Colorado River Availability Study Phase II

Task 7: Climate Change Approach and Results

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COLORADO
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Lynker

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Contents

Introduction

CRWAS Phase I (CWCB, March 2012) took the following general approach to investigate the impacts of climate projections on water availability and other system responses as follows:

1. Select Individual Climate Projections from the available CMIP3 down-scaled projections
2. Develop climate-adjusted natural flows
3. Re-sequence climate-adjusted natural flows
4. Adjust climate-dependent irrigation demands
5. Simulate climate-adjusted natural flows and demands in the Colorado River basin StateMod water allocation models

CRWAS Phase I was one of the first studies that specifically investigated the potential effects of climate projections on water available for future development in a water-rights driven system. CRWAS Phase II built on that original effort by incorporating new climate projections from CMIP5, and enhancing methods for estimating natural flows and demands. Changes were made to the original approach taken in Phase I based on additional studies and observations, as described in the **Approach** section below. Results of the Phase II analysis and comparisons to Phase I are provided in **the Analysis Results and Observations** section.

CRWAS-II Study Goals

The CRWAS Continuation, or CRWAS Phase II, study was performed to meet several specific modeling goals outlined by the CWCB:

- Incorporate new data from the CMIP5 (Coupled Model Inter-comparison Project, Phase 5) climate projections to develop improved climate impacted flows.
- Apply updated natural streamflow estimates developed for the parallel Joint Front Range Climate Change Vulnerability Study (JFRCCVS; WRF, 2012).
- Extend the period of record for the Colorado Decision Support System (CDSS) models in the Colorado River Basin to incorporate more recent hydrology.
- Provide detailed technical results to support Colorado's Water Plan (CWCB, 2015) and the Colorado Water Plan Technical Update (CWCB, 2019).

The approach for CRWAS Phase II was used to develop planning scenarios for Colorado's Water Plan (CWP) and the updated StateMod models were used to identify shortages for the Colorado Water Plan Technical Update.

Approach

1. Construct Climate Scenarios

Phase I of the Colorado River Water Availability Study, completed in 2012, investigated water available for future development in the Colorado River basins in Colorado based on historical measured hydrology; paleohydrology estimated from tree-ring information; and climate projected hydrology based on a select group of available climate projections. Phase II supported CWP, completed in 2015, to select hydrology for continued analyses of future demands and supplies throughout Colorado. Three technical memoranda were finalized in September 2015 as follows:

- CRWAS Phase II Climate, Task 1, Literature Review
- CRWAS Phase II Climate, Task 1, Approach for Constructing Climate Scenarios
- CRWAS Phase II Climate, Task 5, CRWAS-II Climate Hydrology Approach and Results

These memos are available on the CWCB website.

The resulting approach to construct climate scenarios met the following objectives:

1. Incorporate projections from the CMIP5 archive. These newer projections were not available to the CRWAS Phase I study. Both the CMIP3 and CMIP5 archives were used to create an inclusive ensemble of the 209 unique available downscaled projections.
2. Reduce or eliminate the problems arising from the use of the temperature/precipitation anomaly space initially used to select scenarios for the CRWAS Phase I study. Although this procedure was also used in several other studies, it resulted in an unexpected bias in the assessment of hydrologic conditions in the 2070 projections. Evaluation of this bias showed that the location of a projection in the temperature/precipitation anomaly space was not a good predictor of change in natural flow. Further, the CRWAS Phase I results also showed that change in runoff alone was not a good predictor of change in water resources system performance. Therefore, a new approach was developed for CRWAS Phase II such that construction of climate scenarios was based on change in runoff and change in consumptive irrigation requirement (CIR; also called irrigation water requirement). These predictors more completely reflect stress of projected climate change on future water resources system performance. The validation of this approach is documented in “CRWAS Phase II Climate, Task 5, CRWAS-II Climate Hydrology Validation of Scenarios,” August 2017.
3. Reduce or eliminate the problems arising from selecting individual projections. The CRWAS Phase I study selected five individual projections to cover 80 percent of the overall range of climate change represented by the entire set of CMIP3 projections (based on system performance). CRWAS Phase II selected seven “regions”, defined as characteristic points in the runoff/CIR anomaly space, that are collectively intended to characterize the distribution of projected system stresses. Each region was characterized by aggregating change across a pool of the 10 nearest neighbors to each of the seven characteristic points.

4. Maintain comparability with CRWAS Phase I results. Projected hydrology and demands for the CRWAS Phase II composite scenarios were simulated using the same modeling process and reviewed based on the same output parameter as CRWAS Phase I results.
5. Continue to represent future conditions relative to the historical natural flow records. CRWAS Phase II used the composite scenarios for 2050 representing hydrologic variability seen over the historical record from 1950 through 2013.

One notable difference in the CRWAS Phase II efforts is that the Interbasin Compact Committee (IBCC) chose to focus on the future year 2050 for next-step planning efforts supported by CRWAS Phase II; whereas CRWAS Phase I represented water availability for 2040 and 2070. The 2050 time frame is characterized by a climate projected period (2035 to 2064), using a similar approach to Phase I.

Figure 5 in the technical memorandum *CRWAS Phase II Climate, Task 1, Approach for Constructing Climate Scenarios* (Lynker Technologies, September 2015, included in Appendix F) shows the Runoff versus CIR plot. Based on this graphic, the IBCC selected a subset of composite scenarios to use in CWP and the associated Colorado Water Plan Technical Update. Figure 1 (Figure 4.9 in the Colorado's Water Plan Report) shows the two composite scenarios selected, representing "**Hot and Dry**" and "Between 20th century observed and Hot and Dry" (**Between**), and shows the plotting position of the **Current** hydrology (also called Historical or Baseline hydrology).The two composite scenarios selected have altered or "perturbed" climate from the historical observed. CRWAS Phase II used the two composite scenarios and the Current hydrology to understand potential future water availability. It is important to note for comparison that CRWAS Phase I selected a broader range of climate projections that included projections that showed less impact to hydrology and climate demands than the **Hot and Dry** and **Between** scenarios.

Figure 1: Model Pooling Approach Graphic

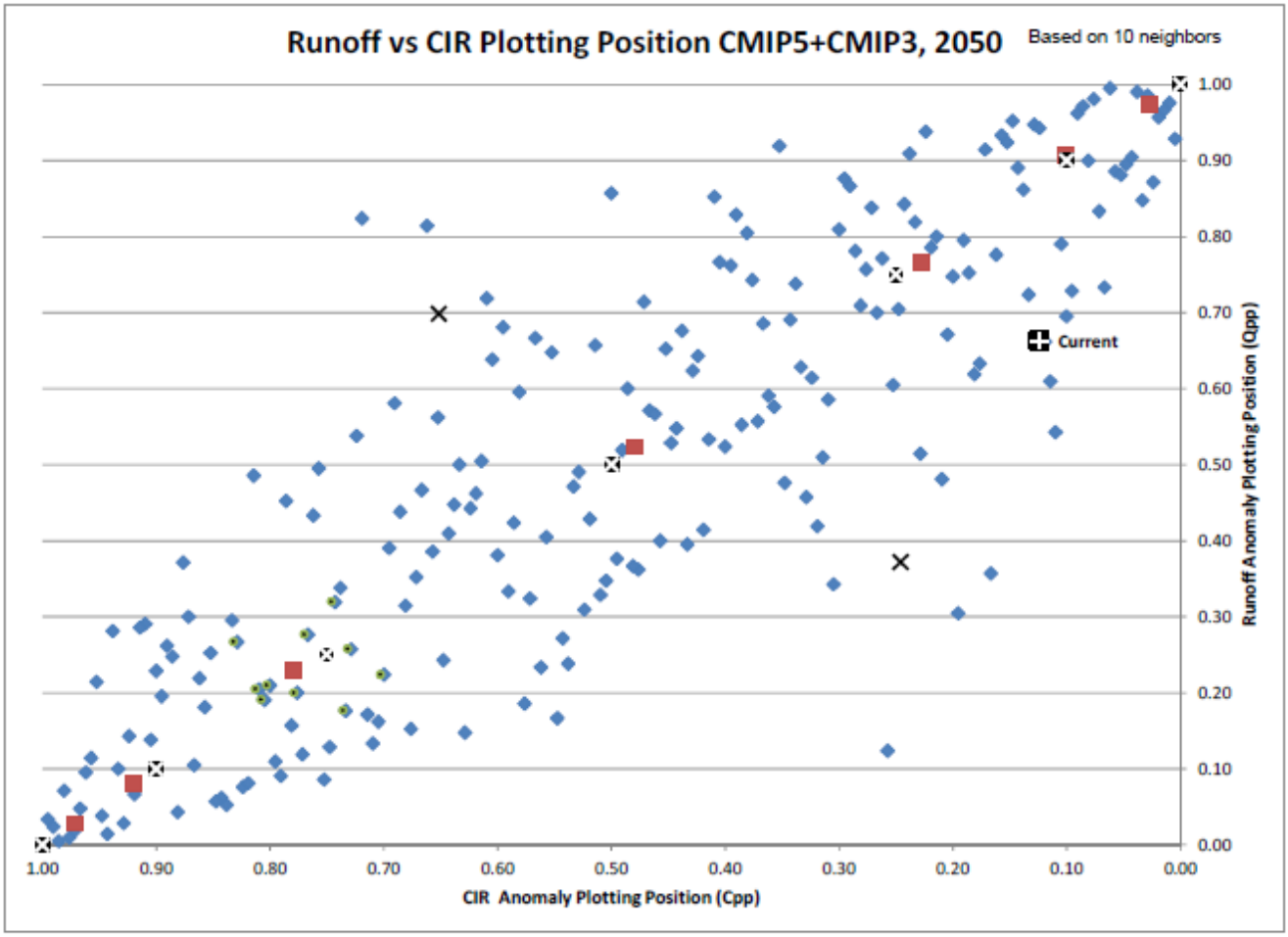


Figure 5. Illustration of CRWAS-II Scenario Development.
Diamonds are individual CMIP3 or CMIP5 projections, squares are characteristics of pooled scenarios. Projections included in the 7525 pool are overlaid with small black circles. Black square with a white *x* are the characteristic point for a pool. The larger black square with a cross is the point of no change from current conditions. The two large black *x* symbols represent unused projection pools (see text).

2. Develop Climate-Adjusted Natural Flows

A similar approach was used to estimate climate-adjusted natural flows in CRWAS Phase II as outlined in the CRWAS Phase I report. Current climate and hydrology conditions were characterized by historical weather and natural flow records. Projected changes to precipitation and temperature were obtained from GCM outputs. Projected changes in natural flow and CIR were characterized using the Variable Infiltration Capacity (VIC) hydrology model (Liang *et al*., 1994, 1996). As with the CRWAS Phase I approach, the VIC model was used to estimate projected changes to natural flow and CIR throughout the Colorado River basins in Colorado. For both CRWAS phases, two applications of the delta approach were used; the first to develop the weather input for the VIC model and the second to adjust historical natural flow and CIR to reflect projected conditions. The process to estimate climate-adjusted natural flow is fully described in the CRWAS Phase I report and is briefly summarized as follows:

1. Historical daily weather conditions (1950 through 2013) were used to force the VIC model to produce simulated baseline monthly hydrologic conditions (runoff and CIR). This was the same process followed and described in CRWAS Phase I.
2. For both the **Hot and Dry** scenario and the **Between** scenario, projected **change** in climate was calculated by averaging the projected change for each of the ten individual projections used to characterize the scenario. This is slightly different from the previous approach, as the selected climate projections were used individually and not combined into composites in CRWAS Phase I. The projected change in climate conditions was applied to the historical daily weather conditions to produce projected future weather for each scenario. This is the first application of the delta method.
3. The projected future weather conditions were used to force the VIC model to produce simulated future hydrologic conditions (runoff and CIR) representing each of the **Hot and Dry** and **Between** scenarios.
4. The change between the simulated baseline runoff and the simulated future runoff for both the **Hot and Dry** and **Between** scenarios was used to adjust the historical natural flows to produce scenario natural flow estimates. Similarly, historical CIR was adjusted using the change in simulated CIR to produce scenario CIR estimates. This is the second application of the delta method.

3. Re-sequence Climate-Adjusted Natural Flows

CRWAS Phase I included a water availability analysis using synthetic sequences of natural flow and demands based on paleo-hydrology estimated from tree rings. This provided the ability to understand water availability based on drought periods and wet periods experienced in the prehistorical past, but not seen in the historical measured record. The paleo sequence was used to produce (100) 56-year traces for each climate projection that reflected more climate variability than seen in the historical measured record.

Based on feedback from water planners, and to match the approach adopted for future water planning as part of CWP process, CRWAS Phase II is based only on the recorded climate variability from 1950 through 2013.

4. Adjust Climate-Dependent Irrigation Demands

In CRWAS Phase I, a procedure was developed to adjust crop irrigation requirements (CIR) using climate-projected temperature and precipitation. The monthly Blaney-Criddle datasets previously developed for the CDSS modeling efforts were used directly; historical mean monthly temperature and total monthly precipitation were adjusted to reflect climate-projected data. This process is described in Section 2.3.5 of the CRWAS Phase I report.

The Colorado River Basin Water Supply and Demand Study, Technical Report C (Reclamation, December 2012) included a review of various approaches to determining effects on crop demands with increases in temperature. The study documented that Blaney-Criddle produced a higher change in crop demand per degree of warming compare to other methods. The unrealistic higher change is because

Blaney-Criddle only used mean monthly temperature and does not account for minimum and maximum temperature variation or other weather variables such as vapor pressure, solar radiation, and wind speed. The Reclamation study and noted that because the Penman-Monteith method is physically based, it is more likely to correctly represent the responses to climate change.

CRWAS Phase II adopted a simplified method to adjust crop demands from an irrigation supply by applying a monthly climate-projected factor to current crop demands to represent increased demand. The VIC model uses Penman-Monteith to calculate the amount of precipitation that is consumed by natural vegetation to determine runoff (natural flow). Similar to the method used to determine adjustment factors for natural flow, native vegetation factors were developed for each Water District throughout the state by comparing the VIC evapotranspiration (ET) estimated using Penman-Monteith under current climate conditions to ET estimates for the **Hot and Dry** and **Between** scenarios. Due to differences in the monthly distribution of demands between the Penman-Monteith and Blaney-Criddle methods, annual factors were used to represent the relative change in CIR under CRWAS Phase II. These annual ET adjustment factors were applied to each month in the current estimates of CIR used in the CDSS modeling efforts.

Table 1 shows the annual increase in climate-projected crop irrigation demands in each Colorado River basin compared to historical conditions. Note that the historical crop irrigation demands vary from the CRWAS Phase I demands due to updates in the current irrigated acreage and an extension of the time-period available in CRWAS Phase II.

Table 1: Average Annual Basin Crop Demand Comparison

Study Basin	Historical Basin CIR (AF)	Between Basin CIR (AF)	Between % Increase	Hot and Dry Basin CIR (AF)	Hot and Dry % Increase
Yampa	151,753	183,889	21%	205,721	36%
White	46,794	57,178	22%	63,917	37%
Upper Colorado	438,924	500,358	14%	538,403	23%
Gunnison	545,628	634,834	16%	666,133	22%
San Juan/Dolores	489,440	600,727	23%	629,869	29%
Total	**1,672,539**	**1,976,986**	**18%**	**2,104,043**	**26%**

Climate scenario results show that the Yampa River and White River basins are likely to see less temperature increase and more precipitation increase relative to the rest of western Colorado. Therefore, it is counterintuitive that both basins show a larger increase in crop irrigation demands compared to the other basins. This can be explained by the relative location of irrigation acreage in the Yampa River and White River basins. In the Colorado basin, the majority of the irrigated acreage is at lower elevations, generally below 5,500 feet; whereas in the Yampa and White river basins the majority of the irrigated acreage is above 5,500 feet. Climate results show a larger percent increase in temperature than lower elevation, resulting in a higher percentage increase in basin-wide crop demands for both the Between and Hot and Dry scenarios in the Yampa and White basins.

The CDSS StateMod Water Allocation Model requires both crop irrigation requirements and river headgate demands as the demand input. Irrigation structure headgate demands are calculated based on crop irrigation requirements and ditch-based average monthly efficiencies for wet, dry, and average hydrologic year types. CRWAS Phase II used the same procedure, as documented in Section 2.3.6 of the CRWAS Phase I report.

CRWAS Phase I did not adjust reservoir net evaporation rates to reflect the effects of increased temperature and changes in precipitation. For CRWAS Phase II, the Water District monthly ET adjustment factors were used to adjust the monthly evaporation rates used by StateMod to estimate net evaporation for the modeled reservoirs.

5. Simulate Climate-Adjusted Natural Flows and Demands in the StateMod Water Allocation Models

The StateMod datasets representing each Colorado River basin in Colorado have been updated since CRWAS Phase I. Specifically, the datasets representing current conditions have been extended by eight years (through 2013) and have been updated to reflect current levels of irrigation, municipal, and transbasin demand. Other significant model updates include the following:

- The Yampa Basin model dataset was updated to represent current Elkhead Reservoir release operations
- The Colorado Basin model was revised to represent current reservoir release operations for the 15-Mile Reach fish flows
- The Gunnison Basin model was revised to reflect operations based on the Aspinall Unit Operations EIS (2012) and Record of Decision (2012)
- The San Juan/Dolores Basin model was revised to more accurately represent Dolores Project operations and Vallecito Reservoir flood-control operations.

The **Current**, **Between**, and **Hot and Dry** model datasets are the basis for future investigations as part of the Colorado Water Plan Technical Update and future Basin Implementation Plan updates.

More detail on the StateMod **Current** datasets (termed Baseline datasets in the CDSS documentation) is documented in each basin's Water Resources Planning Model User Manual, available for download on the CDSS website (http://cdss.state.co.us/). CRWAS Phase II used the same procedures as CRWAS Phase I to adjust the Baseline datasets to include climate-projected natural flows and demands outlined in detail in the CRWAS Phase I report.

As with CRWAS Phase I, providing all the information generated by the StateMod Water Allocation Model is not practical. The model datasets are provided for download on the CWCB website so interested water resource experts can extract the information they find useful for planning purposes. Key model results at the locations of interest selected for CRWAS Phase I, including modeled streamflow, water available to meet future demands, reservoir use, and basin consumptive use, are provided in the **Analysis Results and Observations Section** and the **Appendices**.

6. Process to Update Modeling as new Climate Change Archives Become Available

The Intergovernmental Panel on Climate Change (IPCC) continues to oversee modeling work to generate improved climate change datasets. The World Climate Research Programme Coupled Model Intercomparison Project, Phase 6 (CMIP6) has been completed (Eyring et al 2016). Although the body of research on CMIP6 impacts is growing, it has not yet been assessed in as much detail as CMIP5. As more research and user-friendly datasets for CMIP6 become available, it will be important to understand the changes from CMIP5 and how the projections impact water resources. Advances is climate science will likely show significant improvements in how precipitation is modeled, tighter projections of temperature increase, new data products such as snow cover, and other advancements in parameter estimates that significantly impact Colorado's water resources.

The CWCB will want to understand the relative impacts to between its current work and the latest science from CMIP6 due to updates in climate projection understanding. There are several ways to approach updating Colorado's water resources with new climate model data. The following is the recommend approach based on lessons learned from the CRWAS efforts.

1. There are several research groups and federal agencies that may develop climate-adjusted hydrology for CMIP6 using a calibrated VIC model. The US Bureau of Reclamation developed and ran a VIC model forced by data from CMIP5 and made all results publicly available. The CWCB should lean on these modeling efforts and wait to begin any assessment of CMIP6 until one of these agencies publishes their datasets.
2. Once a gridded CMIP6 hydrology dataset is available, the procedure used in CRWAS Phase II should be used to assess plotting position of runoff and CIR (Figure 1).
3. CMIP6 hydrology may show only slight variation from the Runoff/CIR plot (Figure 1) used to select CMIP5 scenarios under CRWAS-II. The CWCB should decide on criteria to assess how different the CMIP6 and CMIP5 results should be to warrant updating the full CRWAS modeling procedure to determine the impact to Colorado's supply and demand gap.
4. Depending on the performance of the CMIP6 results, the CWCB may choose to rerun a small subset of StateMod surface water allocation models to validate the model results, even if the current CWP conclusions do not change.

Analysis Results and Observations

The results below compare CRWAS Phase I scenarios to the CRWAS Phase II scenarios used in CWP. As noted previously, at a high level, CRWAS Phase I covered a wider range of climate conditions than chosen for CWP. The CRWAS Phase I range included several scenarios that showed an increase in runoff. Within CRWAS Phase II, the range of runoff across the scenarios was much smaller, as CWP used only the median (**Between**) and 75th percentile (**Hot and Dry**) scenarios, representing a smaller subset range of results.

The results are shown in the following appendices for key locations in each basin. Results reflect the hydrologic variability seen during the 1950 through 2013 period.

- Appendix A: Average Monthly Natural Flow
- Appendix B: Average Monthly Modeled Streamflow
- Appendix C: Average Water Available to Meet Future Demands
- Appendix D: Average Monthly Consumptive Use and Losses
- Appendix E: Reservoir Contents
- Appendix F: Average Monthly Natural Flows in Other Basins

Temperature and precipitation results, shown in the CRWAS Phase I Report, are not shown here since they were not a primary factor in selecting model traces for CRWAS-II and were not used specifically for CDSS modeling efforts. Temperature and precipitation inputs were used as inputs for the VIC model but, as outlined above, they did not directly correlate with more or less water availability. Since the CRWAS Phase II scenarios were selected based on runoff and CIR as the primary criteria, natural flow and actual consumptive use results are highlighted.

Natural Flow Results

Natural flow represents flows absent the effects of man. Figure 2 is a graph from Appendix A showing average monthly natural flow at the Colorado River near Granby gage location (gage ID 09019500). Similar to the other graphs shown in Appendix A, the gray shading shows the average annual range in natural flows from the CRWAS Phase I scenarios. The dark black line shows the average monthly natural flow for **Current** hydrology and the red line and blue line show the **Hot and Dry** and **Between** natural flows selected for CWP. Appendix A also includes summary tables reporting average monthly and annual natural for **Hot and Dry** and **Between,** and the annual percent difference compared to **Current**.

As shown in Figure 2, **Hot and Dry** and **Between** natural flows are within the range of natural flows for the CRWAS Phase I climate scenarios. The figure also shows a clear shift in the average peak runoff from June to May compared to **Current** natural flows. This shift is true for both **Hot and Dry** and **Between**.

Figure 2: Example Average Monthly Natural Flow Graph

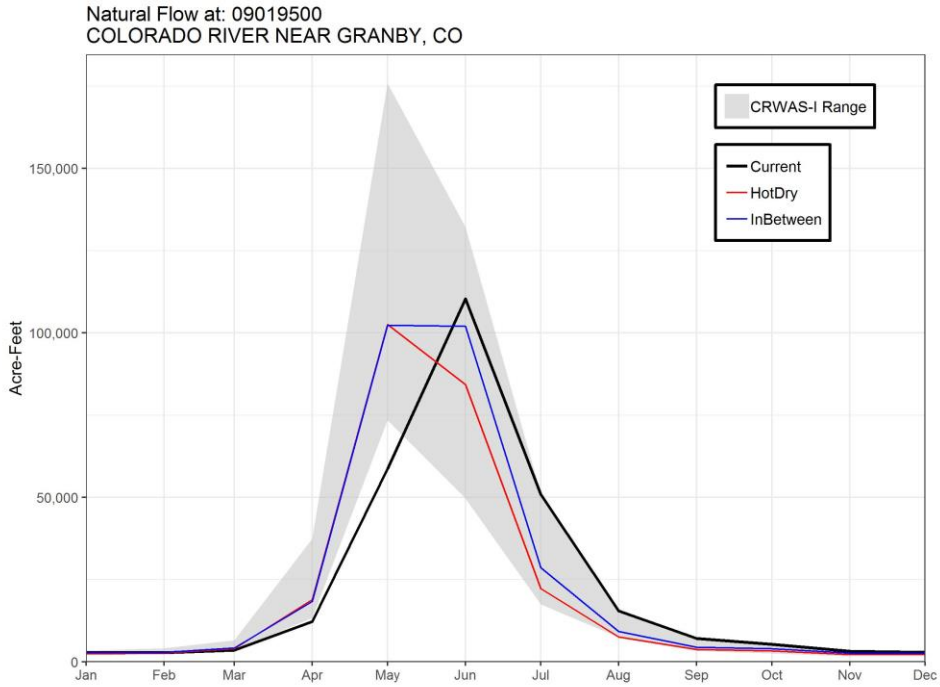


Table 2 highlights key observations illustrated in the natural flow graphs and tables in Appendix A.

Table 2: Key Observations - Natural Flow

Natural Flow
• As expected, CRWAS Phase I results show a much wider variability in natural flow than the **Current, Hot and Dry, and Between** scenarios, since CRWAS Phase I included climate traces showing increased flow from **Current**. • With a few exceptions, the **Between** run is near the median of all CRWAS-I traces. • The **Hot and Dry** natural flows are consistently lower than the **Between** natural flows, though the monthly patterns are similar. • In many of the tributaries, the **Current** peak runoff occurs in June. Natural flows for both the **Between** and **Hot and Dry** scenarios generally show peak runoff occurring in May, a clear shift to earlier snowmelt. • Average annual natural flows for both the **Between** and **Hot and Dry** scenarios are lower than **Current** natural flows in every basin except the Yampa River basin. In the Yampa River basin, the **Between** scenario annual natural flows are greater than **Current** natural flows and the **Hot and Dry** natural flows are less than **Current** natural flows. • Natural flows for both the **Between** and **Hot and Dry** scenarios tend to be much lower than **Current** natural flows in the southern basins (Gunnison River and San Juan River) compared to the northern basins (Yampa River and White River).

For this analysis, a drought year was defined as having annual natural flow less than 80 percent of **Current** average annual flow. Figures 3 through 6 show the drought histograms for select locations. The frequency and duration of years in a drought generally increase under the **Hot and Dry** scenario compared to **Current** in every basin. The frequency and duration of drought years increase under the **Between** scenario except in the Yampa River basin. At several locations, the frequency of one-year droughts decreases as they extend into multiple year droughts.

Figure 3: Drought Frequency, Yampa River near Maybell

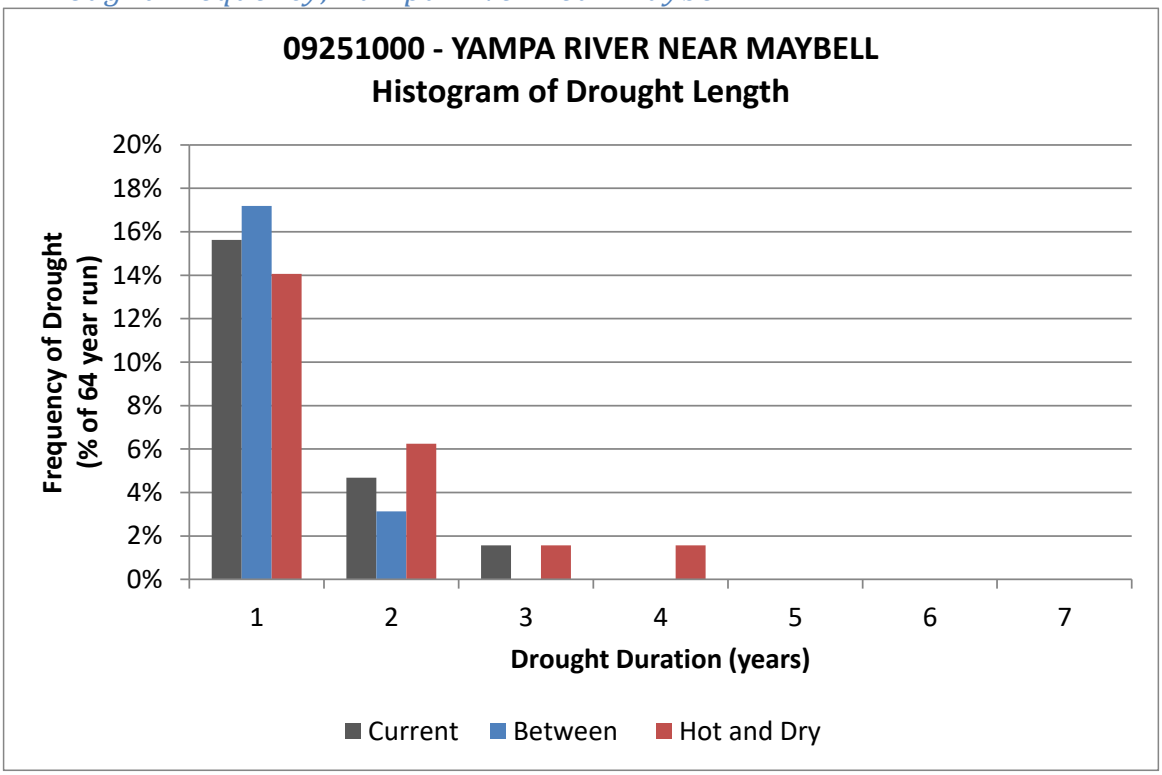


Figure 4: Drought Frequency, Colorado River near Dotsero

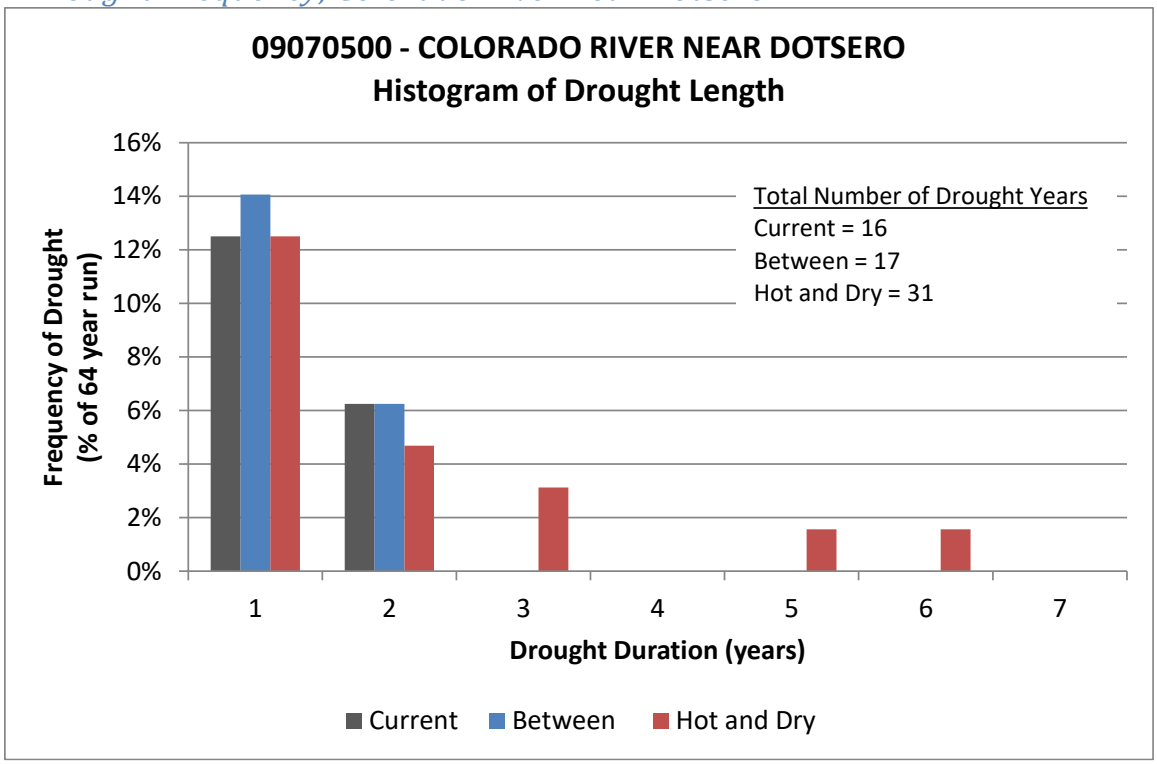


Figure 5: Drought Frequency, Gunnison River near Grand Junction

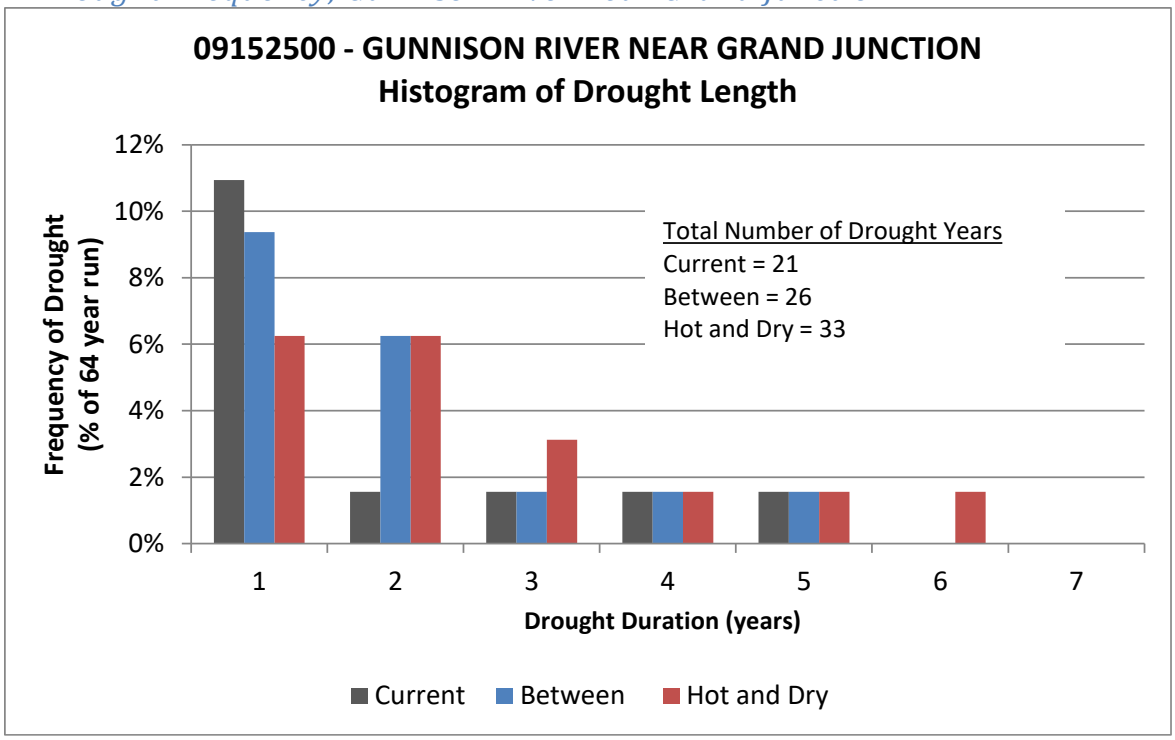
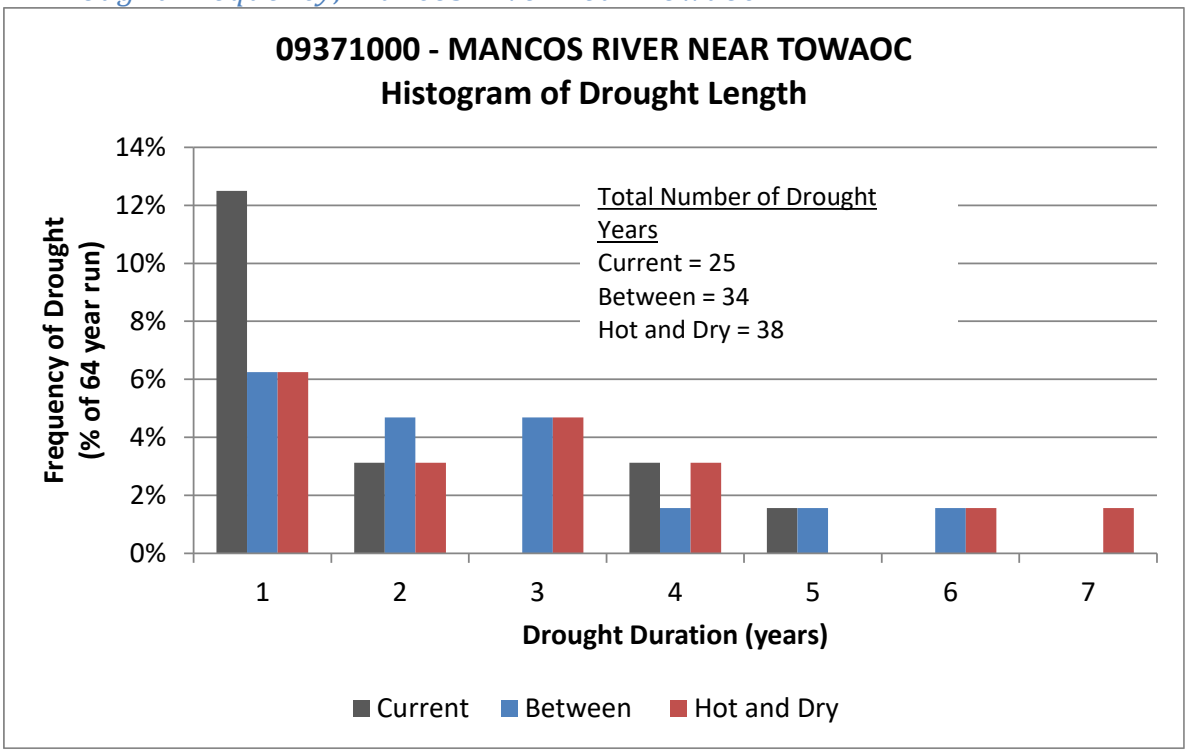


Figure 6: Drought Frequency, Mancos River near Towaoc



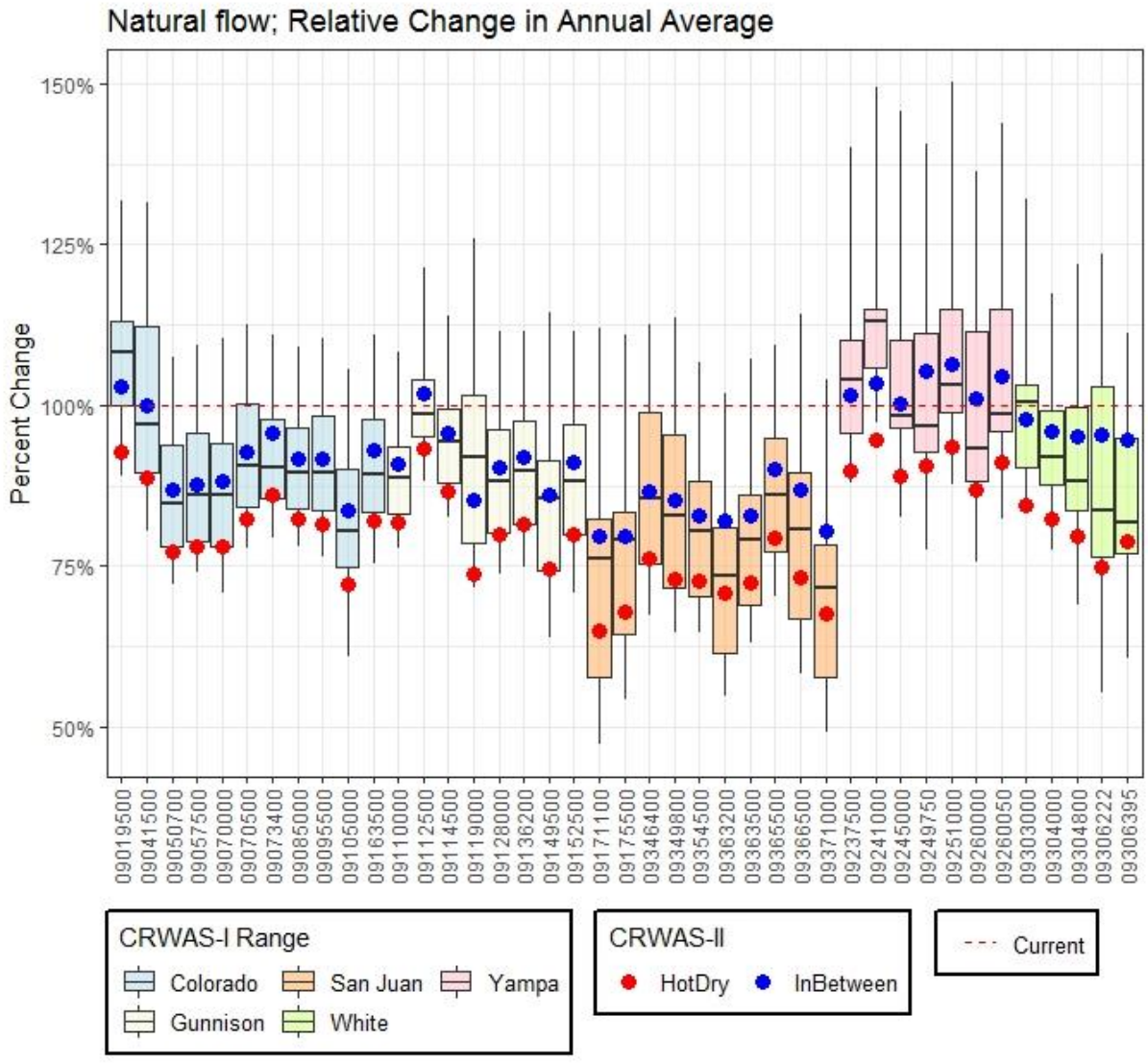
The Figure 7 box and whisker plot shows the average annual percent change in natural flow for the CRWAS Phase I and II scenarios compared to **Current** conditions for the key gages shown in Appendix A. The vertical lines (whiskers) show the range of all CRWAS Phase I model simulations; the shaded boxes show the 25th and 75th percentile range and medium for the CRWAS Phase I results; **Hot and Dry** average annual natural flow from the Phase II model simulations is reflected by the red dot; and **Between** average annual natural flow from the CRWAS Phase II model simulations is reflected by the blue dot. The gage identifiers can be matched to the gage location in the Appendix A tables.

Figure 7 provides a quick-view of natural flow results across each of the basins, and highlights the following observations:

- CRWAS Phase I results show a much wider variability in average annual natural flow than the two CRWAS Phase II climate projections selected for CWP.
- Both the CRWAS Phase I and II selected climate projections generally have lower average annual natural flow at gages in the Colorado River basin, Gunnison River basin, San Juan River basin, and White River basin.
- The **Hot and Dry** climate projection shows a decrease in average annual natural flow compared to current conditions at all gage locations.
- The **Between** climate projection shows a decrease in average annual natural flow compared to current conditions for most gages in every basin except the Yampa River basin.

- Two gages higher in their respective watersheds, the Colorado River near Granby (gage ID 09019500) and the East River at Almont (gage ID 09112500) also show **Between** average annual natural flows greater than current average annual natural flows.
- The **Hot and Dry** and **Between** scenarios represent the 25th and 50th percentile future conditions, respectively. This is consistent with what is shown in the figure.

Figure 7: Average Annual Natural Flow Comparison



Modeled Streamflow Results

StateMod distributes flow to meet demands based on the priorities of water rights and basin operations. During a particular time-step, modeled streamflow at any location represents natural flow

less upstream depletions. Figure 8 is a graph from Appendix B showing average monthly modeled streamflow at the Gunnison River near Gunnison gage location (gage ID 09114500). Similar to the other graphs shown in Appendix B for key locations, the gray shading shows the average annual range in modeled streamflow from the CRWAS Phase I scenarios. The dark black line shows the average monthly modeled streamflow for current hydrology and the red line and blue line show the **Hot and Dry** and **Between** modeled streamflow. Appendix B also includes summary tables reporting average monthly and annual modeled streamflow for **Hot and Dry** and **Between,** and the annual percent difference compared to **Current**.

As shown in Figure 8, **Hot and Dry** and **Between** natural flows are generally within the range of natural flows for the CRWAS Phase I climate scenarios. The figure also shows a clear shift in the average peak runoff from June to May compared to **Current** modeled streamflow.

Figure 8: Example Average Monthly Modeled Streamflow

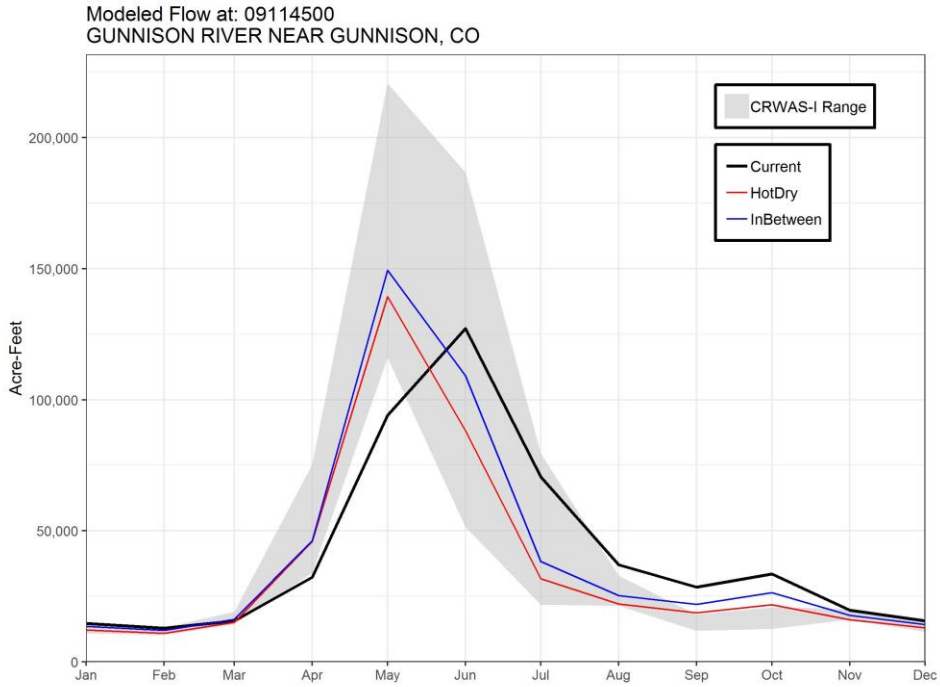


Table 3 highlights key observations illustrated in the modeled streamflow graphs and tables in Appendix B.

Table 3: Key Observations – Modeled Streamflow

Modeled Streamflow

• As with natural flow, the CRWAS Phase I modeled streamflow generally shows the peak streamflow earlier than **Current** conditions.
• All gages show a decrease in average annual modeled streamflow for the **Hot and Dry** scenario compared to **Current**.
• In general, gages in every basin except the Yampa River basin show a decrease in average annual modeled streamflow for the **Between** scenario compared to **Current** that follows a similar patterns as the decrease in natural flows. Gages in the Yampa show slight increases in average annual modeled streamflow, again following the pattern of slight increases in natural flow. The East River at Almont for the **Between** scenario shows a slight increase in average annual modeled streamflow compared to **Current** and the Colorado River near Granby locations shows the same average annual modeled flow for the **Between** and **Current**.
• Similar to natural flow hydrographs, peak modeled streamflow shifts from June to May at many locations under **Hot and Dry** and **Between** scenarios.
• Modeled streamflow for both climate projection scenarios and the **Current** scenario generally follow the same monthly pattern as natural flow. For all three scenarios, modeled streamflow patterns deviate from natural flow patterns for locations below major reservoirs when natural flows are reduced during the spring while reservoirs are filling and, in some cases, when flows are increased in the late irrigation season while the reservoirs are releasing to demands. Locations where modeled streamflow demonstrates a significantly different pattern than natural flow due to reservoir influence include the following:
  ○ Yampa River below Stagecoach Reservoir
  ○ Muddy Creek at Kremmling (below Wolford Mountain Reservoir)
  ○ Blue River below Dillon (below Dillon Reservoir)
  ○ Blue River below Green Mountain Reservoir
  ○ Taylor River at Almont (below Taylor Park Reservoir)
  ○ Los Pinos River at La Boca (below Vallecito Reservoir)
  ○ Florida River at Bondad (below Lemon Reservoir)
• Blue River below Dillon shows higher streamflow in August for the **Hot and Dry** scenario than **Current** or **Between**. The spike is a result of increased Blue River Decree substitution years requiring releases from Dillon Reservoir.

Water Available to Meet Future Demands Results

StateMod distributes flow to meet demands based on the priorities of water rights and basin operations. During a particular time-step, water available to meet future demands at a specific location represents the portion of modeled streamflow that is not allocated to current downstream demands with existing water rights. Water available for future demands accounts for water that must be bypassed to senior downstream water rights; therefore is less than modeled streamflow unless the location is at the state line and there are no downstream demands with Colorado water rights.

Figure 9 is a graph from Appendix C showing average monthly water available to meet future demands at the Gunnison River near Lazear gage location (gage ID 09136200). Similar to the other graphs shown in Appendix C for key locations, the gray shading shows the average annual range in water available to meet future demands from the CRWAS Phase I scenarios. The dark black line shows the average water available to meet future demands for current hydrology and the red line and blue line show the **Hot and Dry** and **Between** water availability. Appendix C also includes summary tables reporting average monthly and annual water available for **Hot and Dry** and **Between,** and the annual percent difference compared to **Current**.

Unlike other locations, average monthly water available to meet future demands for the Gunnison River gages downstream of Blue Mesa Reservoir for the **Hot and Dry** and **Between** climate scenarios does not fall within the range of the CRWAS Phase I scenarios. This is due to recent changes in Aspinall Unit Reservoir operations reflecting the Aspinall Unit Operations EIS (2012) and Record of Decision (2012). Increased reservoir releases, specifically for environmental purposes, are "protected" downstream past the confluence with the Uncompahgre River. Water releases from the Aspinall Unit to generate power and for other operations prior to the Record of Decision, reflected in the CRWAS Phase I modeling results, was available for re-diversion.

Figure 9: Example Average Water Available to Meet Future Demands

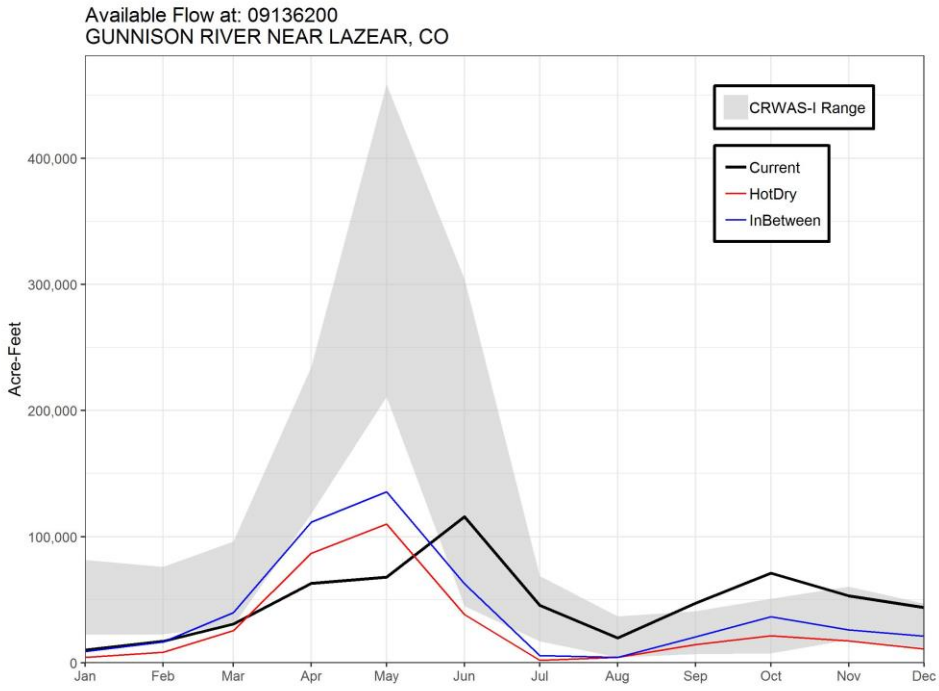


Table 4 highlights key observations illustrated in the water available to meet future demand graphs and tables in Appendix C.

Table 3: Key Observations – Water Available to Meet Future Demands

Water Available to Meet Future Demands

• In all locations, the **Hot and Dry** scenario shows less average annual water available to meet future demands than **Current** and less than the CRWAS-I median flow. In every basin but the Yampa, the available flow under **Between** is less than is available under **Current**.
• For most locations, water available to meet future demands under both climate projection scenarios is higher in May than **Current** and significantly lower in June and July. The increased availability in May and decreased availability in June is a result of the shift in peak natural flow from June to May; the decreased availability in July is caused by lower natural flows under the climate projection scenarios.
• Water available to meet future demands is significantly higher for both climate projection scenarios compared to **Current** on the Roaring Fork River near Aspen on average in May. In the **Current** scenario, the instream flow rights on the Roaring Fork are not generally satisfied in May, resulting in limited water available for future use. The higher runoff in May under the climate projection scenarios can often satisfy the instream flows, resulting in increased water available to meet future demands.
• Locations below major reservoirs generally have less flow available to meet future demands under the **Hot and Dry** scenario than other locations. The reservoirs are releasing to increased demands and, when water is available, are storing more water.
• As noted above, recent changes in operations under the Aspinall Unit do not allow a valid comparison between CRWAS Phase I and Phase II. Gages on the Gunnison River below Blue Mesa Reservoir show there will be significantly less water available to meet future demands than prior to the Record of Decision. Gages that reflect this change include the following:
  ○ Gunnison River below Gunnison Tunnel (09128000)
  ○ Gunnison River near Lazear (09136200)
  ○ Gunnison River near Grand Junction (09152500)
• Near the state line, water available to meet future demands is essentially the same as physical modeled streamflow, since there are no downstream demands with Colorado water rights. Note that since there has never been a Colorado River Compact curtailment, potential future compact restrictions are not included in the CRWAS Phase II modeling effort. The following state line gages show the full modeled streamflow available to meet future demands:
  ○ Colorado River near Colorado-Utah State Line (09163500)
  ○ Dolores River near Bedrock (09171100)
  ○ San Juan River near Carracas (09346400)
  ○ Los Pinos River near La Boca (09354500)
  ○ Animas River near Cedar Hill (09363500)
  ○ Mancos River near Towaoc (09371000)
  ○ Yampa River at Deerlodge (09260050)
  ○ White River near Colorado State Line (09306395)

Modeled Consumptive Use

Crop demand (CIR) for **Hot and Dry** and **Between** scenarios increased in every basin compared to **Current** irrigation demands. As shown in Table 1 in the approach section, the largest increases in CIR for the **Between** climate scenario are in the northern basins (Yampa and White) and the San Juan/Dolores basin. The largest increases for the **Hot and Dry** scenario are in the Yampa and White basins.

Average Monthly Consumptive Use represents the total amount of water consumed in each basin, including actual irrigation consumptive use (the amount of CIR that could be met from the available water supply); losses "incidental" to irrigation, for example tail water consumption by non-crop vegetation; municipal and industrial consumptive use; transbasin diversions; and reservoir evaporation. Figure 10 is a graph from Appendix D showing average monthly consumptive use in the Yampa River basin. Similar to the other graphs shown in Appendix D for each basin, the gray shading shows the average annual range in in consumptive use from the CRWAS Phase I scenarios. The dark black line shows the consumptive use for current hydrology and the red line and blue line show the **Hot and Dry** and **Between** consumptive use.

As shown, the consumptive use in the Yampa under both **Hot and Dry** and **Between** is less than the range from the CRWAS Phase I. This is primarily due to the change in methodology used to determine CIR, as discussed in the approach section, which resulted in lower climate-adjusted CIR and lower actual crop consumptive use for CRWAS Phase II in every basin. The crop demands under the **Hot and Dry** and **Between** are still significantly greater than the **Current** demands; yet they were able to be met from available water supply in the Yampa basin in most average and wet years.

Figure 10: Average Monthly Total Consumptive Use in the Yampa Basin

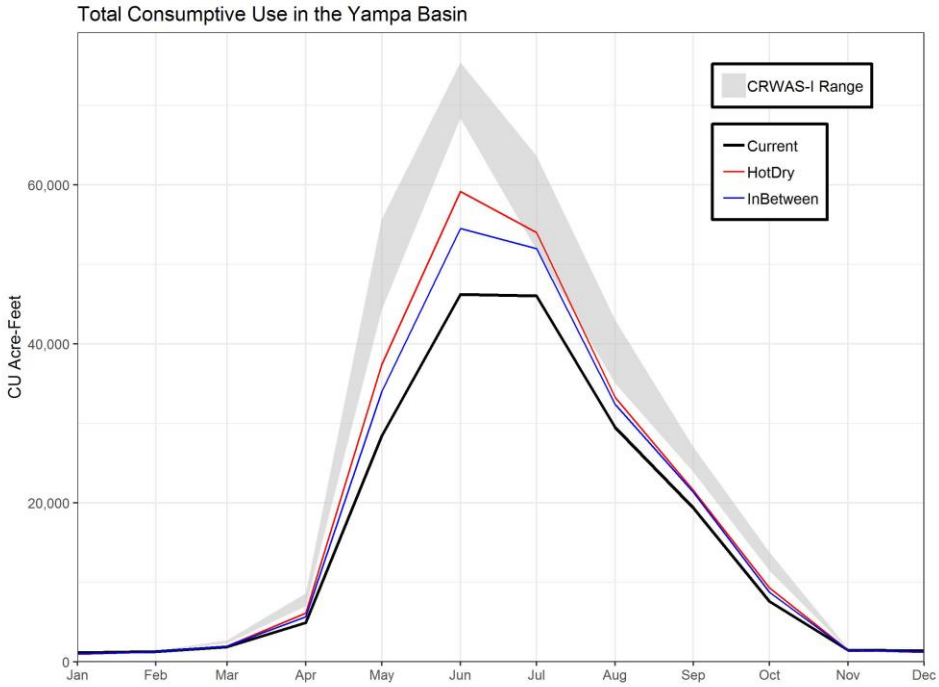


Table 5 highlights key observations illustrated in the basin-wide consumptive use graphs and tables in Appendix D.

Table 5: Key Observations – Consumptive Use

Modeled Consumptive Use
• The average and monthly consumptive use modeled under **Current**, **Between**, and **Hot and Dry** is less than all CRWAS Phase I scenarios. This is due to the change in consumptive use adjustment methodology • Consumptive use in the Yampa and White basins is primarily from crop irrigation. Consumptive use in these basins is greater than **Current** in both climate projection scenarios, indicating that there is generally water available to meet the increased crop demands. • A significant portion of the consumptive use in the Colorado River basin is the result of transbasin diversions. The total consumptive use in the Colorado River basin in both climate projection scenarios is similar to **Current** consumptive use. Increased irrigation demands under both climate projection scenarios can often be met; however, there is generally not enough natural flow to meet the more junior transbasin diversions compared to **Current**. • Consumptive use in the Gunnison basin is primarily from crop irrigation. Consumptive use is greater than **Current** in both climate projection scenarios, indicating that even though natural flow decreases under climate projections, there is generally water available to meet the increased crop demands. • Consumptive use in the San Juan basin is primarily from crop irrigation. Consumptive use demands are much greater in both climate projection scenarios than **Current**; however, the modeled actual consumptive use is only slightly higher in the **Between** scenario and is lower in the **Hot and Dry** scenario, indicating that increased crop demand is generally not satisfied due to insufficient water supply.

