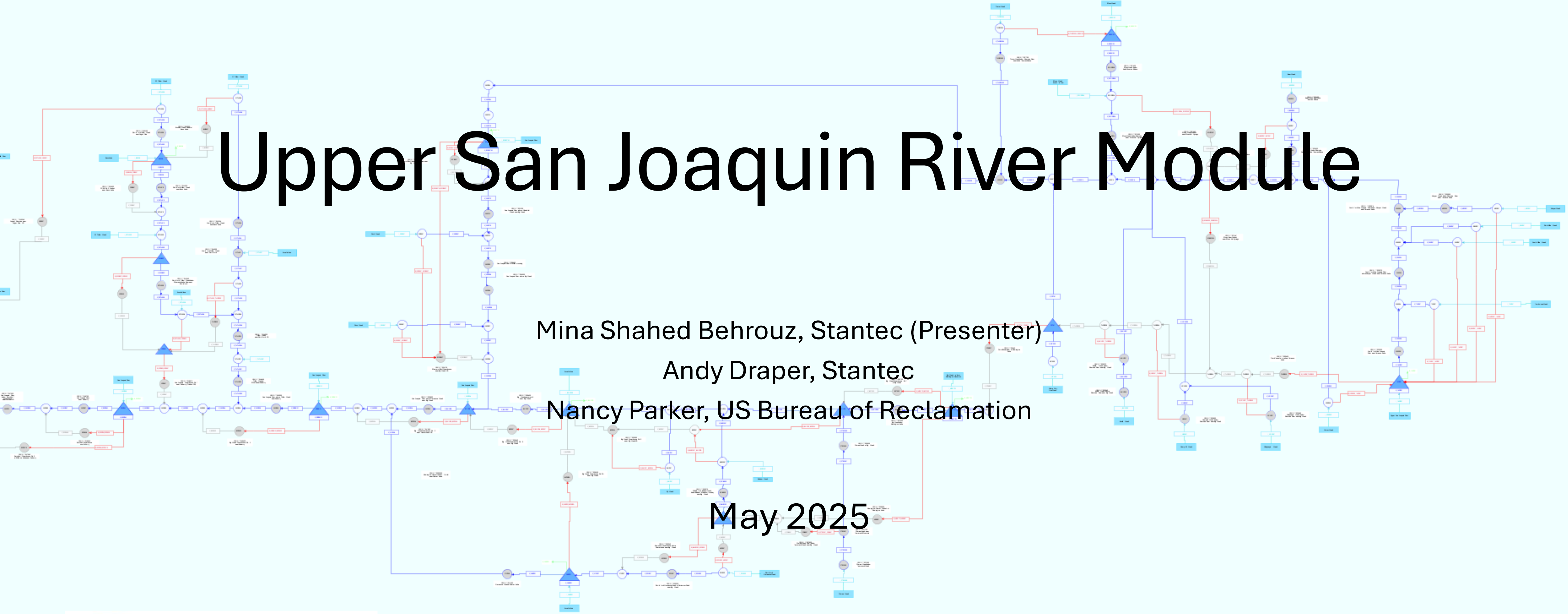


Upper San Joaquin River Module

Mina Shahed Behrouz, Stantec (Presenter)

Andy Draper, Stantec

Nancy Parker, US Bureau of Reclamation

May 2025

BUREAU OF RECLAMATION

Stantec

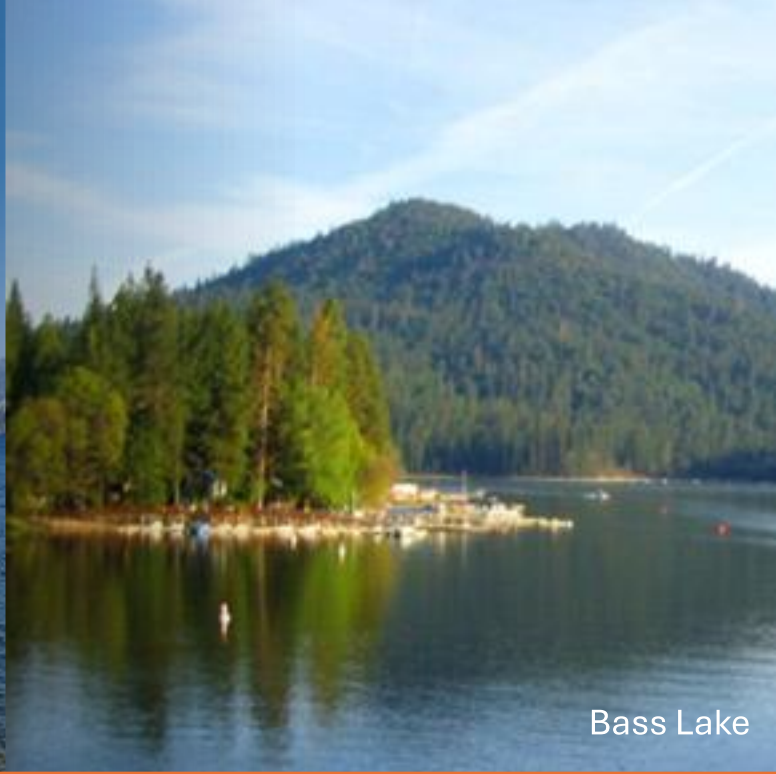

Middle Fork San Joaquin River

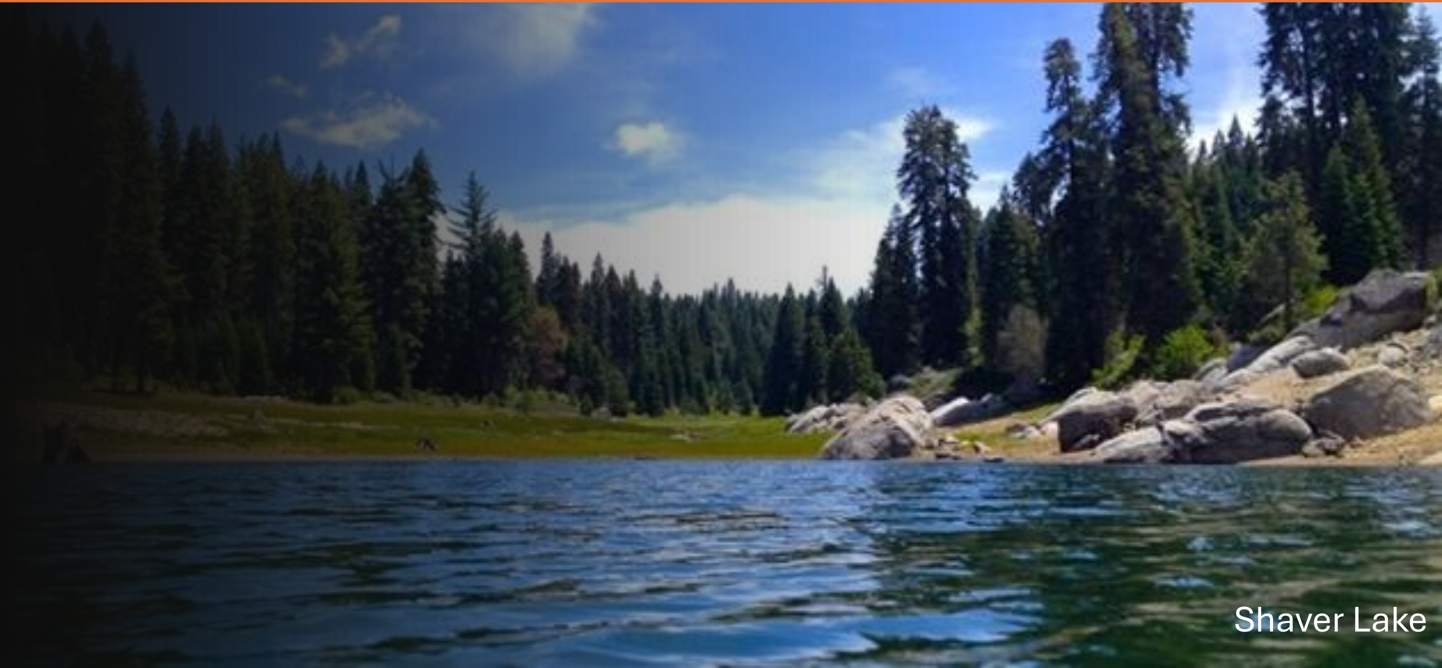
Agenda

1. Background
2. Hydrology
3. Model Simulation and Refinements
4. Model Results
5. Documentation
6. Next Steps

Background


Huntington Lake


Bass Lake

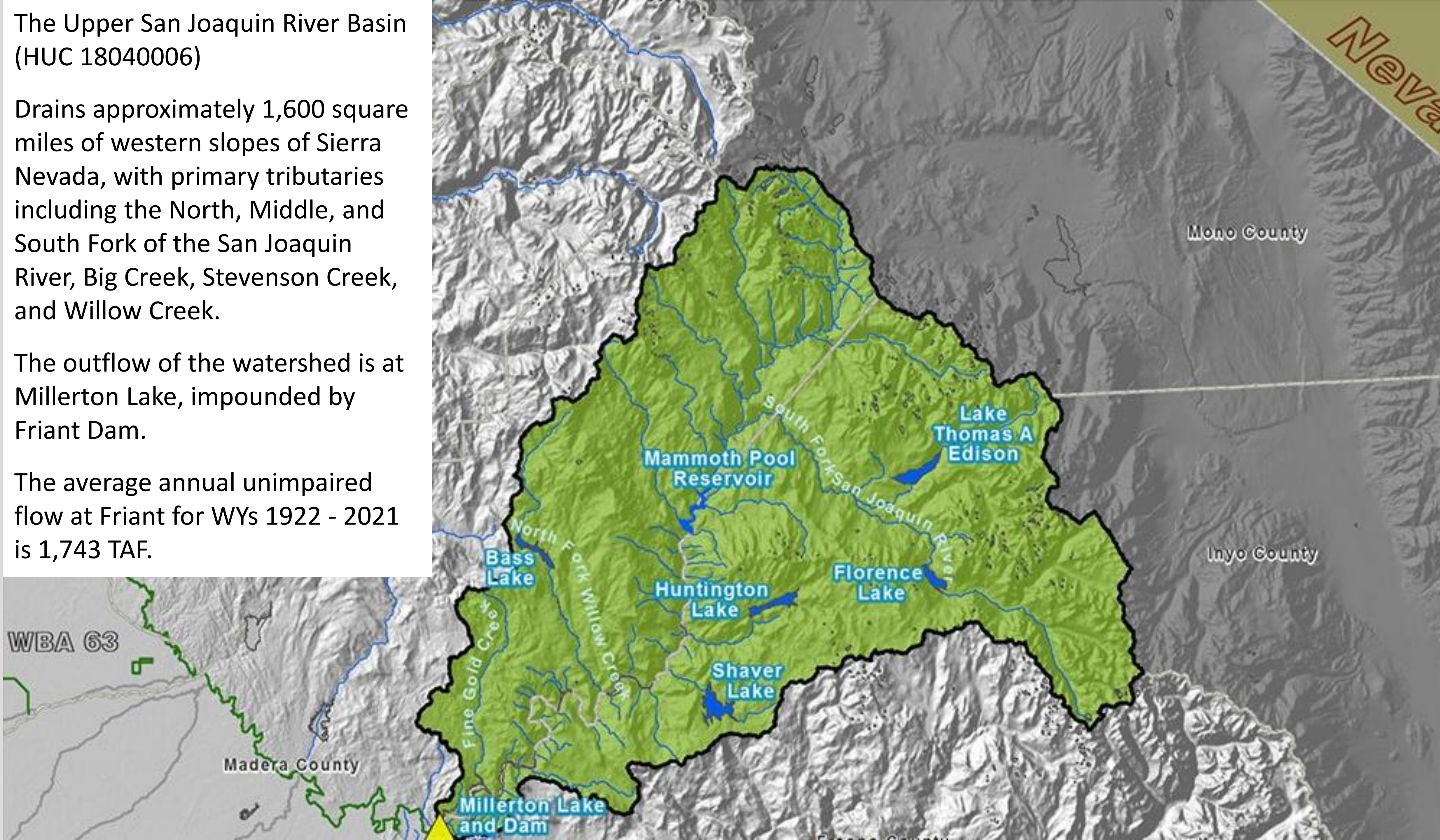

Shaver Lake

The Upper San Joaquin River Basin (HUC 18040006)

