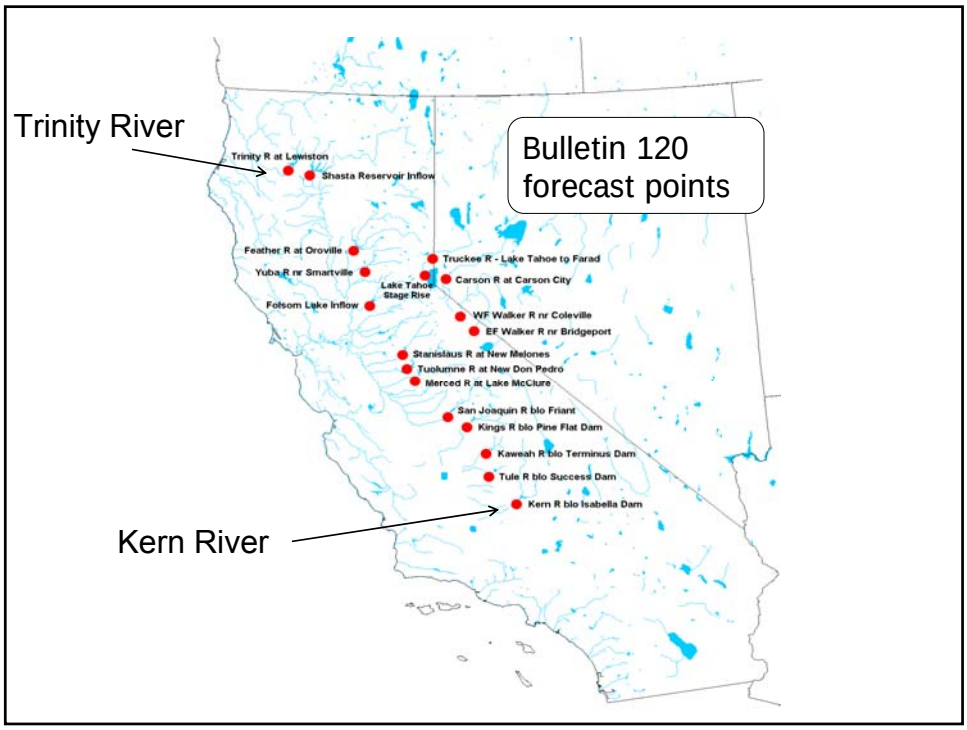
Water Supply Forecasting

California DWR – Dec 15, 200



Snow Surveys Water Supply Forecast Products

Seasonal … … …

Monthly Bulletin 120 April-July Runoff Forecasts (Produced Feb – May)

Weekly Bulletin 120 Updates (Produced Feb – June)

… … … … Water Year

Sacramento River Water Supply Index (SRR and SVI) (Produced Dec-May)

San Joaquin River Water Supply Index (SJI) (Produced Dec-May)

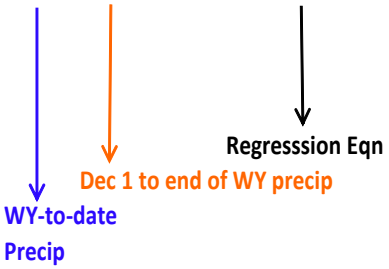
Water Year Forecast Products

1) WY volume forecast:
   - Based on first-of-month (Dec-May) precipitation

2) Water Year Classification forecast:
   - Weighted index using current year flow and last year's index value
   - The index is unitless

San Joaquin River WY runoff calculation for December 1

Probability of	Precipitation [in]			Forecast WY Runoff [taf]		Cumulative from date to end of WY		
Exceedance	To date	Future	Total	Computed	% WY Avg	Oct 1	Nov 1	Dec 1
99%	5.25	9.60	14.85	489	27%	12.00	11.00	9.60
90%	5.25	13.60	18.85	868	47%	18.00	16.50	13.60
75%	5.25	16.60	21.85	1169	64%	21.50	19.90	16.60
50%	5.25	22.00	27.25	1674	91%	28.00	25.60	22.00
25%	5.25	28.00	33.25	2241	122%	34.50	32.00	28.00
10%	5.25	37.00	42.25	3082	168%	44.00	41.50	37.00



