is driving changes in downstream gaged flow)	Accepted.
196	224	10 References	——. 2025. “Downscaled CMIP6 Climate Projections. Release of LOCA2 Downscaled CMIP6 Climate Projections and Comparison with Preceding Information.” Denver, Colorado.	If you want to add a url for this, it is going to be:http://gdo-dcp.llnl.gov/downscaled_cmip_projections/techmemo/loca2_release_tm.pdf	Accepted.

Attachment B: Comments to Technical Memorandum – Snow Analysis (TM No. ENV-2026-001)

Comment	Page	Section	Text	Comment	Response to Comments
1	1	Executive Summary	Acronyms and Abbreviations	Generic list. Needs to be refined at the end.	
2	24	1.3 The 2026 SECURE Water Act Report	This technical memorandum also includes a literature review discussing complexities of evaluation of historical and projected future streamflow. Another technical memorandum analyzes historical and future projected snow (Snow Analysis, TM-ENV-2026-002). The third and final technical memorandum (this one) analyzes historical evaporation rates and volumes at major Reclamation reservoirs (Reservoir Evaporation Analysis, TM-ENV-2026-003).	Incorrect memorandum identified in these sentences. Move "(this one)" to first sentence.	New introduction from WRPO
3	24	1.3 The 2026 SECURE Water Act Report	WWA	Should we add "other" WWA TMs, since this is one of them?	New introduction from WRPO
4	25	1.4 Snow in the Western United States	that offset temperature-driven decreases in snowpack	Or increases in precipitation at high elevations that will remain above freezing levels even with warming	Added statement about elevation influence as suggested.
6	26	1.4 Snow in the Western United States	To supplement the LOCA2 temperature data, this analysis uses SWE information produced for the US Department of Energy's (DOE) SECURE Water Act Section 9505 Assessment (Kao et al., 2022, 2024).	Due to differences in LOCA2 and ORNL 9505 forcing I am not sure how closely you can connect the dots. For simplicity I am not sure you need to get into LOCA2 in this report as it isn't used in any SWE analysis.	We use LOCA2
7	28	2.1 Snow Hydrology	water year	Suggest adding "(October 1st-September 30th)" or some other clarification to the reader	*Added (October 1st-September 30th)* -- For most of the seasonal snow zone, snow begins to accumulate in the late fall or early winter, after the start of the water year (October 1st – September 30th).
8	28	2.1 Snow Hydrology	Snow accumulation depends on several factors, including elevation, temperature, and precipitation patterns that control the amount and form (i.e. rain or snow)	I would suggest using a more general term rather than elevation so that it can cover other related, physiography (e.g., aspect, slope, and landcover). Thinking something like: "physiography (elevation, aspect, slope, and landcover)"	Changed elevation to physiography
9	28	2.1 Snow Hydrology	often aligns better	Aligns better than what? Reservoir storage?	Clarified runoff timing aligns better.
10	28	2.1 Snow Hydrology	Snow depth varies through space based on terrain, land cover, accumulation/melt patterns, and redistribution from wind or avalanches. The snowpack also acts as an insulating layer, protecting the underlying soil and vegetation from extreme cold, which can have benefits for ecosystem and control snowmelt recharge.	There should be citations for this	Added citations
11	28	2.1 Snow Hydrology	The rate of ablation depends primarily on weather conditions such as temperature, radiation, wind speed and how exposed the snowpack is to these conditions. Landscape features, such as cloud cover, terrain (including aspect which describes the direction a slope faces), and land cover (such as forest canopy) can modulate this exposure and affect ablation rates differently across a watershed through their influence on the snowpack's energy balance. Albedo, a property that describes how much solar energy the exposed snow surface reflects, is also an important control on the snowpack's energy balance, with contaminants such as dust that darken the snow resulting in a lower albedo and more energy available for melt	Missing citations?	Added citations
12	29	2.1 Snow Hydrology	Earlier, slower snowmelt often leads to less runoff and conversely faster melt can lead to greater streamflow by driving greater baseflow; however, subsurface properties such as flow paths, ambient soil moisture conditions, and frozen soils complicate this relationship (Barnhart et al. 2016)	I think it's important to depict between flows and volumes. faster melt can lead to greater streamflow initially, but overall volumes are decreased in late season.	Incorporated suggested language from Climate Report and clarified that this is talking about runoff efficiencies, not total seasonal volumes. Pointed out how this relationship is not the same everywhere

Comment	Page	Section	Text	Comment	Response to Comments
13	29	2.2 Snow Measurement and Estimation Approaches	platforms	You can keep this term if it is commonly used, otherwise I'd suggest changing this to "technologies" or some other term. When I read "platforms" in this context I imagine a physical platform in the sky…😀	Replaced platforms with instrumentation
14	30	3.1.1 Historical dataset screening	Whereas satellite imagery can characterize an area daily but aggregated over a coarser spatial resolution (e.g. 500 m).	But can cover a large area	Whereas satellite imagery can characterize a larger area daily but is aggregated over a coarser spatial resolution (e.g. 500 m).
15	30	3.1.1 Historical dataset screening	statistical-model	And process based models? E.g. SNODAS	Added process based models
16	31	3.1.1 Historical dataset screening	Table 1. Commonly used historical datasets to evaluate snow trends. All datasets contain either snow water equivalent (SWE), snow depth (SD) or fractional snow-covered area (fSCA).	You don't have to add to this list, but Snow Course data is a very long (the longest?) and commonly used dataset of records of snowpack that could be added to this first category.	Added
17	32	3.1.2 Global Seasonal Mountain Snow Mask	seasonal	Seasonally?	Corrected to seasonally
18	33	3.1.2 Global Seasonal Mountain Snow Mask	ephemeral snow or seasonal snow	Where are these defined?	Response: They are defined in the next sentence. "For this report, we focus on areas that are classified as either ephemeral or seasonal snow class (Figure 2). Seasonal snow is defined as areas where snow persists for more than two months, and ephemeral snow accounts for areas where snow is observed seasonally but persists for less than two months (Sturm, Holmgren, and Liston 1995). "
19	34	3.1.2 Global Seasonal Mountain Snow Mask	Columbia	The Columbia has such a large area that is "indeterminate"!	Added a row to the table for indeterminate percentages and text to Columbia and Klamath sections: Notably, approximately 15% of the basin is classified as indeterminate due to clouds. Due to the classification uncertainties associated with this area, these areas are excluded from the analysis.
20	36	3.2.2 University of Arizona SWE	Researchers at the University of Arizona produce daily 4 km and 800 m gridded snow water equivalent data over the Conterminous US (from here on referred to as UA SWE) (Figure 3). The UA SWE product utilizes precipitation and temperature data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) (PRISM Group, Oregon State University 2014), SWE and snow depth data from SNOTEL (section 3.2.1) and snow depth data from National Weather Service Cooperative Observer station network (National Weather Service, n.d.). Assimilation methods stem from Broxton, Zeng, and Dawson 2016 snow density model methodology is based on Broxton, Zeng, and Dawson 2016 and Dawson, Broxton, and Zeng 2017. Trend analysis descriptions are described in Zeng, Broxton, and Dawson 2018, 20. The downscaling approach used to produce the 800m product from the 4km product is described in Broxton et al 2024.	Do we know if PRISM (and therefore UA SWE) has accounted for the known bias in SNOTEL temperature data between 1990s and 2023? If these are not accounted for, I think we'll want to recognize there could be some systematic bias in the modeled gridded SWE (because of the temperature bias). https://www.nrcs.usda.gov/resources/guides-and-instructions/air-temperature-bias-correction	This was a great comment. Thanks to Tim for raising the question (and answering it!)

Comment	Page	Section	Text	Comment	Response to Comments
21	36	3.2.2 University of Arizona SWE	Researchers at the University of Arizona produce daily 4 km and 800 m gridded snow water equivalent data over the Conterminous US (from here on referred to as UA SWE) (Figure 3). The UA SWE product utilizes precipitation and temperature data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) (PRISM Group, Oregon State University 2014), SWE and snow depth data from SNOTEL (section 3.2.1) and snow depth data from National Weather Service Cooperative Observer station network (National Weather Service, n.d.). Assimilation methods stem from Broxton, Zeng, and Dawson 2016 snow density model methodology is based on Broxton, Zeng, and Dawson 2016 and Dawson, Broxton, and Zeng 2017. Trend analysis descriptions are described in Zeng, Broxton, and Dawson 2018, 20. The downscaling approach used to produce the 800m product from the 4km product is described in Broxton et al 2024.	PRISM has accounted for the bias: "Finally, an adjustment was made to SNOTEL temperature data for stations employing the YSI Extended Range temperature sensor; it was discovered that the NRCS had used an erroneous equation to transform voltage to temperature" https://prism.oregonstate.edu/documents/PRISM_datasets.pdf	This was a great comment. Thanks to Tim for raising the question (and answering it!)
22	37	3.2.3 Western United States UCLA Daily Snow Reanalysis	is	Data -> plural, throughout	change 'data is' to 'data are' throughout
23	38	3.2.5 Airborne Snow Observatories, Inc.	sustainably	Substantially? - I thought this was nuanced, it can in some years but doesn't in many years? May be helpful to add more context to the statement	Added context: Reclamation 2021b found including the ASO SWE estimates near peak SWE into water supply forecast models can improve ensemble streamflow predictions by decreasing error originating from storms throughout the accumulation season
24	38	3.2.5 Airborne Snow Observatories, Inc.	matched actual operations	Match runoff observations? Over the past 3 years it has been a mixed bag how which products matched obs the best	reworded: . In a more recent study, Fennema (2022) reports ASO SWE estimates can provide information to improve forecasts used in operations in the Truckee and Carson River Basins
25	39	3.2.5 Airborne Snow Observatories, Inc.	Figure 5. Spatial coverage of Airborne Snow Observatories' flights from 2013 to 2024. The shade of each basin reflects number of flights flown in the general area over the period of record.	I'd assumed we can only count flights as integers. Consider changing the legend to use only integers: 1-4, 5-11, 12-19, etc.	Fixed figure
26	39	3.3 Future Datasets	Global Circulation Models (GCM)	Flagging this terminology - several years ago usace transitioned from use of General Circulation Models to Global Climate Models for consistency in all documents. The former being the legacy definition, the latter being more reflective of current state (simulating more than circulation). The use here is in-between, should pick one and be consistent with all products	Changes all occurances to global climate model

Comment	Page	Section	Text	Comment	Response to Comments
27	40	3.3 Future Datasets	Many future analyses of climate impacts on water resources rely on the outputs from Global Circulation Models (GCM), which simulate atmospheric and oceanic processes or the more complex Earth Systems Models (ESM) that also include representations of terrestrial and marine biogeochemical cycles. The World Climate Research Programme's (WCRP) Working Group on Coupled Modelling (WGCM) organizes global model experiments with a shared experimental design across modeling centers worldwide. The WCRP oversees the Coupled Model Intercomparison Project, or CMIP, which produces multi-model datasets of past, present, and future climate. CMIP6 (Eyring et al. 2016) is the most current phase available and serves as the global climate information for the future projections in this analysis. ScenarioMIP is a modeling experiment performed as part of CMIP6 that evaluates different future socio-economic and emissions scenarios called Shared Socioeconomic Pathways (SSPs). SSPs conceptually replace the representative concentration pathways (RCPs) used in CMIP5 and provide a narrative around future political and socio-economic environments broadly described in O'Neill et al. (2016). The five resulting SSPs are defined as: Sustainability (SSP1), Middle of the road (SSP2), Regional rivalry (SSP3), Inequality (SSP4), and Fossil-fuel development (SSP5). SSPs are paired with forcing pathways and possible climate adaptation policies to achieve a forcing pathway that stabilizes at desired levels (e.g. 4.5 W/m2). ScenarioMIP denotes these different combinations as 'SSPx-y', with x representing the SSP number and y representing the forcing pathway (e.g. a middle of the road scenario stabilizing at 4.5 W/m2 is SSP2-4.5 or simply SSP245). The SSP and forcing pathway combinations used in CMIP6 span the same range of future emissions as the CMIP5 RCPs but fill some of the gaps.To capture relevant processes, ESMs are run on a grid that covers the globe. The horizontal grid resolution (50-250 km) of the models used to compare scenarios in CMIP6 is coarse enough to make the model intercomparison project computationally feasible. In contrast, capturing weather patterns in complex topography, such as snow-dominated headwaters, requires higher resolution models to	Looking for opportunities for conciseness - do you intend for each memo to be stand-alone? It seems like a lot of the background info not directly related to snow will be the repeated across memos. Can it be stated in one and the other's reference it? Or can it be shelved in an appendix and boiled down to a sentence or two here?	Each memo will stand alone
28	40	3.3.1 LOCA2	LOCA2	Is LOCA2 used at all in SWE analyses? (sorry if this comes in later). Recommend leaving out if not.	Yes, LOCA2 is used later in the report
29	40	3.3.1 LOCA2	an approach	Add "statistical" somewhere in this sentence, to clarify this is a statistical downscaling/bias correction method, not a dynamical method.	Added statistical
30	42	3.3.2 Department of Energy CMIP6 SWE	run on over	Run on or run over?	changed to run across
31	42	3.3.2 Department of Energy CMIP6 SWE	first version results through 2059	Might be helpful to remind the reader this represents scenario SSP585.	Great suggestion. This reminder was added.
32	42	3.3.2 Department of Energy CMIP6 SWE	of	delete	corrected
33	42	3.3.2 Department of Energy CMIP6 SWE	of	I assume this document will still go through some technical editing so I will stop making that type of comment.	corrected
34	43	3.3.2 Department of Energy CMIP6 SWE	4	Reference above is VIC version 5	VIC v5 is correct. 4 was removed from the table

Comment	Page	Section	Text	Comment	Response to Comments
35	44	4.1 Snow Metrics	Table 6. Overview of snow metrics.	All of these metrics are "area average" for the basin, snowzone, and elevation band, right? Do we want to clarify that, in case anyone thinks that these could refer to something less than that? (e.g., the first occurrence of 0.1 in in any gridcell, or the max SWE in any gridcell, etc.). If so, we'll want to make this clarification at least in the text ("all metrics are area average unless otherwise specified") and/or in the tables and figures ("area average SWE"). People are used to seeing point measurements from SNOTEL being used to represent basin conditions, so I think this distinction/clarification is important.	This study calculates metrics for each grid cell of a gridded product and aggregates over specified areas, such as snow zones and elevation bands.
36	45	4.1 Snow Metrics	The ablation index describes when the snow has melted, often defined as the first occurrence of snow water equivalent equal to 0 after the date of peak SWE. For this analysis, we set the ablation index threshold to the first instance of SWE less than 0.1 inches following date of peak SWE	Is this the same as the Date of Melt? The figure below shows Date of Melt not ablation index	Updated figure to say ablation index instead of date of melt
37	45	4.1 Snow Metrics	date of melt	Can you define this to clarify that it's when the snow is completely melted?	changed date of melt to ablation index
38	46	4.1 Snow Metrics	Figure 7	I think it's worth adding the other definitions given above on here or being consistent with the language. For example, you show Date of Melt here rather than ablation index. And don't show April 1 SWE on here	changed date of melt to ablation index. Added April 1
39	46	4.1 Snow Metrics	Figure 7. Example timeseries of SWE over a water year, referred to as a SWE curve, with SWE-based metric labeled, including Peak SWE (in), Date of Peak SWE, Ablation Duration (Days) and Date of Melt.	If using "area average", this example figure would be another good place to make that distinction.	Clarified above, but consider this plot generic and useful illustration to describe metrics over a given water year
40	46	4.1 Snow Metrics	At-Risk Snow (ARS) is the climatological classification of an area experiencing an average air temperature in December, January and February greater than zero degrees Celsius over a 30-year span (Nolin et al. 2021) ARS may suggest an area has experienced, or is vulnerable to, a shift in mid-winter precipitation from snow to rain. This metric may also capture areas that are susceptible to rain-on-snow events from December to February, particularly as basin starts to get rain as a more dominant precipitation form in the basin. Frequency of Warm Winter (FWW) quantifies the number of warm winters over a 30-year span. A warm winter is defined as a winter during which the average monthly air temperature exceeds zero degrees Celsius during any one of the core winter months (December-February). FWW captures some basins that are not at risk of converting fully to rainfall from snowfall, but quantifies the shift to more rain and earlier melt based on temperature (Nolin and Daly 2006; Nolin et al. 2021).	I'd love to see these same metrics calculated using observed temperature data in the historical analysis. Or at least I'm confused by why these metrics aren't included in the historical analysis.PRISM would be the most consistent dataset, since that is what UA SWE is built on. I'd be curious to see how the calculations of FWW and ARS using observed data (PRISM) compare to the "historical period" from the GCMs / LOCA2.	Agreed but outside of scope at this time
41	47	4.2 Trend Statistics	The MK is a non-parametric test used to identify significant trends in time series data	The metric this produces is Kendall Tau, right? We might want to state that here	Added - The trend presented is a Theil-Sen slope.
42	49	5.1.2 UA SWE and ASO	we compare the ASO SWE product with UA SWE.	is the purpose of this to understand the accuracy of UA SWE?	The purpose of this comparison is to understand the accuracy of UA SWE, while acknowledging that ASO estimates SWE based on snow depth observed using lidar and modeled density.
43	49	5.1.2 UA SWE and ASO	we compare the ASO SWE product with UA SWE.	Did you consider making these comparisons based on snow depth not SWE? Since UA has SD, and ASO snow depth can be considered closer to "truth" - curious is the model Depth to "truth" depth - tells a different story than model-to-model SWE estimates	LB removed snow depth as a variable we were focusing on in section 3.1.1