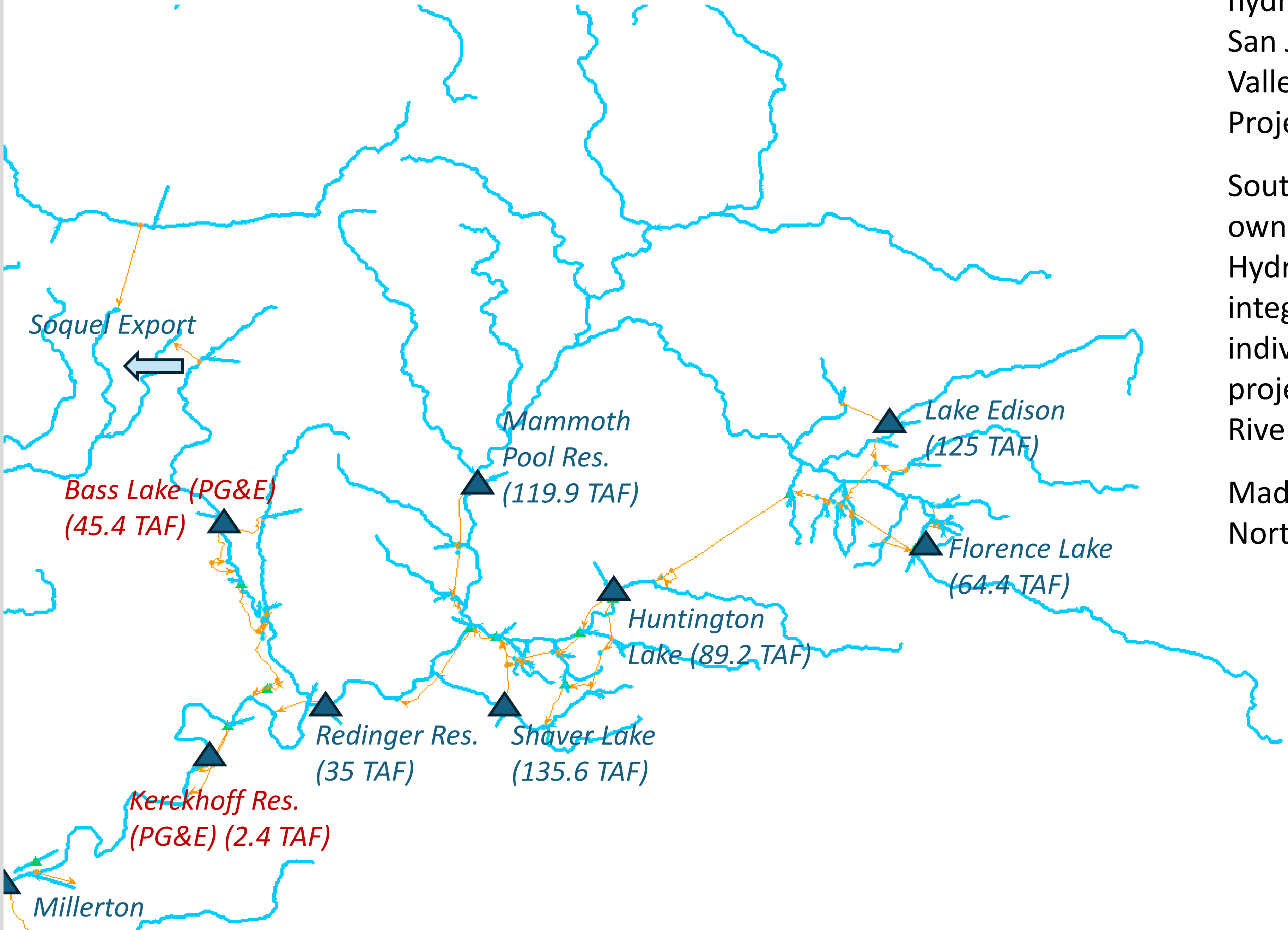
Drains approximately 1,600 square miles of western slopes of Sierra Nevada, with primary tributaries including the North, Middle, and South Fork of the San Joaquin River, Big Creek, Stevenson Creek, and Willow Creek.

The outflow of the watershed is at Millerton Lake, impounded by Friant Dam.

The average annual unimpaired flow at Friant for WYs 1922 - 2021 is 1,743 TAF.



Water Infrastructure



PG&E owns and operates two hydroelectric projects in the upper San Joaquin River Basin: the Crane Valley Project and the Kerckhoff Project.

Southern California Edison (SCE) owns and operates the Big Creek Hydroelectric System (BCHS) - an integrated network of seven individually licensed hydroelectric projects in the Upper San Joaquin River watershed.

Madera ID exports water from the North Fork Willow Creek.

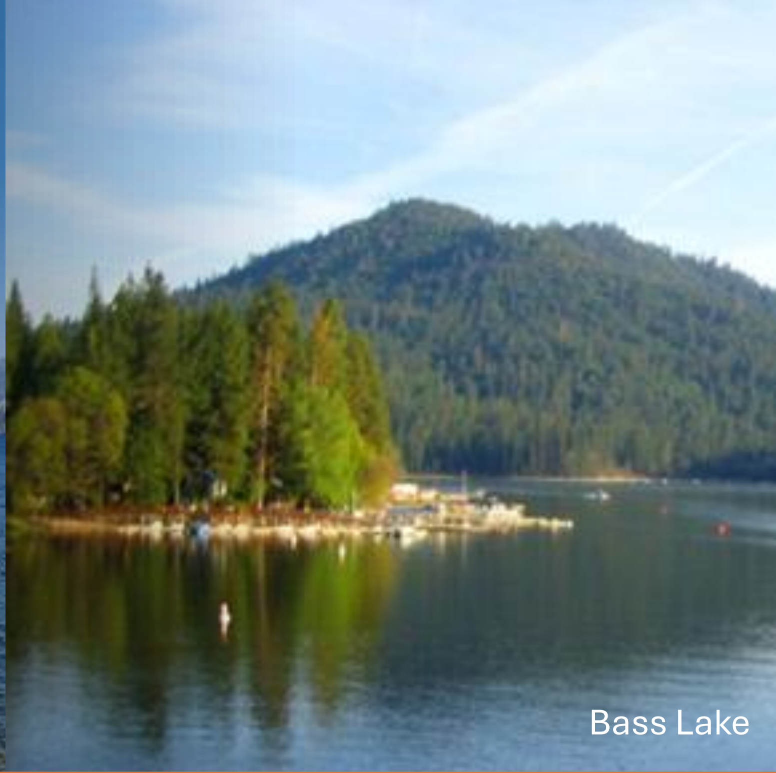
Source Material

- FERC license/ applications
- Water rights (eWRIMS) and reports of diversion and water use
- Flow gauges and storage records
- PRISM climate data

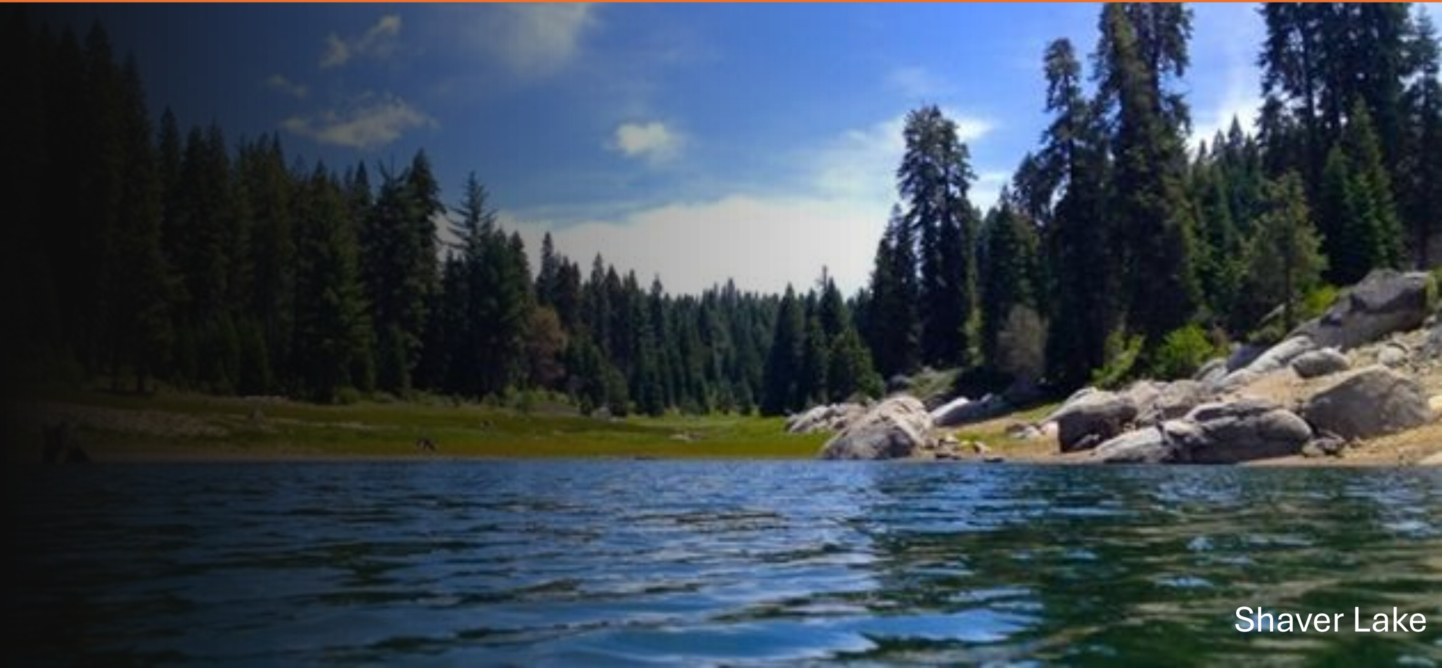
FERC: Federal Energy Regulatory Commission