Historical fraction of water year runoff for given wy flow San Joaquin River

WY FNF	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
650	0.02	0.03	0.03	0.03	0.05	0.10	0.19	0.27	0.17	0.05	0.03	0.02
875	0.02	0.03	0.03	0.04	0.06	0.09	0.18	0.26	0.19	0.07	0.03	0.01
1275	0.02	0.03	0.04	0.05	0.06	0.08	0.13	0.26	0.22	0.08	0.03	0.01
2050	0.01	0.02	0.04	0.06	0.06	0.08	0.11	0.24	0.22	0.11	0.03	0.02
2950	0.01	0.02	0.03	0.06	0.06	0.08	0.11	0.20	0.23	0.15	0.04	0.02
3700	0.01	0.01	0.03	0.06	0.06	0.08	0.10	0.20	0.22	0.15	0.05	0.03

Sacramento Valley Index

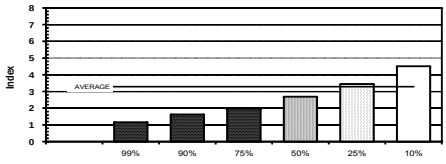
- Based on 40-30-30 weighting
  - .40.....current Apr-Jul fcast (maf)
  - .30.....current Oct-Mar fcast (maf)
  - .30.....last year's index value
    (with cap of 10.0)

San Joaquin Valley Index

- Based on 60-20-20 weighting
  - .60.....current Apr-Jul fcast (maf)
  - .20.....current Oct-Mar fcast (maf)
  - .20.....last year's index value
    (with cap of 4.5)

Note: the weighting of the AJ value is greater than with the Sac Index because a greater portion of the WY flows are during the AJ period.

SAN JOAQUIN VALLEY
WATER YEAR TYPE INDEX (60-20-20)
2010 Water Year Forecast as of December 1, 2009



Probability of Exceedance

Date of Forecast	99%	90%	75%	50%	25%	10%
December 1, 2009	1.2	1.6	2.0	2.7	3.5	4.5

Water Year Index based on flow in million acre feet

Index = 0.6 * Current Apr-Jul Runoff [1]
+ 0.2 * Current Oct-Mar Runoff [1]
+ 0.2 * Previous Year's Index [2]

Notes:
(1) Runoff is the sum of unimpaired flow in million acre-feet at:
Stanislaus River below Goodwin Reservoir (aka inflow to New Melones Res.)
Tuolumne River below La Grange (aka inflow to New Don Pedro Reservoir)
Merced River below Merced Falls (aka inflow to Lake McClure)
San Joaquin River inflow to Millerton Lake
(2) Maximum 4.5 for previous year index term

Year Classification

TYPE	INDEX
Wet	
Above Normal	3.8
Below Normal	3.1
Dry	2.5
Critical	2.1

Previous Water Year Indices:

2009 =	2.7	83% of avg.
1977 (Min) =	0.8	26% of avg.
1983 (Max) =	7.2	219% of avg.
1956-2005 average =	3.3	

BULLETIN 120 – Regression Formula variables

- Regression Formula variables include:
  - October – March Precipitation Index
  - April – June Precipitation Index
  - High and Low April 1 Snow Indices
  - Current year Oct-Mar flow
  - Antecedent flow conditions

The B120 report…How long does it take?

