United States Department of Agriculture

Natural Resources Conservation Service

Arizona Basin Outlook Report March 1, 2019

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Basin Outlook Reports
And Federal – State – Private Cooperative Snow Surveys

How forecasts are made

Most of the annual streamflow in Arizona originates as snowfall that has accumulated in the mountains during the winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Measurements of snow water equivalent at selected manual snow courses and automated Snow Telemetry (SNOTEL) sites, along with precipitation and streamflow values, are used in statistical and simulation models to prepare runoff forecasts. These forecasts are coordinated between hydrologists in the Natural Resources Conservation Service (NRCS) the National Weather Service, and the Salt River Project.

Forecasts of any kind are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertainty of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The forecast, therefore, must be interpreted not as a single value but rather as a range of values with specific probabilities of occurrence. The middle of the range is expressed by the 50% exceedance probability forecast, for which there is a 50% chance that the actual flow will be above, and a 50% chance that the actual flow will be below, this value. To describe the expected range around this 50% value, four other forecasts are provided, two smaller values (90% and 70% exceedance probability) and two larger values (30%, and 10% exceedance probability). For example, there is a 90% chance that the actual flow will be more than the 90% exceedance probability forecast.

The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of the future weather conditions become known. This is reflected by a narrowing of the range around the 50% exceedance probability forecast. Users should take this uncertainty into consideration when making operational decisions by selecting forecasts corresponding to the level of risk they are willing to assume about the amount of water to be expected. If users anticipate receiving a lesser supply of water, or are concerned about having an adequate water supply, they may want to base their decisions on the 90% or 70% exceedance probability forecasts. On the other hand, if users anticipate receiving too much water, or are concerned about the threat of flooding, they may want to base their decisions on the 30% or 10% exceedance probability forecasts. Regardless of the forecast value users choose, they should be prepared to deal with either more or less water.

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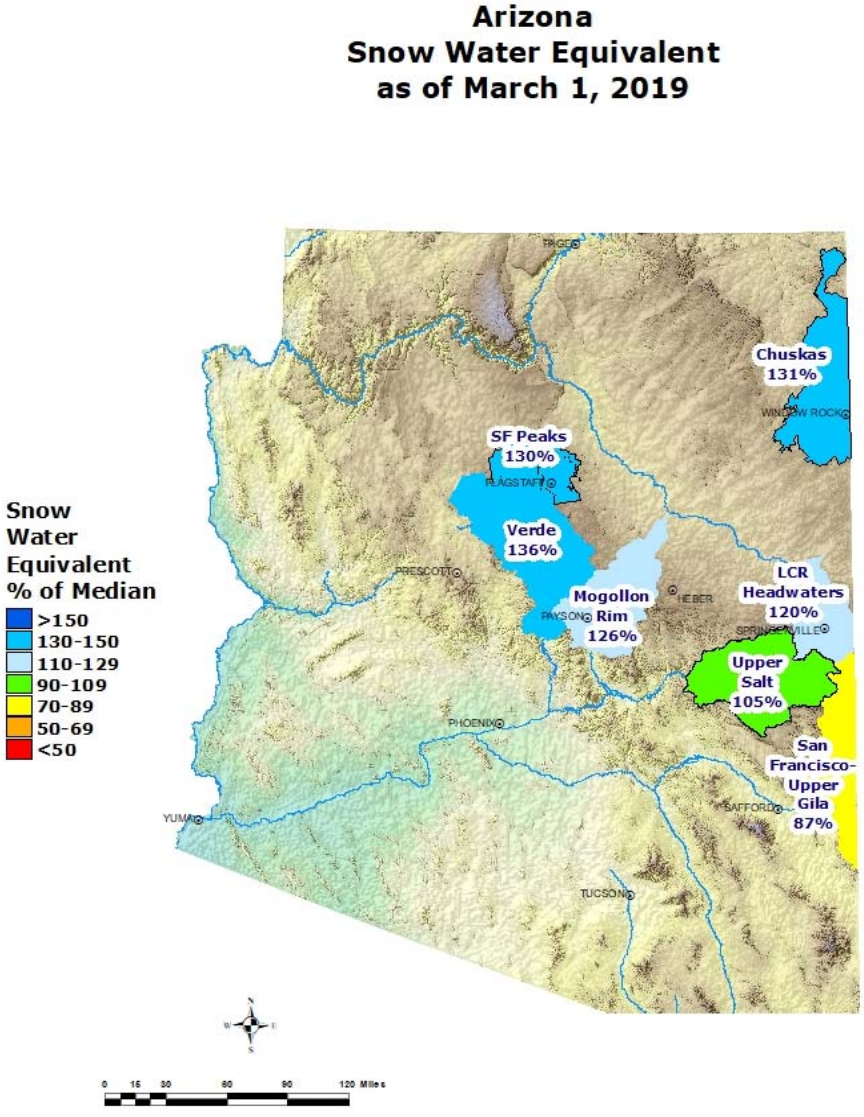
ARIZONA Basin Outlook Report
as of March 1, 2019

SUMMARY

As of March 1, snowpack levels are below normal to well above normal throughout the major basins of the state. Precipitation for the month of February was well above normal in the major river basins. The Salt and Verde River reservoir system stands at 62 percent of capacity, while San Carlos Reservoir is at 8 percent of capacity. The forecast calls for well below normal to well above normal runoff in the basins for the spring runoff period.

SNOWPACK

Snow water equivalent levels in the state's major river basins are below normal to well above normal, ranging from 136 percent of median in the Verde River Basin to 87 percent of median in the Upper Gila River Basin. The statewide snowpack is above normal at 124 percent of median.