Hydrology

Huntington Lake



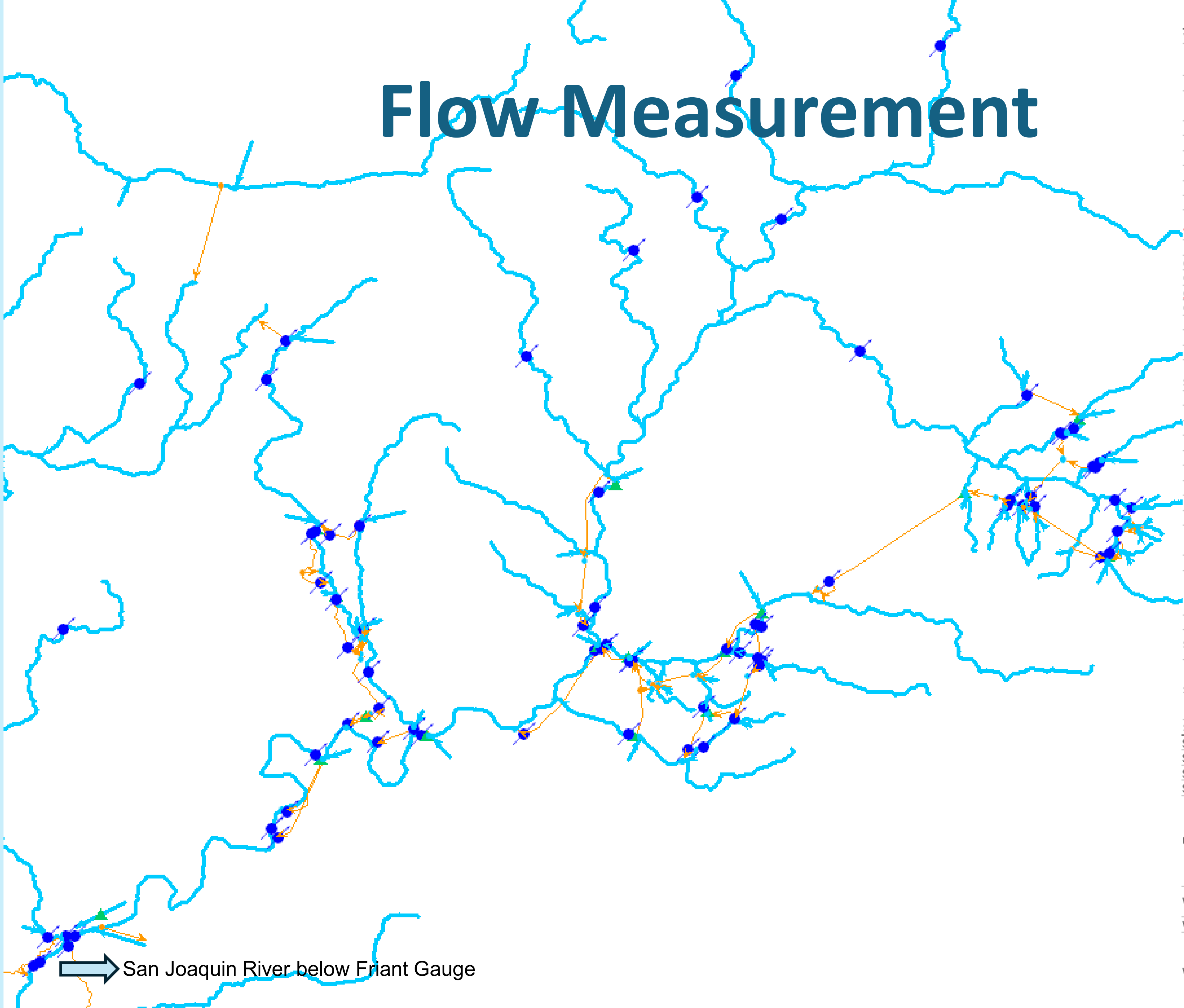
Bass Lake



Shaver Lake

Hydrology

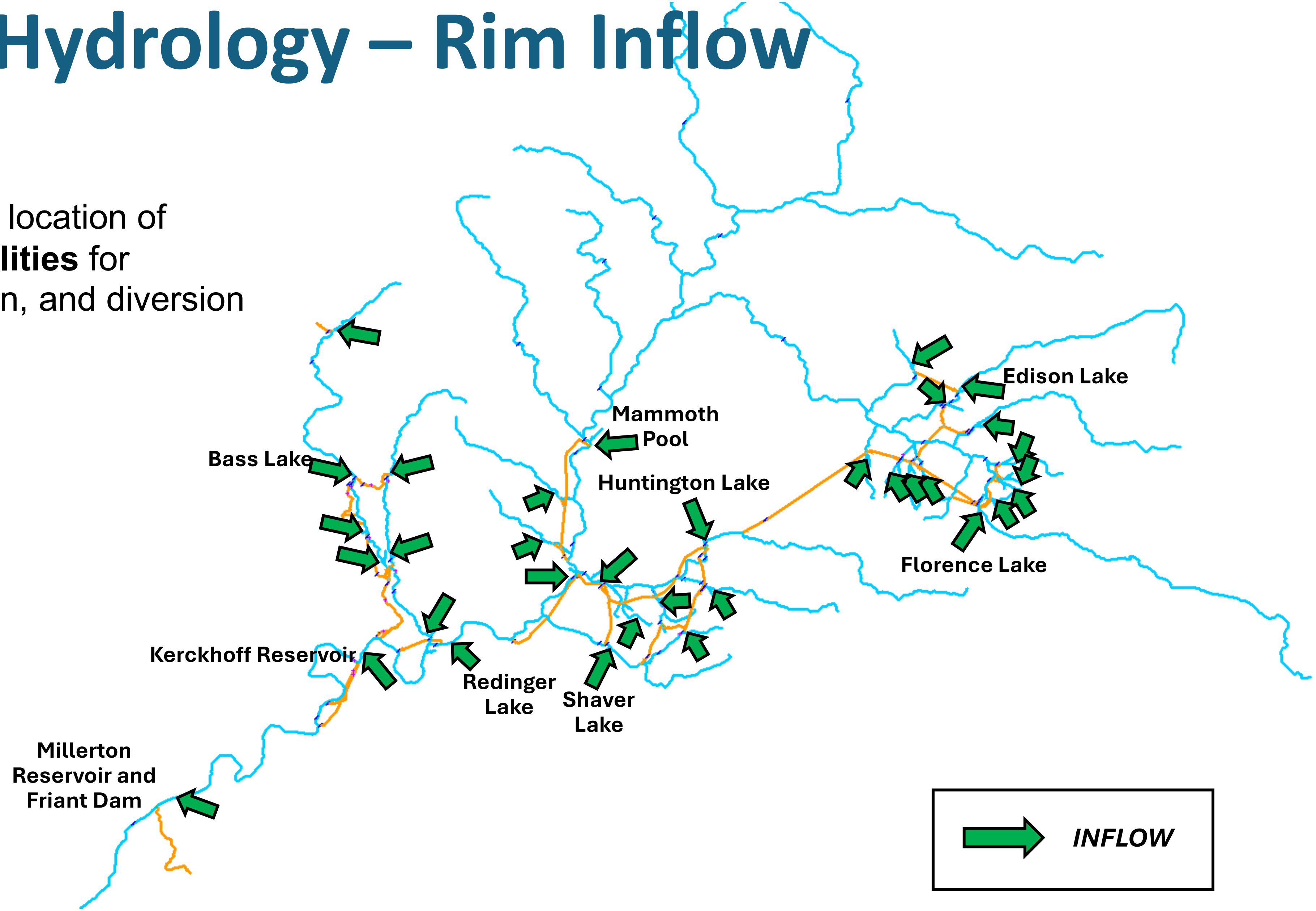
Flow Measurement



River/Facility	Gauge Name	Available Period
Wishon PH	USGS 11246610 San Joaquin PH No 1 nr Auberry	1/1980 - present
Bear Creek	USGS 11230500 Bear Creek nr Lake Edison	10/1921 - present
	USGS 11230530 Bear Creek bl Diversion Dam nr Lake Edison	10/1986 - present
Bear Creek Diversion	USGS 11230520 Bear Creek Conduit nr Lake Thomas A Edison	10/1986 - present
Big Creek	USGS 11237000 Big Creek bl Huntington Lake	7/1925 - present
	USGS 11238500 Big Creek nr Mouth nr Big Creek	6/1923 - present
Big Creek No. 1 PH	USGS 11238100 Big Creek PH No 1 at Big Creek	10/1980 - present
Big Creek No. 2 PH	USGS 11238380 Big Creek PH No 2 nr Big Creek	10/1980 - present
Big Creek No. 2A PH	USGS 11238400 Big Creek PH No 2a nr Big Creek	10/1980 - present
Big Creek No. 3 PH	USGS 11241800 Big Creek PH No 3 nr Shaver Lake	10/1980 - present
Big Creek No. 4 PH	USGS 11246530 Big Creek PH No 4 nr Auberry	10/1980 - present
Big Creek No. 8 PH	USGS 11238550 Big Creek PH No 8 nr Big Creek	10/1980 - present
Bolsillo Creek	USGS 11230650 Bolsillo Creek ab Diversion Dam nr Big Creek	10/1985 - 8/1995
	USGS 11230670 Bolsillo Creek bl Diversion Dam nr Big Creek	10/1985 - 5/2004
Browns Creek Canal	USGS 11243300 Browns Creek Canal at Bass Lake	1/1986 - present
Camp 62 Creek	USGS 11230600 MP 62 bl Diversion Dam nr Big Creek	5/1987 - 6/2008
Chinquapin Creek	USGS 11230560 Chinquapin Creek bl Diversion Dam nr Big Creek	5/1987 - 6/2003
Chiquito Creek	USGS 11234500 Chiquito Creek nr Bass Lake	10/1921 - 8/1970
Crane Valley PH	USGS 11243500 PG&E No 3 Conduit nr Bass Lake	1/1940 - present
Eastwood PH	USGS 11238250 Eastwood Powerplant ab Shaver Lake nr Big Creek	10/1987 - present
Friant Kern Canal	USGS 11250000 Friant-Kern Canal at Friant	7/1949 - present
Hooper Creek	USGS 11230200 Hooper Creek bl Diversion Dam nr Florence Lake	10/1986 - present
Huntington Pitman	USGS 11236080 Huntington-Shaver Conduit at Huntington Lake	10/1974 - 8/1983
Shaver Conduit	USGS 11239000 Huntington-Shaver Conduit Outlet nr Shaver Lk	11/1928 - 6/1985
Kerckhoff 1 PH	USGS 11246950 Kerckhoff PH nr Auberry	10/1978 - present
Kerckhoff 2 PH	USGS 11247050 Kerckhoff PH No 2 at Millerton Lake nr Auberry	10/1983 - present
Madera Canal	USGS 11249500 Madera Canal at Friant	10/1948 - present
Mammoth Pool Turbine	USGS 11234750 Mammoth Pool Fishwater Turbine nr Big Creek	10/1977 - present
Mammoth Pool PH	USGS 11235100 Mammoth Pool Powerplant nr Big Creek	10/1980 - present
Balsam Creek	USGS 11238270 MF Balsam Creek bl Balsam Meadows Forebay	2/1989 - present
MF San Joaquin	USGS 11224000 MF San Joaquin River nr Mammoth Lake	10/2010 - present
Mono Bear Siphon	USGS 11231551 Mono Bear Conduit nr Mono Hot Springs	10/2009 - present
Mono Creek Diversion	USGS 11231550 Mono Creek Conduit nr Mono Hot Springs	10/1970 - present
Mono Creek River	USGS 11231600 Mono Creek bl Diversion Dam nr Mono Hot Springs	10/1970 - present
	USGS 11231500 Mono Creek bl Lake Thomas at Edison	10/1921 - present
NF Stevenson Creek	USGS 11239300 NF Stevenson Creek at Perimeter Rd nr Big Creek	2/1989 - present
Pitman Creek	USGS 11237500 Pitman Creek bl Tamarack Creek	12/1927 - present
	USGS 11238000 Pitman Creek at Big Creek	1/1910 - 8/1927
	USGS 11237700 Pitman Creek nr Tamarack Mountain	10/1986 - present
Pitman Creek Diversion	USGS 11237600 Pitman Creek Shaft bl Tamarack Creek nr Big Creek	10/1986 - present
SF Willow Creek	USGS 11245000 SF Willow Creek nr North Fork	1/1910 - 1/1917
	USGS 11243405 SF Willow Creek nr Bass Lake	11/2009 - present
SF San Joaquin River	USGS 11232000 SF San Joaquin River nr Hoffman Meadows	10/1921 - 8/1928
	USGS 11230070 SF San Joaquin River ab Hooper C nr Florence Lake	10/2009 - present
	USGS 11230215 SF San Joaquin River Bl Hooper C nr Florence Lake	10/1975 - present
	USGS 11230000 SF San Joaquin River nr Florence Lake	10/1921 - 8/1980
SJ No. 1A PH	USGS 11246590 San Joaquin PH No 1a nr Auberry	10/1980 - present
SJ No. 2 PH	USGS 11246570 San Joaquin PH No 2 nr North Fork	1/1980 - present
SJ No. 3 PH	USGS 11244100 San Joaquin PH No 3 nr North Fork	1/1980 - present
Soquel Diversion	USGS 11242350 Soquel Diversion nr Sugar Pine	1/1969 - 1/1977
Stevenson Creek	USGS 11241500 Stevenson Creek at Shaver Lake	10/1916 - present
Upper San Joaquin	USGS 11234760 San Joaquin River ab Shakeflat Creek nr Big Creek	10/1959 - present
	USGS 11238600 San Joaquin River ab Stevenson Creek nr Big Creek	10/1973 - present
	USGS 11242000 San Joaquin River ab Willow Creek nr Auberry	4/1951 - present
	USGS 11246700 San Joaquin River nr Auberry	10/1986 - present
	USGS 11247000 San Joaquin River bl Kerckhoff PH nr Prather	4/1901 - 8/1981
	USGS 11235000 San Joaquin River ab Big Creek	10/1912 - 8/1962
Ward Tunnel	USGS 11235500 Portal Powerplant at Huntington Lake	10/1927 - present
	USGS 11229500 Ward Tunnel at Intake at Florence Lake	5/1925 - present
Warm Creek	USGS 11231700 Warm Creek bl Diversion Dam nr Lake Thomas Edison	10/1986 - 9/2016
Willow Creek	USGS 11246500 Willow Creek at Mouth nr Auberry	1/1952 - present
	USGS 11244000 NF Willow Creek nr Bass Lake	1/1940 - present
	USGS 11242400 NF Willow Creek nr Sugar Pine	1/1965 - 1/2009
	USG S 11245300 Willow Creek nr North Fork	10/2009 - present
	USGS 11244050 NF Willow Creek bl Manzanita Lake Dam nr North Fork	7/2012 - 2/2018

