Riverbend Sciences
1614 West Ave.
Eureka, CA 95501
(707) 832-4206
www.riverbendsci.com

MEMORANDUM REPORT

To: Klamath Tribal Water Quality Consortium
From: Eli Asarian, Riverbend Sciences
Date: September 21, 2021
Re: Review and comments on *Public Draft Scott Valley Groundwater Sustainability Plan*

The public draft of the "Scott Valley Groundwater Sustainability Plan" was circulated for public comment by the Siskiyou County Flood Control & Water Conservation District in August, 2021. To assist the member Tribes of the Klamath Tribal Water Quality Consortium in the preparation of their comments, Riverbend Sciences and subcontractors have reviewed the document and prepared the comments provided here for the Tribes' use.

A) COMMENT OVERVIEW

We have reviewed the public draft of the Scott Valley Groundwater Sustainability Plan (GSP) and wish to provide the following comments. Our comments are arranged into three sections: A) Comment overview in which we provide a summary of our most important big-picture comments, B) Suggestions for improving the Scott Valley Integrated Hydrologic Model (SVIHM), and C) comments on specific sections of the GSP chapters using the comment form provided.

A summary of our big-picture comments is provided in the following bullets, which are then discussed in the paragraphs below:

- The GSP falls far short of what is needed to avoid adverse impacts to interconnected surface water
- The GSP ignores adverse impacts caused by streamflow depletion outside the September–November period
- The GSP's primary management actions (managed aquifer recharge and in lieu recharge) do not work well in critical drought years
- The GSP lacks transparency
- Many GSP actions and goals sound great but are loosely defined so do not actually achieve much
- The GSP does not deal appropriately with climate change
- The Scott Valley Integrated Hydrologic Model (SVIHM) is a valuable tool but has some shortcomings that need to be addressed in future model updates

The GSP falls far short of what is needed to avoid adverse impacts to interconnected surface water

The GSP proposed to set the Minimum Threshold (MT) for the Interconnected Surface Water (ISW) Sustainable Management Criterion (SMC) based on a percent of the streamflow depletion caused by groundwater pumping from the area not covered by the Scott River adjudication. We agree that groundwater users outside the adjudicated zone are not responsible for solving all the water issues in the Scott River (i.e., they are not responsible for impacts caused by surface water users or groundwater users inside the adjudicated zone).

ISW MT should not be defined based on a proportion or partial contribution to an undesirable result. SGMA requires that an MT define the minimum threshold for a full undesirable result. The whole concept of defining the ISW MT on what the PMA can achieve is putting the cart before the horse. The MT is a numeric value used to define an undesirable result (this may be why the GSP spends so much time confusing and twisting the definition of undesirable result). The MT, if exceeded, may cause an undesirable result. PMAs are a means to avoid exceeding an MT, not a mechanism to define an MT. TC-001

The approach taken in the GSP is backwards. Rather than first defining an arbitrary endpoint based on what groundwater users can relatively easily tolerate (i.e., the approach outlined the GSP), the first step should be to determine the instream flows needed by fish, then calculate the difference between those needed flows and current flows, and then assign the same percent reductions needed by all water users (surface, adjudicated groundwater, and unadjudicated groundwater) to meet that difference. This approach should be applied to all parts of the year that have flows that are not meeting fish needs, not just September through November. To use a hypothetical example (we have not actually done the calculations), if overall water use needs to be reduced by 40% to meet instream flow targets, then surface water users, adjudicated groundwater users, and unadjudicated groundwater users should each be responsible for reducing their water use (or coming up with projects that produce an equivalent amount of seasonal supply) by that same 40%. TC-002

The paltry 15% streamflow reversal proposed is far short of the non-adjudicated groundwater users' responsibility meeting existing laws and regulations such as the Public Trust Doctrine, Total Maximum Daily Loads (TMDLs), and the Endangered Species Act. TC-003

The GSP ignores adverse impacts caused by streamflow depletion outside the September–November period

The GSP proposes an MT for streamflow depletion only for the September–November period. The September–November this period is the time of year with the lowest flows and is very important for migration and spawning of adult salmon, but streamflow depletion also has adverse impacts at other times of year, such as during winter when salmon eggs are incubating, during spring when fish are rearing and outmigrating, and during summer when low flows can exacerbate high water temperatures. TC-004

The GSP's primary management actions (managed aquifer recharge and in lieu recharge) do not work well in critical drought years

The primary management actions proposed by the GSP to partially remedy streamflow depletion are managed aquifer recharge (MAR), in which extra surface water is diverted during January through March and infiltrated into the ground to recharge groundwater, and in lieu recharge (ILR), in which surface water is used for early season irrigation so that groundwater can be preserved (rather than solely relying on pumped groundwater to fulfill all irrigation needs). Both of MAR and IRL only work if there is "excess" surface water available. In critical drought years, there is very little excess water and thus MAR and IRL do not provide much benefit to instream flows. This is unfortunately because reversing streamflow depletion is arguable more important in critical drought years that in normal and wet years. The GSP should have proposed management strategies that are tailored to water year type, so that streamflow depletion could be substantially reversed in all water year types. TC-005

The GSP lacks transparency

Collaborative management and transparency and core tenants of SGMA. How will transparency and public access to data be incorporated into reporting and data sharing agreements? All data that is paid for with public money should be accessible to the public. All GSP reporting (i.e., annual and five-year review reports) should include electronic appendices with easily accessible data, so others could run their own analyses on the data. TC-006

We understand the political sensitivity of well metering, but how can groundwater be managed at a basinwide scale without metering? At least some subset of the wells should be mandated to be metered. Examples could include the largest wells, or new wells drilled after the passage of the SGMA legislation or after adoption of the Scott Valley GSP. How can existing ordinances, such as the prohibition on the use of groundwater for cannabis production or the requirement for permits being needed for inter-basin transfers of groundwater, be enforced without the well metering? How can the effects of efficiency projects be verified without metering? The lack of metering requirements suggests a lack of transparency, which further suggests a lack of will to actually manage groundwater extraction. TC-007

We also have serious concerns with the lack of transparency with the current Scott Valley and Shasta Valley Watermaster District program. Watermastering should be returned to the State of California, implemented basinwide, with well-organized publicly accessible records of diversions. TC-008

Many GSP actions and goals sound great but are loosely defined so do not actually achieve much

The GSP full of things like that sound great like the "Avoiding Significant Increase of Total Net Groundwater Use from the Basin" project and management action (PMA), but when we look closely at the details we see that the wording is loosely defined so that it does not actually guarantee anything. Since all well metering is voluntary, how is it possible to verify this?

If the GSP is to actually achieve the stated objectives, it needs more things that can actually be readily verified. Examples that we recommend include:

- No additional wells for new land use or additional cropping will be permitted in the basin. Only new wells intended to replace old wells and existing crops will be permitted, and these replacement wells will be metered. The intent here is to avoid net increase in groundwater use. TC-009
- Wells intended to replace stream diversions will not be permitted, even if there will be no additional net water usage (i.e., pumped groundwater will be used to replace surface water irrigation of existing crops). The intent here is to allow the SWRCB to ascertain and regulate surface water rights and stream and spring flows. The use of groundwater wells in place of stream or spring diversions simply moves the point of diversion and lessens the ability of the SWRCB to carry out its mission.

The GSP does not deal appropriately with climate change

The GSP appears to treat climate change as a check-the-box exercise rather than seriously grappling with what it will mean for groundwater management. The GSP does include model runs for future climate change, these results are not presented in a coherent way that highlights the major challenges that climate change will pose to water management. A warming climate will cause a shift in precipitation form (less snow, more rain) that will in turn shift the seasonal timing of tributary surface flows into the valley. Regardless of what happens to total precipitation or total runoff, this change in precipitation form and runoff timing is a huge issue that water management is going to need to recon with. Perhaps we missed it TC-010 (and if so, we apologize), but we did not see evidence that the GSP recognizes the severity of the coming changes to climate, nor presents a coherent plan to adapt to it.

The Scott Valley Integrated Hydrologic Model (SVIHM) is a valuable tool but has some shortcomings that need to be addressed in future model updates

We agree with the SVIHM's overall approach and appreciate the many years of work that the modeling team has invested in developing and refining the model. While the model has been peer-reviewed, we have some concerns that we think should be addressed in future updates (i.e., the five-year review). Details regarding the following suggestions are provided in the modeling section of comments: 1) need for a sensitivity analysis to quantify how sensitive SVIHM modeled outflows are to tributary inputs (especially during September and October); 2) need to incorporate fall/winter stockwater diversions into SVIHM; 3) need to reduce the MODFLOW model timestep to something shorter than a month; and, 4) need to use a better method for filling the large gaps in tributary inflows (e.g., considering other model types beyond linear regression, and using Salmon River gage as an alternative to the Scott River gage for filling tributary data gaps at least for some months and/or sites). While data are generally lacking for the fall/winter stockwater diversions, in our comments below we use data from the State of California's eWRIMS database to calculate that during the October 2020 drought when mainstem Scott River flows averaged 7.2 cfs and salmon could not reach their spawning grounds, the Scott Valley Irrigation District (SVID) reported diverting 4.2 cfs (2.7 million gallons/day) for stockwater, which is equivalent is 100 times more water than the 2,700 gallons/day that the livestock were actually consuming (assuming an estimate of 15 gallons/day).

TC-011

B) SUGGESTIONS FOR IMPROVING THE SCOTT VALLEY INTEGRATED HYDROLOGIC MODEL

As part of our review of the Scott GSP, we reviewed the documentation for the Scott Valley Integrated Hydrologic Model (SVIHM) including the Scott GPS appendices 2-C and 2-D. We agree with the SVIHM's overall approach and appreciate the many years of work that the modeling team has invested in developing and refining the model. It is important to understand the limitations of the data and methods. While the model has been peer-reviewed (Foglia et al. 2013, Tolley et al. 2019), we have some concerns that we think should be addressed . We recommend some specific suggestions that that would likely increase the accuracy of SVIHM's predicted late summer and fall flows, but we recognize that implementing these suggestions would take time and may trigger a cascade of additional work including re-calibration and re-running of all model scenarios. Given that this level of effort is likely not feasible at present given the SGMA timelines, we recommend that these improvements be evaluated and incorporated whenever the next time the model will be re-calibrated (five-year evaluation?).

Details on our suggestions are provided in the remainder of these comments, but we begin here with a brief summarized list:

- Need for a sensitivity analysis to quantify how sensitive SVIHM modeled outflows are to tributary inputs (especially during September and October)
- Need to incorporate fall/winter stockwater diversions into SVIHM;
- Need to reduce the MODFLOW model stress period to something shorter than a month; and
- Need to use a better method for filling the large gaps in tributary inflows (e.g., considering other model types beyond linear regression, and using Salmon River gage as an alternative to the Scott River gage for filling tributary data gaps at least for some months and/or sites).

Some of the following comments are repeated from the comment form.

Need for a sensitivity analysis to quantify how sensitive SVIHM modeled outflows are to tributary inputs (especially during September and October)

Given that tributary inputs are largely estimated rather than measured, we would like to see a sensitivity analysis to quantify how sensitive modeled outflows are to tributary inputs, especially during September and October when the correlation between measured outflows and measured inflows is extremely weak (i.e., explains less than 25% of the variability). Modeled streamflow depletion during September and October is a key management endpoint upon which the GSP evaluated management actions (PMAs), yet we currently have no idea how well the model actually predicts flow differences between scenarios in these months. The modeled outflows for the base case scenario match the observed outflows decently well in these months (i.e., see Figure 2 in Appendix 2-D). However, without a sensitivity analysis we cannot know how much of this apparent success is an artifact of setting the inflows based on observed outflows (i.e., is the model a circular self-fulfilling prophecy?).