Comment	Page	Section	Text	Comment	Response to Comments
45	50	5.1.2 UA SWE and ASO	UA SWE uses SNOTEL data, which is available in the state of Nevada, but snow pillows in California are not part of the SNOTEL network but rather managed by the state. While it is not explicitly stated in the documentation of the product, UA SWE may lack calibration data in California to estimate SWE in certain portions of the Sierras, leading greater uncertainties in the state of California compared to other regions that are adequately characterized by SNOTEL.	I will ask Patrick Broxton to review	LB removed snow depth as a variable we were focusing on in section 3.1.1
46	51	5.2 Historical Analysis	While the majority of water is held in the snowpack in the seasonal snow zone, it is necessary to evaluate trends in the ephemeral snow zone, as it experiences differing vulnerabilities and play a contributing role to water supply.	I'm curious if there's any papers that give estimates of how much ephemeral snow contributes vs seasonal snow contributions that could give an idea of the relative importance of the two.	Not aware at this time
47	51	5.2.1 West-wide overview	Geographically, these basins are closest to the Pacific Ocean, which is serves as a moisture source for precipitation (Neiman et al. 2008)	It may also be worth noting these basins feature “maritime snowpack”, while the other basins mostly feature “intermountain” and “continental snowpack”. Trujillo and Molotch 2014	Added: Geographically, these basins are closest to the Pacific Ocean, which is serves as a moisture source for precipitation (Neiman et al. 2008). These basins also feature maritime snowpack, while the other basins mostly feature intermountain and continental snowpack (Trujillo and Molotch 2014).
48	51	5.2.1 West-wide overview	Negative trends in ablation index suggest snowmelt is occurring earlier in the water year.	If the ablation index is “defined as the first occurrence of snow water equivalent equal to 0 after the date of peak SWE” then I am not sure it necessarily follows that snowmelt is occurring earlier as the date of peak SWE can vary widely from year to year.	Changed sentence: Negative trends in ablation index suggest ablation following peak SWE is occurring earlier in the water year.
49	51	5.2.1 West-wide overview	Negative trends in ablation index suggest snowmelt is occurring earlier in the water year.	Perhaps we just need to trade “snowmelt” for “ablation” or “melt out” or some other term that clearly defines the end of snowpack for a given year.	Addressed above
50	52	5.2.1 West-wide overview	Figure 10. Historical averages of each metric in the seasonal snow zone summarized by basin, where each point represents an individual water year.	In the opening paragraph you define the date range used for historical averages. Might be helpful to include in this caption and/or figure.	Updated: Figure 10. Historical averages from WY 1982 through 2023 of each metric in the seasonal snow zone summarized by basin, where each point represents an individual water year.
51	52	5.2.1 West-wide overview	Table 7	Does the period after the arrow mean anything? and what does the up and down arrow without an asterisk mean? And if there's no trend, why is there an asterisk and a down arrow for some of these?	Cleaned up table caption and reassigned arrows/symbols to meet a 55% area threshold.
52	52	5.2.1 West-wide overview	Historical average	Same comment about date range	Updated: "Table 7. Historical average from WY 1982 through 2023 of each..."
53	53	5.2.1 West-wide overview	⍰⍰	I’m not sure what having both arrows means. Should this be an * for no trend? Or are the different arrows reporting on different elevation bands, in which case all cells should have two symbols?	Cleaned up table caption and reassigned arrows/symbols to meet a 55% area threshold.
54	53	5.2.2 Arkansas River Basin	with 2% (4,960 square miles) of the basin falling within the seasonal snow zone and 3% (7,440 square miles)	I’m guessing these are approximate areas calculated based off of the percentages reported earlier and the exactness of the areas listed. I suggest adding “approximately” to the parentheticals here and in future basin sections.	Added approximately everywhere, but I think it is excessive. Can we state that they are approximations early on to avoid repetition?
55	54	5.2.2 Arkansas River Basin	negative	Are all statistically significant? Or a mixture? (Similar comment anytime we’re talking about trends)	Refined presentation of trends and p-value

Comment	Page	Section	Text	Comment	Response to Comments
56	55	5.2.2 Arkansas River Basin	Table 8. Historical average and trend in Peak SWE (in) over the seasonal and ephemeral snow zones by 1000 feet elevation bands in the Arkansas River Basin.	It would be helpful to see the p-values listed with the trends to understand if the trends are statistically significant. Consider adding another column where the p-values can be listed? And/or some sort of symbology for significant or not significant?	Refined presentation of trends and p-value
57	55	5.2.2 Arkansas River Basin	in/dec	I'm guessing this is inches/decade. Please define this measurement in the text and/or add a footnote to the table.	Added: Historical trend results are presented in units of inches per decade (in/dec).
58	55	5.2.2 Arkansas River Basin	in/dec	I agree, this needs to be defined as it is not nearly as common as in/yr or other units	
59	55	5.2.2 Arkansas River Basin	0	Should this be 70?	Changed minimum in all Arkansas tables to 70
60	55	5.2.2 Arkansas River Basin	3000-4000 -- -- -- -- -- --	Is there no snow in this elevation band?	Not necessarily. We present results where the elevation band account for >0.01% of the area within the elevation band. It may also be that the seasonal snow mask does not classify those areas as seasonal and ephemeral snow.
61	56	5.2.2 Arkansas River Basin	Below 9,000 feet, the snowpack transitions to be classified as more ephemeral, with most of the water stored in the snowpack at peak SWE in the ephemeral snow zone in elevation bands below 8,000 feet.	I'm confused with what this sentence is trying to say	Reworded.
62	57	5.2.2 Arkansas River Basin	(days/dec)	What is this unit?	days/decade. Described in caption
63	57	5.2.2 Arkansas River Basin	The historical average April 1st SWE is 3.63 inches and 0.12 inches in the seasonal and ephemeral snow zone, respectively	It appears this might be areally weighted? If so, would suggest including that in the sentence before "historical". Or maybe note elsewhere in the document that this was done since the numbers will differ from NRCS. Might also consider adding a row to Table 10 showing the historical averages.	The historical averages are in table 10. Why will these numbers differ from NRCS? The averages reported are the average over each snow zone for the full period of record. I added a stence about the high elevation areas recieving the majority of snow in the basin
64	61	5.2.3 Colorado River Basin	including,	Why not just list all seven states (Colorado is the only one missing), instead of using "including"?	replaced with : The Colorado River Basin is in the southwestern region of the United States. The basin stretches across seven states: Wyoming, Colorado, Utah, Arizona, New Mexico, Nevada and California.
65	61	5.2.3 Colorado River Basin	The basin is approximately 253,000 square miles, with 34% (86,020 square miles) of the basin falling within the seasonal snow zone and 10% (25,300 square miles) of the basin falling within the ephemeral snow zone.	Same comment as earlier: I'm guessing these are approximate areas calculated based off of the percentages reported earlier. I suggest addinga "approximately" to the parentheticals.	addressed
66	69	5.2.4 Columbia River Basin	The elevation in the Columbia River Basin ranges from 0-13,000 ft. The basin is approximately 260,000 square miles, with 71% (184,000 square miles) of the basin falling within the seasonal snow zone and 8% (20,800 square miles) of the basin falling within the ephemeral snow zone.	This is for the entire basin, not just the US portion, correct? Might be helpful to state that, especially since the analysis below excludes the Canadian portion. The outline for UASWE in Figure 3 shows the dataset extending quite a bit further north. Are those extents correct? Can the analysis be expanded above the Canadian border using the same dataset?	The historical analysis is constrained by the spatial coverage of the UA SWE product. Approximately 40,000 square miles of the Columbia River Basin are in Canada, placing them outside the spatial domain of the UA SWE product. Within the dataset's spatial domain, which encompasses the contiguous United States (CONUS), about 220,000 square miles of the basin are included. Of this area, approximately 66% lies within the seasonal snow zone, while 10% falls within the ephemeral snow zone. The historical analysis of the Columbia River Basin will focus solely on the areas within the United States.

Comment	Page	Section	Text	Comment	Response to Comments
67	69	5.2.4 Columbia River Basin	The elevation in the Columbia River Basin ranges from 0-13,000 ft. The basin is approximately 260,000 square miles, with 71% (184,000 square miles) of the basin falling within the seasonal snow zone and 8% (20,800 square miles) of the basin falling within the ephemeral snow zone.	On this point, is there any kind of supplemental information (or actual data analysis) we can include to understand how things are changing in the Canadian portion? My understanding is this portion of the basin produces a disproportionate percentage of total Columbia River runoff.	Added info on the % in Canada
68	70	5.2.4 Columbia River Basin	The historical average peak SWE is 10.53 inches and 2.00 inches in the seasonal and ephemeral snow zone, respectively (Figure 26)	In just the US portion, correct? We might want to include a statement that all seasonal averages and trends for the Columbia Basin include only the US portion.	Yes, added statement above when discussing areas
69	71	5.2.4 Columbia River Basin	outside of the UA SWE product domain	Mention that this area is Canada	added mention of canada in Missouri and Columbia captions (hashed area)
70	71	5.2.4 Columbia River Basin	Percent of Area	Percent of Area within the US? I agree with Tim that we need to be consistent with pointing out what we are showing for Columbia since a large portion of the seasonal snow area is in Canada.	Yes, added statement above when discussing areas
71	72	5.2.4 Columbia River Basin	rend in date of peak SWE are variable throughout the basin	There does seem to be a trend based on elevation with higher elevations experiencing a decrease and lower elevations experiencing an increase.	added: Within the seasonal snow zone, higher elevations are experiencing negative trends, and lower elevations are experiencing positive trends in date of peak SWE (Table 19). These results suggest peak SWE is occurring earlier in the higher elevations and later in the lower elevations across the seasonal snow zone in the Columbia River Basin.
72	76	5.2.4 Columbia River Basin	ephemeral	This actually shows mostly positive trends	replaced with new trend results:). Elevation bands above 4,000 feet in the seasonal snow zone show negative trends in ablation index, representing earlier snow melt out. Elevation bands below 4,000 feet in both the seasonal and ephemeral snow zone show positive trends, suggesting later snow melt out.
73	85	5.2.6 Klamath River Basin	These 17 sites are located in the 4,000 to 8,000 ft elevation range	And all in the Upper Basin. Annual precipitation at K Falls airport is about 14 inches, compared to 80 inches at Klamath, CA near the mouth of the river. Evidence of the strong atmospheric river influence.	Added: These 17 sites are in northeast region of the basin within the 4,000 to 8,000 feet elevation range
74	88	5.2.6 Klamath River Basin	The historical average date of peak SWE is February 19th	Certainly different when you weight it by area instead of using NRCS SWE index, which says median peak SWE on March 14 for Klamath. And of course when I showed the peak SWE dates by years and decades for the Klamath Basin report, I used the NRCS index.	We discuss this in the snotel section and ephasize the limitations of both snotel and gridded in this report.
75	93	5.2.7 Missouri River Basin	The elevation in the Missouri River Basin ranges from 360 to 14,100 ft. The basin is approximately 521,000 square miles, with 38% (197,980 square miles) of the basin falling within the seasonal snow zone and 31% (161,510 square miles) of the basin falling within the ephemeral snow zone.	Similar to the Columbia: This is for the entire basin, not just the US portion, correct? Might be helpful to state that, especially since the analysis below excludes the Canadian portion. The outline for UASWE in Figure 3 shows the dataset extending quite a bit further north. Are those extents correct? Can the analysis be expanded above the Canadian border using the same dataset?	The historical analysis is constrained by the spatial coverage of the UA SWE product. Approximately 10,400 square miles of the Columbia River Basin are in Canada, placing them outside the spatial domain of the UA SWE product. Within the dataset's spatial domain, which encompasses the contiguous United States (CONUS), about 510,600 square miles of the basin are included. Of this area, approximately 37% lies within the seasonal snow zone, while 32% falls within the ephemeral snow zone. The historical analysis of the Missouri River Basin will focus solely on the areas within the United States.

Comment	Page	Section	Text	Comment	Response to Comments
76	95	5.2.7 Missouri River Basin	0	Should this be 360?	Changed to 360. Modified all minimums
77	96	5.2.7 Missouri River Basin	Figure 48. Distribution of percentage of peak SWE volume of the cumulative historical average peak SWE over the seasonal and ephemeral snow zones in the Missouri River Basin.	The bimodality with the northern great plains seasonal snowpack and the rocky mountain seasonal snowpack is interesting!	Noted
78	104	5.2.1 Rio Grande Basin	Arkansas River	Rio Grande	Corrected
79	109	5.2.2 Sacramento and San Joaquin River Basins	Sacramento San-Joaquin	Shouldn't the dash be between Sacramento and San Joaquin? "Sacramento-San Joaquin". If so, please change other instances in section/report	Changed to Sacramento and San Jouaquin at request of region/to alligin with others
80	125	5.3 Future Analysis	historical period	The CMIP6 historical period, right? Not change from the historical period (section 5.2 observed data)	Added in () and to table.
81	125	5.3 Future Analysis	Future trends in temperature-based metrics, including Frequency of Warm Winter (FWW) and At-Risk Snow (ARS), are presented spatially across the entire basin.	I see we look at the "historical period" from the different CMIP6 model runs, but curious why similar At-Risk Snow and FWW calculations weren't done using observed datasets (whether PRISM or daymet or some other gridded product) to have a more direct comparison of what we're observing versus what has been modeled over the historical period and is projected into the future.	Agreed but outside of scope at this time
82	126	5.3.1 West-wide overview	Figure 74.	I'm confused about the use of gray for this because some of these areas don't receive emphemeral or seasonal snow (like Baja Calfornia) so is it really 100% at risk?	added in section above: ARS is a temperature-based metric that encompasses all areas, including both those within and outside the seasonal and ephemeral snow zones. Historically, lower latitude regions, such as the Texas-Gulf region, do not consistently experience snowfall, which aligns with the ARS metric shown in Figure 74. Areas demonstrating 100% ARS model agreement are illustrated in grey.
83	126	5.3.1 West-wide overview	Risk	The grey is confusing since much of that area doesn't normally get snow. Is there a way to mask this dataset to snow cover layer? This would help show the scale or areas actually at risk.	Don't crop to snow zoens because they dervive from other dataset. Added text to clairfy gray area in 5.3.1
84	127	5.3.1 West-wide overview	change	higher change?	greater change
85	129	5.3.2 Arkansas River Basin	Figure 76. Change in future snow metrics relative to the historical period (WY 1985-2014) in the Arkansas River Basin within the seasonal snow zone. Shared Socioeconomic Pathways (SSPs) are denoted by color. Hydrology model is denoted by shape, with triangles representing VIC4 and circles represented PRMS. Boxplot whiskers represent the 5th and 95th percentiles.	I like the rotation of the dates (x-axis) versus swe (y-axis). It's a nice way to visualize change in different types of metrics.	Forced y and x axes to the same for all SWE and date metrics
86	129	5.3.2 Arkansas River Basin	Figure 76. Change in future snow metrics relative to the historical period (WY 1985-2014) in the Arkansas River Basin within the seasonal snow zone. Shared Socioeconomic Pathways (SSPs) are denoted by color. Hydrology model is denoted by shape, with triangles representing VIC4 and circles represented PRMS. Boxplot whiskers represent the 5th and 95th percentiles.	Not necessary, but curious if using shared y-axis for the SWE and shared x-axis for the dates could be helpful for a quick visual comparison	
87	129	5.3.2 Arkansas River Basin	FWW	We've already defined this acronym in the earlier chapters and the WWA portion of this chapter. I'm guessing this is intentional, as it is likely different water users/readers will only be interested in their particular basin chapter. I wonder if it would be helpful to say something about acronyms being defined multiple times somewhere in the intro? Or else just to define only once?	Defined at start of section then use acronym throughout. Captions currently use Frequency of Warm Winter but we can replace to FWW if necessary.