Modeled Reservoir Storage

The StateMod models include over 60 operating reservoirs in the Colorado River basin in Colorado. Several of the larger reservoirs in the upper Colorado River Basin are operated for direct transmountain diversion or for exchange to allow transbasin diversions (Granby, Shadow Mountain, Williams Fork, Dillon, Meadow Creek, Willow Creek, Upper Blue Reservoirs, and Homestake). Storage and releases from these reservoirs primarily satisfy transbasin demands in the South Platte and Arkansas River basins. Increased demands in the South Platte and Arkansas River basins due to the **Hot and Dry** and **Between** climate scenarios were not addressed as part of this project. The CRWAS Phase I report recommended investigating potential increased transmountain demand under future climate conditions in CRWAS Phase II; however, due to CWCB and IBCC ongoing efforts to collaboratively address the impact of future climate conditions on transbasin diversions, the decision was made to continue to use current demand levels. Therefore, changes to these reservoirs only reflect changes in natural flow hydrology.

Figure 11 is a graph from Appendix E showing the end-of-month (EOM) reservoir storage for Green Mountain Reservoir (WDID 3603543) for the period 1990 to 2013 and Figure 12 is a graph from Appendix E showing the average monthly reservoir storage for Green Mountain Reservoir for the

period 1950 to 2013. Similar to the other graphs shown in Appendix E, the dark black line shows EOM storage for current hydrology and the red line and blue line show the **Hot and Dry** and **Between** EOM storage. Many of the reservoir operations in the Colorado River basin were updated to better reflect current practices between CRWAS Phase I and CRWAS Phase II; therefore a comparison of reservoir results between the phases was not appropriate for most reservoirs. Therefore, results only compare reservoir contents based on **Current**, **Hot and Dry**, and **Between** for representative reservoirs.

The reservoirs shown in Appendix E operate for varying purposes, including primarily for irrigation (Stagecoach, Vega, Ridgway, and McPhee reservoirs); exchange for transbasin diversions (Green Mountain Reservoir); and enhanced fish flows (Green Mountain and Blue Mesa reservoirs). Each of the reservoirs generally release more under **Hot and Dry** and **Between** compared to **Current**. In most years, reservoirs under the **Hot and Dry** scenario are not able to fill to the levels simulated under the **Current** scenario.

Figure 11: Green Mountain Reservoir Storage Contents (1990 - 2013)

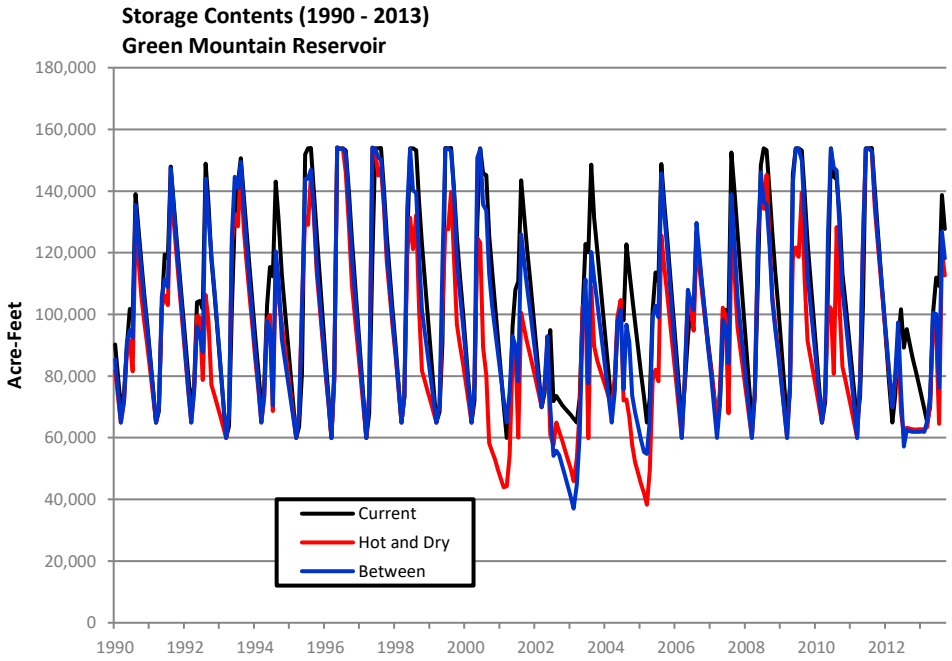


Figure 12: Green Mountain Reservoir Average Monthly Storage Contents (1950 - 2013)

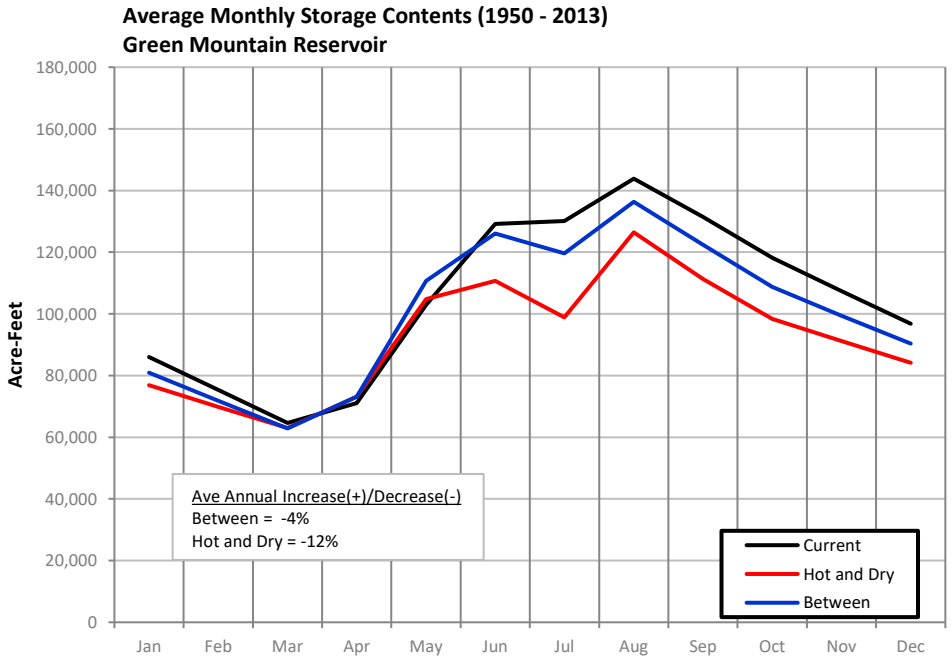


Table 6 highlights key observations illustrated in the reservoir storage graphs in Appendix E.

Table 6: Key Observations – Modeled Reservoir Storage

Modeled Reservoir Storage
• Reservoirs generally release more under both climate projection scenarios compared to **Current**. Earlier runoff patterns result in less natural flow available to meet increased irrigation demands during the peak irrigation season. In most years, reservoirs under the **Hot and Dry** scenario are not able to fill to the levels simulated under the **Current** scenario because of reduced natural flow. • Green Mountain Reservoir does not show significantly more use in the wet and average years compared to **Current** in either climate projection scenario. The slight increased use in dry years is primarily from the Colorado-Big Thompson Exchange account. Note that the Historical User Pool (HUP) account does release more water to in-basin demands; however, since remaining HUP water is released late in the season to improve flows in the 15-Mile Reach in **Current** and both climate projection scenarios, there is little change in the account use between scenarios. With the exception of driest years in the **Hot and Dry** scenario, the HUP account is able to fill to **Current** scenario levels. • Reservoirs that provide supplement water for irrigation generally release more water for both the **Between** and **Hot and Dry** scenarios due to increased irrigation demands and, except in the driest years, can generally refill to the same level as **Current**. • Blue Mesa Reservoir operates based on the Aspinall Unit Operations EIS (2012) and Record of Decision (2012). Although releases are not significantly greater than **Current** in either climate projection scenario, the reservoir is often not able to fill to **Current** scenario levels in the **Hot and Dry** scenario. • McPhee Reservoir releases less water due to increased demands for the climate projection scenarios compared to **Current**, and decreased natural flows do not allow the reservoir to recover to **Current** levels.

Natural Flow in Other Basins

As part of CWP and Colorado Water Plan Technical Update, it was important to develop natural flow and adjusted crop irrigation demands for the **Hot and Dry** and **Between** scenarios for every basin in the state – not just for the west slope basins scoped for CRWAS Phase II. To be consistent across the state, the CRWAS Phase II technical procedures and methodology were used to estimate natural flow at key locations in every river basin in Colorado. Appendix F provides graphs and summary tables comparing **Current** average monthly natural flows to natural flows under **Hot and Dry** and **Between** scenarios.

Table 7 highlights key observations illustrated in the natural flow graphs in Appendix F for the North Platte, South Platte, Arkansas, and Rio Grande basins.

Table 7: Key Observations – Natural Flow in Other Basins

Natural Flow in Other Basins
• There is a shift in the average peak natural flow from June to May for both the **Between** and **Hot and Dry** in the North Platte River basin. Similar to the Yampa Basin, average annual natural flow is higher for the Between scenario than the **Current**; and **Hot and Dry** average annual flow is about the same as **Current**. • There is a shift in the average peak natural flow from June to May at most locations for the **Hot and Dry** scenario in the South Platte River basin; however the **Between** natural flows generally peak in June similar to **Current** natural flows. Average annual naturals flows for both the **Between** and **Hot and Dry** are lower than **Current** natural flows. **Between** natural flows average 10 percent lower than **Current** when all locations are considered. **Hot and Dry** natural flows average 23 percent lower than **Current** when all locations are considered. • The Arkansas River basin had just begun the process to develop CDSS models when the CRWAS Phase II effort was undertaken; therefore natural flows based on **Current** conditions were not available throughout the basin. With the exception of the Arkansas River near Leadville location, adjustments were made to historical gaged data – not to natural flow estimates. Therefore, natural flow observations are more difficult to make, but adjustment factors indicate that the impact to natural flows in the **Hot and Dry** and **Between** scenarios is significantly greater in the lower southern tributaries to the Arkansas River than to the northern headwater locations. • There is a shift in the average peak natural flow from June to May for both the **Between** and **Hot and Dry** at every location in the Rio Grande basin. The natural flow for both the **Between** and **Hot and Dry** scenarios are significantly lower than **Current** in July through September.

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Appendix A: Average Monthly Natural Flow