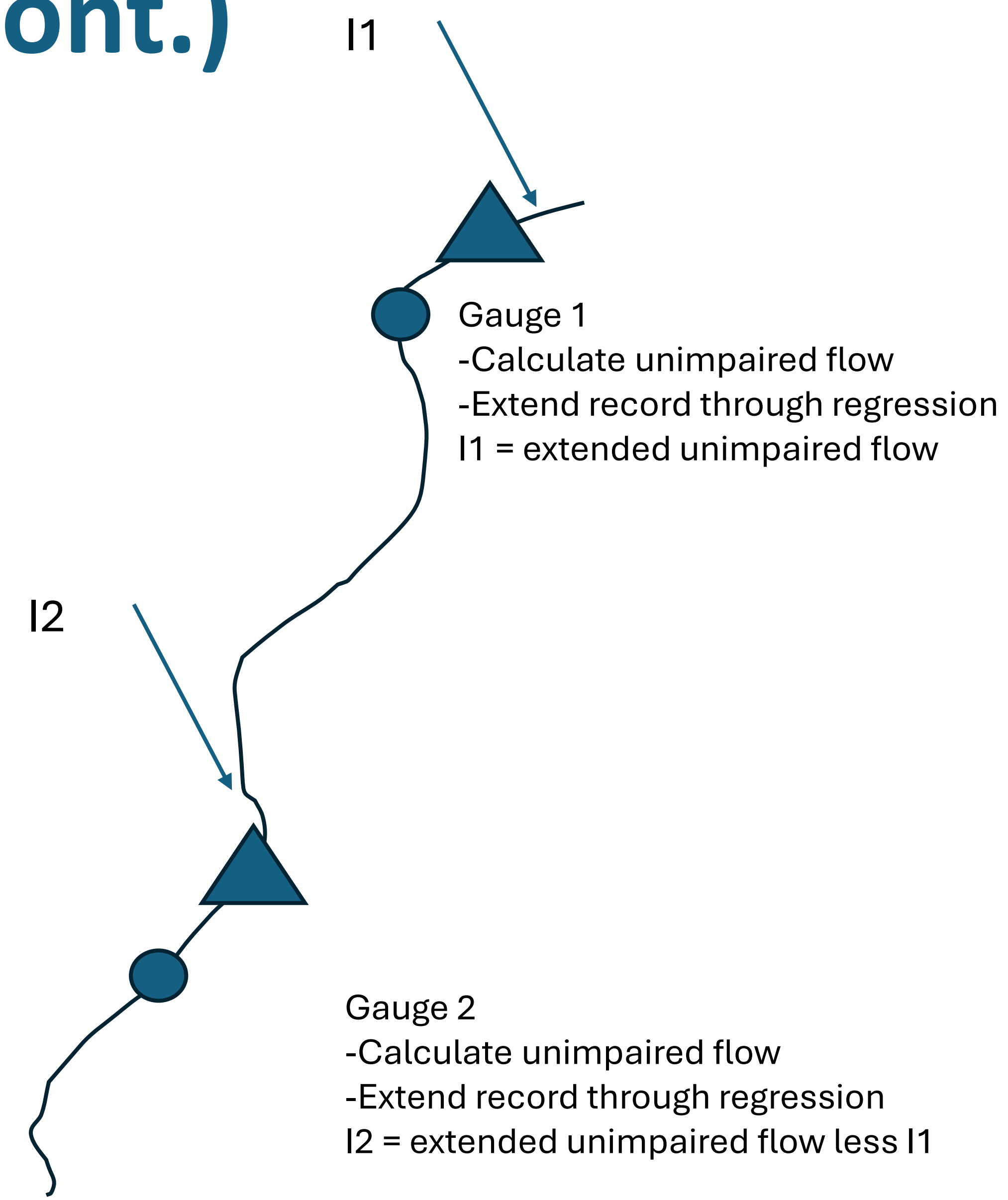
Hydrology – Rim Inflow

Rim inflows calculated at location of **water management facilities** for storage, power generation, and diversion



Hydrology – Rim Inflow (cont.)

- **Negative values in unimpaired flows:**
  - The sum of upstream flows had higher values than the calculated unimpaired flow below Friant.
- **Proposed approach:**
  - Include a bias correction using drainage area and precipitation
- Same approach can be used for other upper watersheds such as the Upper American River.



Hydrology – Rim Inflow (cont.)

- **Methodology:**
  Redistributing based on contribution of each of the Rim inflow to the final inflow based on 30-year average.
  - **Assumption:**
    Percentage of annual contribution is assumed to be same based on 30-year average (1991-2020).
  - **Steps:**
    - Calculate weighted average precipitation using gridded 30-year normal PRISM data (ppt)
    - Calculate percent contribution of each watershed to the unimpaired flow at Millerton:

$$\frac{rim\ inflow\ drainage\ area * ppt}{Sum\ (rim\ inflow\ drainage\ area * ppt)}$$

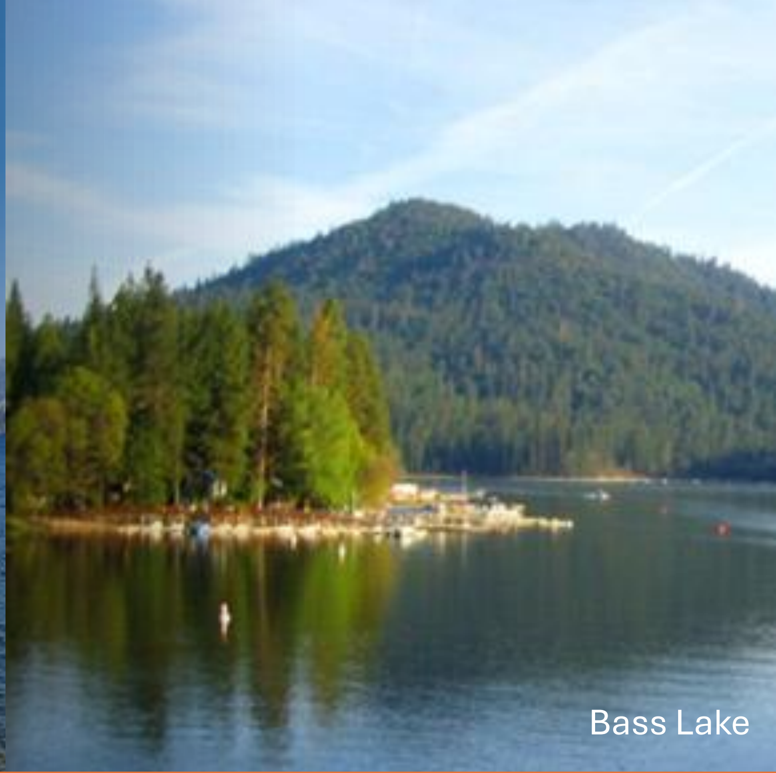
    - Calculate flow contribution =

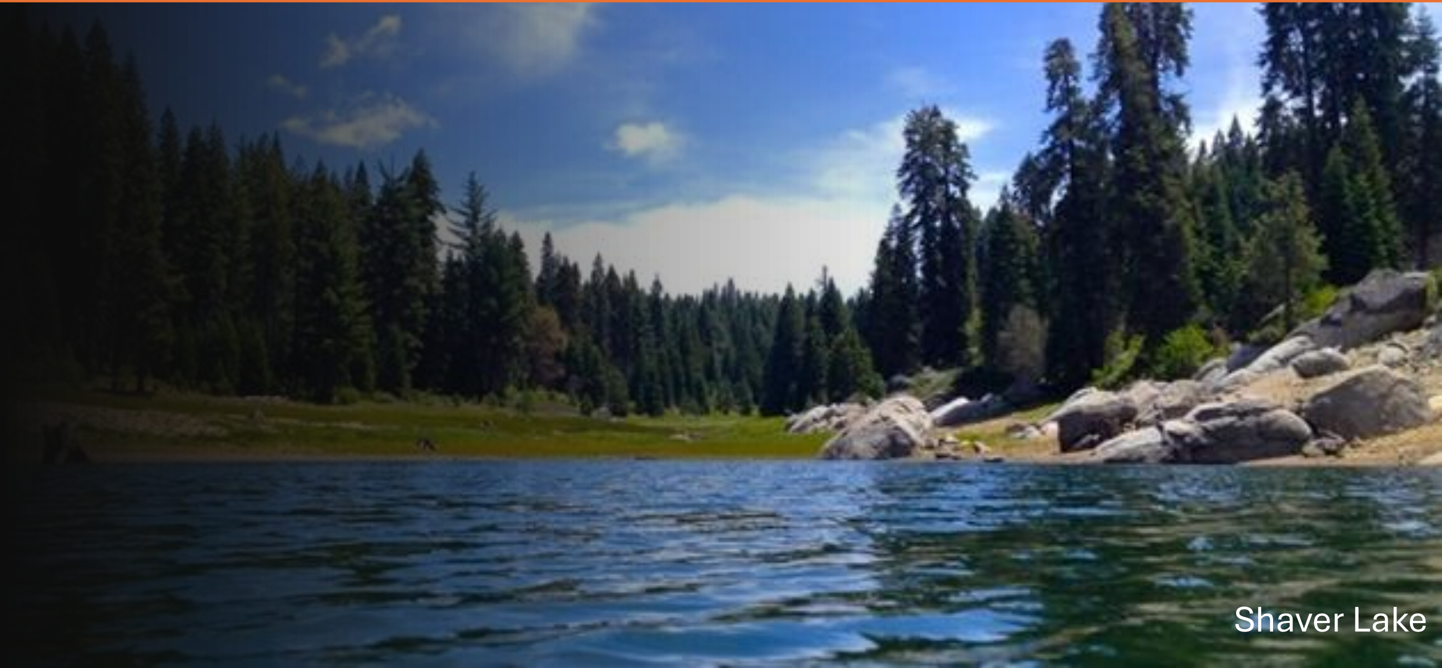
      Percent contribution of each watershed * total unimpaired flow at Millerton Lake

    - Scale the annual rim inflow volume by percent contribution of each watershed

Model Simulation


Huntington Lake


Bass Lake


Shaver Lake

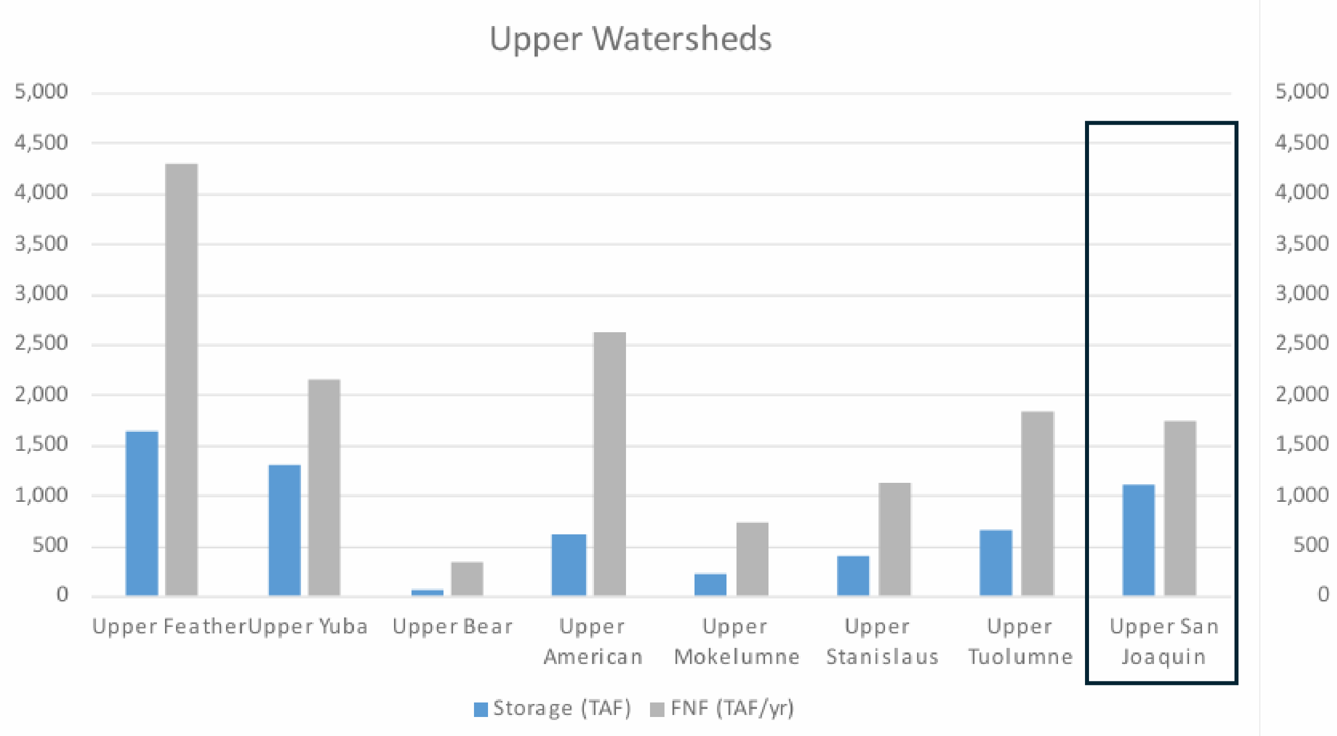
Model Simulation

Purpose

Why was the Upper San Joaquin Model developed?