Comment	Page	Section	Text	Comment	Response to Comments
88	137	5.3.4 Columbia River Basin	(darkest red)	It's kind of hard to distinguish between the different reds. Is there any way to show this more easily? The color bars with 5 colors instead of 3 could be worth a test. Ie the bar on the left or the next image.	Changed colors
89	138	5.3.5 Great Basin Region	In general, the range for each metric, with the exclusion April 1 SWE.	Missing part of this sentence	In general, the range for each metric increases, with the exclusion April 1 SWE
90	143	5.3.6 Klamath River Basin	result in less precipitation falling as snow and less water being stored in the snowpack, resulting in less water availability	Which is especially problematic in basins such as Klamath which have limited storage capability. Upper Klamath Lake cannot store even one full season's worth of water supply and depends on snow pack to make up the shortfall.	This is more appropriate for basin chapter to loop in streamflow/res capacity
91	143	5.3.6 Klamath River Basin	The likelihood of an area being at-risk creeps from low to high elevations.	Does this mean that the likelihood of an area being at risk increases with elevation?	The likelihood of an area being at-risk creeps from low to high elevations, suggesting the likelihood increases with elevation
92	143	5.3.6 Klamath River Basin	The likelihood of an area being at-risk creeps from low to high elevations.	The higher elevations (which are mostly to the northeast) only turn grey during the later time period. I interpret this as meaning the low-lying areas are already at risk whereas the risk "creeps" uphill over time, correct?	
93	158	6.1 Synthesis	All basins experienced a decrease in peak SWE during the historical period across the majority of elevation bands in the seasonal and ephemeral snow zones, although these changes were limited to the higher elevations in the seasonal snow zones for the Klamath and Sacramento and San Joaquin River basins	what does this mean?	All basins experienced a decrease in peak SWE during the historical period across the majority of elevation bands in the seasonal and ephemeral snow zones, although these changes were **only seen in the** higher elevations in the seasonal snow zones for the Klamath and Sacramento and San Joaquin River Basins. A decrease in peak SWE suggests the maximum snow accumulation has decreased over the historical period of record
94	158	6.1 Synthesis	This region is susceptible to the influence of warm, wet storms originating in the Pacific Ocean, which can potentially lead to extreme snowfall, or warm wet precipitation (Neiman et al. 2008).	How does this translate into streamflow and snowpack volumes and does that align with the findings above?	All basins experienced a decrease in peak SWE during the historical period across the majority of elevation bands in the seasonal and ephemeral snow zones, although these changes were only seen in the higher elevations in the seasonal snow zones for the Klamath and Sacramento and San Joaquin River Basins. A decrease in peak SWE suggests the maximum snow accumulation has decreased over the historical period of record. The Klamath and Sacramento and San Joaquin River Basins are geographically situated towards the coast of the Pacific Ocean in comparison to other more inland basins. This region is susceptible to the influence of warm, wet storms originating in the Pacific Ocean, which can potentially lead to extreme snowfall, or warm wet precipitation (Neiman et al. 2008). Due to varying temporal patterns of extreme events, it is challenging to untangle extreme event behavior when assessing trends over a historical period. Statistically significant positive trends in the lower elevation bands in the Klamath River Basin may be the result of large extremes influencing the historical average or

Comment	Page	Section	Text	Comment	Response to Comments
95	158	6.1 Synthesis	This region is susceptible to the influence of warm, wet storms originating in the Pacific Ocean, which can potentially lead to extreme snowfall, or warm wet precipitation (Neiman et al. 2008).	If the large warm, wet events often referred to as atmospheric rivers occur during the winter months in Klamath, we may experience significant snowmelt, decreasing snowpack and streamflow later in the year. But I agree that the paragraph can be confusing when it starts by talking about a decrease in peak SWE but then finishes by mentioning potential extreme snowfall.	more frequent extremes over the historical period
96	158	6.1 Synthesis	Ablation duration is the time in between peak SWE and ablation index, or date of melt	This should probably be more consistent across plots etc. Suggest picking one and going with it.	changed to ablation index only
97	158	6.1 Synthesis	In terms of water resources, shorter melt could result in potentially faster snowmelt and/or less snowmelt reaching the reservoirs due to infiltration (Barnhart et al. 2016)	From Barnhart 2016 "This pattern also suggests a potential snowmelt rate-driven streamflow generation mechanism, whereby rapid snowmelt delivers water to the soil column, bringing it above field capacity, inducing percolation below the root zone, and contributing to excess soil water. Excess soil water then leads to increased subsurface flow, which results in elevated BSA values. In contrast, when this relationship is inverted, slower snowmelt corresponds to lower, even negative, BSA values, suggesting a decrease in proportional streamflow production and greater partitioning to evapotranspiration."This conclusion seems to be the opposite of this sentence implying faster snowmelt leads to less streamflow.	Reworded this section
98	159	6.1 Synthesis	Barnhart et al. 2016 found more rapid snowmelt produced greater streamflow anomalies, and earlier, slower snowmelt may produce less streamflow due to percolation.	Statement seems misleading. Again, from Barnhart 2016 "Our analyses, when combined with previously identified negative trends in mountain snowpack and melt rates, suggest that earlier, slower snowmelt may reduce percolation below the root zone resulting in proportionally less streamflow." Maybe rephrase this sentence to read "...due to less percolation."	Barnhart et al. 2016 found more rapid snowmelt produced greater streamflow anomalies, **whereas** earlier, slower snowmelt may produce less streamflow **due to percolation**.
99	159	6.1 Synthesis	in some instances by magnitude	I'm not sure what this means. By "order of magnitude"? I expect them to vary in magnitude, so perhaps you mean they will vary in "sign"?	Changed magnitude to sign
100	159	6.1 Synthesis	dam and public safety	Can you explain why?	dam and public safety due to flood potential
101	161	6.3 Future Work	demand	Perhaps change this to "need" since we use "water demand" later in this sentence	changed to need
102	163	7 Conclusions	The Future analysis projects impacts to all snow metrics that become more severe by the end of the century and with higher Shared Socioeconomic Pathways that result in higher emissions.	This sentence is confusing	Reworded
103	164	8 Appendix	igure 103.	Tech writer to support appendix formatting, including figures.	Done.
104	169	8.1 Appendix: Trend significance plots	Trend significance plots	Maybe it would be good to add a sentence at the beginning of this section on what the p-value represents.	Added for reference

Attachment C: Comments to Technical Memorandum – Reservoir Evaporation Analysis (TM No. ENV-2026-002)

Comment	Page	Section	Text	Comment	Response to Comment
1	7	1 Introduction	the eight	Reclamation has more than 8 major basins we manage. Suggest deleting "the eight" in first sentence and leaving it in the second sentence. Or just delete "the" in the first sentence.	We have updated the text to reflect the point that the 8 major basins called out in the report actually represent basins called out in the SECURE Water Act.
2	20	3.1.1 Model Description	Acknowledging this limitation of the Penman equation, Zhao et al. (2019) develop the Lake Evaporation Model (LEM), a model that relies on a modified Penman equation combined with an "equilibrium temperature" algorithm to estimate heat storage and ultimately daily reservoir evaporation rate. Zhao et al. (2024) convert LEM into a daily version, referred to as the Daily Lake Evaporation Model (DLEM).	Watch verb tenses, use developed and converted.	We are using present tense verbs throughout the tech memo, even in reference to past studies/reports/manuscripts.
3	21	3.1.2 Meteorological Inputs	during the early part of the historical period	Is this because RTMA data is not available for the early part of the historical period?	Yes, partners make this analysis decision because RTMA data are not available during the early part of the historical record. We have updated the text to reflect this point.
4		3.2 paragraph 2		variety "of" spatial scales	Updated text
5		General		Consistency with in-text citations using "," and not	The TSC tech writing group has addressed all formatting inconsistencies.
6		2.3 Evaporation and Water Management		Worth mentioning the frequency (infrequency) of updates to area capacity tables from LiDar studies which also impacts the estimates of volumetric reservoir evaporation?	We have added similar text to the text.
7		2.3 Evaporation and Water Management section:		Climate change scenarios are not necessarily incorporated into reservoir evaporation (operational decisions) in all Reclamation Basins/reservoirs. Is this sentence referring to CRSS planning runs?	We have eliminated this text and streamlined the remaining content.
8		2.3 Evaporation and Water Management section:		In addition to environmental flows - recreation and hydropower are also impacted by estimates of evap volume	We have eliminated this text and streamlined the remaining content.
9		3.0: Paragraph 1		last sentence "the study"	Updated text
10		3.1.1		Potential typo "dLauring"?	Updated text
11		3.1.1: Second paragraph, first sentence:		changed to developed	We are utilizing present verb tense throughout the entire report. As such, we do not make this text change.
12		3.1.1:		Eqns 11-14 missing? Some symbols for variables also missing in paragraphs	The TSC tech writing group has addressed all formatting inconsistencies.
13		3.2		throughout - Lake Mead and Lake Mohave are technically NV and AZ	We have udpated the text.
14		3.2		Table 1. There appears to be a pretty big difference in Daily and Monthly Correlation Coefficients for Clear Lake and American Falls. Should this be addressed?	We have added p-values to the table and note that monthly correlations at both locations are not statistically significant with an alpha of 0.05. However, daily correlations are statistically significant.
15		4.1		Paragraph 1 - define spin-up and why used	We have updated the text to explain this concept.
16		5.1.1		: Figure 3 - should this be in/yr units if it is rate?	We have updated the units associated with all evaporation metrics that represent rates to length per time.
17		5.1.1		• Is it useful to color by Region? If so, have a key with the Region per color. Perhaps this actually by Basin since Powell and Mead are the same color?	We have updated the text to reference the figure in which these colors are defined.
18		5.1.1: pg 50. Sentence 2		• . Not sure I would use the term "real life". Same comment in section 6.2	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
19		5.1.1:		• : general comment: I understand that condensation is negative evaporation but technically condensation is a physical volume of water - should be positive in graphs with condensation as the y axis? Perhaps having it graphed as negative is standard.	We have removed this content from the report.
20		5.1.1		• Figure 18-right, the combo of the faintness of the trends and the low number of statistically insignificant sites makes it hard to follow the analysis. Might be better to just keep the text narrative and remove the figure?	We have eliminated these figures and the associated text from the report.
21		General		• Unsolicited opinion: I find the graphs, such as figure 23) a bit more useful as narrative figures rather than the maps unless talking about regional differences in evaporation	We acknowledge different reading styles and have opted to leave both the graphic and text in the memo.
22		5.1.1		Figure 24 - Add labels for Jan-Apr	We have updated the figure to include labels.
23		5.1.1		• Figure 25 - overlap with x axis and "Statistically Significant" - there is one reservoir that has such a negative trend in the Missouri Basin	Fixed
24		General		there is one reservoir in the Missouri Basin that seems to have such high negative trends in Fig 22, 24, 25 - curious which reservoir this is and why. This might be Lake Minatare?	This is Lake Minatare in western Nebraska. We have moved this analysis to an appendix. We cannot explain this single trend with the analysis provided.
25		5.1.1		Should Grand Coulee be "Franklin Delano Roosevelt Lake" and "American Falls" be "American Falls Reservoir"	We have updated the figures.
26		General		Emphasize importance of technologies	We have updated the future work section to emphasize additional observational studies, which speaks to observational technologies.
27		General		• Were there sites that were consistently insignificant. Can you tie anything about common physical settings or geometries that are influencing evaporation trends	We have updated the discussion text to reflect the need for additional analysis focused on understanding drivers of these trends.
28		Section 6-2		real-world conditions is an odd term	We have updated the text.
29		Cpt 7 - paragraph 2		• (there is an erroneous "1F1" next to SECURE)	We have corrected the text.
30				• Overall I think it is good. Emphasizing some of the key messages from the last paragraph in 6.2 answered a lot of my questions - most of which had to so with what physical aspects of a reservoir/region were driving some of these trends	No action required
31				- No time series anywhere in report. Okay?	We are not opposed to time series, yet none of the reviewers (TSC or otherwise) asked that time series be added. Consequently, no action needed.
32				Mention that volumes may not agree with consumptive use and loss reporting	We have updated the text.
33				- Make it very clear somewhere that this dataset is brand new. We have never had an entire west-wide reservoir evaporation dataset.	We have updated the text to reflect this.
34				- Bring up volumes and large differences in volumes across sites. Can be a discussion section.	We have added a paragraph to the discussion section.
35				Add comments in methods section on applications of certain methods at Reclamation: EC Lake Mead, Elephant Butte, Caballo, Lake Powell; BREB at Lake Mead; Aerodynamic and Lake Powell and Elephant Butte, Caballo	We have updated the text.
36		Section 1.4		reservoir evaporation - need citation for CRLE here	We have added the appropriate citations here.
37		Section 2.2		do we have any information that we can report on how many Reclamation reservoirs have evaporation pans (still?) and to what extent these data are still relied on operationally?	We do not have data on this for Reclamation.

Comment	Page	Section	Text	Comment	Response to Comment
38		Section 2.2		when describing the Eddie Covariance method, what makes environmental conditions, physical setting, and experimental design appropriate such that this method can be used?	We have updated the text to further explain these ideas.
39		Intro to section 3		this could be a useful place to make a statement that the dataset developed based on the model to be described is the basis for the evaporation analysis focused in this TM.	We have updated the text.
40		Section 3.1.3		Do we note which reservoirs have simulated volumes based on ACAPs and water level obs or static reservoir depth? That would be useful to document in this TM.	We have added this information in graphical and tabular format.
41		Section 4.1		maybe state that We characterize historical evaporation from each of the 247 reservoirs in the DLEM dataset described in section 3 by computing a series of evaporation metrics relevant to water management and resources	We have added this to the text.
42		Section 5.1		I'm wondering why in the statement below: The largest positive trends are located in Oregon, California, Colorado, Texas, and Oklahoma. The largest negative trends are located in Wyoming, Utah, Montana, and the Dakotas.	Yes, this is an interesting question. We have updated the discussion section to include a need for additional analysis on drivers of trends.
43		Figure 9		Upper Klamath Lake is known as Upper Klamath Lake, not Upper Klamath Lake Reservoir	We have updated the figure text.
44		Figure 16		on the left panel I'm curious if we can point out those reservoirs when mean days is zero. The color scheme does not allow for distinguishing between days = >0-5inches versions days==0 inches.	We have eliminated this figure and associated text from the analysis.
45		Page 47		I'm curious about reporting of trends to the 6th decimal place. It seems that fewer significant digits would be more appropriate? ** Removed exact trend mangitudes from text.	We have removed this analysis from the text.
46		Figure 23		plot would benefit from larger labels	We have updated the figure.
47		Table 5		maybe some shading of negative differences to allow for easier distinction between positive difference and negative difference	We tested a few options and came to the conclusion that the negative symbol is the best indicator of differences in sign.
48		Limitations		do we have any analysis (maybe from past studies like KNFS) to provide information as to uncertainties in the model and how it is implemented? What is the greatest source of uncertainty do you think? Inputs? Process representation? Lack of verification data?	We have updated the text.
49		General		Can we include anything about how gridmet compares with P and T observations? Perhaps referencing work by DRI?	We have updated the text to include comparisons of gridMET against point observations.
50	7	1 Introduction	Uncertainty with changes in hydrologic variability driven by Earth's climate presents a growing risk to effective water management in the Western United States	Better in active voice	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
51	8	1.2 Previous SECURE Water Act Reports	expanded	Other bullet points are in present tense	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
52	8	1.2 Previous SECURE Water Act Reports	used	Tense check	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
53	9	1.3 The 2026 SECURE Water Act Report	Wwest	Consistency check	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
54	9	1.3 The 2026 SECURE Water Act Report	wWestern water managers	Consistency check	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.