Need to incorporate fall and winter stockwater diversions into SVIHM

If we understand correctly, the SVIHM assumes that no surface water diversions occur outside of the irrigation season (i.e., after September 30? or is it weather driven?). In reality, there are substantial diversions for stockwater, with many diversions remaining in place after the end of irrigation season. In years when there is not much fall rain (i.e., 2009, 2020), these stockwater diversions can divert the flow of entire creeks and leave downstream reaches dry during salmon spawning season. Not including these diversions is a considerable deficiency of the SVIHM. The effect of these winter stockwater diversions on fall/winter flows is an important management question that we need tools like the SVIHM to answer. Incorporating these stockwater diversions into the model would be difficult because these diversions are unreported and unmetered. One approach would be to bookend the estimates in a sensitivity analysis with low and high scenarios. The low scenario could assume that the diversions match demand including transmission losses (i.e., recent State Water Boards emergency regulations set maximum diversion rates based on the number of animals and assumed 90% conveyance losses, see https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/surface_water_stockwater_diverters_090121.pdf). The high scenario could assume that the diversions match the irrigation season right (i.e., from the adjudication), since the stockwater diversions utilize the same ditches as the irrigation diversions. We are not very familiar with the day-to-day operation of these stockwater diversions and thus are unclear if they are pulsed (i.e., on for a few days, off for a few days, etc.) or continuous, but hopefully local farmers and ranchers could provide information on that as well as advise on the volume of the diversions.

One exception to the data gaps on winter stockwater diversions is that the Scott Valley Irrigation District (SVID) diversions are reported monthly for the years 2010–2020 in the State of California's eWRIMS database. For example, SVID diversions for the October 2019 for "1000-1800 cattle-sheep-horses" were reported as 260.4 AF (https://rms.waterboards.ca.gov/LicensePrint_2019.aspx?FORM_ID=476977). This equates to 4.2 cfs during a month when flows at the USGS gaged average 7.1 cfs. Assuming that each head of livestock needs 15 gallons per day (cattle value from https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/surface_water_stockwater_diverters_090121.pdf), then 1800 cattle would need 27,000 gallons/day. In comparison the 260.4 AF diversion equates to 8.4 AF/day, or 2.7 million gallons/day, which is 100x greater than the amount of water actually needed to sustain the livestock. Is this a "reasonable" use of water at a time when mainstem river flows were so low that salmon could not access their spawning grounds?

Conversion of winter stockwater diversions to stock tanks fed by small wells could be the lowest-hanging fruit for achieving meaningful increases in fall river flows while having little or no economic cost to agriculture (assuming the conversions are paid for with public money). We recognize that the GSP cannot dictate management of surface flows; however, the analyses and models used in the GSP should consider the real-world water budget and not ignore important drivers of key groundwater management endpoints (i.e., fall flows).

Need to reduce the MODFLOW model stress period to something shorter than a month

The MODFLOW model, the groundwater simulation component of the SVIHM, the "stress period" over which fluxes such as pumping and recharge change is monthly, although the model runs at a daily "time step" within each period. This seems like an un-necessary coarsening of the data, given that the most computationally intensive part is the daily time step of the daily model, right? Why do that? The surface water budget is calculated on a daily basis. Flow data could be estimated on a daily basis. The model is used for purposes such as predicting the date when flows in the fall first increase to above 20 cfs, so a monthly model seems less than desirable for those purposes. Foglia et al. 2013 wrote: "However, if warranted, the budget model described here can also be applied to an integrated hydrologic modeling scenario with weekly or bi-weekly varying stress periods or to stress periods of varying period length." This issue is particularly pertinent in the fall, when the model does not do well at representing the timing and magnitude of flow increases (i.e., as discussed in Appendix 2-D). We recommend exploring the use of a shorter stress period such as a week or two weeks to see if that improves performance in the fall period.

Need to use a better method for filling the large gaps in tributary inflows

Overview

The primary boundary conditions for the Scott Valley Integrated Hydrologic Model (SVIHM) are monthly inflows from 12 tributaries. The SVIHM uses a linear regression model to fill the substantial gaps in the flow records for these tributaries (Figure 1a). To assess the quality of the gap-filling method and potential effects on SVIHM results, we have reviewed the available documentation including Foglia et al.'s (2013) supplementary material and Tolley et al.'s (2019) compiled data for water years (WY) 1942–2016 and data processing code written in the R language and available at https://github.com/UCDavisHydro/SVIHM. During this evaluation, we modified the R code to explore the data and test alternative approaches. We are happy to share our R code if that would facilitate refinements.

The SVIHM method consists of compiling the available daily flow data for the USGS Scott River at Fort Jones gage (11519500) and ten tributaries, summarizing data to a monthly time step, converting data to normalized log-transformed units (i.e., taking base 10 logarithm, subtracting the mean, and dividing by the standard deviation), developing a linear regression model to predict the tributary flow from the USGS gage data (Figure 2a). Two additional small tributaries (Johnson and Crystal creeks) are assigned flows based on a percentage of estimated Patterson Creek flows.

Scott River summer flows appear to have decreased significantly since the 1977 drought, so the data were split and separate regressions were developed for the WY 1957–1972 and WY 1973–2016 study periods (Figure 1a). For those tributaries that do not have any measured data during the WY 1973–2016 period, the WY 1957–1972 regression is used. Given that there is extremely strong evidence that the relationship between tributary flows and Scott River flows changed between the WY 1957–1972 and WY 1973–2016 periods (i.e., Figure 1a), it does not make sense to apply the WY 1957–1972 regressions without adjusting for that difference. Rather than doing two separate regression models (i.e., one for each period), it would make more sense to just have a single regression model covering all years, but include "Period" as a categorical variable (to account for the difference in intercept between the periods), and an interaction of

"Period" and Fort Jones (to account for the difference in slope between the periods). In contrast, the current approach does not take maximum use of the available data, ignoring factors that are known to be important (i.e., the difference between the periods).

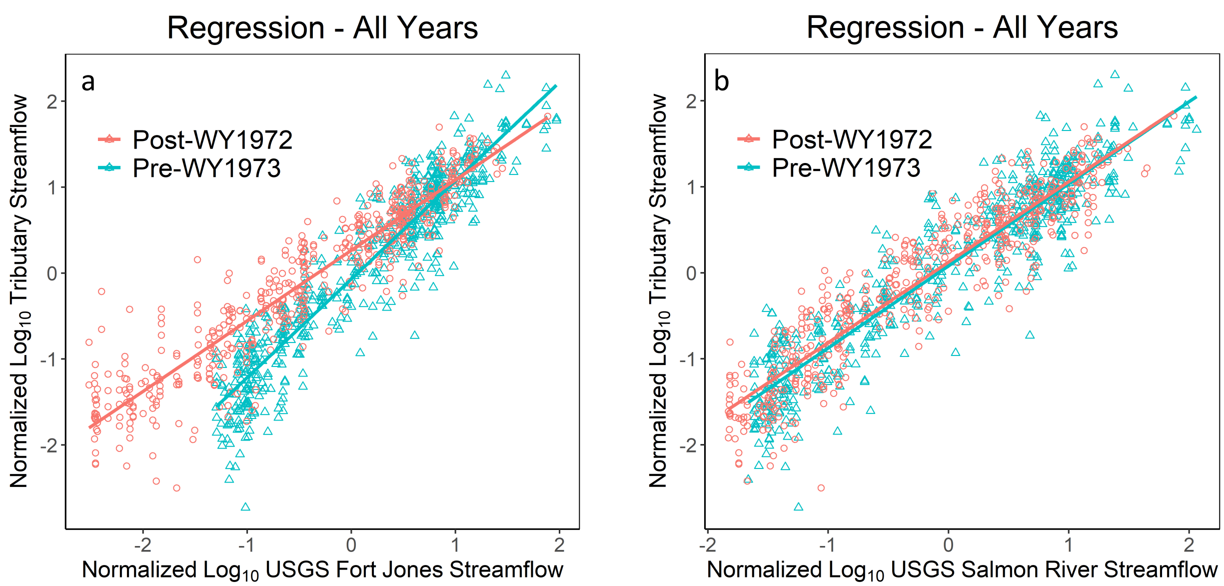

Figure 1. Scatterplot with linear regressions between gaged monthly flows in Scott River tributaries and gaged monthly flows in (a) Scott River USGS gage currently used in SVIHM, and (b) Salmon River at Somes Bar USGS gage which we recommend using for some sites and months. Colors differentiates the older WY 1957–1972 period from the more recent WY 1973–2016 period.

<u>Using an *outlet* gage to define tributary *inflows* is problematic, especially with so many data gaps</u>

The first thing to recognize about the gap-filling is that gaps are substantial (Figure 2a), so the methods for filling them matters. For the current SGMA GSP, the SVIHM was run for WY1991–2018. Prior to WY 2002, all (100%) of tributaries were estimated using regression against the USGS gage. Since WY 2002, additional gages have been installed but most were operated in only a subset of recent years and now only Sugar Creek and French Creek are still operational (Figure 2). The version of SVIHM used for SGAM did not use any tributary data for 2017-2018. The percent of total estimated inflows in a month that are based on measurements (i.e., gages) only sporadically exceeds 50% (Figure 2b, 2c). The USGS 11519500 gage that is the source for all the regression-based estimates is located at the outlet of Scott Valley. It is problematic to use a gage that is the surface water <u>output</u> of a groundwater basin to estimate the surface water <u>inputs</u> to the same basin, because that groundwater basin exerts profound natural and human influences on hydrology, including water diversions, groundwater pumping, evapotranspiration, groundwater recharge, and leakage of groundwater to streams. In reality, these influences vary not only seasonally (e.g., spring vs. fall) but also inter-annually (i.e., wet years vs. dry years), but using linear regression assumes a constant relationship between the input and output. For example, long-term management changes can affect the relationship between inflows and outflows (i.e., see Figure 1a showing effects of increased groundwater extraction). This gage is also used for calibration and verification of the SVIHM. Given that inflows are an important driver of groundwater dynamics, using the outflow to estimate inflows may artificially inflate the apparent accuracy of the SVIHM (because estimated inflows are automatically scaled based on measured outflows).

Salmon River gage as an alternative to the Scott River gage (at least for some months and/or sites)

We explored using the USGS gage in the Salmon River at Somes Bar as an alternative to the USGS Scott River at Fort Jones. The Salmon River has several characteristics that make it worth of evaluation for filling gaps in Scott River tributary flows, including: long-term data records, close proximity (i.e., immediately to west) to the Scott River sub-basin, lack of dam regulation, lack of major diversions, and does not contain a large alluvial groundwater basin with intensive groundwater extraction. The Salmon River's relative lack of diversions and groundwater extraction may make it a better choice than the Scott River during the low-flow season. While overall fit for the WY 1973–2016 period is similar for Scott River gage model ($R^2 = 0.87$) and Salmon River gage model ($R^2 = 0.86$), fit varies by month with the Scott River performing better (i.e., higher R^2, Figure 3b) in January–August and the Salmon River model performing better in September–November (i.e., $R^2 = 0.20$, 0.70, and 0.71 compared to $R^2 = 0.14$, 0.25, and 0.56)(Figure 3). Differences are especially strong in October, with $R^2 = 0.70$ for the Salmon River model compared to $R^2 = 0.25$ for Scott River model (Figure 3). Based on this evaluation, we recommend using the Salmon River model to fill tributary flow gaps in the months of September–November, which is the period when the groundwater basin begins filling and flows begin rising in response to increased precipitation and decreased evapotranspiration following the hot dry summer and year's lowest flows. This period is biologically important because it coincides with the start of chinook salmon spawning season. We are unclear on the how the poor fit of the Scott River regression model during this period (Figure 3a) affects the simulation of groundwater dynamics and outflows in the SVIHM. Have any sensitivity analyses been conducted to see how sensitive outflows are to inflows during this period?