Appendix A Contents

Appendix A: Average Monthly Natural Flow

Figure A1: Gage 09019500: Colorado River Near Granby, CO

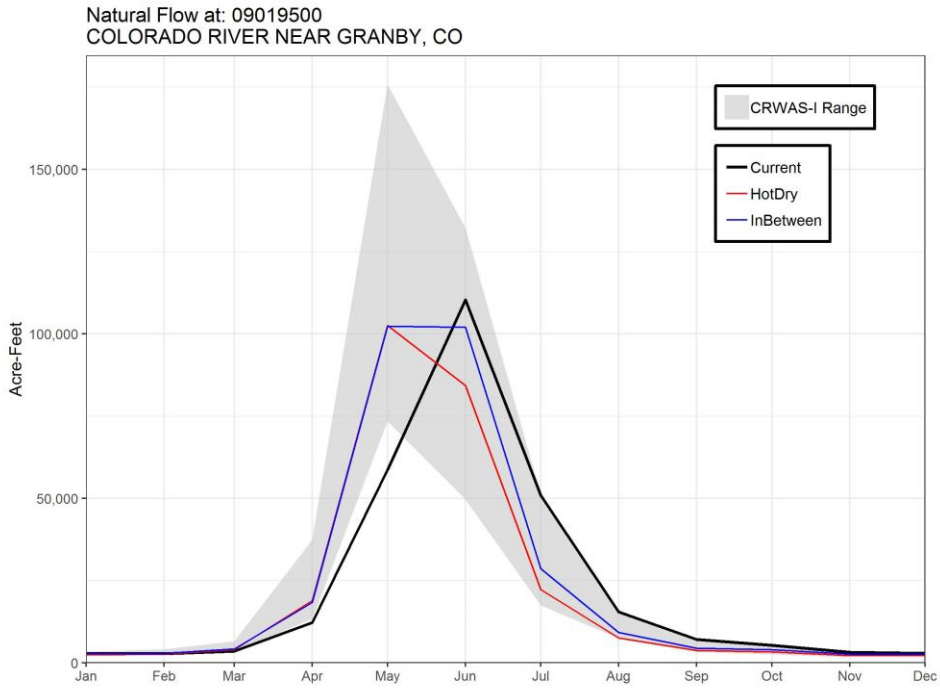


Figure A2: Gage 09041500: Muddy Creek At Kremmling, CO

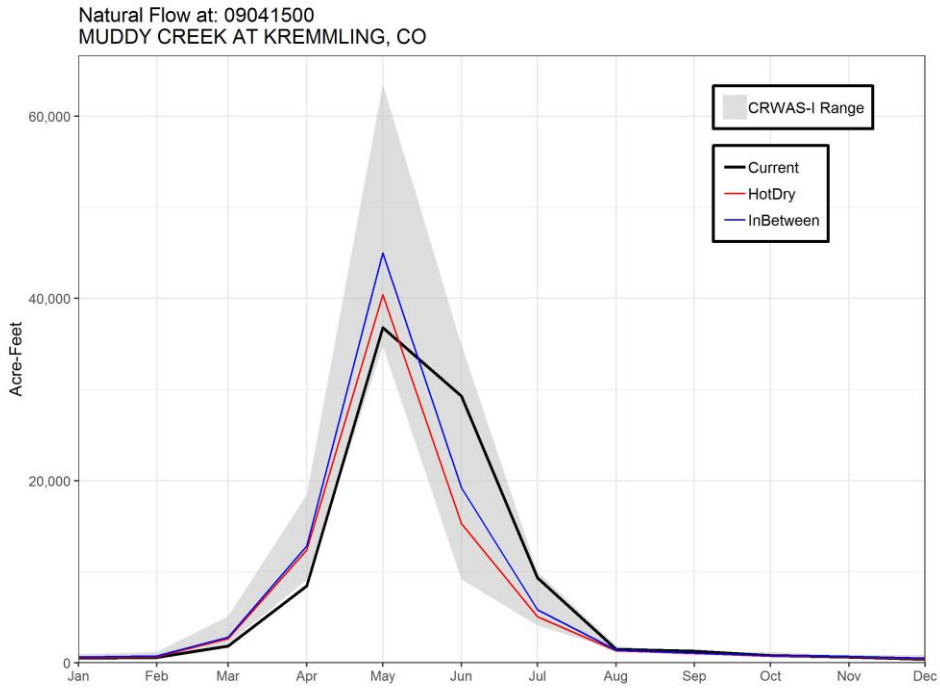


Figure A3: Gage 09050700: Blue River Below Dillon, CO

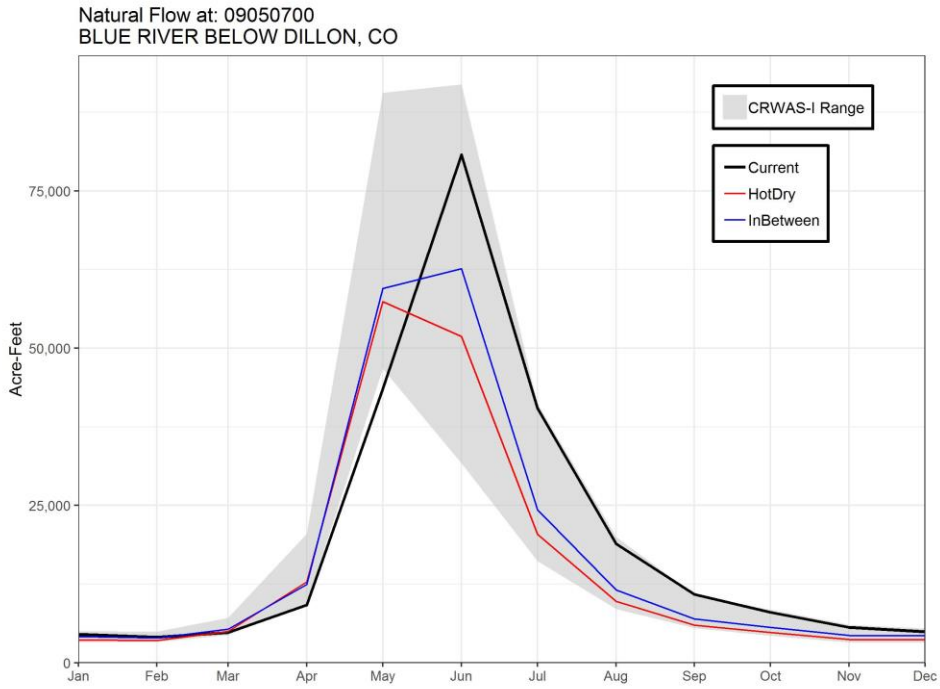


Figure A4: Gage 09057500: Blue River Below Green Mountain Reservoir, CO

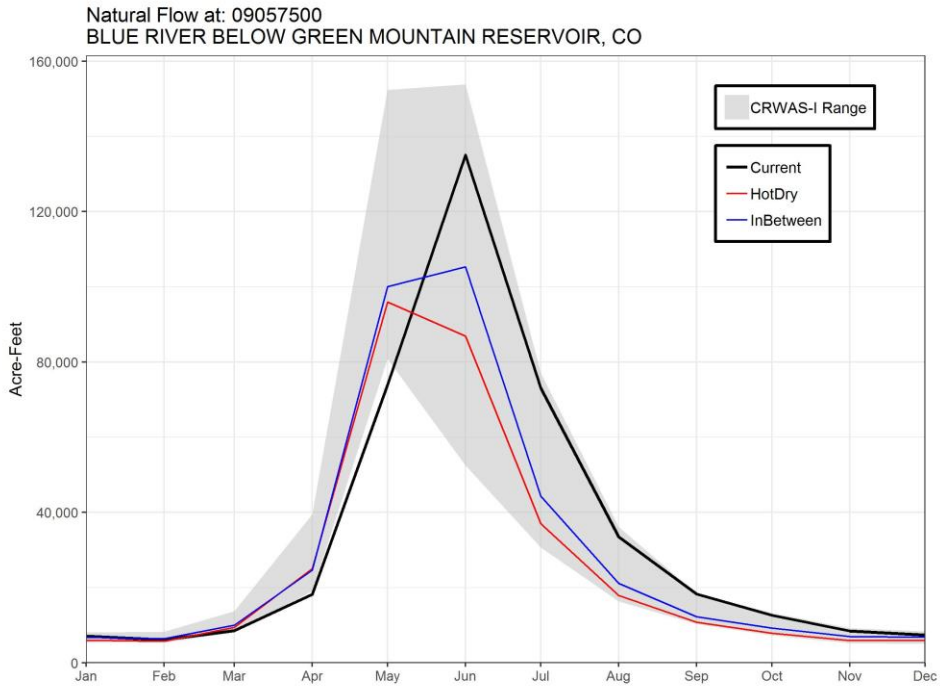


Figure A5: Gage 09070000: Eagle River Below Gypsum, CO

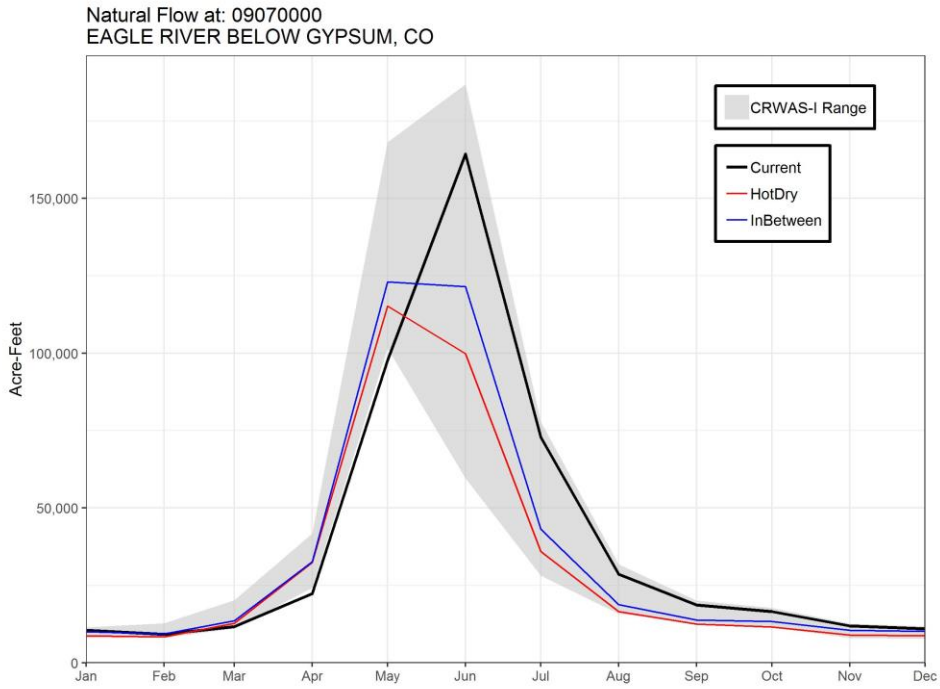


Figure A6: Gage 09070500: Colorado River Near Dotsero, CO

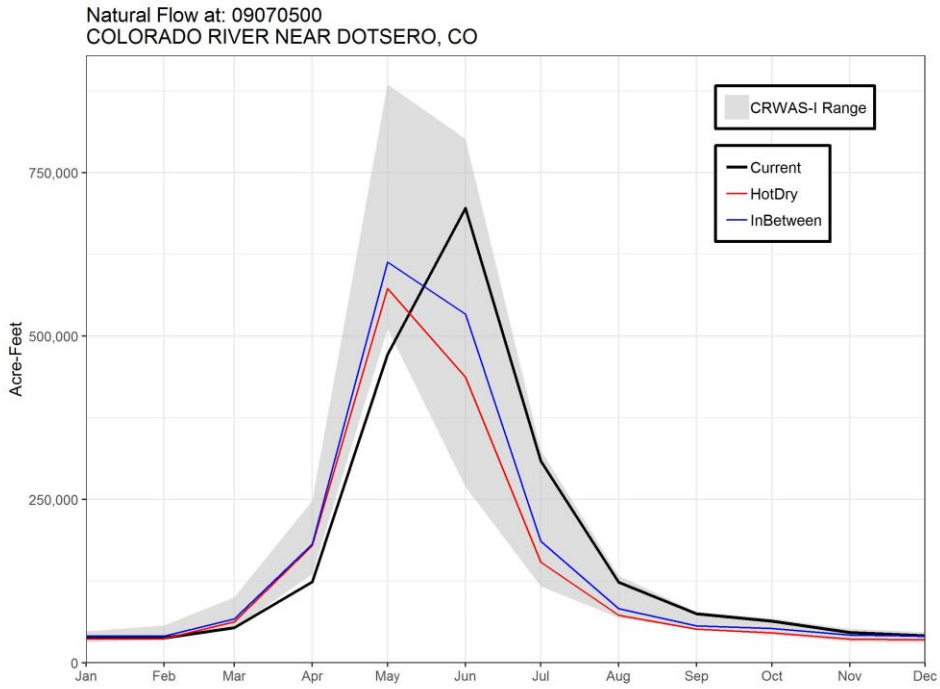


Figure A7: Gage 09073400: Roaring Fork River Near Aspen, CO

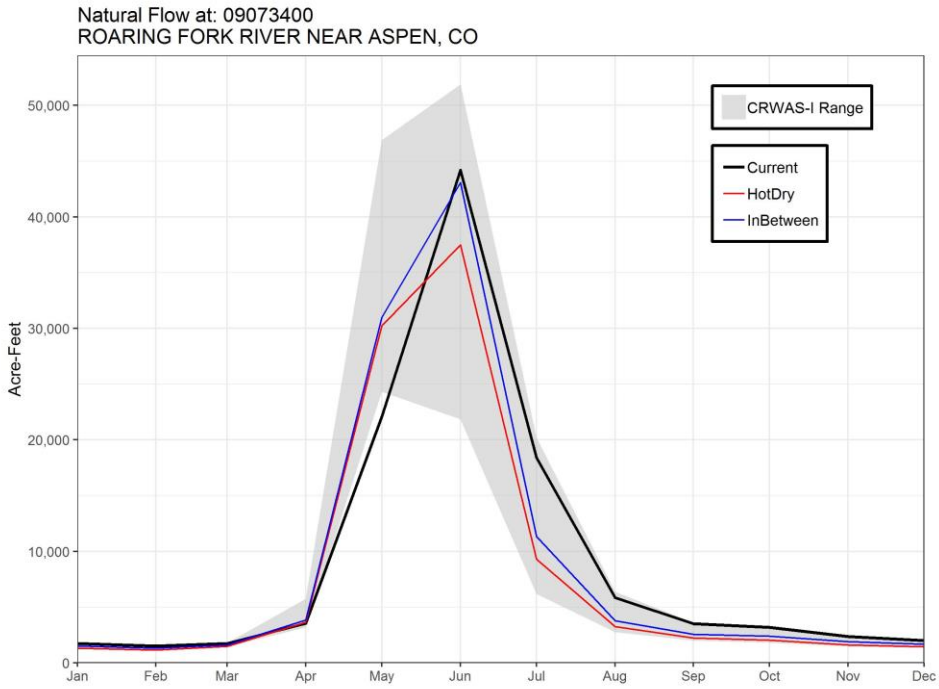


Figure A8: Gage 09085000: Roaring Fork River At Glenwood Springs, CO

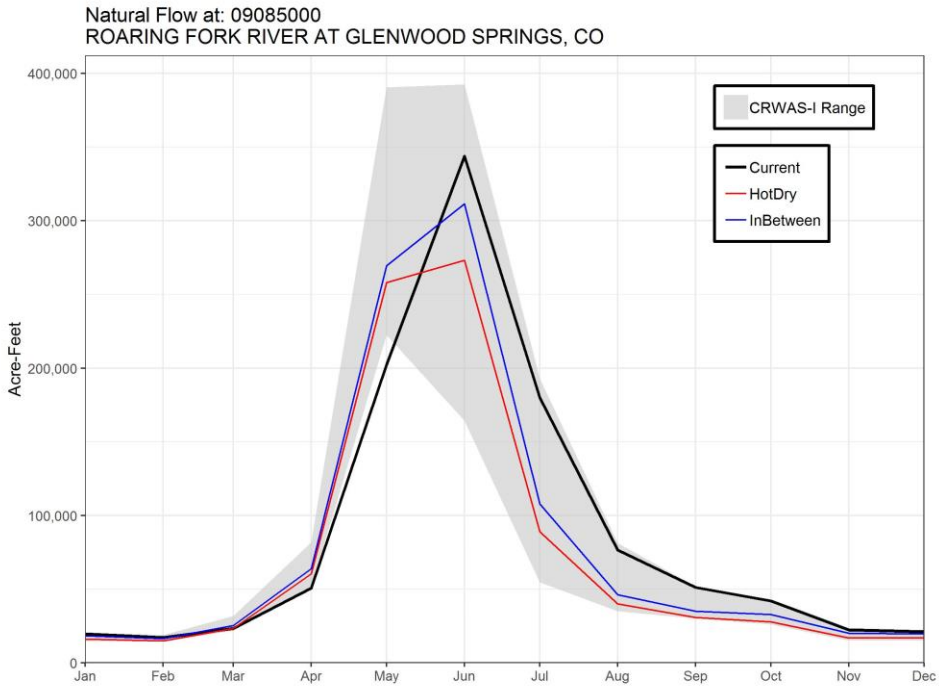


Figure A9: Gage 09095500: Colorado River Near Cameo, CO

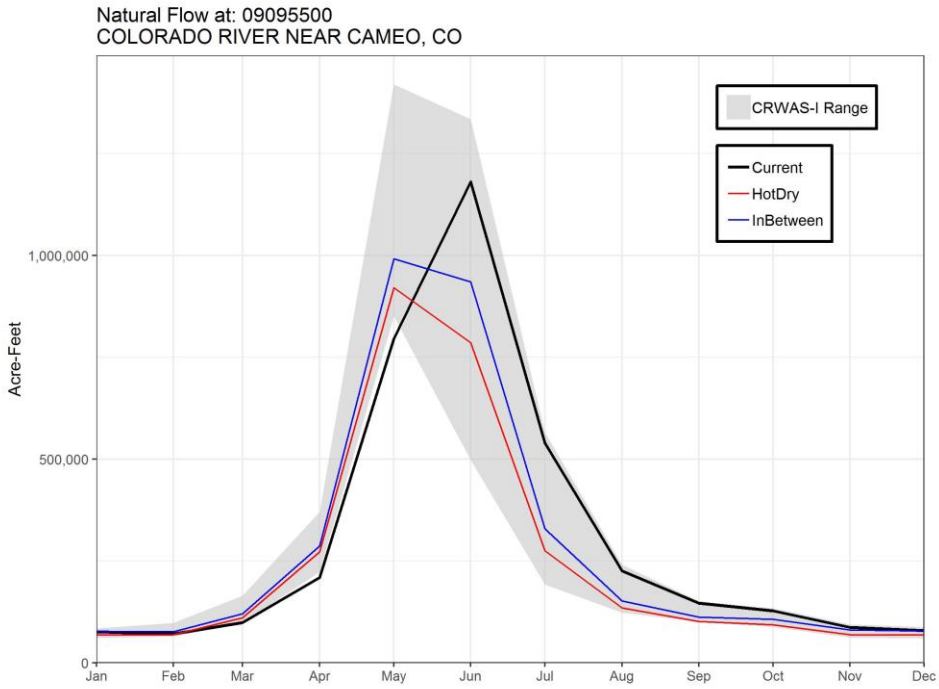


Figure A10: Gage 09105000: Plateau Creek Near Cameo, CO

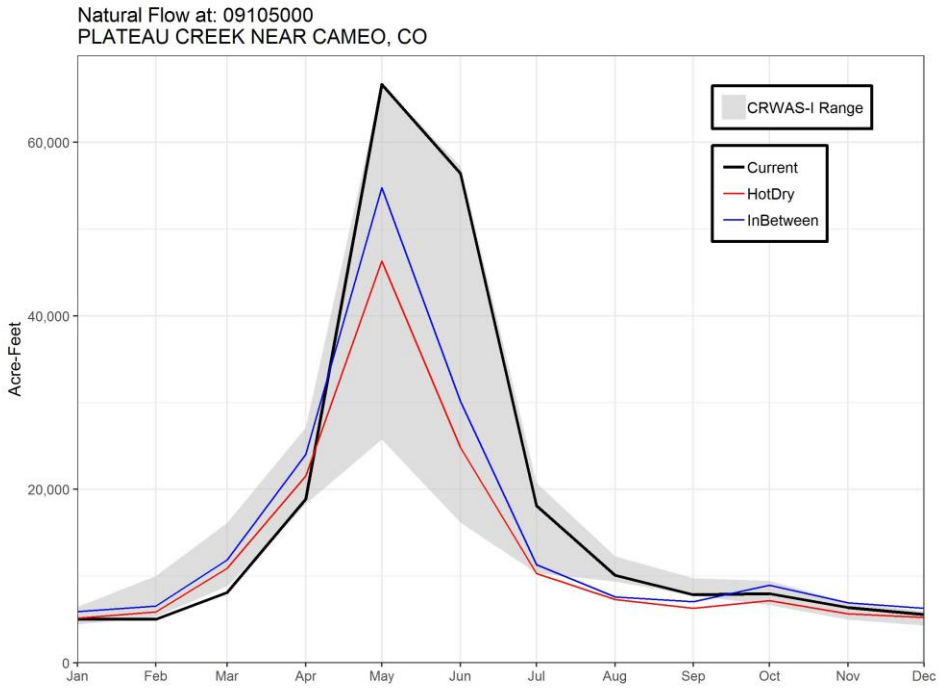


Figure A11: Gage 09163500: Colorado River Near Colorado-Utah State Line

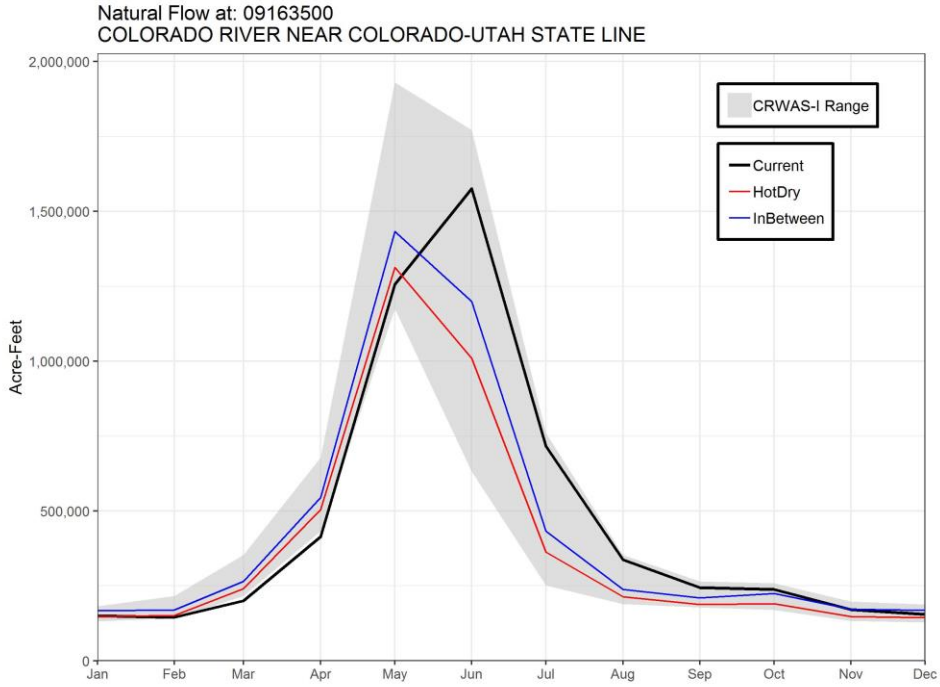


Figure A12: Gage 09110000: Taylor River At Almont, CO

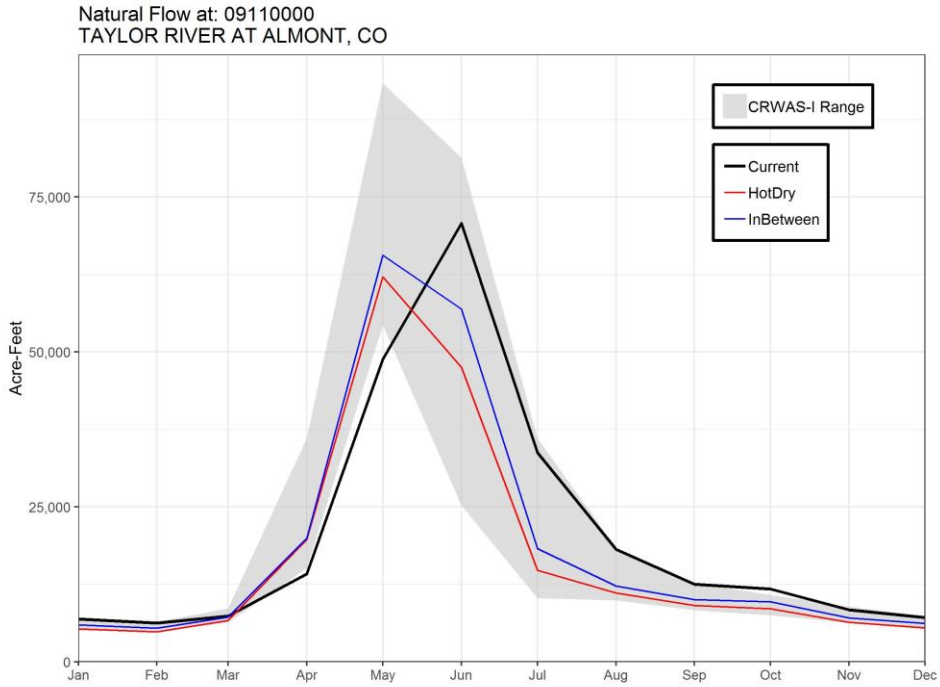


Figure A13: Gage 09112500: East River At Almont, CO

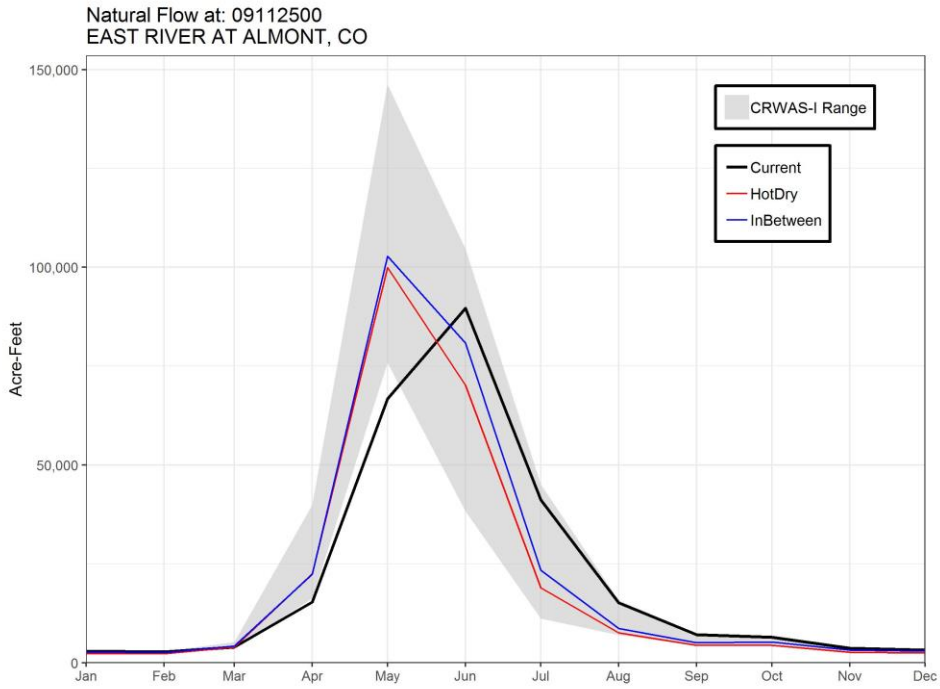


Figure A14: Gage 09114500: Gunnison River Near Gunnison, CO

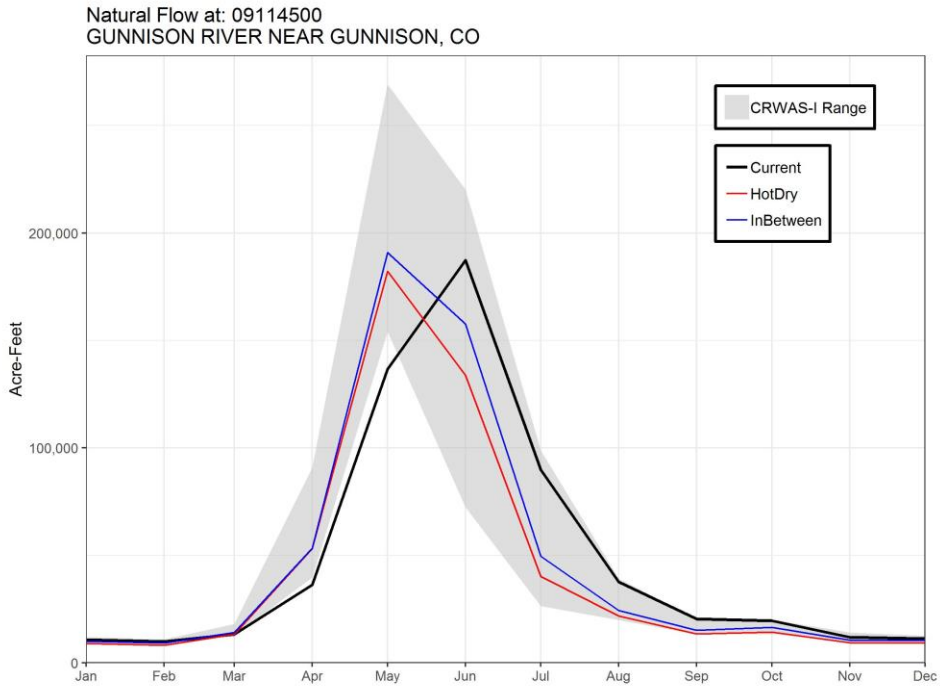


Figure A15: Gage 09119000: Tomichi Creek At Gunnison, CO

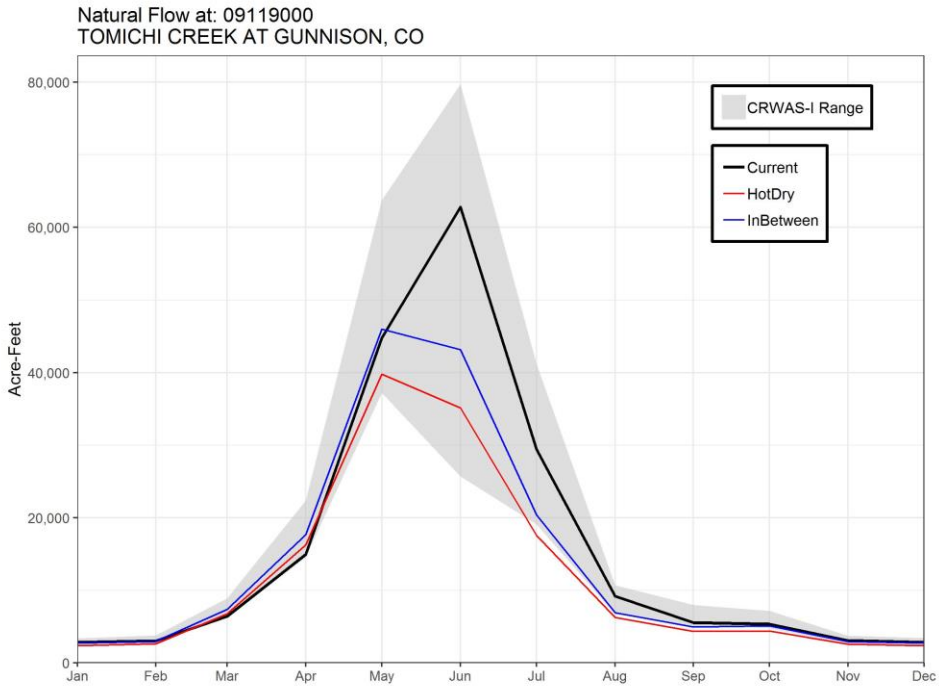


Figure A16: Gage 09128000: Gunnison River Below Gunnison Tunnel, CO

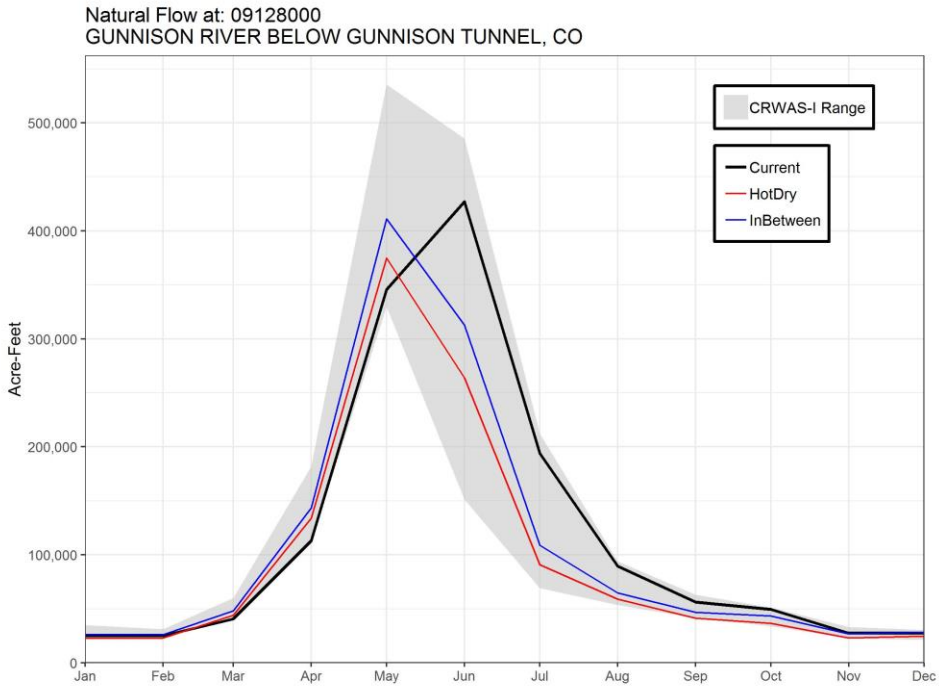


Figure A17: Gage 09136200: Gunnison River Near Lazear, CO

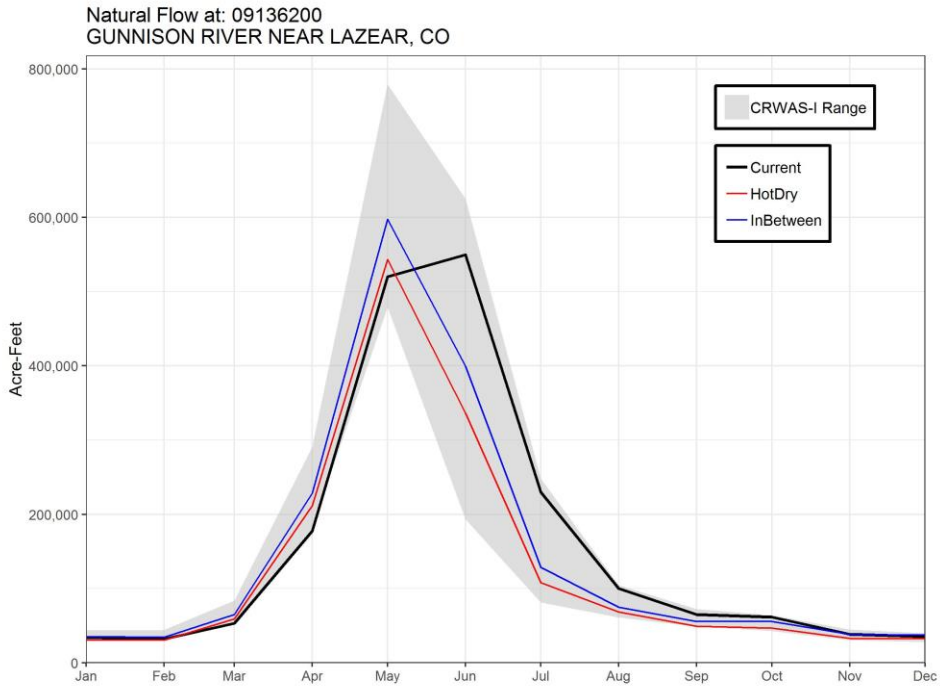


Figure A18: Gage 09149500: Uncompahgre River At Delta, CO

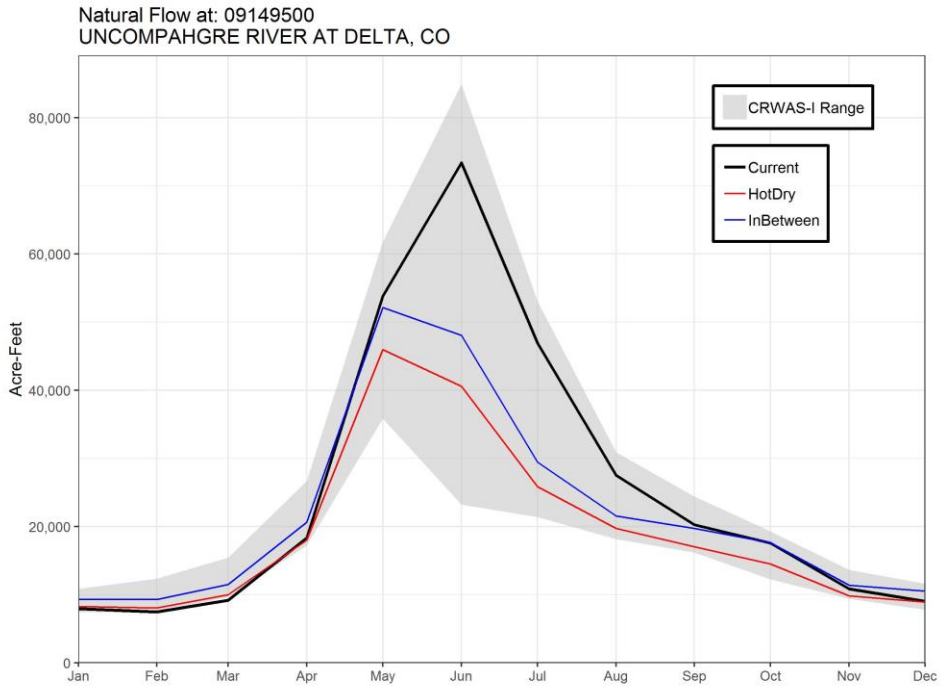


Figure A19: Gage 09152500: Gunnison River Near Grand Junction, CO

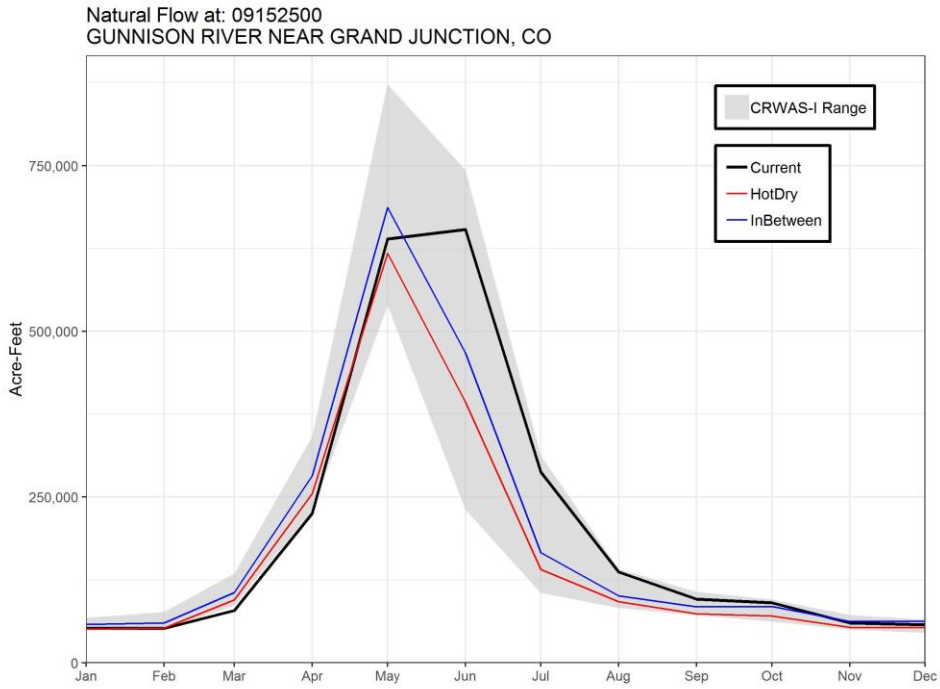


Figure A20: Gage 09171100: Dolores River Near Bedrock

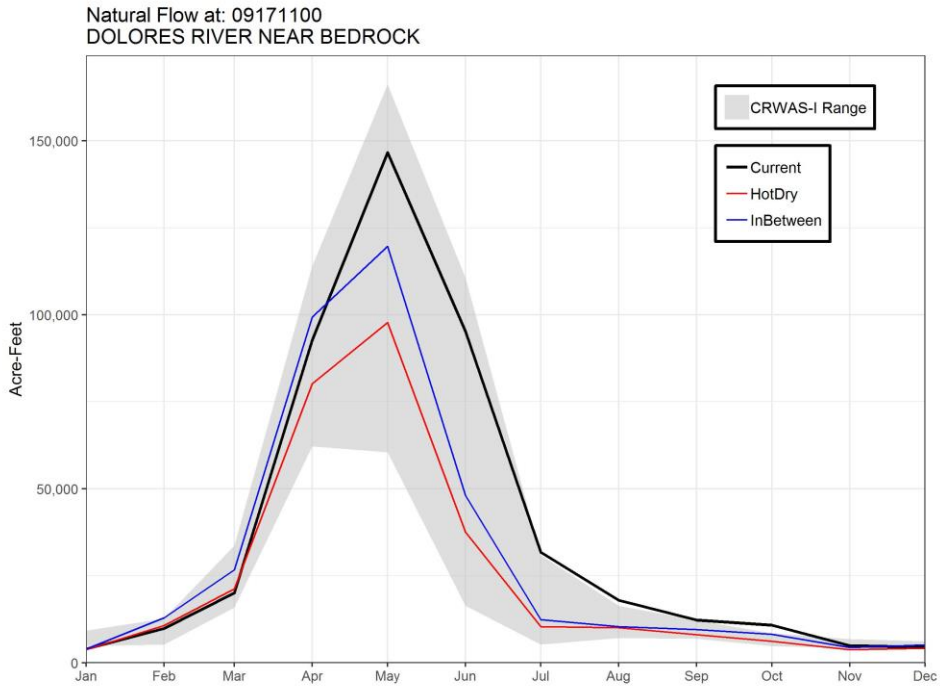


Figure A21: Gage 09175500: San Miguel River At Naturita

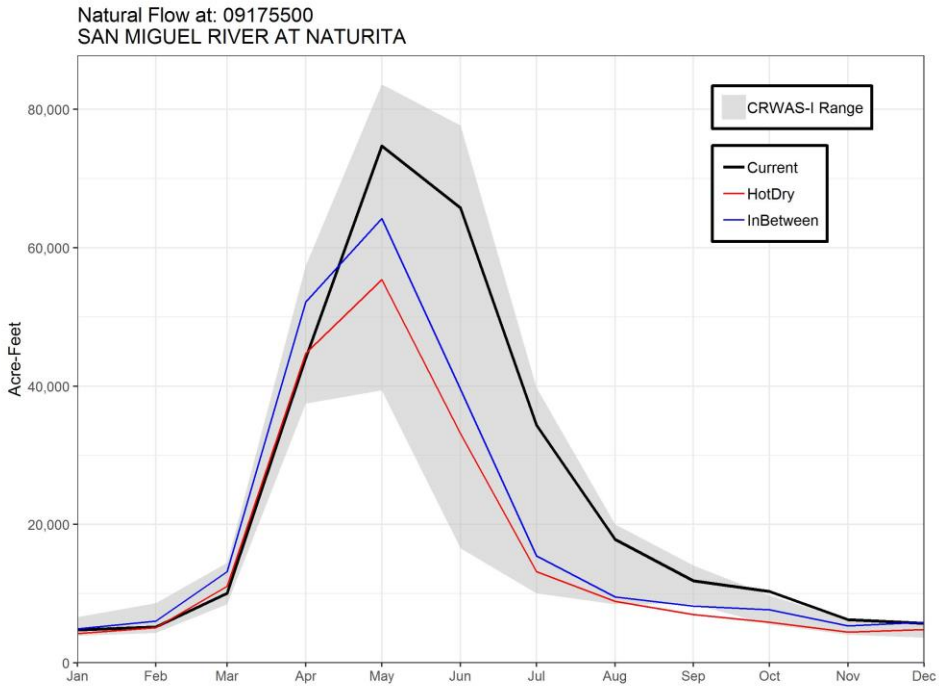


Figure A22: Gage 09346400: San Juan River Near Carracas, CO

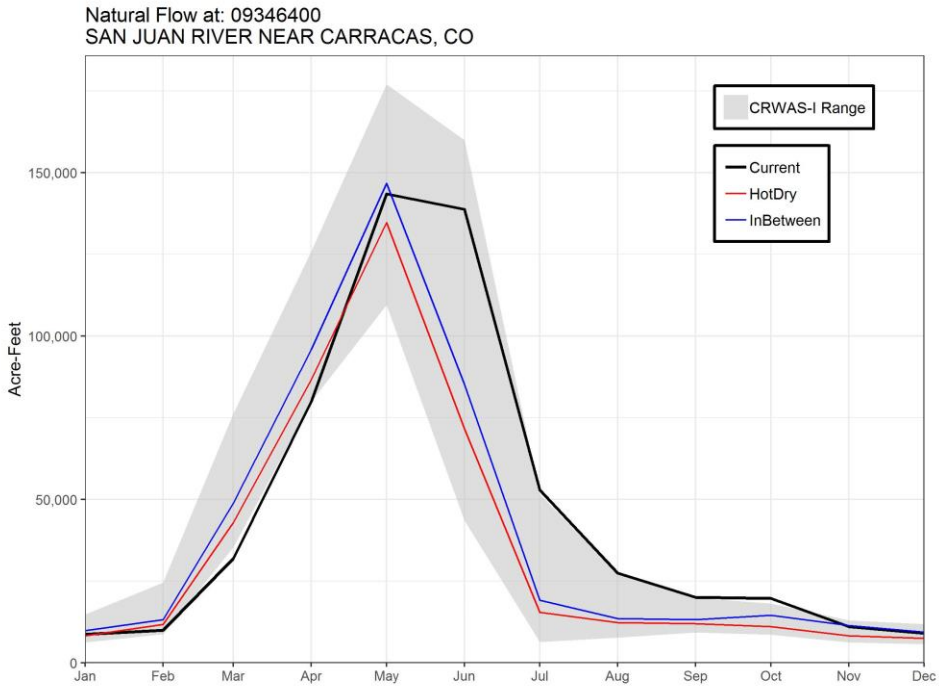


Figure A23: Gage 09349800: Piedra River Near Arboles, CO

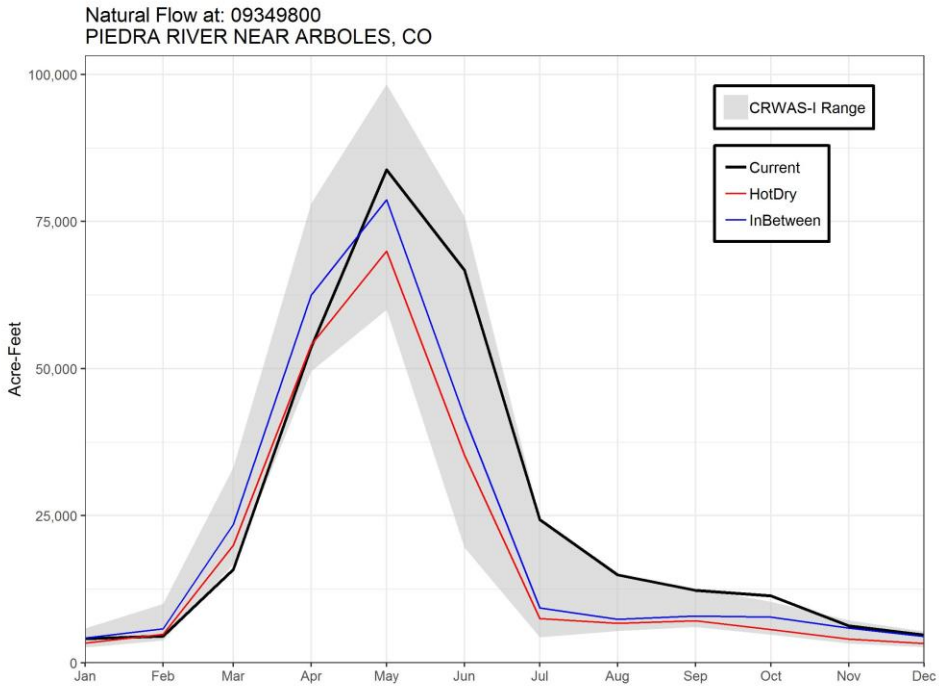


Figure A24: Gage 09354500: Los Pinos River At La Boca, CO

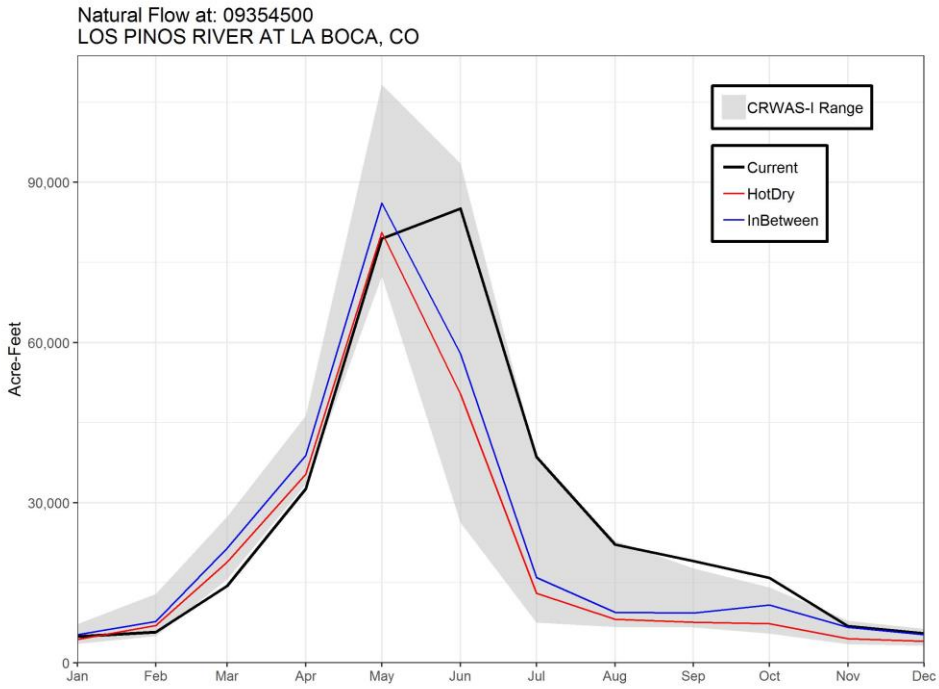


Figure A25: Gage 09363200: Florida River At Bondad, CO

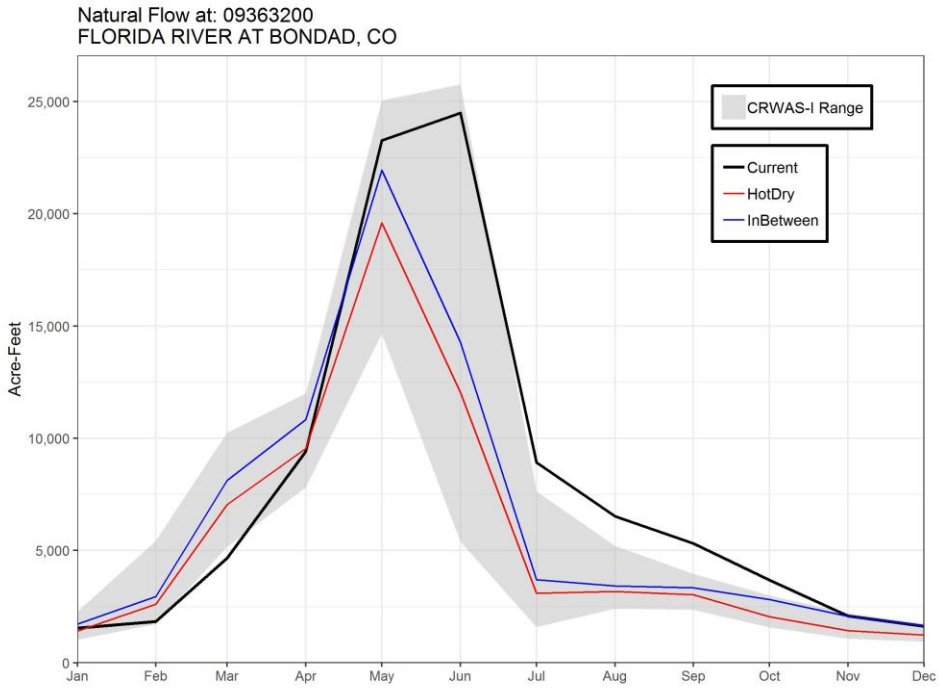


Figure A26: Gage 09363500: Animas River Near Cedar Hill, NM

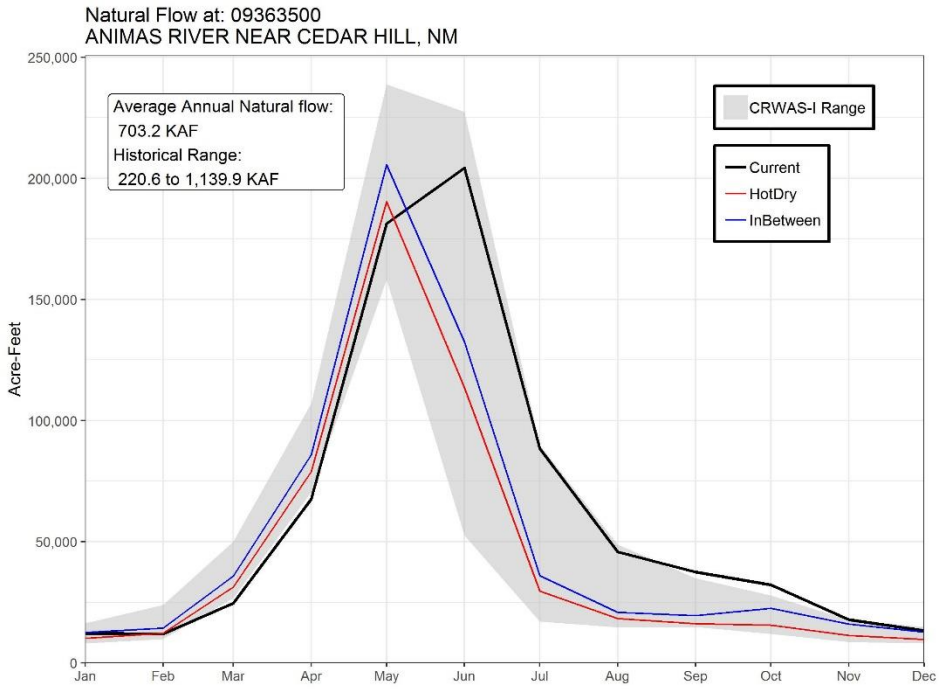


Figure A27: Gage 09365500: La Plata River At Hesperus, CO

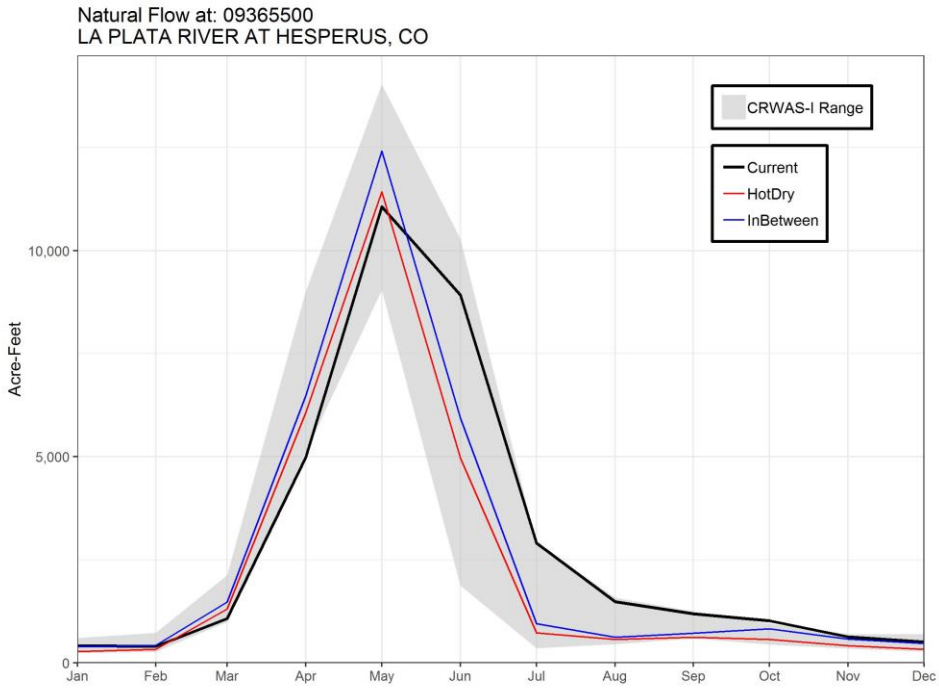


Figure A28: Gage 09366500: La Plata River At Colorado-New Mexico State Line

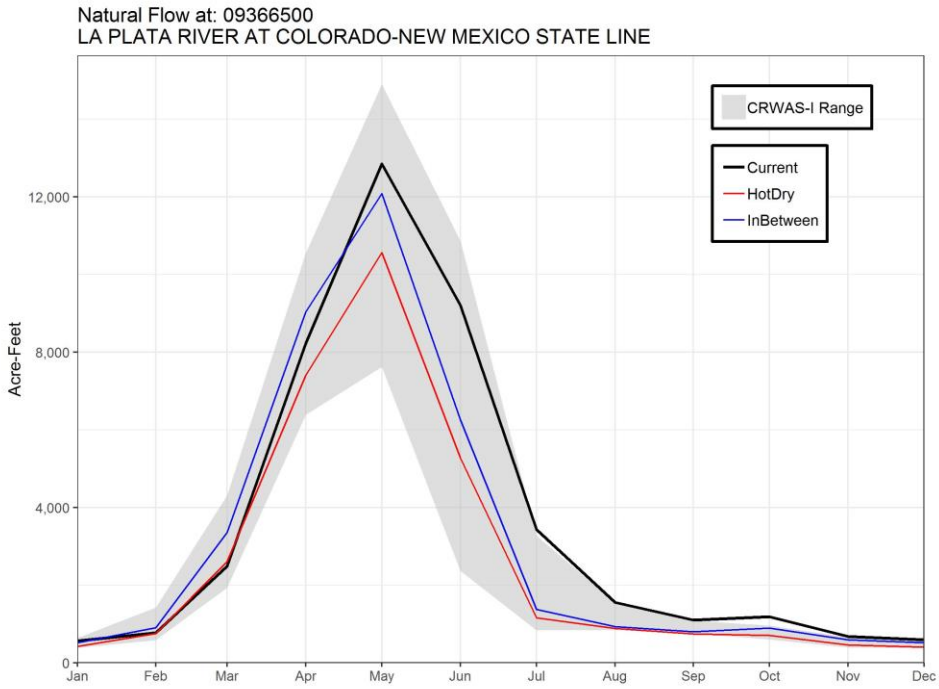


Figure A29: Gage 09371000: Mancos River Near Towaoc, CO

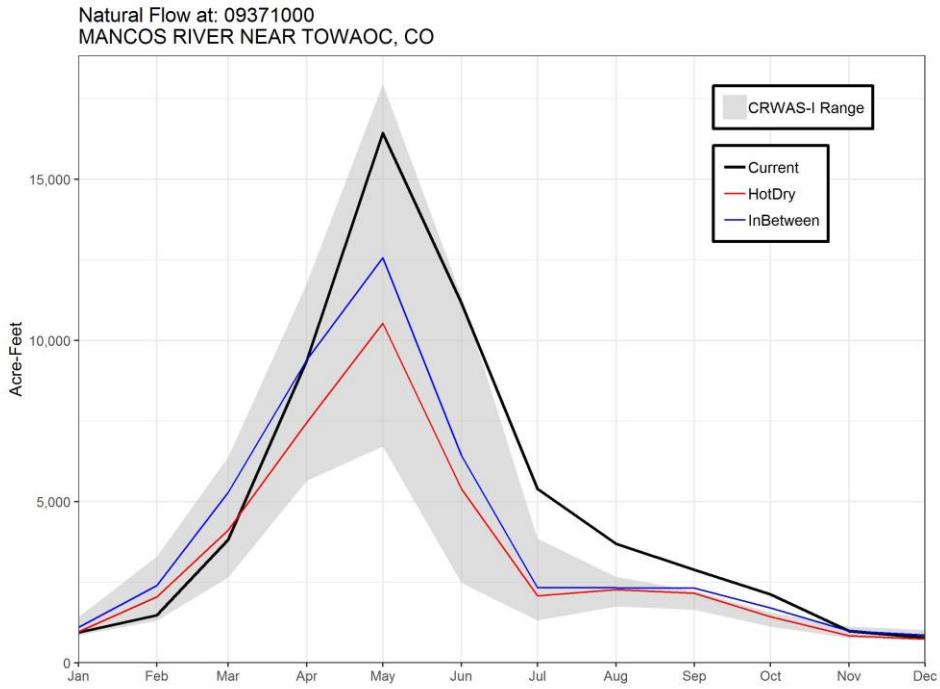


Figure A30: Gage 09237500: Yampa River Below Stagecoach Reservoir, CO

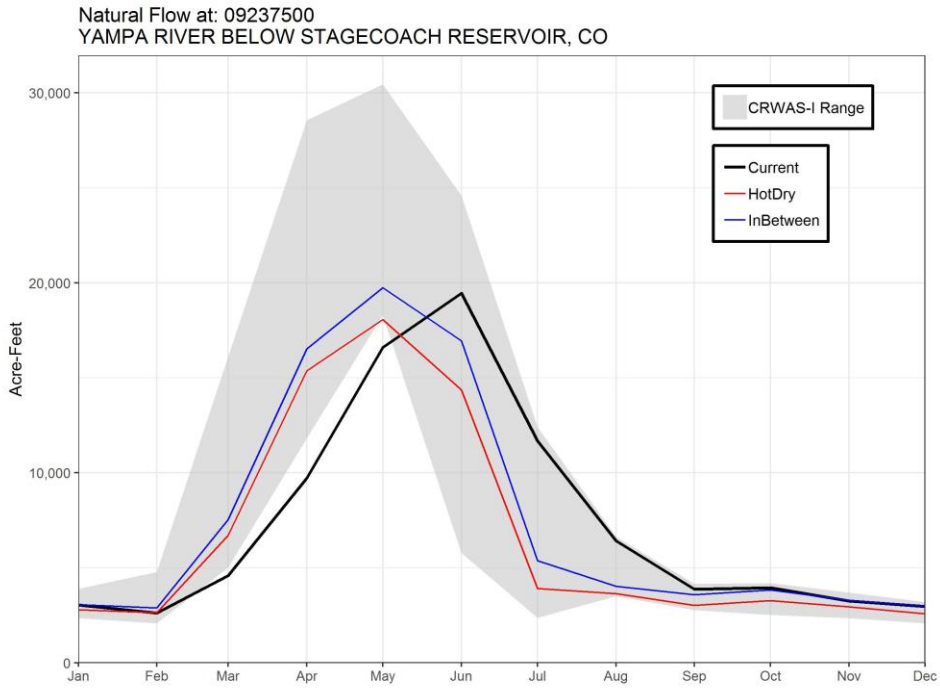


Figure A31: Gage 09241000: Elk River At Clark, CO

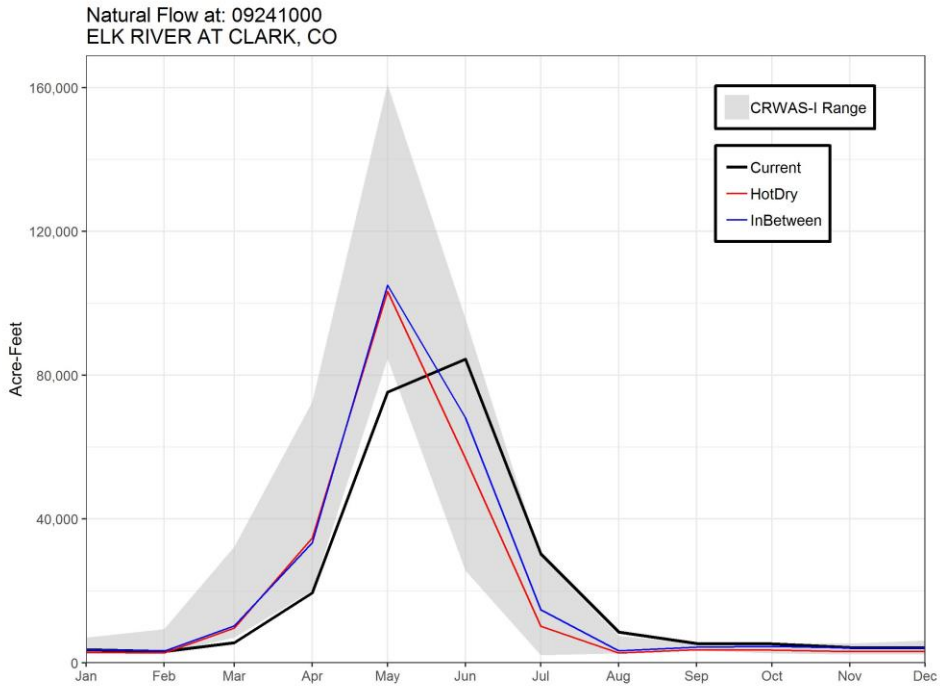


Figure A32: Gage 09245000: Elkhead Creek Near Elkhead, CO

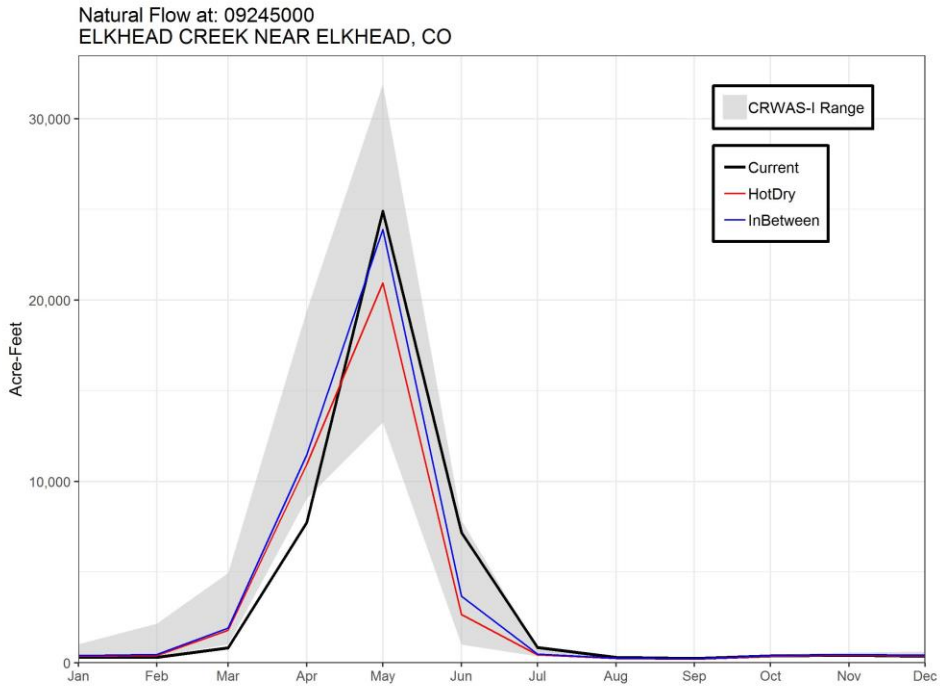


Figure A33: Gage 09249750: Williams Fork At Mouth, Near Hamilton, CO

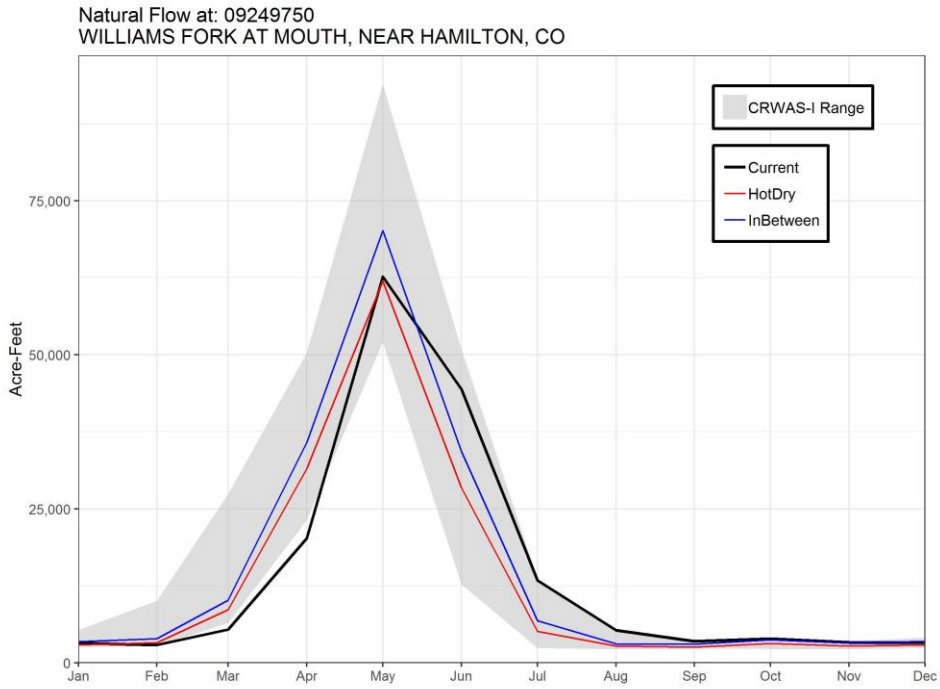


Figure A34: Gage 09251000: Yampa River Near Maybell, CO

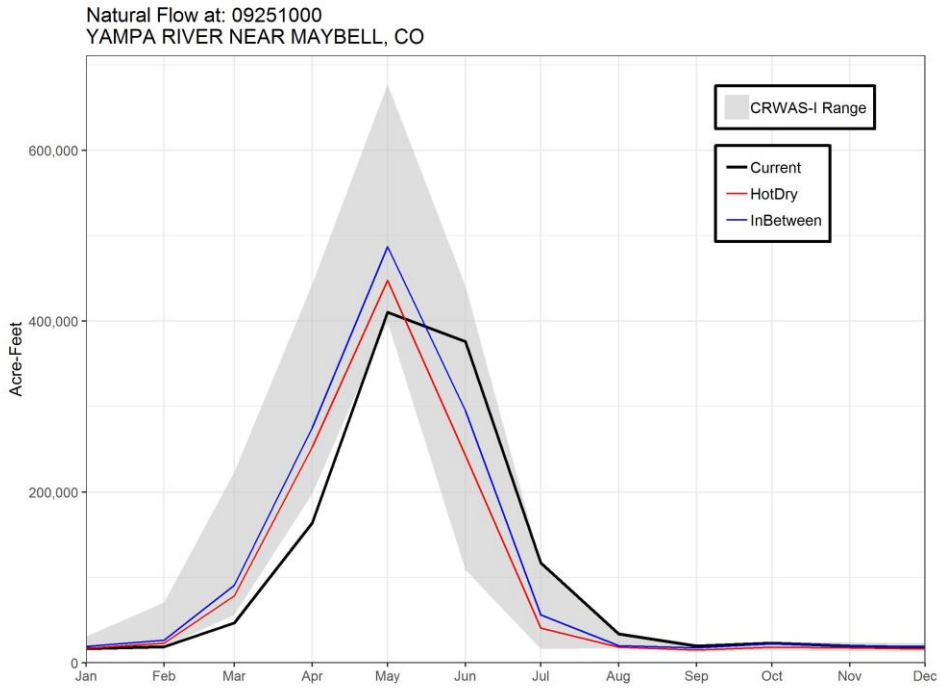


Figure A35: Gage 09260000: Little Snake River Near Lily, CO

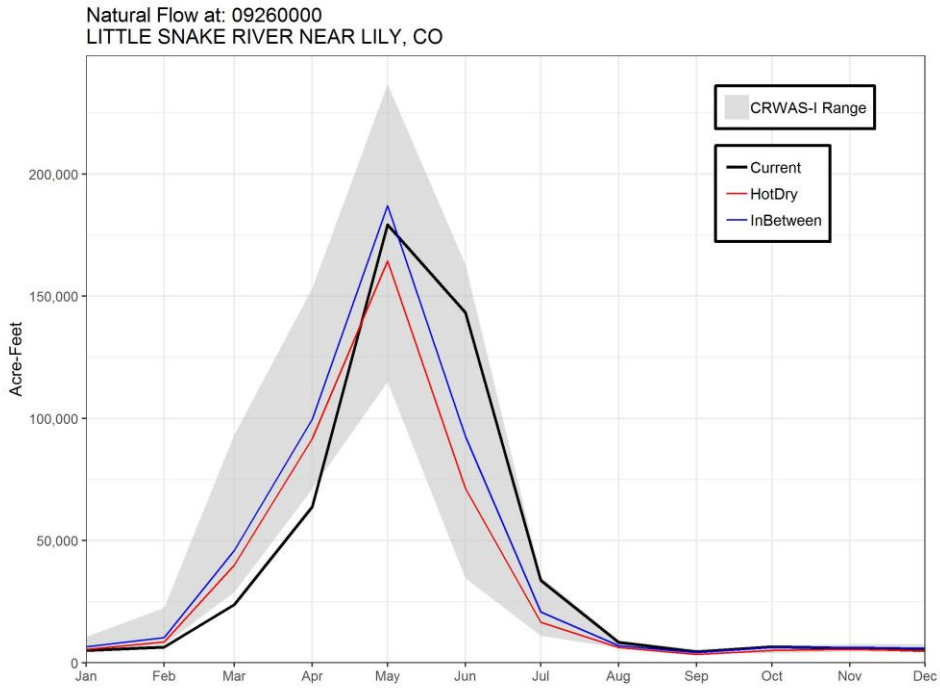


Figure A36: Gage 09260050: Yampa River At Deerlodge Park, CO

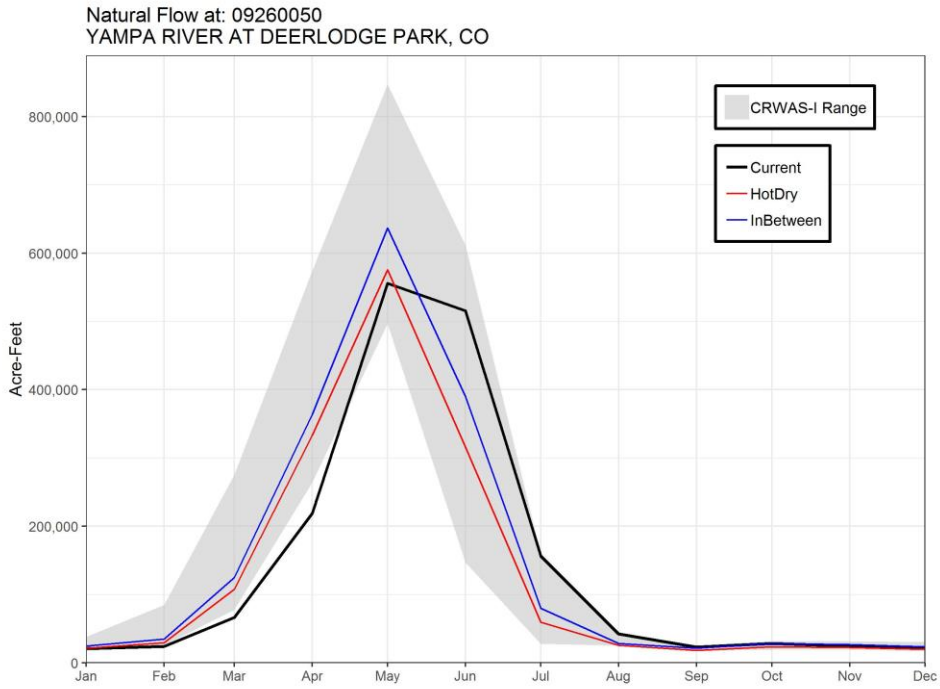


Figure A37: Gage 09303000: North Fork White River At Buford, CO

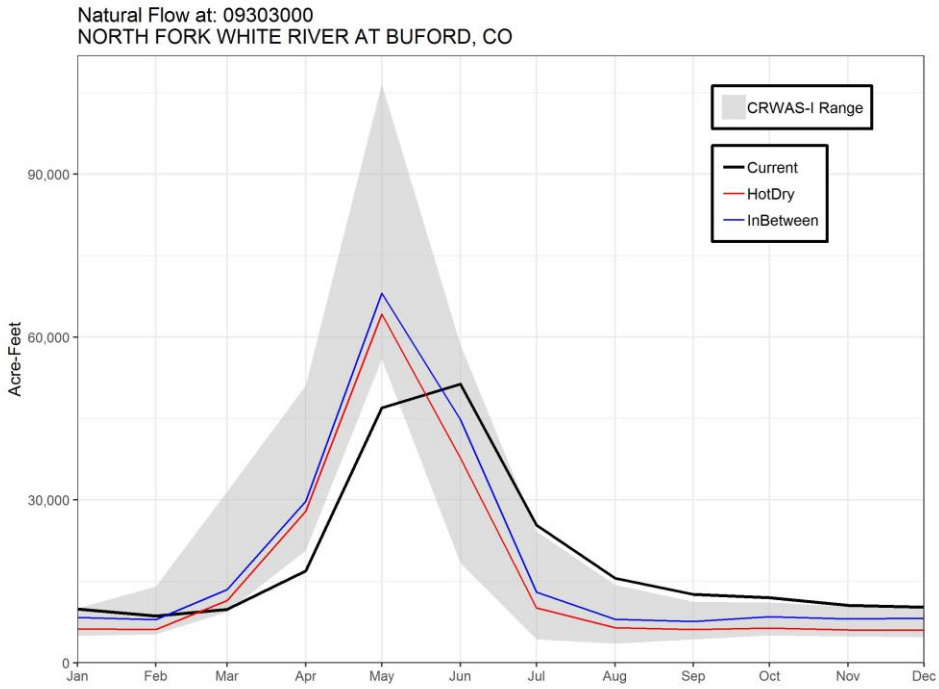


Figure A38: Gage 09304000: South Fork White River At Buford, CO

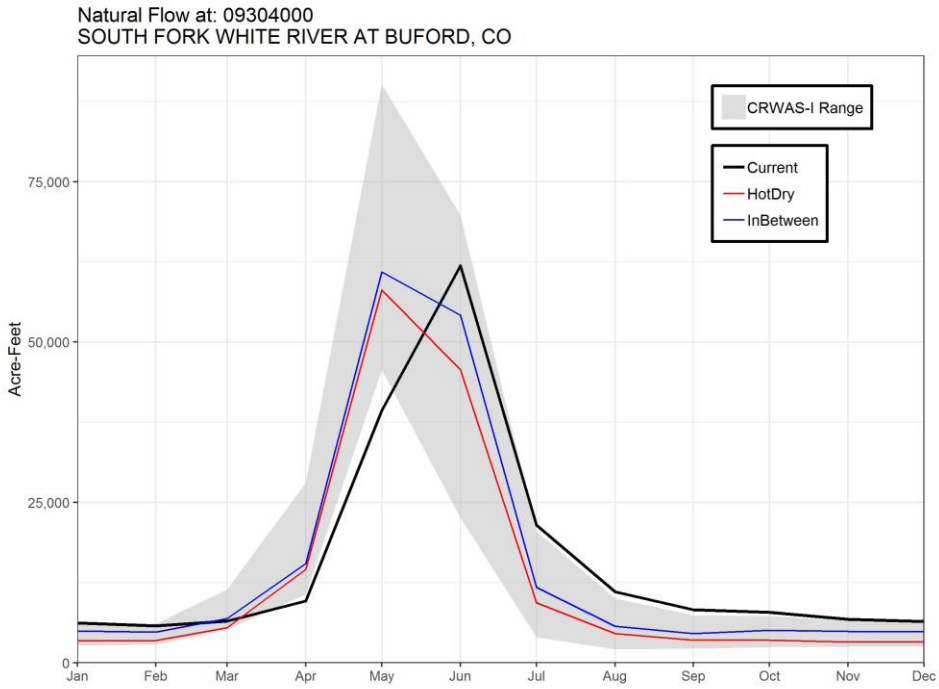


Figure A39: Gage 09304800: White River Below Meeker, CO

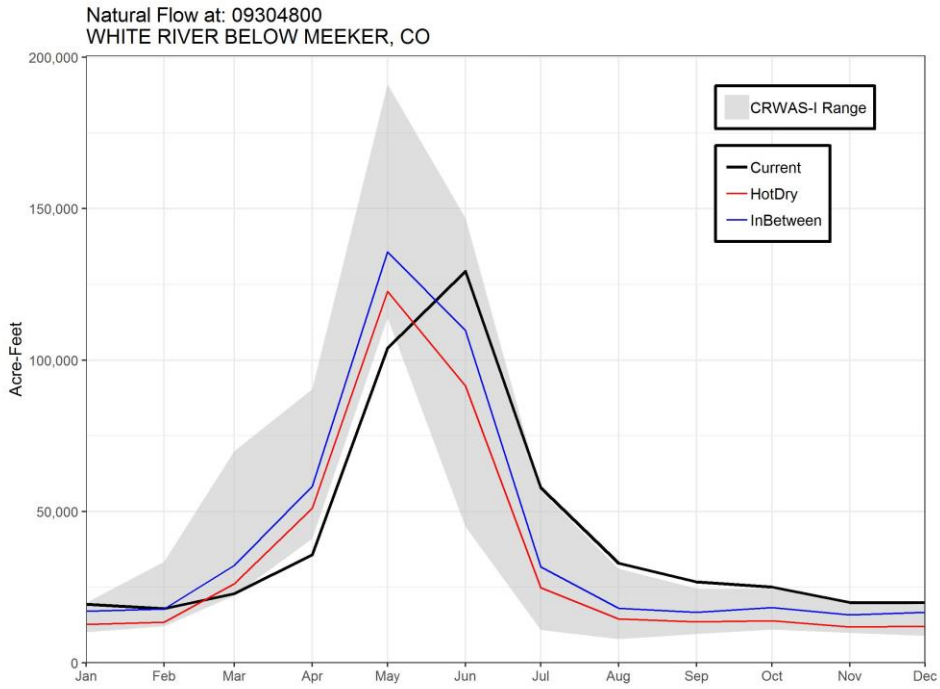


Figure A40: Gage 09306222: Piceance Creek At White River, CO

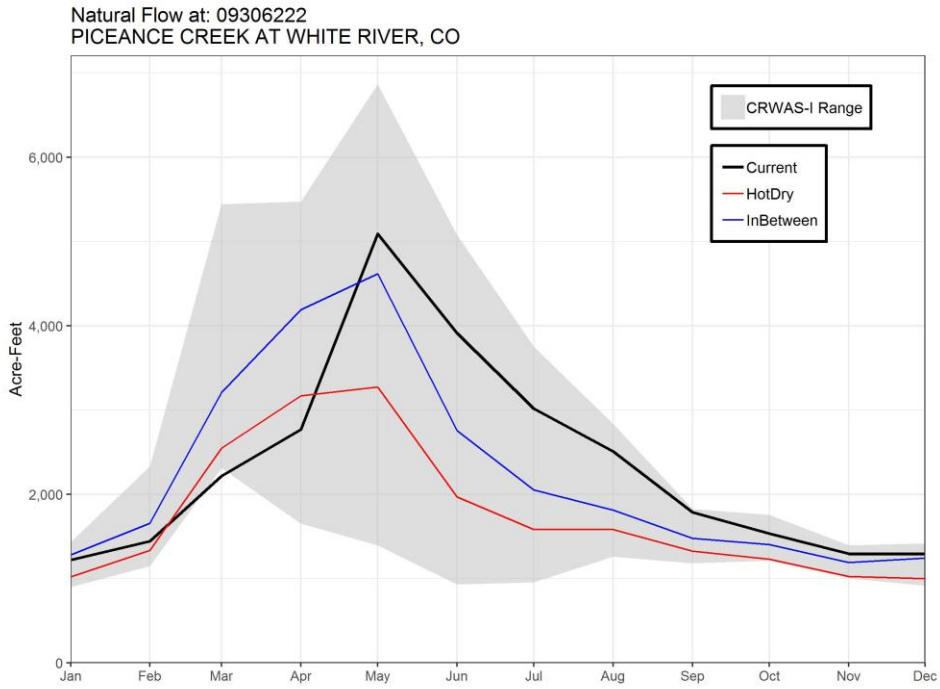
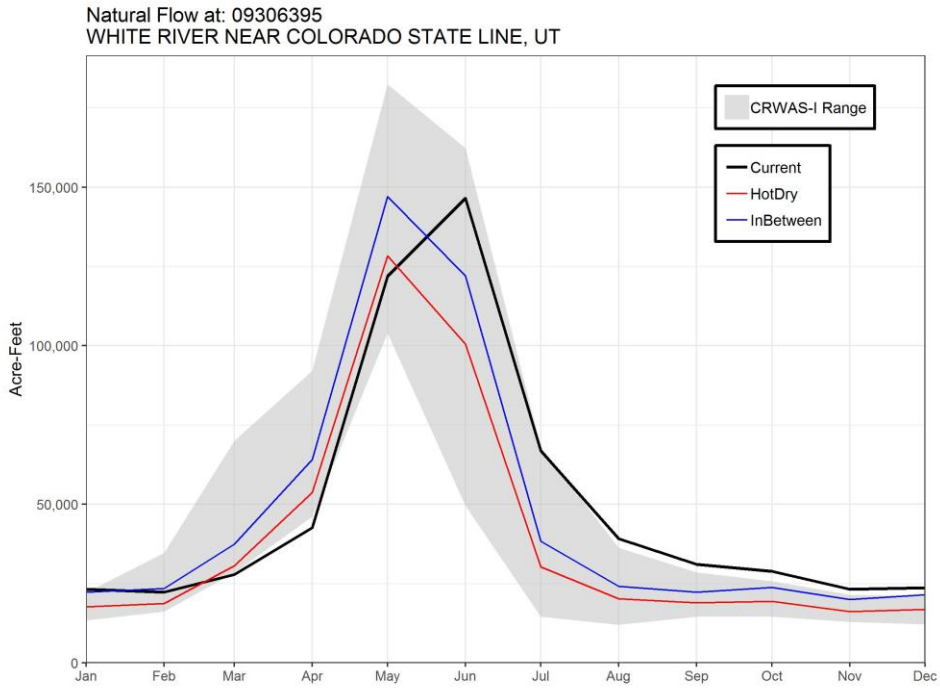


Figure A41: Gage 09306395: White River Near Colorado State Line, UT



Appendix A: Average Monthly Natural Flow

Table A1: Upper Colorado River Basin Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09019500	Colorado River Near Granby, CO															
	Current	2,780	2,752	3,522	12,221	58,678	110,438	50,851	15,494	7,148	5,351	3,167	2,832	273,738	N/A	N/A
	HotDry	2,397	2,623	3,964	18,965	102,552	84,273	22,267	7,576	3,753	3,286	2,183	2,231	253,663	-20,075	-7%
	InBetween	2,731	2,927	4,257	18,385	102,313	101,978	28,602	9,189	4,457	4,022	2,635	2,600	281,483	7,746	3%
09041500	Muddy Creek At Kremmling, CO															
	Current	527	582	1,826	8,451	36,808	29,263	9,343	1,494	1,271	820	637	411	90,866	N/A	N/A
	HotDry	574	689	2,632	12,370	40,420	15,268	5,081	1,337	1,036	725	661	457	80,494	-10,372	-11%
	InBetween	635	746	2,810	12,842	44,984	19,236	5,821	1,388	1,088	783	725	511	90,697	-169	0%
09050700	Blue River Below Dillon, CO															
	Current	4,517	4,076	4,837	9,207	43,527	80,746	40,430	18,890	10,897	8,056	5,618	4,953	234,615	N/A	N/A
	HotDry	3,658	3,545	5,015	12,885	57,405	51,891	20,408	9,760	6,009	4,811	3,706	3,689	181,327	-53,288	-23%
	InBetween	4,166	3,938	5,327	12,478	59,498	62,646	24,327	11,598	6,954	5,663	4,380	4,293	203,720	-30,896	-13%
09057500	Blue River Below Green Mountain Reservoir, CO															
	Current	7,104	6,171	8,568	18,242	73,962	135,091	73,074	33,528	18,336	12,656	8,494	7,406	400,629	N/A	N/A
	HotDry	6,009	5,757	9,401	25,068	95,957	86,904	37,035	17,964	10,851	7,926	5,967	5,911	312,078	-88,551	-22%
	InBetween	6,805	6,383	10,004	24,680	100,036	105,312	44,332	21,105	12,309	9,211	6,991	6,825	351,081	-49,548	-12%
09070000	Eagle River Below Gypsum, CO															
	Current	10,497	9,165	11,649	22,293	97,669	164,342	72,889	28,572	18,628	16,592	11,901	10,944	472,758	N/A	N/A
	HotDry	8,794	8,355	12,765	32,371	115,175	99,800	35,987	16,595	12,548	11,585	8,999	8,754	368,859	-103,899	-22%
	InBetween	10,024	9,310	13,644	32,617	123,043	121,438	43,199	18,839	13,825	13,310	10,554	10,166	416,793	-55,965	-12%
09070500	Colorado River Near Dotsero, CO															
	Current	39,727	37,968	53,480	123,698	471,660	695,398	308,973	123,118	75,316	63,997	46,627	41,158	2,070,770	N/A	N/A
	HotDry	36,180	37,109	62,690	179,197	572,566	437,048	153,873	73,036	51,392	45,857	36,414	35,270	1,706,091	-364,679	-18%
	InBetween	40,879	41,095	67,002	181,737	612,921	533,325	186,054	82,913	56,808	52,635	42,289	40,579	1,921,947	-148,822	-7%
09073400	Roaring Fork River Near Aspen, CO															
	Current	1,742	1,496	1,723	3,561	22,095	44,198	18,392	5,856	3,528	3,188	2,360	1,993	109,561	N/A	N/A
	HotDry	1,313	1,162	1,468	3,657	30,216	37,502	9,307	3,258	2,242	2,044	1,607	1,438	94,252	-15,309	-14%
	InBetween	1,492	1,303	1,617	3,840	30,998	43,068	11,339	3,780	2,553	2,411	1,897	1,669	104,938	-4,623	-4%
09085000	Roaring Fork River At Glenwood Springs, CO															
	Current	19,734	17,024	23,289	50,583	202,396	343,883	180,073	76,524	51,143	41,901	22,367	21,172	1,044,944	N/A	N/A
	HotDry	16,211	14,808	23,461	60,461	258,158	273,296	89,041	39,965	30,840	27,761	16,897	16,853	859,781	-185,163	-18%
	InBetween	18,297	16,406	25,457	63,789	269,451	311,455	107,864	46,280	35,073	32,901	20,001	19,508	957,911	-87,033	-8%

Appendix A: Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09095500	**Colorado River Near Cameo, CO**															
	Current	75,921	71,046	98,965	209,826	795,693	1,180,360	539,773	225,245	146,815	127,771	86,991	78,848	3,618,939	N/A	N/A
	HotDry	68,447	69,055	110,826	272,613	921,056	786,293	274,819	134,523	101,729	93,402	69,417	67,991	2,945,590	-673,350	-19%
	InBetween	77,151	76,481	120,092	286,793	991,367	935,284	329,070	151,564	112,364	107,311	80,483	78,085	3,318,507	-300,433	-8%
09105000	**Plateau Creek Near Cameo, CO**															
	Current	5,003	5,029	8,104	18,888	66,702	56,416	18,117	10,083	7,872	7,971	6,361	5,559	215,022	N/A	N/A
	HotDry	5,147	5,847	10,892	21,531	46,352	24,849	10,288	7,307	6,273	7,157	5,654	5,245	155,167	-59,855	-28%
	InBetween	5,928	6,527	11,854	24,010	54,763	30,142	11,312	7,607	7,064	8,968	6,930	6,292	179,743	-35,279	-16%
09163500	**Colorado River Near Colorado-Utah State Line**															
	Current	149,980	145,716	200,559	415,019	1,257,445	1,576,446	716,653	336,841	244,600	237,990	170,813	155,652	5,581,496	N/A	N/A
	HotDry	147,361	151,367	240,660	505,473	1,312,657	1,009,762	363,198	213,596	187,849	190,665	147,855	144,577	4,578,157	-1,003,338	-18%
	InBetween	167,351	170,043	264,659	545,284	1,432,642	1,200,066	433,061	237,762	210,743	224,312	172,297	168,106	5,183,938	-397,557	-7%

Table A2: Gunnison River Basin Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09110000	**Taylor River At Almont, CO**															
	Current	6,897	6,238	7,407	14,211	48,801	70,773	33,763	18,157	12,535	11,736	8,373	7,155	244,961	N/A	N/A
	HotDry	5,307	4,859	6,696	19,720	62,099	47,514	14,764	11,115	9,120	8,589	6,393	5,502	200,092	-44,869	-18%
	InBetween	5,941	5,435	7,191	19,891	65,612	56,941	18,252	12,245	10,063	9,670	7,112	6,179	222,799	-22,162	-9%
09112500	**East River At Almont, CO**															
	Current	2,960	2,730	3,943	15,374	66,774	89,668	41,182	15,157	7,159	6,516	3,660	3,259	256,818	N/A	N/A
	HotDry	2,412	2,283	3,984	22,468	99,958	70,239	18,980	7,583	4,400	4,390	2,719	2,525	239,325	-17,492	-7%
	InBetween	2,747	2,556	4,254	22,409	102,800	80,889	23,437	8,732	5,055	5,288	3,241	2,954	261,584	4,766	2%
09114500	**Gunnison River Near Gunnison, CO**															
	Current	10,702	9,946	13,289	36,224	136,741	187,299	89,832	37,686	20,407	19,629	11,840	11,199	581,546	N/A	N/A
	HotDry	8,936	8,249	13,214	53,106	182,239	133,757	40,171	21,752	13,444	14,356	9,286	9,103	502,657	-78,888	-14%
	InBetween	10,074	9,227	14,147	53,370	190,982	157,704	49,596	24,308	15,111	16,579	10,577	10,384	556,666	-24,880	-4%
09119000	**Tomichi Creek At Gunnison, CO**															
	Current	2,821	3,001	6,431	14,959	44,765	62,825	29,435	9,163	5,539	5,341	3,073	2,840	189,029	N/A	N/A
	HotDry	2,392	2,616	6,754	16,236	39,794	35,144	17,540	6,257	4,334	4,392	2,564	2,378	139,148	-49,881	-26%
	InBetween	2,731	2,977	7,388	17,646	45,966	43,172	20,390	6,901	4,954	5,117	2,898	2,724	161,348	-27,681	-15%
09128000	**Gunnison River Below Gunnison Tunnel, CO**															
	Current	25,436	24,928	40,844	113,110	345,610	426,928	194,175	89,429	56,422	49,327	27,484	27,915	1,413,701	N/A	N/A
	HotDry	22,777	23,116	44,201	134,138	374,917	263,779	90,930	58,853	41,337	36,617	23,012	24,610	1,128,248	-285,452	-20%
	InBetween	25,977	26,097	48,245	143,522	411,103	312,862	108,707	64,615	46,719	43,324	26,684	28,568	1,274,916	-138,784	-10%
09136200	**Gunnison River Near Lazear, CO**															
	Current	34,392	31,937	53,249	177,560	520,149	549,491	230,095	100,190	65,158	61,553	38,273	35,324	1,886,499	N/A	N/A
	HotDry	31,068	30,429	59,382	211,786	543,229	336,354	108,162	68,510	49,493	46,968	33,044	32,363	1,536,328	-350,171	-19%
	InBetween	35,272	34,306	65,266	228,560	597,486	399,700	128,678	74,938	55,939	55,535	38,315	37,682	1,735,108	-151,390	-8%
09149500	**Uncompahgre River At Delta, CO**															
	Current	7,966	7,466	9,183	18,334	53,825	73,375	46,924	27,516	20,279	17,591	10,828	8,999	301,047	N/A	N/A
	HotDry	8,276	8,063	9,993	17,984	45,952	40,593	25,826	19,714	17,051	14,499	9,836	8,938	224,700	-76,347	-25%
	InBetween	9,340	9,319	11,524	20,662	52,165	48,054	29,460	21,576	19,720	17,622	11,378	10,540	258,955	-42,092	-14%
09152500	**Gunnison River Near Grand Junction, CO**															
	Current	52,526	52,135	78,829	225,343	639,079	653,886	287,660	136,783	96,218	90,438	59,997	57,286	2,417,089	N/A	N/A
	HotDry	50,774	52,498	94,823	254,970	617,656	393,528	140,772	92,127	73,854	70,901	53,725	53,083	1,931,383	-485,707	-20%
	InBetween	57,941	59,926	106,273	282,201	687,036	467,455	166,248	100,940	84,272	85,261	62,606	62,469	2,202,351	-214,739	-9%

Table A3: San Juan/Dolores River Basin Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09171100	Dolores River Near Bedrock															
	Current	3,979	9,921	20,130	92,716	146,665	95,271	31,742	18,003	12,273	10,878	4,945	4,539	447,965	N/A	N/A
	HotDry	3,788	10,733	21,244	80,183	97,787	37,545	10,426	10,062	8,078	6,154	3,766	4,223	290,684	-157,281	-35%
	InBetween	4,042	12,951	26,735	99,387	119,678	48,100	12,386	10,359	9,608	8,251	4,410	5,191	357,002	-90,964	-20%
09175500	San Miguel River At Naturita															
	Current	4,785	5,188	10,032	44,077	74,711	65,785	34,350	17,868	11,855	10,321	6,262	5,692	289,248	N/A	N/A
	HotDry	4,253	5,075	11,051	44,729	55,413	33,173	13,193	8,871	7,001	5,897	4,449	4,796	196,016	-93,232	-32%
	InBetween	4,908	6,021	13,207	52,160	64,219	39,535	15,469	9,533	8,178	7,667	5,360	5,880	229,962	-59,286	-20%
09346400	San Juan River Near Carracas, CO															
	Current	8,747	10,002	31,996	79,925	143,518	138,860	52,910	27,462	20,021	19,697	11,050	9,038	549,986	N/A	N/A
	HotDry	8,324	11,774	42,890	86,674	134,801	71,632	15,446	12,323	12,017	11,053	8,309	7,522	418,155	-131,831	-24%
	InBetween	9,806	13,264	48,911	95,864	146,773	85,193	19,216	13,557	13,192	14,536	11,439	9,369	475,846	-74,141	-13%
09349800	Piedra River Near Arboles, CO															
	Current	4,092	4,560	15,900	53,664	83,809	66,773	24,310	14,939	12,294	11,413	6,259	4,751	301,153	N/A	N/A
	HotDry	3,370	4,866	19,966	54,034	69,969	35,312	7,538	6,700	7,124	5,674	4,051	3,285	219,575	-81,579	-27%
	InBetween	4,239	5,792	23,530	62,492	78,725	41,774	9,361	7,392	7,991	7,794	5,937	4,450	256,797	-44,356	-15%
09354500	Los Pinos River At La Boca, CO															
	Current	4,955	5,737	14,406	32,559	79,486	85,099	38,551	22,142	19,073	15,917	6,855	5,488	328,529	N/A	N/A
	HotDry	4,376	6,980	18,869	35,366	80,601	50,337	13,018	8,128	7,611	7,349	4,553	4,019	238,533	-89,997	-27%
	InBetween	5,296	7,777	21,494	38,808	86,143	57,944	15,987	9,496	9,338	10,818	6,628	5,265	272,030	-56,499	-17%
09363200	Florida River At Bondad, CO															
	Current	1,556	1,844	4,665	9,411	23,258	24,486	8,917	6,523	5,311	3,680	2,089	1,631	92,822	N/A	N/A
	HotDry	1,417	2,604	7,048	9,549	19,594	12,045	3,104	3,185	3,029	2,060	1,436	1,245	65,606	-27,216	-29%
	InBetween	1,735	2,957	8,131	10,833	21,942	14,275	3,709	3,429	3,348	2,814	2,063	1,653	76,063	-16,758	-18%
09363500	Animas River Near Cedar Hill, NM															
	Current	12,201	11,866	24,603	67,628	181,378	204,380	88,433	45,839	37,548	32,190	17,895	13,320	733,084	N/A	N/A
	HotDry	10,146	12,215	31,222	78,913	190,364	113,589	29,596	18,253	16,118	15,540	11,281	9,596	531,064	-202,020	-28%
	InBetween	12,558	14,283	35,776	85,912	205,627	132,462	35,972	20,883	19,453	22,569	15,945	12,620	607,811	-125,273	-17%
09365500	La Plata River At Hesperus, CO															
	Current	420	403	1,078	4,984	11,066	8,918	2,908	1,487	1,192	1,018	628	502	34,383	N/A	N/A
	HotDry	278	325	1,302	6,066	11,425	4,971	731	564	618	567	414	324	27,270	-7,112	-21%
	InBetween	387	424	1,472	6,481	12,411	5,936	947	625	718	830	573	468	30,921	-3,462	-10%

Appendix A: Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09366500	La Plata River At Colorado-New Mexico State Line															
	Current	563	769	2,489	8,228	12,856	9,208	3,431	1,557	1,100	1,183	678	597	42,364	N/A	N/A
	HotDry	424	756	2,616	7,412	10,573	5,278	1,155	887	748	707	465	409	31,012	-11,352	-27%
	InBetween	517	906	3,363	9,038	12,093	6,258	1,377	933	806	898	596	517	36,802	-5,562	-13%
09371000	Mancos River Near Towaoc, CO															
	Current	938	1,478	3,823	9,373	16,434	11,156	5,398	3,691	2,886	2,119	990	789	58,708	N/A	N/A
	HotDry	970	2,040	4,114	7,454	10,534	5,402	2,079	2,273	2,154	1,434	845	734	39,657	-19,051	-32%
	InBetween	1,096	2,391	5,286	9,399	12,570	6,437	2,331	2,332	2,312	1,699	982	858	47,220	-11,488	-20%

Table A4: Yampa River Basin Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09237500	Yampa River Below Stagecoach Reservoir, CO															
	Current	3,045	2,623	4,594	9,710	16,598	19,467	11,685	6,428	3,873	3,951	3,265	2,966	87,846	N/A	N/A
	HotDry	2,797	2,643	6,715	15,375	18,062	14,363	3,921	3,649	3,034	3,268	2,940	2,590	78,825	-9,021	-10%
	InBetween	3,073	2,900	7,547	16,522	19,758	16,952	5,386	4,027	3,580	3,842	3,297	2,979	89,256	1,410	2%
09241000	Elk River At Clark, CO															
	Current	3,657	3,175	5,571	19,448	75,309	84,438	30,345	8,588	5,349	5,331	4,277	4,203	248,261	N/A	N/A
	HotDry	2,993	2,753	9,661	34,692	103,274	56,891	10,191	2,743	3,636	3,517	3,167	3,217	234,699	-13,562	-5%
	InBetween	3,639	3,276	10,244	33,376	105,065	68,200	14,762	3,399	4,344	4,612	4,186	4,147	257,019	8,759	4%
09245000	Elkhead Creek Near Elkhead, CO															
	Current	326	303	831	7,725	24,913	7,197	848	301	233	389	416	355	43,505	N/A	N/A
	HotDry	367	400	1,795	10,956	20,945	2,668	444	249	199	362	430	378	38,740	-4,765	-11%
	InBetween	409	453	1,919	11,479	23,887	3,683	492	253	227	404	459	419	43,567	62	0%
09249750	Williams Fork At Mouth, Near Hamilton, CO															
	Current	3,192	2,929	5,418	20,241	62,669	44,407	13,363	5,312	3,485	3,896	3,304	3,290	170,529	N/A	N/A
	HotDry	2,916	3,237	8,610	31,518	61,986	28,432	5,123	2,711	2,580	3,118	2,752	2,890	154,495	-16,034	-9%
	InBetween	3,422	3,901	10,158	35,728	70,161	34,292	6,837	3,088	3,011	3,712	3,219	3,512	179,431	8,903	5%
09251000	Yampa River Near Maybell, CO															
	Current	16,882	18,750	46,796	163,654	410,285	376,256	117,251	33,986	19,845	23,234	19,492	17,647	1,256,322	N/A	N/A
	HotDry	17,000	22,959	78,627	252,448	447,605	242,848	40,643	18,235	15,014	18,559	17,344	16,125	1,175,819	-80,504	-6%
	InBetween	19,159	26,706	91,094	275,488	487,099	295,131	56,012	20,297	17,496	22,421	20,305	19,196	1,337,085	80,763	6%
09260000	Little Snake River Near Lily, CO															
	Current	5,101	6,451	23,758	63,846	179,248	143,242	33,678	8,424	4,493	6,541	5,908	5,014	482,251	N/A	N/A
	HotDry	5,573	8,496	40,065	91,722	164,391	71,327	16,555	6,331	3,427	5,114	5,466	4,903	418,910	-63,340	-13%
	InBetween	6,523	10,272	45,970	99,704	187,051	92,590	20,898	7,099	4,199	6,246	6,377	6,015	487,618	5,368	1%
09260050	Yampa River At Deerlodge Park, CO															
	Current	21,039	23,845	66,505	218,626	555,758	515,610	156,390	42,394	23,037	28,629	24,731	21,807	1,687,571	N/A	N/A
	HotDry	21,368	29,439	107,716	332,907	575,933	316,166	59,246	25,478	17,976	23,594	22,654	19,700	1,536,591	-150,981	-9%
	InBetween	24,523	34,908	124,815	363,521	636,801	390,189	80,013	28,588	21,290	28,636	26,539	23,800	1,765,380	77,809	5%