Comment	Page	Section	Text	Comment	Response to Comment
55	9	1.3 The 2026 SECURE Water Act Report	what	what what?	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
56	10	1.4 Reservoir Evaporation	western	Consistency check - this is capitalized earlier	The technical writers group will review and make all necessary capitalization changes to the report.
57	10	1.4 Reservoir Evaporation	report	This is previously capitalized but is not capitalized in this section	The technical writers group will review and make all necessary capitalization changes to the report.
58	10	1.4 Reservoir Evaporation	report	Consistency check	The technical writers group will review the report and update/fix/address as needed.
59	11	1.4 Reservoir Evaporation	by the Texas Water Development Board	Added for more context	We have accepted the text change.
60	11	1.4.1 Report Objectives	Report Objectives	I'm not sure if this makes sense as a subsection of 1.4 Reservoir Evaporation. Should this be 1.5?	We have moved this text to a new section.
61	11	1.4.1 Report Objectives	report	Consistency check	The technical writers group will review the report and update/fix/address as needed.
62	11	1.4.1 Report Objectives	new Reclamation-wide dataset	Add a bit more information about this new dataset here - why is it important/different?	We have updated the text to indicate why this dataset is novel (i.e., first Reclamation-wide reservoir evaporation dataset).
63	12	1.4.2 Report Structure	Report Structure	Should this be 1.5.1?	We have updated the text.
64	14	2.1 Drivers of Evaporation	Beyond meteorological forcings,	Suggesting an edit here since this paragraph is about both meteorological and hydrologic factors impacting evapPrevious paragraph is about temporal/spatial scales, this paragraph is about metero and hydro variables	We have updated the text.
65	15	2.2 Methods for Estimating	where Rnet is net radiation, Qsed is heat transfer to the water from sediments, Anet is the net heat advected into the lake	Suggest making the explanation of variables the same format for all equations	We have updated the text.
66	18	2.3 Evaporation Volume and Water Management	with the same evaporation rate	This is confusing	We have updated the text.
67	20	3 Estimating Historical Evaporation	In this chapter, we describe the lake evaporation model (Section 3.1), required forcing data and inputs (Section 3.1.2, 3.1.1), lake evaporation model output (Section 3.3), some validation efforts, and details of the historical dataset utilized in the study.	Suggestion to format like this	We have updated the text.
68	21	3.1.2 Meteorological Inputs	original	Not clear what the original dataset is and how it differs from the "new" dataset	We have updated the text.
69	25	3.3 DLEM Output	West-Wide	Reproject this plot using EPSG 5070 (Albers Equal Area CONUS)?	We have updated the map.
70	27	4.1 Evaporation Metrics	a change point	describe/indicate what this change is? Relatively large amount of data (7 years) to remove because of this	We have updated the text to explain this concept.
71	27	4.1 Evaporation Metrics	Water yYears (WYs),	WY previously defined. Add definition of water year (Oct - Sept) somewhere. Consistency check - previously not capitalized	We have added a definition of water year and provided sample dates.
72	28	4.1 Evaporation Metrics	k	Is this kAF?	The unit is kAF because k stands for kilo in the SI system.
73	33	5.1.1 Annual Metrics	totals	Check? Or move to the next paragraph if this is about totals	We have updated metrics and units to more accurately reflect scientific notation (e.g., inches per year, inches per year per decade, etc.).
74	34	5.1.1 Annual Metrics	/Figure 3 – Average annual evaporation rate (in) simulated by DLEM between	Suggestion to remove the lat-lon grid lines from this plot. They distract from the state borders	We have changed the color of these lines to make them more distinct.
75	34	5.1.1 Annual Metrics	total	Check?	We have updated all units to reflect the correct use of the term "rate".

Comment	Page	Section	Text	Comment	Response to Comment
76	35	5.1.1 Annual Metrics	in/dec	this isn't defined anywhere, I added it to the abbreviations page above	The tech writers will verify that all appropriate acronyms appear in the acronym list.
77	36	5.1.1 Annual Metrics	/Figure 5 – Trend in annual evaporation rate (in/dec) simulated by DLEM between WY 1981 and WY 2015. Sites with trends significant at the 95% level based on the Mann-Kendall trend test are indicated by the filled circle.	Same comment as above - remove the lat lon grid lines	We have changed the color of these lines to make them more distinct.
78	36	5.1.1 Annual Metrics	significant sites	This made it sound like there were special sites	We have updated the text to indicate how we refer to statistically significant sites.
79	38	5.1.1 Annual Metrics	(in/yr)	The figure says units are (in/dec), is this correct?	We have updated all figure units.
80	38	5.1.1 Annual Metrics	(i.e., annual evaporation rates are the same order of magnitude among all 247 sites).	This may need more explanation.....	Order of magnitude refers to powers of ten. No change to the text.
81	40	5.1.1 Annual Metrics	-69.7 kAF/dec to 5.9	Is this right? The bins for the plot range don't communicate this large negative trend - can't distinguish which sites have a trend of -5 kaf/dec or a trend of -70 kaf/dec	This range of trends is correct. There is one location with a negative trend that far exceeds other locations. We have opted to leave this text and figure alone, yet we have added a summary figure of average annual evaporation rate and volume, along with trends, for 12 large and important reservoirs.
82	40	5.1.1 Annual Metrics	/Figure 10 – Trend	Same comment for this plot and all similar plots below - remove lat lon grids or make them lighter than state border lines	We have changed the color of these lines to make them more distinct.
83	43	5.1.1 Annual Metrics	(in/yr)	Check this - plot says in/dec	We have updated all figure units.
84	45	5.1.1 Annual Metrics	in/yr)	In/dec?	We have updated all figure units.
85	46	5.1.1 Annual Metrics	condensation rates are barely below 0 in	Should this say evaporation rates? Or, could say something like "high elevation regions experience little condensation."	We have removed this analysis and associated text from the report.
86	47	5.1.1 Annual Metrics	/Figure 17 – R	Should the y-axis be positive values, since we are talking about condensation (negative evap)? Or, should it be labeled average evap?	We have removed this analysis from the text.
87	50	5.1.1 Annual Metrics	days/yr	Days/dec?	We have removed this analysis and associated text from the report.
88	51	5.1.2 Seasonal Metrics	statistically significant	Does this mean statistically significant? Can be confusing to describe as only "significant"	We have updated the text to indicate how we refer to statistically significant sites.
89	53	5.1.2 Seasonal Metrics	/Figure 23	Since the percentage values are not explicitly mentioned in the text, it might be helpful to add the percentage values overlaying the bars in the plot	We have increased the size of the figure.
90	54	5.1.3 Monthly Metrics	/Figure 24 –	Missing Jan-Apr titles	We have updated the figure.
91	55	5.1.3 Monthly Metrics	in/yr	In/month? Plot legend says in/dec	We have updated all figure units.
92	56	5.1.3 Monthly Metrics	/Figure 26 –	It's interesting that the largest statistically significant positive trend is in April - a month important to water managers/stakeholders. Might be worth expanding on in the text	We have updated the text.
93	58	5.2 Comparisons with Past Efforts	Values in the upper left of each subplot represent the mean annual evaporation rate (in) simulated by CRLE and DLEM	Mean annual evaporation rate for all time	We have updated the figure caption.
94	63	6.1 Synthesis	A negative trend in average condensation rate, a negative value, represents	Should this be a negative trend in evaporation rate represents an increase in condensation rate?	We have removed this analysis and associated text from the report.
95	65	6.3 Future Work	Future Work	More widespread in-situ observations/monitoring	We have updated the text.
96	65	6.3 Future Work	could quantify and propagate uncertainty	rephrase	We have updated the text.
97	67	7 Conclusions	Western U.S.	Consistency check	The tech writers will ensure consistency across memos and with Reclamation style requirements.
98	67	7 Conclusions	SECURE1F1	?	We have updated the text.
99	68	7 Conclusions	secure the future of water resources in the west.	Or something else if this is too cheesy	We have updated the text.
100	1	Executive Summary	Climate	The word "Climate" is used over 50 times in this document. Consider making an effort to not using or minimizing using the word.	Language in the SECURE Water Act authorizes Reclamation to perform this work and includes focus on climate and climate change. We therefore chose to retain the word "climate" in this report.

Comment	Page	Section	Text	Comment	Response to Comment
101	7	1 Introduction	for	Delete "for"	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
102	9	1.2 Previous SECURE Water Act Reports	can be	Should this be "were"?	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
103	9	1.3 The 2026 SECURE Water Act Report	helps	This should be "help"	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
104	9	1.3 The 2026 SECURE Water Act Report	what historical conditions and to consider potential future variability within those decisions.	Is this sentence missing something? It doesn't seem complete or make sense.	Sections 1.0 and 1.1 are provided by WRPO. We have updated the text to reflect recommendations from their office and authors.
105	10	1.4 Reservoir Evaporation	Reclamation 2025	Is this referencing Reclamation 2025 a, b, or c?	We have updated the text.
106	10	1.4 Reservoir Evaporation	Attema 2020	Reference not listed	We have updated the text.
107	10	1.4 Reservoir Evaporation	Reclamation (2015)	Reference not listed	We have updated the text.
108	10	1.4 Reservoir Evaporation	Maurer et al. (2002)	Reference not listed	We have updated the text.
109	10	1.4 Reservoir Evaporation	Wood et al. 2004	Reference not listed. Looks like a lot of the references are not listed in the "References" section.	We have updated the text.
110	13	2.1 Drivers of Evaporation	importace	Fix spelling	We have updated the text.
111	16	2.2 Methods for Estimating Evaporation Rate	w'	Use same apostrophe style to make this sentence consistent with formula (7).	We have updated the text.
112	20	3 Estimating Historical Evaporation	th	Should be "the"	We have updated the text.
113	20	3.1.1 Model Description	dLauring	during	We have updated the text.
114	20	3.1.1 Model Description	ρ is the density of water	Density of water at the average water column temp?	The authors of DLEM assume a fixed density of water, which we have added to the text.
115	21	3.1.1 Model Description	advected heat	Wouldn't advected heat be significant in reservoirs like Lake Powell and Lake Mead? Where, the yearly inflows/outflows are close to 100% of their current storage.	We have added a paragraph to the discussion section on the importance of advected heat.
116	21	3.1.2 Meteorological Inputs	DePondeca et al., 2011	Tried looking up name in references to see if it was spelled DePondeca or De Pondeca (as in next paragraph, but it looks like Reference section has not been completed yet as most of the references in this section are not included.	We have updated all references.
117	21	3.1.2 Meteorological Inputs	during the early part of the historical period	Is this because RTMA data is not available for the early part of the historical period?	The RTMA dataset used by partners at DRI starts in 2016. We have updated the text to reflect this point.
118	22	3.1.3 Reservoir Inputs	When multiple area-capacity curves are available for a single reservoir, the most recently developed curve is used to reconstruct surface area and volume values for all dates in the historical record.	Problematic for Upper Klamath Lake since reconnection of Agency-Barnes wetlands in Jan 2025 added approximately 14,000 acres surface area and 70 TAF of storage to UKL's previous 486 TAF of active storage. Using the new bathymetry would be very misleading for earlier years.	We have added a paragraph to the discussion section on the importance of reservoir inputs within DLEM.
119	23	3.2 DLEM Validation Efforts	in	Delete	We have updated the text.
120	25	3.3 DLEM Output	West-Wide	Reproject this plot using EPSG 5070 (Albers Equal Area CONUS)?	We have updated the map.