- Day 1-3: gather data for FNF calcs, precip and snow (courses and pillows)
- Day 4-6: produce B120 fcast, confer with NWS, revise B120 with new data, produce WSI, disseminate fcast

DATA NEEDED FOR B120 CALCULATIONS

FNF	AMOUNT OF DATA
Monthly Flow	33
Diversions/Accretions	37
Evaporation	7
Storage	70
Irrigation/Consumption	5
SUB TOTAL=	152
SNOW	
courses	165
SUB TOTAL=	165
PRECIPITATION	
stations	135
SUB TOTAL=	135
TOTAL	452

San Joaquin River Snow Courses

	Name	Basin	Elev	4/1avg	Sched
High	Mono Pass	SJoaq	11450'	28.8	_234_
Snow	Piute Pass	SJoaq	11300'	33.9	_2345
	Pioneer Basin	SJoaq	10400'	31.9	_234_
	Heart Lake	SJoaq	10100'	26.3	___4_
	Volcanic Knob	SJoaq	10050'	28.2	___4_
	Rose Marie	SJoaq	10000'	27.0	_234_
	Colby Meadow	SJoaq	9700'	21.4	___4_
	Mammoth Pass	Owens	9300'	42.0	_2345
	Agnew Pass	SJoaq	9450'	30.0	_234_
	Dutch Lake	SJoaq	9100'	27.8	_234_
	Cora Lakes	SJoaq	8400'	35.4	__345
Low	Badger Flat	SJoaq	8300'	29.4	_234_
Snow	Nellie Lake	SJoaq	8000'	34.8	_234_
	Lake Thomas A Edison	SJoaq	7800'	13.5	_234_
	Chilkoot Lake	SJoaq	7450'	36.5	_2345
	Tamarack Creek	SJoaq	7250'	24.4	_234_
	Florence Lake	SJoaq	7200'	7.7	_234_
	Clover Meadow	SJoaq	7000'	22.2	__345
	Jackass Meadow	SJoaq	6950'	22.4	__345
	Chiquito Creek	SJoaq	6800'	21.3	__345
	Poison Meadow	SJoaq	6800'	24.2	_2345

Snow Index Calculation

March 1

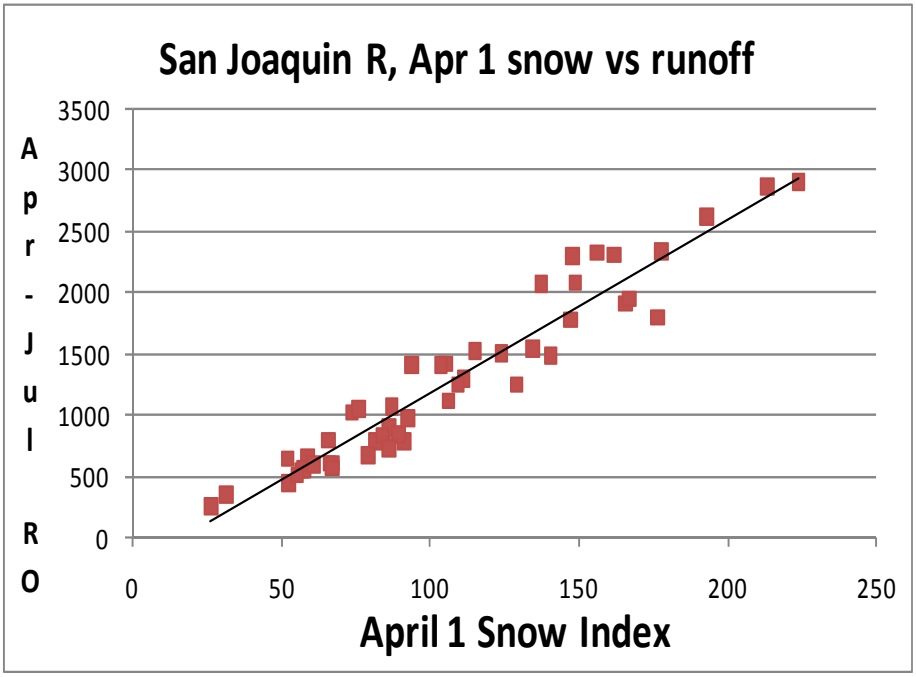
Name	Basin	Elev	4/1avg	Pr.st	Ratio	Date	raw WC	int Pcp	adj WC	% Apr 1 avg
A	SJ	9300'	42.6	14	1.5	02/25/09	40.0	0	40.0	94%
B	SJ	8900'	36.7	14	1.3	02/26/09	34.2	0	34.2	93%
C	Mer	8800'	24.1	14	.9	02/27/09	24.6	+.5	25.1	104%
D	Mer	8700'	46.4	14	1.7	02/28/09	46.4	0	46.4	100%
E	SJ	8400'	45.3	14	1.6	02/27/09	43.9	0	43.9	97%