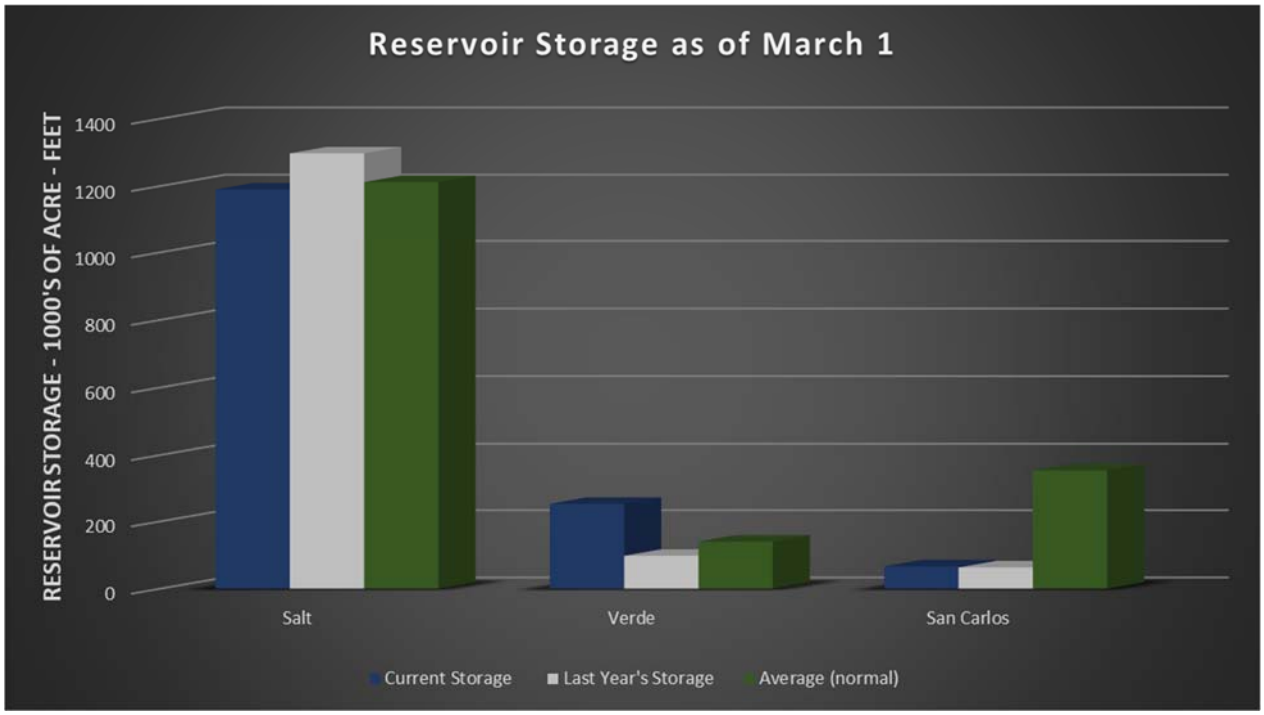


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for February was well above average in the major river basins. Cumulative precipitation since October 1 is normal to well above normal throughout the basins. Please refer to the precipitation bar graphs found in this report for more information on precipitation levels in the basins.

RESERVOIR STORAGE

As of March 1, the Salt and Verde River reservoir system stands at 62 percent of capacity. San Carlos Reservoir is currently at 8 percent of capacity.

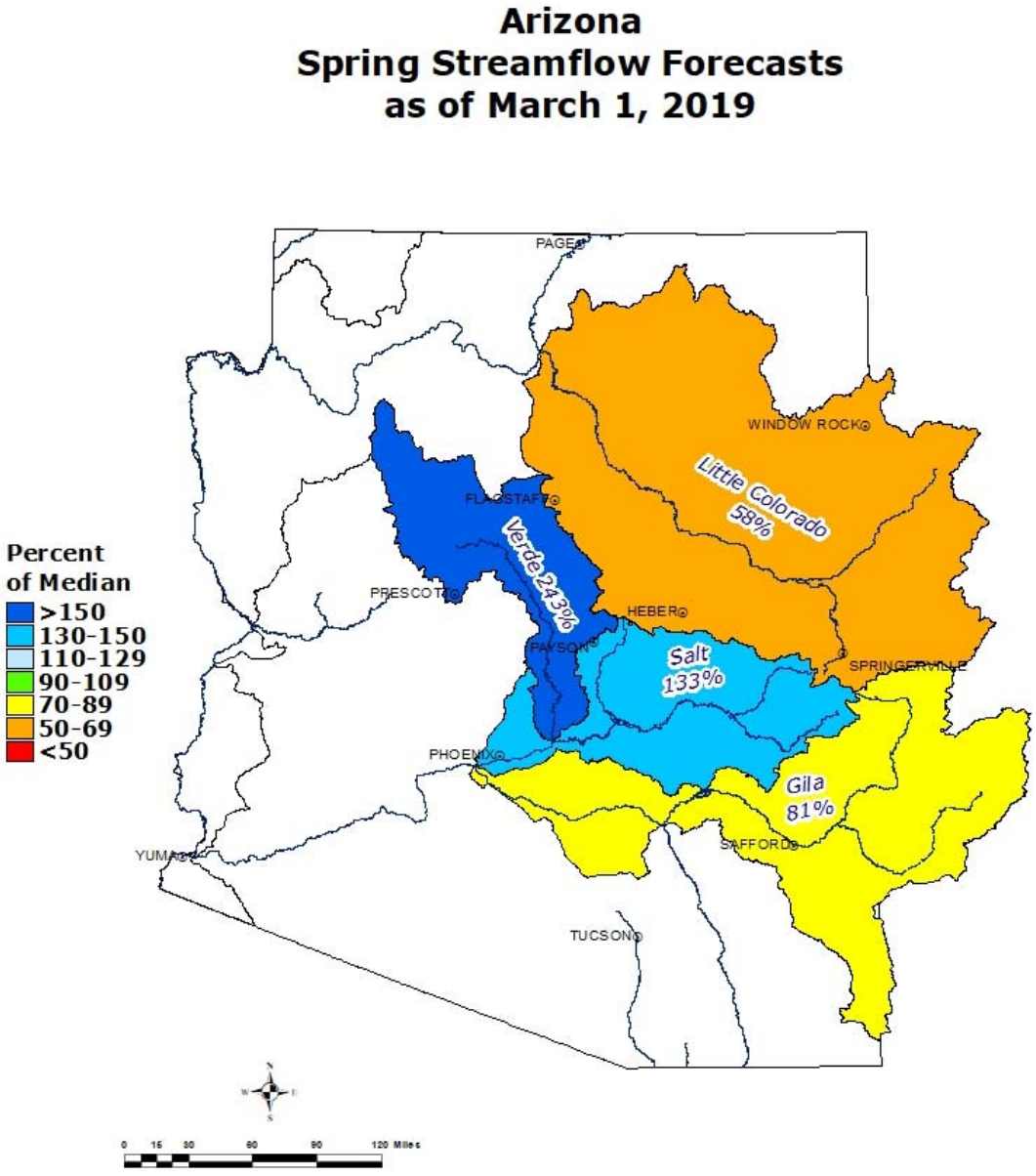


Key storage volumes displayed in thousands of acre-feet (x1000):