Comment	Page	Section	Text	Comment	Response to Comment
121	27	4.1 Evaporation Metrics	Second, we avoid a change point in the meteorological forcing data.	I recommend elaborating on this point more. Is this is change point in datasources, or a change point in the variable (i.e. step change in temperature or another variable?). A change in dataset is strong rationale where changing the forcing data characteristics by switching methods in the timeseries could lead to spurious trends. Further explanation will help address a common question that comes up on similar analyses - why not compute metrics to present, especially since more extreme conditions have been observed in the last decade. That lends to perceptions of the results being dampened by leaving out recent years.	Text in the report is referring to a change point in the dataset used to force DLEM. We have updated the text to reflect this detail and better explain what change points are and why they matter.
122	28	4.2 Trends and Statistical Significance	Trends and Statistical Significance	I found it a little confusing when two of the trend analysis techniques are called models, one is a test, and the other is an estimator. However, the term for each is used consistently.	We have thinned the discussion of statistical methods to include only those used in the report. We have also updated report figures and all captions.
123	30	4.2 Trends and Statistical Significance	However, in most cases these assumptions will not be fully met, making the non-parametric approaches like Sen's slope or Mann-Kendall test as good or better than OLS	What the value of presenting all methods if Sen's and MK are as good or better for most cases? It may be simpler to present and communicate results from a smaller set of methods.	We have removed this text.
124	30	4.2.1 Ordinary Least Squares Linear Regression	Regression	If there is interest in conciseness you could drop these sections are cite a common statistical reference. These are widely used statistics.	We have removed this text.
125	34	5.1.1 Annual Metrics	Latitude is not the only factor that influences simulated annual evaporation totals; elevation is also important. Reservoirs with some of the lowest simulated average annual evaporation rates are located at elevations in excess of 8200 ft (2500 m). Average annual evaporation rates among reservoirs located near sea level show more variability than sites located above 8200 ft, variability that may be explained by latitude	Maybe provide reason(s) for lower evaporation rates at higher altitudes?	We have updated the text.
126	35	5.1.1 Annual Metrics	The range in trend magnitude among sites with significant trends is -0.5 to 1.2	Maybe proving the trend as a % increase(or decrease) per decade would be more useful for water managers to understand the magnitude for their respective reservoirs.	We have updated the text.
127	35	5.1.1 Annual Metrics	in/dec	Is this inches/decade? Maybe add this to the acronyms list at the beginning?	We have updated the acronyms list and rates throughout the report.
128	35	5.1.1 Annual Metrics	in/dec	Agree. This is not as common as in/yr	We have updated units associated with all evaporation metrics that include rates.
129	36	5.1.1 Annual Metrics	Sites with trends significant at the 95% level based on the Mann-Kendall trend test are indicated by the filled circle.	Was the Mann-Kendall test the only one used for this trend analysis?	Yes, the Mann-Kendall test is the only test used to assess trend significance in this report.
130	36	5.1.1 Annual Metrics	method	Maybe mention what "method" is being talked about? (e.g. "statistical trend estimation method")	We have removed this analysis from the text.
131	36	5.1.1 Annual Metrics	We highlight the impact of method on trends in annual evaporation rate simulated by DLEM	Has any analysis been conducted to quantify the individual contributions of the forcing variables to the changes in evaporation?	We have removed this analysis from the text.
132	36	5.1.1 Annual Metrics	However, population medians are largest for the linear model method and smallest for the Sen's slope method. The range in trends is also largest for the linear model and smallest for Sen's slope	This tracks with sensitivity to outliers. It may be worth describing that or condensing down to the non-parametric methods.	We have removed this figure from the report.
133	37	5.1.1 Annual Metrics	Sen, robust linear model, and linear model	Why is Mann-Kendall trend test not shown in Figure 6? Yet it appears to be the only analysis used for Figure 5.	Removed figure
134	38	5.1.1 Annual Metrics	/	Given the differences in total annual totals, it would be great to see the trends as %/decade as well.	We now show %/dec (normalized by reservoir avg) in Figure 11
135	38	5.1.1 Annual Metrics	Figure 7 – Box and whisker plots of average annual evaporation rate (in) and trend in average annual evaporation rate (in/yr) simulated by DLEM between WY 1981 and WY 2015 at each available reservoir across select Reclamation basins. Thick horizontal lines represent the population median, boxes extend to the 25th and 75th percentiles. Whiskers extend to the 5th and 95th percentiles.	What analysis was used to generate trend results in Figure 7?	Theill Senn and Mann-kendall, revised to make more clear (also removed discussion of the other trend techniques OLS and RLM since results for those are not shown).
136	39	5.1.1 Annual Metrics	Reclamation region	Reference figure 2	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
137	40	5.1.1 Annual Metrics	Of the negative trends, 45 are significant	This is a large enough number to provide more discussion on. If not provided later I recommend discussing drivers of this result.	We have updated the text.
138	40	5.1.1 Annual Metrics	Figure 10 – Trend in annual evaporation volume (kAF/dec) as estimated by DLEM output between WY 1981 and WY 2015.	Trend analysis used?	Added clarification
139	43	5.1.1 Annual Metrics	Sites with significant trends based on the Mann-Kendall trend test are indicated by a filled circle.	Now the Mann-Kendall test is mentioned again.	Added clarification
140	45	5.1.1 Annual Metrics	In DLEM, and in the absence of ice formation, condensation takes the form of negative evaporation	Has condensation in DLEM or in any derived measurement been evaluated? At first blush it seems pretty small - certainly within model error - and not significant to overall mass balance. Given that I would see this section as a candidate for removal if there is interest in making the memo more concise.	We have removed metrics and analyses related to condensation (or negative evaporation rate).
141	47	5.1.1 Annual Metrics	Figure 18 – Trend in the (left) number of condensation days (days/dec) and (right) condensation rate (in/dec) simulated by DLEM between WY 1981 and WY 2015.	Is this still Mann-Kendall?	We have removed this analysis from the text.
142	52	5.1.3 Monthly Metrics	Monthly Metrics	Consideration for conciseness - if you present monthly do you need seasonal composites?	We have moved seasonal analyses to an appendix.
143	56	5.2 Comparisons with Past Efforts	studies	Most locations show more evap in late winter early spring. Can that be attributed to a specific attribute listed above? Additionally Powell and Mead are drastically different - which warrants some targeted explanation (a sentence or two)	We have updated the text.
144	61	5.3 Projected Changes	Whereas global or national studies provide broad estimates of projected changes in evaporation rates, site-specific investigations of lake and reservoir evaporation can be more useful for water management and planning activities. La Fuente et al. (2022) utilize five lake models forced with bias corrected climate projections from four different GCMs contributing to CMIP5 under three RCP scenarios (RCP 2.6, RCP 6.0, and RCP 8.5) to simulate historical and future evaporation rate at Lake Kinneret, Israel (for a total of 20 model realizations per RCP). Lake models include Flake (Kirillin, 2002), General Lake Model (GLM; Hipsey et al. 2019), General Ocean Turbulence Model (GOTM; Burchard et al. 1999), MyLake (Saloranta and Andersen 2007), and Simstrat (Goudsmit et al. 2002). Relative to the historical average (1971-2000), projections suggest increases in annual evaporation rate of 9 %, 14 %, and 22 % between 2070-2099 under RCP 2.6, RCP 6.0, and RCP 8.5 scenarios, respectively. At a seasonal time scale, projected percent changes are largest during spring, while projected absolute changes are largest during summer.	Consider removing. I am not sure the findings and technical details for an analysis of a lake in Israel adds much to this report.	We agree that a lake in Israel is outside our study domain. However, the modeling chain (GCM to BC method to lake model) employed by the authors is relevant. We retain this text.
145	62	6.1 Synthesis	The largest positive and significant trends are located in California, Colorado, Texas, and Oklahoma.	The affected states are somewhat distinct, geographically. Any conclusions that we can repeat here as to the reason for these areas seeing the most significant increases in evaporation? (See two paragraphs later, how condensation rate changes may be explained by converting natural landscape to irrigated fields.)	We have updated the text.
146	62	6.1 Synthesis	Trends in annual evaporation volume can conflict with trends in annual evaporation rate due to changes in surface area	An explanation as to why these conflicts occur (e.g., is it due to major reservoir drawdowns affecting surface area, or local hydrological factors?) would provide more actionable insights.	We have updated the text.
147	62	6.1 Synthesis	Trends in average condensation rate are largely insignificant, however there are few sites where the trend is statistically significant and negative, primarily located in Oklahoma and Nebraska. A negative trend in average condensation rate, a negative value, represents an increase in condensation rate. One possible explanation for these changes may be positive trends in dew point temperature observed across the Great Plains due to land-use changes (Mahmood et al. 2004). Some studies suggest that dew points are increasing from the conversion of natural landscape to irrigated fields. Another explanation could involve water temperatures. More specifically, water temperatures could be increasing such that the water surface temperature is approaching the dew point temperature more often.	See previous comment on the relative importance (w.r.t. water volumes) for analyzing and explaining condensation in this report	We have removed metrics and analysis related to condensation in the report.

Comment	Page	Section	Text	Comment	Response to Comment
148	63	6.1 Synthesis	project changes	Use "projected changes" as La Fuente does rather than "project changes". This will also help avoid confusion as to whether we are talking about changes in a Reclamation project, or projected changes in evaporation.	We have updated the text.
149	63	6.1 Synthesis	Results indicate that annual evaporation rate are increasing	Providing more information on the degree to which rising air temperatures or specific meteorological changes are estimated to contribute to these increases would be useful.	This information is reservoir specific. As such, we refer the reviewer to section 2.1, which speaks to the drivers of evaporation and how complex they are (meteorologically, hydrologically, and limnologically).
150	63	6.2 Limitations	First, the lake evaporation model excludes advected heat, atmospheric stability, and ice dynamics. While this simplifies the modeling framework, it also introduces notable limitations. By neglecting advected heat, the model omits the influence of inflows and outflows on the lake's thermal structure, which can be significant in reservoirs with substantial tributary inputs or controlled releases. The absence of atmospheric stability considerations overlooks the impact of stratification on heat and moisture exchanges between the lake surface and the atmosphere, potentially leading to inaccuracies in simulating evaporation rates under varying meteorological conditions. Finally, disregarding ice processes fails to account for the insulating effect of ice cover during winter months, which can suppress evaporation and alter the seasonal energy balance (Van Cleave et al. 2014). Studies have demonstrated that models incorporating these physical processes provide more accurate simulations of lake-atmosphere interactions.	It would be useful, for water managers, to explicitly discuss the potential magnitude or direction of the inaccuracies on the reported evaporation rates and volumes due to neglecting these. For example, if neglecting ice cover during winter tends to overestimate evaporation, quantify this if possible, or provide a qualitative assessment of its impact.	We have updated the text.
151	65	6.3 Future Work	A better understanding of the limitations associated with gridded variables critical to evaporation, such as wind speed and humidity, is essential for improving the accuracy of reservoir evaporation estimates in both modeling and observational studies.	Given the limitation of gridded wind speed data, maybe consider adding a recommendation for integrating over-water wind speed observations as a priority for improving input data?	We have updated the text.
152	66	7 Conclusions	SECURE1F1	Typo?	We have updated the text.
153	66	7 Conclusions	memorandum	Either memoranda or memorandums	We have updated the text.
154	67	7 Conclusions	understanding how surface area of surface storage reservoirs may change	Maybe adding how future changes in reservoir operations (e.g., drawdowns due to increased demand or reduced supply) could influence future evaporation volumes in the discussion section would be valuable?	We have updated the text.
155	7	1 Introduction	Introduction	The introduction should focus on the introduction of this TM, and I don't think it needs to include all of the SECURE background. This Report's introduction starts in Section 1.4. Please edit this section accordingly, and just provide reference to the past SECURE and this SECURE efforts. Again, the focus of this introduction should be on this Report.	The funding office wrote much of the introduction as a means to connect all three tech memos. This text is coming from WRPO, and we update accordingly.
156	10	1.1 Reservoir Evaporation	Reservoir Evaporation	Also, please see comment with the first sub-heading of Chapter 4 – 4.1 Study Domain.	We have updated the text.
157	10	1.1 Reservoir Evaporation	Morton 1979, 1983, 1986	Morton, F. I. (1979). Climatological estimates of lake evaporation. Water Resources Research, 15(1), 64–76. https://doi.org/10.1029/WR015i001p00064 Morton, F. I. (1986). Practical estimates of lake evaporation. Journal of Applied Meteorology and Climatology, 25(3), 371–387. https://doi.org/10.1175/1520-0450(1986)025%3C0371:PEOLE%3E2.0.CO;2	We have updated the references section.
158	12	1.1.2 Report Structure	. In Chapter 3, we describe the Daily Lake Evaporation Model and summarize its validation provide a summary of the foundational dataset used in this study.	The title of Chapter 3 is, "Estimating Historical Evaporation". This chapter describes the DLEM, and DLEM validation. Let's update the chapter name to Daily Lake Evaporation Model.	We have updated the text.
159	12	1.1.2 Report Structure	Methods for analyzing the historical dataset are reviewed in Chapter 4, including a summary of relevant evaporation metrics and methods used for determining statistical significance.	Suggest renaming Chapter 4 to explicitly describe its content. Suggested chapter title, "Methods for Analyzing Historical Evaporation Data Across Reclamation".	We have updated the text.
160	13	2.1 Drivers of Evaporation	in Harbeck (1962),	Reference missing.	We have updated the text.
161	13	2.1 Drivers of Evaporation	Trenberth 1995	Trenberth, K. E. (Ed.). (1995). Climate System Modeling. Cambridge University Press, 788 p.	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
162	16	2.2 Methods for Estimating Evaporation Rate	literature	Please add references.	We have updated the text.
163	17	2.2 Methods for Estimating Evaporation Rate	In-situ methods are critical for understanding and quantifying evaporation during periods of time where quality observations are available.	Unclear sentence; please rewrite.	We have modified the sentence for clarity.
164	17	2.2 Methods for Estimating Evaporation Rate	(first term on the right -hand side of Equation 8) and an aerodynamic component (second term on the right -hand side of Equation 8),	These additions will likely come across to be verbose, but I believe it will be helpful to the broader audience of this report.	We have updated the text.
165	18	2.2 Methods for Estimating Evaporation Rate	(Priestley and Taylor 1972)	Priestly, C. H. B., & Taylor, R. J. (1972). On the Assessment of Surface Heat Flux and Evaporation Using Large-Scale Parameters. Monthly Weather Review, 100(2), 81-92. https://doi.org/10.1175/1520-0493(1972)100%3C0081:OTAOSH%3E2.3.CO;2	We have updated the references section.
166	20	3 Estimating Historical EvaporationDaily Lake Evaporation Model	Bureau of Reclamation's	I have assumed this notation, Bureau of Reclamation (Reclamation), has been used in a previous chapter – let's verify.	The tech writers will ultimately decide this format.
167	21	3.1.2 Meteorological Inputs	Daly et al. 1994	Daly, C., Neilson, R. P., and Phillips, D. L. (1994). A Statistical-Topographic Model for Mapping Climatological Precipitation over Mountainous Terrain. Journal of Applied Meteorology and Climatology, 33(2), 140–158. https://doi.org/10.1175/1520-0450(1994)033<0140:ASTMFM>2.0.CO;2	We have updated the references section.
168	22	3.1.2 Meteorological Inputs	early part of the historical period	Add the historical period in parenthesis.	We have updated the text.
169	23	3.2 DLEM Validation Efforts	DLEM Validation Efforts	I think "Efforts" can be dropped from the section header.	We have updated the text.
170	23	3.2 DLEM Validation Efforts	slight	I will avoid such qualifiers unless there is a quantitative basis to define such thresholds.	We have updated the text.
171	23	3.2 DLEM Validation Efforts	Reclamation (2025b)	Reclamation (2025a) has not been referenced before or in the document, from a quick search. Reclamation (2025) has been referenced. Let's make the referencing consistent.	We have updated the text.
172	23	3.2 DLEM Validation Efforts	Monthly correlations (Pearson's product moment correlation coefficient) among all sites range from 0.64 to 0.97, while daily correlations among the sites range from 0.27 to 0.92.	Provide p-value to show correlation significance levels. Use R function, cor.test. Even though the daily correlations are low in some cases (e.g., American Falls and Clear Lake), they will likely come out to be significant given the sample size. However, the strength of the relationship, i.e., rho value, is more important than the p-value significance determination when we have a large sample. After you run cor.test, just include the p-value to the correlation magnitudes.	We have updated the table to include p-values.
173	24	3.2 DLEM Validation Efforts	Reclamation (2024)	Include/update reference. Currently not in the list of references.	We have updated the text.
174	24	3.2 DLEM Validation Efforts	Reclamation (2024)	Please add reference.	We have updated the text.
175	24	3.2 DLEM Validation Efforts	Reclamation (2024)	Please add reference.	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
176	25	1.1 Study Domain	Thus, we largely focus on evaporation rate and associated metrics.	This was an important motivation point mentioned in an earlier section (Section 2.3), and suggest that we include the point again here. Otherwise, it can come across that the focus is on the analysis of evaporation rates only. It is important to emphasize the significance of estimating volumetric losses, and as mentioned at the end of Section 2.3 -- "rates inform physical process understanding, while volumes translate this understanding into resource management decisions."	We have updated text to indicate that we analysis evaporation volumes. We have also expanded the number of evaporation metrics related to evaporation volumes. We now include monthly and seasonal evaporation estimates.
177	25	1.1 Study Domain	West-Wide	Reproject this plot using EPSG 5070 (Albers Equal Area CONUS)?	We have updated the map.
178	26	1.1 Study Domain	Table 2 – Reservoir count among WWA Basins. Eleven reservoirs in the historical dataset are located outside of these basins.	Based on the description above, you may want to organize this table into two blocks. First block, all the WWA basins in alphabetical order of the basin names; second block, sites not in the WWA basins. This will help with the readability and keep the content consistent with the SECURE Water Act (SWA). The SWA lists eight major Reclamation basins. Basins such as the Arkansas, or Texas-Gulf Coast Region are not listed in the Act. These sites should be in the block of non-WWA basins.	We have restructured the presentation of basins within Reclamation's boundary.
179	27	4.1 Study Domain	Study Domain	As a suggestion – since this section is quite small, and not to simply inflate it, but if there are additional information that could be relevant to include in the context of reservoirs this would be a good section to do it. Maybe once you work through the Introduction section, some of that information could be summarized here. The Introduction section should include context and the importance of reservoirs in managing water in the West. This is not included in this version of the Report, and should be added in the revision.	We have modified the text to move this section (Study Domain) into chapter 1. We have also bolstered the discussion of evaporation rates and volumes, and their importance, in the introduction.
180	27	4.1 Study Domain	Of the 247 reservoirs, 11 are located outside of the WWA basins	Please update numbers as needed after grouping the information into the two blocks – WWA basins and non-WWA basins.	We have updated and rearranged the text.
181	27	4.1 Study Domain	West-Wide	Reproject this plot using EPSG 5070 (Albers Equal Area CONUS)?	We have updated the map.
182	28	4.1 Study Domain	Table 2 – Reservoir count among WWA Basins. Eleven reservoirs in the historical dataset are located outside of these basins.	Based on the description above, you may want to organize this table into two blocks. First block, all the WWA basins in alphabetical order of the basin names; second block, sites not in the WWA basins. This will help with the readability and keep the content consistent with the SECURE Water Act (SWA). The SWA lists eight major Reclamation basins. Basins such as the Arkansas, or Texas-Gulf Coast Region are not listed in the Act. These sites should be in the block of non-WWA basins.	We have restructured the presentation of basins within Reclamation's boundary.
183	28	4.2 Evaporation Metrics	we avoid a change point	Add clarification for change-point, it is too abstract for a general reader. In these situations, it is best to illustrate with an example.	We have updated the text.
184	28	4.2 Evaporation Metrics	the selected time period better aligns with meteorological seasons	Why so? Let's explain. What is specific to this time period that it aligns more closely with meteorological seasons and water years? This first paragraph needs to be re-written and be made clear. Consider a reader who is picking this information up for the first time, and not aware of technical details such as change-points or meteorological seasons and close alignment with meteorological seasons. Please add clarification details.	We have expanded this portion of the section to better explain model spin-up and change points.
185	28	4.2 Evaporation Metrics	Thus, we largely focus on evaporation rate and associated metrics, but also present results for volumetric evaporative losses.	This was an important motivation point mentioned in an earlier section (Section 2.3), and suggest that we include the point again here. Otherwise, it can come across that the focus is on the analysis of evaporation rates only. It is important to emphasize the significance of estimating volumetric losses, and as mentioned at the end of Section 2.3 -- "rates inform physical process understanding, while volumes translate this understanding into resource management decisions."	We have updated the text.
186	28	4.2 Evaporation Metrics	(Table 3)	Add a non-breaking space between table and figure number. Word shortcut, CTRL+SHIFT+SPACE.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.