There is significant storage regulation in upper watersheds.

To determine the inflow to Lake Millerton



Model Activation

The upper San Joaquin River module consists of a single cycle named UPPERSANJOAQUIN, which is activated by setting the state variable simulateupperSanJoaquin to a value of 1 in the mainUpperSanJoaquin.wresl file:

```
initial {

svar simulateupperSanJoaquin    {value 1.} ! Under construction

}

SEQUENCE CYCLE1 {
    model    UPPERSANJOAQUIN
    condition simulateupperSanJoaquin >= 0.5
    order    1
    }
```

Model Simulation

System WRESL Files

Minimum Flow Requirements

- Minimum instream flows
- Regulatory requirements, from FERC license
- Set on river arcs
- For power generation but also protecting aquatic ecosystem

Example:

```
define C_EDSON_MIF {std kind 'FLOW-MIN-INSTREAM' units 'CFS'}
define C_EDSON_SHTG{std kind 'FLOW-SHORTAGE-INSTREAM' units 'CFS'}
define C_EDSON_ADD {std kind 'FLOW-EXCESS-INSTREAM' units 'CFS'}
! REG P2086 Mono Blw Edison
define minflow_EDSON {value 10.} !cfs
```

```
! Below Edison Lake
goal C_EDSONtotal    {C_EDSON = C_EDSON_MIF + C_EDSON_ADD}
goal setEDSONMin     {C_EDSON_MIF + C_EDSON_SHTG = minflow_EDSON}
```

Weight Table

```
!====================================
!Instream Flow Requirement Weights
!====================================

!FERC flow requirements
![C_BASSL_MIF,200000],
[C_SFW005_MIF,200000],
[C_WWC006_MIF,200000],
[C_NFW008_MIF,200000],
[C_KRCKH_MIF,200000],
[C_NFS003_MIF,200000],
[C_MFB000_MIF,200000],
![C_BSM001_MIF,200000],
[C_EDSON_MIF,200000],
[C_PTM001_MIF,200000],
[C_BGCD5_MIF,200000],
[C_SJR296_MIF,200000],
[C_SJR305_MIF,200000],
[C_WRM003_MIF,200000],
[C_MON004_MIF,200000],
[C_CQC000_MIF,200000],
![C_RCK001_MIF,200000],
![C_RSS001_MIF,200000],
[C_BRC000_MIF,200000],
[C_HPC000_MIF,200000],
[C_CMP002_MIF,200000],
![C_PRTLF_MIF,200000],
[C_SJR313_MIF,200000],
[C_SSJ022_MIF,200000],
[C_STV006_MIF,200000],
[C_HNGTN_MIF,200000],
![C_ELY001_MIF,200000],
[C_NSC001_MIF,200000],
```

```
!==========================================================
!Powerhouses
!==========================================================

! PG&E FERC 1354
[C_PCB001, 15000], ! PG&E No.3 conduit
[C_SP2003,    100], ! PG&E No.3 conduit
[C_SPA001,    100], ! PG&E No.3 conduit

[C_EPS002,    100], ! Eastwood PH !15000
![C_PPH007,    100], ! Portal PH !15000
[C_PPH007,  15000], ! Portal PH !15000
![C_WRD006, 15000], ! below FLRNC
[C_BP1003,    100], ! PH No.1 !15000
[C_BP2004,    100], ! PH No.2
[C_BP3005,    100], ! PH No.3 !15000
![C_HCH001, 15000], !below HNGTN
[C_BCPH2A,    100], ! PH No.2A
[C_MPB007,    100], ! Mammoth Pool PH !1500 last
![C_MTB001, 15000], ! below MAMTH
[C_BPA003,  10000], ! PH No.4
[C_BP8001,    100], ! PH No.8
[C_KPA008,  10000], ! Kerckhoof PH No.1 !100
[C_KPM010,  10000], ! Kerckhoof PH No.2 !100
```

Nr Bass Lake

Nr Huntington Lake

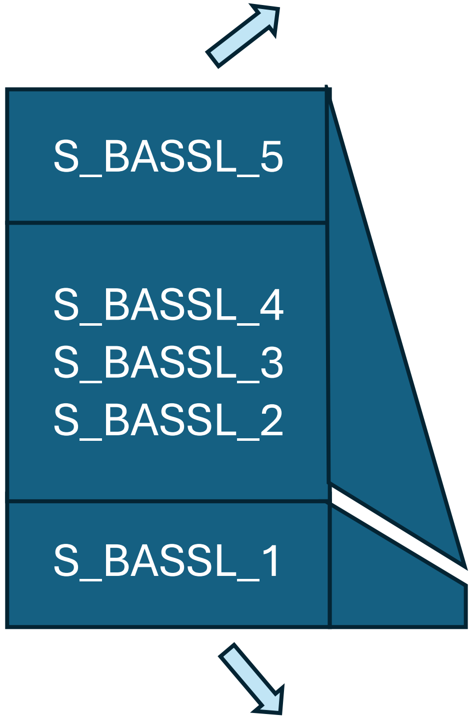
Nr Redinger Res.

Nr Kerckhoff Res.

```
!==========================================================
!Diversion Weights
!==========================================================

[D_NFW026_SDS001,150000],
```

```
!==========================================================
!Storage/Reservoir Weights
!==========================================================
! BASSL > FLRNC > EDSON > MAMTH > HNTGN > SHVER > RDNGR

[S_BASSL_1, 1000010*taf_cfs],
[S_BASSL_2,  100010*taf_cfs],
[S_BASSL_3,   50010*taf_cfs],
[S_BASSL_4,   50000*taf_cfs],
[S_BASSL_5,   10010*taf_cfs],

[S_FLRNC_1, 1000009*taf_cfs],
[S_FLRNC_2,  500009*taf_cfs],
[S_FLRNC_3,  200009*taf_cfs],
[S_FLRNC_4,  100000*taf_cfs],
[S_FLRNC_5,   10009*taf_cfs],

[S_RDNGR_1, 1000004*taf_cfs],
[S_RDNGR_2,  100004*taf_cfs],
[S_RDNGR_3,   50004*taf_cfs],
[S_RDNGR_4,   30000*taf_cfs],
[S_RDNGR_5,   10004*taf_cfs],

[S_MAMTH_1, 1000007*taf_cfs],
[S_MAMTH_2,  100007*taf_cfs],
[S_MAMTH_3,   50007*taf_cfs],
[S_MAMTH_4,   30000*taf_cfs],
[S_MAMTH_5,   10007*taf_cfs],

[S_SHVER_1, 1000005*taf_cfs],
[S_SHVER_2,  100005*taf_cfs],
[S_SHVER_3,   50005*taf_cfs],
[S_SHVER_4,   30000*taf_cfs],
[S_SHVER_5,   10005*taf_cfs],

[S_EDSON_1, 1000008*taf_cfs],
[S_EDSON_2,  100008*taf_cfs],
[S_EDSON_3,   50008*taf_cfs],
[S_EDSON_4,   40000*taf_cfs],
[S_EDSON_5,   10008*taf_cfs],

[S_HNGTN_1, 1000006*taf_cfs],
[S_HNGTN_2,  100006*taf_cfs],
[S_HNGTN_3,   50006*taf_cfs],
[S_HNGTN_4,   30000*taf_cfs],
[S_HNGTN_5,   10006*taf_cfs],

}
```

Reservoir flood control space to be kept evacuated



Reservoir dead storage and/or FERC-mandated minimum pool levels

Operational WRESL Files

MammothPoolOperatingAgreement.wresl includes the Mammoth Pool Operating Agreement (MPOA).

5 MPOA reservoirs include:

- Mammoth Pool
- Lake Thomas A. Edison
- Florence Lake
- Huntington Lake
- Shaver Lake

- MPOA storage is the sum of the storage for the 5 MPOA reservoirs.

Model Simulation

MPOA

Mammoth Pool Operating Contract September 30 Storage Constraints and Minimum Flow Constraints			
Computed Natural Run-off @ Friant Dam (acre-feet)	**10/1 Beginning Storage (acre-feet)**	**9/30 Maximum Allowable Year-Ending Storage (acre-feet)**	**Minimum Allowable Flow Past Dam 7 (cubic feet per second)**
A-J = April to July FWY = Full Water Year			---
A-J ≤ 650,000	(1st year)	≤ 152,500	---
A-J ≤ 650,000	(2nd sequential year)	Not to exceed beginning storage	---
A-J > 650,000 FWY ≤ 1,200,000	≥ 202,500 & < 325,000	Equal as nearly as possible to beginning storage	---
A-J > 650,000 FWY ≤ 1,200,000	≥ 325,000	Not more than beginning storage and not less than 325,000	---
A-J > 650,000 FWY ≤ 1,200,000	< 202,500	Not more than beginning storage (plus amount computed A-J run-off at Friant exceeds 750,000) but not to exceed 202,500	---
FWY > 1,200,000 ≤ 1,600,000	≥ 202,500	Not less than beginning storage plus amount of FWY computed run-off at Friant less 1,200,000	≥ 615,000 Jun 1 – Sept 30 ≥ 450,000 Jul 1 – Sept 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,200,000 ≤ 1,600,000	< 202,500	Not less than 202,500 but may exceed beginning storage by up to 50,000 but total cannot exceed 325,000	≥ 615,000 Jun 1 – Sept 30 ≥ 450,000 Jul 1 – Sept 30 (shall be reduced if necessary to meet storage criteria)
FWY > 1,600,000	---	≥ 350,000	≥ 465,000 Jul 1 – Sept 30 (shall be reduced if necessary to meet storage criteria)

Mammoth Pool Operating Contract September 30 Storage Constraints and Minimum Flow Constraints		
Preceding Year Computed Natural Run-off at Friant Dam (acre-feet)	**10/1 Beginning Storage (acre-feet)**	**3/1 Minimum Storage (acre-feet)**
---	≤ 300,000	Not less than beginning storage less 150,000
≤ 1,400,000	> 300,000	Not less than the greater of (I) 150,000 or (ii) beginning storage less 175,000
> 1,400,000	> 300,000	Not less than 50% of beginning storage
> 2,000,000	> 350,000	As much as 50,000 less than 50% of beginning storage

Reservoir Operations

Example:

Estimated based on historical drawdown minimum

Level 4 is based on the average monthly historical storage data for 5 water year types in the last 30 year (1992-2021).

```
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!! Bass Lake (BASSL)      !!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
define S_BASSLlevel1 {value 0.6}
define S_BASSL_1 {std kind 'STORAGE-ZONE' units 'TAF'}
define S_BASSLlevel2 {value 0.6}
define S_BASSL_2 {std kind 'STORAGE-ZONE' units 'TAF'}
define S_BASSLlevel3 {value 0.6} !{select target from res_level where res_num=3,level=3,month=month}
define S_BASSL_3 {std kind 'STORAGE-ZONE' units 'TAF'}
define S_BASSLlevel4_init {select target from UpperSanJoaquinRiver_ResLevel where res_num=1,level=4,month=month, WYT=SJR602020} !{timeseries kind 'STORAGE-LEVEL' units 'TAF'}
! in case the reservoir storages is being drawn down to meet the req of MPOA, prevents refill in Oct.
define S_BASSLlevel4 {
    case first {
    condition month == Oct
    value min (S_BASSLlevel4_init, S_BASSL(-1))}
    case other {
    condition always
    value S_BASSLlevel4_init
}}

define S_BASSLlevel4DV {alias S_BASSLlevel4 kind 'STORAGE-LEVEL' units 'TAF'}
define S_BASSL_4 {std kind 'STORAGE-ZONE' units 'TAF'}
define S_BASSLlevel5 {value 45.410}
define S_BASSL_5 {std kind 'STORAGE-ZONE' units 'TAF'}
define S_BASSL {std kind 'STORAGE' units 'TAF'} !Bass Lake
define E_BASSL {lower unbounded kind 'EVAPORATION' units 'CFS'}
define A_BASSL {std kind 'SURFACE-AREA' units 'ACRES'}
define ER_BASSL {timeseries kind 'EVAPORATION-RATE' units 'IN'}
define A_BASSLlast {select area from UpperSanJoaquinRiver_ResInfo given storage=1000*S_BASSL(-1) use linear where res_num=1}
define A_BASSLforward {select area from UpperSanJoaquinRiver_ResInfo given storage=1050*S_BASSL(-1) use linear where res_num=1
define A_BASSLback {select area from UpperSanJoaquinRiver_ResInfo given storage=950*S_BASSL(-1) use linear where res_num=1}
define coefev_BASSL {value (A_BASSLforward - A_BASSLback)/(100*max(0.01,S_BASSL(-1)))}
! define relcap_BASSL {select discharge from UpperSanJoaquinRiver_ResInfo given storage=1000*S_BASSL(-1) use linear where res_
```