Reservoir	Current Storage	Last Year Storage	30-Year Average	Storage Capacity
Salt River System	1190.0	1297.4	1181.0	2025.8
Verde River System	252.6	98.0	135.7	287.4
San Carlos Reservoir	66.9	63.4	324.9	875.0
Lyman Lake	3.7	11.1	11.8	30.0
Lake Havasu	573.4	590.0	562.7	619.0
Lake Mohave	1704.0	1703.6	1602.0	1810.0
Lake Mead	10682.0	10697.0	20297.0	26159.0
Lake Powell	9260.7	13335.0	17745.0	24322.0

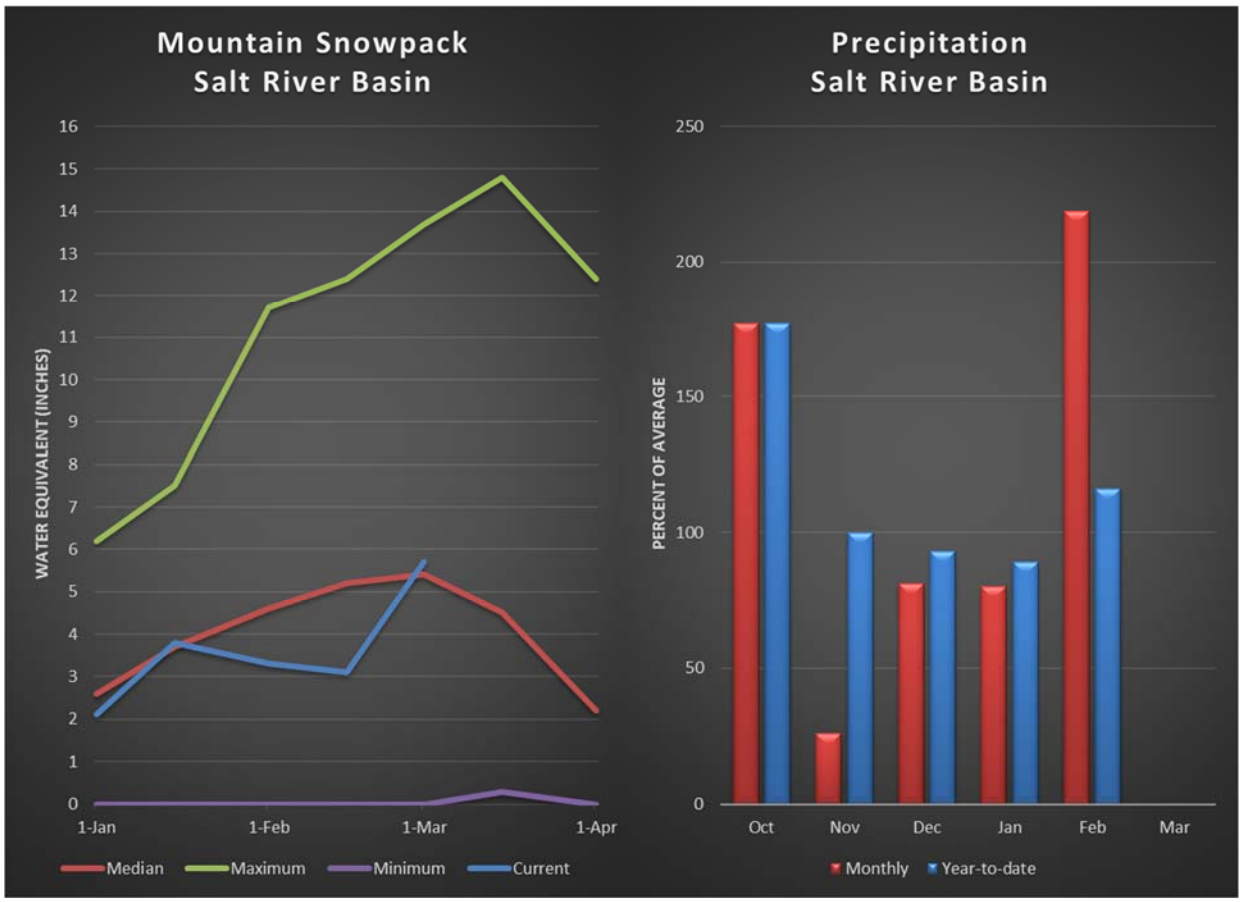
STREAMFLOW

As of March 1, the forecast calls for below normal to well above normal streamflow for the spring runoff period, ranging from 58 percent of median in the Little Colorado River above Lyman Lake to 243 percent of median in the Verde River above Horseshoe Dam. Total precipitation since the beginning of the water year has been well above average, producing ideal conditions for runoff. Please refer to the basin forecast tables found in this report for more information regarding water supply forecasts.



SALT RIVER BASIN as of March 1, 2019

Well above normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 133% of median streamflow through May, while at Tonto Creek, the forecast calls for 273% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 105% of median.



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Salt River Basin
Streamflow Forecasts - March 1, 2019

SALT RIVER BASIN	Forecast Period	Forecast Exceedance Probabilities for Risk Assessment: Chance that actual volume will exceed forecast — 90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Salt R nr Roosevelt[3]								
	MAR			200	175%			114
	MAR-MAY	182	260	320	133%	390	515	240
Tonto Ck ab Gun Ck nr Roosevelt[3]								
	MAR			38	247%			15.4
	MAR-MAY	25	44	60	273%	80	117	22