In contrast to the major differences in the relationships between tributaries flows and Scott River flows for the WY 1957–1972 and WY 1973–2016 periods (Figure 1a), there appears to be no difference between the periods when the Salmon River gage is used instead (Figure 1b). The lack of difference between these periods in the Salmon River models suggests that for tributaries that have no post-1972 flow data (i.e., Shackelford, Patterson, Moffett, and Etna creeks)(Figure 2a), it is likely better to use of Salmon River models for gap-filling additional months (i.e., maybe June–December for these tributaries, instead of the September–November we are recommending for the other tributaries?). The recommendation for June–December is based on the observation that the between-period divergence occurs at normalized $\log_{10}$ Scott River flows less than zero (Figure 1a) and in the WY 1973–2016 period such flows tend to occur more frequently in June–December than other months (Figure 4a).

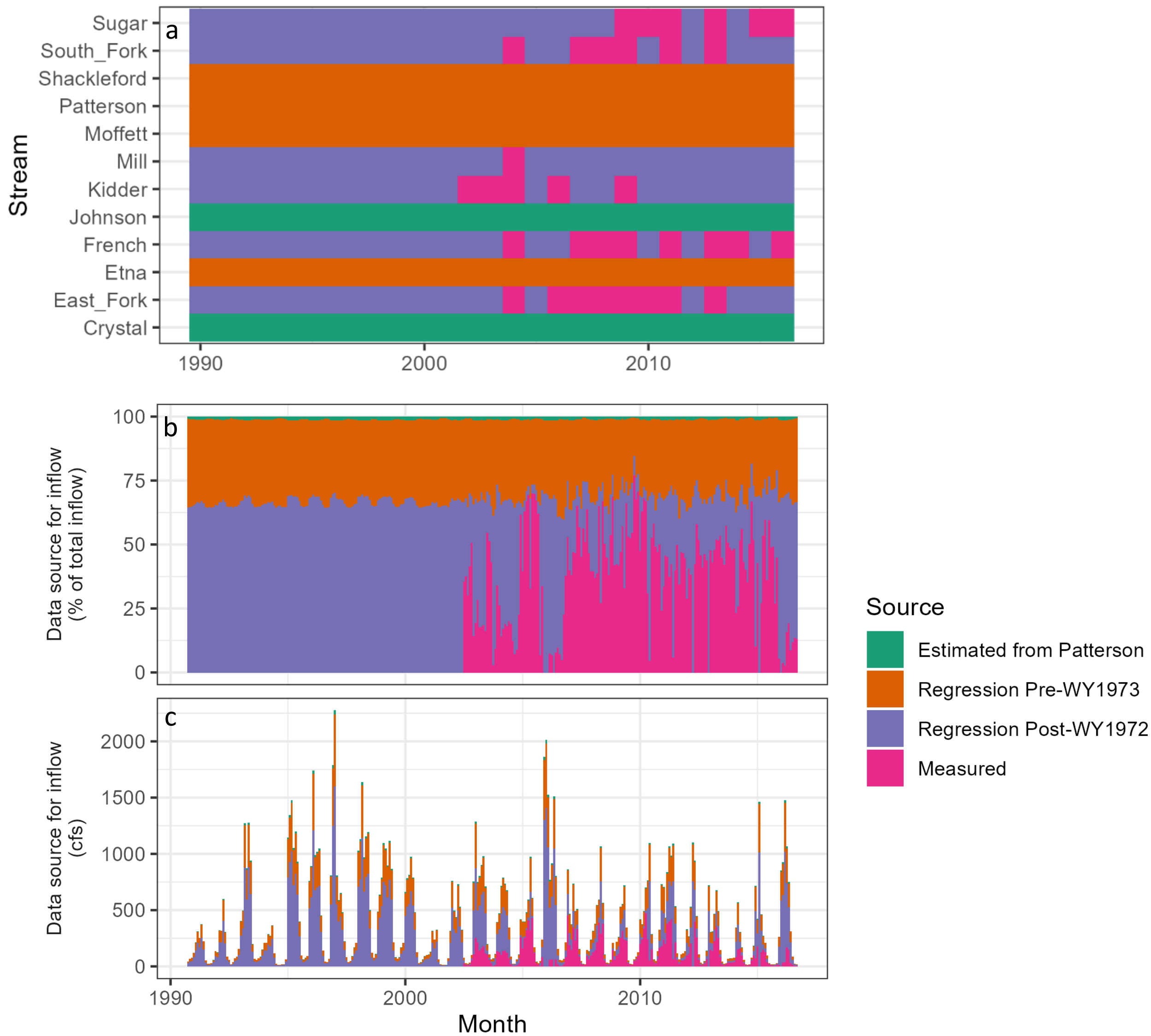

Figure 2. Monthly time series for hydrologic years 1991–2016 for the existing SVIHM's (a) data sources for flow data at twelve tributaries, (b) percent of total inflows from each data source method, (c) total inflows for inflows from each data source method. We generated this time series by adapting the Tolley et al. (2019) data processing codes.

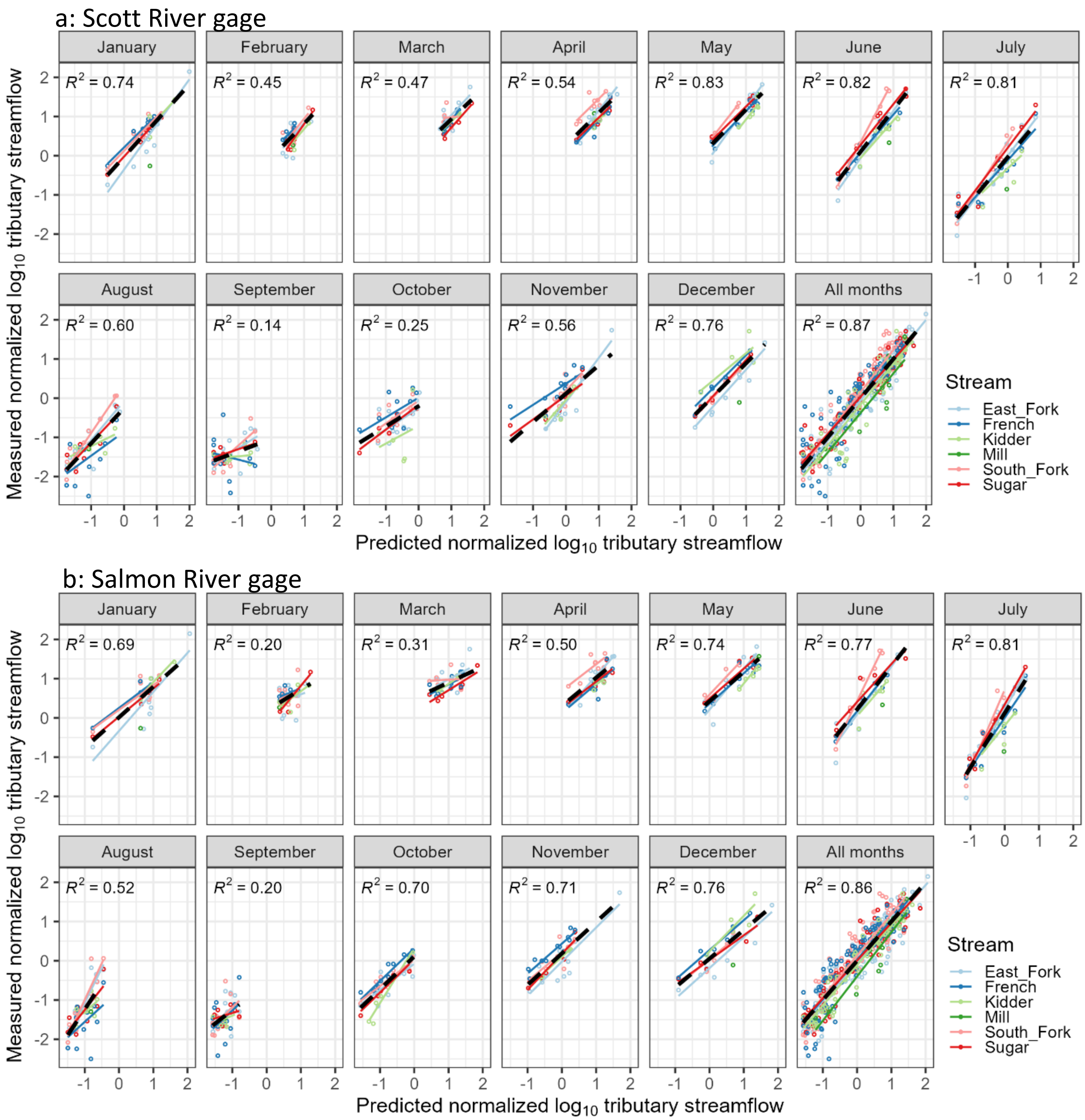

Figure 3. Scatterplot comparing measured monthly Scott River tributary flows with regression predictions based on gaged monthly flows for the WY 1973–2016 period in (a) Scott River USGS gage, and (b) Salmon River at Somes Bar USGS gage. Black linear trendlines are for all sites combined, with R^2 labeled in the upper left corner of each panel. Colored linear trendlines are for individual sites. R^2 indicates the fraction of variation explained by the model (value of 1 would indicate a perfect correlation with predictors explaining 100% of variation in the response variable while a value of 0 indicates none of the variation is explained).