Percent of April 1 Average : 98%

Median Increments: Feb 1 to Apr 1: 31

Mar 1 to Apr 1: 15

Snow Index calculation: 98 + 15 = 113



San Joaquin River Precip Stations

ID	Name	Elev (ft)
SLK	South Lake	9600'
FLR	Florence Lake	7330'
HNT	Huntington Lake	7000'
GRO	Grant Grove	6600'
YSV	Yosemite Valley	3970'
CRR	Crane Valley PH	3400'
NFR	North Fork RS	2630'
MIL	Friant Gov't Camp	410'
Basin average:		5120'

Precipitation Index Calculation

Example is for April 1

Name	Oct-Mar avg	Oct prec. 0.5	Oct index	Nov prec. 0.6	Nov index	Dec prec. 0.7	Dec index	Oct-Dec index	Jan prec. 0.8	Jan index	Feb prec. 0.9	Feb index	Mar prec. 1.0	Mar index
A	16.90	.88	2.6	3.01	10.7	2.19	9.1	22.4	.83	3.9	3.53	18.8	4.25	25.1
B	33.90	4.31	6.4	6.20	11.0	2.58	5.3	22.7	3.03	7.2	12.31	32.7	9.92	29.3
C	13.30	.58	2.2	2.24	10.1	2.87	15.1	27.4	1.04	6.3	3.57	24.2	4.46	33.5
Avg:	21.4	1.9	3.7	3.8	10.6	2.5	9.8	26.6	1.6	5.8	6.5	25.2	6.2	29.3
Historical median Index:										26.0		22.0		18.0
								Oct-Mar Index:						84.4
								Apr-Jun Index:						87.0

15.1 = 2.87 divided by 13.3 times 0.7 times 100

84.4 = sum of purple values

What about last year…or two?

- 20 of the 24 main stem locations have an equation that uses flow data from the prior year's AJ period.
- 2 of the 24 use flow data from 2 seasons ago……Sac R at Bend Bridge and Pit R.
- Why? Volcanic soils that release water several years later

San Joaquin River inflow to Millerton Lake

B120 April-July forecasting equation

Equation components	Index	Index multiplier	Runoff
pre A-J runoff (taf)	1042	0.04	44
O-M runoff (taf)	375	0.12	46
High Snow	86	7.53	645
Low Snow	89	3.19	283
O-M precip	85	0.8	67
A-J precip	81	3.18	257
Constant	-	-379.00	-379
Sum →			964 taf

Big Question:

What happens when the WSI values don't match the B120 values?

Answer:

The B120 numbers take priority

San Joaquin River WY Runoff calculation for April 1

Compare the orange and blue numbers

Orange - WSI process

Blue = B120 process

Probability of Exceedance	Precipitation [in] To date	Future	Total	WY forecast WSI Process	WY forecast B120 f'cast
99%	20.98	1.20	22.18	803	
90%	20.98	2.00	22.98	863	850
75%	20.98	2.80	23.78	927	
50%	20.98	4.00	24.98	1000	980
25%	20.98	5.80	26.78	1100	
10%	20.98	8.80	29.78	1267	1240

Conclusions:

WSI Wyforecast (maf):

- Dec – May
- Precip based only
- 6 exceedence levels

WSI Index:

- unitless
- Sac 40-30-30
- San J 60-20-20

Conclusions (cont'd)

- B120 forecast:
  - Oct-Mar precip is weighted
  - April-June precip is weighted
  - High and Low snow
  - Antecedent conditions for most basins
  - Current year flows