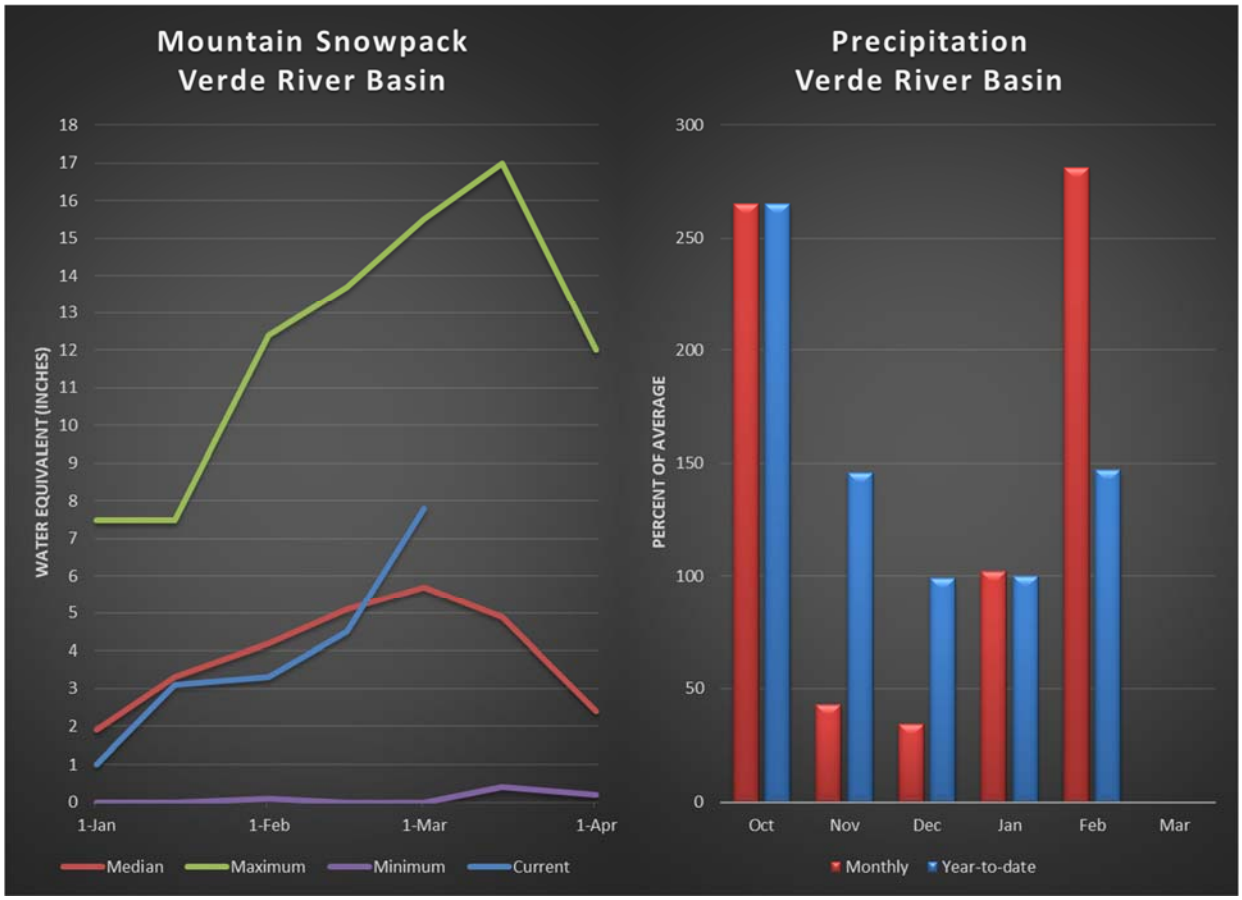
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System	1190.0	1297.4	1302.0	2025.8
Basin-wide Total	1190.0	1297.4	1302.0	2025.8
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
SALT RIVER BASIN	11	105%	16%

VERDE RIVER BASIN as of March 1, 2019

Well above normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 243% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 136% of median.



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Verde River Basin
Streamflow Forecasts - March 1, 2019

		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
VERDE RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Verde R bl Tangle Ck ab Horseshoe Dam[3]								
	MAR			180	305%			59
	MAR-MAY	116	192	260	243%	340	490	107

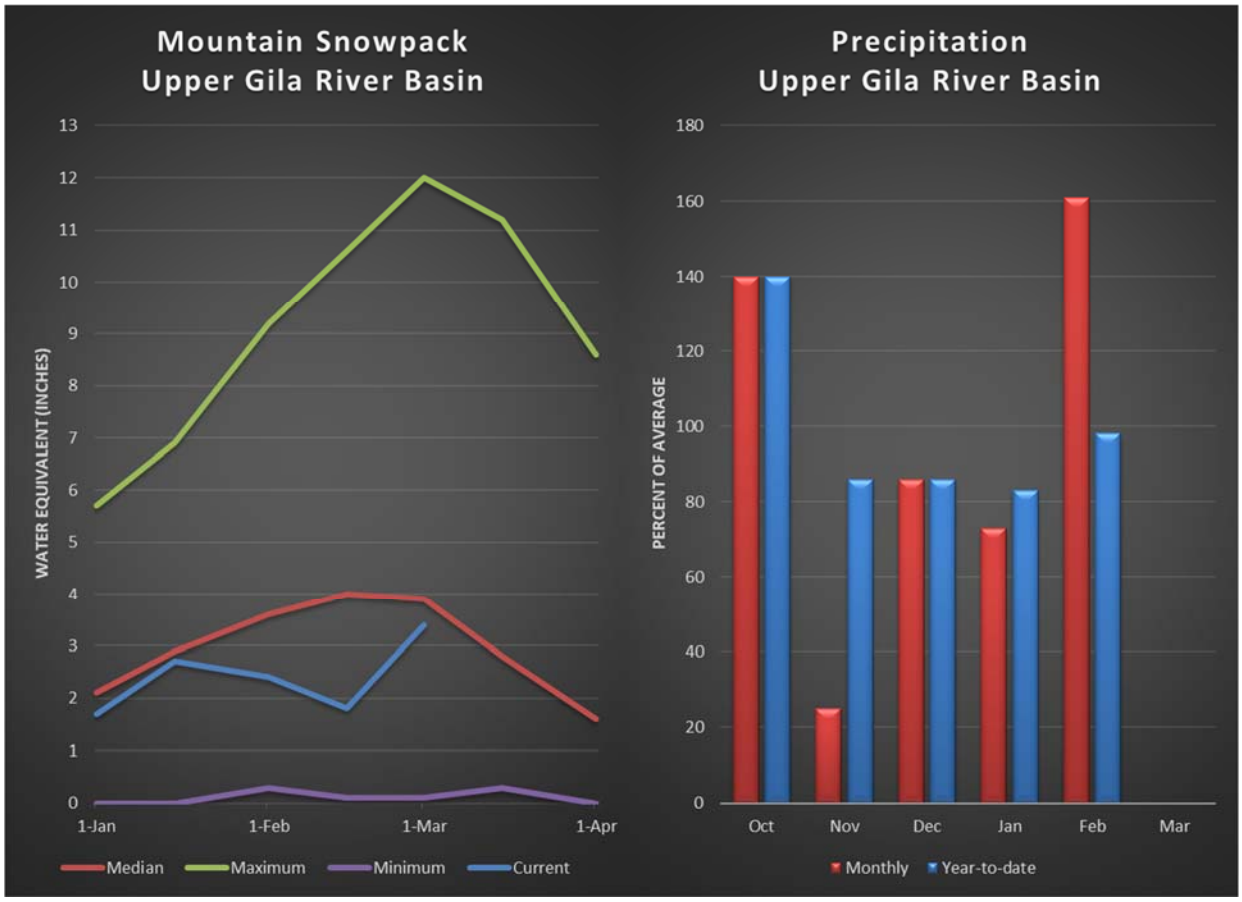
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	252.6	98.0	168.0	287.4
Basin-wide Total	252.6	98.0	168.0	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	12	136%	40%