Gross storage in TAF from FERC License Application 1354

UpperSanJoaquinRiver_ResLevel

res_num	level	month	target	WYT
1	4	1	27.1	1
1	4	2	22.7	1
1	4	3	23.6	1
1	4	4	25.6	1
1	4	5	31.6	1
1	4	6	32.8	1
1	4	7	38.7	1
1	4	8	42.6	1
1	4	9	43.2	1
1	4	10	41.6	1
1	4	11	38.9	1
1	4	12	34.3	1

UpperSanJoaquinRiver_ResInfo

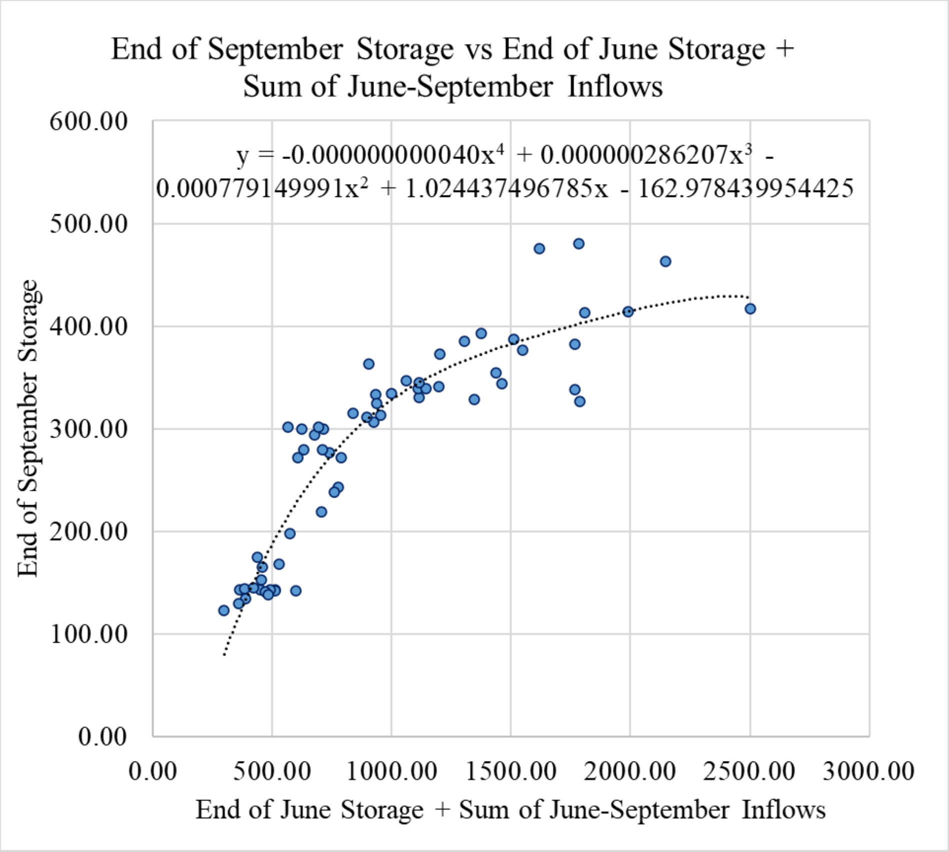
res_num	storage	area	discharge	elevation
1	0	0	999999	0
1	145	29	999999	3275
1	590	60	999999	3285
1	1393	100.6	999999	3295
1	2650	150.8	999999	3305
1	4494	218	999999	3315
1	7150.5	313.3	999999	3325
1	10972	451	999999	3335
1	16445	643.6	999999	3345
1	23892	845.8	999999	3355
1	33169.5	1009.7	999999	3365
1	41814	1123.75	999999	3373.2
1	45410	1165	999999	3376.4

Model Refinements on Rule Curves

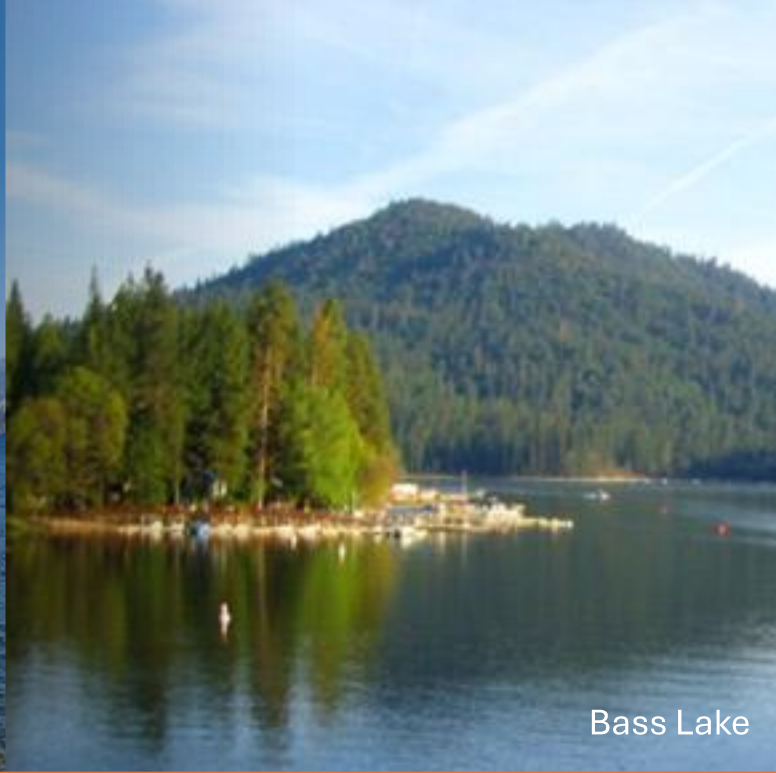
- **Problem:**
  - Releases rely on historical data.
- **Approach:**
  - Implement generalized rule curves for level 4 so instead of using historical data, it uses current storage and runoff forecast.

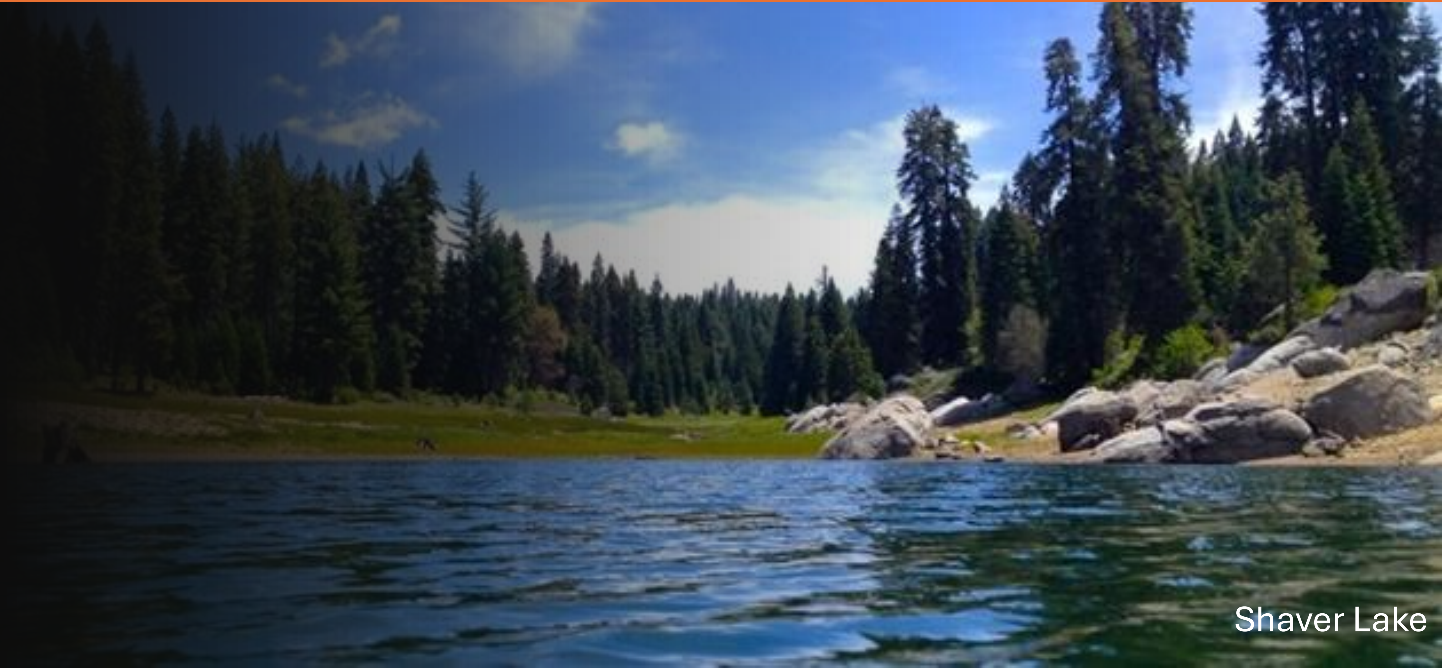
Steps:

- ○ Calculate End of Jun Storage + Sum of Inflows (Jun-Sep) for 5MPOA reservoirs
- ○ Calculate End of Sep Storage for 5MPOA Reservoirs Based on the Historical Pattern
- ○ Redistribute Storage for each of the 5 MPOA Reservoirs in the months of Jul, Aug, Sep