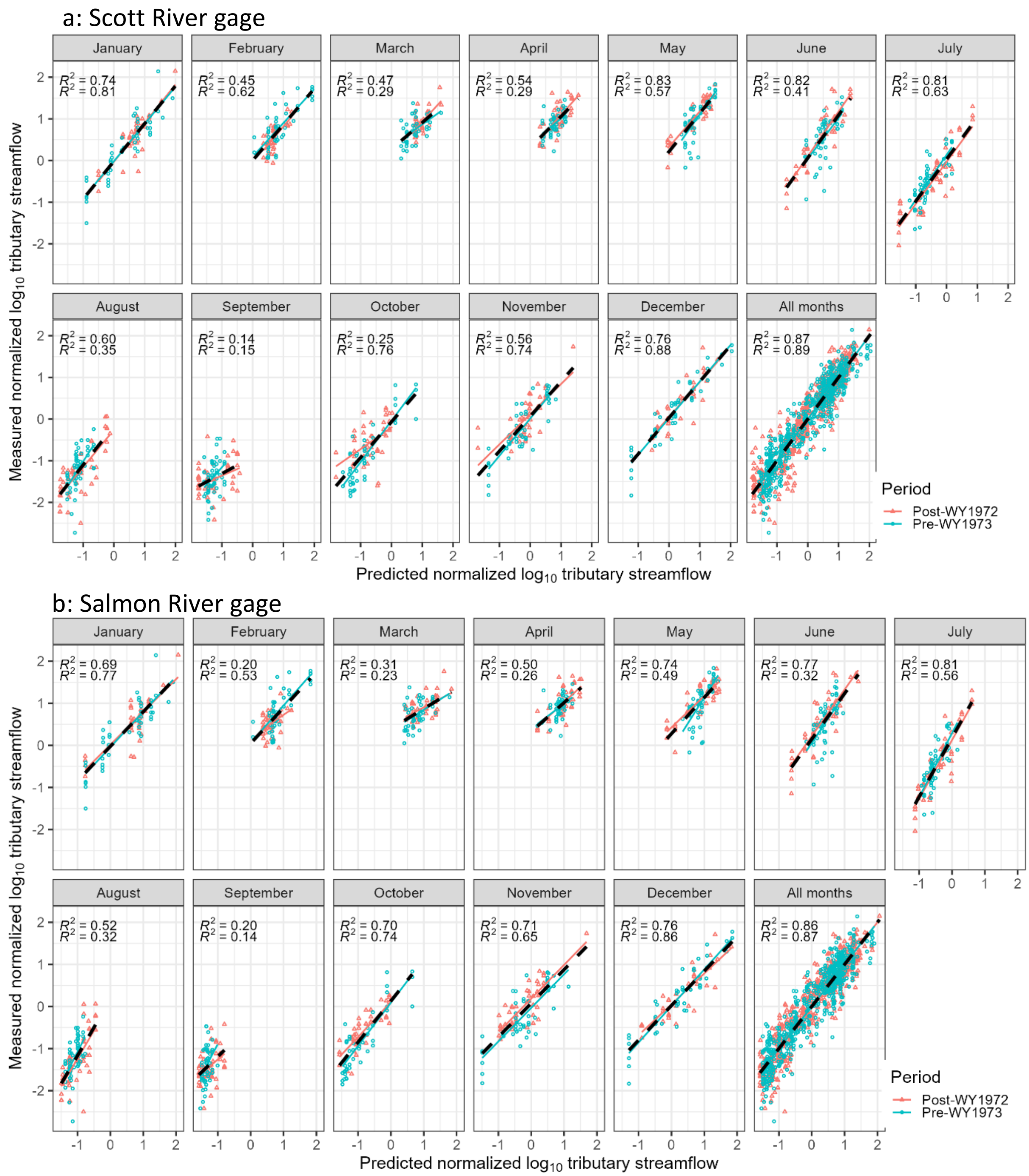

Figure 4. Scatterplot comparing measured monthly Scott River tributary flows with regression predictions based on gaged monthly flows in (a) Scott River USGS gage, and (b) Salmon River at Somes Bar USGS gage, with separate regressions for the WY 1957–1972 and WY 1973–2016 periods. Black linear trendlines are for combined periods whereas colored linear trendlines are for individual periods. R^2 values in each panel match legend order (top is post-WY1972, bottom is pre-WY1973).

Consideration of model types beyond linear regression

One additional suggestion for potential additional refinements to the methods for filling data gaps that we do not currently not have time to test, but want to mention here so it could potentially be followed up on later, it to use hierarchical models and account for watershed area. The SVIHM's normalization (a.k.a. "standardizing", our preferred term) of the flow data (subtracting the mean and dividing by standard deviation, with the mean and standard deviation calculated individually for each site based on that site's period of record) is intended to allow all tributaries to be included together in the same regression model. However, we have some concerns that for sites with short records (e.g., 11 months at Mill Creek, 6 months at Etna and Patterson creeks), there are far too few data points for the mean and standard deviation to be representative of long-term patterns, which could lead to artifacts in the regression outputs. A possibly more robust alternative would be to instead be to convert the flow data to specific discharge (i.e., flow per watershed area in units of cfs/mi^2 or its metric areal equivalent mm/d), then standardizing by subtracting the mean and dividing by standard deviation (with the mean and standard deviation calculated from the entire pool of specific discharges from all sites, rather than calculating the mean and standard deviation only from each site's period of record). From these standardized specific discharges, a single hierarchical model (a.k.a. mixed effects model) could be constructed with appropriate random effects to explicitly account for inter-site differences. R packages available for implementing such models include 'mgcv', 'lme4', and 'nlme'. A hierarchical model could help account for inter-site differences. For example, not surprisingly given its the relatively low elevation watershed, Moffett Creek appears to have a greater percent of its annual flow occur during January–March than other tributaries and then a lesser percent of its annual flow occurs during May–June snowmelt runoff (not shown here). There are clear, albeit relatively small, seasonal patterns in the residuals (calculated as measured minus modeled) in both the Scott River and Salmon River regression models, with both models under-predicting tributary flows in May–June and October–November underpredicting tributary flows in January–March and August–September (Figure 5). A hierarchical model would likely help remove the seasonal patterns in model residuals.

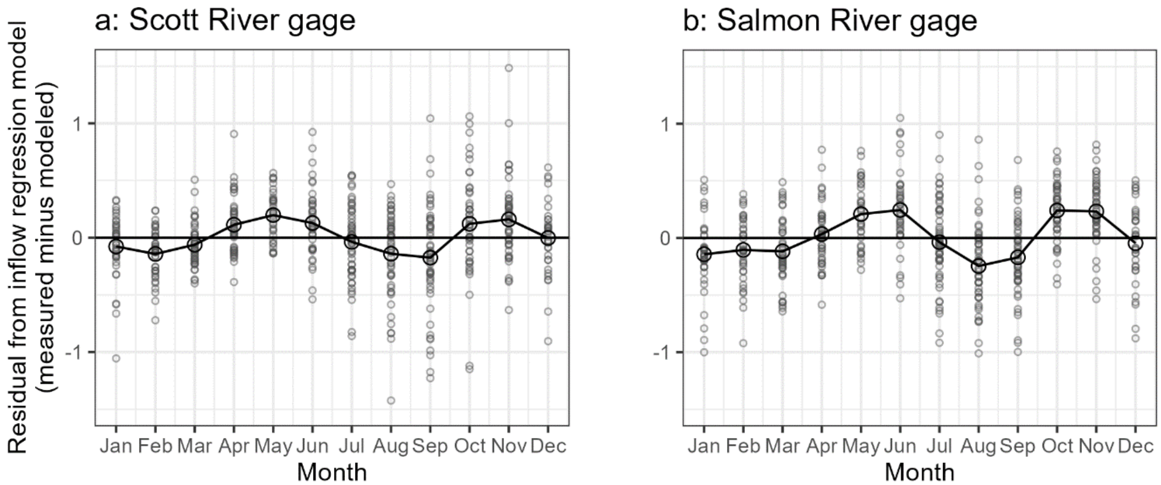

Figure 5. Monthly distribution of residuals from regression models that predict monthly Scott River tributary flows for the WY 1973–2016 period using (a) Scott River USGS gage, or (b) Salmon River at Somes Bar USGS gage. Small gray points are individual site-month-year combinations while large black circles are the mean of all points within a month. Values above zero indicate model is under-predicting flow while values below zero indicate the model is over-predicting flow.

C) COMMENTS ON SPECIFIC GSP SECTIONS USING THE COMMENT FORM PROVIDED

Chapter	Page	Section	Line/Table/ Figure #	Comment	
ES	8	ES-2	214-215	"…lateral flux of Mountain Front Recharge (MFR) is assumed constant at <18 TAF." Seems odd that this would be assumed constant between years. See comment below regarding Chapter 2, page 117, section 2.2.3.2.	TC-012
2	13-15	2.1.2	259-369	It would be very helpful to provide citations for most (or all) of the documents listed on these pages, rather than the current few. The top of the sections says "This chronology was provided by Sari Sommarstrom (2019), with additional details from select sources", but Sommarstrom (2019) is not listed in the references at the end of this chapter.	TC-013
2	15	2.1.3	378	Should Karuk Tribe be added to the list of monitoring entities because they monitor water quality at the mouth of the Scott River, or is this list only for monitoring within and upstream of the Scott Valley? Even though the Karuk Tribe monitoring is downstream, it is informative to conditions within the basin.	TC-014
2	18	2.1.3	Table 2	For Quartz Valley Indian Reservation Environmental Department, Plan/Program columns should be updated to: "Flow monitoring, groundwater elevation, and ~~Annual~~ surface and groundwater quality monitoring". Also, "Regulatory?" column should be changed to "Yes" and "What is regulated?" column should be changed to "Surface and groundwater quality", because QVIR has been approved by U.S. EPA for Treatment as a State status for regulating those with tribal trust lands.	TC-015
2	19	2.1.3	Table 2	In the "Tool" section of the table, a row should be added for "Quartz Valley Indian Reservation Environmental Department", with "Plan/Program" of "Statistical model to predict water temperature at Scott River USGS gage"	TC-016
2	30	2.1.3	839	Add new sentence to end of paragraph: "QVIR was approved by U.S. EPA for Treatment as a State status for regulating water quality within the tribal trust lands."	TC-017

Chapter	Page	Section	Line/Table/ Figure #	Comment	
2	30	2.1.3	840	Add new paragraph: "QVIR and Riverbend Sciences have developed a statistical model to predict daily water temperatures at Scott River USGS gage using flow and air temperature data. The model was calibrated with 24 years of data is currently undergoing peer review (Asarian and Robinson 2021). It is freely available from an online repository." In addition, we recommend the first sentence on line 840 be revised to: "The QVIR Environmental Department has made this water quality and water level monitoring data and statistical model available for use in GSP development." Citation to add to references section: "Asarian, J. E., & Robinson, C. (2021). Modeling Seasonal Effects of River Flow on Water Temperatures in an Agriculturally Dominated California River [Preprint]. Earth and Space Science Open Archive; Earth and Space Science Open Archive. https://doi.org/10.1002/essoar.10506606.1" We are hopeful that the final peer-reviewed version of the article will be complete in late 2021 or early 2022.	TC-018
2	39	2.1.5.2	1241-1245	"The Advisory Committee discussed modeled scenarios using the Siskiyou County Sheriff Department's estimate of 2 million illicit cannabis plants and a consumptive use of 4-10 gallons of water per plant per day, to consider the potential impacts to groundwater resources from this activity under current and future conditions. This information can be found at Appendix [ ]." What appendix is this referring to? Also, it would be good to clarify if the estimate of 2 million plants is regarding the whole county or just the Scott basin.	TC-019
2	41	2.1.5.2	1299	The Lee 2016 document cited here is not included in the references at the end of the chapter.	TC-020
2	44	2.2.1.2	1379-1391	This paragraph discusses trends at 9 snow stations. The up-to-date data are appreciated, but it would also would be good to cite previous analyses of regional snowpack data, something like "Since the 1940s, the percent of precipitation falling as snow has decreased in the region (Lynn et al. 2020) and April 1 snowpack has decreased, especially at lower elevations (Van Kirk and Naman 2008)." Citation: "Lynn, E., Cuthbertson, A., He, M., Vasquez, J. P., Anderson, M. L., Coombe, P., Abatzoglou, J. T., & Hatchett, B. J. (2020). Technical note: Precipitation-phase partitioning at landscape scales to regional scales. Hydrology and Earth System Sciences, 24(11), 5317–5328. https://doi.org/10.5194/hess-24-5317-2020"	TC-021
2	69	2.2.1.6	1878	"Some of these flow gauges (notably French Creek and Sugar Creek) have later end dates than the years listed…"	TC-022