SAN FRANCISCO-UPPER GILA RIVER BASIN as of March 1, 2019

Below normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 68% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 81% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 79% of median through May. Snow survey measurements show the snowpack for this basin to be at 87% of median.



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San Francisco-Upper Gila River Basin
Streamflow Forecasts - March 1, 2019

		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
SAN FRANCISCO-UPPER GILA RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Gila R at Gila[3]								
	MAR-MAY	15.5	23	29	85%	36	49	34
Gila R bl Blue Ck nr Virden[3]								
	MAR-MAY	14	25	36	84%	48	70	43
San Francisco R at Glenwood[3]								
	MAR-MAY	3.3	6.7	10.2	67%	14.6	23	15.2
San Francisco R at Clifton[3]								
	MAR-MAY	7	16.8	26	68%	37	57	38
Gila R nr Solomon[3]								
	MAR			30	79%			38
	MAR-MAY	24	50	72	81%	98	145	89
San Carlos Reservoir Inflow[3]								
	MAR-MAY	5.2	21	42	79%	73	142	53

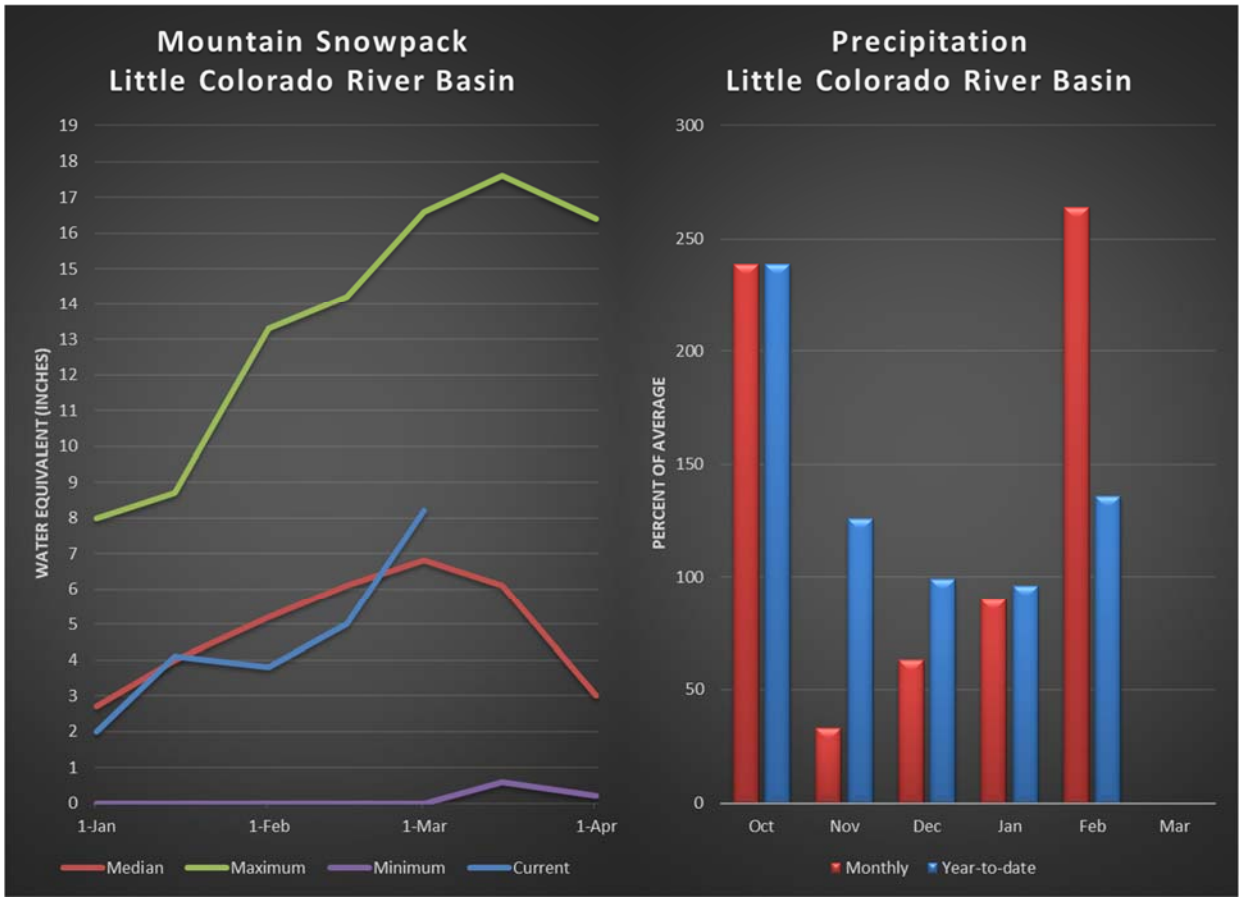
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	66.9	63.4	404.1	875.0
Basin-wide Total	66.9	63.4	404.1	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	10	87%	13%

LITTLE COLORADO RIVER BASIN as of March 1, 2019

Well below normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 58% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 89% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 120% and 126% of median, respectively.