Table A5: White River Basin Average Monthly Natural Flow

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09303000	North Fork White River At Buford, CO															
	Current	9,920	8,652	9,876	16,956	46,993	51,379	25,339	15,601	12,628	12,002	10,600	10,243	229,391	N/A	N/A
	HotDry	6,256	6,116	11,484	27,919	64,245	37,736	10,092	6,470	6,142	6,437	6,037	6,016	193,445	-35,946	-16%
	InBetween	8,377	7,960	13,486	29,767	68,054	44,784	13,041	8,039	7,639	8,485	8,078	8,216	224,352	-5,039	-2%
09304000	South Fork White River At Buford, CO															
	Current	6,217	5,779	6,519	9,672	39,319	61,896	21,476	11,053	8,297	7,902	6,770	6,458	190,512	N/A	N/A
	HotDry	3,448	3,458	5,475	14,544	58,122	45,704	9,387	4,543	3,528	3,530	3,267	3,302	156,810	-33,702	-18%
	InBetween	4,938	4,789	6,884	15,448	60,932	54,215	11,756	5,726	4,546	5,104	4,878	4,868	182,501	-8,011	-4%
09304800	White River Below Meeker, CO															
	Current	19,364	17,851	22,853	35,647	103,916	129,351	57,873	32,912	26,706	25,075	19,983	19,817	509,342	N/A	N/A
	HotDry	12,712	13,421	26,151	51,062	122,716	91,462	24,816	14,546	13,532	13,874	11,816	12,141	405,237	-104,105	-20%
	InBetween	17,099	17,766	32,193	58,342	135,760	109,739	31,688	18,001	16,714	18,304	15,844	16,635	484,629	-24,713	-5%
09306222	Piceance Creek At White River, CO															
	Current	1,222	1,443	2,218	2,769	5,093	3,912	3,016	2,510	1,788	1,535	1,297	1,293	27,978	N/A	N/A
	HotDry	1,020	1,334	2,549	3,168	3,275	1,969	1,583	1,584	1,325	1,228	1,024	998	20,952	-7,026	-25%
	InBetween	1,281	1,657	3,207	4,192	4,620	2,756	2,051	1,815	1,480	1,403	1,190	1,244	26,721	-1,257	-4%
09306395	White River Near Colorado State Line, UT															
	Current	23,242	22,291	27,811	42,665	121,857	146,527	66,839	39,160	31,042	28,821	23,233	23,679	594,803	N/A	N/A
	HotDry	17,630	18,710	30,552	53,724	128,366	100,489	30,293	20,224	18,968	19,384	16,125	16,860	468,524	-126,278	-21%
	InBetween	22,241	23,462	37,378	64,122	147,035	122,021	38,381	24,083	22,332	23,776	19,919	21,484	562,666	-32,137	-5%