Chapter	Page	Section	Line/Table/ Figure #	Comment
2	70	2.2.1.6	1934-1936	In contrast, lower baseflow in September and October since the 1970s has been attributed to climate change as the dominant factor (ibid. Figure 6; Drake et al., 2000), although Asarian and Walker (2016) found that flow declines in August, September, and October were much larger than could be explained by precipitation alone." Suggested language is based on Figure 8 from Asarian and Walker (2016) which shows declines in precipitation-adjusted flow. Citation: Asarian, J. E., & Walker, J. D. (2016). Long-Term Trends in Streamflow and Precipitation in Northwest California and Southwest Oregon, 1953-2012. Journal of the American Water Resources Association, 52(1), 241–261. https://doi.org/10.1111/1752-1688.12381 TC-023
2	70	2.2.1.6	1936-1939	"Over the past 22 years, the relative frequency of below average and dry years has been much higher than during any period in the 20th century during which Scott River flows at Fort Jones have been measured (Figure 16). This has resulted in more frequent occurrence of baseflow conditions of less than 20 cfs, although low flows measured in recent years have not been lower than low flows measured prior to 2015 (Figure 16)." These sentences are unclear and should be re-worded. The phrase "below average and dry years" implies precipitation, but Figure 16 shows flows not precipitation, so should probably be re-worded as "years with low-flows". Are water year types (and methods used to derive water years types) explicitly defined somewhere in the GSP (i.e., see comment on Chapter 2, Section 2.2.3, page 108, line 2991)? The purpose of the statement "although low flows measured in recent years have not been lower than low flows measured prior to 2015" is unclear and should either be deleted or explain why that is notable. Minimum flows have clearly declined over the period of record (e.g., see Figure 16, or the statistical analyses in Asarian and Walker 2016). Looking at Figure 7 on page 26 which shows precipitation, the period 2000-2021 does not look obviously drier than 1977-1999. TC-024
2	73	2.2.1.7	1960-1963	"Figure 18 illustrates the monthly variations in the amount and direction of water exchange between groundwater and surface water. Losing sections are indicated by red colors and the positive value of the logarithm of the rate of stream leakage to groundwater. Gaining stream sections are indicated by blue colors…" The Figure 18 on page 72 (a map of dry and wet river/stream reaches from SRWC 2018) does not match the description on page 73. Page 73 appears to instead describe Figure 5 from Tolley et al. (2019) which we do not see in the GSP document. TC-025
2	73	2.2.1.7	1975	Tributary names should be labeled on subject Figure. TC-026
2	75	2.2.1.7	2040	When talking about summer baseflow period depletion, what is the rationale for only presenting estimates for the Sept.-Oct. period? What is going on earlier in the summer and in the late fall? TC-027

Chapter	Page	Section	Line/Table/ Figure #	Comment	
2	75	2.2.1.7	2026-2051	Table 7 provides summaries of stream depletion. Values are presented as ranges (e.g., 43-65 cfs). Please clarify what these ranges are (e.g., is the minimum and maximum of the seasonal averages observed across all years?) and briefly discuss in the text if there are any apparent patterns driving the variation between years (e.g., is stream depletion generally greater in low-snowpack/flow years?).	TC-028
2	76	2.2.1.8	2063-2065	"For purposes of this section, 'GDE' is used to refer to a spatial area covered by vegetation that is observably distinct from dry-land terrestrial vegetation." What about areas that historically had groundwater-dependent riparian vegetation but do not current support this vegetation because of groundwater depletion. For example, the valley reach of Moffett Creek used to have large riparian trees but they are nearly all dead now, with a few standing skeletons remaining. Moffett Creek is not mapped as GDE in Figure 19, should it be?	TC-029
2	80	2.2.1.8	2172-2174	What depth to groundwater mapping analysis performed? What seasonal (winter vs. summer) groundwater level information used to inform the DTW determination?	TC-030
2	80	2.2.1.8	2179-2180	The GDE mapping appears to be based solely on visual or aerial map inspection. Were all iGDEs assumed to be GW dependent or were some removed due to excessive DTW? What iGDEs dropped and why, if any?	TC-031
2	82	2.2.1.8	Table 1	Shouldn't cascade frogs and willow flycatchers be added to Table 1 (or related text), even they were not listed by the Nature Conservancy?	TC-032
2	108	2.2.3	2991	It is unclear how water year types were defined. Tolley et al. (2019) used the "Sacramento Valley water year hydrologic classification" (though no citation is provided so it is unclear what that is) while Foglia et al. (2013) used an analysis of Fort Jones and Callahan precipitation data. Please clarify here how water year types were defined.	TC-033
2	112	2.2.3	3030-3050	In Table 15, the SW Irrigation values do not add up to the Farmers and SVID Div. values presented in Table 14. Where do the SW Irrigation values in Table 15 come from? Similarly, the GW Irrigation values in Table 15 don't equal the "Wells" values presented in Table 16 – where do the GW Irrigation values come from and why do they differ from the Wells values?	TC-034
2	112	2.2.3	3030-3050	The Median SW budget values indicates a 10 TAF deficit in stream flow. This suggests a long-term chronic condition of stream outflows exceeding inflows during most years. It would also be helpful to present the Average values on Tables 14-16 for comparison.	TC-035

Chapter	Page	Section	Line/Table/ Figure #	Comment	
2	113	2.2.3	3079-3081	"The streamflow regression model is a statistical tool used to estimate tributary inflows at the valley margins when upper watershed flow data are unavailable ('streamflow regression model') (Foglia et al. 2013)." While true, this statement is somewhat misleading. During the 1992-2018 model period, most tributary inflows are estimated not measured. It would probably be more accurate to revise this to: "…used to estimate tributary inflows at the valley margins, supplemented by gaged upper watershed flows when data are available ('streamflow regression model') (Foglia et al. 2013)."	TC-036
2	113	2.2.3.1	3090	"Agricultural irrigation is calculated based on daily crop demand." should be revised to "Agricultural irrigation is calculated based on daily crop demand, with an efficiency assigned to each field based on source of irrigation water and type of irrigation." Efficiency is an important component of the model that merits brief explanation here even if the details are explained in Appendix 2-C.	TC-037
2	114	2.2.3.1	3096-3097	All precipitation falling on cultivated fields and native vegetation is assumed to infiltrate completely and "runoff is neglected". Yet, the SW budget indicates runoff (overland flow). So, are the water budget models double accounting for runoff? (i.e., ppt. runoff contributing to SW flow and ppt. runoff being infiltrated into soil budget and possibly being transferred to GW recharge).	TC-038
2	114	2.2.3.1	3121	What does "weakly coupled" mean?	TC-039
2	114	2.2.3.1	3130-3134	"However, for the MODFLOW model, daily values of stream inflow from the upper watershed, pumping, and recharge, including canal and mountain front recharge, are aggregated (averaged) to each calendar month and held constant within a calendar month. In MODFLOW, the calendar month is referred to as a 'stress period'". This seems like an un-necessary coarsening of the data, given that the computationally intensive part is the daily time step of the daily model, right? Why do that? The surface water budget is calculated on a daily basis. Flow data could be estimated on a daily basis. The model is used for purposes such as predicting the date when flows in the fall first increase to above 20 cfs, so a monthly model seems less than desirable for those purposes. Foglia et al. 2013 wrote: "However, if warranted, the budget model described here can also be applied to an integrated hydrologic modeling scenario with weekly or bi-weekly varying stress periods or to stress periods of varying period length." This issue is particularly pertinent in the fall, when the model does not do well at representing the timing and magnitude of flow increases (i.e., as discussed in Appendix 2-D).	TC-040

2	116	2.2.3.2	3197	"Surface water irrigation diversions are computed as a function of irrigation demand. Fall/winter diversions for stockwater are not included in the current version of SVIHM, but will be added in the future." If we understand correctly, the SVIHM assumes that no surface water diversions occur outside of the irrigation season (i.e., after September 30? or is it weather driven?). In reality, there are substantial diversions for stockwater, with many diversions remaining in place after the end of irrigation season. In years when there is not much fall rain (i.e., 2009, 2020), these stockwater diversions can divert the flow of entire creeks and leave downstream reaches dry during salmon spawning season. Not including these diversions is a considerable deficiency of the SVIHM. The effect of these winter stockwater diversions on fall/winter flows is an important management question that we need tools like the SVIHM to answer. These diversions inadvertently (from a water rights perspective, though we cannot rule out that recharge might be part of diverters' motivation) provide some amount of beneficial aquifer recharge in late winter or spring once surface flows are reconnected throughout the valley. On the other hand, during fall these diversions likely extend the period of low river flow by some unknown number of days because they take water from the channel and recharge the aquifer in locations far from the river where the water may take weeks or months to return. Stockwater diversions in the fall cause recharge during the worst possible time of year (managed aquifer recharge should occur in the late winter and spring, not the summer and fall!). Incorporating these stockwater diversions into the model would be difficult because these diversions are unreported and unmetered. One approach for dealing with the data gaps would be to bookend the estimates in a sensitivity analysis with low and high scenarios. The low scenario could assume that the diversions match demand including transmission losses (i.e., recent State Water Boards emergency regulations set maximum diversion rates based on the number of animals and assumed 90% conveyance losses, see https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/surface_water_stockwater_diverters_090121.pdf). The high scenario could assume that the diversions match the irrigation season right (i.e., from the adjudication), since the stockwater diversions utilize the same ditches as the irrigation diversions. We are not very familiar with the day-to-day operation of these stockwater diversions and thus are unclear if they are pulsed (i.e., on for a few days, off for a few days, etc.) or continuous, but hopefully local farmers and ranchers could provide information on that as well as advise on the volume of the diversions. One exception to the data gaps on winter stockwater diversions is that the Scott Valley Irrigation District (SVID) diversions are reported monthly for the years 2010–2020 in the State of California's eWRIMS database. For example, SVID diversions for the October 2019 for "1000-1800 cattle-sheep-horses" were reported as 260.4 AF

TC-041

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				(https://rms.waterboards.ca.gov/LicensePrint_2019.aspx?FORM_ID=476977). This equates to 4.2 cfs during a month when flows at the USGS gaged average 7.1 cfs. Assuming that each head of livestock needs 15 gallons per day (cattle value from https://www.waterboards.ca.gov/drought/scott_shasta_rivers/docs/surface_water_stockwater_diverters_090121.pdf), then 1800 cattle would need 27,000 gallons/day. In comparison the 260.4 AF diversion equates to 8.4 AF/day, or 2.7 million gallons/day, which is 100x greater than the amount of water actually needed to sustain the livestock. Is this a "reasonable" use of water at a time when mainstem river flows were so low that salmon could not access their spawning grounds? Conversion of winter stockwater diversions to stock tanks fed by small wells could be the lowest-hanging fruit for achieving meaningful increases in fall river flows while having little or no economic cost to agriculture (assuming the conversions are paid for with public money). We recognize that the GSP cannot dictate management of surface flows; however, the analyses and models used in the GSP should consider the real-world water budget and not ignore important drivers of key groundwater management endpoints (i.e., fall flows).
2	116	2.2.3.2	3197-3200	"Surface water diversions are computed as a function of irrigation demand. The conceptual diversion points from tributary flows are just outside the Basin boundary, except for two internal diversions (6 TAF, see below), which is consistent with most diversions occurring near the Basin margin." Due to data constraints, the approach of estimating diversions based on irrigation demand (i.e., deduct diversion from gages surface inflows) makes sense. However, since some tributary flow gages are located downstream of substantial diversions (e.g., French Creek), it seems like the flows at these gages should be treated differently than gages that are upstream of diversions, but we do not see this mentioned anywhere in the documentation. For fields irrigated with water diverted upstream of flow gages, shouldn't the water demand <u>not be</u> deducted from the gaged flows? Deducting the demand seems like double-counting the diversion (first it is already implicitly deducted prior to the gage measurement because the water is not physically there, then it is explicitly deducted during data processing).