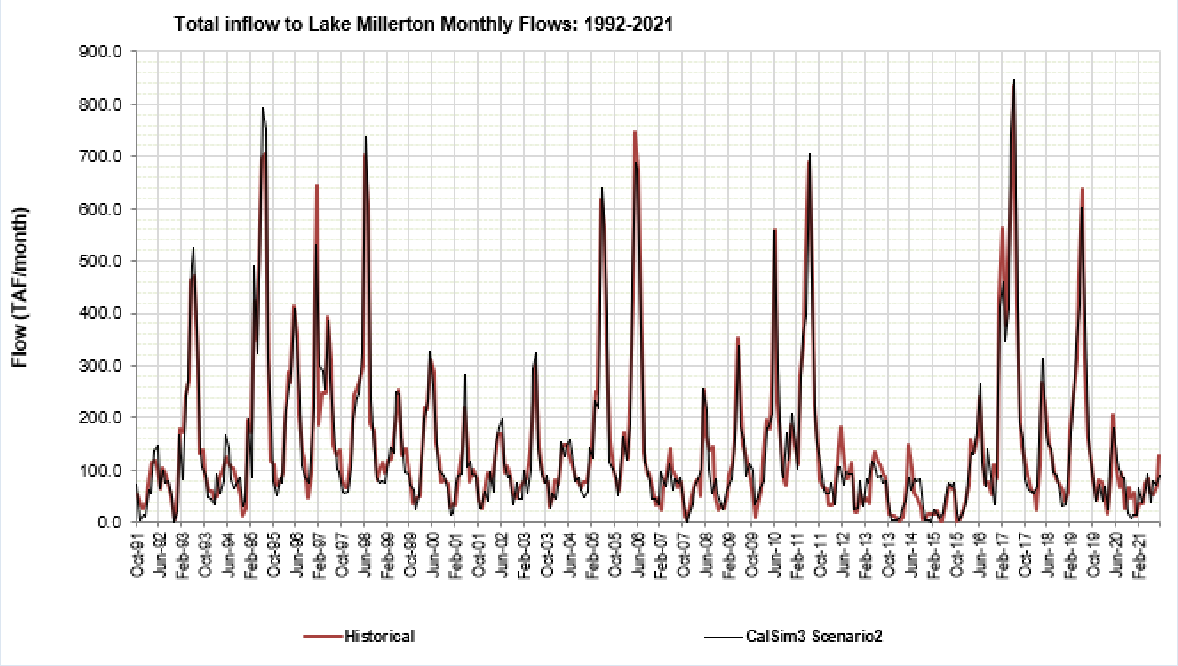
Model Results

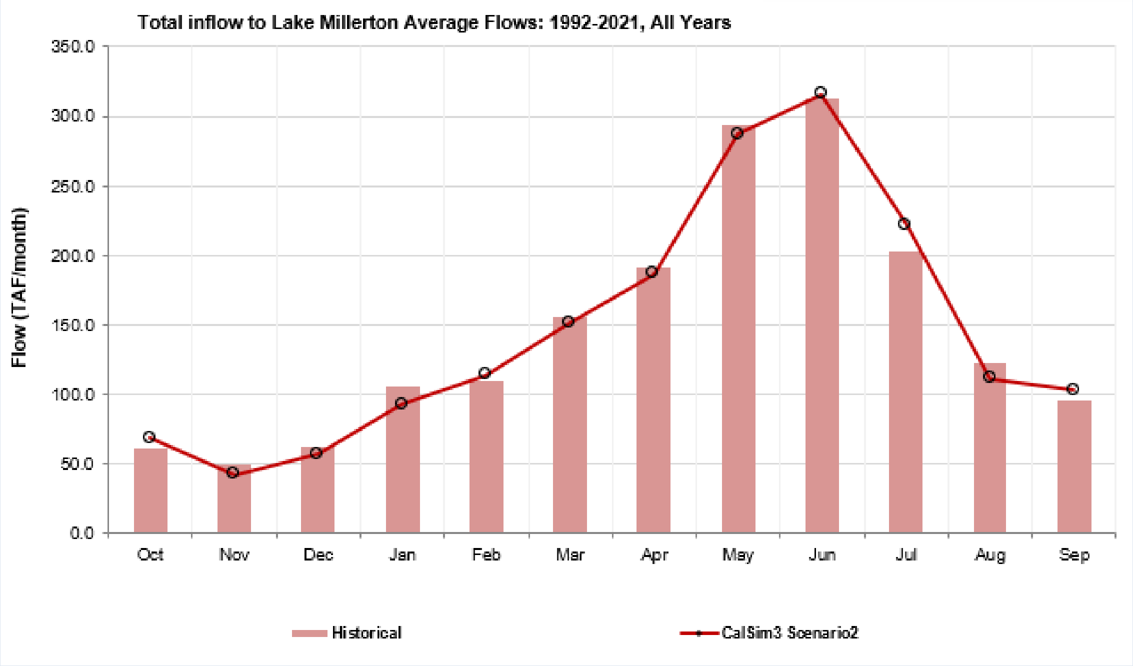




Millerton Lake Inflow

Av. Annual Value (TAF)	
1,763	Historical
1,752	CalSim3 Scenario 2
-11	-1%

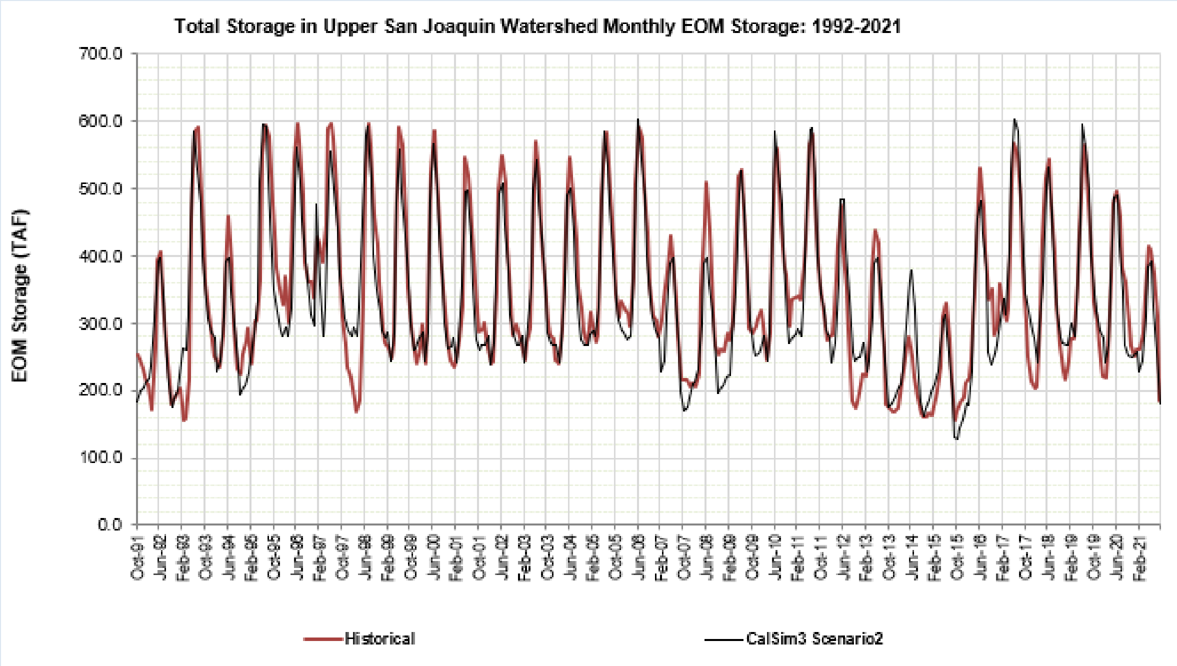


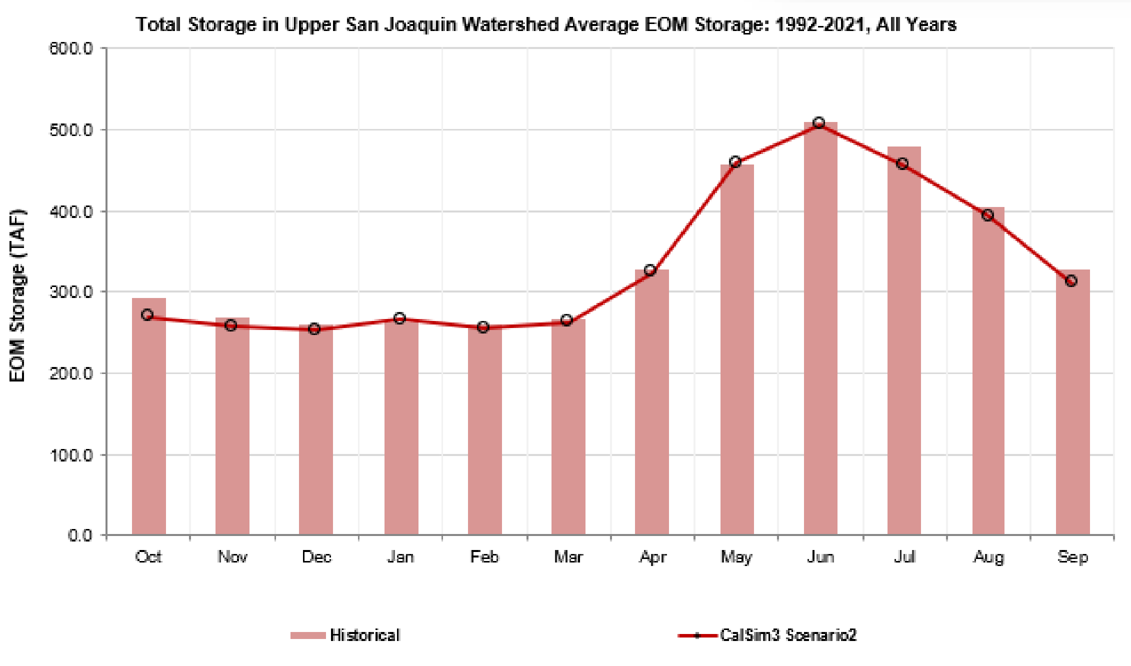


Model Outputs

Total Reservoir Storage

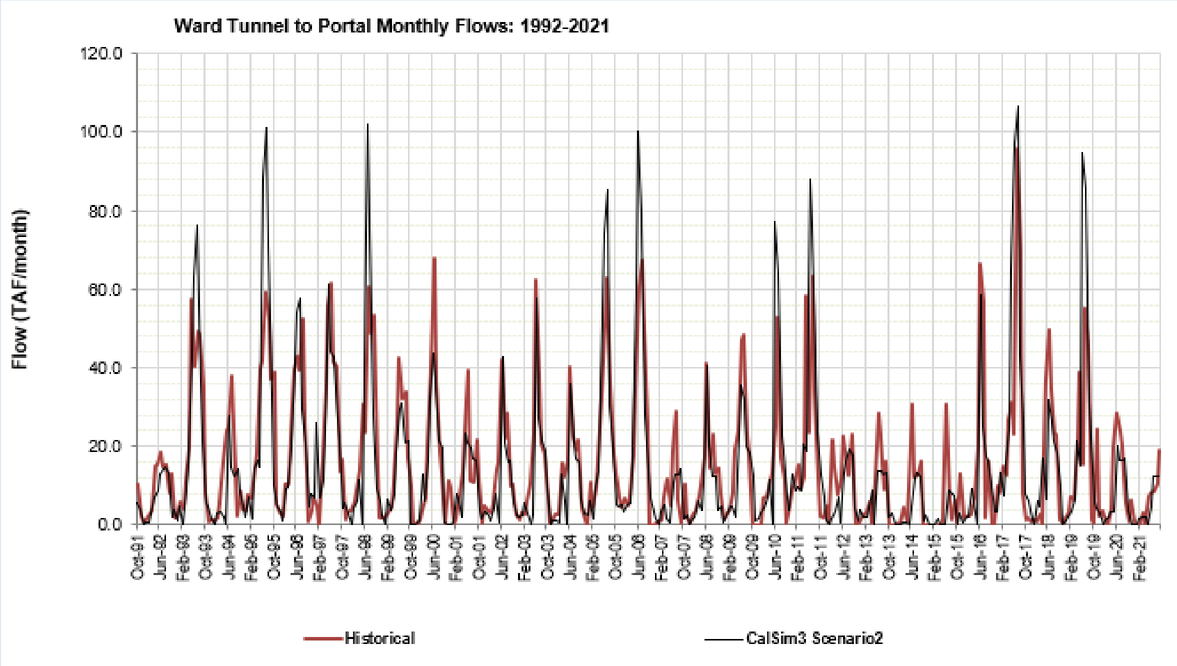
Av. Annual Value (TAF)	
343	Historical
335	CalSim3 Scenario 2
-8	-2%