Comment	Page	Section	Text	Comment	Response to Comment
187	29	4.2 Evaporation Metrics	Seasonal metrics are defined by meteorological seasons, where fall is defined as September, October, and November (SON), winter is defined as December, January, February (DJF), spring is defined as March, April, and May (MAM), and summer is defined as June, July, and August (JJA).	Move this to the previous paragraph.	We have updated the text.
188	30	4.2 Evaporation Metrics	Units	Could you please check on all units? I came back to this table after I started to go through the results, and I started to see some inconsistencies. Please review unit related comments – these are mostly in Chapter 5.	We have checked all units. We have updated figures and captions to reflect these units. We have also added a column to our metrics table that shows trend units.
189	30	4.2 Evaporation Metrics	throughu	For consistency with earlier usage in text.	We have updated the text.
190	30	4.2 Evaporation Metrics	Day of water year on which 50% of WY evaporation rate occurs	Why is this a rate? Shouldn't this be related to volume? That's how streamflow is handled.	We are trying to strike a balance between climate-driven analyses and analyses relevant to water managers. While expressing this as a volume and the day of water year when a volume is reached could be useful, we are trying to emphasize potential changes in evaporation that are driven by climate and not management changes, where management changes ultimately impact water levels and surface area. As a result, we leave this as a rate to emphasize changes in the timing of evaporation rates, not volumes.
191	30	4.2 Evaporation Metrics	Day of water year on which 75% of WY evaporation rate occurs	Same as previous comment.	Same response as above.
192	30	4.2 Evaporation Metrics	), day of water year when 50% of WY evaporation rate has occurred, and day of water year when 75% of WY evaporation rate has occurred.	I will have to come back to this after I go through the results … 50% or 75% evaporation rate doesn't seem to be meaningful. Volume makes sense.	Same respoonse as above.
193	31	4.3 Trends and Statistical Significance	However, most if not all statistical tests yield a probability value (p), which is "the probability of obtaining the computed test statistic, or one even more extreme, when the null hypothesis is true" (Helsel et al. 2020).	Please include the page number from which this quote is taken from the Helsel et al. (2020) reference. If quotes are taken from references, we should add the exact page number(s).	No need for page numbers based on 2026 SECURE report conststency guide: "For pull quotes, no need to cite the page range for the quote, just the source. "
194	31	4.3 Trends and Statistical Significance	In simpler terms, p is the "probability to which the data support the null hypothesis"	This statement does not appear to be quite correct. It all depends on how the null hypothesis is stated for a given test. For example, H0: no correlation versus H0: correlation exists, can have H0 rejected or we can fail to reject with the data being analyzed, and the p-value outcomes will be different for p > alpha or p <= alpha. So, this statement is not consistent without knowing what H0 is.	We agree that the original statement was incorrect, but not for the reasons stated. The p-value is not the probability that the null hypothesis is true, nor is it a direct measure of the support for the null hypothesis. Rather, it represents the probability of obtaining results as extreme as, or more extreme than, those observed, assuming the null hypothesis is true. While the specific form of the null hypothesis (e.g., no correlation vs. some correlation exists) affects the test's design and directionality, the interpretation of the p-value remains consistent: it is a conditional probability, calculated under the assumption that the null hypothesis is true. The comparison of p to a significance level (α) determines whether the null hypothesis is rejected, but the p-value itself is not determined by this threshold—it is a continuous measure. This statement has been removed.
195	31	4.3 Trends and Statistical Significance	(DASU, n.d.).	Not sure what reference this one is.	Removed

Comment	Page	Section	Text	Comment	Response to Comment
196	31	4.3 Trends and Statistical Significance	Table 4 – Possible outcomes of a trend test and associated probabilities. Reproduced from Helsel et al. (2020).	This table is adapted from Figure 4.2 (p. 101) of Helsel et al. (2020). You need to clearly state what your null hypothesis is. The beginning of the paragraph simply states H0 is the null hypothesis, but it should state very clearly what H0 are we testing – there is trend or no trend. Hypothesis testing is extremely nuanced and we should use the very exact language. If we are going to include a table, let's use Figure 4.2 (Helsel et al. 2020, p. 101) exactly and explain it in the context of the application here. I know you attempted to do that, but I would like to see the exact language used in hypothesis testing. For example, "Fail to Reject", and this is important.	In the middle of the first paragraph of section 4.2 we state: "Most trend analyses rely on hypothesis testing to determine whether there is no trend in a variable's central tendency (H0 – the null hypothesis) or if a trend exists (HA – the alternative hypothesis)." Then we present the table. Although I do have no trend and trend exists in the test outcome column, I left Ho and Ha more general in the table cells because not only is hypothesis testing more general than just trend applications, but also, within trend estimation each method has a different null and alternative hypothesis (e.g., for OLS, Ho: B1 = 0 but for Mann Kendall, Ho: P = 0.5). In the following subsections describing each method we used for trend estimation, I describe Ho and Ha explicitly. Also, the table is adapted from Table 12.1 in Helsel et al (2020) - page 330, not from Figure 4.2 (p 101). Nonetheless, we have added Section 4.2.3 which explicitly states the trend analysis process used. We have also added more description to Section 4.2.1 on p values.
197	32	4.3 Trends and Statistical Significance	Helsel et al. (2020).	The hyperlink to the PDF should be in the reference. We don't need the hyperlink here.	Revised
198	32	4.3.1 Ordinary Least Squares Linear Regression		All along equations were numbered. We want to be consistent and do the same here and in the following equations too.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
199	33	4.3.2 Mann-Kendall Trend test		Add numbers to the equations.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
200	33	4.3.2 Mann-Kendall Trend test	acf	For style consistency let's use italics for R function and package names. Or, whatever style you prefer is fine, but just use it consistently through out the document.	We have updated the text to reflect this request. However, the technical writing team will make sure that all changes are consistent with Reclamation style requirements.
201	33	4.3.2 Mann-Kendall Trend test		Add number to the equation.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
202	33	4.3.2 Mann-Kendall Trend test		Add number to the equation.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
203	34	4.3.3 Theil-Sen Slope Estimator		Add equation number.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
204	34	4.3.3 Theil-Sen Slope Estimator		Add equation number.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
205	34	4.3.3 Theil-Sen Slope Estimator		Add equation number.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
206	34	4.3.4 Robust Linear Regression		Add number to equations.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.

Comment	Page	Section	Text	Comment	Response to Comment
207	35	4.3.4 Robust Linear Regression	(Venables and Ripley 2002Ripley et al, 2024)	Add citation to the reference list. The MASS package was released by Venables and Ripley in 2002. From R (version 4.3.0) using citation("MASS"). Venables, W. N. & Ripley, B. D. (2002) Modern Applied Statistics with S. Fourth Edition. Springer, New York. ISBN 0-387-95457-0 Please format the reference to match the reference style in this document.	We have removed this analysis from the text.
208	35	4.3.4 Robust Linear Regression	...	We need to add a paragraph here to summarize how the methodology and metrics will be calculated and help the reader transition to the next chapter (Chapter 5) where the results will be presented and discussed.	Added
209	38	5.1.1 Annual Metrics	average annual evaporation total (in) simulated by DLEM between WY 1981 and WY 2015.	The vertical axis of the two plots, should say Average of Annual Total Evaporation. Also, these latitudes and elevations are for the reservoir centroids, right? It will be helpful to add these types of clarification; or, point to the metadata, which I am hoping will served electronically as part of an online resource. If you also just include all of that in an appendix table that will be good too. That way, it will be in this report.	We have updated the y-axis text. We have also added an explanation in the DLEM chapter on what the latitutde, longitude points represent, which is the full-pool surface area centroid.
210	38	5.1.1 Annual Metrics	Eighty three of the 198 sites show statistically significant positive trends, while only one of the 49 sites shows a statistically significant negative trend in annual evaporation rate. Thus, 99% of all statistically significant trends are positive.	We need to include p-value information to go with these. Anytime we use the term significant, we should be adding the corresponding p-value. Depending on the range of p-values, we can either add it to the text or if there is substantial variability in the p-values across sites, a figure (map) will be more useful.	Added
211	39	5.1.1 Annual Metrics	trends significant at the 95% level	The significance level (alpha) is 5%.	Revised to state:' sigificant at the 95% confidence level'
212	39	5.1.1 Annual Metrics	However, population medians	Please clarify, how do we know what the population median is? Without a very large sample size, we cannot have population estimates of statistical parameters.	We have removed this text.
213	40	5.1.1 Annual Metrics	slopes estimated from linear model, robust linear model, and Sen	The order in figure caption should match with order of legend. We want to be consistent also with the order in the text.	We have removed this figure from the analysis.
214	41	5.1.1 Annual Metrics	in average annual evaporation rate (??in/yr)	The unit in the figure is inches per decade (in/dec) – please check and correct.	We have updated the text.
215	41	5.1.1 Annual Metrics	representativebest	What are the criteria to select best, and in relation to what? Also, let's include a table in this report with representative reservoir surface areas used or include it as part of the electronic metadata for this report.	We have added a new figure to the report showing reservoir locations and the type of surface area used to compute volumes (static or dynamic). We have also included analysis of trends in reservoir surface area to support the analysis of evaporation volumes.
216	41	5.1.1 Annual Metrics	severalfour orders of magnitude	Please check.	Four orders of magnitude is accurate. We retain the text.
217	43	5.1.1 Annual Metrics	Significant trends	Include p-values.	Added maps of p values for all metrics included in report
218	45	5.1.1 Annual Metrics	Trends in April through October evaporation rate are shown in Figure 13.	Is it? Please see comment below for figure caption 13.	We do not understand the question.
219	46	5.1.1 Annual Metrics	Trend in April through October evaporation total (in/yr)	The text says, evaporation rate, the caption says evaporation total (in/yr), the color legend bar has the unit (in/dec) – lots of inconsistencies; makes it hard to interpret results. Please review and correct.	We have updated the text.
220	46	5.1.1 Annual Metrics	statistically significant	Like I mentioned in earlier comments – please include p-values throughout whenever statistical significance is referenced.	Added maps of p values for all metrics included in report
221	47	5.1.1 Annual Metrics	14-day evaporation rate (in)	The dimension for any rate variable is [LT-1]; so some inconsistency here. If we say rate it should have the units to match the dimension of rate correctly. With a depth unit it should represent a total. Please review and update.	We have updated the text.
222	48	5.1.1 Annual Metrics	Figure 15 – Trend in annual maximum 14-day evaporation total (in/yr) simulated by DLEM between WY 1981 and WY 2015. Sites with significant trends based on the Mann-Kendall trend test are indicated by a filled circle.	Same comment as for Figure 13 caption.	Revised

Comment	Page	Section	Text	Comment	Response to Comment
223	50	5.1.1 Annual Metrics	rate	Rate and unit used are dimensionally inconsistent.	We have updated the text.
224	50	5.1.1 Annual Metrics	reservoir elevation (ftm)	Plot shows unit of feet. Please check and update.	We have updated the text.
225	50	5.1.1 Annual Metrics	Trends in the number of simulated condensation days per year are largely insignificant: four sites show significant increasing trends, and 11 sites show significant decreasing trends.	See earlier comments on showing p-values, and also go back to the comment on the use of hypothesis testing language – see comments related to Table 4.	We have removed the figure and associated text from the report.
226	51	5.1.1 Annual Metrics	amount rate	Having read this far … I am thinking changing rate to amount may be the way to address some of comments related to units. Please see if this will indeed address this issue with use of the term rate and units. Again, we want to be consistent and avoid any confusion for the reader. Depending on how the text is structured, maybe just dropping the term rate would be adequate. Consistency is the key!	We have updated units throughout the memo.
227	51	5.1.1 Annual Metrics	statistically significant positive and negative trends	Again, throughout the document, please add the p-values anytime we mention statistical significance. It would be interesting to see if the p-values have any spatial pattern. I had a comment earlier on this related to adding p-values either to the text or maybe even a figure (map). Without seeing a spatial distribution of p-values it is somewhat hard to make that decision – adding a description in the text versus making a figure. It becomes repetitive to add this p--value information request comment throughout the document, so there are instances where I don't have this comment. When you are doing the revision, as applicable, please include it throughout the document.	Added maps of p values for all metrics included in report.
228	52	5.1.1 Annual Metrics	(days/yr)	Legend says, days/dec. Please review and update.	We have updated the text.
229	52	5.1.2 Seasonal Metrics	highestgreatest	You may want to use highest instead of greatest. Highest is more appropriate when ranks are in consideration.	We have updated the text.
230	57	5.1.3 Monthly Metrics	Trend in monthly evaporation rate (in/yr)	Unit inconsistency between figure legend and caption. Similar to earlier figures.	We have updated the text.
231	58	5.2 Comparisons with Past Efforts	locally calibrated coefficients.	This is very important to note. The TR model coefficients were calibrated to observed solar radiation of the COOP stations. I haven't looked into this, but how similar or different are these point estimates from the gridded information? If you have some insights to add on this, it will be useful.	We are focusing on differences in evaporation rate from CRLE and DLEM, while acknowledging differences in meteorological inputs.
232	58	5.2 Comparisons with Past Efforts	spatially interpolated mean monthly dew point depression surfaces	This was information that JH (DRI) provided, and I know we applied it, but it would be good to add a reference or maybe we have this now publicly available through a resource such as OpenET. Again, something that would be useful to add.	This information is based on a past report with a summary provided by J. Huntington very recently. We have updated the text to include a reference to the recent email exchange with JH.
233	59	5.2 Comparisons with Past Efforts	The largest differences in monthly rates occur at Elephant Butte Reservoir, NM, Lake Mead, NV, Lake Powell, AZ/UT, and Lake Shasta, CA. These differences may be explained by differences in forcing datasets, forcing dataset periods, differences in evaporation formulation, including the impact of heat storage, and/or differences in reservoir depth between the two studies.	Any thoughts on submitting a proposal to S&T or IAST to look into the causes for such differences- attribution analysis? I think the surface geometry of these four reservoirs likely contributes substantially to large differences between CRLE and DLEM estimates. Trying to draw analogy between a watershed's shape and it's hydrologic response.	No action needed.
234	63	5.3 Projected Changes	Zhou et al. (2021)	Reference missing.	We have updated the text.
235	63	5.3 Projected Changes	La Fuente et al. (2024)	Reference missing. Please check for all references that they are included in the list of references . I have only done spot checks.	We have updated the text.
236	63	5.3 Projected Changes	arecan be	Happy to be assertive.	We have updated the text.
237	63	5.3 Projected Changes	La Fuente et al. (2022)	Is this a different reference from the 2024 reference. Missing in the list of references.	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
238	63	5.3 Projected Changes	Whereas global or national studies provide broad estimates of projected changes in evaporation rates, site-specific investigations of lake and reservoir evaporation arecan be more useful for water management and planning activities. La Fuente et al. (2022) utilize five lake models forced with bias corrected climate projections from four different GCMs contributing to CMIP5 under three RCP scenarios (RCP 2.6, RCP 6.0, and RCP 8.5) to simulate historical and future evaporation rate at Lake Kinneret, Israel (for a total of 20 model realizations per RCP). Lake models include Flake (Kirillin, 2002), General Lake Model (GLM; Hipsey et al. 2019), General Ocean Turbulence Model (GOTM; Burchard et al. 1999), MyLake (Saloranta and Andersen 2007), and Simstrat (Goudsmit et al. 2002).	Many of the references are missing from the list of references.	We have updated the text.
239	64	5.3 Projected Changes	2070-–2099	More for the technical writers/editors – year ranges throughout the document should use non-breaking N-dash. I have inserted one here as an example.	The text will be formatted according to guidelines followed and implemented by the TSC's tech writers group.
240	65	6.1 Synthesis	Trends in annual evaporation volume can conflict with trends in annual evaporation rate due to changes in surface area, which may be driven by hydrometeorological/climatological changes as well as management decisions.	In the past, these reports were accompanied by a Press Release. Ensure to include this concept if there is a Press Release.	No action needed.
241	65	6.1 Synthesis	One possible explanation for these changes may be positive trends in dew point temperature observed across the Great Plains due to land-use changes (Mahmood et al. 2004). Some studies suggest that dew points are increasing from the conversion of natural landscape to irrigated fields.	This is not surprising given the groundwater pumping that occurs from the Ogallala Aquifer to support irrigated agriculture throughout the Great Plains area. In fact, over summer the land over this region becomes the primary moisture source, and even drives extreme precipitation events.	We have removed the analysis that this block of text refers to. As such, no action is required.
242	66	6.1 Synthesis	total water year evaporation rate	Please verify. Comments on this subject of using the term rate are in many places throughout the document.	We have updated the text.
243	67	6.2 Limitations	Global Meteorological Forcing Dataset developed for Lland Ssurface Mmodeling	Add citation and include in the reference list. Department of Civil and Environmental Engineering/Princeton University. 2006. Global Meteorological Forcing Dataset for Land Surface Modeling. Research Data Archive at the National Center for Atmospheric Research, Computational and Information Systems Laboratory. https://doi.org/10.5065/JV89-AH11. Accessed dd Mmm yyyy.	We have updated the text.
244	67	6.3 Future Work	LAKE (Stepanenko et al., 2016) and GOTM (Simpson et al., 1990),	Hard to tell what these acronyms are without the citations. Expand acronym and add citations to the reference list.	The acronym list has been updated.