TC-041, Cont'd

TC-042

Chapter	Page	Section	Line/Table/ Figure #	Comment	
2	117	2.2.3.2	3209-3214	"Mountain Front Recharge, the phenomenon of diffuse water flow through mountain soil or fractured bedrock into the alluvial sediments of an aquifer along a valley margin, is simulated along the western edge of the model domain. It is estimated to be a volume that changes month-to-month (i.e., greater recharge during the wet season) but which is identical year over year (see Appendix 2-C for more details)." We have reviewed the Appendix 2-C documents as well as the S.S. Papadopulos (2012) report that is cited for the original estimate. Mountain Front Recharge is estimated at <18 TAF (thousand acre-ft), so is quite small relative to other inputs (i.e., it is <5% of the other inflows [stream inflow and precipitation] on average). While we sympathize with the difficulty of estimating this parameter, we do not understand why it should be constant between years, given that it is derived from a water balance of terms that vary considerably between years (i.e., precipitation minus evapotranspiration minus surface flows). Seems like it would make more sense to scale it to be larger in wet years than dry years?	TC-043
2	120	2.2.3.2	3330-3331	"Recharge from the land surface occurs primarily in winter months but is limited – except under flood irrigation – during the summer months." This ignores fall/winter stockwater diversions, which are substantial but not included in the SVIHM. See comments above regarding chapter 2, page 116, section 2.2.3.2, line 3197.	TC-044
2	125-126	2.2.4	3437-3515	The "Future Water Budget" section is lacking discussion of some key factors. For example, what changes are expected to snowpack and tributary inflow hydrographs (i.e., runoff timing) of the four climate change scenarios evaluated? What are the greenhouse gas emissions trajectories associated with the climate scenarios (i.e., does it assume "business as usual" or that aggressive efforts are made to reduce greenhouse gas emissions, or something intermediate?). Listing the degrees Celsius (or Fahrenheit) of air temperature increase associated with each scenario would be helpful for context.	TC-045
2	125	2.2.4	3473	DWR 2018 citation is not included in the references cited at the end of the chapter.	TC-046
2	126	2.2.4	3499-3502	Figure citation should be fixed: "Importantly for sustainable groundwater management, none of the future climate scenarios indicate that the lowest groundwater storage points decrease over repeated drought occurrence (Figure 31~~28~~)." Also, please explain the significance/implications of this. Does it mean that long-term overdraft and subsidence are unlikely? Or that late summer streamflows will not be lower with climate change?	TC-047

Chapter	Page	Section	Line/Table/ Figure #	Comment
2	130	2.2.4	Figure 32	"Figure 32. Projected flow at the Fort Jones Gauge, in difference (cfs) from Basecase, for four future projected climate change scenarios. Near and Far scenarios show minimal differences from historical basecase flow conditions." Perhaps we are mis-understanding what these scenarios are, but are extremely skeptical of any claims that the temperature-driven changes in precipitation form due to climate change (i.e., more rain and less snow) are not going to substantially decrease river flows in summer and fall, regardless of what happens to total annual amount of precipitation. The GSP should acknowledge these realities and then describe how the model predicts that this will seasonally change river flow and groundwater. The format of the graph makes it very difficult to see meaningful seasonal patterns. The y-axis scale that ranges from -2,000 to +12,000 cfs makes it impossible to see what is happening during low flows. Can you add a second panel that to graph so that the low-flow period is legible (maybe -100 to +100 cfs?)? Or maybe limit the months to just show April through October? TC-048
2	137	References	3775-3777	Langridge, Ruth, Abigail Brown, Kirsten Rudestam, and Esther Conrad. 2016. "An Evaluation of California's Adjudicated Groundwater Basins." https://www.waterboards.ca.gov/water_issues/programs/gmp/docs/resources/swrcb_012816.pdf ~~https://doi.org/10.1038/nmicrobiol.2016.214~~ TC-049
3	9	3.3	351-353	"Where it is necessary, the GSA will coordinate with existing programs to develop an agreement for data collection responsibilities, monitoring protocols and data reporting and sharing." How will transparency and public access to data be incorporated into these data reporting and sharing agreements? All data that is paid for with public money should be accessible to the public. TC-050
3	21	3.3.5.1	748+	Surface water flow estimates in SVIHM appear to only be calibrated to the Ft. Jones gauge. Comparing simulated stream flow against only one calibration point for such a large river system calls into question how well the model is at simulating stream flow in other reaches that may be experiencing different management and hydrogeologic conditions. The proposed monitoring plan does not call for any additional river flow monitoring along the mainstem river. We recommend adding additional stream flow monitoring gauges along the mainstem river to better calibrate/validate the stream flow estimates along the entire reach, not just at the downstream Ft. Jones outflow point. Given the need for additional tributary gages as model inputs, we are not sure how we would rank the priority of additional mainstem gages. Perhaps these additional mainstem gages should just be operated for a few years, long enough to capture different water year types. Or perhaps there are discrete flow measurements collected during other sampling or special projects (i.e., in the early/mid 2000s in preparation of the TMDLs) that could be used for calibration and verification? TC-051

Chapter	Page	Section	Line/Table/ Figure #	Comment	
3	26	3.3.5.2	935-972	In this “Assessing and Improving SVIHM” section, we recommend several additional tasks. These model refinements are described in more detail in a separate comment document (not in this comment form), but are briefly summarized here: 1) use a better method for filling the large gaps in tributary inflows (e.g., considering other model types beyond linear regression, and using Salmon River gage as an alternative to the Scott River gage for filling tributary data gaps at least for some months and/or sites), 2) incorporate fall/winter stockwater diversions, 3) shorten the MODFLOW model timestep to something shorter than a month, 4) do a sensitivity analysis to quantify how sensitive modeled outflows are to tributary inputs (especially during September and October).	TC-052
3	30	3.4.1	Figure 5	The definition of Minimum Threshold in Figure 5 is confusing: “Minimum Threshold: historic low – (10 % of max historical depth to water or 10 ft, whichever is less)” Maybe revise to “Minimum Threshold: historic low minus either 10% of max historical depth to water or 10 ft, whichever is less”	TC-053
3	30-38	3.4.1	1088-1265	As currently proposed, the Actions Trigger occurs if water levels at a well fall below the historic level for two consecutive years and the Minimum Threshold occurs if a well falls more than 10% (or 10 ft, whichever is less) of the historic level. We have not actually tried an experiment with hypothetical or real well data, but it seems possible that well levels could have long-term declines but not ever violate the Actions Trigger and Minimum Threshold if the decline is “bumpy”, meaning there are not consecutive drought years. For example, well levels could alternate between moderate/high levels in wet or normal years, followed by a severe drought year in which well levels drop to historically low levels (but not exceeding the 10 ft or 10%), followed by moderate/high levels in wet or normal years, followed by a severe drought year in which well levels drop to historically low levels (but not exceeding the 10 ft or 10%), etc. This seems very problematic because conditions could progressively deteriorate but never violate the AT or MT.	TC-054
3	34	3.4.1.1	1173-1183	This paragraph of the GSP, similar to other sections of the GSP, does not mention one of the key elements of climate change for which there is high certainty- there will be a shift in precipitation form (less snow and more rain) that will shift the seasonal timing of tributary surface flows into the valley. Regardless of what happens to total precipitation or total runoff, this change in precipitation form and runoff timing is a huge issue that water management is going to need to deal with.	TC-055
3	35	3.4.1.2	1236-1237	As these are depth to groundwater values in Table 5, shouldn’t the MO values have less-than signs, not greater than signs?	TC-056

Chapter	Page	Section	Line/Table/ Figure #	Comment	
3	35-36	3.4.1.2	1227-1245	Is “primary trigger (PT)” here the same as “Action Trigger” in Figure 5 (on page 30)? If the meaning is the same, then it would be better (i.e., easier to understand) to use the same phrase/abbreviation rather than have two separate terms that mean the same thing. On the other hand, if they are different, then shouldn’t Figure 5 also show the PT in addition the Action Trigger?	TC-057
3	44	3.4.1.3	1495-1531	The water quality triggers are all based on the 75th percentile of wells, so it is conceivable that water quality conditions could deteriorate horribly at 20% of wells and that would not violate any triggers. Seems like it might make sense to also have some metric that would reflect conditions in the wells with the worst water quality?	TC-058
3	46	3.4.3.1	1591-1593	Same comment from March Draft: Irrigating with water containing moderate to high nitrate levels may also increase nitrate concentrations in underlying groundwater.	TC-059
3	46	3.4.3.2	1618-1621	Same comment from review of draft in May: This language is very confusing and unclear how it translates to concentrations. One way it reads suggests that a 14% annual increase per year over a 10 year period in no more than 25% of wells is acceptable. However, compounding a 14% increase over a 10 year period results in a 370% increase in concentration. Perhaps the intent of the statement is, "Monitoring well concentrations shall not exceed the Maximum threshold by 15% in more than 25% of wells during any given year". One could also argue that it isn't warranted - a Maximum threshold should be treated as a just that - a Maximum threshold. Why are exceptions warranted? Theoretically, reaching/exceeding the trigger concentrations should trigger corrective actions. Perhaps the 15% annual exceedance in 25% of wells exception should be applied to trigger values, not Maximum thresholds.	TC-060
3	54	3.4.5.1	1868-1870	Asarian and Robinson (2021) would be a good citation for this sentence: “Excessive stream temperatures are also related to earlier completion of the snowmelt/spring flow recession…” Full reference is: Asarian, J. E., & Robinson, C. (2021). Modeling Seasonal Effects of River Flow on Water Temperatures in an Agriculturally Dominated California River [Preprint]. Earth and Space Science Open Archive; Earth and Space Science Open Archive. https://doi.org/10.1002/essoar.10506606.1	TC-061

Chapter	Page	Section	Line/Table/ Figure #	Comment	
3	54	3.4.5.1	1885-1889	"Some consumptive uses of groundwater may have a more immediate impact on streamflow than others; for example, a well that begins pumping groundwater 66 ft (20 m) from the river bank may cause stream depletion hours or days later, while a well that begins pumping two miles (3 km) west of the river bank may not influence streamflow for months or even a year." This is an important point. Unfortunately, the SVIHM is not capable of simulating the short-term impacts. Prudic et al. (2004) provide the following statement on the associated limitations on MODFLOW's streamflow routing package: *"The mass-balance or continuity approach for routing flow and solutes through a stream network may not be applicable for all interactions between streams and aquifers. The SFR1 Package is best suited for modeling long-term changes (months to hundreds of years) in ground-water flow and solute concentrations using averaged flows in streams. The Package is not recommended for modeling the transient exchange of water between streams and aquifers when the objective is to examine short-term (minutes to days) effects caused by rapidly changing streamflows."*	TC-062
3	58	3.4.5.1	2032-2034	"The reasonableness of groundwater use that may contribute to stream depletion could depend on a number of circumstances, including the benefits of pumping groundwater and the resource benefits of pumping groundwater" This statement distracts from the issue as it addresses the beneficial uses of groundwater consumers, not the beneficial uses of surface waters.	TC-063
3	58	3.4.5.1	2044-2047	"In the context of assessing MTs for the ISW SMC, it is reasonable to only hold groundwater users~~producers~~ outside the adjudicated zone to a modest percentage of stream depletion reversal because any greater responsibility would unreasonably constrain groundwater users in the basin." We agree that groundwater users outside the adjudicated zone are not responsible for solving all the water issues in the Scott River. However, the approach taken here is backwards. Rather than first defining an arbitrary endpoint based on what groundwater users can relatively easily tolerate, the first step should be to determine the instream flows needed by fish, then calculate the difference between those needed flows and current flows, and then assign the same percent reductions needed by all water users (surface, adjudicated groundwater, and unadjudicated groundwater) to meet that difference. To use a hypothetical example, if overall water use needs to be reduced by 40% to meet instream flow targets, then surface water users, adjudicated groundwater users, and unadjudicated groundwater users should each be responsible for reducing their water use (or coming up with projects that produce an equivalent amount of seasonal supply) by that same 40%.	TC-064