Appendix B. Average Monthly Modeled Streamflow

Appendix B Contents

Appendix B: Average Monthly Modeled Streamflow

Appendix B: Average Monthly Modeled Streamflow

Figure B1: Gage 09019500: Colorado River Near Granby, CO

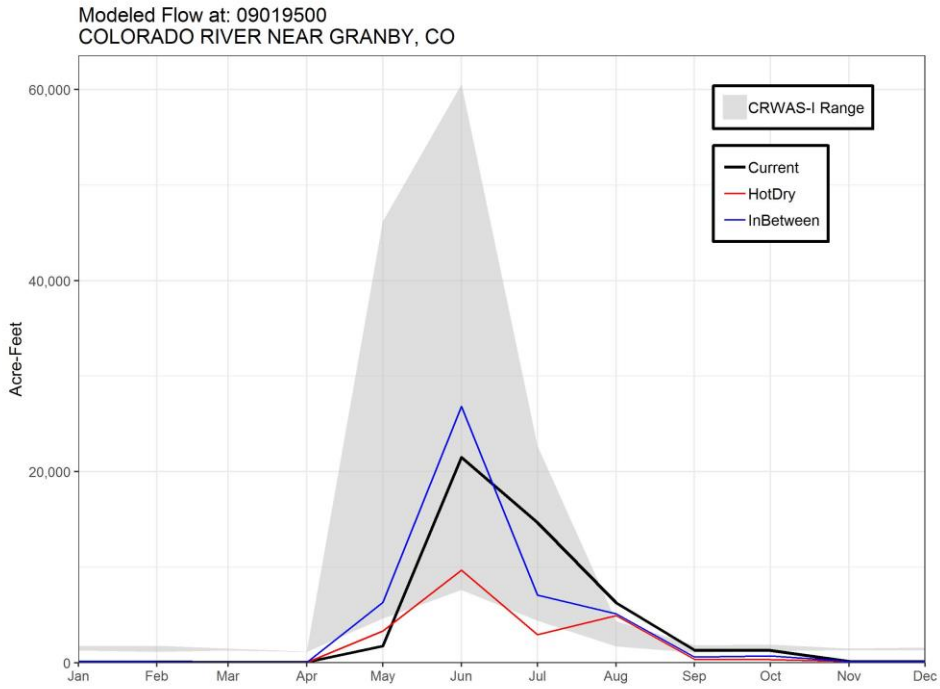


Figure B2: Gage 09041500: Muddy Creek At Kremmling, CO

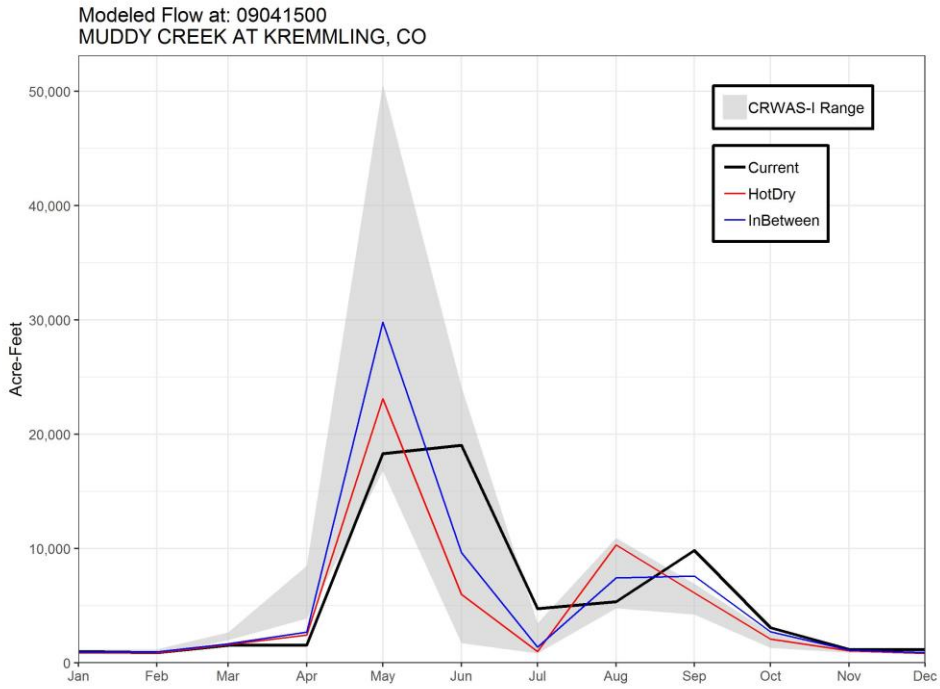


Figure B3: Gage 09050700: Blue River Below Dillon, CO

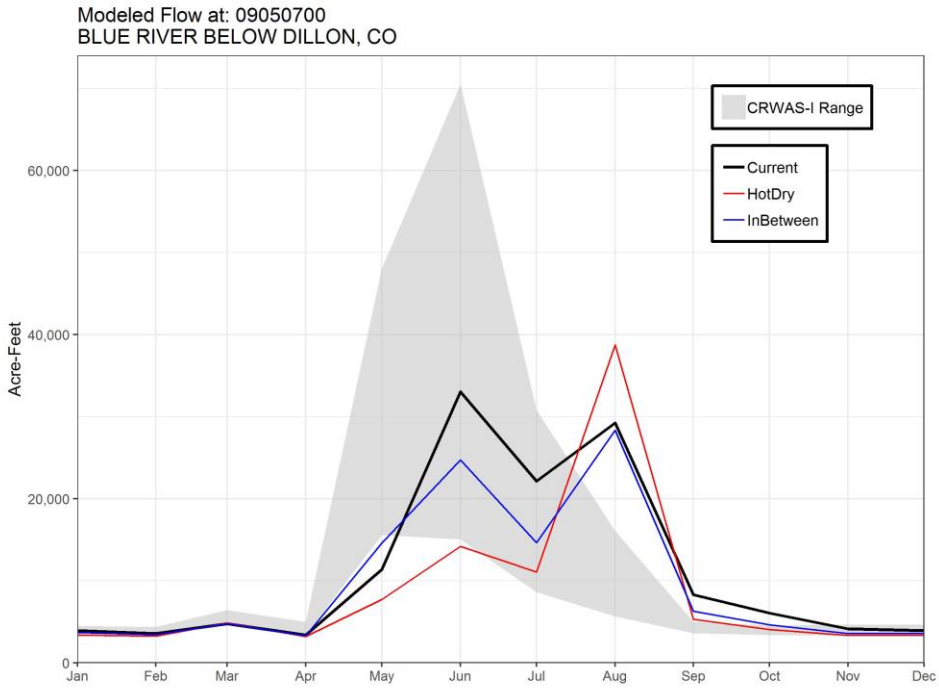


Figure B4: Gage 09057500: Blue River Below Green Mountain Reservoir, CO

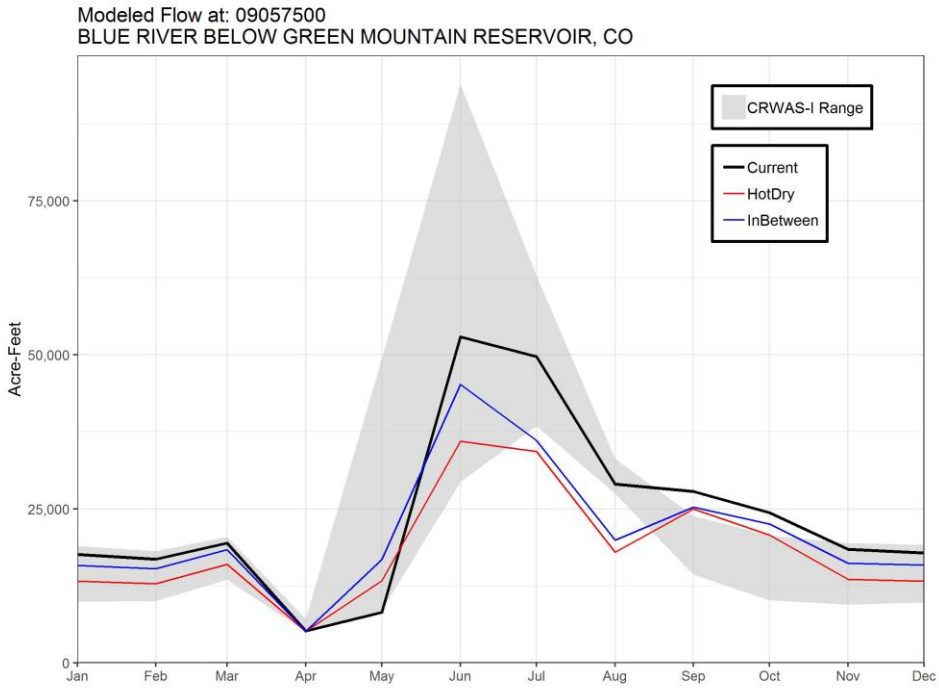


Figure B5: Gage 09070000: Eagle River Below Gypsum, CO

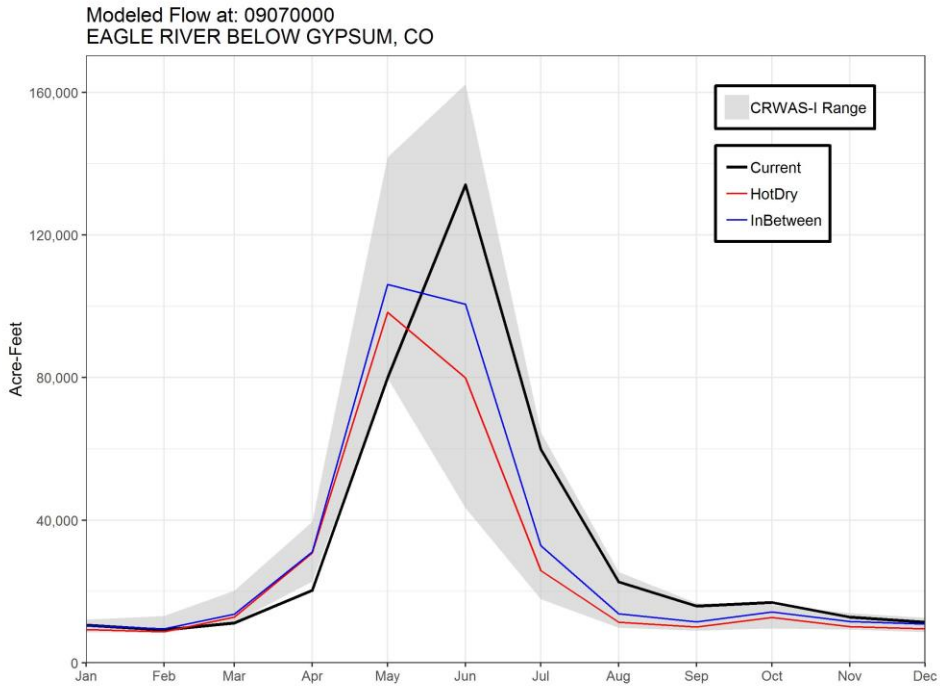


Figure B6: Gage 09070500: Colorado River Near Dotsero, CO

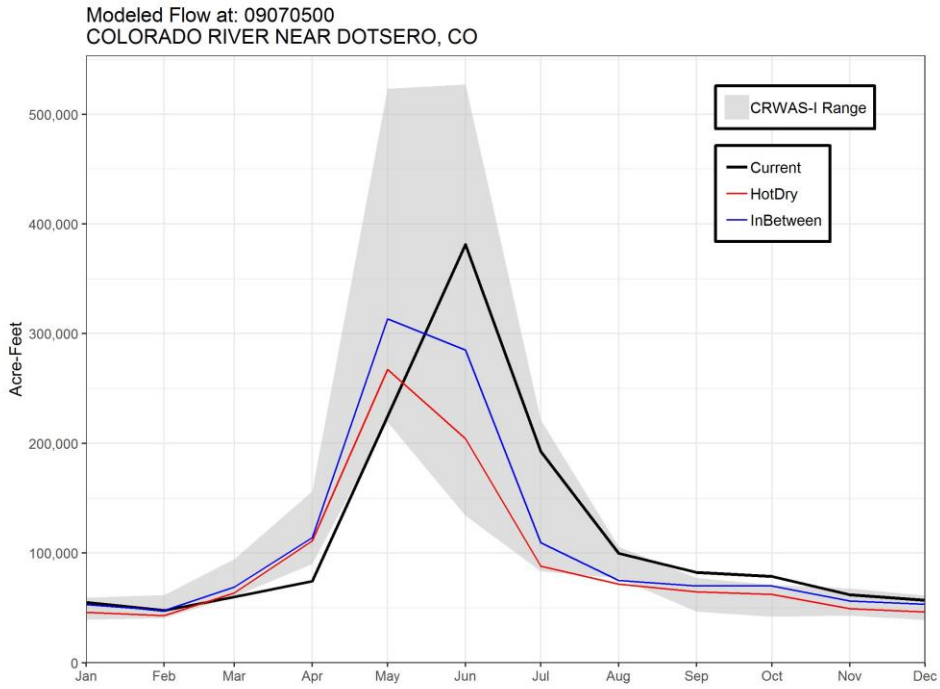


Figure B7: Gage 09073400: Roaring Fork River Near Aspen, CO

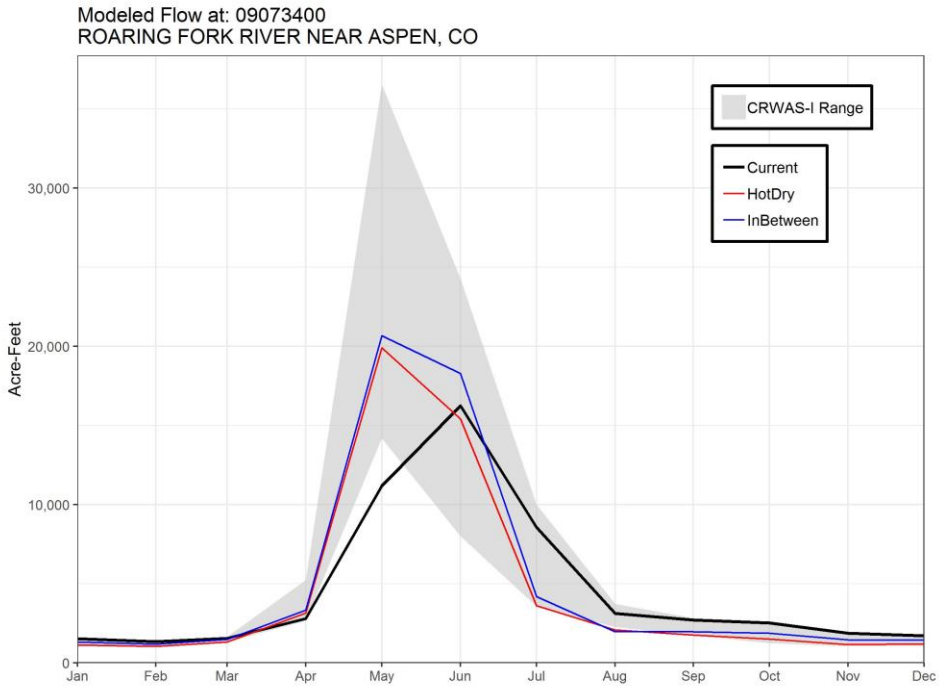


Figure B8: Gage 09085000: Roaring Fork River At Glenwood Springs, CO

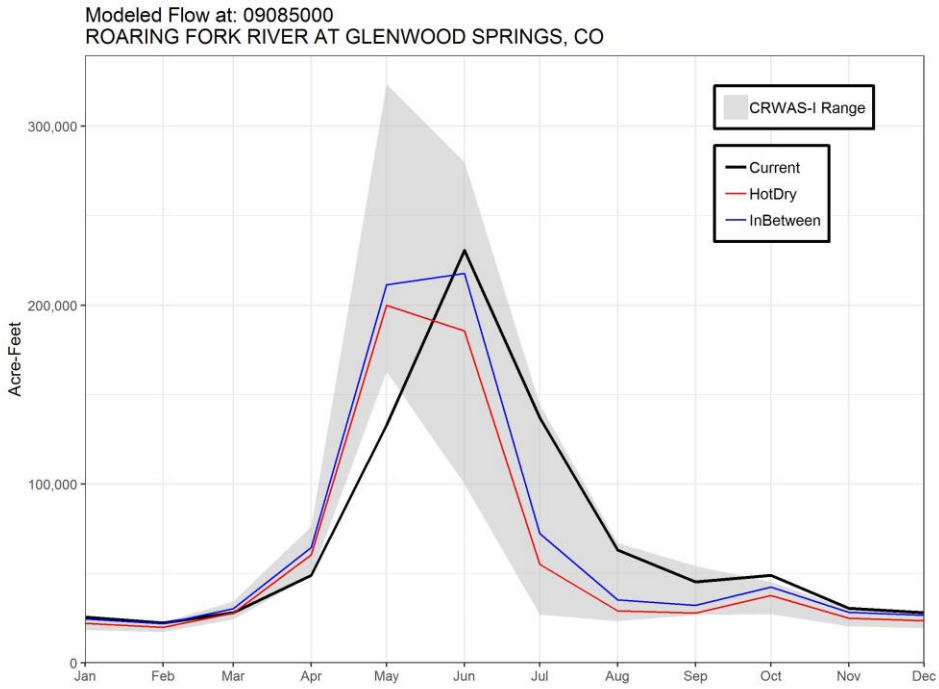


Figure B9: Gage 09095500: Colorado River Near Cameo, CO

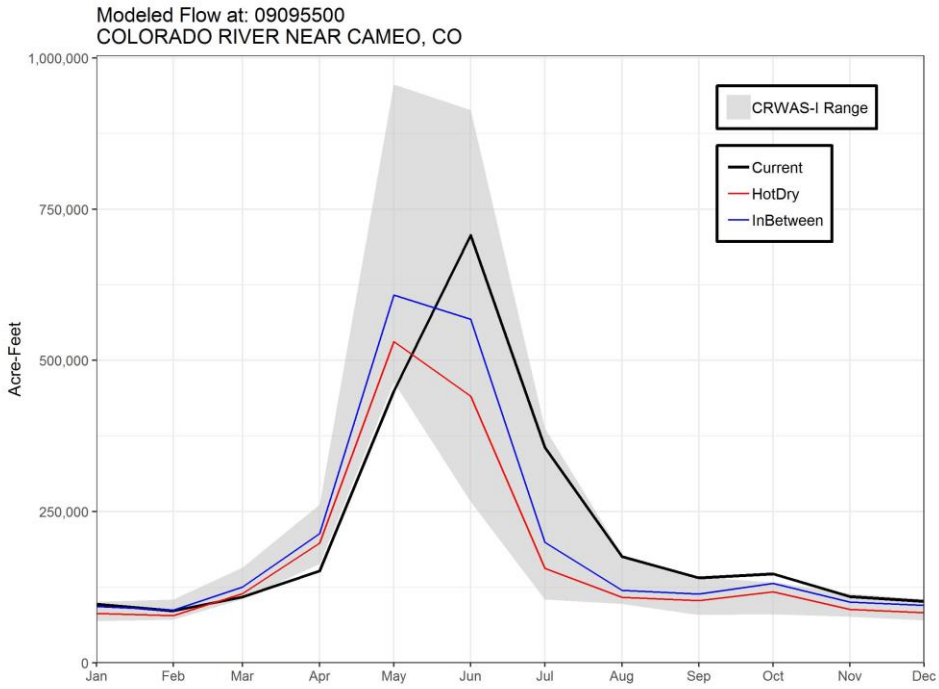


Figure B10: Gage 09105000: Plateau Creek Near Cameo, CO

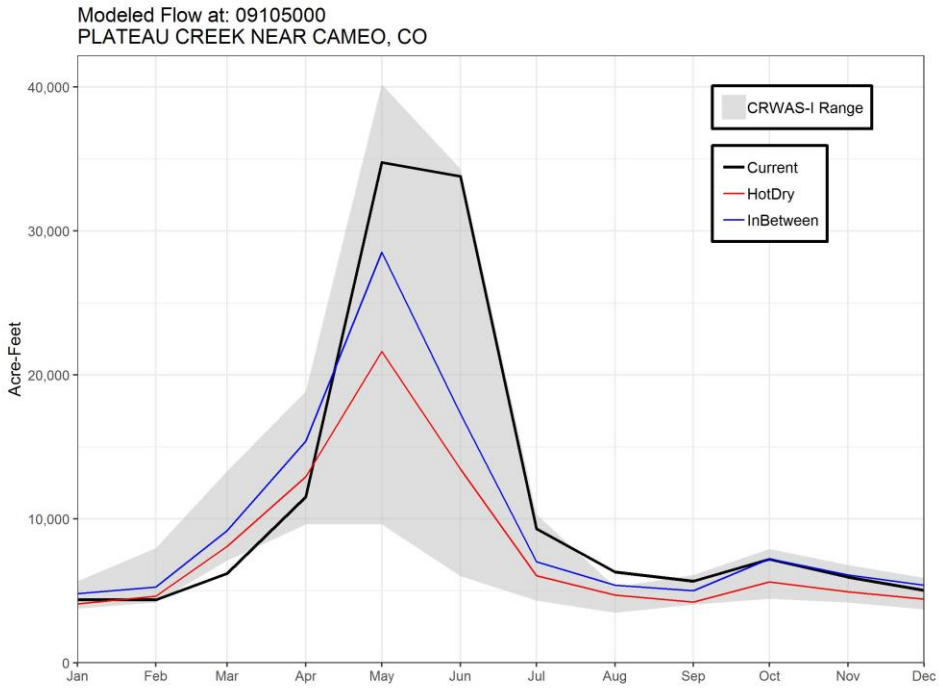


Figure B11: Gage 09163500: Colorado River Near Colorado-Utah State Line

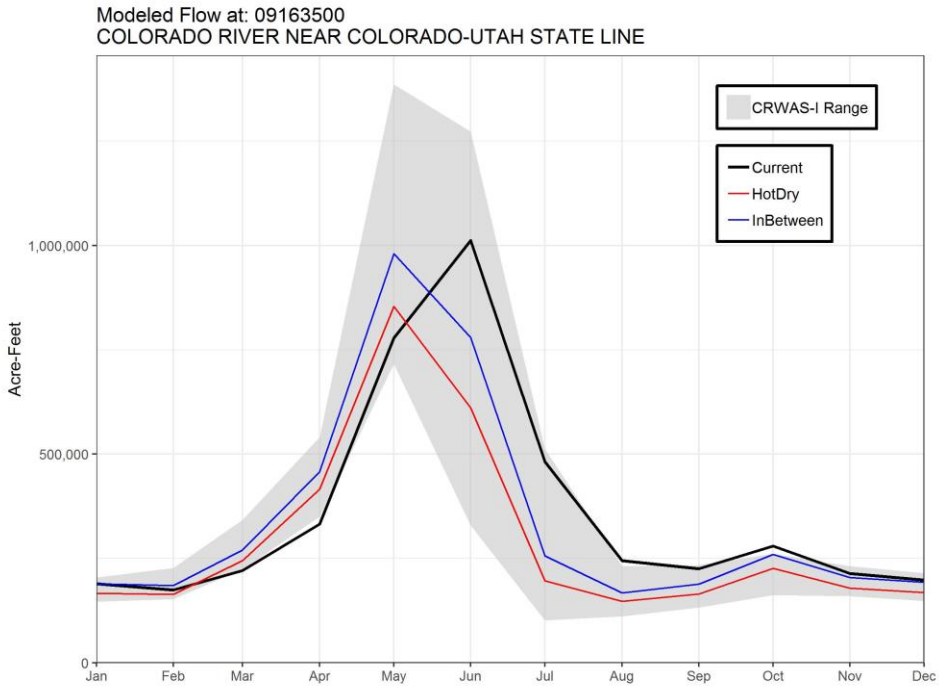


Figure B12: Gage 09110000: Taylor River At Almont, CO

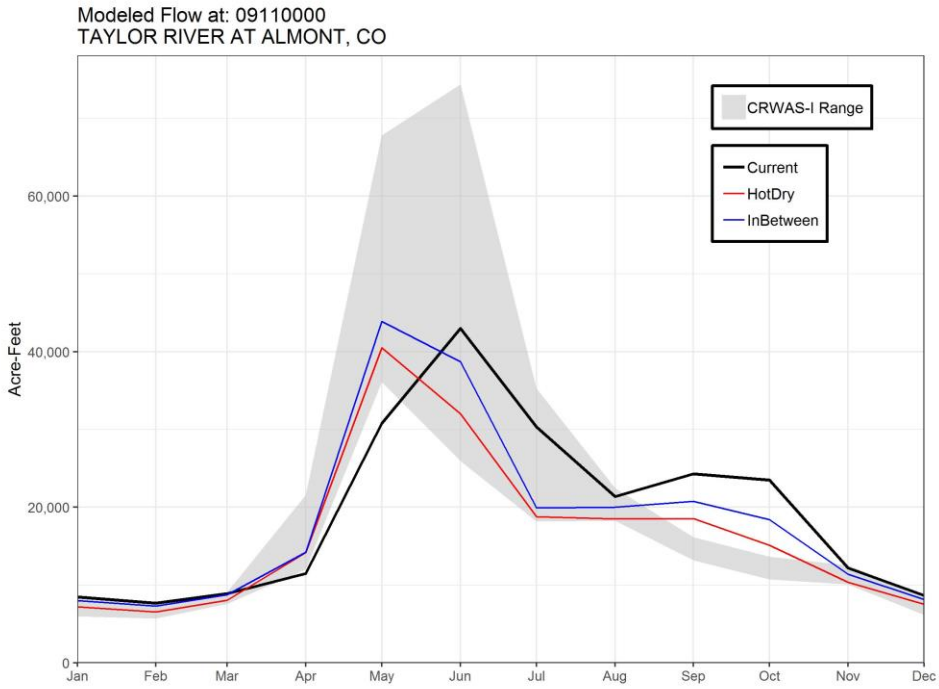


Figure B13: Gage 09112500: East River At Almont, CO

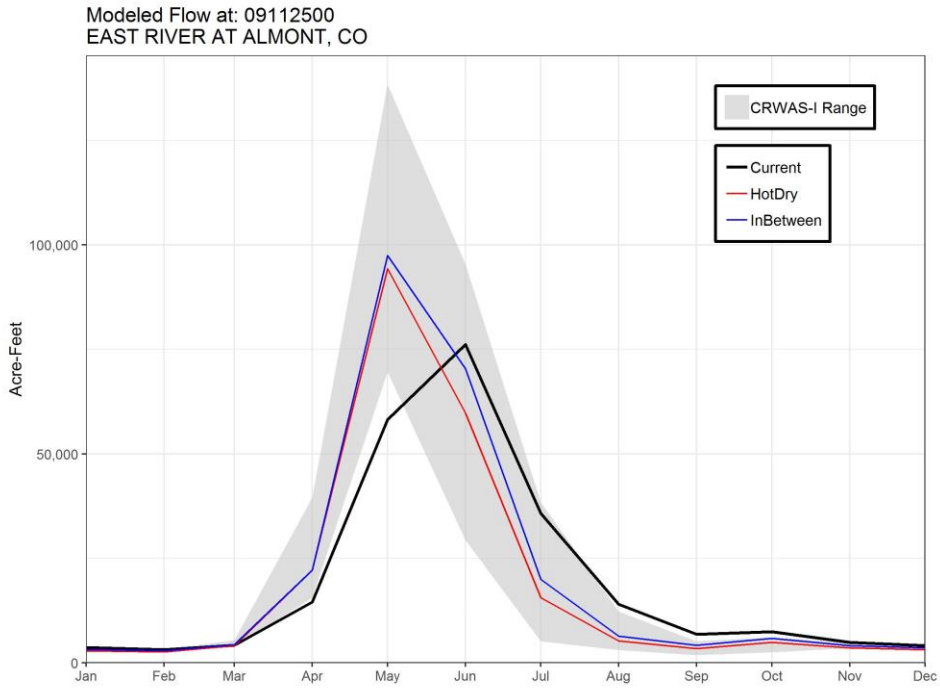


Figure B14: Gage 09114500: Gunnison River Near Gunnison, CO

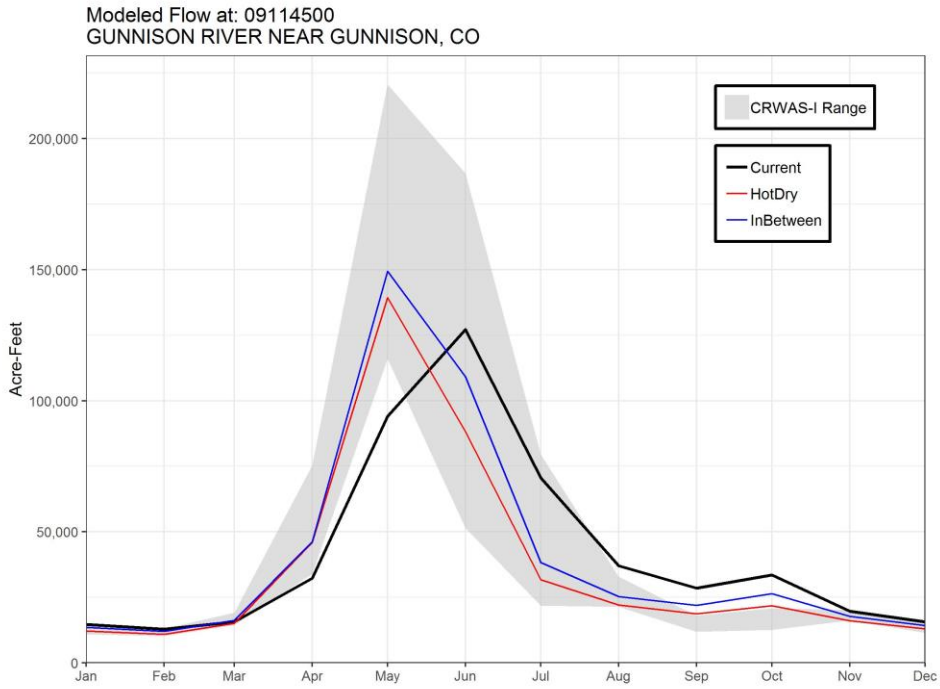


Figure B15: Gage 09119000: Tomichi Creek At Gunnison, CO

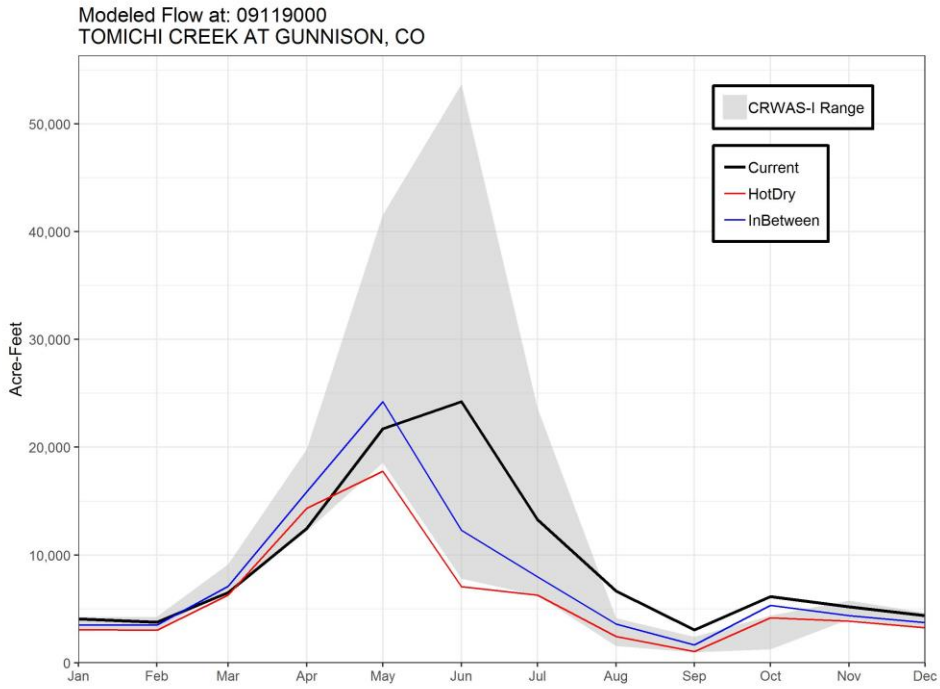


Figure B16: Gage 09128000: Gunnison River Below Gunnison Tunnel, CO

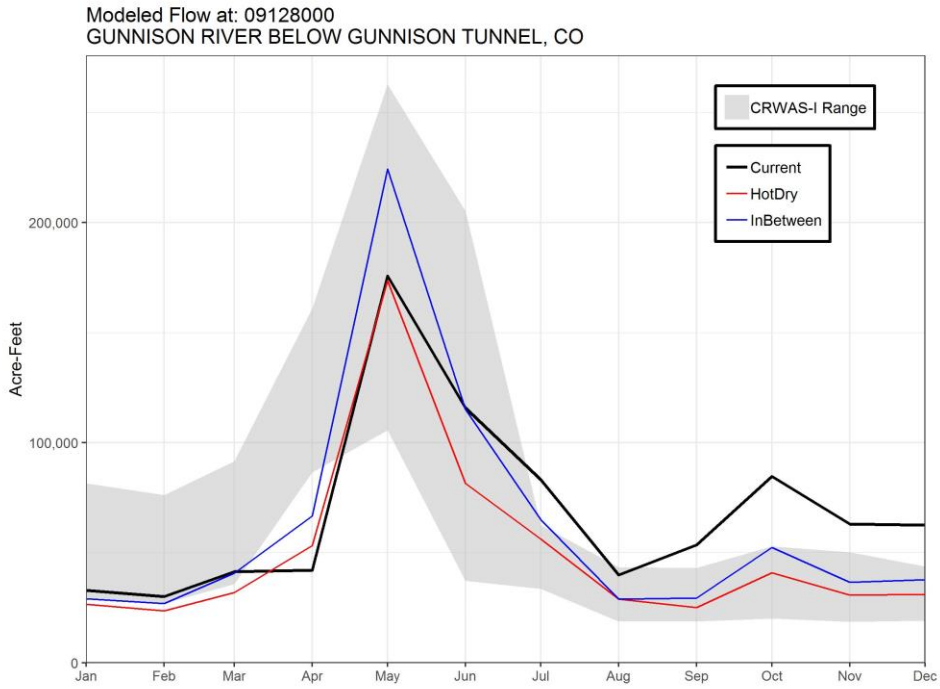


Figure B17: Gage 09136200: Gunnison River Near Lazear, CO

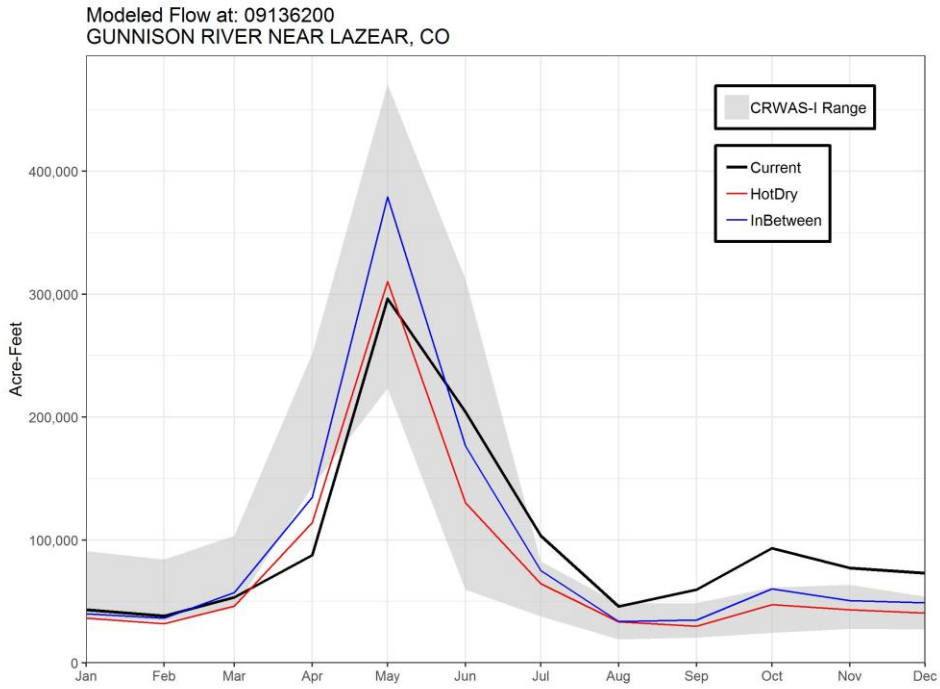


Figure B18: Gage 09149500: Uncompahgre River At Delta, CO

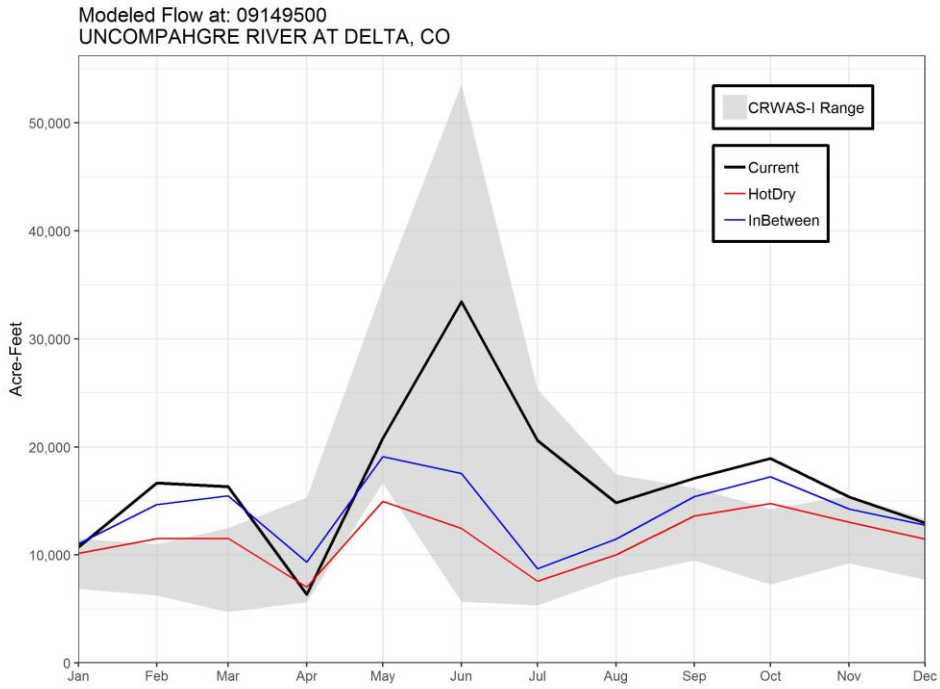


Figure B19: Gage 09152500: Gunnison River Near Grand Junction, CO

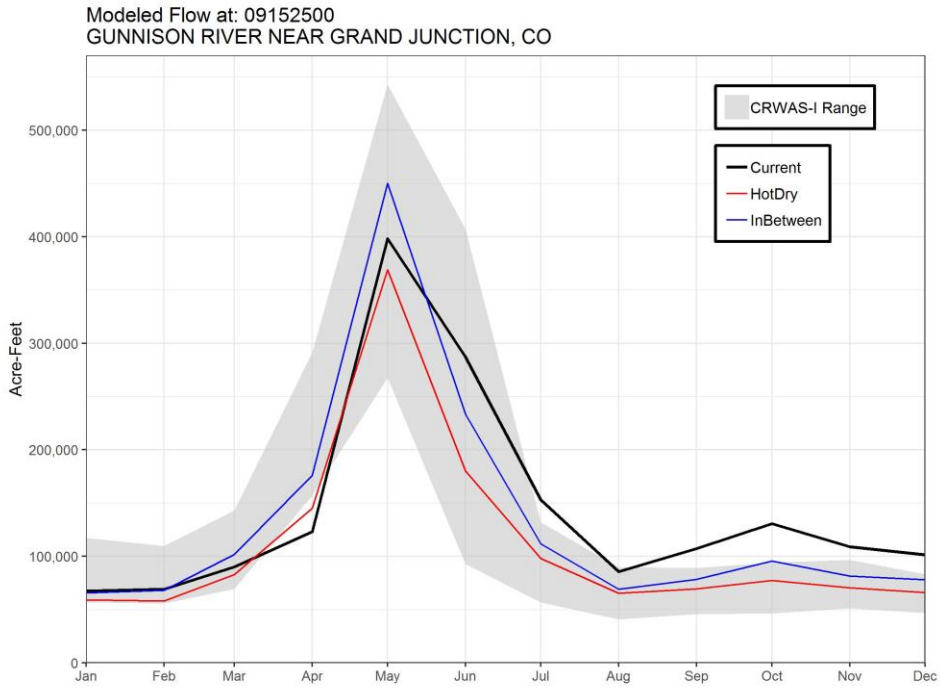


Figure B20: Gage 09171100: Dolores River Near Bedrock

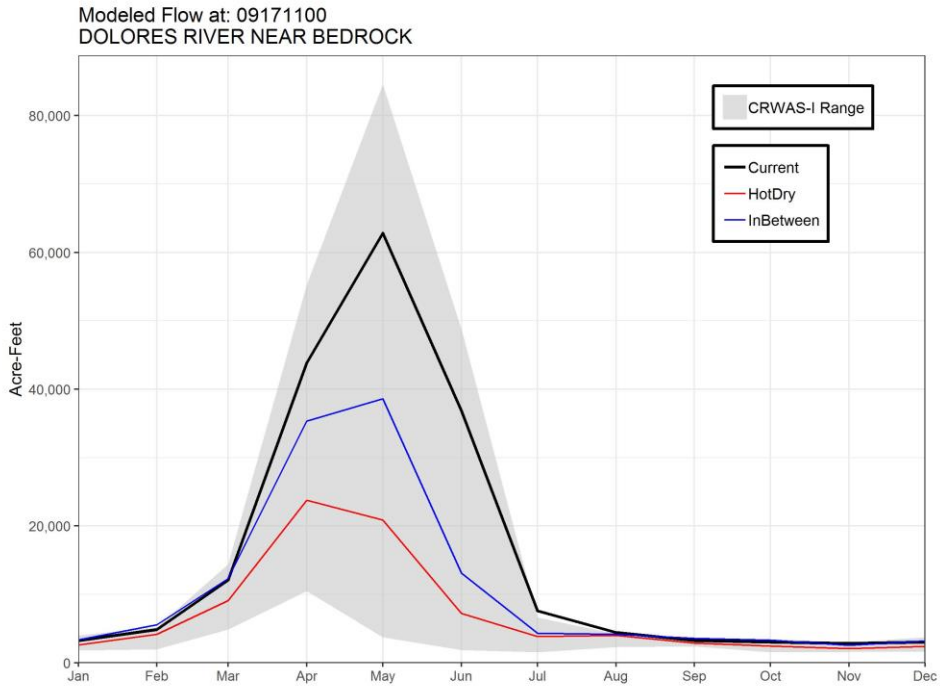


Figure B21: Gage 09175500: San Miguel River At Naturita

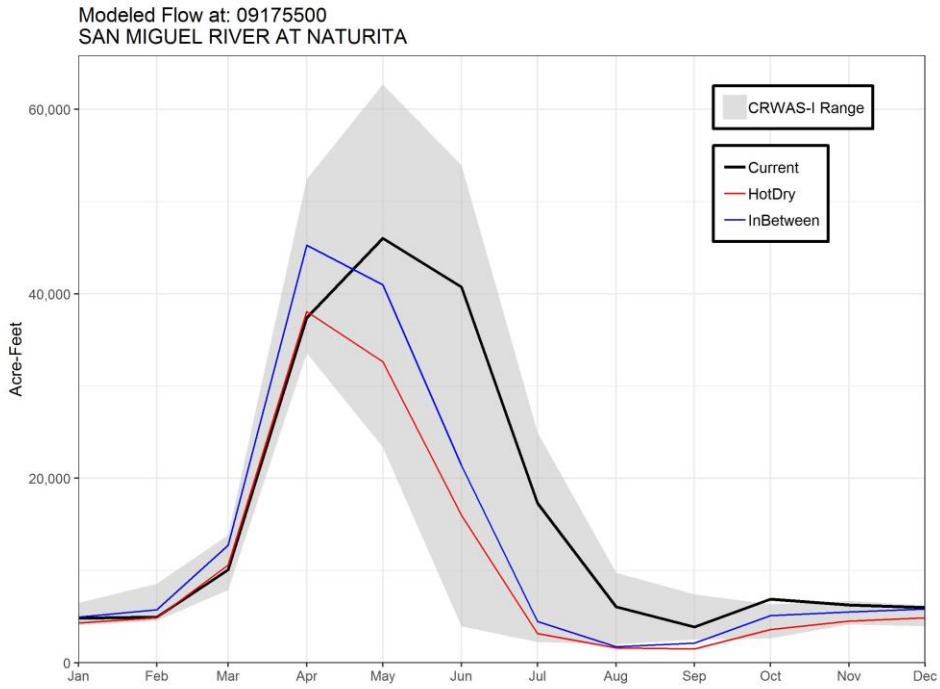


Figure B22: Gage 09346400: San Juan River Near Carracas, CO

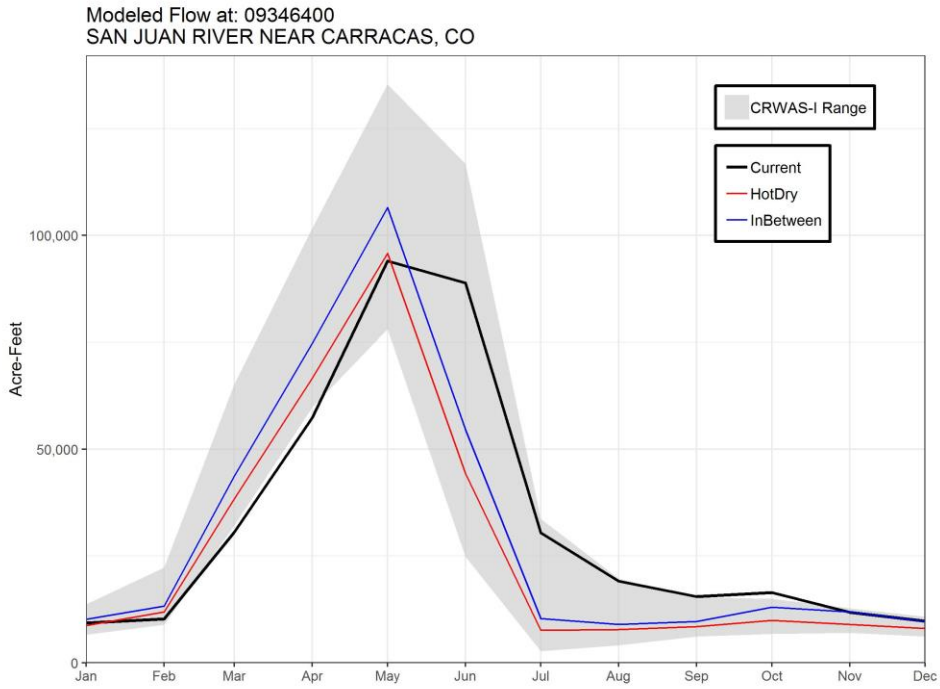


Figure B23: Gage 09349800: Piedra River Near Arboles, CO

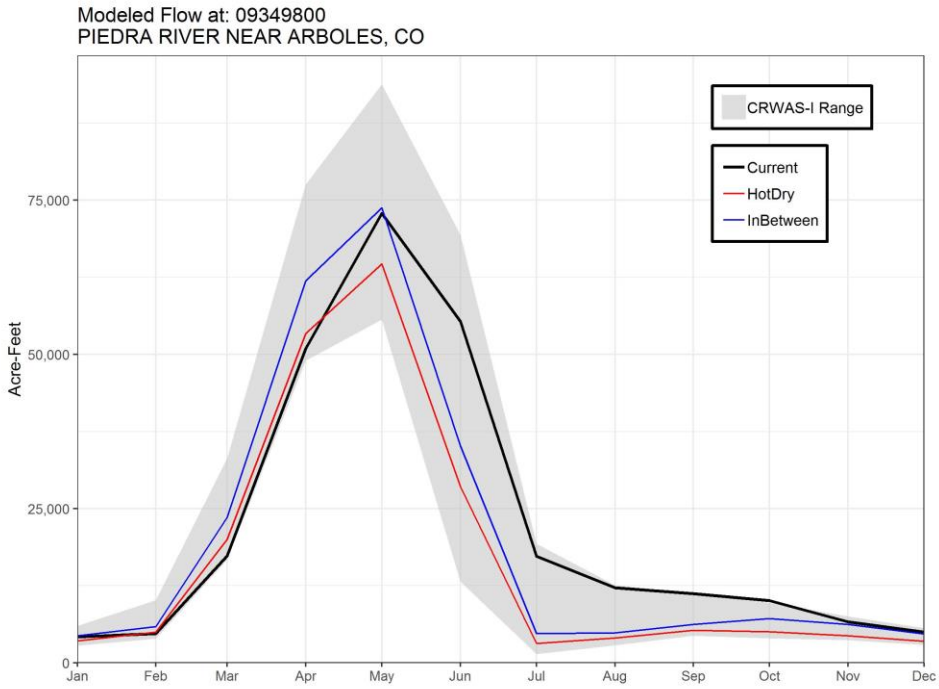


Figure B24: Gage 09354500: Los Pinos River At La Boca, CO

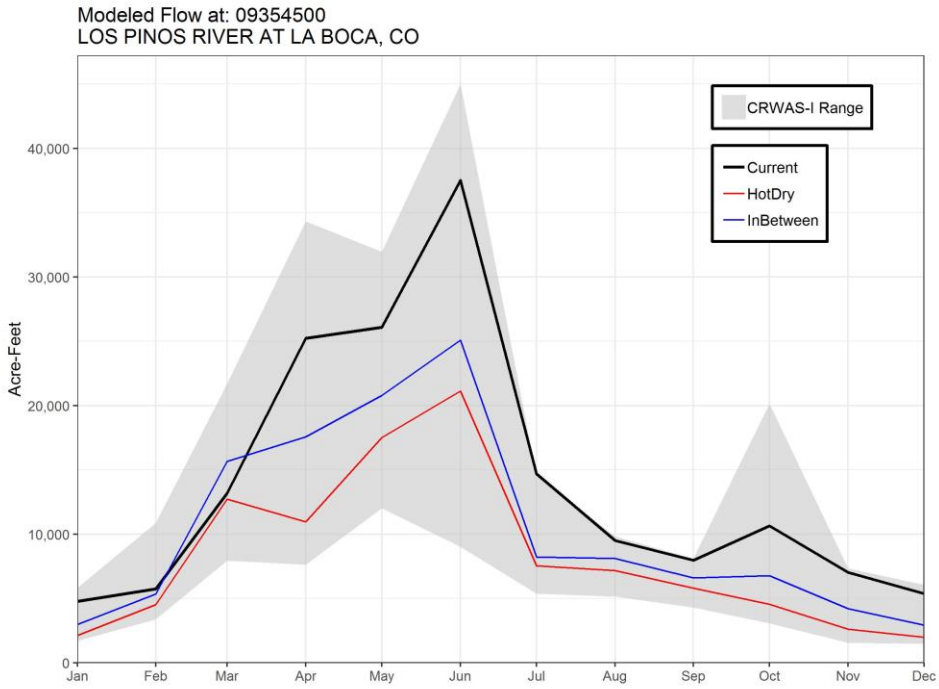


Figure B25: Gage 09363200: Florida River At Bondad, CO

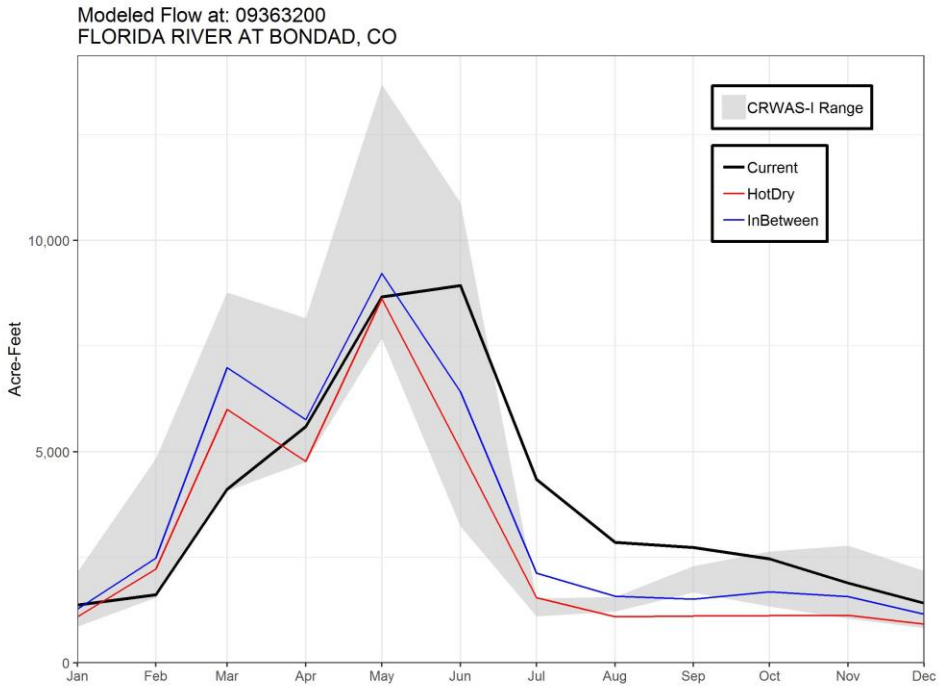


Figure B26: Gage 09363500: Animas River Near Cedar Hill, NM

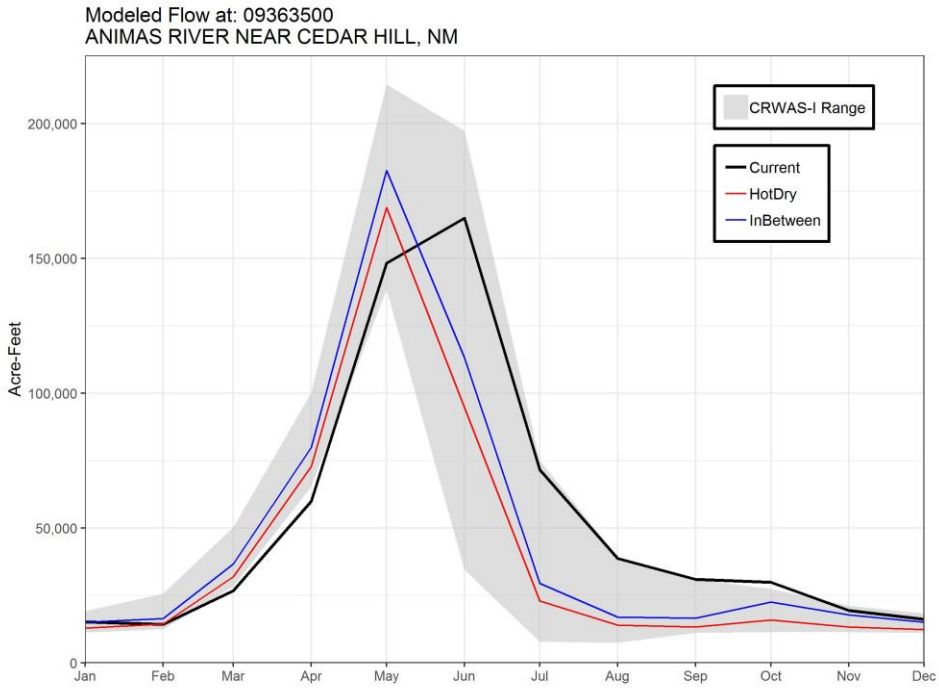


Figure B27: Gage 09365500: La Plata River At Hesperus, CO

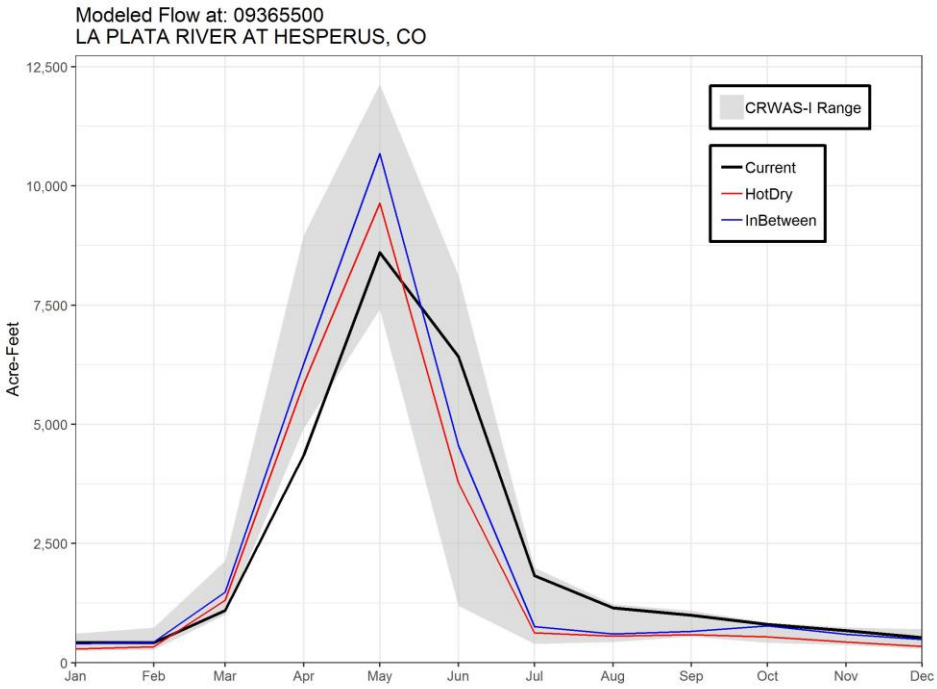


Figure B28: Gage 09366500: La Plata River At Colorado-New Mexico State Line

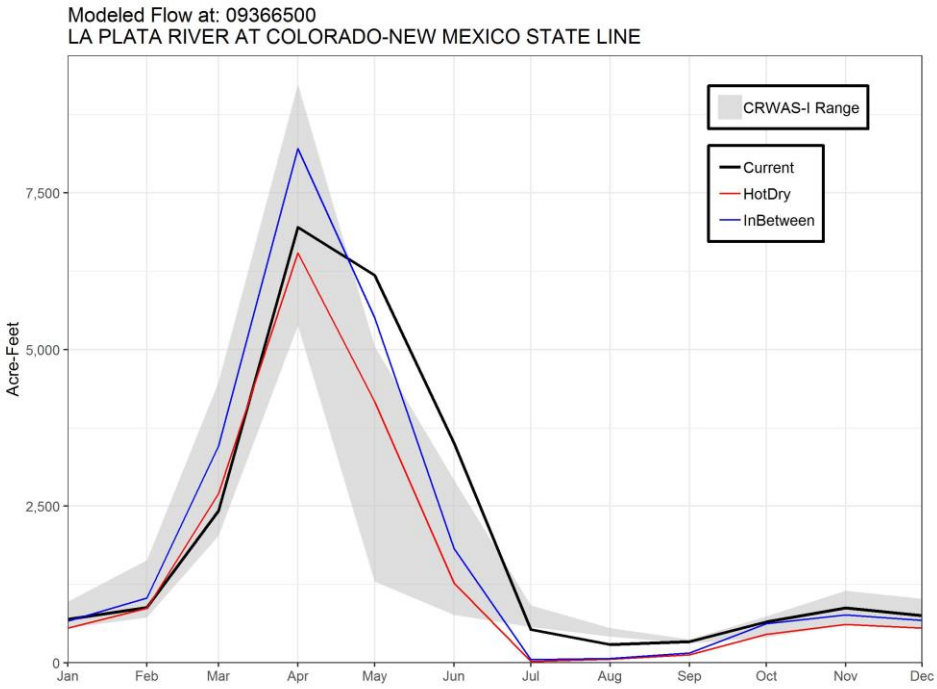


Figure B29: Gage 09371000: Mancos River Near Towaoc, CO

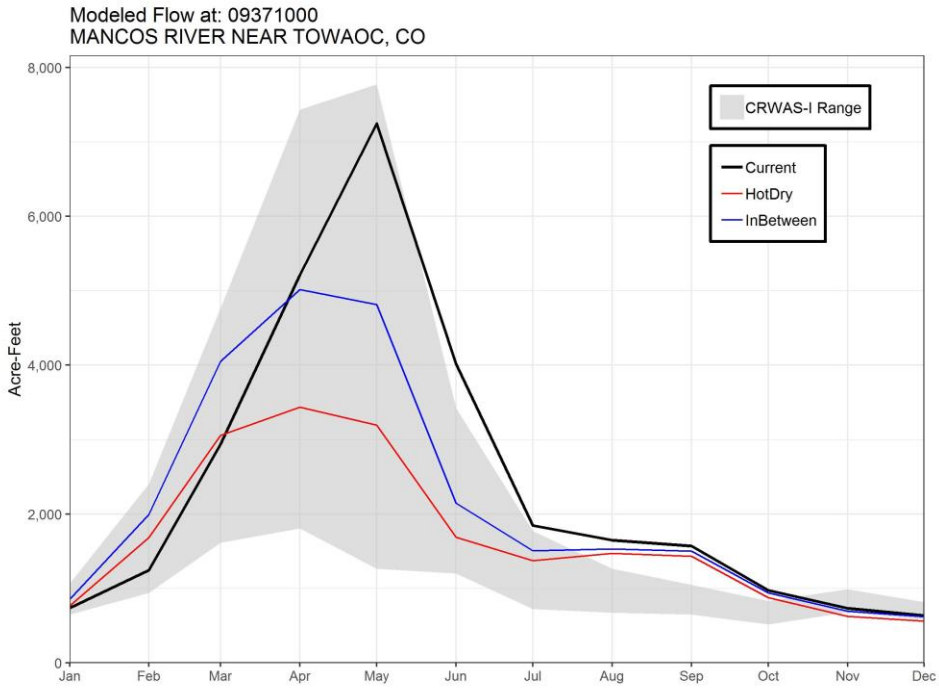


Figure B30: Gage 09237500: Yampa River Below Stagecoach Reservoir, CO

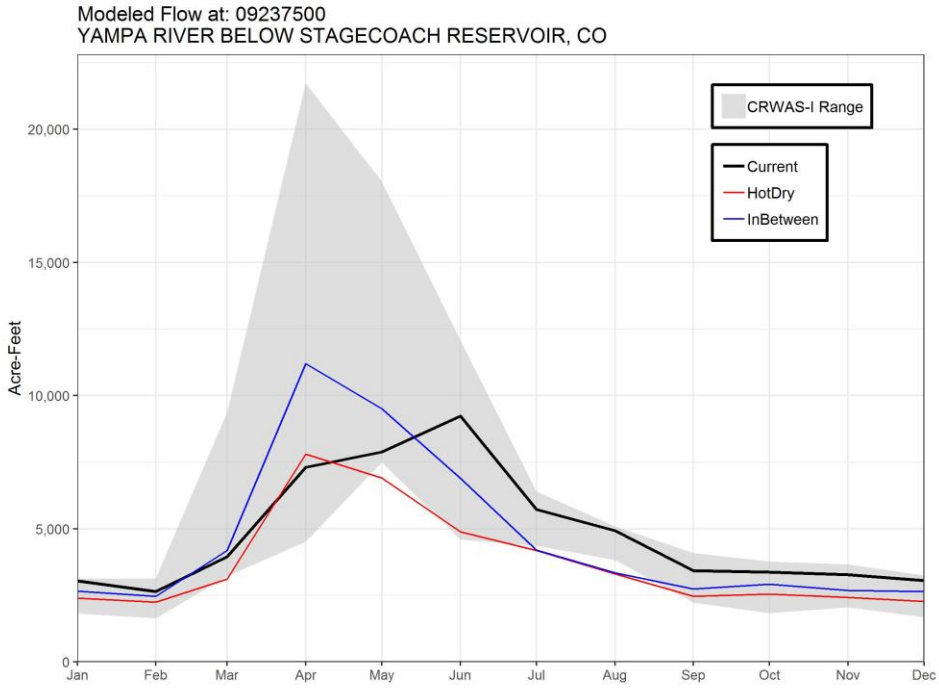


Figure B31: Gage 09241000: Elk River At Clark, CO

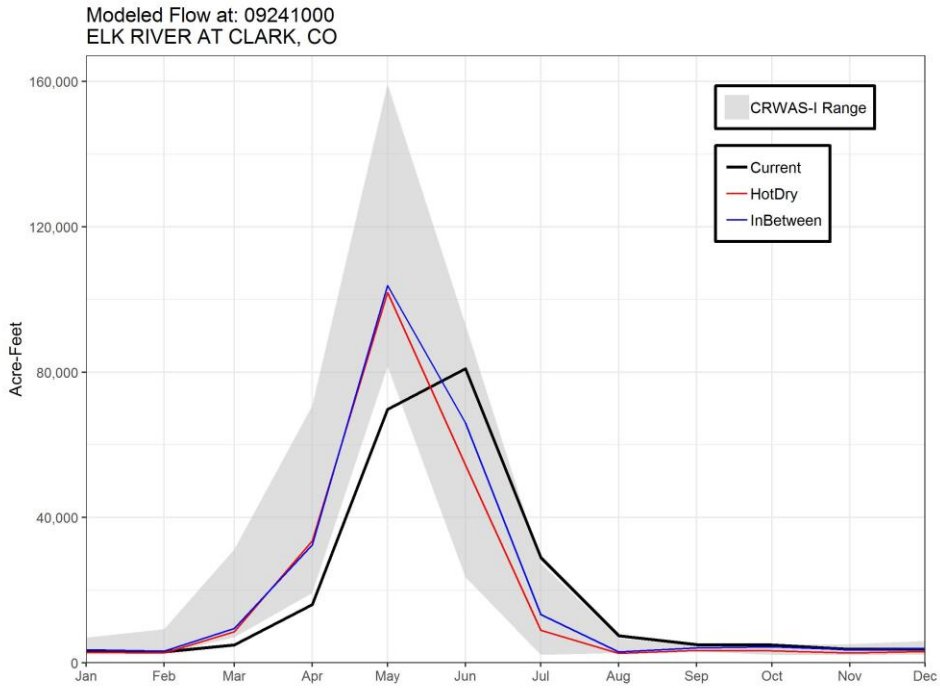


Figure B32: Gage 09245000: Elkhead Creek Near Elkhead, CO

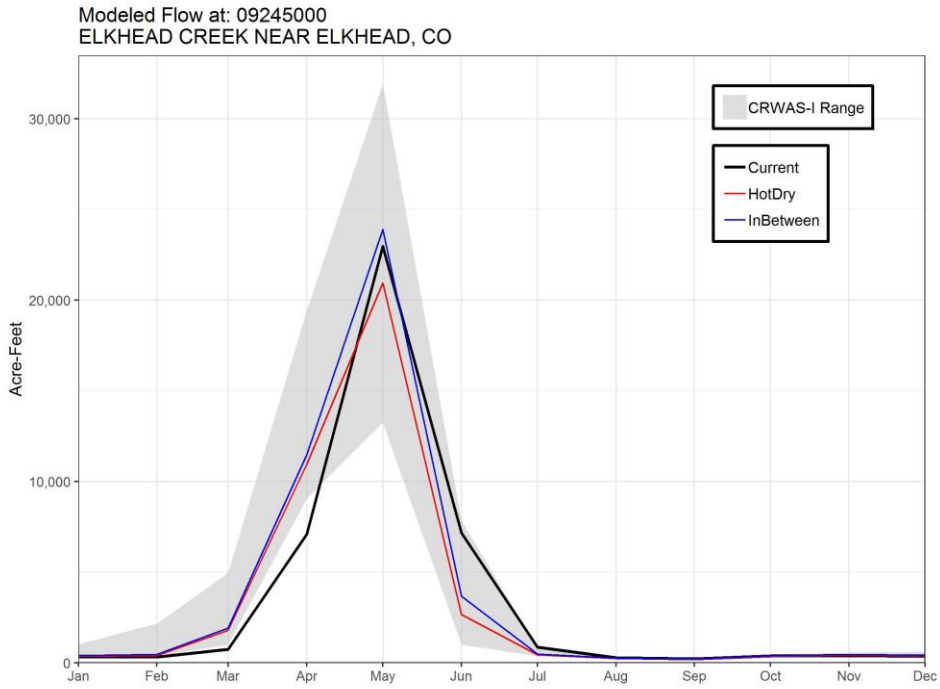


Figure B33: Gage 09249750: Williams Fork At Mouth, Near Hamilton, CO

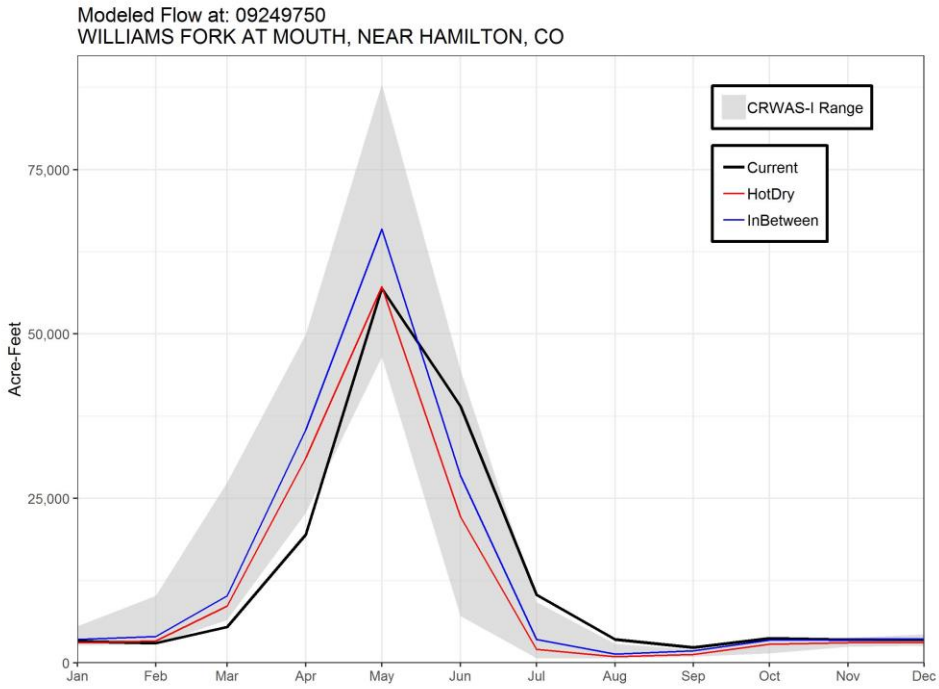


Figure B34: Gage 09251000: Yampa River Near Maybell, CO

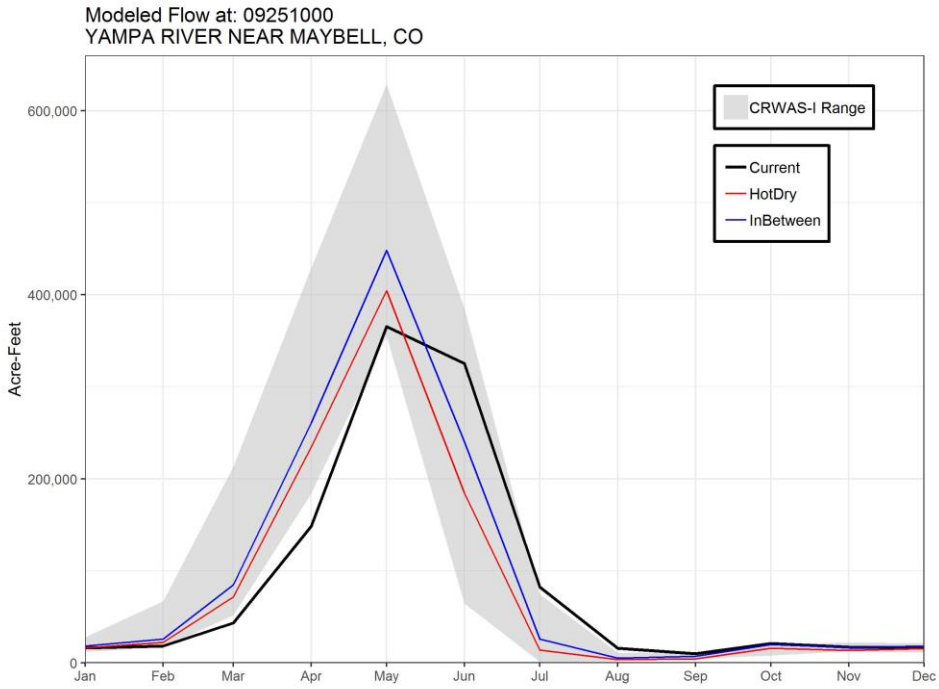


Figure B35: Gage 09260000: Little Snake River Near Lily, CO

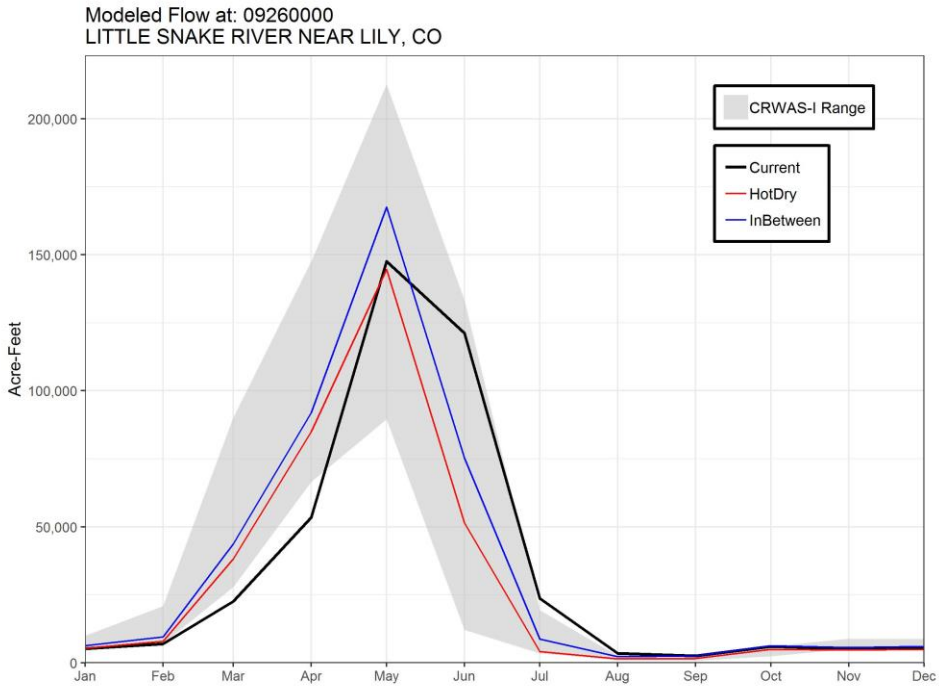


Figure B36: Gage 09260050: Yampa River At Deerlodge Park, CO

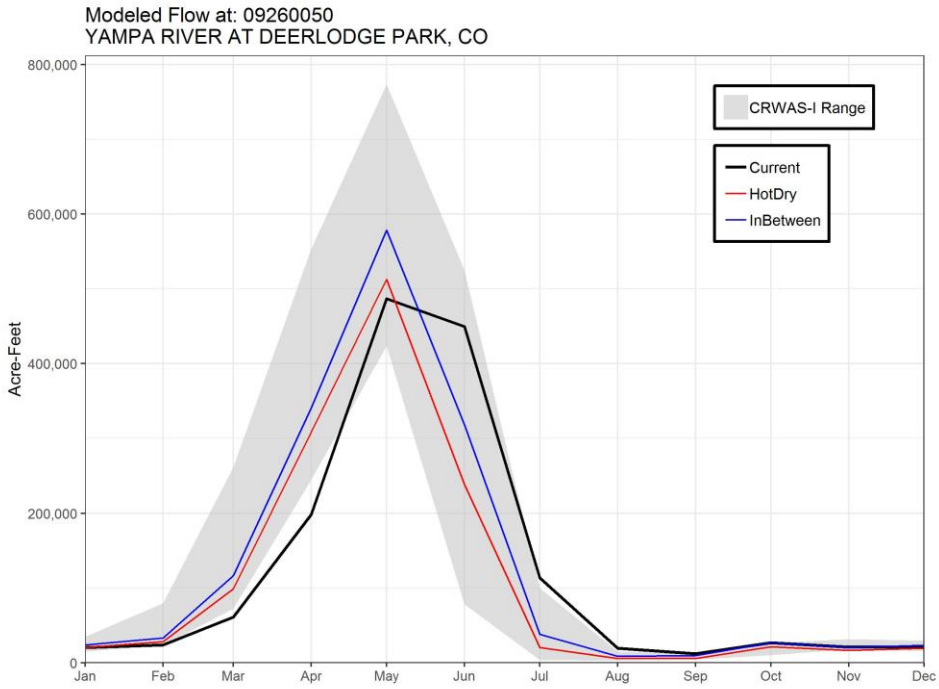


Figure B37: Gage 09303000: North Fork White River At Buford, CO

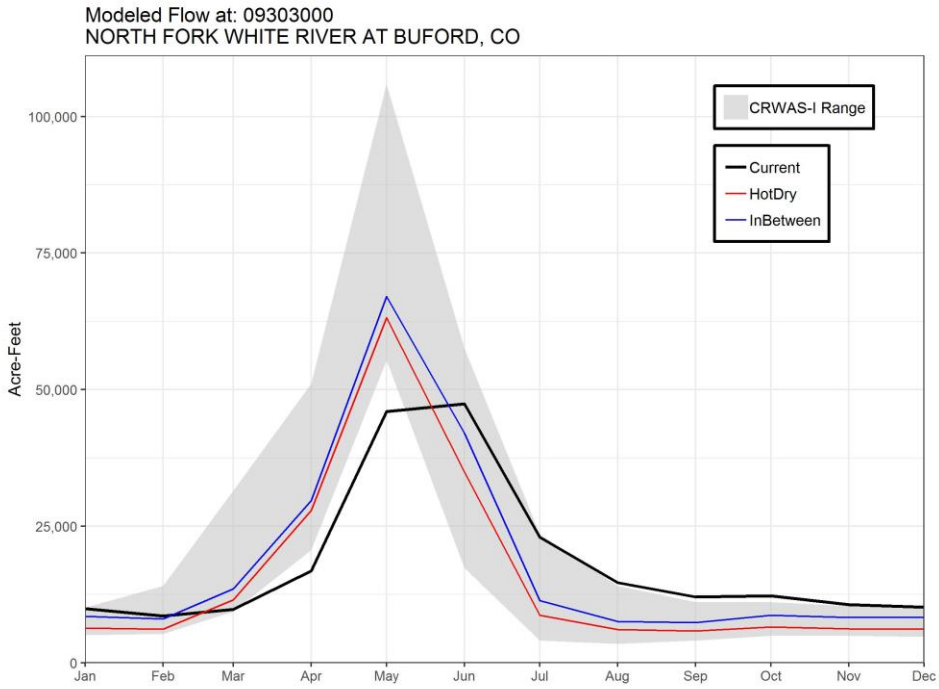


Figure B38: 09304000: South Fork White River At Buford, CO

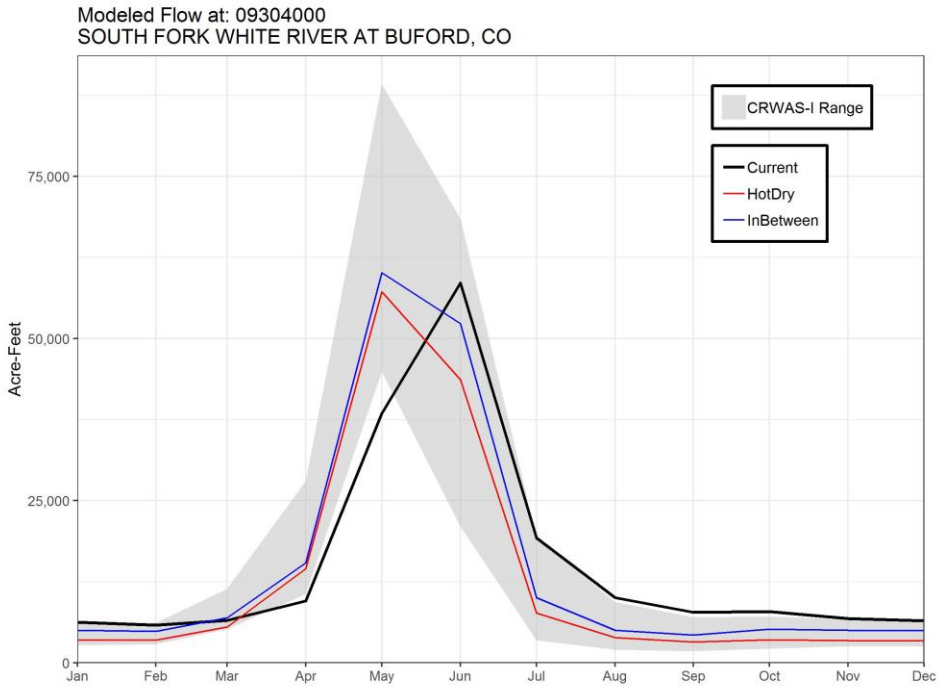


Figure B39: Gage 09304800: White River Below Meeker, CO

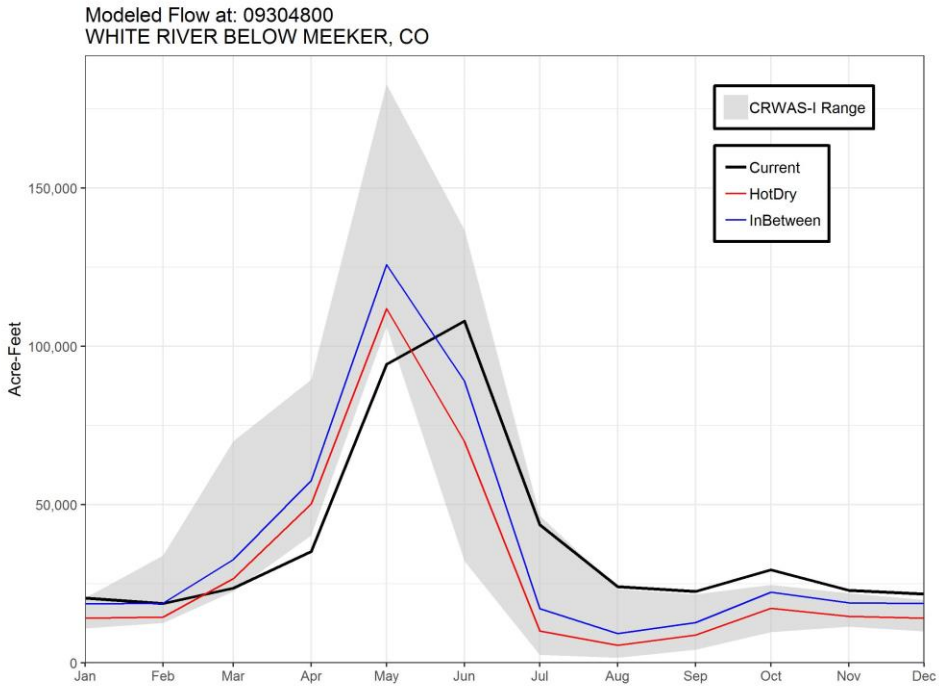


Figure B40: Gage 09306222: Piceance Creek At White River, CO

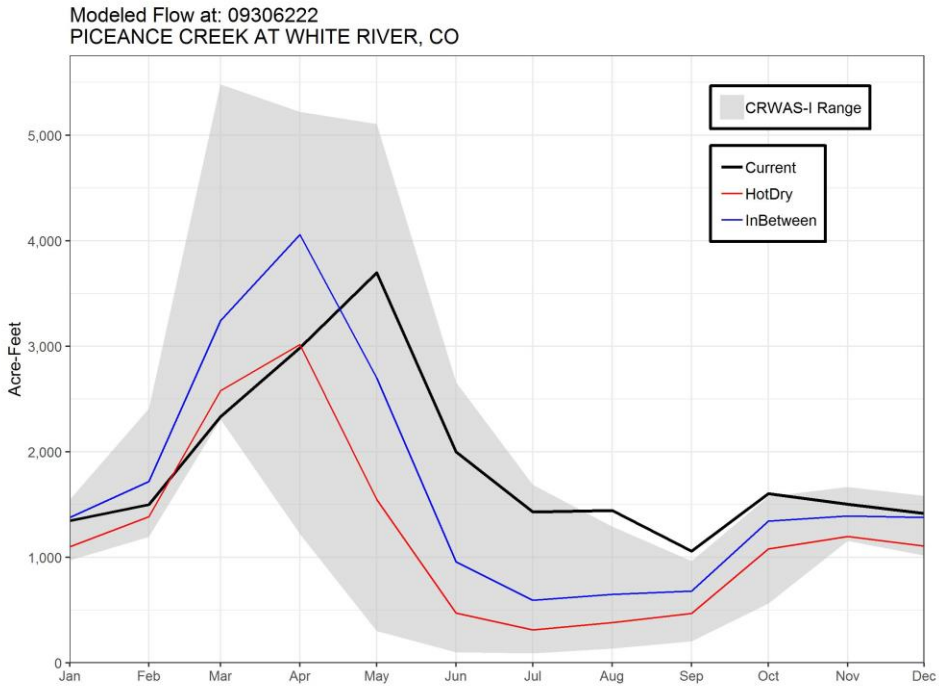
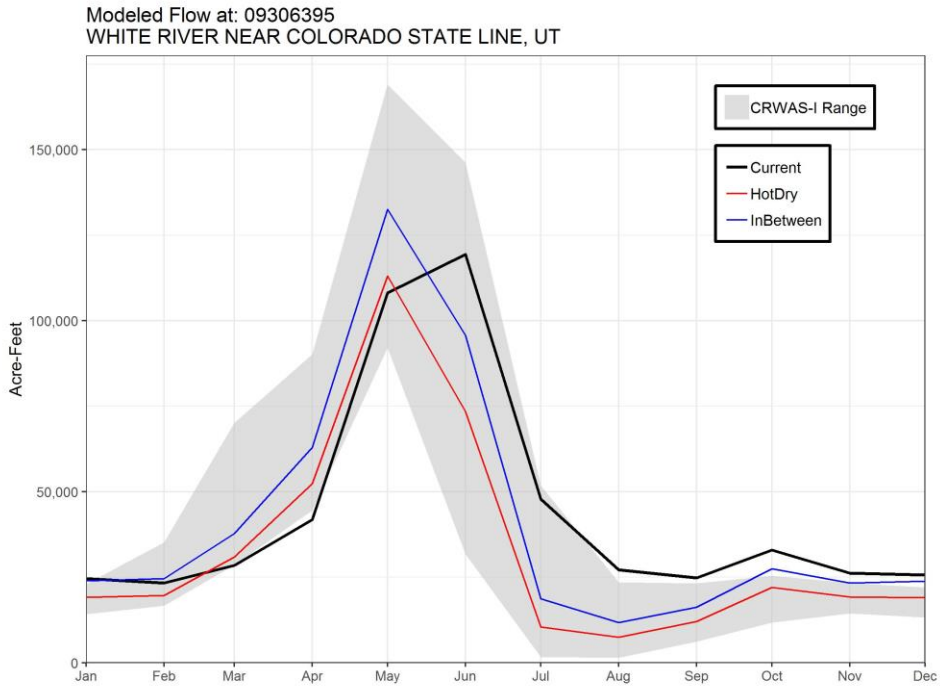


Figure B41: Gage 09306395: White River Near Colorado State Line, UT



Appendix B: Average Monthly Modeled Streamflow

Table B1: Upper Colorado River Basin Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09019500	**Colorado River Near Granby, CO**															
	Current	88	96	49	68	1,761	21,519	14,693	6,297	1,326	1,290	149	109	46,764	N/A	N/A
	HotDry	101	123	48	35	3,320	9,693	2,944	4,937	379	348	152	112	21,890	-24,873	-53%
	InBetween	95	108	49	35	6,325	26,853	7,082	5,125	614	734	154	113	46,601	-163	0%
09041500	**Muddy Creek At Kremmling, CO**															
	Current	984	889	1,538	1,566	18,306	19,035	4,725	5,361	9,844	3,070	1,183	1,147	67,115	N/A	N/A
	HotDry	850	861	1,607	2,418	23,111	5,982	979	10,325	6,102	2,066	1,044	823	55,910	-11,205	-17%
	InBetween	938	958	1,650	2,701	29,787	9,644	1,385	7,418	7,578	2,713	1,127	909	66,353	-762	-1%
09050700	**Blue River Below Dillon, CO**															
	Current	3,930	3,581	4,791	3,383	11,374	33,055	22,150	29,219	8,314	6,083	4,152	3,945	133,261	N/A	N/A
	HotDry	3,385	3,269	4,861	3,225	7,717	14,215	11,052	38,761	5,314	4,079	3,342	3,326	102,019	-31,243	-23%
	InBetween	3,684	3,415	4,783	3,315	14,592	24,728	14,624	28,360	6,289	4,636	3,569	3,613	115,013	-18,248	-14%
09057500	**Blue River Below Green Mountain Reservoir, CO**															
	Current	17,601	16,840	19,445	5,183	8,215	52,940	49,681	29,026	27,844	24,362	18,426	17,808	285,547	N/A	N/A
	HotDry	13,228	12,868	16,006	5,136	13,343	35,958	34,302	17,970	24,941	20,776	13,571	13,261	220,079	-65,468	-23%
	InBetween	15,836	15,274	18,346	5,113	16,772	45,196	36,080	19,934	25,275	22,555	16,197	15,863	250,985	-34,562	-12%
09070000	**Eagle River Below Gypsum, CO**															
	Current	10,622	9,286	11,211	20,334	79,927	134,064	59,936	22,744	15,875	16,962	12,804	11,407	402,429	N/A	N/A
	HotDry	9,360	8,706	12,820	30,849	98,301	79,945	25,848	11,426	10,099	12,720	10,194	9,588	317,445	-84,985	-21%
	InBetween	10,491	9,592	13,653	31,117	106,178	100,534	32,896	13,722	11,532	14,222	11,625	10,845	363,728	-38,701	-10%
09070500	**Colorado River Near Dotsero, CO**															
	Current	55,092	47,560	60,134	74,458	224,812	381,147	192,610	99,788	82,285	78,732	61,907	56,911	1,404,617	N/A	N/A
	HotDry	46,192	42,886	63,853	111,098	267,568	204,183	88,100	71,760	64,671	62,534	49,380	46,488	1,110,401	-294,216	-21%
	InBetween	52,935	47,712	68,922	114,219	313,628	284,976	109,442	75,122	70,254	70,016	56,547	53,523	1,307,099	-97,518	-7%
09073400	**Roaring Fork River Near Aspen, CO**															
	Current	1,536	1,334	1,556	2,791	11,188	16,244	8,563	3,132	2,706	2,530	1,862	1,715	54,734	N/A	N/A
	HotDry	1,141	1,034	1,321	3,138	19,911	15,427	3,600	2,074	1,757	1,495	1,155	1,191	52,736	-1,998	-4%
	InBetween	1,319	1,175	1,471	3,320	20,666	18,279	4,187	1,959	1,972	1,862	1,445	1,423	58,562	3,828	7%
09085000	**Roaring Fork River At Glenwood Springs, CO**															
	Current	25,588	22,358	28,121	48,914	132,931	230,737	137,005	62,993	45,306	48,958	30,554	28,120	834,395	N/A	N/A
	HotDry	22,010	19,883	27,762	60,474	199,962	185,596	55,010	29,157	27,904	37,592	24,970	23,549	707,427	-126,969	-15%
	InBetween	24,507	21,957	30,288	64,579	211,459	217,801	72,248	35,300	32,115	42,310	28,321	26,539	800,312	-34,084	-4%

Appendix B: Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09095500	Colorado River Near Cameo, CO															
	Current	96,848	86,019	109,032	152,172	449,389	706,773	355,957	175,482	140,351	147,106	109,443	101,543	2,609,357	N/A	N/A
	HotDry	81,540	78,100	114,368	197,724	530,936	440,800	156,274	108,291	102,860	117,595	88,504	83,013	2,083,704	-525,653	-20%
	InBetween	93,504	87,424	125,105	213,579	607,991	568,272	199,066	119,759	114,028	131,468	100,696	95,042	2,436,352	-173,005	-7%
09105000	Plateau Creek Near Cameo, CO															
	Current	4,389	4,364	6,200	11,527	34,766	33,809	9,314	6,310	5,674	7,194	5,949	5,030	133,087	N/A	N/A
	HotDry	4,105	4,638	8,101	12,931	21,641	13,471	6,055	4,716	4,225	5,623	4,935	4,438	93,948	-39,138	-29%
	InBetween	4,812	5,265	9,194	15,406	28,528	17,310	7,015	5,382	5,011	7,217	6,096	5,401	115,437	-17,649	-13%
09163500	Colorado River Near Colorado-Utah State Line															
	Current	189,538	174,704	221,071	332,684	778,801	1,011,789	481,745	245,074	225,408	279,645	213,760	198,389	4,318,270	N/A	N/A
	HotDry	166,399	164,478	245,027	416,126	854,027	610,597	196,363	147,410	164,878	226,775	178,879	168,045	3,511,991	-806,278	-19%
	InBetween	189,435	184,897	270,567	457,819	980,480	779,274	256,323	167,515	188,461	260,011	204,079	193,237	4,099,176	-219,093	-5%

Table B2: Gunnison River Basin Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09110000	**Taylor River At Almont, CO**															
	Current	8,467	7,690	8,915	11,496	30,805	42,983	30,347	21,386	24,316	23,517	12,206	8,640	231,170	N/A	N/A
	HotDry	7,196	6,532	8,059	14,155	40,526	32,009	18,790	18,501	18,576	15,127	10,367	7,521	198,019	-33,151	-14%
	InBetween	7,984	7,292	8,758	14,203	43,913	38,699	19,936	20,021	20,781	18,418	11,377	8,165	220,006	-11,164	-5%
09112500	**East River At Almont, CO**															
	Current	3,649	3,180	4,218	14,533	58,210	76,176	35,790	14,033	6,850	7,413	4,899	4,154	230,753	N/A	N/A
	HotDry	2,872	2,601	4,126	22,185	94,282	59,745	15,577	5,210	3,384	4,916	3,592	3,141	219,191	-11,562	-5%
	InBetween	3,218	2,882	4,403	22,154	97,524	70,394	20,004	6,369	4,236	5,895	4,138	3,587	242,176	11,423	5%
09114500	**Gunnison River Near Gunnison, CO**															
	Current	14,632	12,803	15,706	32,313	94,056	127,189	70,638	37,065	28,514	33,584	19,634	15,597	499,055	N/A	N/A
	HotDry	12,188	10,835	15,027	45,942	139,389	88,172	31,767	22,078	18,787	21,793	16,066	12,979	432,867	-66,188	-13%
	InBetween	13,493	12,014	16,175	46,207	149,361	109,128	38,345	25,300	21,959	26,413	17,674	14,246	487,621	-11,434	-2%
09119000	**Tomichi Creek At Gunnison, CO**															
	Current	4,059	3,778	6,535	12,464	21,706	24,245	13,279	6,667	3,071	6,145	5,192	4,382	110,391	N/A	N/A
	HotDry	3,098	3,006	6,280	14,332	17,782	7,053	6,287	2,428	1,044	4,174	3,879	3,249	72,007	-38,384	-35%
	InBetween	3,546	3,481	7,084	15,855	24,231	12,293	7,976	3,614	1,661	5,344	4,370	3,728	92,316	-18,075	-16%
09128000	**Gunnison River Below Gunnison Tunnel, CO**															
	Current	32,964	30,128	41,391	42,008	175,664	115,731	83,116	39,983	53,606	84,685	63,123	62,570	827,205	N/A	N/A
	HotDry	26,562	23,577	31,968	53,318	173,624	81,589	56,200	28,898	25,035	40,875	30,803	31,023	608,673	-218,533	-26%
	InBetween	29,101	26,959	40,813	66,673	224,248	115,084	64,979	28,909	29,495	52,354	36,676	37,748	756,084	-71,121	-9%
09136200	**Gunnison River Near Lazear, CO**															
	Current	43,216	38,111	53,307	87,750	296,344	204,229	103,294	45,925	59,606	93,150	77,293	73,120	1,173,784	N/A	N/A
	HotDry	36,253	31,868	46,194	114,074	310,326	130,198	64,236	33,233	29,848	47,390	43,063	40,653	929,071	-244,713	-21%
	InBetween	40,035	36,370	57,105	134,755	379,137	176,628	75,257	33,794	34,900	60,326	50,737	48,989	1,126,967	-46,817	-4%
09149500	**Uncompahgre River At Delta, CO**															
	Current	10,715	16,668	16,329	6,359	20,783	33,445	20,584	14,834	17,100	18,941	15,359	12,945	201,675	N/A	N/A
	HotDry	10,153	11,503	11,537	7,025	14,978	12,452	7,557	9,999	13,621	14,772	13,034	11,460	136,651	-65,025	-32%
	InBetween	11,035	14,670	15,457	9,322	19,114	17,549	8,713	11,481	15,405	17,223	14,253	12,764	165,185	-36,490	-18%
09152500	**Gunnison River Near Grand Junction, CO**															
	Current	67,495	69,083	90,012	123,261	398,366	287,121	153,032	85,750	107,256	130,562	108,978	101,518	1,715,501	N/A	N/A
	HotDry	59,079	57,945	82,818	145,070	368,872	180,238	98,109	65,218	69,404	77,502	70,473	65,890	1,338,679	-376,821	-22%
	InBetween	65,804	68,027	101,889	176,201	450,252	233,430	111,920	69,176	78,523	95,552	81,593	78,156	1,605,013	-110,488	-6%

Table B3: San Juan/Dolores River Basin Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09171100	Dolores River Near Bedrock															
	Current	3,257	4,864	12,097	43,841	62,813	36,866	7,579	4,465	3,243	3,025	2,841	3,057	185,380	N/A	N/A
	HotDry	2,637	4,181	9,109	23,751	20,887	7,198	3,847	4,028	2,906	2,447	2,084	2,404	84,372	-101,007	-54%
	InBetween	3,355	5,584	12,316	35,345	38,594	13,119	4,344	4,171	3,595	3,301	2,562	3,200	127,752	-57,627	-31%
09175500	San Miguel River At Naturita															
	Current	4,853	4,970	10,082	37,411	46,017	40,760	17,324	6,059	3,896	6,899	6,260	5,976	188,435	N/A	N/A
	HotDry	4,320	4,871	10,618	38,090	32,641	16,014	3,161	1,620	1,500	3,619	4,530	4,874	124,576	-63,859	-34%
	InBetween	4,948	5,753	12,756	45,282	40,981	21,420	4,478	1,749	2,128	5,134	5,507	5,847	154,377	-34,057	-18%
09346400	San Juan River Near Carracas, CO															
	Current	9,294	10,285	30,594	57,355	94,015	88,861	30,390	19,098	15,537	16,448	11,793	9,762	389,499	N/A	N/A
	HotDry	8,758	11,876	38,361	66,634	95,874	44,335	7,627	7,830	8,456	9,948	9,025	8,033	313,388	-76,110	-20%
	InBetween	10,162	13,308	43,710	74,768	106,511	54,569	10,330	9,019	9,685	13,053	11,946	9,712	362,840	-26,659	-7%
09349800	Piedra River Near Arboles, CO															
	Current	4,241	4,764	17,346	50,970	72,893	55,367	17,301	12,151	11,214	10,070	6,638	4,966	265,323	N/A	N/A
	HotDry	3,534	4,973	20,019	53,420	64,671	28,553	3,131	4,020	5,285	5,037	4,365	3,513	198,375	-66,947	-25%
	InBetween	4,404	5,899	23,585	61,920	73,742	35,184	4,754	4,862	6,244	7,194	6,251	4,679	236,204	-29,118	-11%
09354500	Los Pinos River At La Boca, CO															
	Current	4,781	5,749	13,174	25,225	26,088	37,504	14,699	9,497	7,978	10,641	7,037	5,376	165,554	N/A	N/A
	HotDry	2,137	4,540	12,738	10,978	17,502	21,146	7,553	7,175	5,816	4,543	2,620	1,977	97,490	-68,064	-41%
	InBetween	2,988	5,362	15,656	17,573	20,799	25,086	8,237	8,111	6,613	6,784	4,223	2,944	122,791	-42,763	-26%
09363200	Florida River At Bondad, CO															
	Current	1,369	1,617	4,110	5,595	8,667	8,935	4,343	2,855	2,731	2,461	1,892	1,411	45,436	N/A	N/A
	HotDry	1,089	2,219	6,005	4,771	8,626	5,046	1,542	1,094	1,108	1,122	1,128	919	34,263	-11,173	-25%
	InBetween	1,271	2,483	6,989	5,762	9,224	6,418	2,124	1,580	1,505	1,683	1,573	1,154	41,269	-4,167	-9%
09363500	Animas River Near Cedar Hill, NM															
	Current	15,158	14,296	26,751	59,982	148,324	165,021	71,605	38,671	30,936	29,954	19,476	16,123	629,478	N/A	N/A
	HotDry	12,878	14,434	31,987	72,877	168,927	94,675	22,955	13,945	13,255	15,830	13,299	12,320	482,194	-147,284	-23%
	InBetween	15,131	16,479	36,654	79,922	182,663	113,171	29,540	16,983	16,572	22,588	17,773	15,076	556,708	-72,770	-12%
09365500	La Plata River At Hesperus, CO															
	Current	433	420	1,100	4,352	8,602	6,422	1,827	1,150	997	809	677	532	27,050	N/A	N/A
	HotDry	291	335	1,309	5,855	9,643	3,767	632	558	589	543	438	342	24,027	-3,024	-11%
	InBetween	402	435	1,480	6,277	10,677	4,552	758	608	664	773	602	489	27,408	358	1%

Appendix B: Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09366500	La Plata River At Colorado-New Mexico State Line															
	Current	698	880	2,426	6,954	6,189	3,510	534	291	336	657	875	753	23,760	N/A	N/A
	HotDry	557	871	2,701	6,544	4,170	1,274	20	57	126	453	613	555	17,686	-6,074	-26%
	InBetween	665	1,035	3,460	8,212	5,508	1,825	50	68	156	623	766	681	22,719	-1,040	-4%
09371000	Mancos River Near Towaoc, CO															
	Current	738	1,245	2,938	5,215	7,245	4,019	1,844	1,648	1,571	972	731	635	28,477	N/A	N/A
	HotDry	768	1,685	3,059	3,436	3,196	1,688	1,373	1,470	1,433	874	625	561	19,985	-8,492	-30%
	InBetween	855	1,992	4,051	5,014	4,816	2,147	1,507	1,529	1,501	939	695	622	25,401	-3,076	-11%

Table B4: Yampa River Basin Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09237500	**Yampa River Below Stagecoach Reservoir, CO**															
	Current	3,039	2,636	3,944	7,300	7,882	9,237	5,724	4,924	3,428	3,373	3,267	3,058	57,649	N/A	N/A
	HotDry	2,393	2,235	3,106	7,806	6,901	4,890	4,184	3,302	2,465	2,538	2,416	2,271	44,471	-13,178	-23%
	InBetween	2,661	2,469	4,188	11,200	9,501	6,892	4,201	3,340	2,739	2,918	2,683	2,638	55,298	-2,351	-4%
09241000	**Elk River At Clark, CO**															
	Current	3,441	3,010	4,910	16,056	69,804	80,986	28,984	7,426	5,042	4,900	3,682	3,793	229,922	N/A	N/A
	HotDry	2,919	2,711	8,571	33,530	101,962	54,465	8,987	2,599	3,444	3,332	2,743	3,086	226,398	-3,524	-2%
	InBetween	3,603	3,232	9,503	32,486	103,891	66,088	13,333	2,969	4,076	4,428	3,573	3,927	248,955	19,033	8%
09245000	**Elkhead Creek Near Elkhead, CO**															
	Current	334	311	736	7,098	22,958	7,161	871	273	218	387	405	353	40,609	N/A	N/A
	HotDry	367	400	1,795	10,956	20,945	2,668	444	249	199	362	430	378	38,740	-1,869	-5%
	InBetween	409	453	1,919	11,479	23,887	3,683	492	253	227	404	459	419	43,567	2,958	7%
09249750	**Williams Fork At Mouth, Near Hamilton, CO**															
	Current	3,274	3,017	5,462	19,507	56,907	39,018	10,373	3,540	2,359	3,705	3,516	3,542	152,822	N/A	N/A
	HotDry	3,054	3,328	8,654	31,154	57,212	22,231	2,050	955	1,293	2,816	3,048	3,079	137,653	-15,169	-10%
	InBetween	3,558	3,992	10,203	35,406	65,934	28,472	3,569	1,313	1,826	3,453	3,509	3,699	163,472	10,650	7%
09251000	**Yampa River Near Maybell, CO**															
	Current	16,280	18,397	43,402	148,581	365,385	325,451	82,406	16,085	10,113	21,067	17,078	16,774	1,069,994	N/A	N/A
	HotDry	16,289	22,081	71,822	234,608	404,321	184,450	13,743	3,360	4,185	15,834	13,580	15,529	990,083	-79,911	-7%
	InBetween	18,447	25,784	84,883	260,607	448,162	240,146	26,000	5,101	6,988	19,940	16,579	18,442	1,159,495	89,502	8%
09260000	**Little Snake River Near Lily, CO**															
	Current	5,302	6,944	22,678	53,417	147,543	121,180	23,655	3,430	2,588	6,044	5,248	5,209	398,711	N/A	N/A
	HotDry	5,398	7,968	38,197	85,043	144,672	51,422	4,139	1,466	1,667	4,929	4,751	5,005	350,869	-47,842	-12%
	InBetween	6,282	9,583	43,699	91,985	167,494	75,336	8,744	2,322	2,479	6,283	5,669	6,032	421,227	22,516	6%
09260050	**Yampa River At Deerlodge Park, CO**															
	Current	20,626	23,918	61,049	198,262	487,051	449,626	113,535	19,693	12,306	27,124	20,884	20,857	1,439,374	N/A	N/A
	HotDry	20,685	28,170	99,118	308,381	512,821	238,273	20,318	5,749	5,927	21,260	16,612	19,485	1,283,725	-155,649	-11%
	InBetween	23,762	33,425	116,406	340,918	578,241	318,259	38,181	8,669	9,617	26,739	20,627	23,327	1,522,284	82,910	6%

Table B5: White River Basin Average Monthly Modeled Streamflow

2050 Climate Projections		Average Monthly Modeled Streamflow (AF)													Reduction in Avg Annual Modeled Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09303000	North Fork White River At Buford, CO															
	Current	9,943	8,603	9,801	16,850	45,977	47,403	22,985	14,661	12,089	12,247	10,675	10,210	220,272	N/A	N/A
	HotDry	6,351	6,183	11,518	27,862	63,140	34,936	8,733	6,081	5,842	6,563	6,229	6,147	188,135	-32,137	-15%
	InBetween	8,489	8,040	13,531	29,723	67,029	42,034	11,397	7,580	7,396	8,702	8,304	8,372	219,080	-1,193	-1%
09304000	South Fork White River At Buford, CO															
	Current	6,288	5,813	6,560	9,543	38,463	58,573	19,231	10,023	7,813	7,886	6,838	6,488	182,239	N/A	N/A
	HotDry	3,520	3,509	5,503	14,488	57,241	43,655	7,684	3,870	3,192	3,572	3,413	3,402	151,598	-30,642	-17%
	InBetween	5,012	4,842	6,914	15,400	60,145	52,288	10,035	5,009	4,285	5,172	5,027	4,971	177,563	-4,676	-3%
09304800	White River Below Meeker, CO															
	Current	20,510	18,717	23,611	35,169	94,370	108,014	43,653	24,117	22,575	29,384	22,946	21,770	462,052	N/A	N/A
	HotDry	14,147	14,414	26,636	50,281	111,993	69,961	10,098	5,561	8,797	17,251	14,679	14,120	355,385	-106,666	-23%
	InBetween	18,655	18,860	32,686	57,701	125,853	89,020	17,133	9,195	12,731	22,326	18,944	18,783	438,841	-23,211	-5%
09306222	Piceance Creek At White River, CO															
	Current	1,347	1,499	2,332	2,985	3,695	1,997	1,429	1,444	1,058	1,603	1,502	1,415	22,166	N/A	N/A
	HotDry	1,102	1,386	2,579	3,015	1,548	472	312	383	469	1,078	1,196	1,108	14,605	-7,561	-34%
	InBetween	1,379	1,719	3,242	4,058	2,702	957	593	647	680	1,344	1,391	1,376	19,980	-2,186	-10%
09306395	White River Near Colorado State Line, Ut															
	Current	24,601	23,320	28,476	41,879	108,133	119,433	47,891	27,193	24,876	32,998	26,182	25,741	527,584	N/A	N/A
	HotDry	19,190	19,734	30,941	52,370	113,113	73,497	10,481	7,479	12,093	22,070	19,232	19,056	397,102	-130,482	-25%
	InBetween	23,942	24,594	37,777	62,937	132,584	95,766	18,760	11,752	16,310	27,460	23,284	23,857	496,051	-31,533	-6%