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Little Colorado River Basin
Streamflow Forecasts - March 1, 2019

		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
LITTLE COLORADO RIVER BASIN	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Little Colorado R ab Lyman Lake[3]	MAR-JUN	1.24	2.4	3.5	58%	4.9	7.6	6
Rio Nutria nr Ramah[3]	MAR-MAY	0.07	0.41	0.9	80%	1.69	3.5	1.12
Zuni R ab Black Rock Reservoir[3]	MAR-MAY	0	0.01	0.2	87%	0.82	3	0.23
Blue Ridge Reservoir Inflow[3]	MAR-MAY	3.7	7.9	12	89%	17.3	28	13.5
Lake Mary Reservoir Inflow[3]	MAR-MAY	0.82	1.72	2.6	90%	3.7	6	2.9

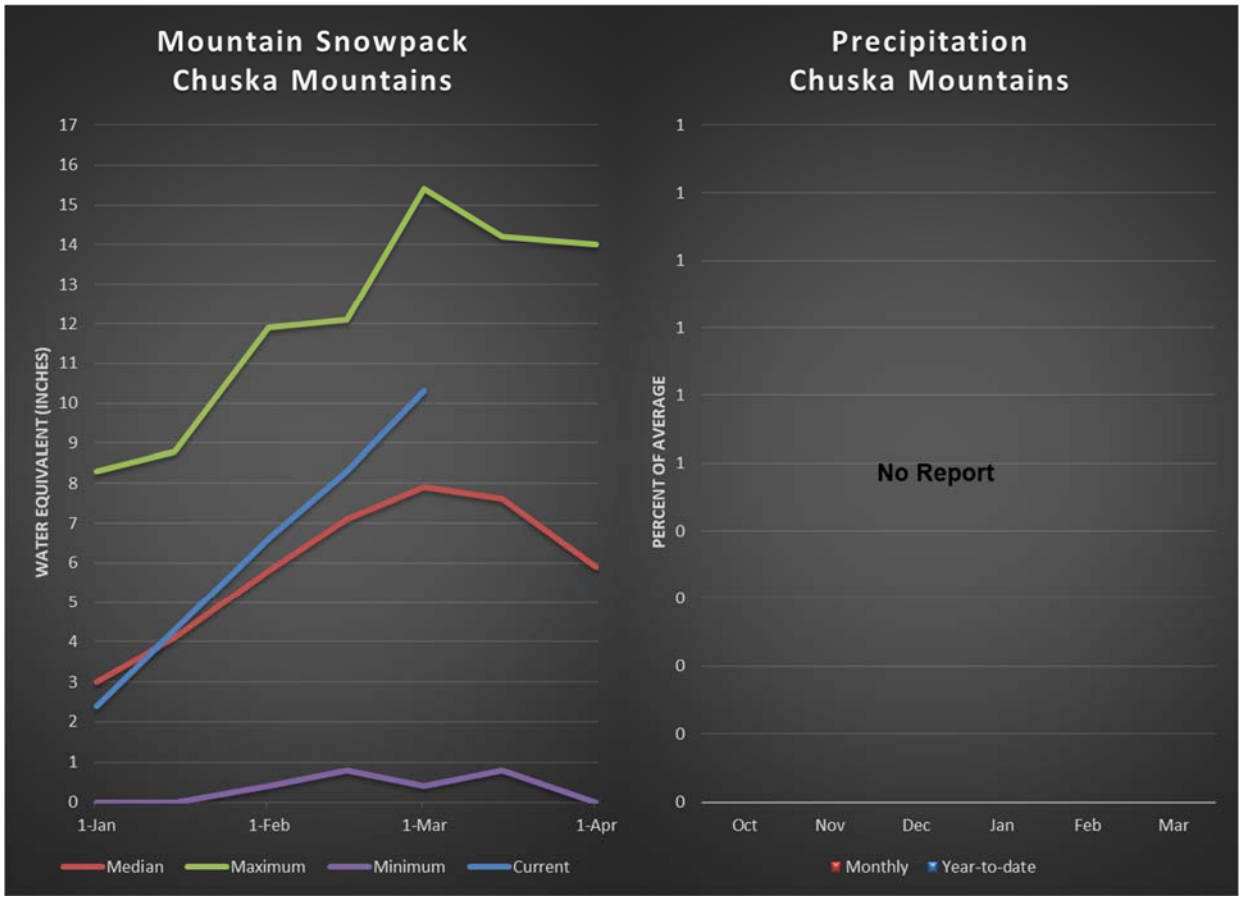
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	3.7	11.1	12.9	30.0
Basin-wide Total	3.7	11.1	12.9	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	10	120%	30%
CENTRAL MOGOLLON RIM	4	126%	35%

CHUSKA MOUNTAINS as of March 1, 2019

Snow survey measurements conducted by staff of the Navajo Nation Water Management Branch show the Chuska snowpack to be at 131% of median. The forecast calls for well above normal runoff for Wheatfields Creek, Captain Tom Wash, and Bowl Canyon Creek.



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Chuska Mountains
Streamflow Forecasts - March 1, 2019