Chapter	Page	Section	Line/Table/ Figure #	Comment	
3	58	3.4.5.1	2044-2047	What is "modest" and how is it quantified in terms of groundwater use?	TC-065
3	59	3.4.5.1	2089-2090	"…that is, what is an "unreasonable" amount of stream depletion, which could 2089 be reframed as: what is a "reasonable" amount of avoided groundwater use?". This statement is not how SGMA defines an unreasonable impact for ISW. The GSA can't replace "unreasonable impacts on beneficial uses of surface water" with reasonable use of groundwater.	TC-066
3	60+	3.4.5.1	2108-2209	ISW MT should not be defined based on a proportion or partial contribution to an undesirable result. SGMA requires that an MT define the minimum threshold for a full undesirable result. The whole concept of defining the ISW MT on what the PMA can achieve is putting the cart before the horse. The MT is a numeric value used to define an undesirable result (this may be why the GSP spends so much time confusing and twisting the definition of undesirable result). The MT, if exceeded, may cause an undesirable result. PMAs are a means to avoid exceeding an MT, not a mechanism to define an MT.	TC-067
3	63	3.4.5.1	Table 7	The caption here says that streamflow depletion is summarized across the "Sep 1 to Nov 1" period. Is that correct, or should it be "Sep 1 to Nov 30", as is stated on the Slide 8 of Appendix 4-a? Given that the model's primary time scale is monthly, the correct time period is probably Sept. 1 – Nov. 30, right?	TC-068
4	3	4.1	107-110	"In developing PMAs, priorities for consideration include effectiveness toward maintaining the sustainability of the Basin, minimizing impacts to the Basin's economy, seeking cost-effective solutions…" Based on the description here, it seems like increasing the efficiency of fall/winter stockwater diversion and delivery systems (so these diversions could be dramatically reduced with little economic impact) would be low-hanging fruit that should have been included as a PMA. This would not improve groundwater conditions, but could (we do not know, in part because the SVIHM is not currently set up to be able to provide answers to this important question) mitigate some of the fall streamflow depletion caused by groundwater pumping. While ditches currently used for stockwater could be very useful for managed aquifer recharge (MAR), this activity should only occur during times when there is abundant surface water, such as late winter and spring of normal and wet years, and should utilize a MAR-specific water right so it can be appropriately managed to benefit, rather than harm, instream flows. See our comments on Chapter 2, page 116, section 2.2.3.2 for additional information on this topic.	TC-069

Chapter	Page	Section	Line/Table/ Figure #	Comment	
4	5	4.1	205	Which "Existing reports, proposals" were used to develop the PMAs for recharge? Please provide specific citations.	TC-070
4	5	4.1	206	Shouldn't the Scott River Watershed Council be listed as an entity that is engaged in planning and implementing habitat improvement projects? Table 1 on page 7 lists several PMAs being implemented by the Council.	TC-071
4	7	4.1	Table 1	Increasing the efficiency of fall/winter stockwater diversion and delivery systems (so these diversions could be dramatically reduced with little economic impact) should be included as a PMA. See our comments on Chapter 2, page 116, section 2.2.3.2 for additional information on this topic.	TC-072
4	8	4.1	Table 1	Beaver Dam Analogues (BDAs) are listed solely in the "Habitat Improvement" category. Aren't they also designed to increase groundwater storage and recharge? Why weren't model runs conducted on the effects of BDAs? Is the model not capable of simulating BDAs? If not, what modifications to the model would be needed to simulate BDAs?	TC-073
4	8	4.1	Table 1	Prescribed fire should be added to the list of activities described in the Scott River Watershed Council's "Upslope Water Yield Projects" PMA.	TC-074
4	9	4.1	Table 1	In the "Voluntary Managed Land Repurposing" PMA, we recommend adding groundwater recharge. See our comments on Chapter 4, Section 4.3, pages 24-28, lines 640-809 for additional discussion of this topic.	TC-075
4	13	4.3	316	The "Avoiding Significant Increase of Total Net Groundwater Use from the Basin" PMA does not provide a definition of what "significant" means, so we suggest removing that word. Without a definition, isn't this PMA meaningless? It should probably either be percent (e.g., 1%) or volume? See related comment regarding Chapter 4, page 17, section 4.3, lines 454-456.	TC-076

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4	13	4.3	340-344	We are unable to understand exactly what the "Avoiding Significant Increase of Total Net Groundwater Use from the Basin" PMA means, especially, this excerpt: "Due to the direct relationship between net groundwater use and ET, implementation of the MA is measured by comparing the most recent five- and ten-year running averages of agricultural and urban ET over both the Basin and watershed, to the maximum value of Basin ET measured in the 2010-2020 period, within the limits of measurement uncertainty." Can it be re-stated more clearly, such as, "The goal of this MA is for X not to exceed Y by Z percent?" Can you provide information on the limits of measurement uncertainty? What is the rationale for using the maximum as the basis for the comparison? Is the purpose of the running averages to smooth out climatic variation (i.e., is ET higher in wet years than dry years)? If there is substantial variation between water year types, then should the goal be different in different water year types? What about the contribution of surface water irrigation to ET? We anticipate that climate change will cause increased reliance on groundwater because surface water flows are going to recede earlier in the irrigation season (due less snowmelt), which could result in ET staying the same but groundwater extraction will increase and flows be lower, all without violating this MA.	TC-077
4	13	4.3	348-352	"To provide an efficient, effective, and transparent planning tool that allows for new urban, domestic, and agricultural groundwater extraction without increase of total net groundwater use. This can be achieved through exchanges, conservation easements, and other voluntary market mechanisms while also meeting current zoning restrictions for open space, agricultural conservation, etc. (see Chapter 2)." Exchanges and markets need real, verifiable information if they to operate properly. Without widespread metering, it would be far too easy to game the system.	TC-078
4	14	4.3	354-356	"To be flexible in adjusting the limit on total net groundwater extraction if and where additional groundwater resources become available due to additional recharge dedicated to later extraction." Groundwater is already over-extracted. Additional recharge should be used to reverse streamflow depletion, not enable more extraction.	TC-079

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4	15	4.3	414-415	“The Basin has negligible groundwater inflow and outflow across its aquifer boundaries. As a result, pumping and recharge outside the Basin do not affect groundwater levels.” Negligible is probably too strong a word, probably should be “relatively little” instead? Mountain Front Recharge (“the phenomenon of diffuse water flow through mountain soil or fractured bedrock into the alluvial sediments of an aquifer along a valley margin”) is estimated constant at <18 thousand acre-feet (TAF), compared to total inflow which ranges from 149 TAF in the driest year to 788 TAF in the wettest year (i.e., see Chapter 2, page 17, Section 2.2.3.2)? Mountain Front Recharge is estimated to be 12% (18/149) of total inflow in the driest year, which isn’t really “negligible,” is it?	TC-080
4	17	4.3	454-456	“The permitting program would ensure that construction of new extraction wells does not significantly expand current total net groundwater use in the Basin (to the degree that such expansion may cause the occurrence of undesirable results).” How are “undesirable results” defined? Please add a definition or citation here. See related comment regarding Chapter 4, page 13, section 4.3, line 316.	TC-081
4	17	4.2	460	“Here are two illustrative examples of an appropriate use of well replacement…” … “Example 2: Replacement of a 1,000-gpm agricultural well that will be properly decommissioned with a new 2,000-gpm capacity agricultural well is permissible with the explicit condition that the 10-year average total net groundwater extraction within the combined area serviced by the old and the new well does not exceed the average groundwater extraction over the most recent 10-years.” Since groundwater use is mostly unmetered (much less publicly accessible), how would this be tracked or enforced?	TC-082
4	21	4.2	543	The discussion of Beaver Dam Analogues (BDAs) discusses habitat, but aren’t BDA’s also designed to increase groundwater storage and recharge? See comments on Chapter 4, Section 4.1, page 21, Table 1 for additional information.	TC-083
4	22	4.2	574	Prescribed fire should be added to the list of activities described in the Scott River Watershed Council’s “Upslope Water Yield Projects” PMA.	TC-084

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4	23	4.2	609-639	For the Irrigation Efficiency Improvements, “Potential benefits were quantified through modelled scenarios of a 10% increase, 20% increase, and 10% decrease in irrigation efficiency. Relative stream depletion reversals resulting from these scenarios were 4%, 12% and -2%, respectively (Appendix 4-A).” Can you add a sentence or two here describing how improved efficiency affects the monthly/annual water budgets and reduces streamflow depletion in the September-November period? There’s a widespread misconception among the public and agencies that increasing irrigation efficiency magically creates water, so it would be helpful if the text here provided specific estimates of how it changes the water budget. Increased efficiency would have zero impact on ET, but would decrease pumping and diversions and would decrease recharge, right? Does efficiency reduce some of the streamflow depletion because the reductions in pumping and diversions outweigh the decreases in recharge?	TC-085
4	23	4.2	631-639	The proposed monitoring of irrigation efficiency omits a key tool– metering of water use. Without metering, how can we know if the efficiency projects are actually working?	TC-086
4	23	4.2	631-639	The proposed monitoring of irrigation efficiency lists “Assessment of the increase in irrigation efficiency, with particular emphasis on assessing the reduction or changes in consumptive water use (evaporation, evapotranspiration) based on equipment specification, scientific literature, or field experiments.” Doesn’t efficiency usually not affect consumptive water use but instead just change recharge (that’s how it is represented in the SVIHM, right?). What is the physical basis for thinking efficiency would affect consumptive use for crops like pasture and alfalfa that have low-lying continuous canopy cover (i.e., in contrast to orchards or row crops like tomatoes where efficient delivery systems like drip irrigation could reduce evaporation from bare soil)?	TC-087
4	27	4.3	764	The Permitting and Regulatory Process section explains the legal basis for how water could be diverted for managed aquifer recharge (MAR) though a SWRCB temporary permit, but we are unclear how the water rights would work for in lieu recharge (ILR). Is switching from groundwater to surface water really legal under California water law? If so, please explain in this section. Would the ILR utilize existing surface water rights (but don’t farmers generally already exhaust their surface water rights each year before switching to groundwater)? Or would ILR require a separate temporary permit than MAR? Or would ILR require new permanent surface water rights? It seems very unlikely that SWRCB would grant new surface water rights for irrigation after the start of the April 1 irrigation season, but there might be new rights available in March.	TC-088

4	24-28	4.3	640-809	We support the concept of managed aquifer recharge (MAR) in winter and in lieu recharge (ILR) during the irrigation season, but have some concerns. The largest concern is that we do not think that MAR/ILR alone are sufficient to reverse enough of the streamflow depletion to make meaningful improvements to river flows. We are also concerned that there has not been sufficient analysis of the effects of MAR and ILR on river flows (and resulting biological effects) during the period of increased diversions (i.e., winter and spring). As shown in the figures in the "Percentile Flows and Flow Regime Comparison" section of Appendix 4-a, the CDFW (2017) flows are very low compared to the historic range of observed flows during March through May (i.e., always <25th percentile and sometimes approach or even drop below the lowest flows ever recorded). For example, CDFW's recommended April flows are 134 cfs, which if that volume remained instream after a full ILR diversion of 43 cfs would mean that 20% of the 168 cfs river flow would being diverted during a severe drought which seems like quite an aggressive rate of diversion. It probably would make more sense to increase the rate of diversion above 43 cfs when flows are higher, but drop to rate far below 43 cfs (or even to zero) when flows are low. Increased diversions after May 1 could have detrimental effects on water temperatures (Asarian and Robinson 2021). The documentation provided in the GSP leaves many unanswered questions. Given the prominence of MAR/ILR in the GSP, we would have expected to see a more detailed level of analysis and discussion. For example: - What MAR/ILR diversion volumes are feasible in individual dry and severe drought years (e.g., 1977, 2001, 2020, 2021), and what effects does this have on river flow during the spring diversion period and the summer/fall period? We see Table 7 in Chapter 3, and the figures in Appendix 4-a, but we would like to see daily hydrographs (comparing the in-river flow and diversions with/without MAR/ILR) for individual severely dry years. - How were the parcels selected for the primary MAR/ILR scenario? Why not also use Farmer's Ditch in addition to Scott Valley Irrigation District (SVID)? - How was 43 cfs selected? Is that capacity of SVID? - What are the "CDFW requirements"? If that the same as CDFW (2017) Interim Instream Flow Criteria, then that document should be cited. - It might also be appropriate to use tributary ditches for MAR during winter high flows? We are hesitant to open this can of worms, but if done carefully (limiting the diversions to limited high-flow periods and only diverting a small percentage of flow [i.e., 5-10%] it could have benefits. - The GSP does not explicitly define the time period for ILR. For example, Appendix 4-a says "in the early growing season, as long as surface water is available." Does this mean