Appendix C. Average Water Available to Meet Future Demands

Appendix C Contents

Figure C1: Gage 09019500: Colorado River Near Granby, CO

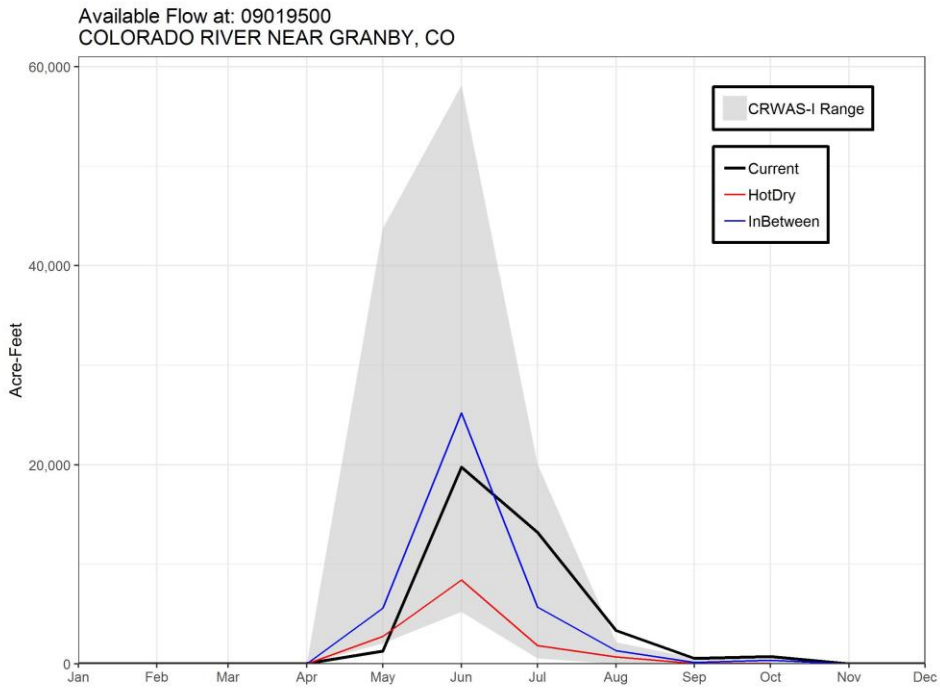


Figure C2: Gage 09041500: Muddy Creek At Kremmling, CO

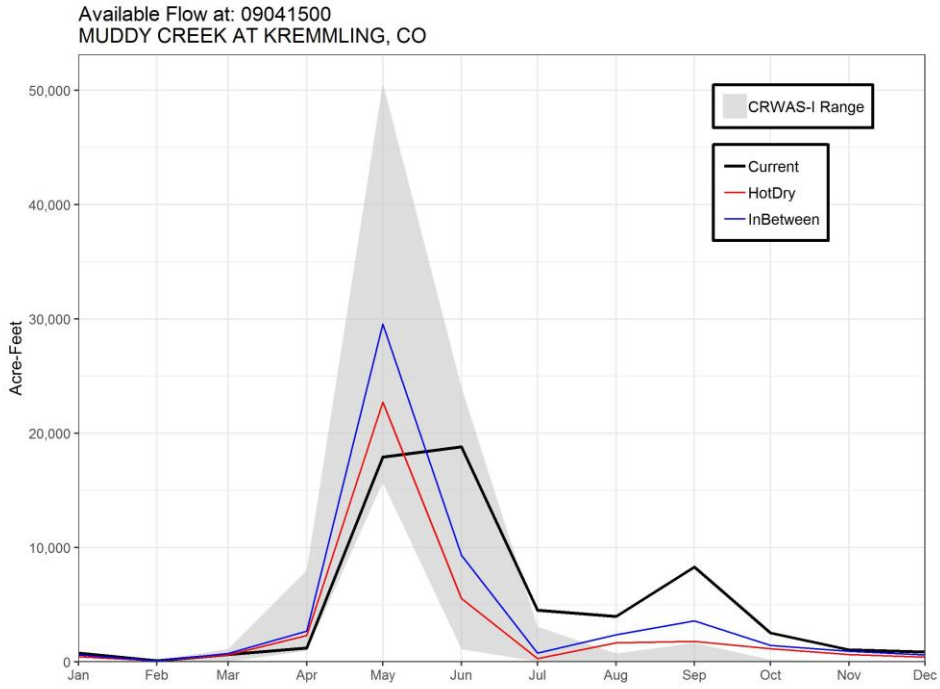


Figure C3: Gage 09050700: Blue River Below Dillon, CO

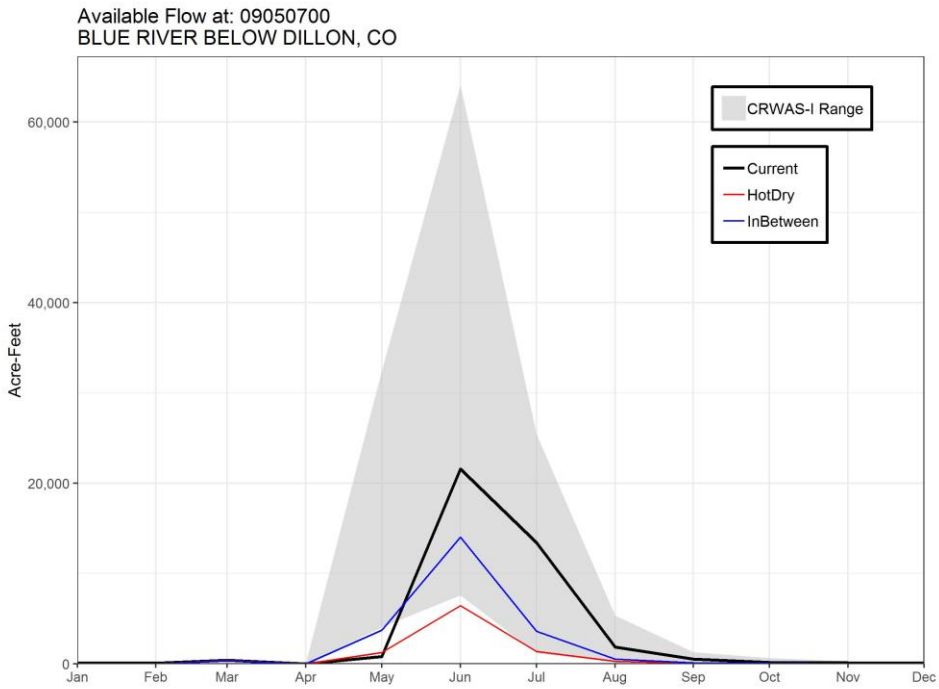


Figure C4: Gage 09057500: Blue River Below Green Mountain Reservoir, CO

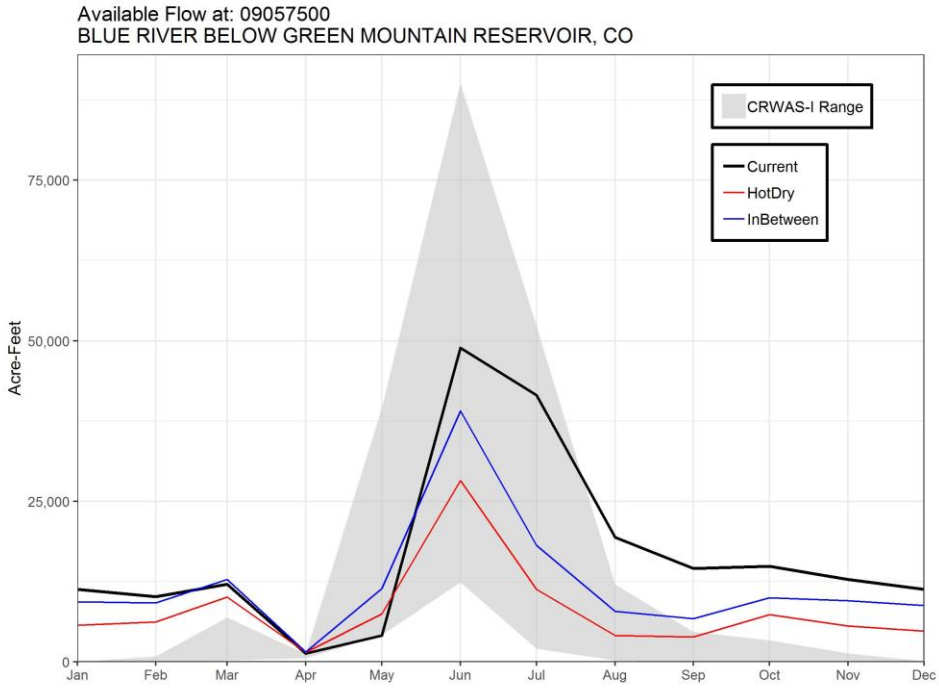


Figure C5: Gage 09070000: Eagle River Below Gypsum, CO

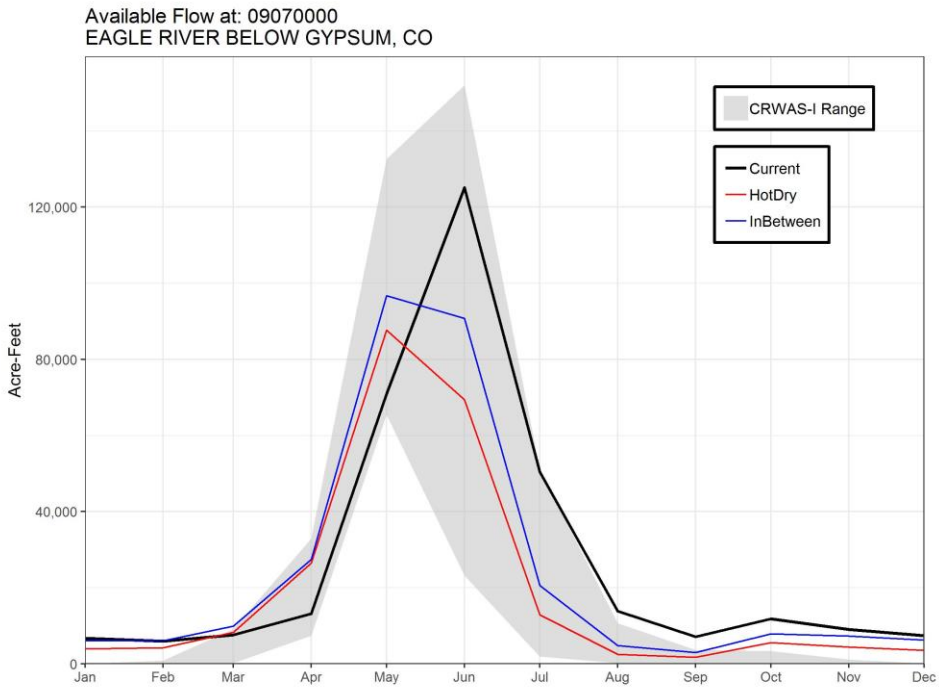


Figure C6: Gage 09070500: Colorado River Near Dotsero, CO

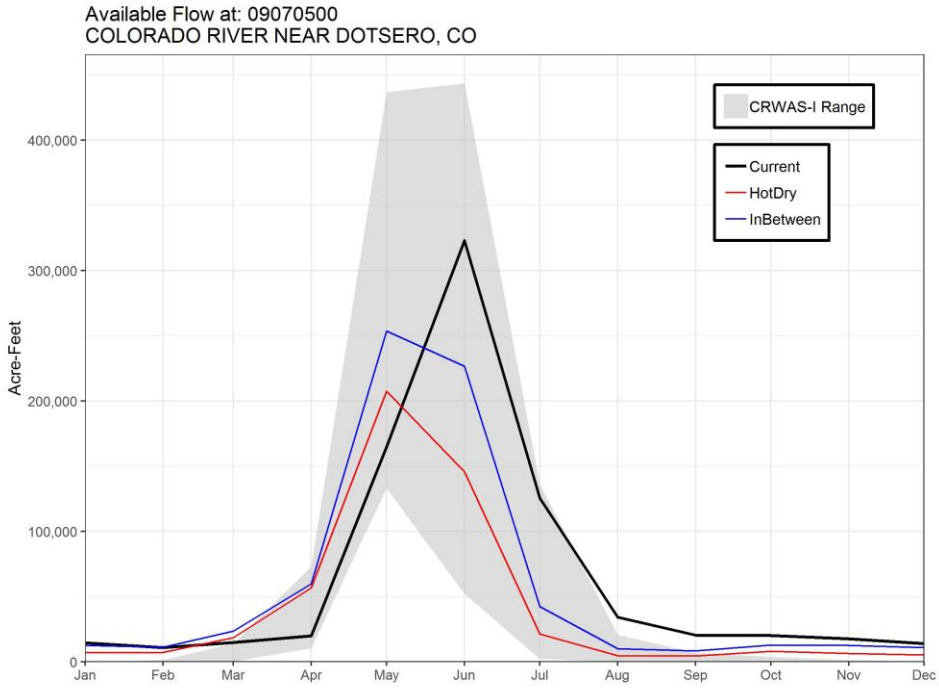


Figure C7: Gage 09073400: Roaring Fork River Near Aspen, CO

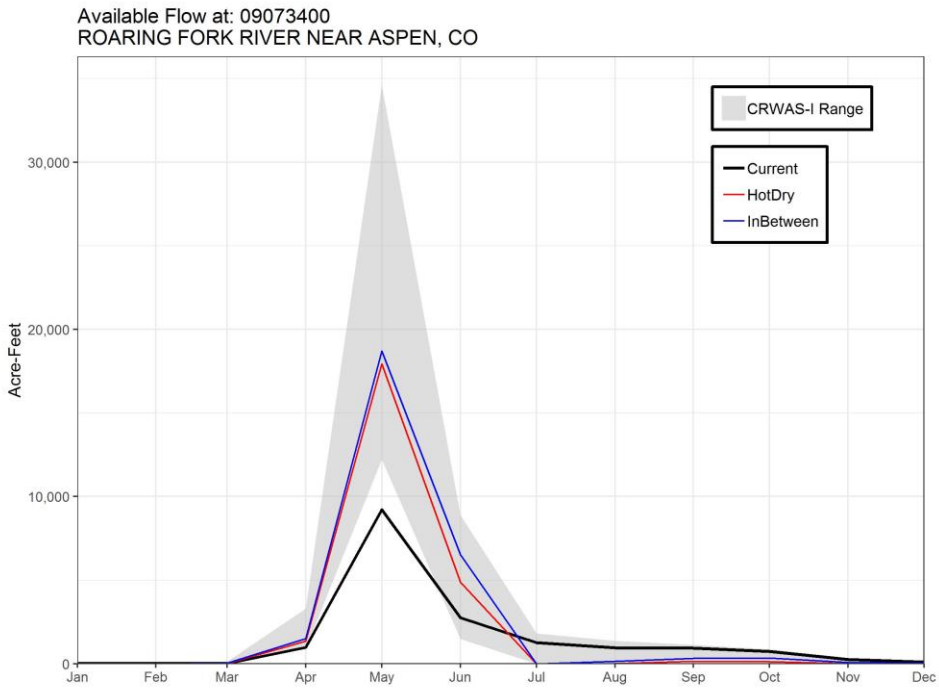


Figure C8: Gage 09085000: Roaring Fork River At Glenwood Springs, CO

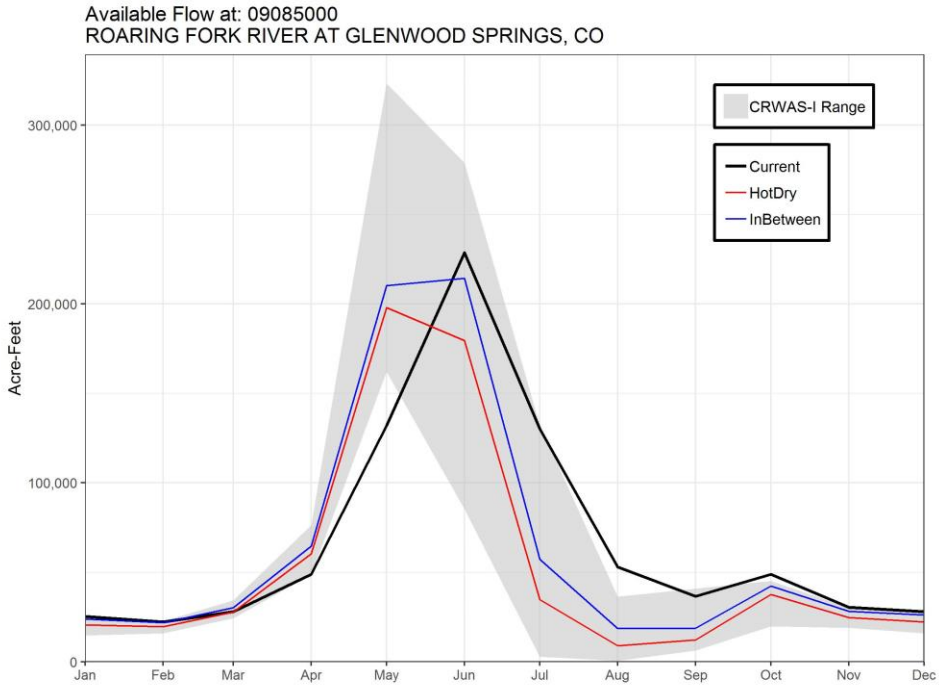


Figure C9: Gage 09095500: Colorado River Near Cameo, CO

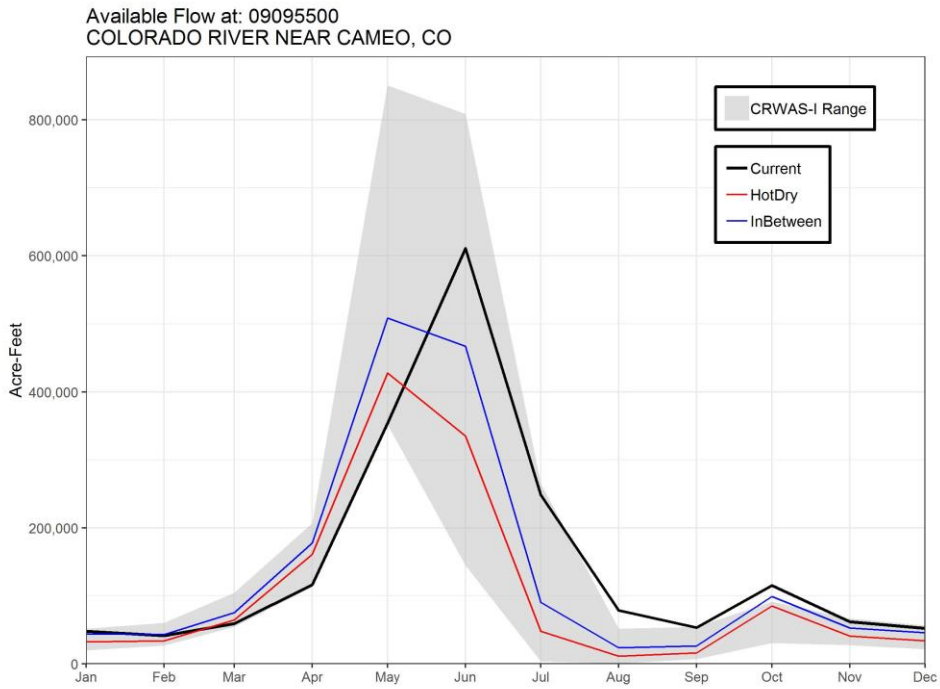


Figure C10: Gage 09105000: Plateau Creek Near Cameo, CO

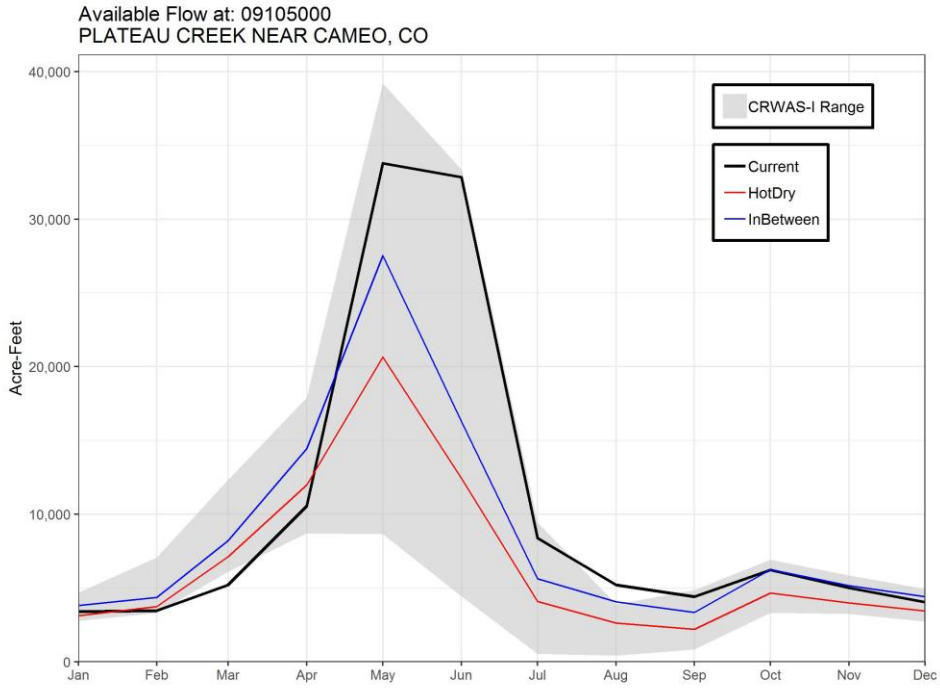


Figure C11: Gage 09163500: Colorado River Near Colorado-Utah State Line

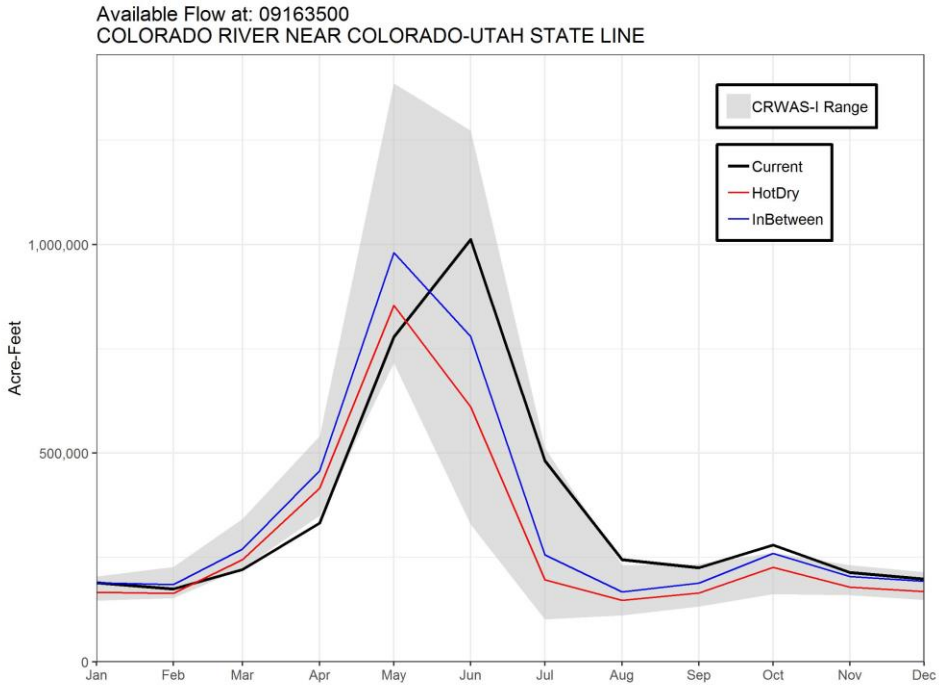


Figure C12: Gage 09110000: Taylor River At Almont, CO

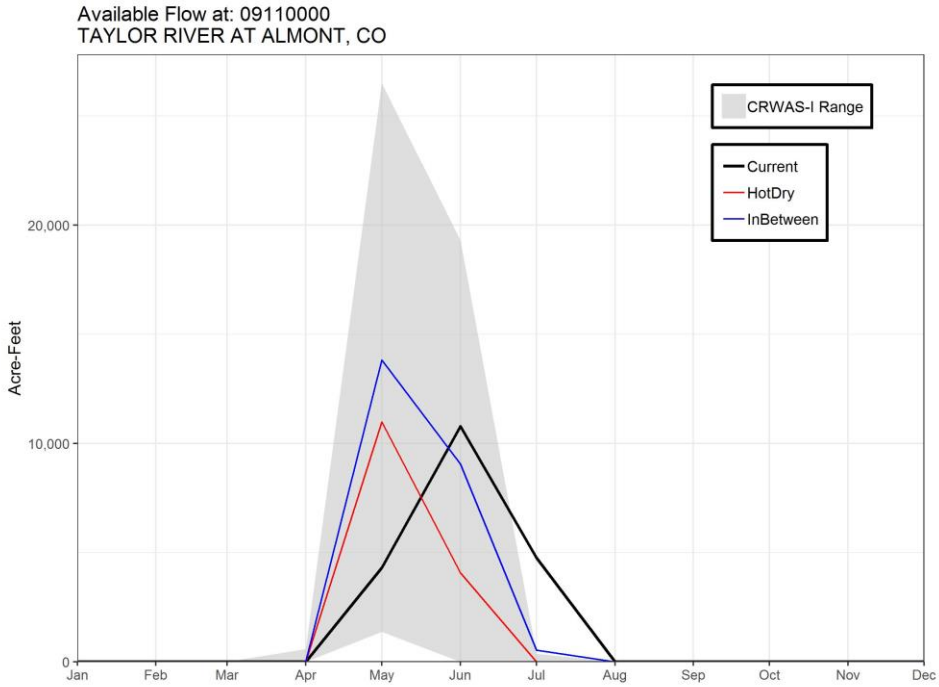


Figure C13: Gage 09112500: East River At Almont, CO

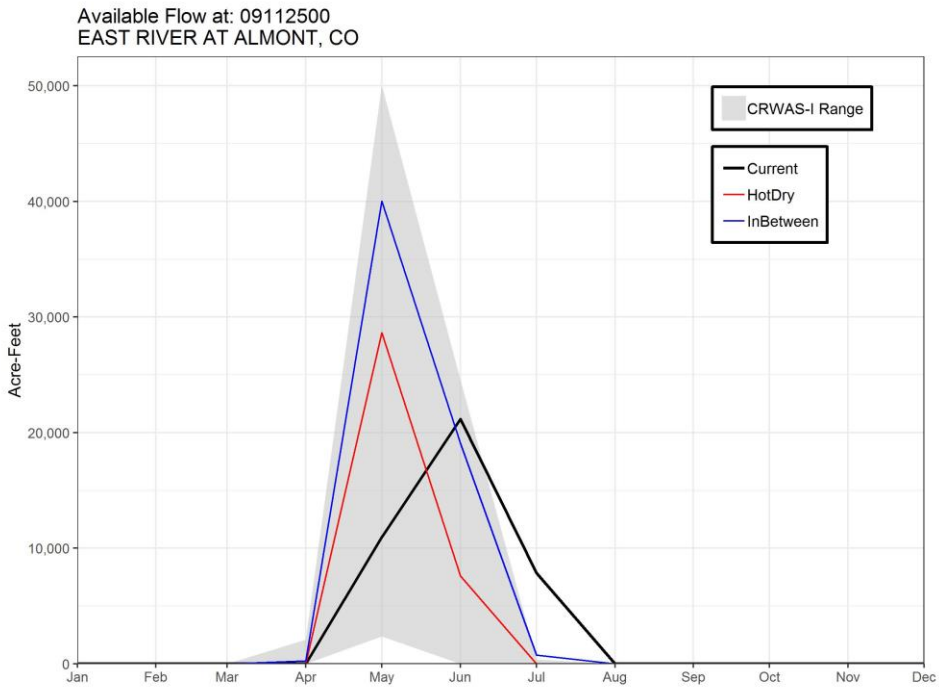


Figure C14: Gage 09114500: Gunnison River Near Gunnison, CO

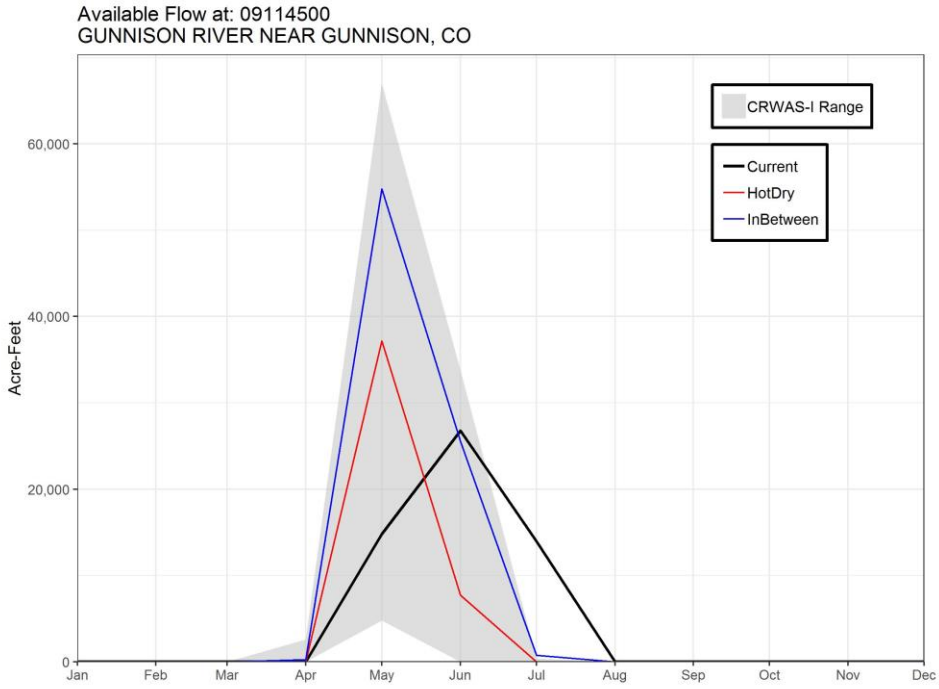


Figure C15: Gage 09119000: Tomichi Creek At Gunnison, CO

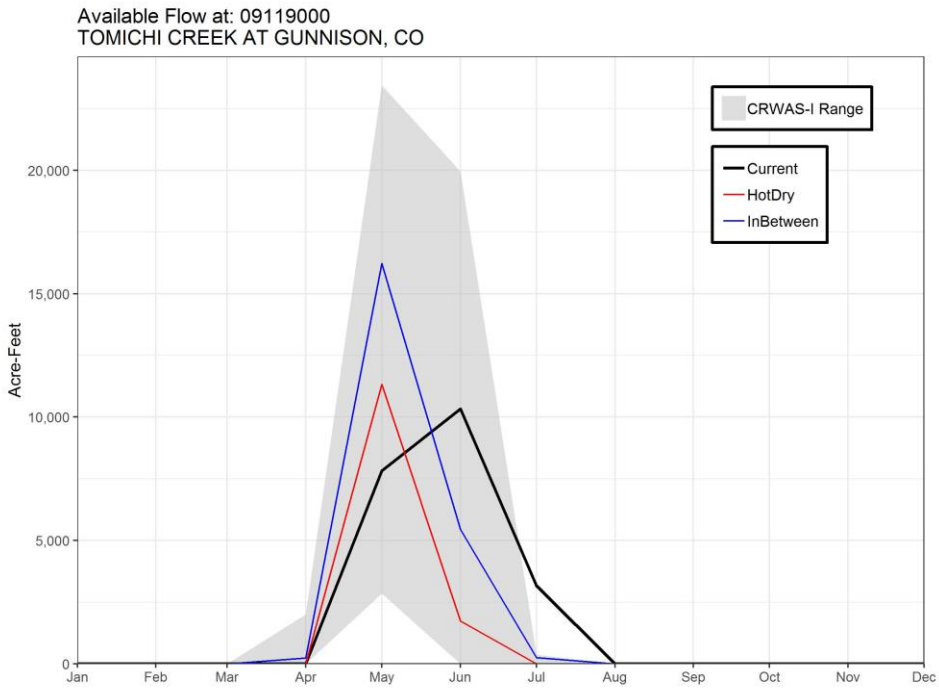


Figure C16: Gage 09128000: Gunnison River Below Gunnison Tunnel, CO

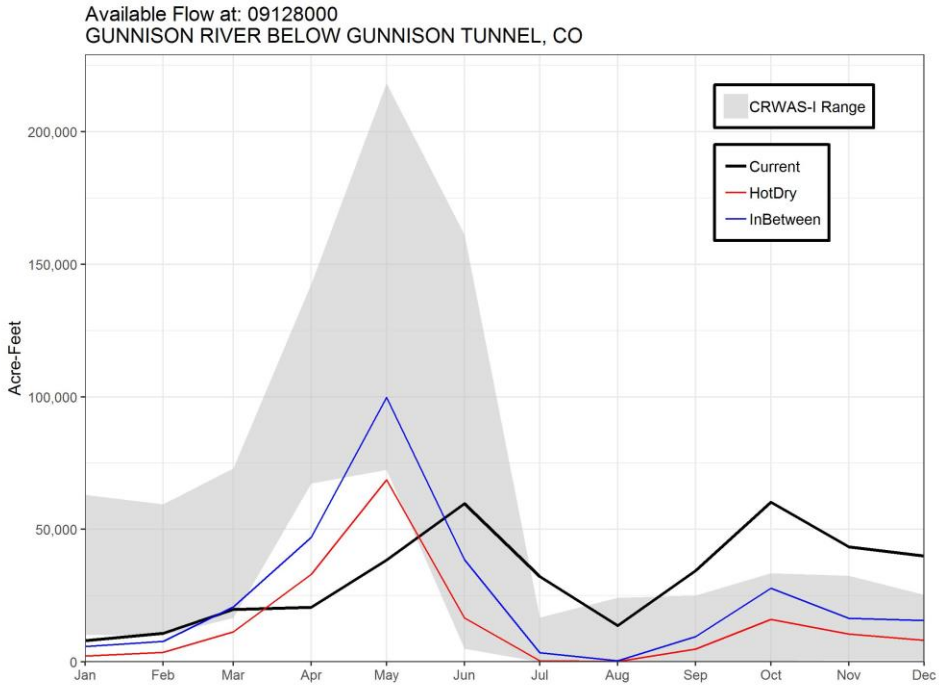


Figure C17: Gage 09136200: Gunnison River Near Lazear, CO

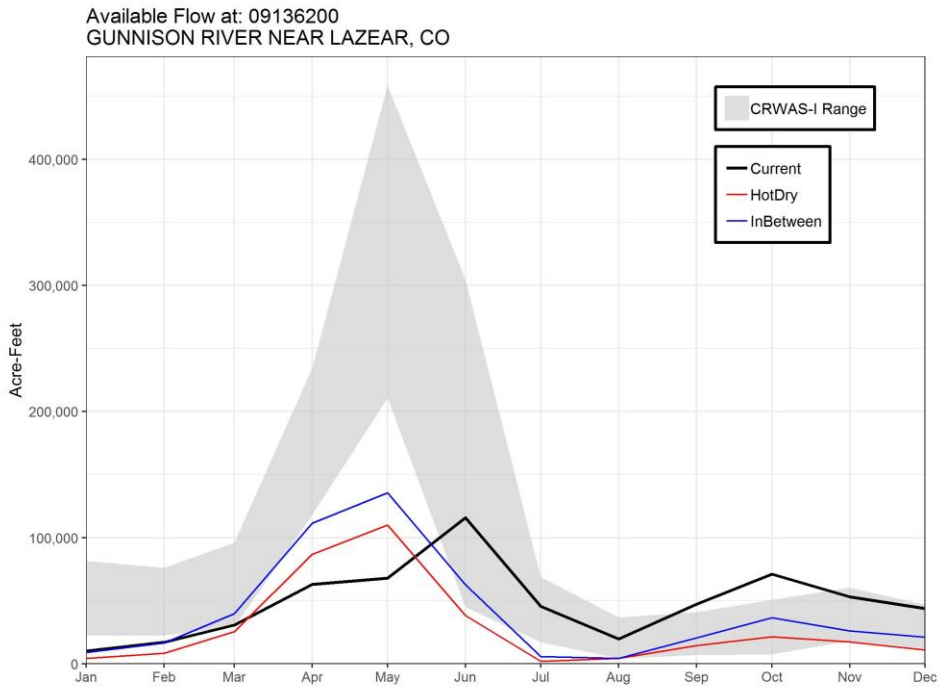


Figure C18: Gage 09149500: Uncompahgre River At Delta, CO

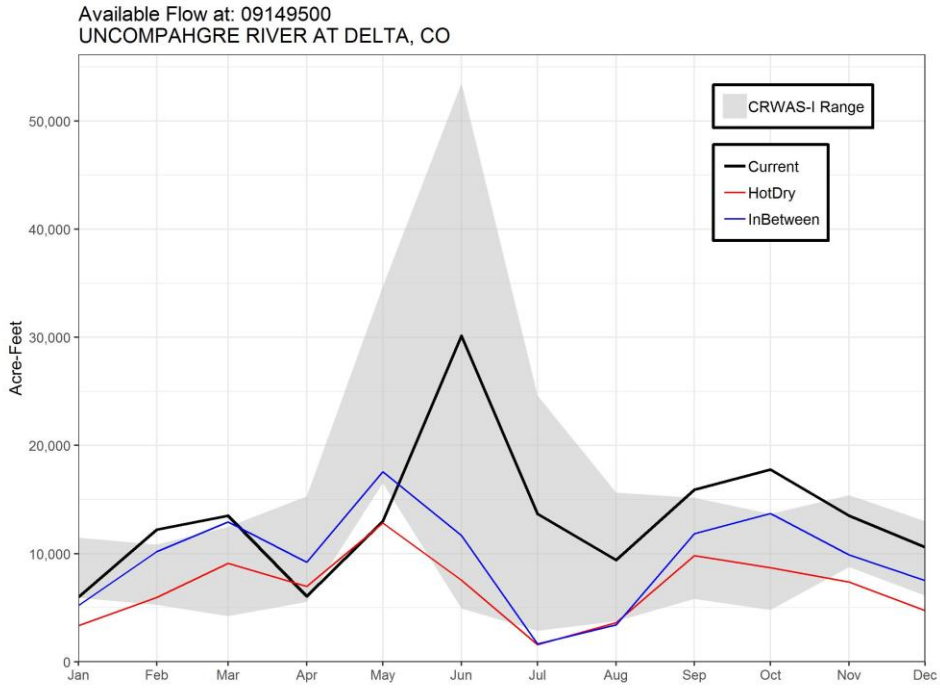


Figure C19: Gage 09152500: Gunnison River Near Grand Junction, CO

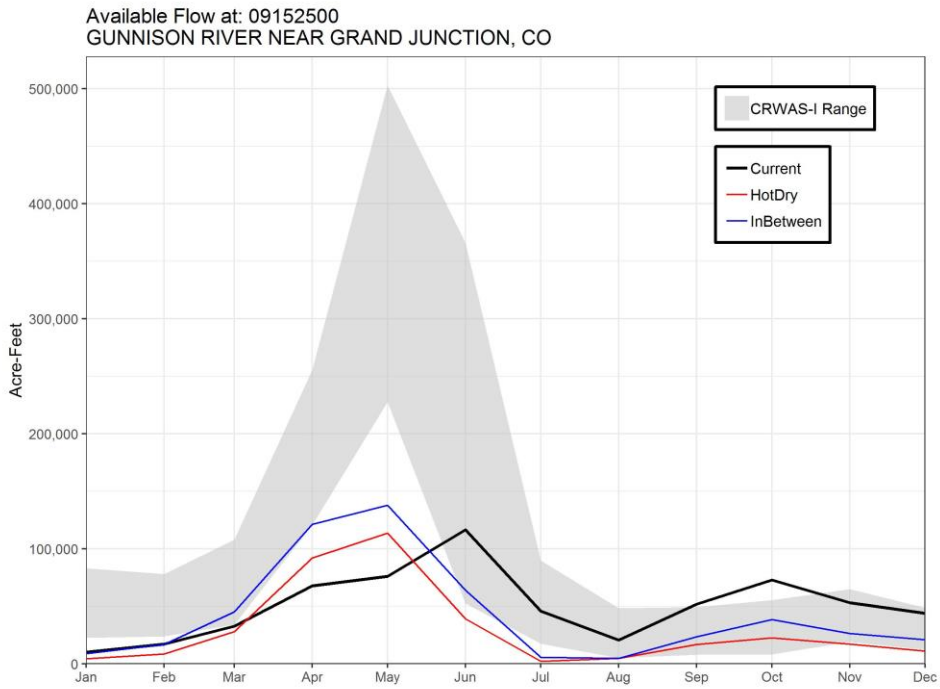


Figure C20: Gage 09171100: Dolores River Near Bedrock

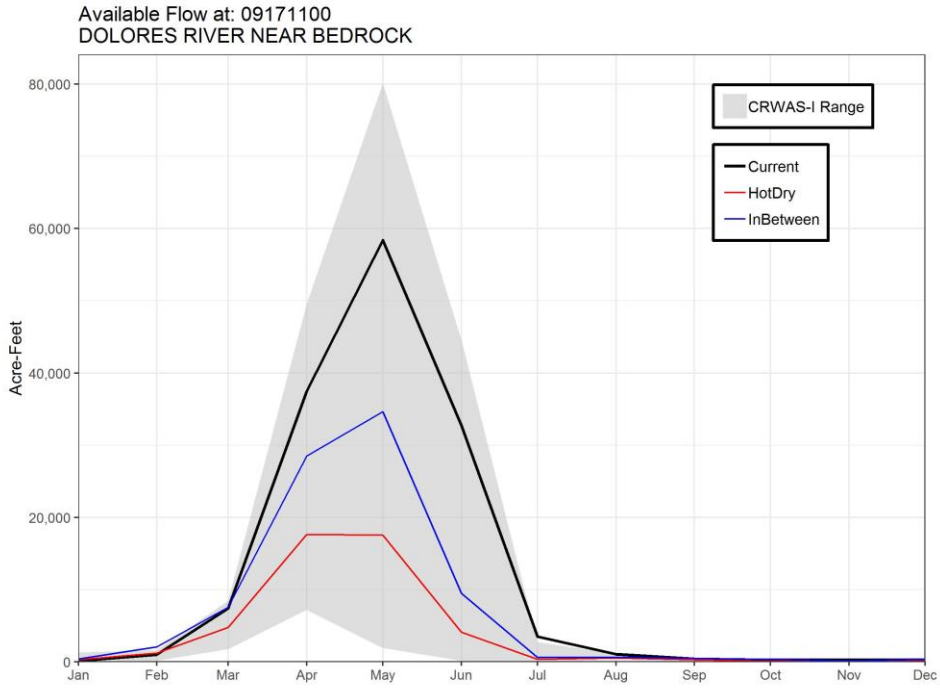


Figure C21: Gage 09175500: San Miguel River At Naturita

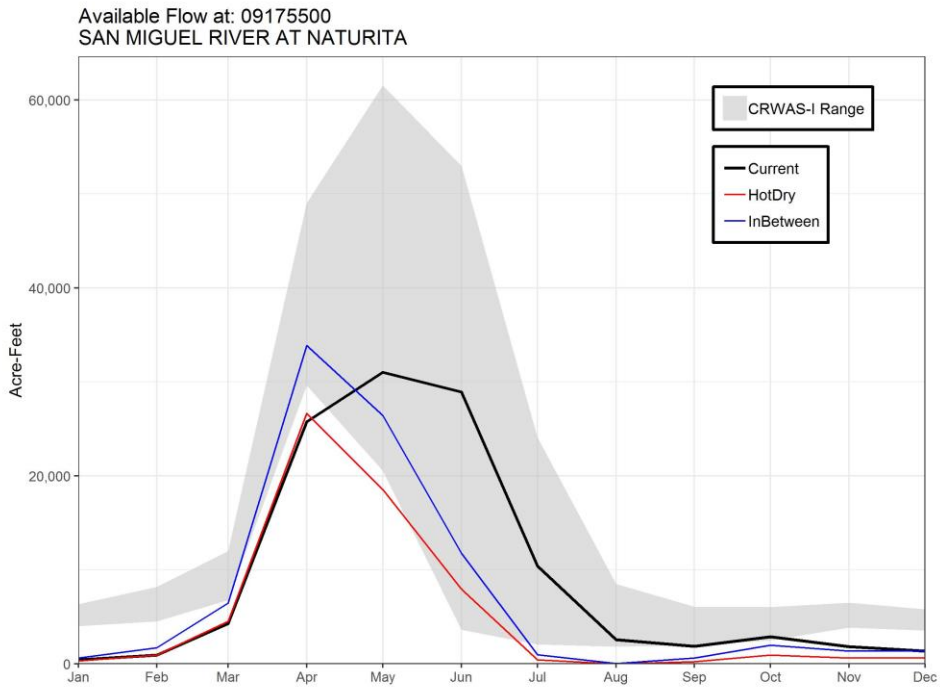


Figure C22: Gage 09346400: San Juan River Near Carracas, CO

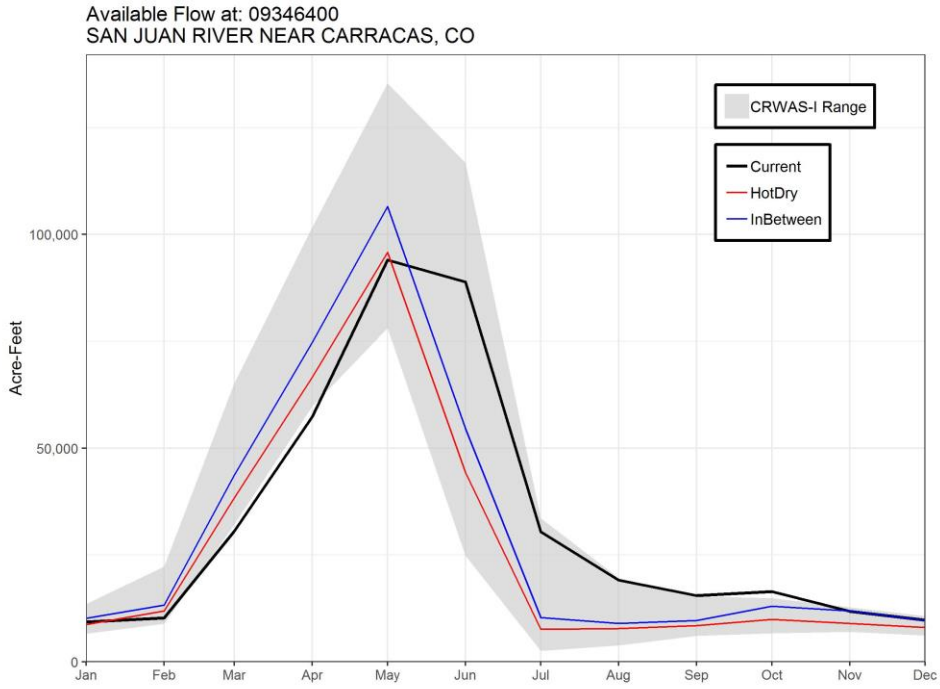


Figure C23: Gage 09349800: Piedra River Near Arboles, CO

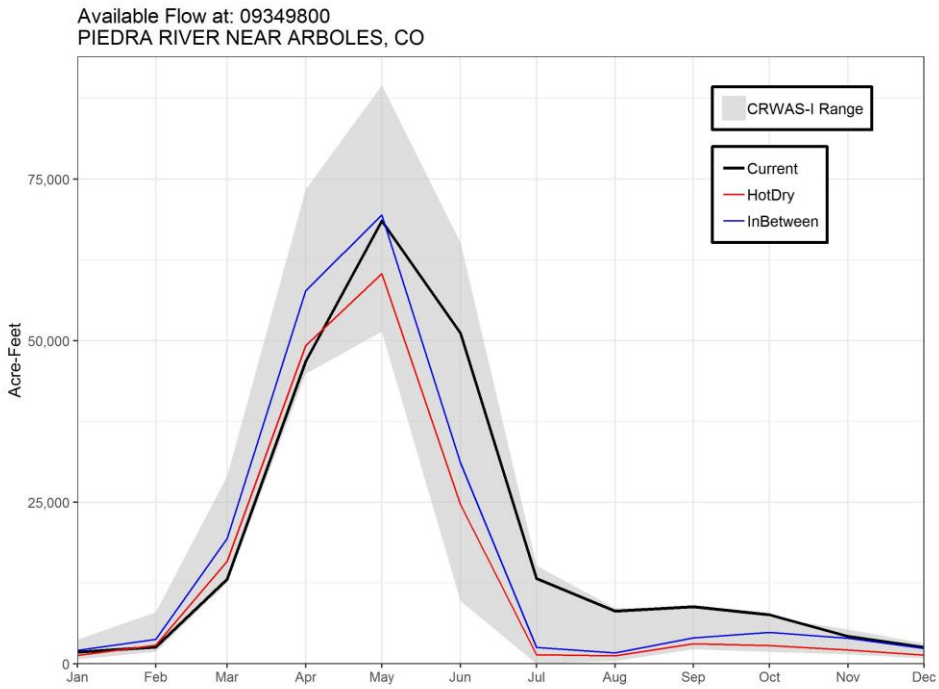


Figure C24: Gage 09354500: Los Pinos River At La Boca, CO

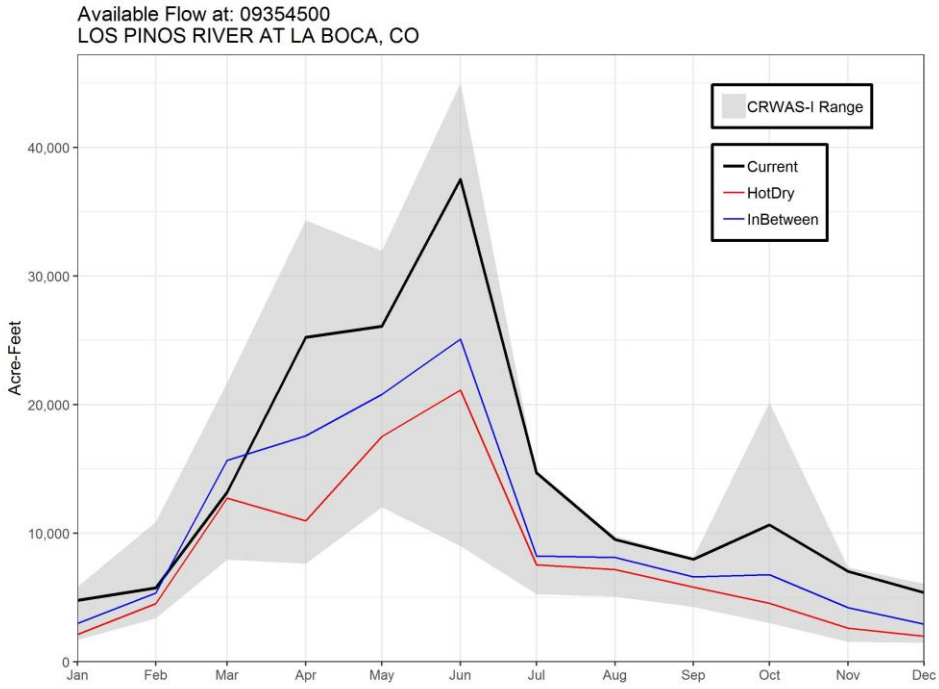


Figure C25: Gage 09363200: Florida River At Bondad, CO

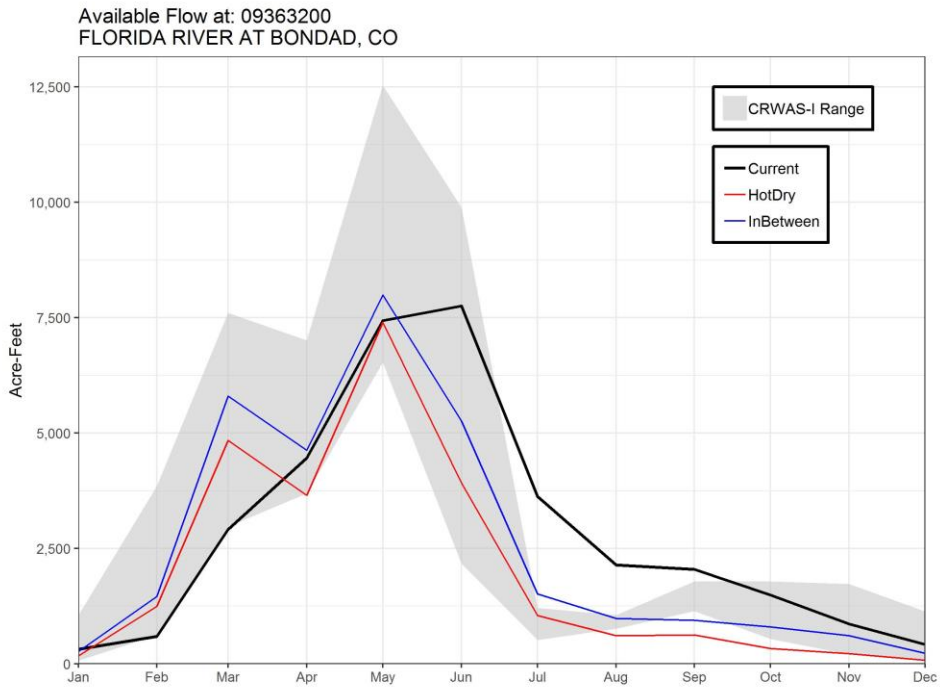


Figure C26: Gage 09363500: Animas River Near Cedar Hill, NM

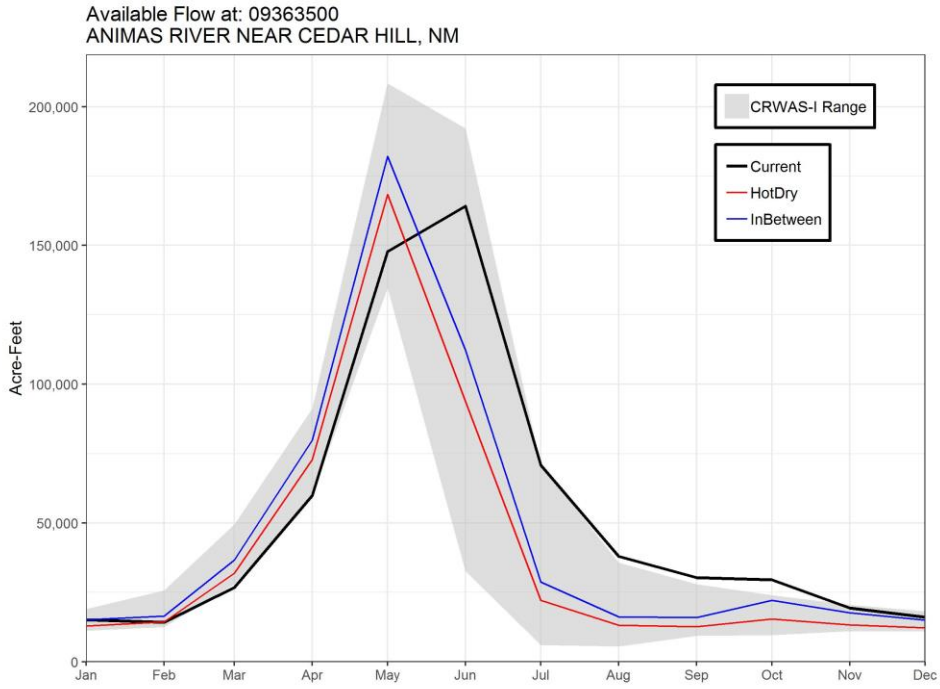


Figure C27: Gage 09365500: La Plata River At Hesperus, CO

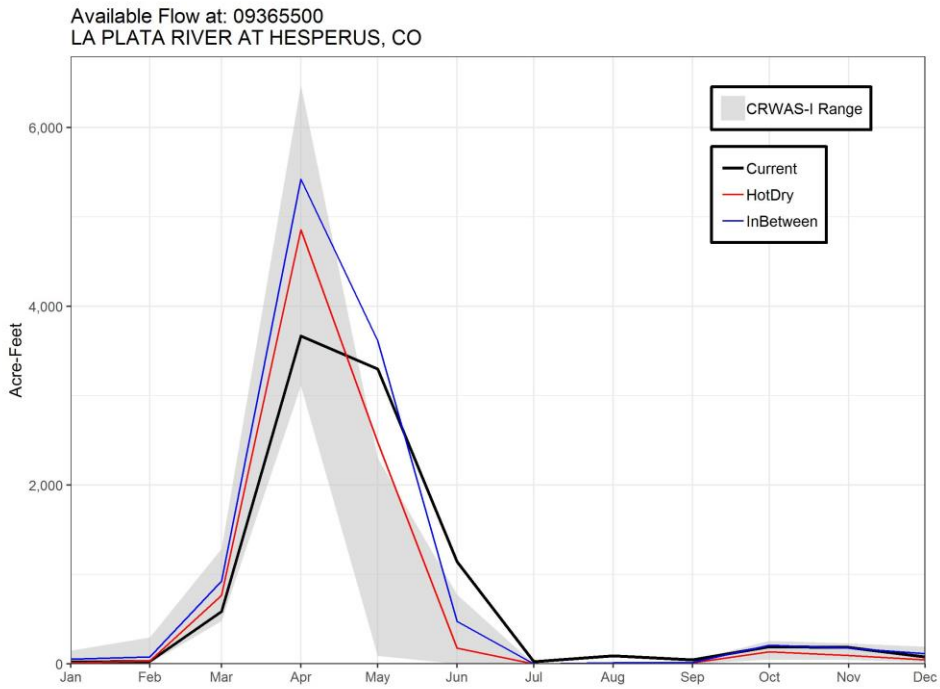


Figure C28: Gage 09366500: La Plata River At Colorado-New Mexico State Line

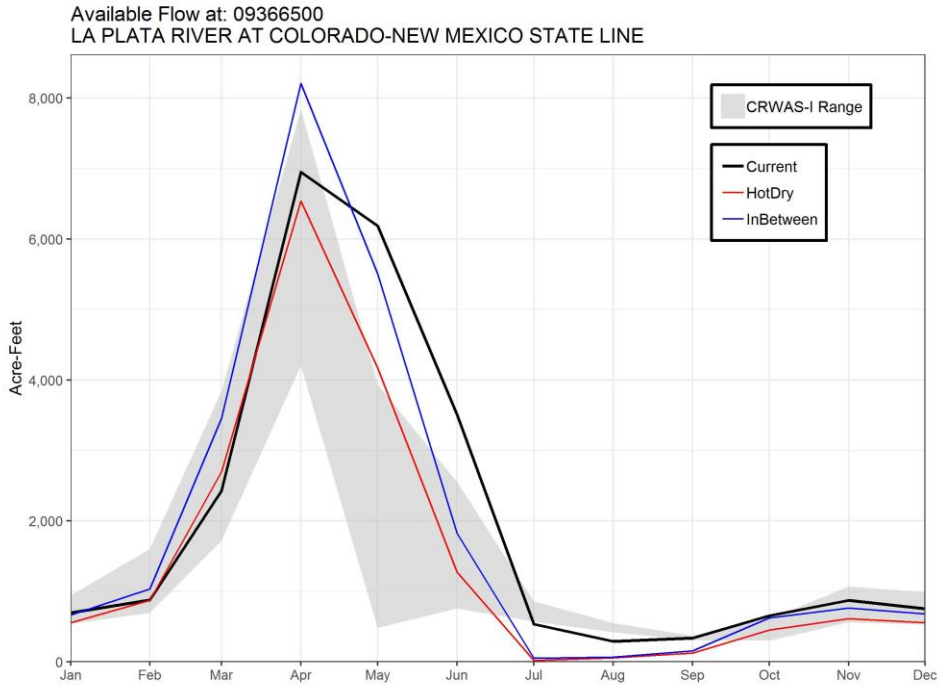


Figure C29: Gage 09371000: Mancos River Near Towaoc, CO

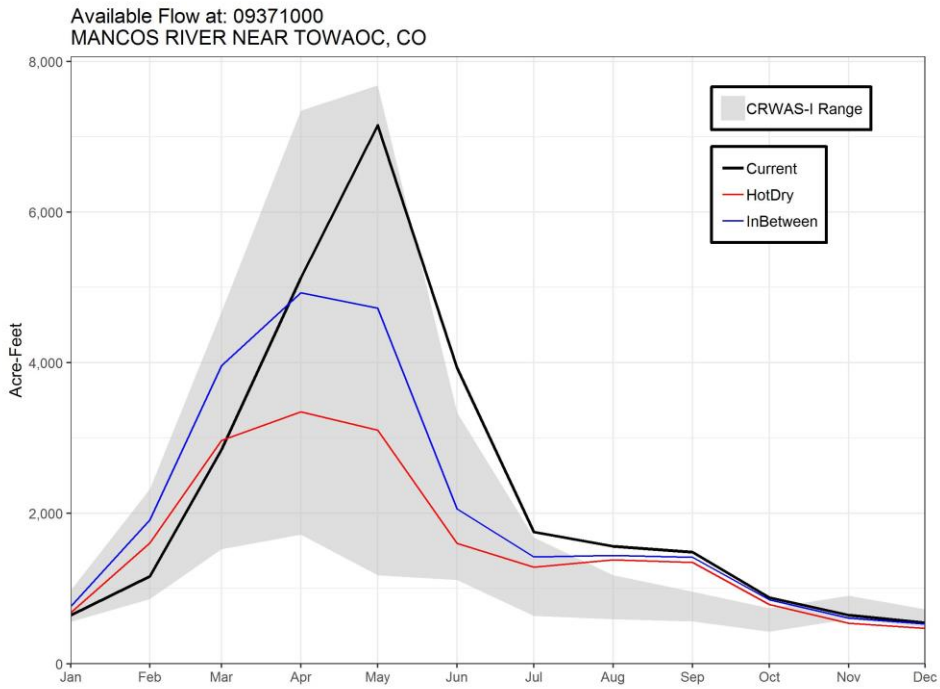


Figure C30: Gage 09237500: Yampa River Below Stagecoach Reservoir, CO

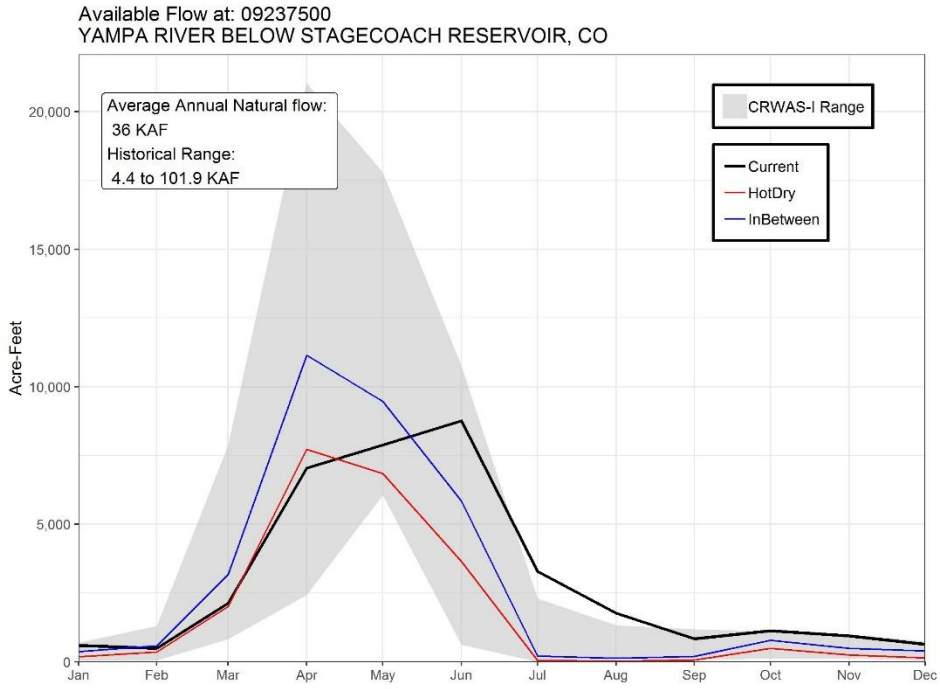


Figure C31: Gage 09241000: Elk River At Clark, CO

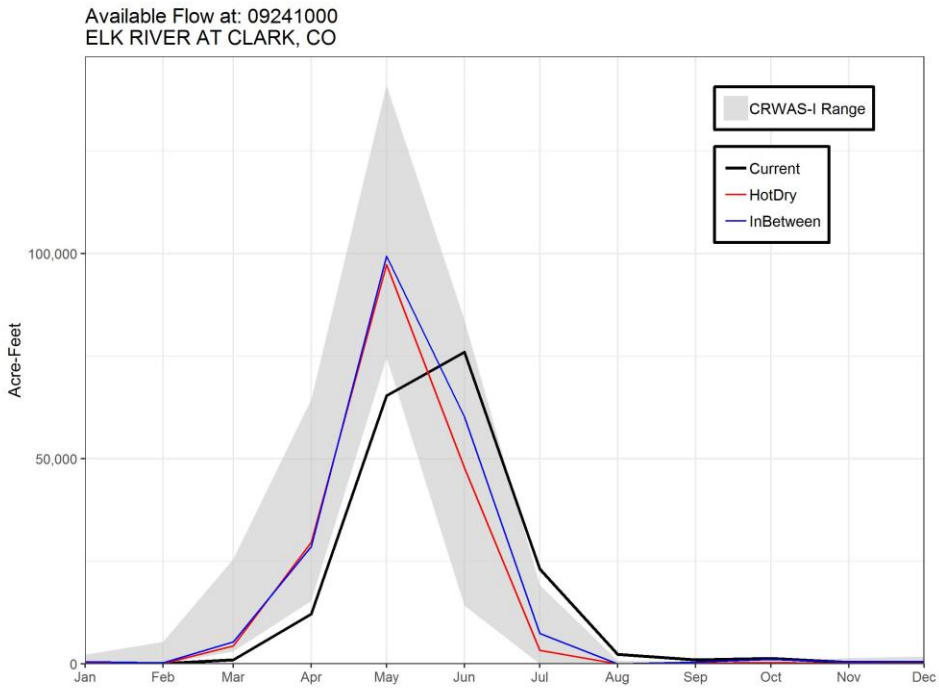


Figure C32: Gage 09245000: Elkhead Creek Near Elkhead, CO

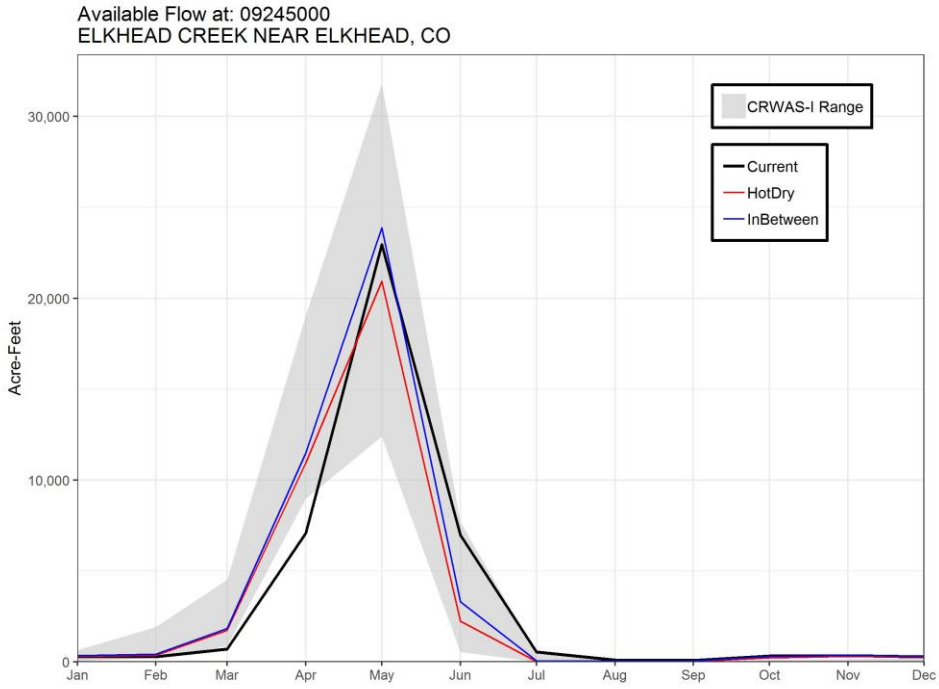


Figure C33: Gage 09249750: Williams Fork At Mouth, Near Hamilton, CO

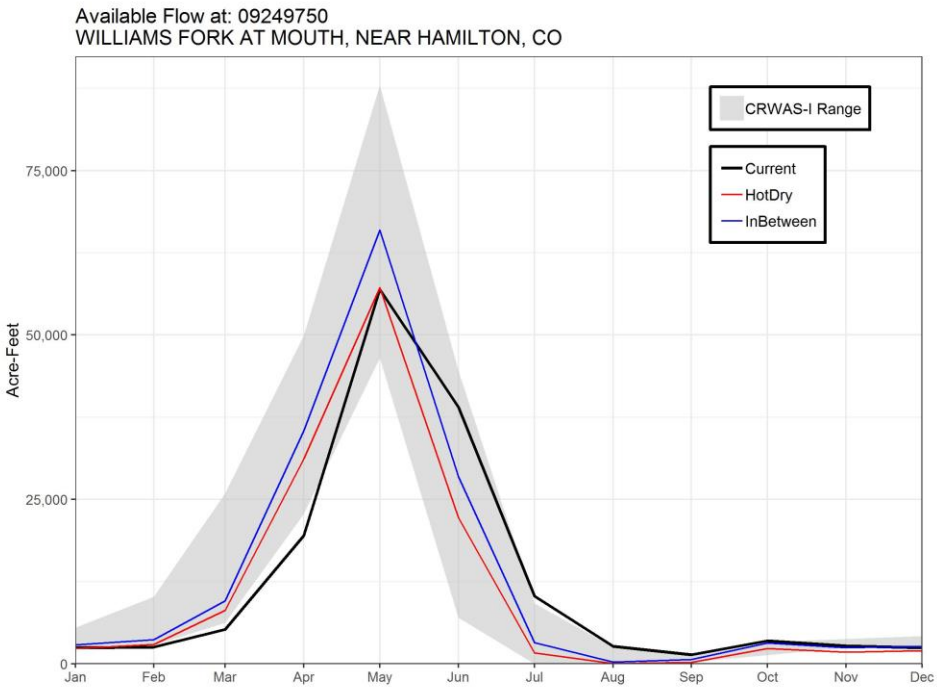


Figure C34: Gage 09251000: Yampa River Near Maybell, CO

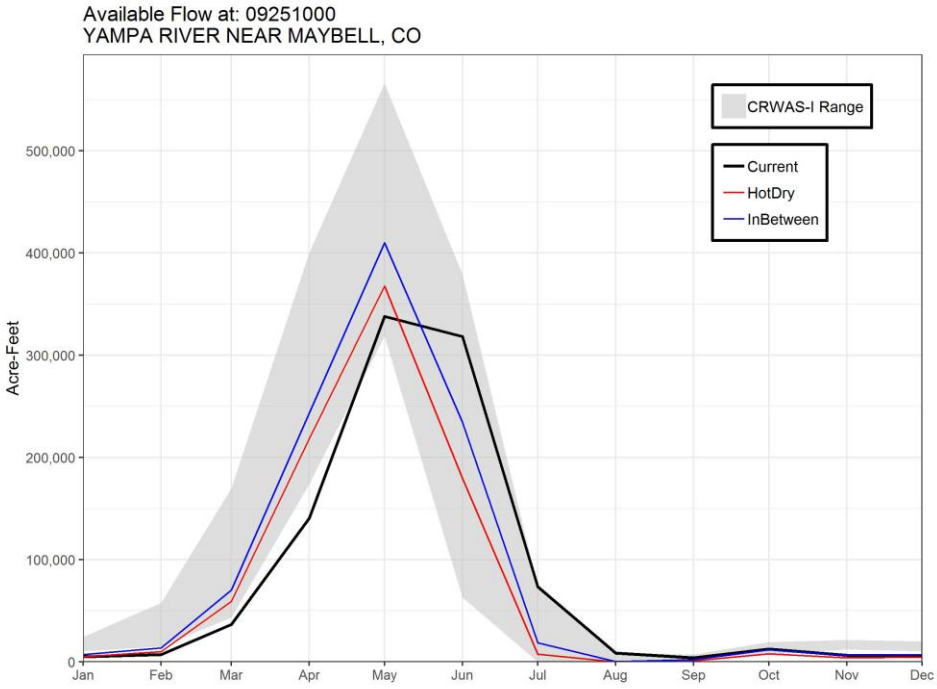


Figure C35: Gage 09260000: Little Snake River Near Lily, CO

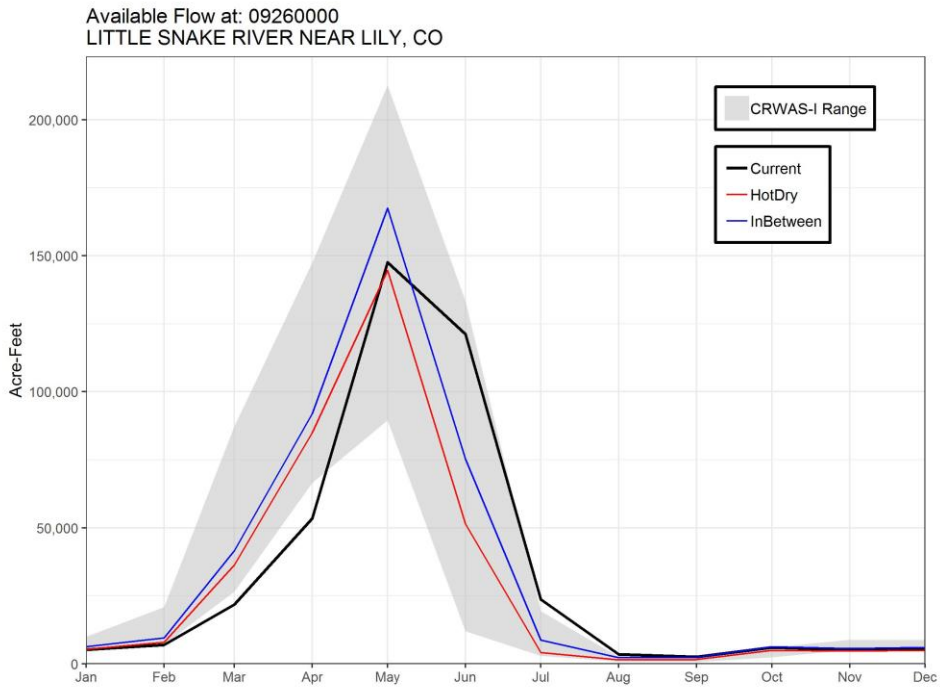


Figure C36: Gage 09260050: Yampa River At Deerlodge Park, CO

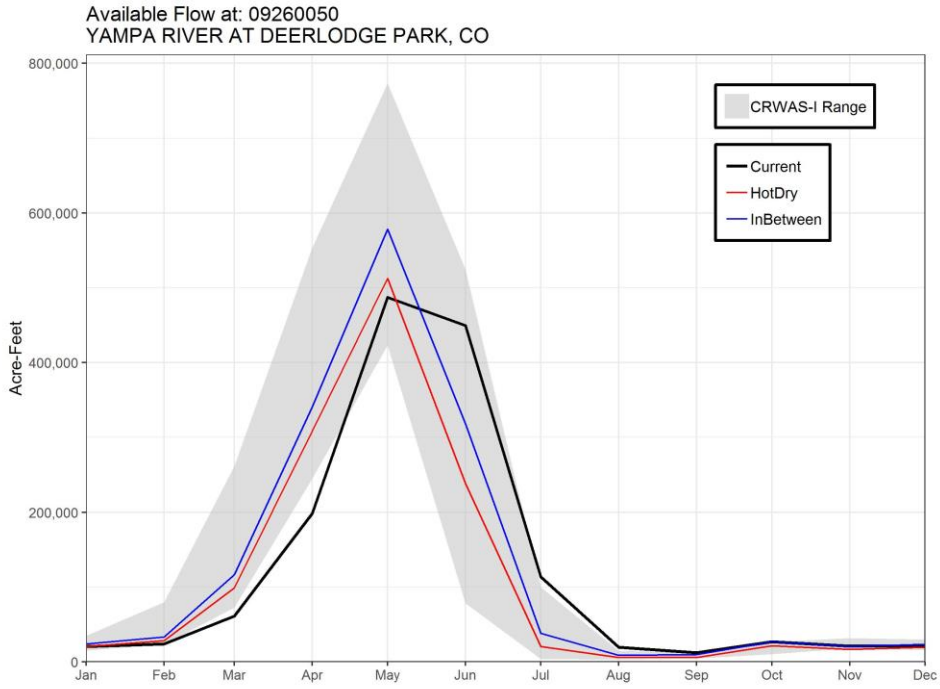


Figure C37: Gage 09303000: North Fork White River At Buford, CO

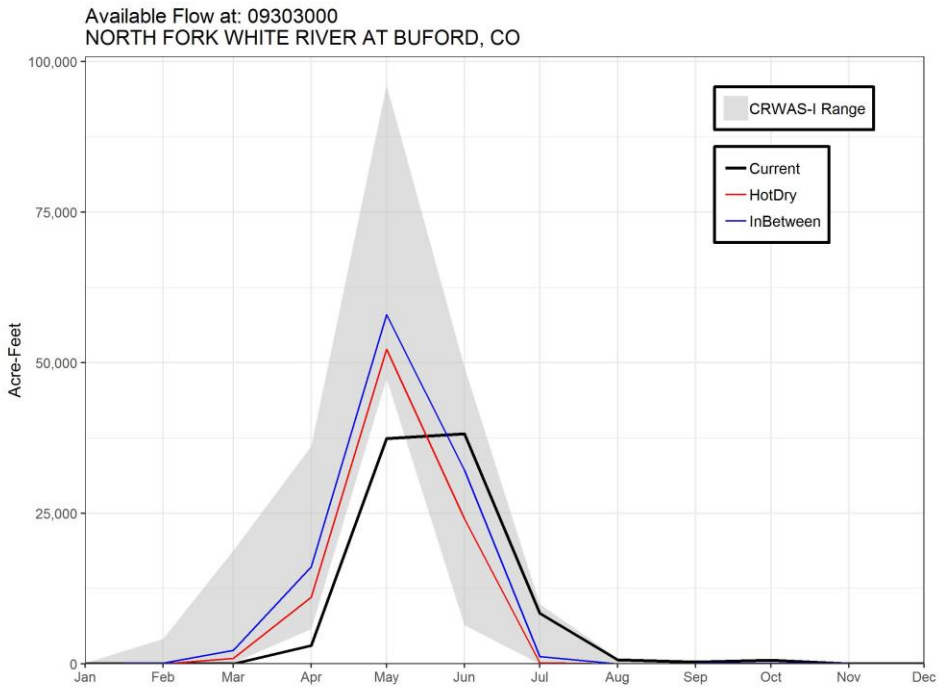


Figure C38: Gage 09304000: South Fork White River At Buford, CO

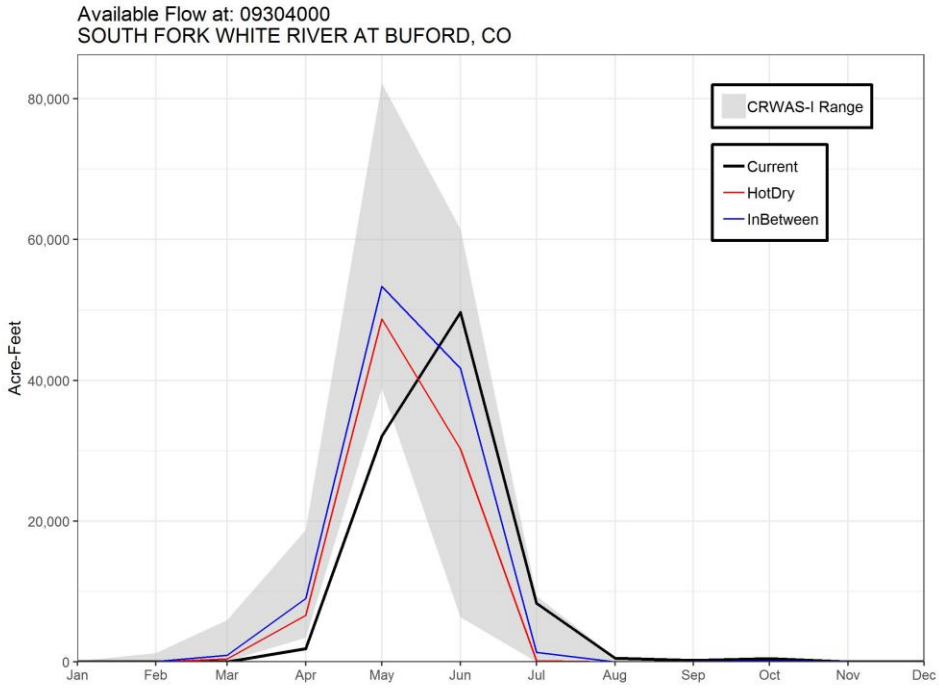


Figure C39: Gage 09304800: White River Below Meeker, CO

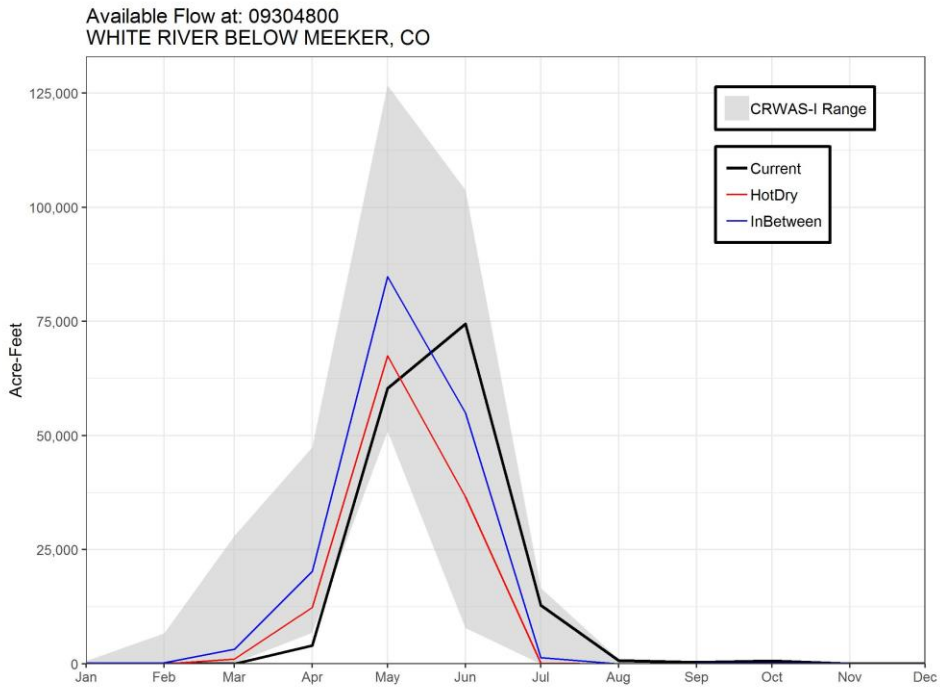


Figure C40: Gage 09306222: Piceance Creek At White River, CO

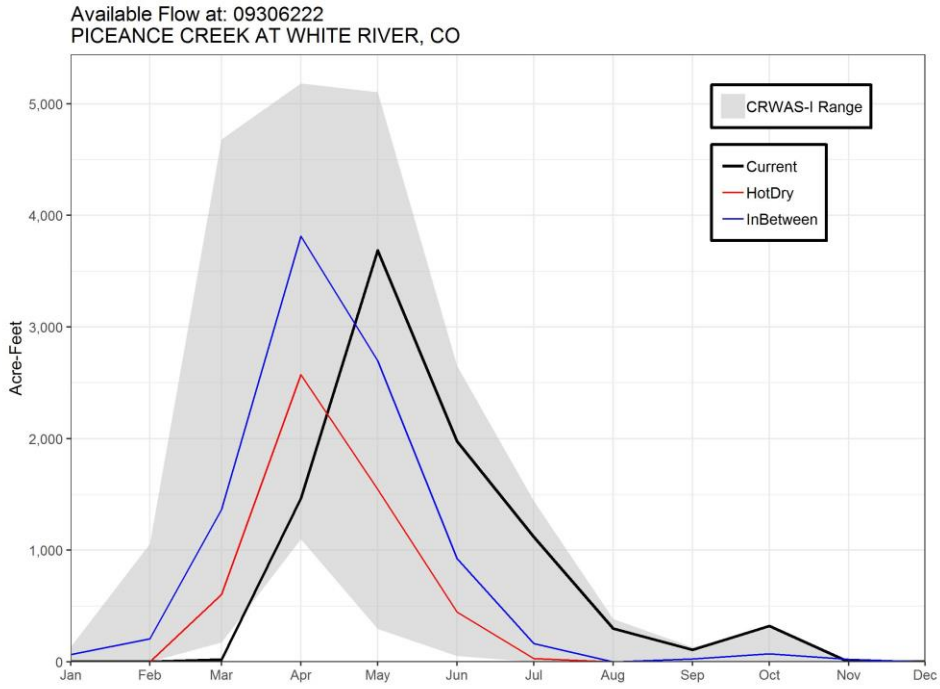


Figure C41: Gage 09306395: White River Near Colorado State Line, UT

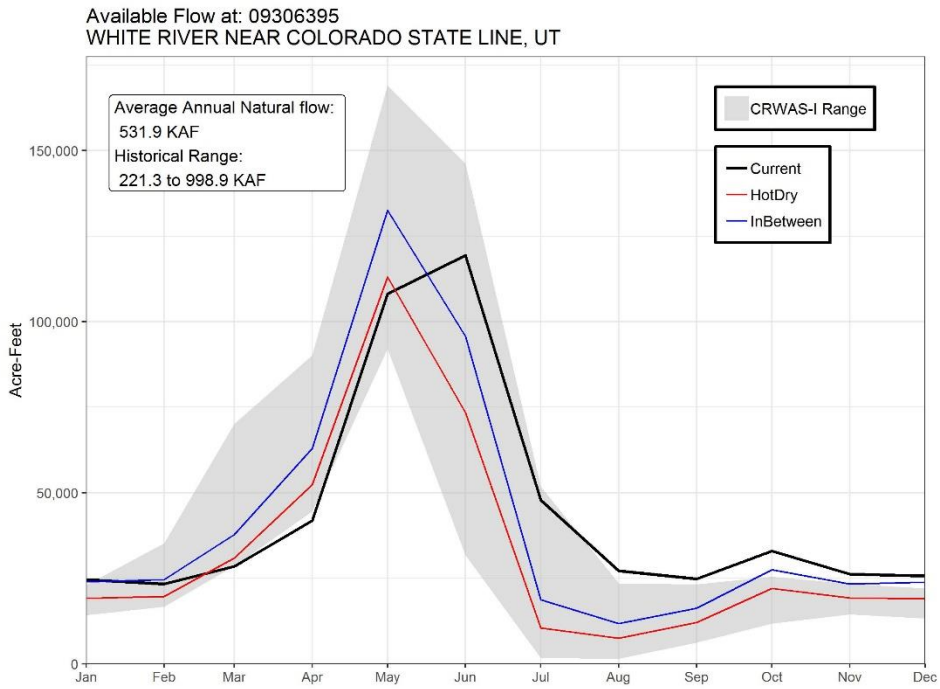


Table C1: Upper Colorado River Basin Average Monthly Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09019500	Colorado River Near Granby, CO															
	Current	2	2	1	33	1,267	19,748	13,224	3,348	533	727	0	0	38,290	N/A	N/A
	HotDry	14	21	0	0	2,752	8,434	1,836	706	16	41	0	0	13,608	-24,682	-64%
	InBetween	7	5	0	0	5,593	25,208	5,702	1,327	136	363	0	0	37,753	-537	-1%
09041500	Muddy Creek At Kremmling, CO															
	Current	750	97	644	1,202	17,920	18,791	4,510	3,977	8,309	2,513	1,051	848	60,013	N/A	N/A
	HotDry	438	81	594	2,289	22,711	5,526	296	1,671	1,780	1,148	651	414	37,197	-22,816	-38%
	InBetween	616	82	741	2,673	29,554	9,334	776	2,367	3,584	1,438	911	601	52,064	-7,949	-13%
09050700	Blue River Below Dillon, CO															
	Current	57	66	418	0	825	21,584	13,412	1,880	517	166	111	71	38,506	N/A	N/A
	HotDry	16	9	352	0	1,268	6,465	1,390	277	60	14	11	13	9,722	-28,784	-75%
	InBetween	28	9	336	0	3,718	14,020	3,616	541	126	64	15	31	22,161	-16,345	-42%
09057500	Blue River Below Green Mountain Reservoir, CO															
	Current	11,290	10,126	12,070	1,301	4,088	48,888	41,517	19,377	14,543	14,893	12,859	11,291	199,687	N/A	N/A
	HotDry	5,700	6,219	10,120	1,481	7,462	28,253	11,273	4,129	3,851	7,343	5,613	4,796	95,003	-104,685	-52%
	InBetween	9,345	9,204	12,833	1,515	11,421	39,059	18,159	7,880	6,716	9,975	9,496	8,768	142,409	-57,279	-29%
09070000	Eagle River Below Gypsum, CO															
	Current	6,759	5,919	7,632	13,204	70,938	125,160	50,434	13,890	7,124	11,839	9,087	7,406	325,488	N/A	N/A
	HotDry	3,956	4,183	8,241	26,504	87,722	69,380	12,848	2,503	1,735	5,592	4,390	3,529	227,731	-97,757	-30%
	InBetween	6,185	6,036	9,880	27,393	96,724	90,764	20,589	4,778	3,002	7,868	7,264	6,258	283,169	-42,319	-13%
09070500	Colorado River Near Dotsero, CO															
	Current	14,557	11,005	14,754	19,939	164,805	322,982	125,479	34,274	20,515	20,300	17,758	13,896	770,254	N/A	N/A
	HotDry	6,972	7,151	18,592	56,579	207,561	145,892	21,319	4,788	4,332	8,009	6,555	5,429	486,916	-283,339	-37%
	InBetween	12,649	11,336	23,525	59,700	253,621	226,745	42,329	10,084	8,514	12,904	12,587	10,975	676,143	-94,111	-12%
09073400	Roaring Fork River Near Aspen, CO															
	Current	18	10	29	983	9,220	2,754	1,269	959	942	751	250	98	17,072	N/A	N/A
	HotDry	2	0	16	1,353	17,943	4,893	0	17	154	123	15	6	24,211	7,139	42%
	InBetween	9	4	39	1,507	18,699	6,536	1	142	332	345	87	34	27,392	10,320	60%
09085000	Roaring Fork River At Glenwood Springs, CO															
	Current	25,380	22,343	28,121	48,914	132,020	228,694	130,106	53,061	36,615	48,958	30,554	27,991	805,549	N/A	N/A
	HotDry	20,617	19,581	27,762	60,474	197,989	179,467	34,701	8,891	12,291	37,592	24,721	22,298	640,121	-165,427	-21%
	InBetween	23,944	21,896	30,288	64,579	210,236	214,407	57,356	18,611	18,744	42,310	28,298	26,211	749,871	-55,678	-7%

Appendix C: Average Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09095500	Colorado River Near Cameo, CO															
	Current	47,657	41,589	59,320	116,168	354,184	610,937	248,171	78,464	53,543	115,011	61,728	52,352	1,820,792	N/A	N/A
	HotDry	32,349	33,670	64,644	161,245	427,647	335,250	47,701	11,176	16,316	85,222	40,782	33,822	1,276,536	-544,257	-30%
	InBetween	44,313	42,994	75,390	177,502	508,649	466,896	90,406	23,862	26,400	99,251	52,979	45,851	1,637,708	-183,085	-10%
09105000	Plateau Creek Near Cameo, CO															
	Current	3,405	3,476	5,217	10,575	33,782	32,857	8,387	5,212	4,418	6,225	5,012	4,046	121,180	N/A	N/A
	HotDry	3,122	3,750	7,118	11,979	20,663	12,436	4,103	2,619	2,197	4,654	3,998	3,454	79,210	-41,970	-35%
	InBetween	3,828	4,377	8,210	14,454	27,545	16,286	5,641	4,074	3,356	6,249	5,159	4,417	102,421	-18,759	-15%
09163500	Colorado River Near Colorado-Utah State Line															
	Current	189,538	174,704	221,071	332,684	778,801	1,011,789	481,745	245,074	225,408	279,645	213,760	198,389	4,318,270	N/A	N/A
	HotDry	166,399	164,478	245,027	416,126	854,027	610,597	196,363	147,410	164,878	226,775	178,879	168,045	3,511,991	-806,278	-19%
	InBetween	189,435	184,897	270,567	457,819	980,480	779,274	256,323	167,515	188,461	260,011	204,079	193,237	4,099,176	-219,093	-5%

Table C2: Gunnison River Basin Average Monthly Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09110000	**Taylor River At Almont, CO**															
	Current	0	0	0	0	4,315	10,784	4,760	0	0	0	0	0	19,554	N/A	N/A
	HotDry	0	0	0	0	10,986	4,070	0	0	0	0	0	0	14,824	-4,730	-24%
	InBetween	0	0	0	16	13,830	9,059	538	0	0	0	0	0	23,081	3,527	18%
09112500	**East River At Almont, CO**															
	Current	0	0	0	0	10,953	21,156	7,851	0	0	0	0	0	39,345	N/A	N/A
	HotDry	0	0	0	0	28,640	7,592	0	0	0	0	0	0	35,675	-3,671	-9%
	InBetween	0	0	0	238	40,036	19,091	742	0	0	0	0	0	59,182	19,837	50%
09114500	**Gunnison River Near Gunnison, CO**															
	Current	0	0	0	0	14,823	26,781	13,944	0	0	0	0	0	54,693	N/A	N/A
	HotDry	0	0	0	0	37,198	7,727	0	0	0	0	0	0	44,233	-10,460	-19%
	InBetween	0	0	0	238	54,807	25,545	742	0	0	0	0	0	80,081	25,387	46%
09119000	**Tomichi Creek At Gunnison, CO**															
	Current	0	0	0	0	7,830	10,332	3,160	0	0	0	0	0	20,994	N/A	N/A
	HotDry	0	0	0	0	11,323	1,741	0	0	0	0	0	0	12,864	-8,130	-39%
	InBetween	0	0	0	238	16,225	5,454	256	0	0	0	0	0	21,832	838	4%
09128000	**Gunnison River Below Gunnison Tunnel, CO**															
	Current	8,024	10,768	19,790	20,633	38,360	59,649	32,148	13,713	34,475	60,332	43,411	39,993	383,318	N/A	N/A
	HotDry	2,152	3,627	11,307	33,071	68,730	16,598	361	92	4,814	16,015	10,556	8,114	179,987	-203,331	-53%
	InBetween	5,745	7,727	20,708	46,981	99,856	38,532	3,471	377	9,562	27,723	16,394	15,611	295,836	-87,482	-23%
09136200	**Gunnison River Near Lazear, CO**															