Comment	Page	Section	Text	Comment	Response to Comment
245	69	7 Conclusions	Reclamation is best known for its dams, powerplants, and canals across the 17 Western States of the United States. As the largest manager and wholesaler of water in the Western U.S. and the second largest producer of hydroelectric power in the country, the agency is responsible for assessing potential risks to water supplies and implementing measures that promote effective management of water resources. Recent studies highlight a broad suite of future changes in climate and hydrology and challenges for managing water, in addition to risks already posed by natural variations in climate and pressures associated with growing populations. Impacts to water supplies, water demands, hydropower, and environmental conditions may influence Reclamation's ability to fulfill its mission. The SECURE1F1 Water Act, and specifically, Section 9503 of the SECURE Water Act, authorizes Reclamation to coordinate and partner with others to ensure the use of best available science; assess specific risks to water supply; analyze the extent to which water supply risks will impact various water-related benefits and services; develop appropriate mitigation strategies; and monitor water resources to support these analyses and assessments. Section 9503 also authorizes Reclamation to assess climate risks to water and environmental resources in the eight major Reclamation river basins, and to develop strategies to either mitigate for or adapt to impacts. The SECURE Water Act also directs Reclamation to submit reports to Congress every 5 years to describe progress in carrying out those activities. This West-Wide Assessment (WWA) Technical Memorandum provides supporting technical information for the benefit of western water managers when assessing impacts to their own resources and operations, as well as supporting information in the 2026 SECURE Water Act Report to Congress. The WWA is composed of three unique reports, each with a different topical area of emphasis. This report focuses on reservoir evaporation across the western US.	How is this relevant to the conclusion of this report which was about reservoir evaporation?	We have updated the text.
246	69	7 Conclusions	Reclamation 2025	This reference has been present throughout the document. The reference lists 2025a, 2025b, 2025c – please update the reference appropriately.	We have updated references throughout the text.
247	1	Appendix A\	High alpine snowmelt flowing into a Western watershed; parched desert soil displaying increased drought across the West; a desert city representing increased populations in the West that augment demand for municipal and industrial water; irrigation water from a Reclamation Project supporting agriculture in Idaho.	Description does not match cover photo	We have updated the text.
248	7	1 Introduction	A growing risk to effective water management in the Western United States is the uncertainty associated with changes in hydrologic variability driven by the Earth's climate	This sentence is a bit hard to understand, maybe change to something like: "Water management is becoming more difficult in the Western United States due to increased hydrologic variability and uncertainty in future conditions"	WRPO is responsible for the introduction content (1, 1.1). We have passed these comments along to WRPO for consideration.
249	9	1.2 Previous SECURE Water Act Reports	built	I think it should be past tense when discussing a previous report? Then present tense for this report?	WRPO is responsible for the introduction content (1, 1.1). We have passed these comments along to WRPO for consideration.
250	9	1.3 The 2026 SECURE Water Act Report	west	Capitalize? It was capitalized earlier in the report, best to be consistent	The technical writers group will review and make all necessary capitalization and consistency changes to the report.
251	9	1.3 The 2026 SECURE Water Act Report	and also quantifies the range of uncertainty in climate projections among datasets	I'm assuming it does this	WRPO is responsible for the introduction content (1, 1.1). We have passed these comments along to WRPO for consideration.
252	9	1.3 The 2026 SECURE Water Act Report	water managers understand what historical conditions and to consider potential future variability within those decisions	Not clear - need to rewrite	WRPO is responsible for the introduction content (1, 1.1). We have passed these comments along to WRPO for consideration.
253	10	1.4 Reservoir Evaporation	simulate	Okay, I'm still not sure but I would think you would use past tense here when talking about a previous completed study? But I'm going to leave that up to you and leave any discussion as previous studies in present tense	We are using present tense throughout the report. Further, the technical writers will review and make all necessary tense changes throughout the report.

Comment	Page	Section	Text	Comment	Response to Comment
254	14	2.2 Methods for Estimating Evaporation Rate	direct	In-situ?	The terms direct and indirect are used throughout the literature to distinguish among types of in-situ methods. Direct methods are always in-situ, but there are some indirect methods that are also in-situ. I have left the text alone.
255	15	2.2 Methods for Estimating Evaporation Rate		Aren't changes in water level due to precipitation, and inflows/outflows, which you are already accounting for in this equation? I think including changes in water levels means you are double counting?	No, we are not double counting. We have added the original water budget equation to the text to demonstrate the transition of solving for delta water level and solving for evaporation.
256	15	2.2 Methods for Estimating Evaporation Rate	2015	I imagine estimates of Qsed are also hard to measure? How is that term typically represented/estimated?	We have updated the text.
257	16	2.2 Methods for Estimating Evaporation Rate	application	Isn't it also difficult to close the heat budget?	The text indicates that there is often large uncertainty in the heat storage term, which makes application of the energy budget method uncertain.
258	19	2.3 Evaporation Volume and Water Management	2023	Do you want to mention some of the available surface area datasets? Like GLEV which covers many of the larger waterbodies world wide?	We have included a citation to the referenced dataset.
259	19	2.3 Evaporation Volume and Water Management	This report will discuss both evaporation rates and volumes across hundreds of reservoirs in the American West.	I'm assuming, I haven't read that far yet 😉	We have updated the text.
260	20	3 Estimating Historical Evaporation	daily lake evaporation model	I don't believe you've introduced DLEM yet.....	We introduced DLEM in the introduction section, so we leave this text alone.
261	20	3 Estimating Historical Evaporation	details	Results?	This chapter focuses solely on DLEM and validation. Results are included in Chapter 5.
262	21	3.1.2 Meteorological Inputs	air temperature	Max and min air temp?	We have updated the text.

Comment	Page	Section	Text	Comment	Response to Comment
263	21	3.1.2 Meteorological Inputs	2013	I would add a bit more here about biases in gridMET (20% bias in solar, large biases in wind, etc.) – you can take the text directly from the Klamath OWE report, no need to use all of it but just the general idea on gridMET biases is important (you could also include what we found when doing an in=depth station comparison in the Klamath Basin – I'll paste it all here too: Previous studies have looked at biases in gridMET climate data across the continental United States (e.g., Abatzoglou 2013; Blankenau et al. 2020) . Blankenau et al. (2020) validated gridMET air temperatures by comparing the dataset to 103 weather stations dispersed throughout the continental United States. Blankenau et al. (2020) found gridMET to have some of the highest correlations as to station data for mean air temperature as compared to other gridded datasets. Mean air temperature biases for gridMET in Blankenau et al. (2020) were found to be positive almost across the board. A previous study by Behnke et al. (2016) also evaluated a suite of gridded datasets through comparison with 3855 Global Historical Climate Network-Daily stations (GHCNd; Menne et al. 2012). Although biases were quite small, Behnke found negative biases when comparing gridMET to stations across the United States, indicating gridMET consistently underestimated maximum and minimum air temperatures. Biases were also largest during extreme temperature days, where gridMET overestimated very cold air temperatures, and underestimated extremely warm air temperatures. Abatzoglou also found a slight cold bias in gridMET minimum air temperatures in the Klamath Basin with correlations upwards of 0.94 to 0.95 (Abatzoglou 2013). Blankenau et al. (2020) also found that gridMET underestimated humidity or vapor pressure as compared to weather stations, with a larger dry bias in the Western United States in heavily irrigated areas. Blankenau et al. (2020) found that gridMET	We have updated the text to reflect documented biases in gridMET and RTMA.
264	21	3.1.2 Meteorological Inputs	analyses	Is this the correct term?	We have updated the text to include a better term.
265	21	3.1.2 Meteorological Inputs	NCEP	I don't think this had been defined yet	We have defined the acronym and added this entry to the acronym list.
266	21	3.1.2 Meteorological Inputs	high spatial resolution	What is the spatial resolution compared to gridmet?	We have updated the text to include the spatial resolution of RTMA.
267	21	3.1.2 Meteorological Inputs	early part of the historical period	Define this period	We have updated the text.
268	21	3.1.2 Meteorological Inputs	image collection	I might not introduce a new term here for the RTMA dataset – it could confuse readers. 'RTMA dataset' is sufficient	We have updated the text.
269	22	3.1.2 Meteorological Inputs	2016 through 2022	Verify this time period.	We have updated the text.
270	22	3.1.2 Meteorological Inputs	2016 through 2022	Oh you have it below! Might be better to mention up front.	We have updated the text.
271	22	3.1.2 Meteorological Inputs	2015	I think it's important to add a paragraph below this looking at how well this adjusted dataset compares to station observations. I'm sure DRI has done this comparison, but it would be nice to show that the biases are much lower than the initial gridMET biases.	DRI has not completed these comparisons. Instead, we have updated the text to include a discussion of RTMA versus RAWS station data. We have also updated the limitations section to include a content on forcing data.
272	22	3.1.3 Reservoir Inputs	reservoir	I am just noticing that before you were calling all waterbodies 'lakes' and now we are using the word 'reservoir'. It might be best to stick with one term? Or 'waterbody'? Or 'lake and reservoir'? I definitely ran into this issue with our Klamath report.	We have updated the text.

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273	22	3.1.3 Reservoir Inputs	A forward fill method is used to fill all missing data. For example, when no data are available for a select period, the last observed elevation value is assumed for the entire missing period until quality data observations resumed	Interesting. I wonder if this is more accurate than linear interpolation?	The authors of the dataset do not state that this method is more accurate. They only make the assumption and document it.
274	22	3.1.3 Reservoir Inputs	Reservoir	I'm not sure if it's been mentioned how many reservoirs this dataset captures that are analyzed in this report. I would document where appropriate the actual number of reservoirs data was gathered for and DLEM was run for.	We have added a new section to the methods chapter describing the study domain, SECURE Water Act basins, number of reservoirs, and reservoirs with static and dynamic surface area.
275	22	3.1.3 Reservoir Inputs	RISE	Define and cite	We defined the acronym in the text and acronyms section.
276	22	3.1.3 Reservoir Inputs	a required input to DLEM	I added this in the intro sentence to this section where I think it fits better	We have removed the text here and kept the earlier inserted version.
277	22	3.1.3 Reservoir Inputs	The methodology for estimating reservoir surface area is consistent with the reservoir information used to calculate rates, but surface areas may differ from values reported by area or regional offices.	Why? I'd either omit this sentence as you already defined how surface areas were estimated or say how they differ.	The intent of this language is to inform readers from Reclamation (e.g., area and regional water managers) that the surface area values reported here could differ from their published values. The reasons for this relate to the methologdy employed (e.g., only one ACAP curve, forward fill for gaps, where no data assume maximum capacity, etc.) We have moved this sentence from the current location to the limitations section.
278	23	3.2 DLEM Validation Efforts	DLEM Validation Efforts	Are all the reservoirs you mention in these validation efforts included in the dataset used in this report? If so - I'd definitely mention that up front as it adds validity to this report. Also, it might be wise to add a few sentences describing what is typical model error for evaporation models (and in-situ observations). There is a lot more uncertainty associated with evaporation estimates, both modeled and in-situ, than a lot of other hydrological variables.	Not all reservoirs in Zhao et al. (2024) are included in our dataset: two of the four are.
279	23	3.2 DLEM Validation Efforts	These four reservoirs are also included in the historical dataset used in this report.	Yes? hopefully	Not all reservoirs in Zhao et al. (2024) are included in our dataset: two of the four are.
280	23	3.2 DLEM Validation Efforts	negative bias	Bias is also estimated a few different ways, so it couldn't hurt to include the equation they used to estimate dlem bias	We have updated the text to reflect the bias computation.
281	23	3.2 DLEM Validation Efforts	7	What are these biases likely from? Suggest adding a sentence saying they are likely due to the fact that these reservoirs are huge, and have large spatial variations in depth, and from your elephant butte study we know that spatially evaporation can very by up to X%. The model error could also be due to meteorological input biases, which if you mention above could explain some of the model error	We have added a sentence listing possible reasons for these biases.
282	23	3.2 DLEM Validation Efforts	92	Why such a low correlation at American Falls? All the others are reasonable, but that one seems off	Observations from American Falls represent warm-season (ice-free) observations and a relatively short period of record. We have updated the text to reflect this.
283	24	3.2 DLEM Validation Efforts	an expanded validation effort	I don't think we actually expanded on their studies so I"d rephrase this to simply "In addition to validating modeled evaporation rates, Reclamation (2024) validated the DLEM heat storage term by comparing simulated water temperature……"	We have updated the text.
284	24	3.2 DLEM Validation Efforts	2024	Also this is going to be a 2025 publication now	We have updated the year.
285	25	3.3 DLEM Output	The total number of reservoirs in the dataset from Reclamation (2025) is 247 (Figure 2).	I think this report would benefit greatly from a 'study area' section a bit earlier in this section. This would be very useful context before you talk about model validation and model inputs I think	Given a similar comment from another reviewer, we have added a new section to chapter 4 that covers the study domain.
286	25	3.3 DLEM Output	The total number of reservoirs in the dataset from Reclamation (2025) is 247 (Figure 2).	You can then just move the other text to appropriate sections and omit the 'DLEM output' section all together.	We have updated the text.