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				a set start date of March 1, or April 1, or a custom date that changes each year depending on the weather? Does it end when there is no water at all, or when flows drop below CDFW requirements? How about voluntary (i.e., paid) permanent conversion of land in key areas (i.e., where that water would not flow the river for many months) for MAR during the spring to extend the season for groundwater recharge into the active growing season? On agricultural lands, MAR would normally have to cease once pasture or crops emerge from dormancy, but if lands were solely dedicated to MAR then the recharge season could be extended. Also, during period (i.e., summer) when there is not sufficient water for MAR, if these areas were not irrigated then they could also contribute to demand reduction. Would doing this require new ditches (because all ditch capacity is already used during irrigation season?), or is there sufficient capacity? TC-089
4	28	4.3	810	In the "Voluntary Managed Land Repurposing" PMA, we recommend adding groundwater recharge. See our comments on Chapter 4, Section 4.3, pages 24-28, lines 640-809 for additional discussion of this topic. TC-090
4	29	4.3	841	The "Voluntary Managed Land Repurposing" PMA discusses "For example, a corner of a field may be well suited for wildlife habitat or solar panel". This is an interesting idea. Would it be possible to convert some agricultural land to solar photovoltaic (i.e., electricity-producing) farms and still use those lands for groundwater recharge? Such a project could accomplish four things: reduce irrigation demand, increase groundwater recharge, generate electricity, and provide a new income stream to the landowner through lease payments. TC-091
4	32	4.4	984	We strongly support the Floodplain Reconnection/Expansion PMA due to its benefits to instream habitat, and potentially its effects on hydrology as well; however, we are confused by the statement that the "Floodplain Reconnection/Expansion" PMA "…will be evaluated and assessed with SVIHM using the methodology described in Section 3.3 and using monitoring data that describes the implementation of the floodplain reconnection/expansion program." We do not see any discussion in Section 3.3 about how changes to floodplains could be modeled by SVIHM. In its current form, SVIHM seems ill-equipped to model floodplain recharge scenarios, because: 1) the monthly timestep for inflows likely does not have a good representation of overbank flows because presumably those occur at shorter time scales (i.e., primarily hours and days, but possibly also weeks), 2) most tributary inflows gages are not rated for high flows, so the model inputs for high flows periods may not be very accurate. Are we mis-understanding something? Another comment we have on this section is that it should specifically TC-092

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4	31	4.4	953-957	"The floodplain reconnection/expansion program will reverse some of these historical effects on groundwater dynamics by reconnecting the river to the floodplain and thus, avoiding further channel incision and leading to stable or even increased water level elevations from flooding." Overall, we like this sentence, but it is an incomplete list of potential benefits. We recommend adding the following sentence: "It is possible that reversing channel incision through aggradation (i.e., raising the channel bed) would not only increase recharge by increasing the frequency of overbank flows, but would also reclaim (increase) aquifer storage by reducing the depth to which the water table is lowered by drainage to the channel during the spring recession." TC-093
4	32	4.4	1009	Discussion of the "High Mountain Lakes" PMA neglects to mention many factors which make this idea not feasible. This PMA should also mention the Wilderness Act which is likely to substantially restrict what can be built in designated Wilderness Areas and the construction methods that would be allowed. Given these legal constraints, in addition to other factors like the aesthetic concerns and a lack of road access, we think that high mountain lakes are unlikely to be a feasible means of meaningfully increasing surface supply and therefore recommend that effort be places into other PMAs. We recommend adding the following sentence: "DWR (1991) recommended against developing mountain lakes as water sources to augment Scott River flows because there were not enough benefits to offset all the negative aspects which include aesthetic concerns in addition to access, logistical, and legal constraints." The exact quote from DWR (1991) was: "Under present law no development inside a wilderness area is permitted. Special legislation may be required to implement this alternative. Second, access and construction methods may make many of these enlargements impractical. Third, while these enlargements may benefit the individual creeks, their cumulative impact on the Scott River is difficult to judge. Water would enter the river from seven different tributaries distributed over the entire Scott Valley. It would not be a concentrated water source. Fourth, it would be difficult, or impossible, to coordinate releases from the 29 lakes to maximize the benefit to the Scott River fishery. Fifth, enlarging the lakes may disturb their natural aesthetic value. DWR does not recommend developing these lakes for water sources to augment the streamflow of the Scott River. There are not enough benefits to offset all the negative aspects of this alternative. " TC-094

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4	33	4.4	1012	We support evaluation of surface reservoirs as means to augment water supply and river flows, if such reservoirs can be constructed in a way that minimizes impacts to fish habitat and would result in meaningful increases in river flows. An off-stream reservoir is particularly appealing. In watersheds like the Scott River that currently have little surface storage, the changes in runoff timing expected to occur with climate change will make surface storage even more important in the future than it is now.	TC-095
4	33	4.4	1043	The "Sediment Removal and River Restoration" PMA is summarized as: "A river restoration project to remove significant sediment from the main stem Scott River from Fort Jones to the mouth of the canyon is envisioned to improve in-stream flow, channel geomorphology, and habitat for fish." We are extremely skeptical of this PMA. Please either provide additional information including a more detailed rationale, citation, and project proponent, or delete this PMA. What is the physical mechanism by which removing sediment could improve instream flow (wouldn't removing sediment cause further incision which would further reduce aquifer storage capacity)? Wouldn't removing sediment decrease floodplain connectivity and be counter to the "Floodplain Reconnection/Expansion" PMA? What specifically is meant by "improve channel geomorphology" (that is vague and could be interpreted many different ways)?	TC-096
4	33	4.4	1052	We support the Strategic Groundwater Pumping Curtailment PMA. This would be particularly valuable in drought years when there is limited water available for MAR/ILR.	TC-097
4	34	4.4	1069	We strongly support a properly designed and implemented Watermaster Program; whoever, we have serious concerns with the lack of transparency with the current Scott Valley and Shasta Valley Watermaster District program. Watermastering should be returned to the State of California, implemented basinwide, with well-organized publicly accessible records of diversions.	TC-098
4	35	4.4	1126	The "Well Inventory Program" section does not mention anything about data management. The results of this inventory should be made publicly accessible.	TC-099
4	35	4.4	1135	Regarding "Voluntary Well Metering," we understand the political sensitivity of well metering, but it seems like the first step is good management is measurement and transparency. At least some subset of the wells should be mandated to be metered. Examples could include the largest wells, or new wells drilled after the passage of the SGMA legislation or after adoption of the Scott Valley GSP. How can existing ordinances, such as the prohibition on the use of groundwater for cannabis production or the requirement for permits being needed for inter-basin transfers of groundwater, be enforced without the well metering? The lack of metering requirements suggests a lack of transparency, which further suggests a lack of will to actually manage groundwater extraction.	TC-100

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5	4	5.1.1	128	The Annual Reporting section does not clarify if the data presented will be figures or actual tables with numbers. The report should include electronic appendices with easily accessible data, so others could run their own analyses on the data. TC-101
5	9	5.1.2	Figure 1	The Figure 1 flow chart says "Model update and calibration using new data (annually for the first five years)". Is it really feasible and desirable to re-calibrate the model every year? That seems like a lot of work for an unclear benefit. Wouldn't it be better to re-calibrate every two to five years rather than every year? There are certainly improvements we'd like to see in the model, and we'd rather have the GSA focus on incorporating these refinements rather than just re-calibrating the model with additional years. These model refinements are described in more detail in a separate comment document (not in this comment form), but are briefly summarized here: 1) use a better method for filling the large gaps in tributary inflows (e.g., considering other model types beyond linear regression, and using Salmon River gage as an alternative to the Scott River gage for filling tributary data gaps at least for some months and/or sites), 2) incorporate fall/winter stockwater diversions, 3) shorten the MODFLOW model timestep to something shorter than a month, 4) do a sensitivity analysis to quantify how sensitive modeled outflows are to tributary inputs (especially during September and October). TC-102
App 2-a	7-10			This section refers to comparing SVIHM modeled outflow from the river flow observed at the USGS for the 2012-2018 period as "validation" because the model was not recalibrated for this period. However, this section fails to note that this is not a truly independent validation because the largest input to the model is tributary flow, which for the 2012-2018 was 100% estimated (i.e., no tributary gages) based on regression with measured flows at the USGS gage at the outlet of the valley. That same USGS gage is then used to "validate" the model's predicted outflows. To be clear, it is not the act of comparing the model predicted outflows to the gaged flows that we object to (indeed, those are the only flow data that are available); however, we assert that when these comparisons are presented it should be clearly noted that these comparisons are somewhat circular and not truly independent. TC-103
App 4-a				This appendix presents a lot of great information in an accessible format. We appreciate the maps and graphs showing effects by month. TC-104
App 4-a				It would be good to also include the Summary Table somewhere in the main text of the GSP rather than solely having it be in the appendix. In addition, the column headers in summary table should be revised to clarify if Sep-Nov means Sep 1-Nov 30 or Sep 1-Nov 1 (i.e., see comment regarding caption of Figure 2 on page 63 of Chapter 3, Section 3.4.5.1). TC-105

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App 4-a		Slide 23		"Restrictions on tributary flow diversions for irrigation at low FJ flows" Since the SVIHM only includes diversions for irrigation, ignoring the considering fall/winter diversions for stockwater, this scenario should be renamed to clarify that it is regarding irrigation diversions only (i.e., not stockwater).	TC-106
App 4-a		Slide 25		The irrigation efficiency scenarios "…assume an unspecified change in irrigation equipment that results in either an increase or decrease in irrigation efficiency on all irrigated fields." Wouldn't it make more sense (i.e., more realistic), to instead have the efficiency increase or decrease depend on the current efficiency of the field? For example, assume all fields with flood irrigation (currently assumed in SVIHM model as 70% efficient [Foglia et al. 2013]) and wheel-line sprinkler (currently assumed in SVIHM model as 75% efficient [Foglia et al. 2013]) were upgraded to 90% efficient center pivot sprinklers? Or maybe that should be added a new scenario?	TC-107
App 4-a		Slide 8		This slide defines the Sept-Nov period as "Critical dry window, Sept. 1 – Nov. 30", which seems to contradict other places in the GSP. For example, "Sep 1 to Nov 1" in caption of Figure 2 on page 63 of Chapter 3, Section 3.4.5.1. Given that the model's primary time scale is monthly, the correct time period is probably Sept. 1 – Nov. 30, right?	TC-108
App 4-a				The slide describing the "Alfalfa irrigation schedule change" scenarios states "Would presumably involve an incentive or compensation program (a back-of-the-envelope estimate of the value of the 3rd cutting of alfalfa is approximately $7.5 million)." Can you provide any more information on the justification for that estimate? This seems somewhat high given that the Siskiyou County annual crop report (https://www.co.siskiyou.ca.us/sites/default/files/fileattachments/agriculture/page/4581/agd_20200909_2019_cropreport.pdf) reported the total value of countywide field crops (including alfalfa but also other crops such as wheat, barley, pasture, etc.) as $86 million in 2019. Scott Valley is just one (though perhaps the largest?) of the alfalfa growing regions within the county and two cuttings of alfalfa would still occur under these scenarios.	TC-109