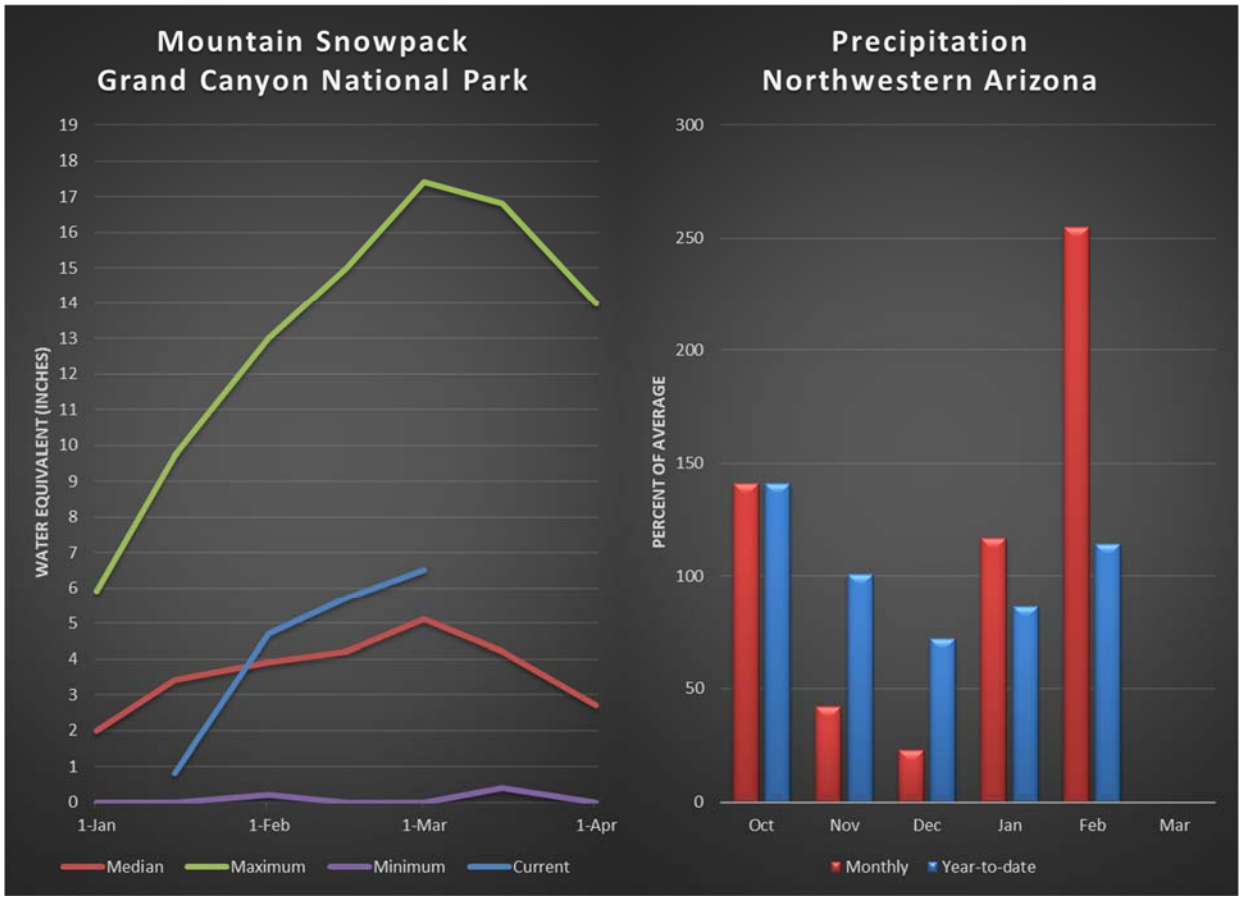
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
CHUSKA MOUNTAINS	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
Captain Tom Wash nr Two Gray Hills								
	MAR-MAY	1.67	2.8	3.8	146%	5	7.2	2.6
Wheatfields Ck nr Wheatfields								
	MAR-MAY	1.22	2.1	2.8	133%	3.6	5	2.1
Bowl Canyon Ck ab Asaayi Lake								
	MAR-MAY	0.96	1.37	1.7	131%	2.1	2.7	1.3

1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
CHUSKA MOUNTAINS	6	131%	24%
DEFIANCE PLATEAU	1	175%	19%

NORTHWESTERN ARIZONA as of March 1, 2019

On the Colorado River, normal inflow to Lake Powell is forecast at 108% of the 30-year average for the forecast period April-July. At the Grand Canyon, measurements conducted by park rangers show the snowpack to be at 128% of median.



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Northwestern Arizona
Streamflow Forecasts - March 1, 2019

NORTHWESTERN ARIZONA	Forecast Period	90% (KAF)	70% (KAF)	50% (KAF)	% Avg	30% (KAF)	10% (KAF)	30yr Avg (KAF)
		Forecast Exceedance Probabilities for Risk Assessment Chance that actual volume will exceed forecast						
Virgin R at Littlefield	APR-JUL	49	72	91	140%	113	152	65
Lake Powell Inflow [2]	APR-JUL		6510	7700	108%	8990		7160

1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage End of February, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	573.4	589.1	560.2	619.0
Lake Mohave	1704.0	1700.0	1673.0	1810.0
Lake Mead	10682.0	10697.0	20575.0	26159.0
Lake Powell	9260.7	13345.8	17055.0	24322.0
Basin-wide Total	22220.1	26331.9	39863.2	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis March 1, 2019	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	2	128%	15%

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Basinwide Summary: March 1, 2019
(Averages/Medians based on 1981-2010 reference period)

Snowpack Summary for March 1, 2019

SALT RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baldy	SNOTEL	9125	26	9.4	8.1	116%	1.4	17%
Beaver Head	SNOTEL	7990	7	2.2	5.2	42%	0.0	0%
Buck Spring	SC	7400	8	2.2	2.2	100%	0.0	0%
Coronado Trail	SNOTEL	8400	5	2.1	2.4	88%	0.0	0%
Hawley Lake	SNOTEL	8300	42	14.7			6.5	
Coronado Trail	SC	8350	7	2.0	1.8	111%	0.0	0%
Fort Apache	SC	9160	36	9.7	8.2	118%	3.1	38%
Hannagan Meadows	SNOTEL	9020	32	12.3	10.3	119%	2.1	20%
Maverick Fork	SNOTEL	9200	32	11.1	8.9	125%	1.9	21%
Nutrioso	SC	8500	3	0.7	0.6	117%	0.1	17%
Nutrioso	SNOTEL	8500	1	0.1			0.0	
Wildcat	SNOTEL	7850	7	2.5	3.2	78%	0.0	0%
Workman Creek	SNOTEL	6900	17	4.4	5.1	86%	0.6	12%
Basin Index						**105%**		**16%**
# of sites						11		11