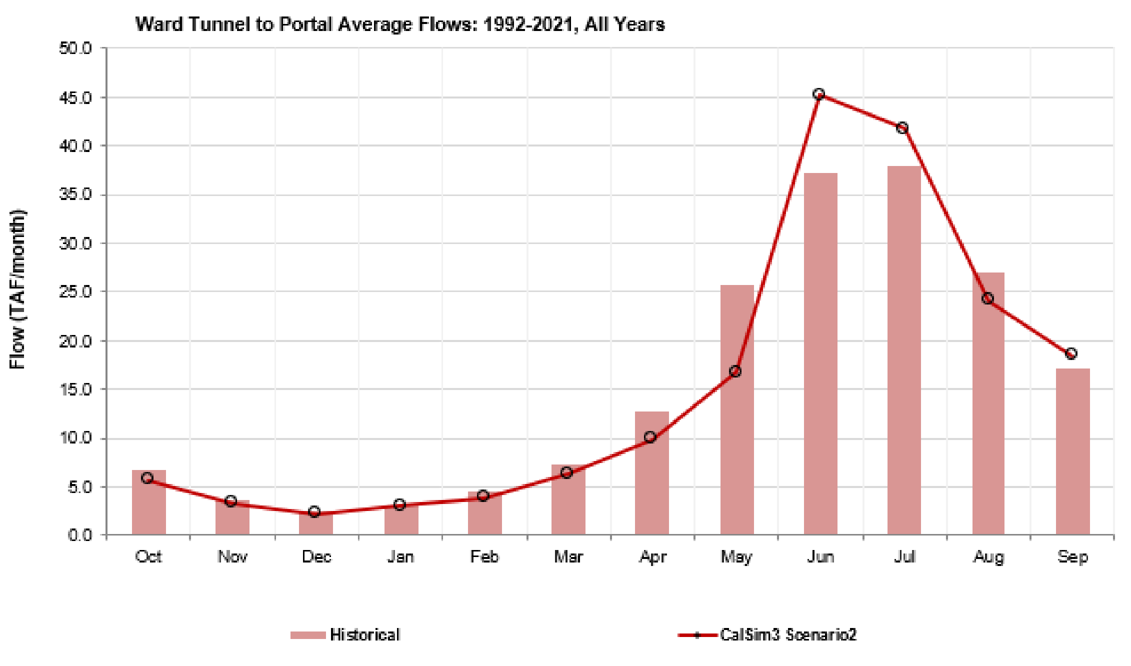




Diversion – Ward Tunnel

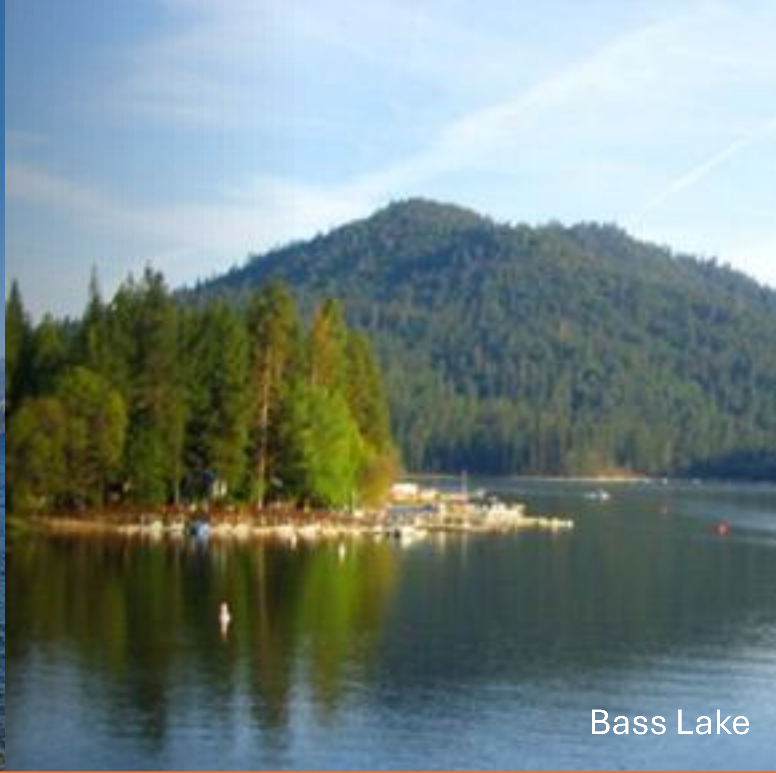
Av. Annual Value (TAF)	
186	Historical
181	CalSim3 Scenario 2
-5	-3%

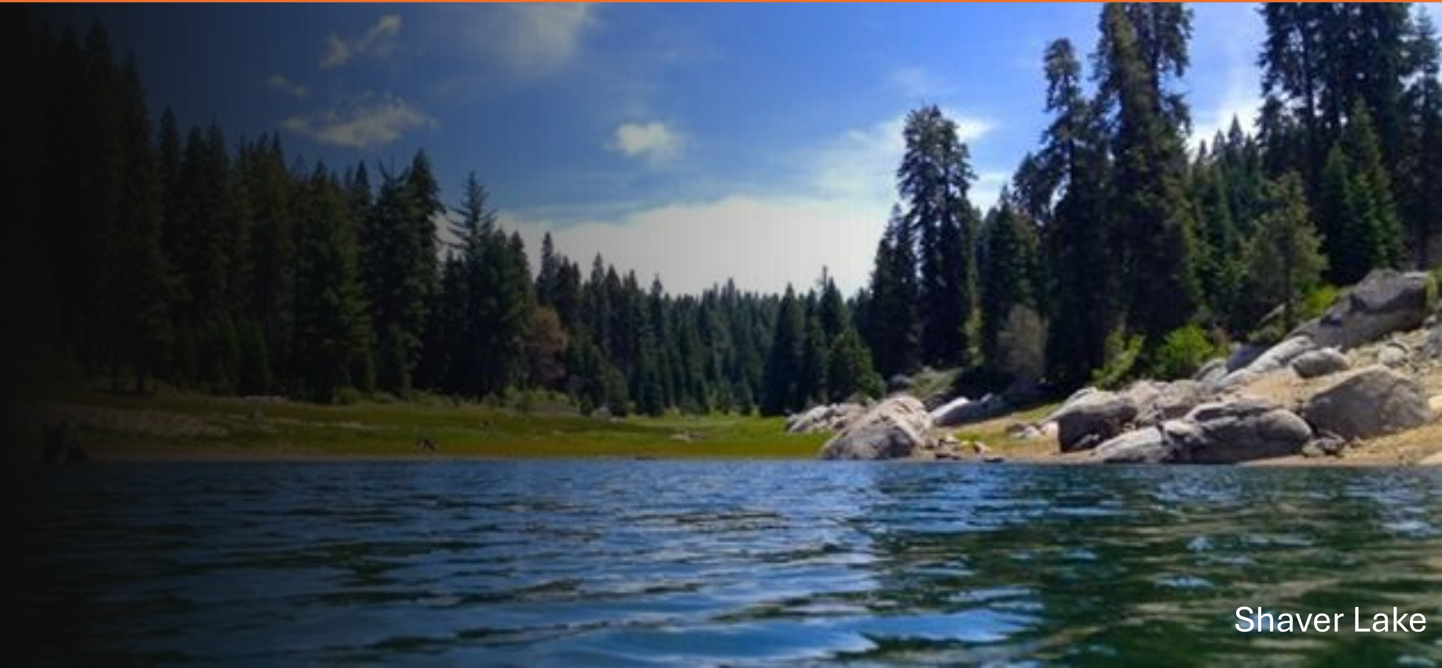




Documentation


Huntington Lake


Bass Lake


Shaver Lake

Organization of Upper San Joaquin River Documentation

Chapter 1 Introduction provides an overview of the upper San Joaquin River model.

Chapter 2 Upper San Joaquin River Basin describes the geography of the upper San Joaquin River watershed, the major water agencies located within the watershed, and operations of control facilities.

Chapter 3 Water Management summarizes water rights and water right decisions associated with stream diversions within the upper San Joaquin River watershed.

Chapter 4 Model Schematic presents the arc-node network for the upper San Joaquin River model.

Chapter 5 Rim Inflows summarizes development of unimpaired surface water inflows to the stream network.

Chapter 6 Reservoir Evaporation summarizes development of reservoir evaporation rates.

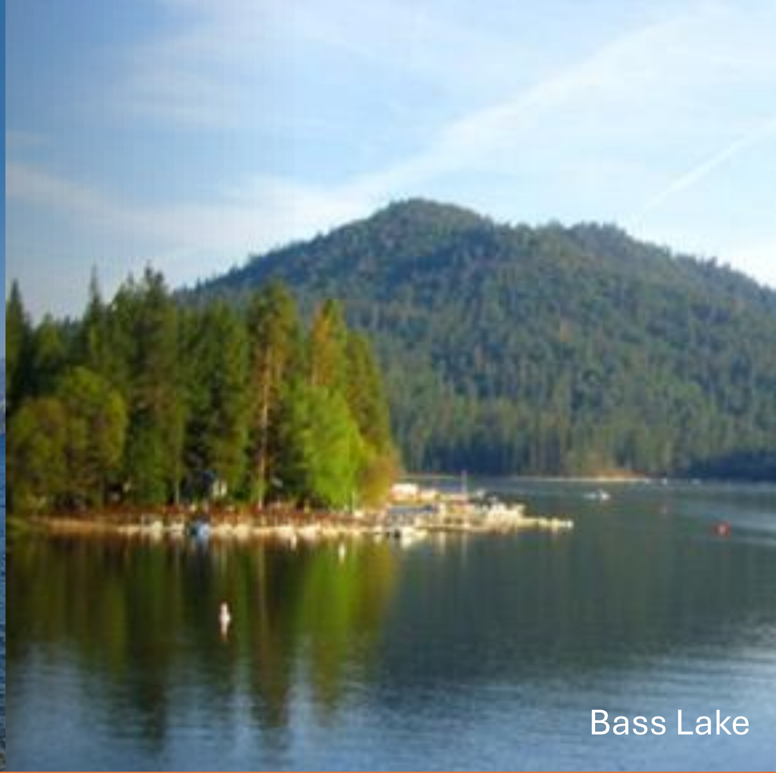
Chapter 7 Model Simulation describes model input files.

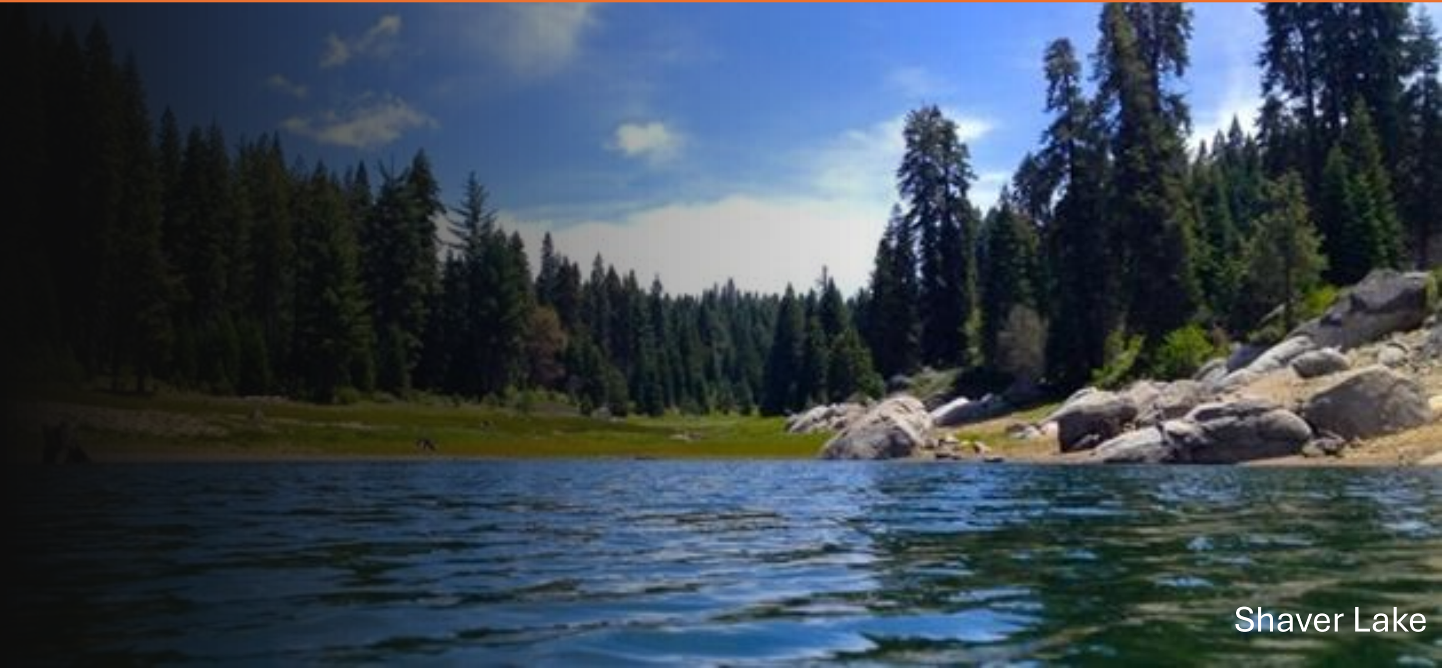
Chapter 8 Model Results and Validation compares simulated reservoir storage, streamflows, and stream diversions to recent historical gauge data.

Chapter 9 References presents sources cited in this report.

Next Steps and Questions


Huntington Lake


Bass Lake


Shaver Lake

Next Steps

- In rescaling the rim inflows, we assumed percentage of annual contribution is constant based on 30-year average.
  - Allow percent contribution to vary from year to year but for the 30-year period, the average annual inflow is equal to the calculated using area*precipitation contribution method.
- Compare simulated and historical streamflow at gauged locations
- Compare simulated and historical flow in diversions if available
- Implement spill forecast for refill period

Questions?

Thank you for your attention! ☺