	Current	10,137	17,188	30,764	62,926	67,944	115,724	45,603	19,864	47,340	71,125	53,089	43,872	584,905	N/A	N/A
	HotDry	4,322	8,520	25,542	86,899	110,025	38,388	2,041	4,413	14,597	21,467	17,262	11,144	346,884	-238,021	-41%
	InBetween	9,023	16,451	39,809	111,637	135,690	62,753	5,697	4,224	20,575	36,694	26,157	21,049	490,294	-94,611	-16%
09149500	**Uncompahgre River At Delta, CO**															
	Current	5,978	12,214	13,508	6,061	12,996	30,154	13,690	9,403	15,915	17,780	13,510	10,609	159,873	N/A	N/A
	HotDry	3,343	5,966	9,121	6,986	12,823	7,556	1,573	3,613	9,833	8,693	7,368	4,752	80,826	-79,047	-49%
	InBetween	5,225	10,198	12,920	9,213	17,593	11,682	1,663	3,423	11,852	13,707	9,888	7,526	113,652	-46,221	-29%
09152500	**Gunnison River Near Grand Junction, CO**															
	Current	10,137	17,277	32,655	67,754	76,213	116,695	45,944	20,610	51,749	72,917	53,192	43,872	608,100	N/A	N/A
	HotDry	4,322	8,520	28,081	92,074	113,684	39,029	2,041	4,834	16,774	22,522	17,307	11,144	362,363	-245,737	-40%
	InBetween	9,023	16,742	45,108	121,251	137,954	63,841	5,697	4,613	23,574	38,483	26,365	21,087	513,989	-94,112	-15%

TableC3: San Juan/Dolores River Basin Average Monthly Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09171100	**Dolores River Near Bedrock**															
	Current	164	1,022	7,401	37,502	58,390	32,721	3,474	1,066	416	251	282	251	140,826	N/A	N/A
	HotDry	292	1,237	4,784	17,631	17,556	4,099	349	528	303	89	77	221	46,479	-94,347	-67%
	InBetween	415	2,064	7,532	28,495	34,637	9,490	592	642	505	337	134	339	83,929	-56,897	-40%
09175500	**San Miguel River At Naturita**															
	Current	430	914	4,299	25,752	31,016	28,921	10,418	2,576	1,858	2,890	1,829	1,374	110,657	N/A	N/A
	HotDry	297	947	4,530	26,667	18,542	7,944	408	0	243	925	612	652	60,856	-49,800	-45%
	InBetween	622	1,698	6,455	33,863	26,433	11,758	978	45	614	1,968	1,343	1,358	85,905	-24,752	-22%
09346400	**San Juan River Near Carracas, CO**															
	Current	9,294	10,285	30,594	57,355	94,015	88,861	30,390	19,098	15,537	16,448	11,793	9,762	389,499	N/A	N/A
	HotDry	8,758	11,876	38,361	66,634	95,874	44,335	7,627	7,830	8,456	9,948	9,025	8,033	313,388	-76,110	-20%
	InBetween	10,162	13,308	43,710	74,768	106,511	54,569	10,330	9,019	9,685	13,053	11,946	9,712	362,840	-26,659	-7%
09349800	**Piedra River Near Arboles, CO**															
	Current	1,834	2,581	13,107	46,802	68,553	51,191	13,211	8,147	8,864	7,613	4,269	2,553	226,230	N/A	N/A
	HotDry	1,323	2,884	15,866	49,250	60,388	24,674	1,385	1,240	3,124	2,818	2,154	1,347	164,395	-61,835	-27%
	InBetween	2,101	3,768	19,387	57,751	69,417	31,091	2,522	1,703	4,022	4,886	3,979	2,403	200,586	-25,644	-11%
09354500	**Los Pinos River At La Boca, CO**															
	Current	4,781	5,749	13,174	25,225	26,088	37,504	14,699	9,497	7,978	10,641	7,037	5,376	165,554	N/A	N/A
	HotDry	2,137	4,540	12,738	10,978	17,502	21,146	7,553	7,175	5,816	4,543	2,620	1,977	97,490	-68,064	-41%
	InBetween	2,988	5,362	15,656	17,573	20,799	25,086	8,237	8,111	6,613	6,784	4,223	2,944	122,791	-42,763	-26%
09363200	**Florida River At Bondad, CO**															
	Current	313	594	2,912	4,464	7,437	7,757	3,628	2,143	2,046	1,494	867	422	33,600	N/A	N/A
	HotDry	172	1,245	4,841	3,653	7,401	3,922	1,050	612	627	330	221	78	23,829	-9,771	-29%
	InBetween	268	1,463	5,799	4,626	7,996	5,263	1,514	982	947	804	611	228	30,080	-3,520	-10%
09363500	**Animas River Near Cedar Hill, NM**															
	Current	15,141	14,281	26,736	59,894	147,746	164,180	70,796	37,952	30,310	29,495	19,440	16,108	625,287	N/A	N/A
	HotDry	12,860	14,420	31,972	72,789	168,343	93,826	22,135	13,217	12,622	15,371	13,262	12,306	477,961	-147,326	-24%
	InBetween	15,114	16,464	36,639	79,835	182,081	112,322	28,722	16,258	15,941	22,129	17,736	15,062	552,483	-72,804	-12%
09365500	**La Plata River At Hesperus, CO**															
	Current	20	30	584	3,666	3,297	1,143	24	91	43	192	185	76	9,211	N/A	N/A
	HotDry	12	31	768	4,856	2,480	176	0	6	12	133	96	45	8,487	-724	-8%
	InBetween	51	79	928	5,420	3,615	476	0	11	16	210	176	115	10,932	1,721	19%

Appendix C: Average Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09366500	La Plata River At Colorado-New Mexico State Line															
	Current	698	880	2,426	6,954	6,189	3,510	534	291	336	657	875	753	23,760	N/A	N/A
	HotDry	557	871	2,701	6,544	4,170	1,274	20	57	126	453	613	555	17,686	-6,074	-26%
	InBetween	665	1,035	3,460	8,212	5,508	1,825	50	68	156	623	766	681	22,719	-1,040	-4%
09371000	Mancos River Near Towaoc, CO															
	Current	648	1,163	2,848	5,129	7,155	3,932	1,754	1,559	1,485	883	645	545	27,422	N/A	N/A
	HotDry	679	1,603	2,970	3,350	3,106	1,601	1,285	1,383	1,346	786	542	472	18,937	-8,484	-31%
	InBetween	765	1,911	3,961	4,928	4,726	2,060	1,418	1,441	1,414	850	610	532	24,350	-3,072	-11%

Table C4: Yampa River Basin Average Monthly Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09237500	**Yampa River Below Stagecoach Reservoir, CO**															
	Current	594	489	2,130	7,042	7,882	8,756	3,283	1,769	842	1,127	940	639	35,281	N/A	N/A
	HotDry	188	352	2,007	7,726	6,847	3,648	55	20	70	487	253	143	21,698	-13,583	-39%
	InBetween	375	586	3,173	11,144	9,469	5,845	218	129	193	781	493	392	32,618	-2,663	-8%
09241000	**Elk River At Clark, CO**															
	Current	243	37	939	12,166	65,327	75,952	23,128	2,316	998	1,306	310	317	180,918	N/A	N/A
	HotDry	185	63	4,402	29,632	97,313	47,804	3,259	0	151	376	86	111	181,481	563	0%
	InBetween	522	272	5,310	28,591	99,395	60,169	7,381	0	457	1,085	415	582	202,023	21,105	12%
09245000	**Elkhead Creek Near Elkhead, CO**															
	Current	286	280	700	7,074	22,958	6,965	550	103	86	313	336	271	39,418	N/A	N/A
	HotDry	296	362	1,726	10,943	20,944	2,227	19	8	27	226	304	277	36,910	-2,508	-6%
	InBetween	346	422	1,832	11,476	23,887	3,301	62	44	66	306	357	328	41,926	2,508	6%
09249750	**Williams Fork At Mouth, Near Hamilton, CO**															
	Current	2,444	2,537	5,258	19,507	56,907	39,018	10,294	2,695	1,360	3,494	2,699	2,424	147,158	N/A	N/A
	HotDry	2,319	2,938	8,147	31,154	57,212	22,219	1,638	63	240	2,334	1,766	1,994	130,754	-16,405	-11%
	InBetween	2,914	3,660	9,564	35,406	65,934	28,472	3,198	265	669	3,191	2,452	2,682	156,910	9,752	7%
09251000	**Yampa River Near Maybell, CO**															
	Current	4,899	6,956	36,484	140,526	338,115	318,360	73,436	8,744	3,731	12,653	6,542	5,759	945,109	N/A	N/A
	HotDry	4,993	10,097	59,022	218,341	367,810	179,753	7,429	63	1,085	7,949	3,917	4,789	855,736	-89,372	-9%
	InBetween	6,963	13,416	70,146	243,498	410,059	234,593	18,625	470	2,243	11,762	6,328	7,303	1,014,091	68,982	7%
09260000	**Little Snake River Near Lily, CO**															
	Current	5,302	6,944	21,798	53,415	147,543	121,180	23,655	3,428	2,577	6,044	5,248	5,207	397,828	N/A	N/A
	HotDry	5,398	7,968	36,319	85,042	144,672	51,403	4,139	1,432	1,561	4,929	4,748	5,003	348,859	-48,969	-12%
	InBetween	6,282	9,583	41,559	91,984	167,494	75,336	8,744	2,305	2,405	6,283	5,669	6,030	419,027	21,198	5%
09260050	**Yampa River At Deerlodge Park, CO**															
	Current	20,626	23,918	61,049	198,262	487,028	449,607	113,526	19,683	12,297	27,123	20,884	20,857	1,439,302	N/A	N/A
	HotDry	20,685	28,170	99,118	308,380	512,795	238,249	20,305	5,735	5,915	21,259	16,612	19,485	1,283,637	-155,665	-11%
	InBetween	23,762	33,425	116,406	340,917	578,220	318,239	38,171	8,658	9,608	26,739	20,627	23,327	1,522,211	82,909	6%

Table C5: White River Basin Average Monthly Water Available to Meet Future Demands

2050 Climate Projections		Average Monthly Water Available to Meet Future Demands (AF)													Reduction in Avg Annual Water Available	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
09303000	North Fork White River At Buford, CO															
	Current	0	0	18	3,056	37,411	38,197	8,388	653	287	585	0	0	87,459	N/A	N/A
	HotDry	0	0	928	11,063	52,246	24,093	146	0	0	0	0	0	87,397	-62	0%
	InBetween	10	105	2,269	16,120	58,001	32,175	1,219	0	40	137	71	0	108,754	21,296	24%
09304000	South Fork White River At Buford, CO															
	Current	0	0	18	1,866	32,077	49,681	8,330	499	222	454	0	0	91,916	N/A	N/A
	HotDry	0	0	411	6,605	48,743	30,241	146	0	0	0	0	0	85,037	-6,878	-7%
	InBetween	1	53	931	8,999	53,374	41,678	1,342	0	40	137	71	0	105,225	13,309	14%
09304800	White River Below Meeker, CO															
	Current	0	0	18	3,979	60,348	74,440	12,806	677	287	610	0	0	151,082	N/A	N/A
	HotDry	0	0	1,006	12,377	67,444	36,545	146	0	0	0	0	0	116,046	-35,036	-23%
	InBetween	113	245	3,177	20,219	84,774	54,966	1,383	0	40	137	71	0	163,006	11,924	8%
09306222	Piceance Creek At White River, CO															
	Current	0	0	18	1,463	3,684	1,977	1,120	300	107	321	0	0	8,853	N/A	N/A
	HotDry	0	0	604	2,573	1,544	447	28	0	0	0	0	0	5,116	-3,737	-42%
	InBetween	66	207	1,366	3,813	2,696	924	164	0	25	73	23	0	9,212	359	4%
09306395	White River Near Colorado State Line, UT															
	Current	24,601	23,320	28,476	41,879	108,133	119,433	47,891	27,193	24,876	32,998	26,182	25,741	527,584	N/A	N/A
	HotDry	19,190	19,734	30,941	52,370	113,113	73,497	10,481	7,479	12,093	22,070	19,232	19,056	397,102	-130,482	-25%
	InBetween	23,942	24,594	37,777	62,937	132,584	95,766	18,760	11,752	16,310	27,460	23,284	23,857	496,051	-31,533	-6%

Appendix D. Average Monthly Consumptive Use

Appendix D Contents

Figure D1: Upper Colorado Basin Consumptive Use

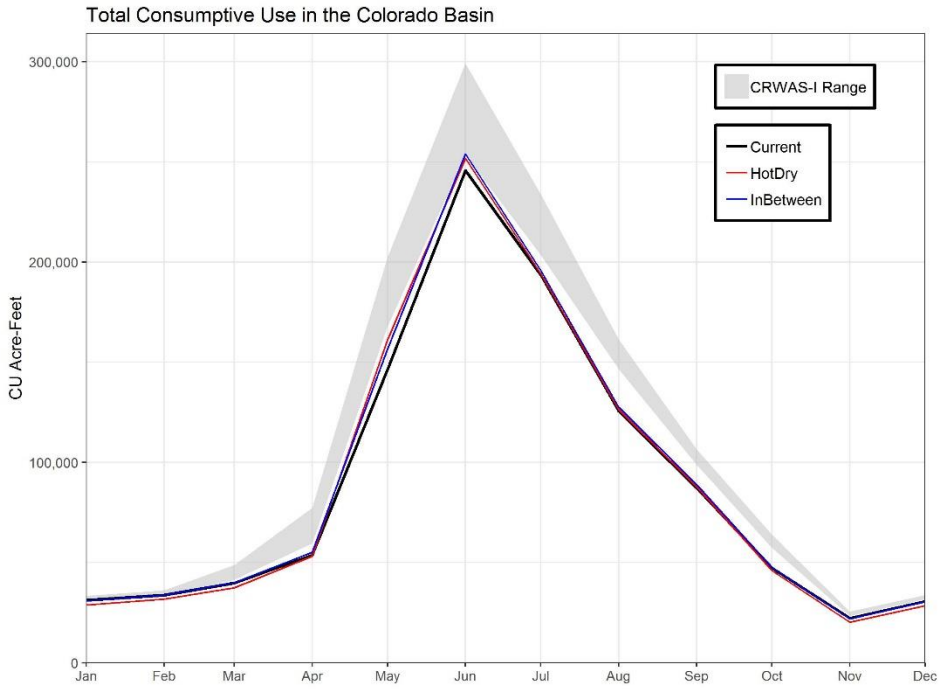


Figure D2: Gunnison Basin Consumptive Use

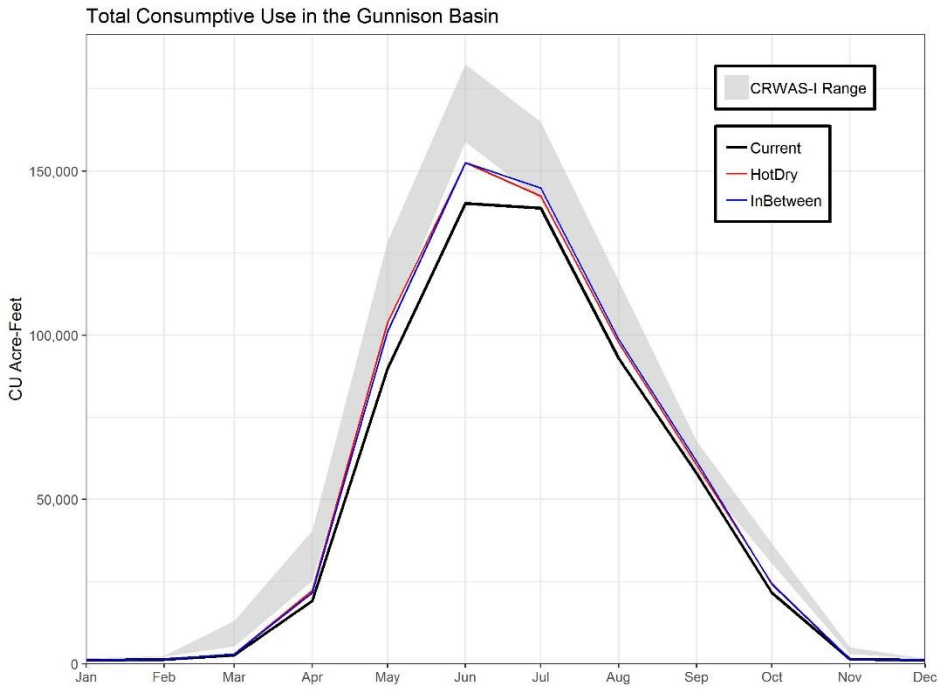


Figure D3: San Juan/Dolores Basin Consumptive Use

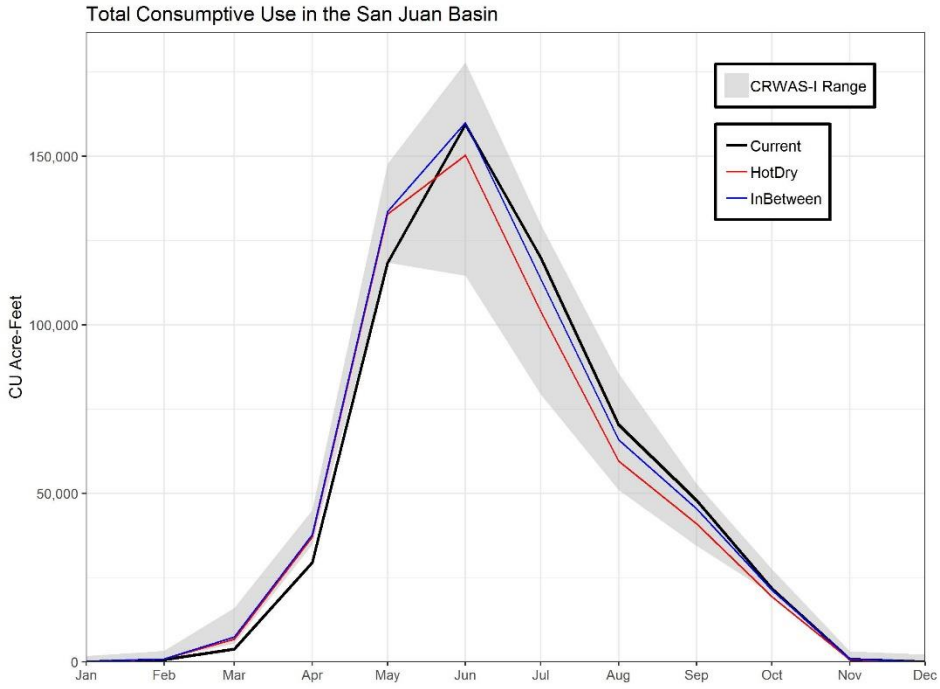


Figure D4: Yampa Basin Consumptive Use

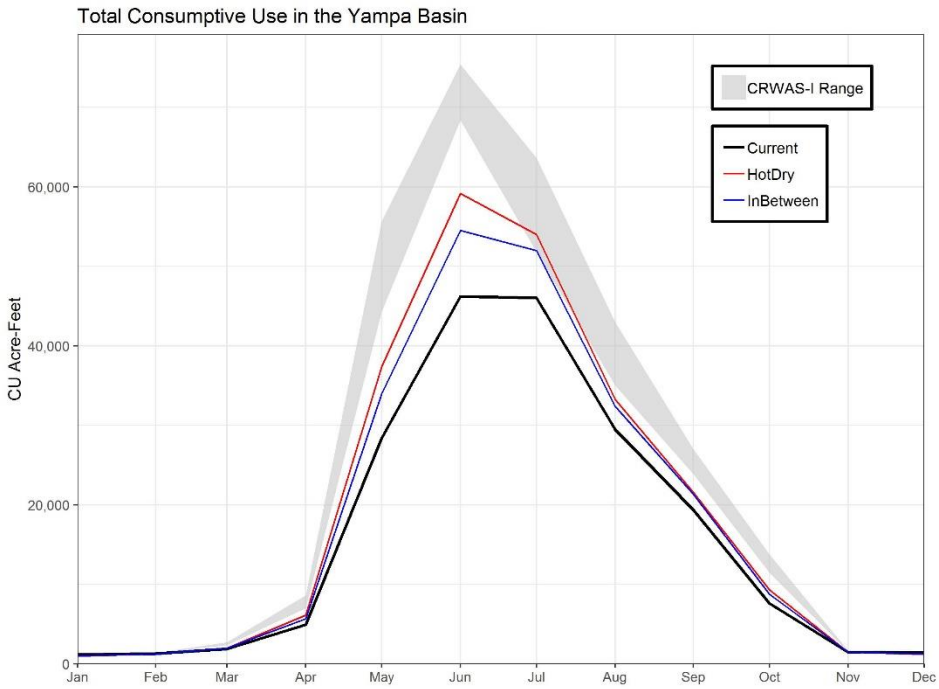
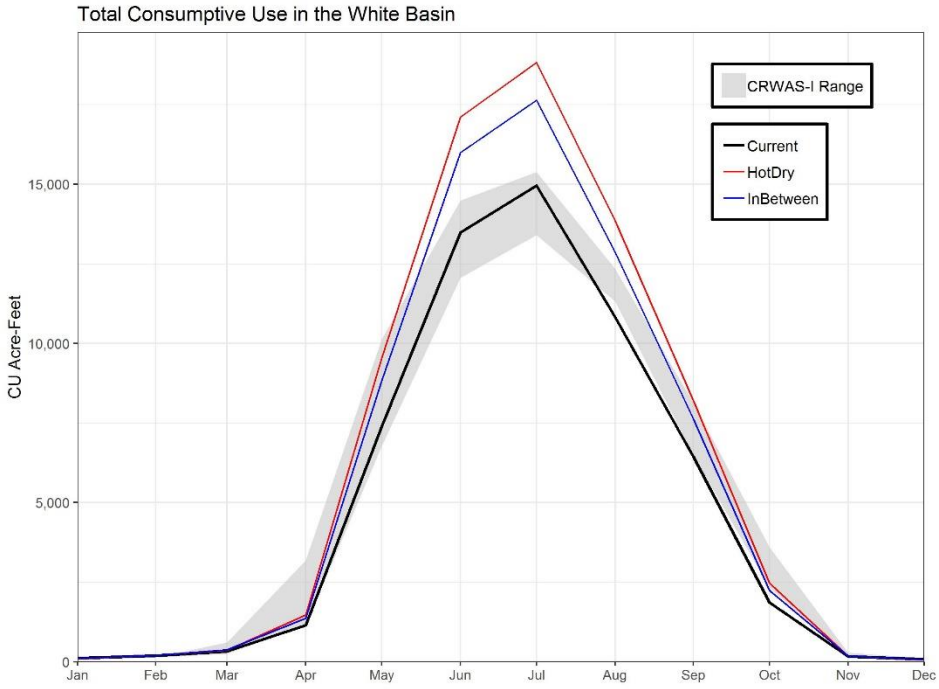


Figure D5: White Basin Consumptive Use



Appendix E. Reservoir Contents

Appendix E Contents

Figure E1: Green Mountain Reservoir Storage Contents (1990 - 2013)

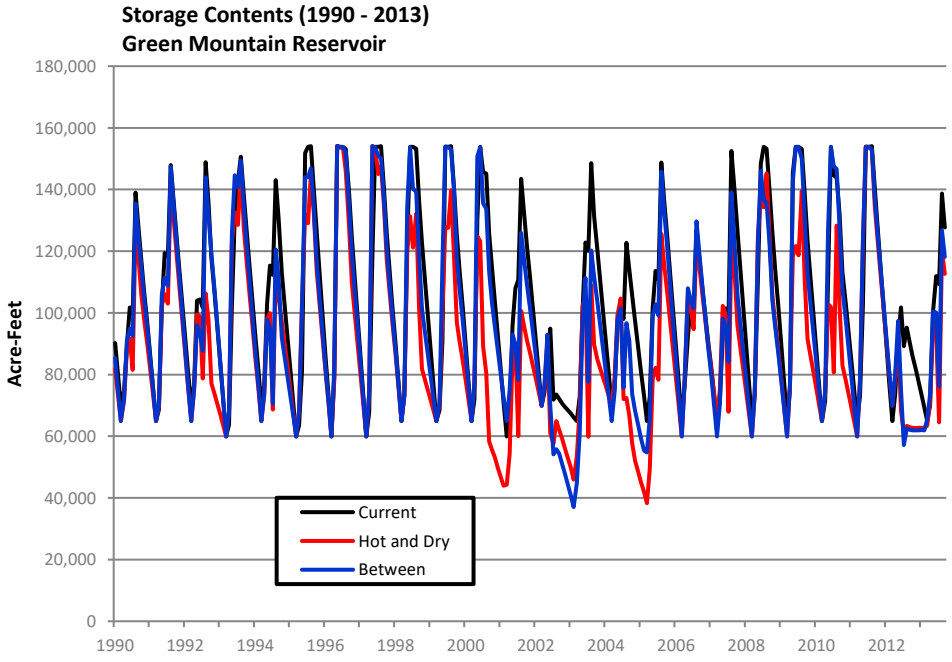


Figure E2: Green Mountain Reservoir Average Monthly Storage Contents (1950 - 2013)

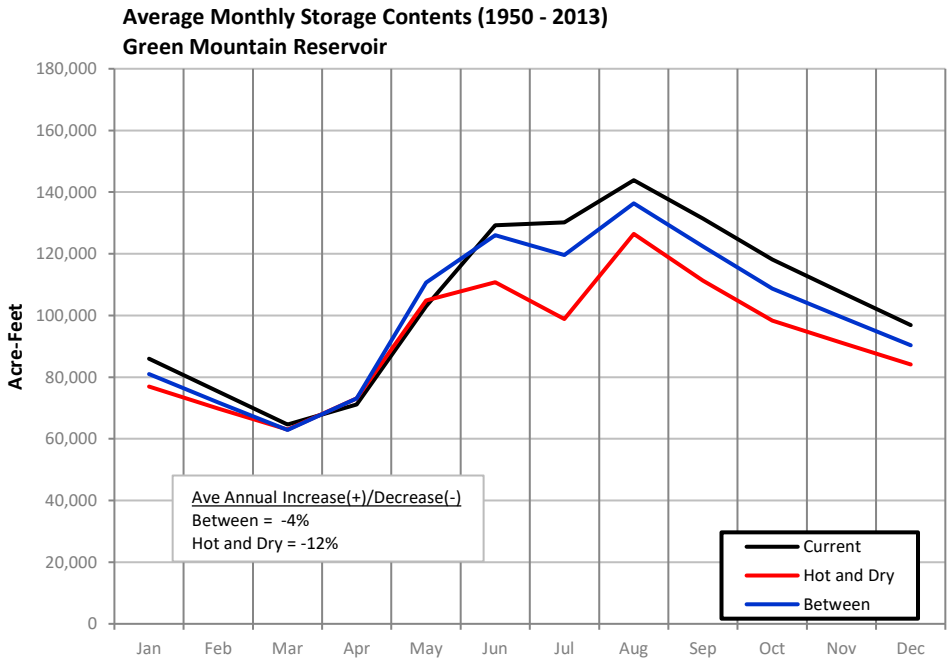


Figure E3: Vega Reservoir Storage Contents (1990 - 2013)

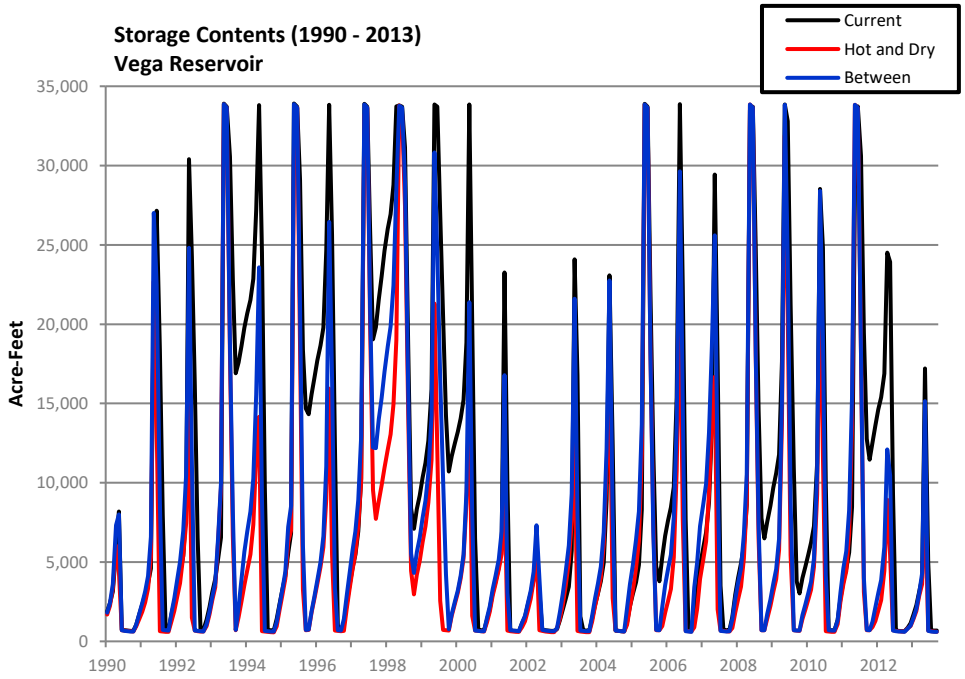


Figure E4: Vega Reservoir Average Monthly Storage Contents (1950 - 2013)