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287	25	3.3 DLEM Output	/	I like this figure but would switch the order in the legend and put the elevation bar below the river basins. I would also move the Esri text down to the bottom of the map so it isn't floating	We have updated this figure and moved the location to earlier in the report.
288	25	3.3 DLEM Output	West-Wide	Reproject this plot using EPSG 5070 (Albers Equal Area CONUS)?	We have updated the map.
289	27	4.1 Evaporation Metrics	fall of 1980. The last season computed with the dataset is fall of 2015	It seems strange to me that the 'Fall' season will have one extra 'n' as compared to the other seasons. Maybe omit the last or first Fall season?	The sample size associated with each season has no impact on analysis. Therefore, we opt to keep the period of analysis the same and update the text to reflect this difference.
290	28	4.1 Evaporation Metrics	Output Frequency	I would say Timescale instead of output frequency bc the output of DLEM is always at a daily timestep and aggregation is a post processing step	We have updated the text.
291	28	4.1 Evaporation Metrics	Annual evaporation rate in Annual October 1, 1980 thru September 30, 2015	Is this inches/year? Or an average daily rate, ie. inches/day? I would specify here and same for all evaporation rates. A rate is length/time	We have updated the text to reflect the time scale of the rate in the denominator of the unit.
292	28	4.1 Evaporation Metrics	Average evaporation rate when evaporation rate is less than 0 in (i.e., average condensation rate)	I think if you're going to do this metric a very complementary metric would be the number of days per year that condensation occurs	We have eliminated condensation-related (i.e., negative evaporation) content from the report.
293	28	4.1 Evaporation Metrics	Average evaporation rate when evaporation rate is less than 0 in (i.e., average condensation rate)	Which you have below! So add this metric to the table 😉	We have eliminated condensation-related (i.e., negative evaporation) content from the report.
294	28	4.1 Evaporation Metrics	in	I do think you should say in/year just for clarification?	We have updated all units.
295	28	4.1 Evaporation Metrics	in	But I do get that makes it hard for the seasonal evaporation rate, or inches/3 months, or inches/season	We have opted to use inches/season (in/seas).
296	28	4.1 Evaporation Metrics	Monthly metrics include monthly evaporation rates for each month (in).	A useful monthly evaporation metric might be the peak evaporative month, ie. the month where water managers want to reduce evap the most by either a smaller surface area or a deeper reservoir	We have added a figure to the results section showing this variable. The variable is not listed as a metric in the metric table, as it is computed from a metric.
297	29	4.2 Trends and Statistical Significance	d	I really like how you described statistical tests and outcomes in this paragraph!	No action required.
298	30	4.2.2 Mann-Kendall Trend test	Mann-Kendall Trend test	The seasonal mann kendall is also used when there is a seasonal component to timeseries (ie. streamflow or daily evaporation rates). Would that have been more appropriate here when looking at trends in monthly and seasonal evaporation? I think it's worth looking in to as those two metrics definitely have a distinct seasonal cycle (annual does not and the regular mann kendall is appropriate for annual)	The seasonal Mann - Kendall test does the same thing as calculating MK on individual/separate month time series, but the seasonal Mann Kendall provides an aggregate p value as well that says if one or more seasons experienced a stat signif change (in addition to p values specific to each season). But since we are interested in which seasons are changing we can just do MK test on individual seasons. See example code to the right.
299	31	4.2.2 Mann-Kendall Trend test		Need to add Equation #s for all of these equations	We have updated the text.
300	31	4.2.2 Mann-Kendall Trend test	mk.test	The seasonal mann kendall is smk.test function	See above comment.
301	31	4.2.2 Mann-Kendall Trend test	the trend package's mk.test function (Pohlert, 2015) as well as with the EnvStats package's kendallTrendTest function (	Why do you use two packages? Just to verify and double check results?	Yes, we added a note to that effect.
302	32	4.2.3 Theil-Sen Slope Estimator	2025	I think typically the mann kendall test is used to test if there is a significant change in evaportion and then you estimate sen's slope to see what the magnitude of that trend actually is. It would be good to specify that somewhere in here. Probably at the beginning of this section where you refer to mann kendall	We have revised the text to make explicit.
303	32	4.2.4 Robust Linear Regression	We use Huber weighting, where data points with high error residuals (e) are down weighted in the regression development, leading to less skew in the trendline towards outliers.	This is so good to know! I haven't used this trend test before	No action required.

Comment	Page	Section	Text	Comment	Response to Comment
304	34	5.1.1 Annual Metrics	/	I think this map needs a scale bar? Maybe not bc of the lat/lon. and I also suggest labeling the color bar as 'Mean Evaporation (in)' or even just 'Evaporation (in)' and then in the caption specify average annual evaporation	Scale bars are not required on figures (but may be required for maps). We include the latitude/longitude lines to help with this. We have had differing responses among reviewers on how to label variables in figures. We are trying to label each variable as accurately as possible.
305	34	5.1.1 Annual Metrics	strong predictor	You could also test the significance of these relationships, although I'm not sure the best test off of the top of my head	We have added these details to each figure.
306	34	5.1.1 Annual Metrics	2024	In addition, temperature generally decreases with increasing latitude, which influences evaporation rates as well, I would think possibly more than solar radiation?	The importance of these variables to evaporation depends on the time scale. At annual time scales, solar radiation is the best predictor.
307	35	5.1.1 Annual Metrics	one of the 49	Did the reservoir depth change a lot over time?	The time series of reservoir depth varies over time but not in a manner consistent with a trend.
308	35	5.1.1 Annual Metrics	dec	Need to define dec = decade	We have added this acronym to the acronym page and defined in the body of the report.
309	37	5.1.1 Annual Metrics	model	I'm sure Subhrendu will also point this out but it's good to put in the caption what the box and whiskers represent (1.5*IQR, median, etc)	We have revised the text.
310	37	5.1.1 Annual Metrics	Simulated	I think it would also be useful to point out if the significance of the trend changed among the three different statistical tests. As in did all 83 reservoirs still have a significantly positive trend when you used the linear model and the robust LM? I believe the sens slope is the magnitude of the trend for the mann kendall test. But best to be clear on that so the reader knows why all four aren't included here	We have removed this figure and associated text from the report.
311	38	5.1.1 Annual Metrics	/	I would decrease the y axis title text and for the upper one just label it 'Annual evaporation (in)' and then explain in the caption that it is average annual evaporation from ...."	We have updated the figure.
312	38	5.1.1 Annual Metrics	/	Are any of those points, particularly in the Colorado basin outliers? Also need to specify again what the difference is between x and circles	Revised to indicate x and circle (or diamond and circle)
313	38	5.1.1 Annual Metrics	kAF	I've always seen this acronymn as 'TAF'?	We had a bit of discussion on acronym for thousands of acre-feet. We have opted for kAF, which we now define in the new acronyms section.
314	38	5.1.1 Annual Metrics	Overall, Reclamation is losing approximately XYZ kAF of water each year across all of their reservoirs to evaporation	Not sure you can calc this but then you could say "....which represents approximately 5% of all stored water" or something like that.	We have added this value to the report.
315	39	5.1.1 Annual Metrics	/	Same here and in all similar figures, color bar should be labeled with the word evaporation in it, similar to 'Annual Evaporation (in)' or just simply 'Evaporation (in)' and include average annual in the caption.	While we have tried adjusting figures to accommodate this ask, we must decline to accept this recommendation. We find that the metric names are too long to include on each spatial map. The requested text consumes too much space. Further, for consistency with other tech memos for SECURE WWA 2026, we retain the "Average (units)" and "Trend (units)" notation. Finally, we note that every caption reflects the full variable name.
316	39	5.1.1 Annual Metrics	/	Mention in the caption what the color means (subbasin?) - I also suggest labeling the y axes as 'Annual Evaporative Volume (kAF)'	We have revised the figure.
317	40	5.1.1 Annual Metrics	years	In fact, it might be useful to go one step farther in this analysis and look at trends in surface area at all the reservoirs. It likely will explain a lot of the changes you are seeing in evaporative volumes across the years	We have added this variable to our analysis.
318	41	5.1.1 Annual Metrics	Average	I would put a subsection header here so the reader knows when you are switching from annual results to seasonal to monthly	We have removed seasonal analyses and added headers for annual and monthly metrics.

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319	42	5.1.1 Annual Metrics	/	It could be useful to water managers to put a trendline to this graph that then they could use to estimate their avg april through october evaporation given their elevation. Did you look at doing a multiple linear regression using both elevation and latitude to explain evaporation rates? That could be an even better predictor for water managers, that they could then put in their latitude and elevation and get a decent estimate of evaporative losses at certain times of the year	We have updated the figure and text.
320	45	5.1.1 Annual Metrics	absence of ice formation	How did you deal with ice when estimating volumetric evaporation during the winter months? Was it just negated? This information should be put in the methods section above	We have updated the DLEM methods section to indicate that ice is not simulated within the current version. We have also removed the condensation metric from the analysis.
321	45	5.1.1 Annual Metrics	average number of days per year where evaporation rate is less than 0 in (i.e., the average number of days per year with condensation).	Oh, I suggested adding this metric! And you did! But you should put it in the table above where you list out all metrics considered	We have removed these metrics from the analysis.
322	47	5.1.1 Annual Metrics	dec	Why is condensation not changing as much over time?	We have removed the condensation analysis from the report.
323	48	5.1.1 Annual Metrics	evaporation rate	I would call this an evaporative loss, not rate	We have updated the text so that all rates (at all time scales) are listed as such with units of depth/time.
324	48	5.1.1 Annual Metrics	190-200 and day 290-300	I would write out what month or time of year these jdays correspond to	We have updated the figure.
325	49	5.1.2 Seasonal Metrics	Metrics	Ah you do have subsections. I think I was just confused as to why april-october evap was under the WY section?	April through October rates are in the annual section because there is one value per year. The heading name (e.g., Annual) represents the frequency at which the metric is reported.
326	53	5.1.3 Monthly Metrics	/	You look to be missing the top row month labels	We have revised the figure.
327	54	5.1.3 Monthly Metrics	circle	I think that this graph shows that changes in heat storage due to increasing temperature impact monthly evaporation rates differently. There are much larger sig decreases in evap during the fall months, which in my mind likely points towards and earlier turnover of the reservoir and release of heat. A similar phenomenon is likely happeing in the spring, where there is a lot larger % of sites showing a sig positive increase, meaning the water is warming up faster and evap is increasing sooner. IT would be good to mention this type of feedback above to give the reader a better idea how heat storage plays an important role in evaporation dynamics throughout the year	We have updated the text surrounding this figure and added additional context to the discussion section.
328	55	5.1.3 Monthly Metrics	2015	How come you looked at annual evaporation volumes but did not look at volumes on a seasonal or monthly timescale?	We have revised the report to now include annual, seasonal, and monthly volumes (means and trends). Given other reviewer comments, we have moved seasonal analyses to an appendix.
329	55	5.2 Comparisons with Past Efforts	simulated by DLEM between September 1980 and November 2015 and by CRLE between January 1950 and December 1999	I strongly suggest limiting this comparison to only the overlapping time period. Sept 1980 through Dec 1999	We have udpated the analysis in the figure.
330	57	5.2 Comparisons with Past Efforts	/	In the klamath report when we compared CRLE we found that in general (most of our reservoirs) CRLE underestimated spring evap and overestimated fall evap, which appears to be the general trend here too! I would mention that in the discussion above, as that points towards the heat storage component of each model playing a large role in monthly evap dynamics	We have updated the text to reflect this agreement.
331	57	5.2 Comparisons with Past Efforts	/	Suggest spelling out evaporation on y axis label since there's room	We have updated the figure.
332	57	5.2 Comparisons with Past Efforts	The authors indicate that monthly agreement varies by lake, where CRLE generally underestimates spring evaporation rates and overestimates fall evaporation rates relative to DLEM.	Yes! Which is also the case in your plot above 😊	We have made the connection in the text.

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333	57	5.2 Comparisons with Past Efforts	negative	Now you want to add in a paragraph here stating why the DLEM estimates are an improvement over the older CRLE ones, especially bc there are differences in the two datasets. I suggest pointing out the new dataset uses a 1. more accurate forcing dataset, 2. a daily timestep which should do a better job accounting for heat storage/lag and seasonality, 3. DLEM accounts for fetch and wind, and 4. DLEM uses a more sophisticated heat storage formulation	We have updated the text.
334	59	5.3 Projected Changes	by the end of the century	Starting when? From XXXX to the end of the century...	We have updated the text.
335	59	5.3 Projected Changes	radiation	What magnitude of change in evap did Zhou see?	We have updated the text.
336	60	5.3 Projected Changes	will increase by 27% by	Starting when? What is the comparison period?	We have updated the text.
337	61	5.3 Projected Changes	summer	Did La Fuente see large differences in projected changes among the 5 different models? I would imagine model selection would matter less than forcing data	LaFuente et al. (2022) does not perform an an uncertainty analysis with the five lake models employed. However, LaFuente et al. (2024) does. We have addressed this comment in the report section on LaFuente et al. (2024).
338	62	6.1 Synthesis	Additional analyses on seasonal and monthly	I think this is what I suggested earlier - why weren't they done for this report? It would be good to be clear on why only annual volumetric analyses were conducted	We have updated the report figures and appendices to include seasonal and monthly volumes (means and trends).
339	63	6.2 Study Limitations and Uncertainty	Study Limitations and Uncertainty	I think this section is a great start to addressing the uncertainty in the modeled results. I'm going to try and add text here and there with a bit more detail and quantifiable numbers from our Klamath work	We have accepted all text recommendations.
340	63	6.2 Study Limitations and Uncertainty	Study Limitations and Uncertainty	Please feel free to modify any of my added text or omit what you do not think is necessary!	We have accepted all text recommendations.
341	64	6.2 Study Limitations and Uncertainty	For instance, the Global Meteorological Forcing Dataset developed for land surface modeling combines reanalysis data with observation-based corrections to mitigate known biases. However, residual errors can persist, especially in regions with sparse observational networks, leading to potential inaccuracies in modeled evaporation rates. Moreover, the coarse spatial resolution of some datasets may not capture localized meteorological phenomena, such as orographic effects or urban heat islands, which can influence evaporation dynamics. Therefore, reliance on a single dataset may limit the model's ability to accurately represent the variability and extremes of historical meteorological conditions across diverse geographic settings.	I would make this specific to the meterolgoical dataset that was used in this study and the biases associated with the RTMA-adjusted gridMET. This may take a bit of digging on your part to read a few papers that have discussed these biases specific to RTMA-adjusted gridmet. Where is is most accurate? Where does it fall short?	DRI has not completed these comparisons. Instead, we have updated the text to include a discussion of RTMA versus RAWS station data. We have also updated the limitations section to include a content on forcing data.
342	64	6.2 Study Limitations and Uncertainty	For instance, the Global Meteorological Forcing Dataset developed for land surface modeling combines reanalysis data with observation-based corrections to mitigate known biases. However, residual errors can persist, especially in regions with sparse observational networks, leading to potential inaccuracies in modeled evaporation rates. Moreover, the coarse spatial resolution of some datasets may not capture localized meteorological phenomena, such as orographic effects or urban heat islands, which can influence evaporation dynamics. Therefore, reliance on a single dataset may limit the model's ability to accurately represent the variability and extremes of historical meteorological conditions across diverse geographic settings.	I suggested adding a paragraph above too discussing the biases associated with RTMA-gridMET so that can be re-iterated here and discussed with more relation to uncertainties in modeled results.	DRI has not completed these comparisons. Instead, we have updated the text to include a discussion of RTMA versus RAWS station data. We have also updated the limitations section to include a content on forcing data.
343	65	6.3 Future Work	Future research on evaporation modeling	I think this wording is confusing as future research is not what benefits, evaporation modeling is. Maybe rephrase to something like, "Evaporation modeling would benefit if future research focuses on......"	We have updated the text.