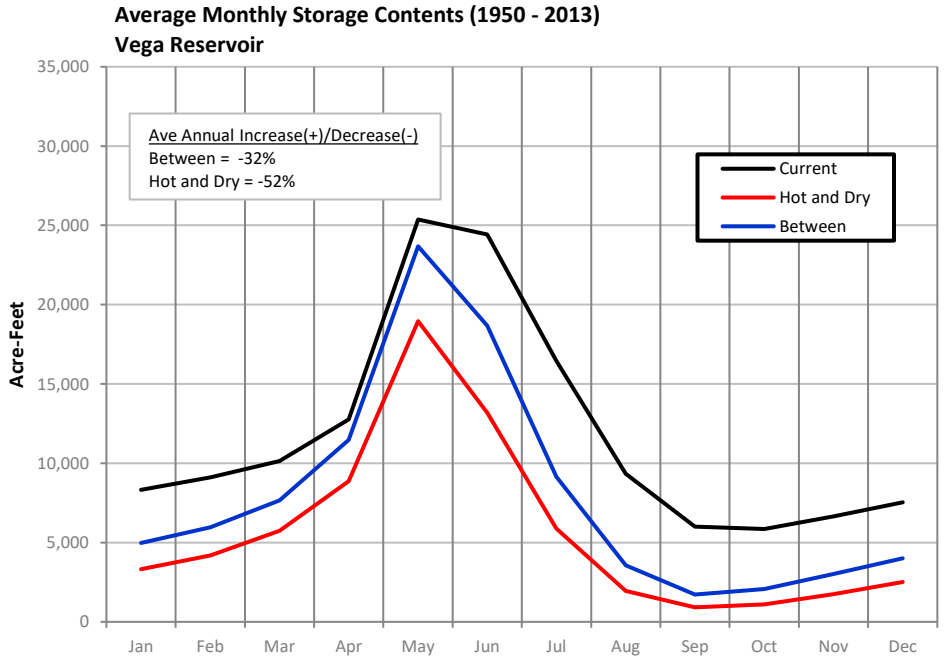


Figure E5: Blue Mesa Reservoir Storage Contents (1990 - 2013)

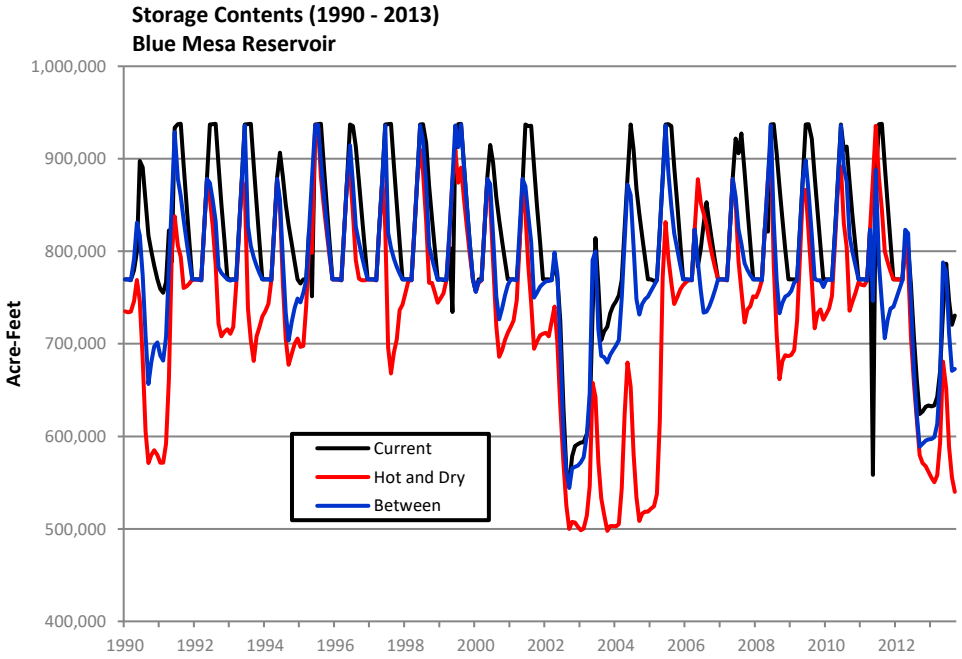


Figure E6: Blue Mesa Reservoir Average Monthly Storage Contents (1950 - 2013)

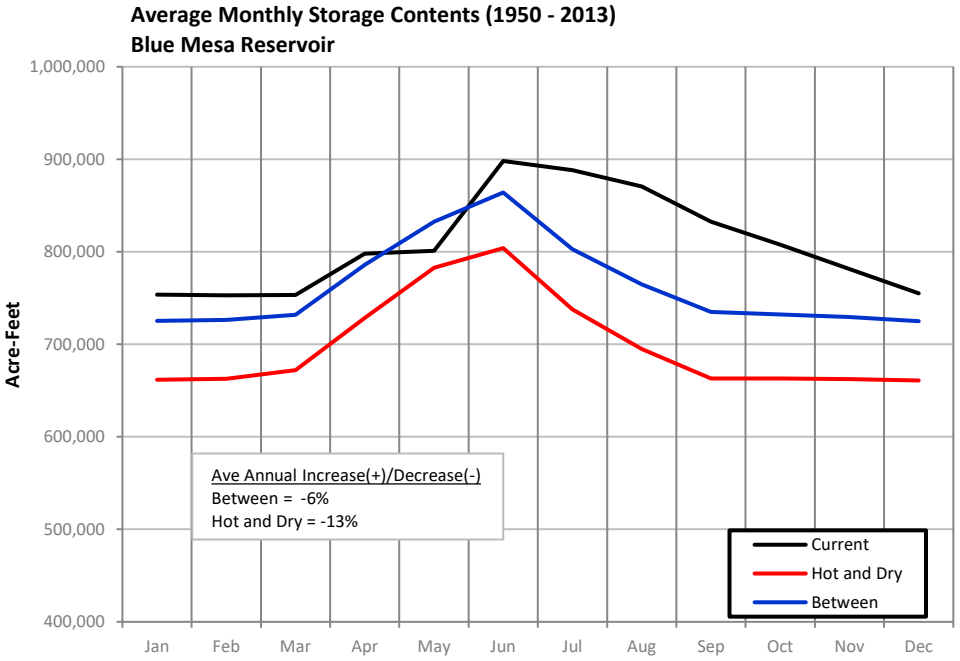


Figure E7: Ridgway Reservoir Storage Contents (1990 - 2013)

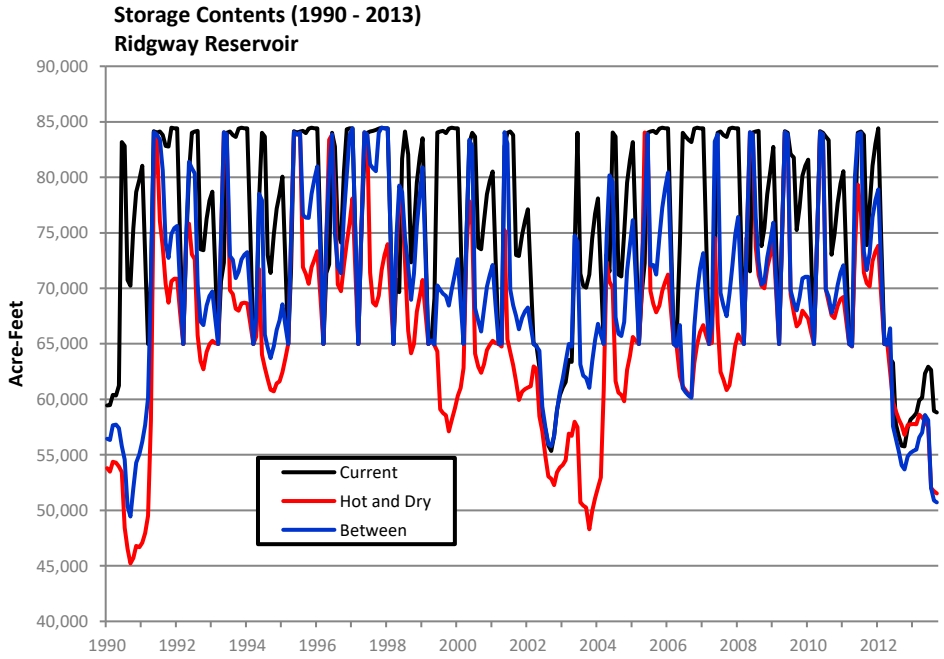


Figure E8: Ridgway Reservoir Average Monthly Storage Contents (1950 - 2013)

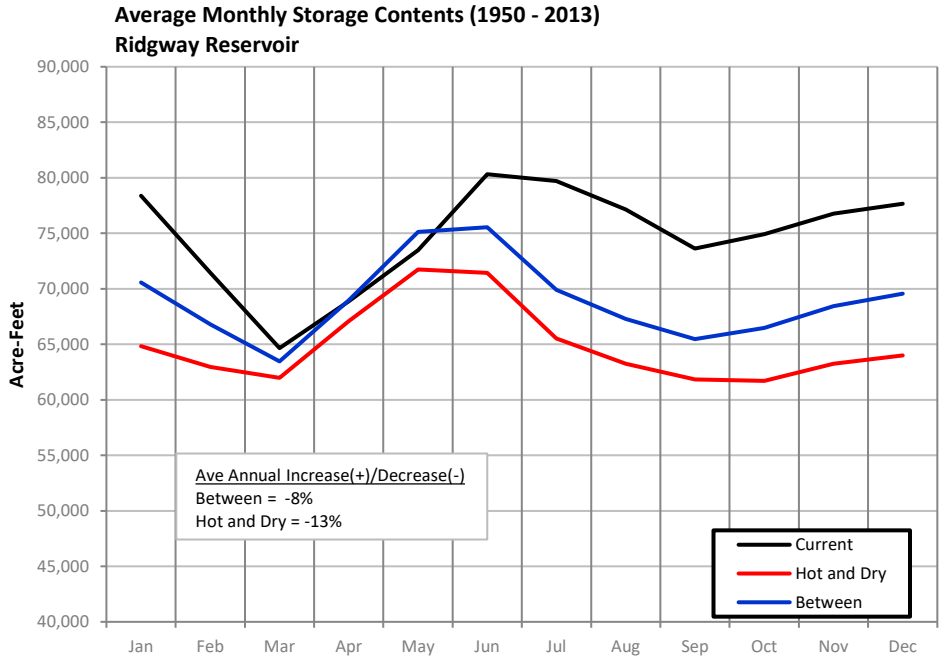


Figure E9: McPhee Reservoir Storage Contents (1990 - 2013)

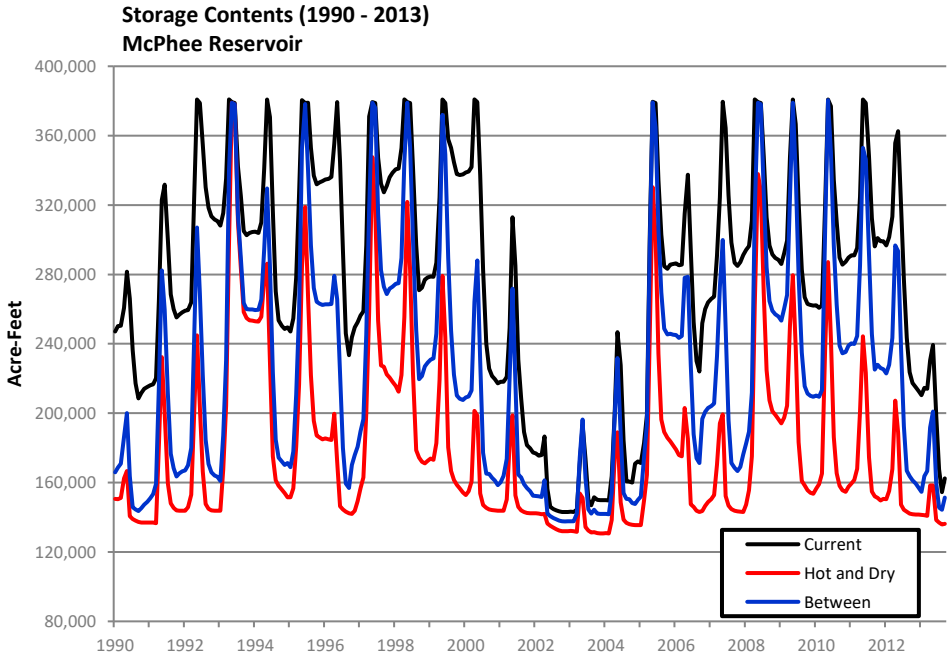


Figure E10: McPhee Reservoir Average Monthly Storage Contents (1950 - 2013)

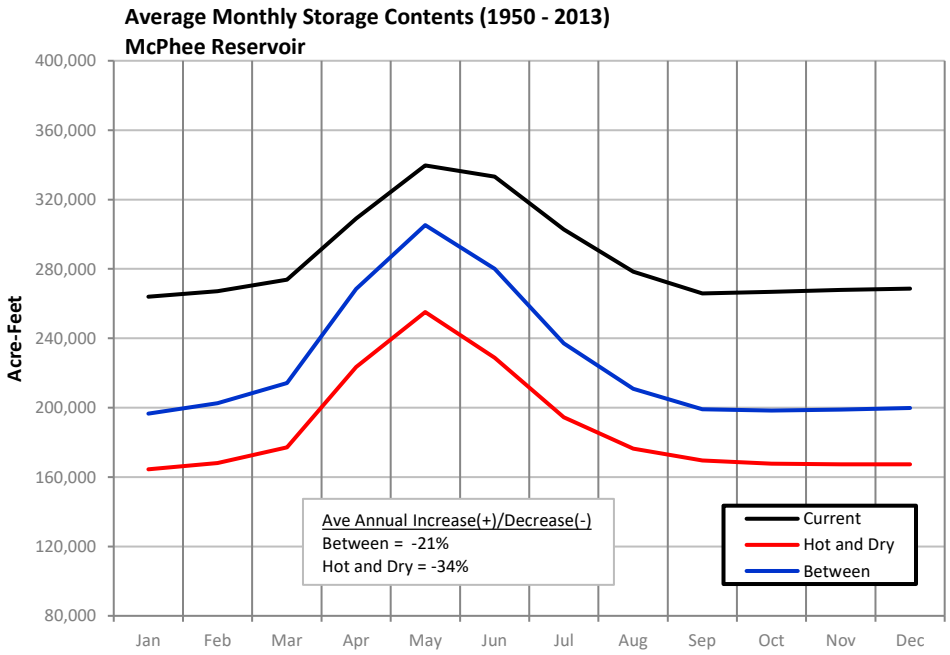


Figure E11: Stagecoach Reservoir Storage Contents (1990 - 2013)

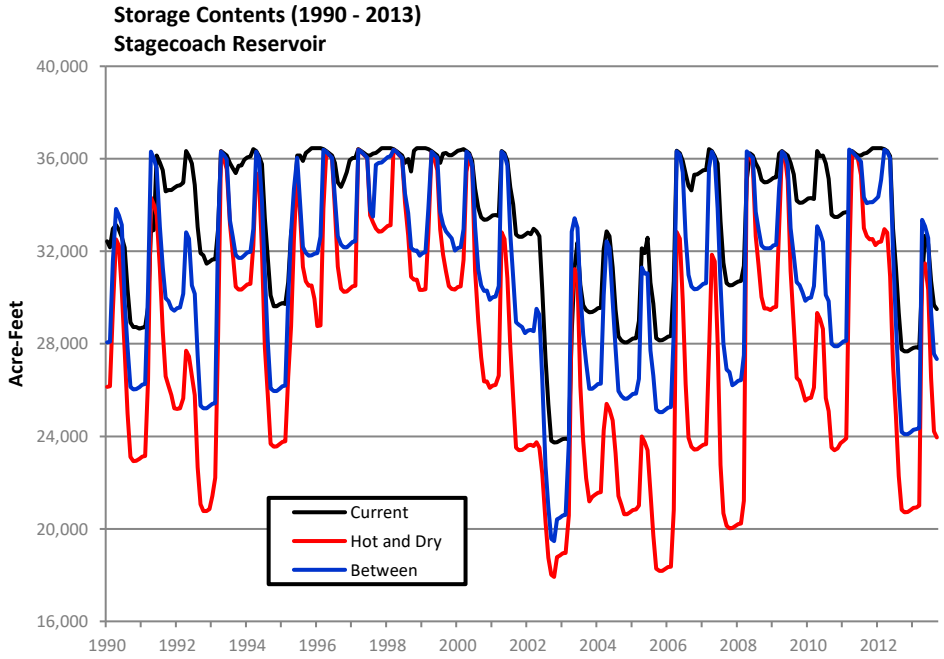
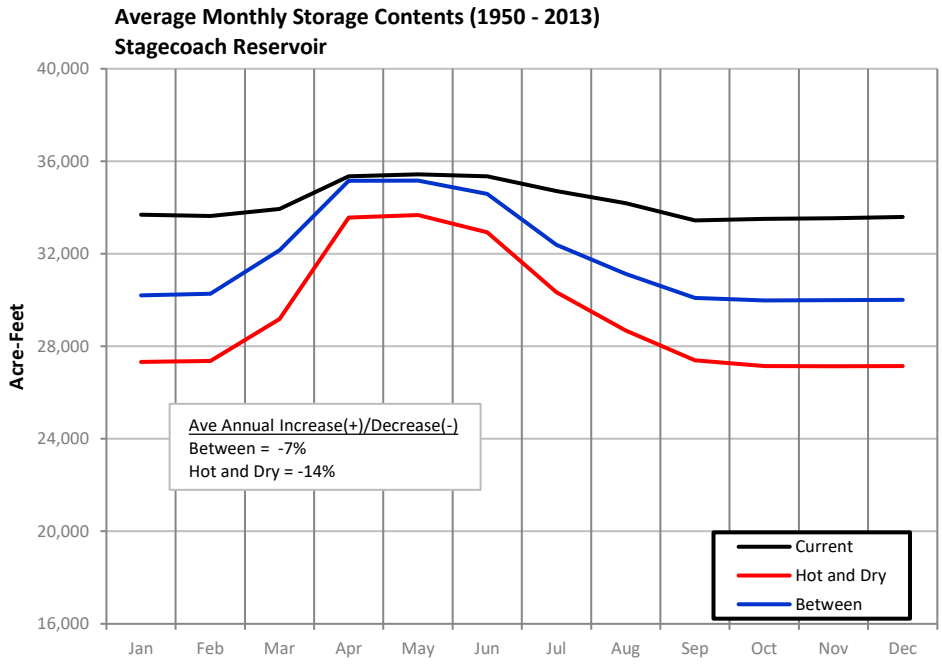


Figure E10: Stagecoach Reservoir Average Monthly Storage Contents (1950 - 2013)



Appendix F. Average Monthly Natural Flows in Other Basins

Appendix F Contents

Figure F1: Gage 06620000: North Platte River Near Northgate, CO

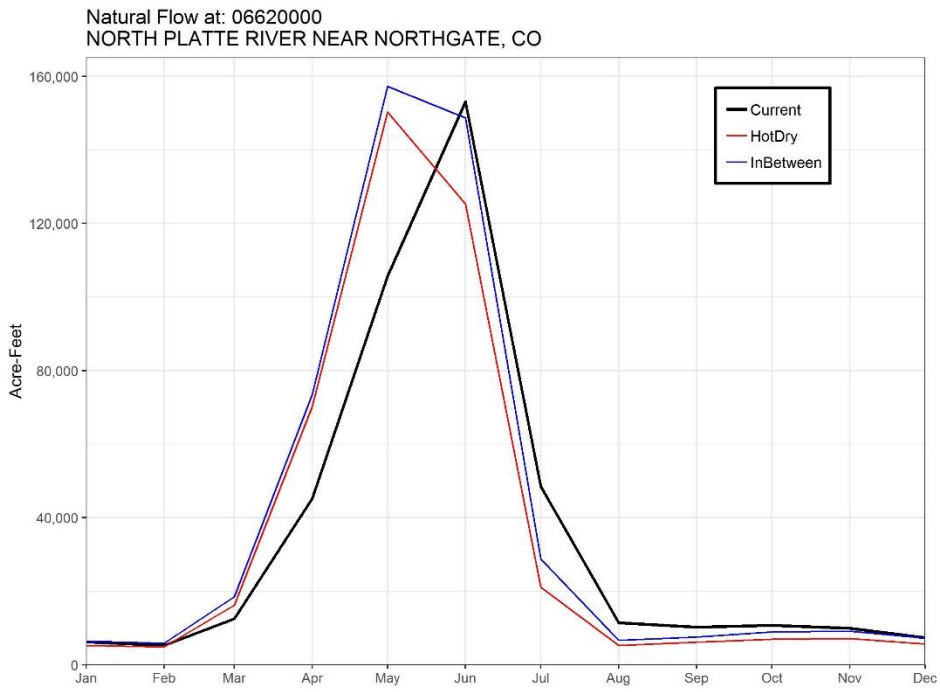


Figure F2: Gage 06695000: S Platte River Ab 11-Mile Canyon Res, nr Hartsel

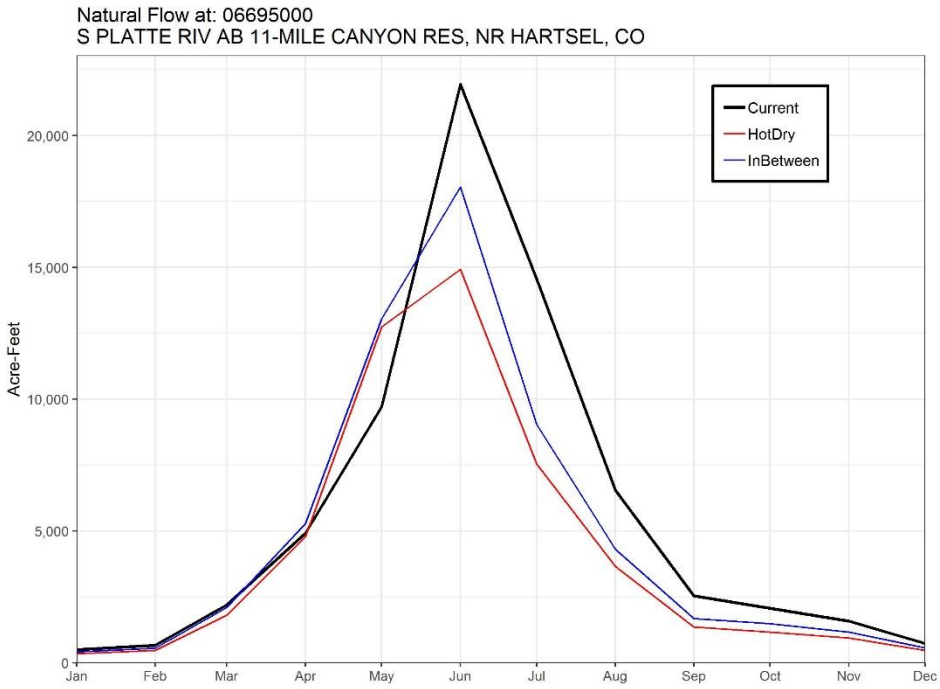


Figure F3: Gage 06710500: Bear Creek At Morrison

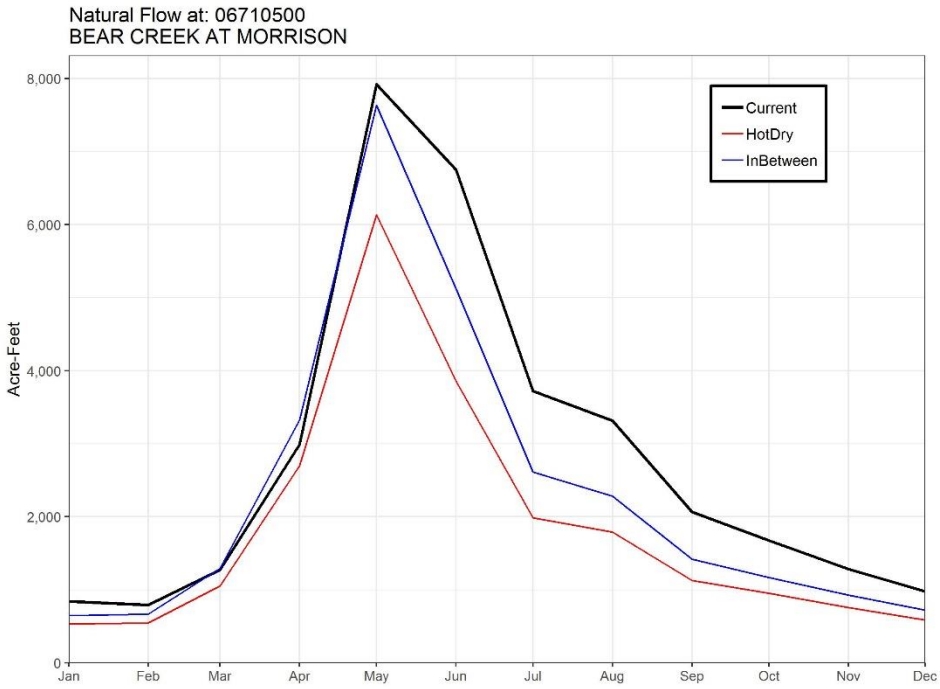


Figure F4: Gage 06714000: South Platte River At Denver

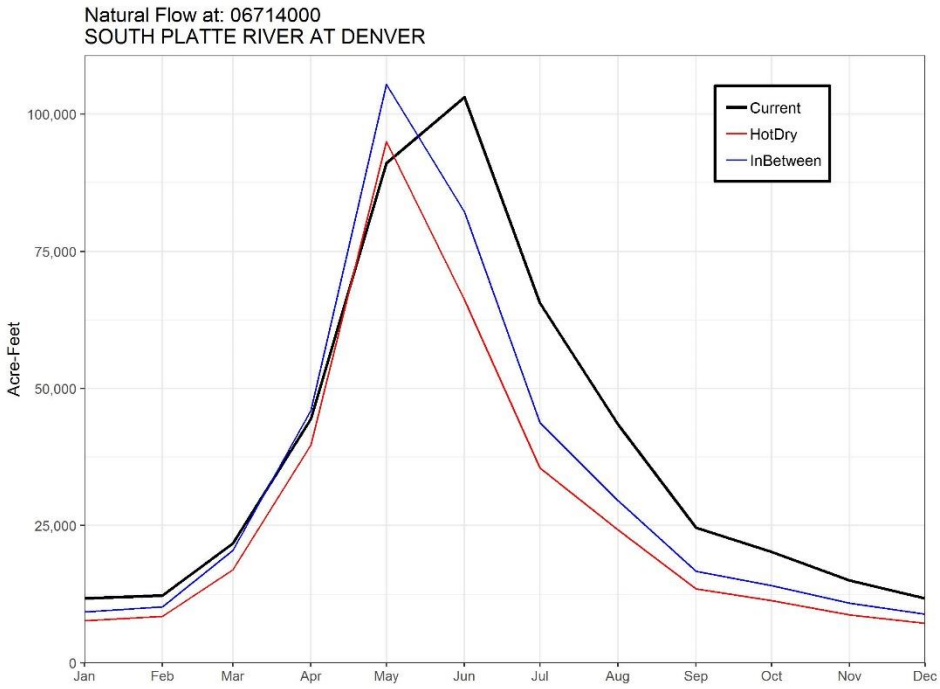


Figure F5: Gage 06716500: Clear Creek Near Lawson, CO

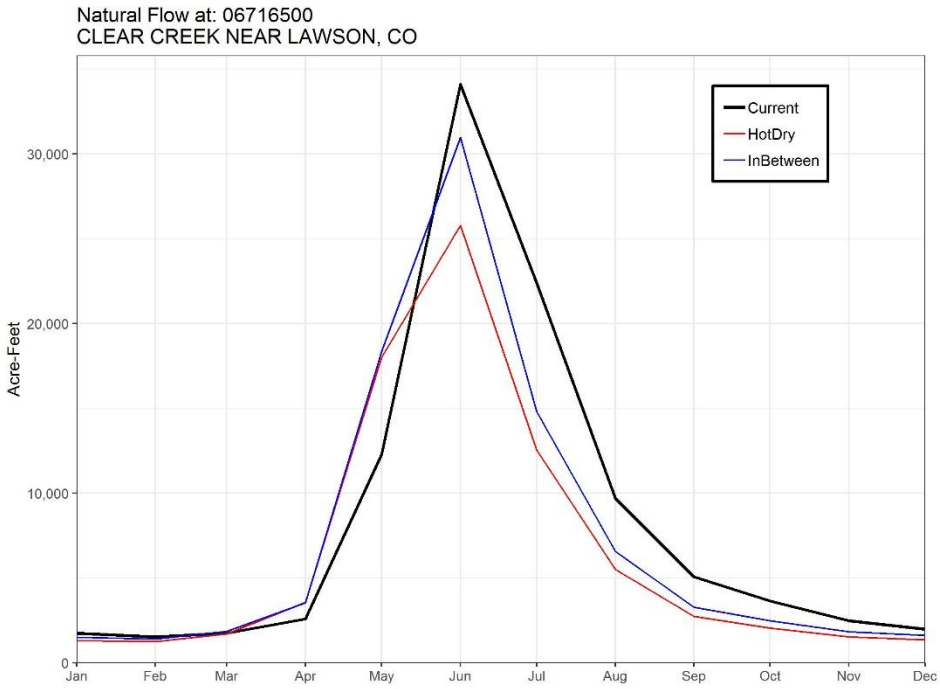


Figure F6: Gage 06724000: St. Vrain Creek At Lyons, CO

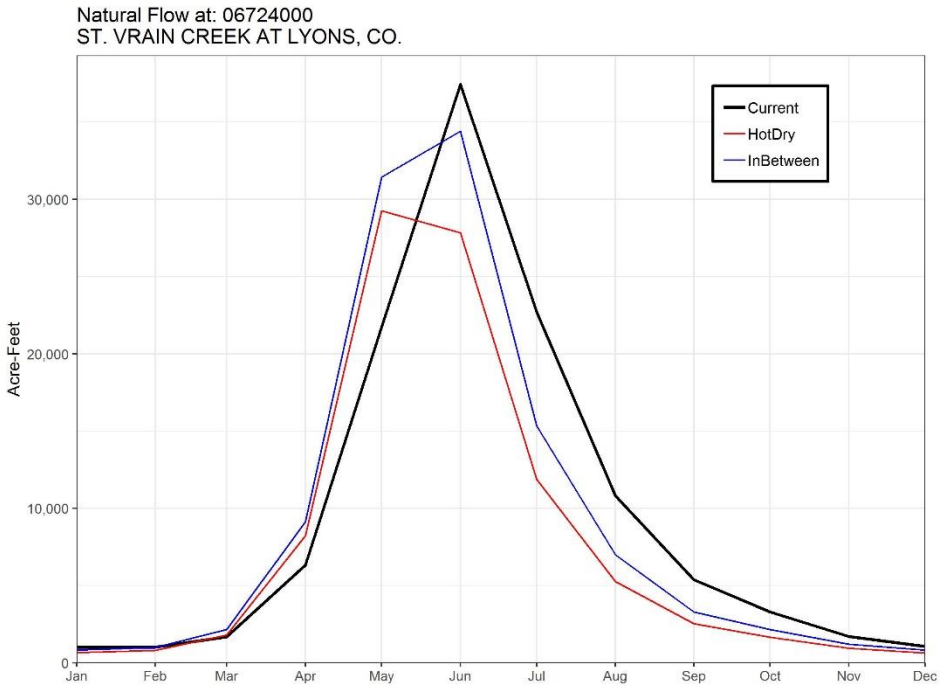


Figure F7: Gage 06727000: Boulder Creek Near Orodell, CO

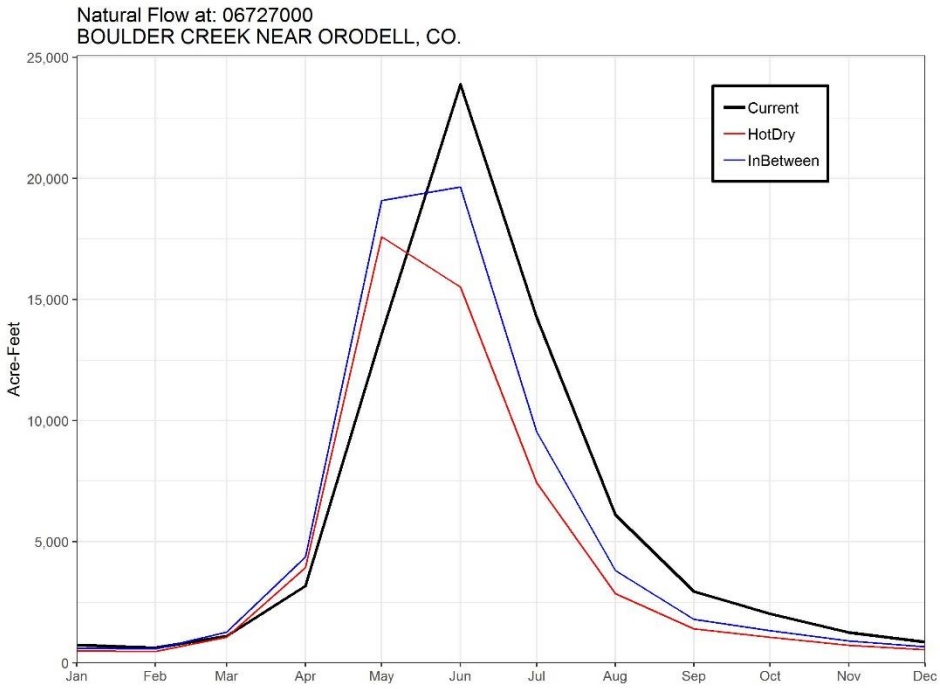


Figure F8: Gage 06738000: Big Thompson River At Mouth Of Canyon Nr Drake, CO

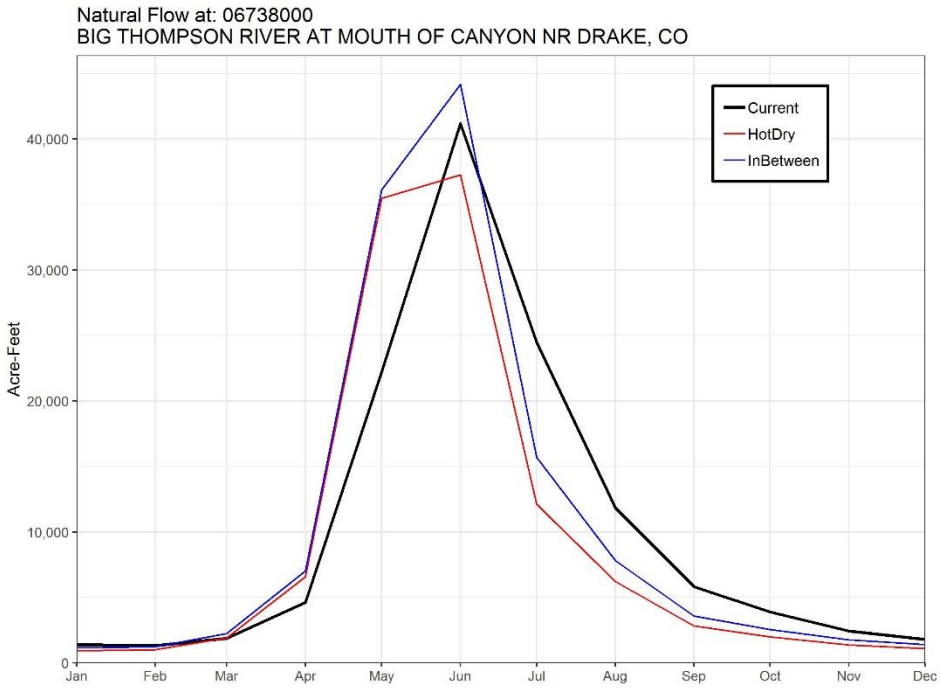


Figure F9: Gage 07081200: Arkansas River Near Leadville, CO

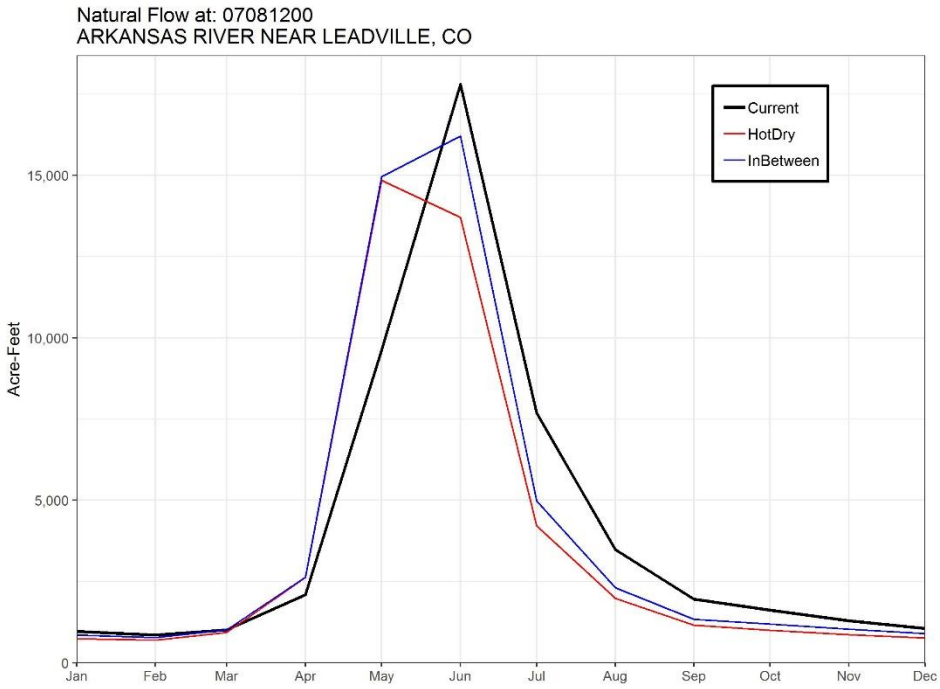


Figure F10: Gage 07111000: Huerfano R At Manzanares Crossing, Nr Redwing, CO

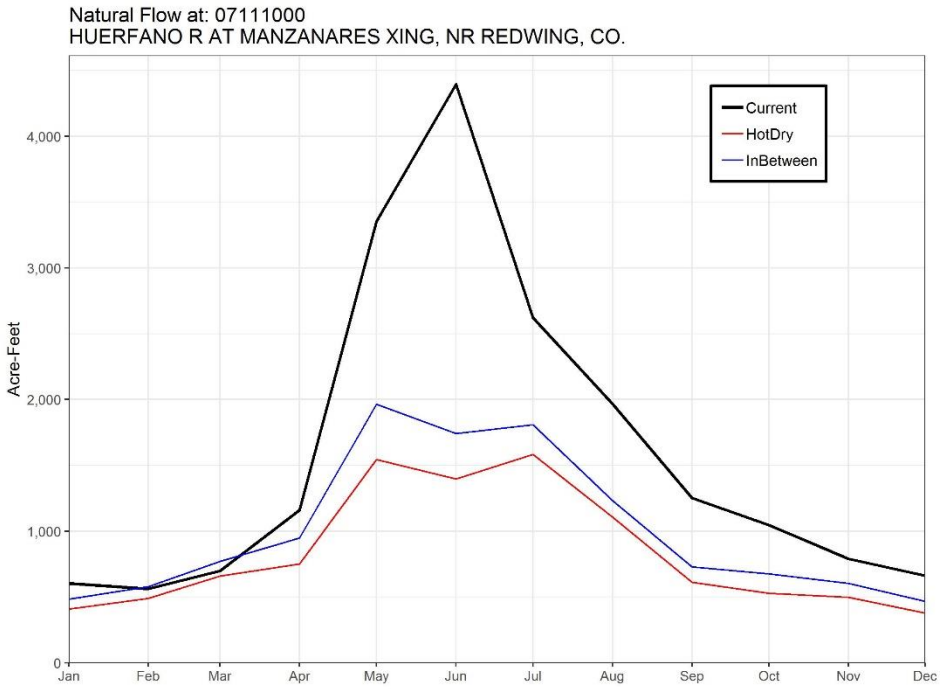


Figure F11: Gage 07124200: Purgatoire River At Madrid, CO

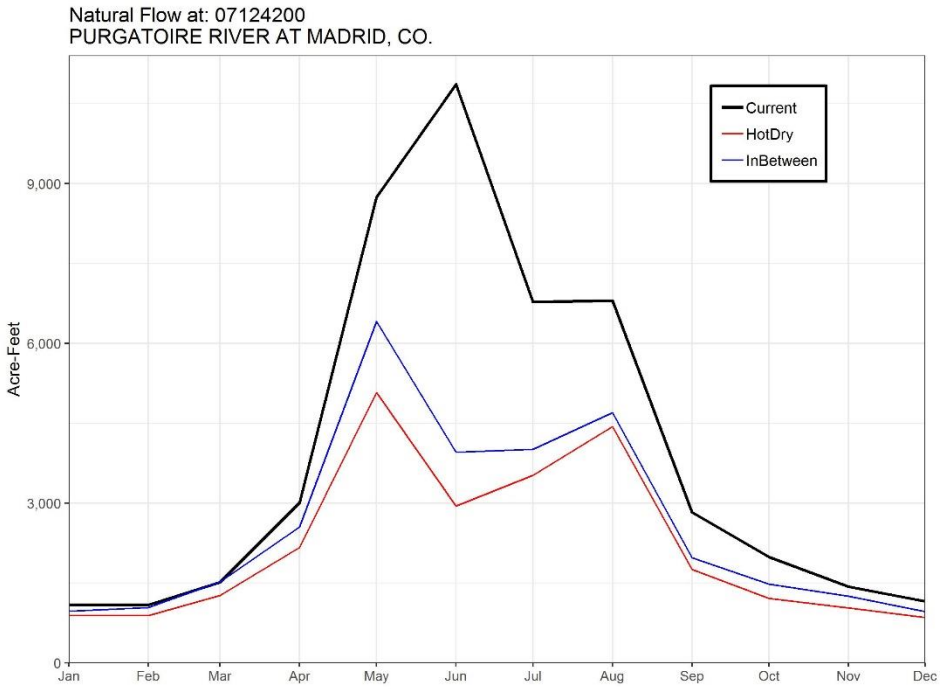


Figure F12: Gage 08217500: Rio Grande At Wagon Wheel Gap, CO

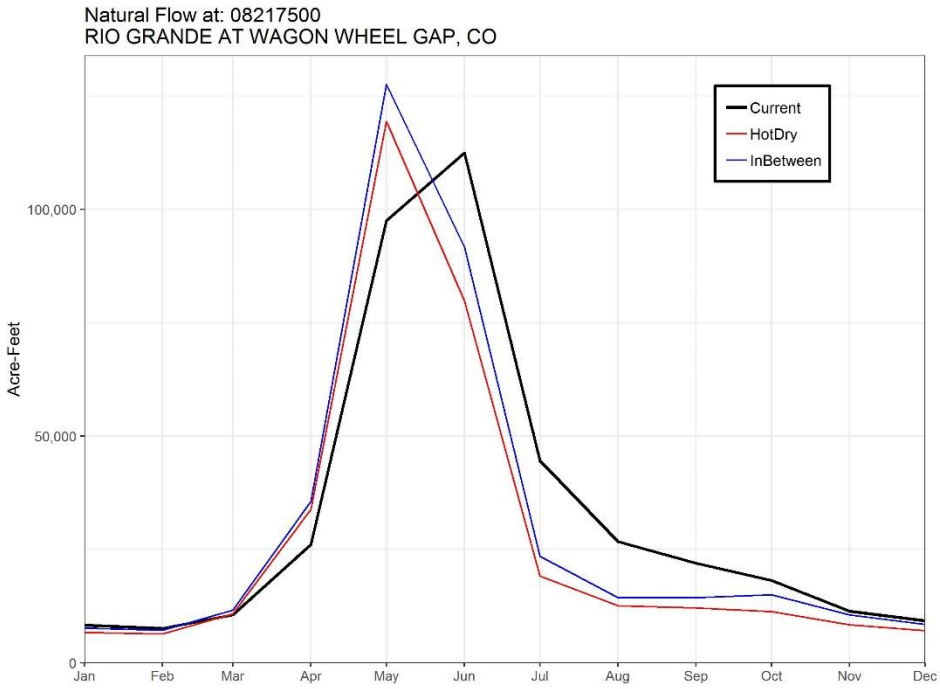


Figure F13: Gage 08236000: Alamosa River Above Terrace Reservoir, CO

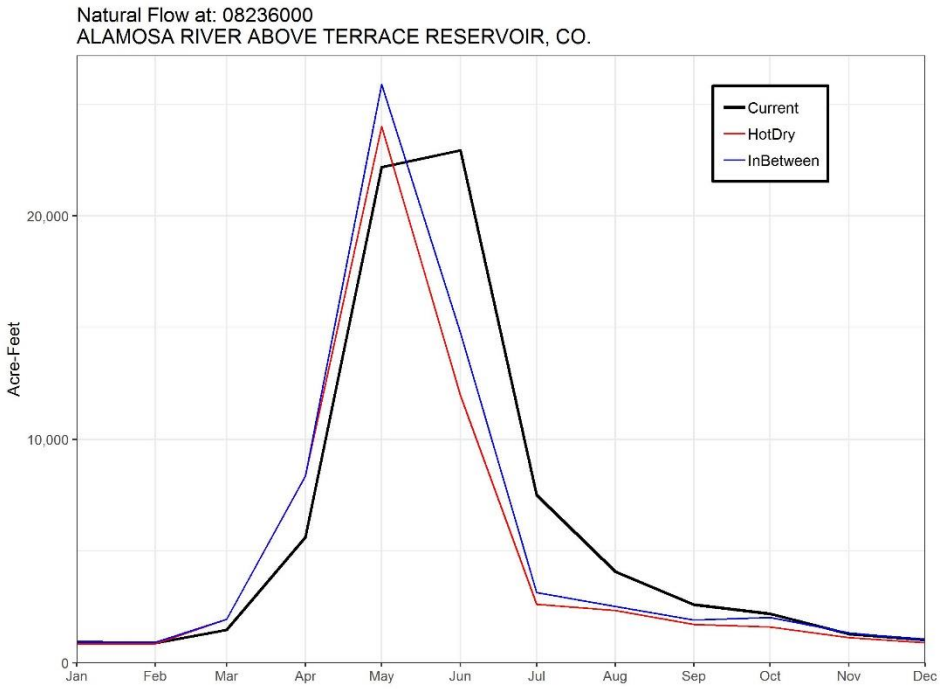


Figure F14: Gage 08240500: Trinchera C Ab Turners Ranch, Nr Ft Garland, CO

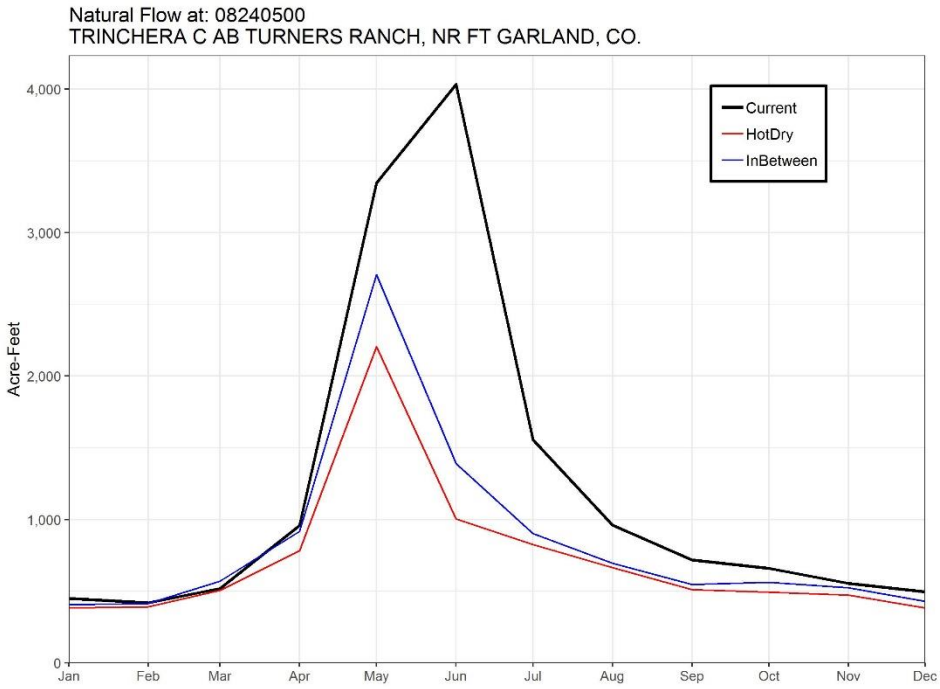
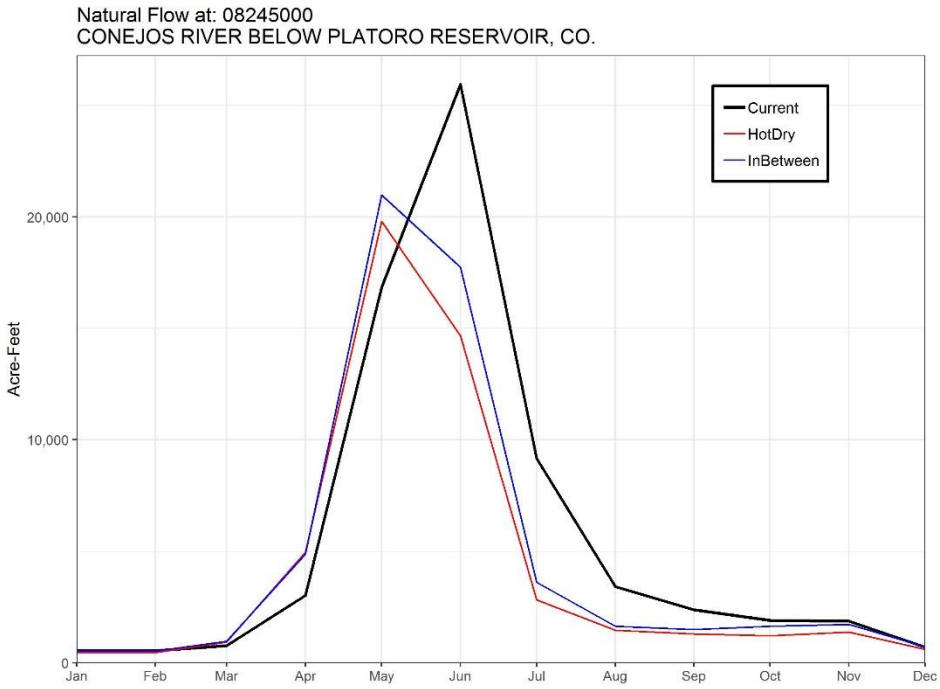


Figure F15: Gage 08245000: Conejos River Below Platoro Reservoir, CO



Appendix F: Average Monthly Natural Flows in Other Basins

Table F1: Average Monthly Natural Flows in Other Basins

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
North Platte Basin																
06620000	**North Platte River Near Northgate, CO**															
	Current	6,274	5,246	12,504	45,263	105,677	153,074	48,486	11,418	10,210	10,720	9,937	7,388	426,198	N/A	N/A
	HotDry	5,279	4,911	16,196	70,193	150,293	125,272	21,067	5,253	6,135	6,956	7,113	5,691	424,359	-1,839	0%
	InBetween	6,445	5,857	18,490	73,468	157,319	148,742	28,822	6,653	7,540	9,001	9,196	7,217	478,750	52,552	12%
South Platte Basin																
06695000	**S Platte Riv Ab 11-Mile Canyon Res, Nr Hartsel, CO**															
	Current	501	664	2,200	4,925	9,719	21,950	14,559	6,545	2,548	2,071	1,587	737	68,007	N/A	N/A
	HotDry	346	476	1,802	4,778	12,747	14,925	7,552	3,649	1,367	1,165	942	473	50,223	-17,784	-26%
	InBetween	410	559	2,099	5,277	13,045	18,059	9,042	4,309	1,675	1,481	1,173	575	57,705	-10,302	-15%
06710500	**Bear Creek At Morrison**															
	Current	840	792	1,275	2,990	7,923	6,752	3,723	3,314	2,065	1,673	1,285	979	33,611	N/A	N/A
	HotDry	534	546	1,053	2,696	6,137	3,855	1,986	1,790	1,130	954	759	589	22,029	-11,581	-34%
	InBetween	649	667	1,294	3,327	7,634	5,120	2,612	2,281	1,421	1,171	929	724	27,829	-5,782	-17%
06714000	**South Platte River At Denver**															
	Current	11,767	12,299	21,747	44,488	91,054	103,071	65,575	43,481	24,625	20,231	14,983	11,740	465,062	N/A	N/A
	HotDry	7,654	8,443	16,965	39,691	95,041	66,181	35,498	24,238	13,477	11,368	8,738	7,234	334,527	-130,535	-28%
	InBetween	9,256	10,206	20,473	46,010	105,442	82,217	43,799	29,604	16,670	14,100	10,851	8,899	397,527	-67,536	-15%
06716500	**Clear Creek Near Lawson, CO**															
	Current	1,755	1,528	1,752	2,594	12,287	34,107	22,393	9,693	5,081	3,641	2,472	1,991	99,293	N/A	N/A
	HotDry	1,306	1,242	1,707	3,560	18,002	25,777	12,555	5,506	2,733	2,039	1,530	1,367	77,325	-21,969	-22%
	InBetween	1,516	1,406	1,859	3,530	18,354	30,974	14,813	6,572	3,277	2,478	1,842	1,619	88,240	-11,053	-11%
06724000	**St. Vrain Creek At Lyons, CO.**															
	Current	999	1,015	1,691	6,334	21,753	37,452	22,721	10,816	5,382	3,293	1,701	1,070	114,226	N/A	N/A
	HotDry	658	800	1,810	8,227	29,270	27,850	11,877	5,266	2,533	1,657	937	640	91,525	-22,702	-20%
	InBetween	827	986	2,165	9,121	31,457	34,417	15,343	6,989	3,299	2,159	1,218	821	108,802	-5,424	-5%
06727000	**Boulder Creek Near Orodell, CO.**															
	Current	744	626	1,103	3,169	13,584	23,892	14,271	6,106	2,955	2,023	1,255	868	70,595	N/A	N/A
	HotDry	499	467	1,058	3,935	17,601	15,516	7,437	2,865	1,413	1,059	724	538	53,111	-17,485	-25%
	InBetween	608	568	1,271	4,367	19,089	19,652	9,548	3,805	1,802	1,331	911	672	63,624	-6,972	-10%
06738000	**Big Thompson River At Mouth Of Canyon Nr Drake, CO**															
	Current	1,399	1,321	1,867	4,606	22,209	41,193	24,469	11,837	5,829	3,888	2,445	1,787	122,851	N/A	N/A
	HotDry	927	1,006	1,903	6,574	35,491	37,281	12,119	6,212	2,810	1,974	1,371	1,096	108,763	-14,087	-11%
	InBetween	1,156	1,223	2,238	7,023	36,116	44,187	15,693	7,791	3,587	2,554	1,771	1,395	124,734	1,883	2%

Appendix F: Average Monthly Natural Flows in Other Basins

2050 Climate Projections		Average Monthly Natural Streamflow (AF)													Reduction in Avg Annual Natural Streamflow	
USGS #	Location Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total	AF	Percent
	Model															
Arkansas Basin																
07081200	**Arkansas River Near Leadville, CO**															
	Current	969	853	1,014	2,100	9,631	17,802	7,689	3,486	1,965	1,622	1,294	1,062	49,487	N/A	N/A
	HotDry	747	694	932	2,622	14,842	13,710	4,219	1,979	1,157	1,003	862	768	43,535	-5,951	-12%
	InBetween	857	780	1,014	2,642	14,954	16,210	4,980	2,311	1,338	1,193	1,031	901	48,210	-1,276	-3%
07111000	**Huerfano R At Manzanares Xing, Nr Redwing, CO.**															
	Current	604	562	697	1,161	3,352	4,395	2,622	1,968	1,253	1,045	791	661	19,110	N/A	N/A
	HotDry	409	491	658	752	1,545	1,397	1,582	1,107	613	530	498	379	9,959	-9,150	-48%
	InBetween	483	577	770	950	1,964	1,743	1,808	1,234	728	675	603	468	12,002	-7,108	-37%
07124200	**Purgatoire River At Madrid, CO.**															
	Current	1,090	1,088	1,516	3,008	8,749	10,867	6,779	6,805	2,825	1,988	1,431	1,156	47,300	N/A	N/A
	HotDry	892	886	1,267	2,167	5,075	2,943	3,525	4,437	1,757	1,210	1,035	853	26,081	-21,220	-45%
	InBetween	969	1,040	1,522	2,553	6,412	3,954	4,014	4,698	1,972	1,481	1,254	961	30,869	-16,431	-35%
Rio Grande Basin																
08217500	**Rio Grande At Wagon Wheel Gap, CO**															
	Current	8,343	7,551	10,610	26,093	97,532	112,477	44,590	26,727	21,958	18,176	11,421	9,282	394,760	N/A	N/A
	HotDry	6,731	6,403	10,780	33,834	119,422	79,791	19,125	12,570	12,074	11,330	8,395	7,111	327,566	-67,194	-17%
	InBetween	7,698	7,142	11,632	35,643	127,587	91,686	23,480	14,395	14,345	15,003	10,584	8,507	367,701	-27,058	-7%
08236000	**Alamosa River Above Terrace Reservoir, CO.**															
	Current	928	891	1,471	5,624	22,188	22,945	7,506	4,082	2,604	2,203	1,300	1,034	72,779	N/A	N/A
	HotDry	828	850	1,952	8,381	24,009	11,965	2,619	2,347	1,715	1,598	1,123	897	58,285	-14,494	-20%
	InBetween	916	918	1,954	8,361	25,895	14,772	3,154	2,518	1,919	2,030	1,349	1,039	64,827	-7,952	-11%
08240500	**Trinchera C Ab Turners Ranch, Nr Ft Garland, CO.**															
	Current	449	419	519	958	3,348	4,035	1,555	961	717	659	555	495	14,670	N/A	N/A
	HotDry	382	390	505	782	2,206	1,003	826	665	510	494	473	383	8,618	-6,051	-41%
	InBetween	407	415	568	918	2,707	1,390	900	695	546	563	523	428	10,060	-4,610	-31%
08245000	**Conejos River Below Platoro Reservoir, CO.**															
	Current	545	533	767	3,023	16,838	25,944	9,172	3,416	2,375	1,911	1,866	706	67,097	N/A	N/A
	HotDry	452	461	929	4,967	19,803	14,671	2,829	1,462	1,296	1,208	1,380	604	50,063	-17,034	-25%
	InBetween	524	523	961	4,886	20,976	17,735	3,614	1,649	1,488	1,649	1,716	721	56,440	-10,657	-16%