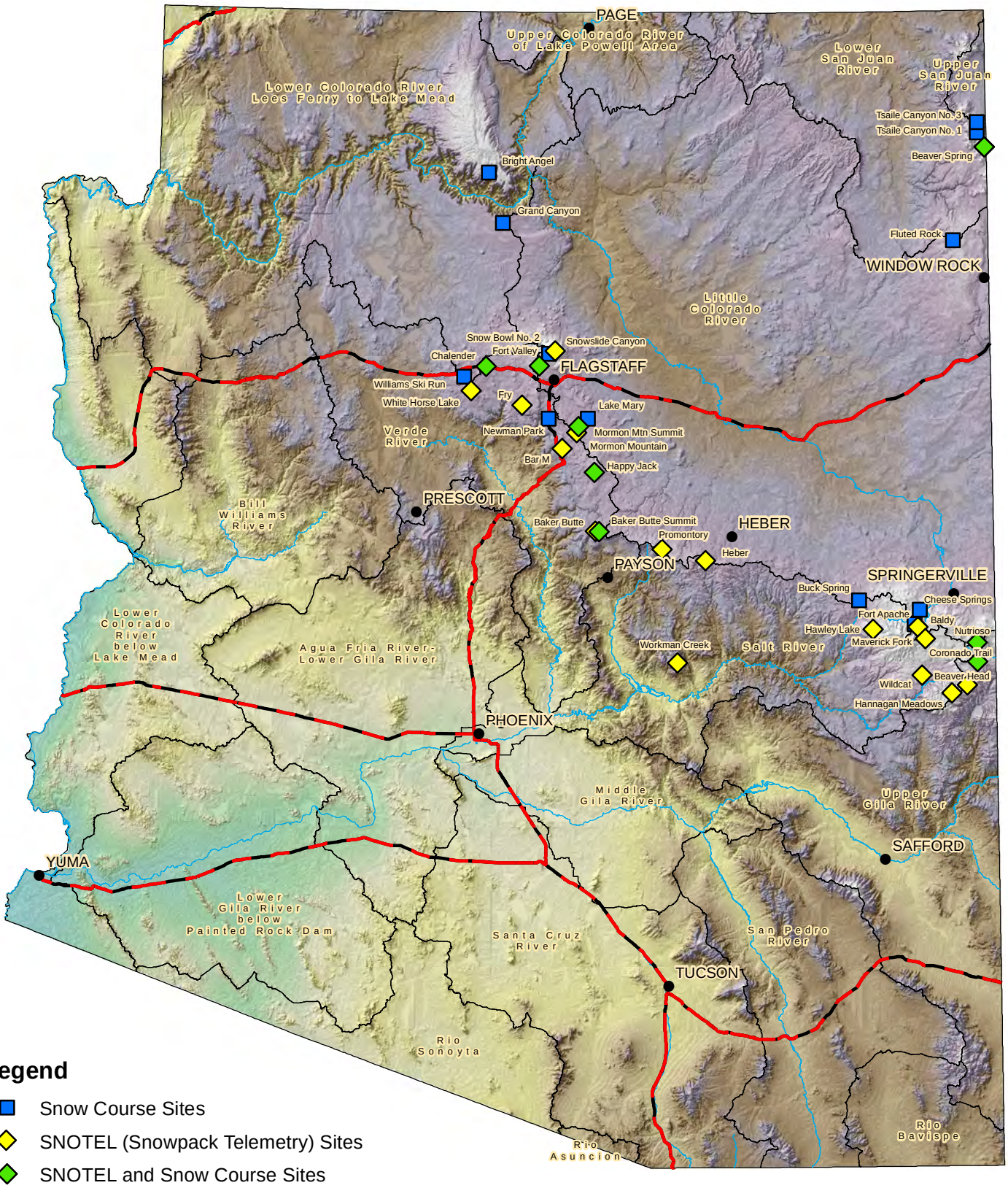
VERDE RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	24	6.8	5.2	131%	2.1	40%
Baker Butte No. 2	SC	7700	44	12.1	10.5	115%	4.4	42%
Baker Butte Smt	SNOTEL	7700	56	15.1			6.0	
Bar M	SNOTEL	6393	7	2.8			0.6	
Chalender	SC	7100	14	3.5	2.0	175%	0.6	30%
Chalender	SNOTEL	7100	20	5.7			0.7	
Fort Valley	SC	7350	8	2.3	1.9	121%	0.2	11%
Fort Valley	SNOTEL	7350	6	2.0			0.2	
Fry	SNOTEL	7200	28	9.2	7.0	131%	4.3	61%
Happy Jack	SNOTEL	7630	32	9.2	5.9	156%	3.0	51%
Happy Jack	SC	7630	18	5.1	4.0	128%	1.2	30%
Mormon Mountain	SNOTEL	7500	23	6.1	4.7	130%	1.9	40%
Mormon Mountain Summit #2	SC	8470	46	15.0	11.2	134%	4.2	38%
Mormon Mtn Summit	SNOTEL	8500	37	11.5			3.6	
Newman Park	SC	6750	16	3.3	2.0	165%	0.7	35%
White Horse Lake	SNOTEL	7180	16	5.5	3.9	141%	0.4	10%
Williams Ski Run	SC	7720	42	12.1	8.2	148%	3.6	44%
Basin Index						**136%**		**40%**
# of sites						12		12

SAN FRANCISCO PEAKS	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Snow Bowl #2	SC	11200	66	16.8	16.1	104%	4.6	29%
Snowslide Canyon	SNOTEL	9730	63	23.9	15.3	156%	6.4	42%
Basin Index						**130%**		**35%**
# of sites						2		2

SAN FRANCISCO-UPPER GILA RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Beaver Head	SNOTEL	7990	7	2.2	5.2	42%	0.0	0%
Coronado Trail	SNOTEL	8400	5	2.1	2.4	88%	0.0	0%
Coronado Trail	SC	8350	7	2.0	1.8	111%	0.0	0%
Frisco Divide	SNOTEL	8000	5	2.1	2.4	88%	0.0	0%
Hannagan Meadows	SNOTEL	9020	32	12.3	10.3	119%	2.1	20%
Hummingbird - Aerial And Snow Course	SC	10550			11.9			

Lookout Mountain	SNOTEL	8500	0	0.0	0.6	0%	0.0	0%
Nutrioso	SC	8500	3	0.7	0.6	117%	0.1	17%
Nutrioso	SNOTEL	8500	1	0.1			0.0	
Signal Peak	SNOTEL	8360	0	0.0	4.3	0%	0.0	0%
Silver Creek Divide	SNOTEL	9000	25	8.9	8.3	107%	2.6	31%
State Line	SC	8000	11	2.1	1.4	150%	0.0	0%
Whitewater - Aerial And Snow Course	SC	10750			18.6			
Basin Index						**87%**		**13%**
# of sites						10		10
LITTLE COLORADO RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	24	6.8	5.2	131%	2.1	40%
Baker Butte No. 2	SC	7700	44	12.1	10.5	115%	4.4	42%
Baker Butte Smt	SNOTEL	7700	56	15.1			6.0	
Baldy	SNOTEL	9125	26	9.4	8.1	116%	1.4	17%
Buck Spring	SC	7400	8	2.2	2.2	100%	0.0	0%
Cheese Springs	SC	8700	24	6.6	5.8	114%	2.4	41%
Fort Apache	SC	9160	36	9.7	8.2	118%	3.1	38%
Heber	SNOTEL	7640	21	6.7	4.5	149%	0.5	11%
Lake Mary	SC	6930	12	2.7	3.4	79%	0.5	15%
Maverick Fork	SNOTEL	9200	32	11.1	8.9	125%	1.9	21%
Promontory	SNOTEL	7930	44	14.1	11.3	125%	3.9	35%
Basin Index						**120%**		**30%**
# of sites						10		10
CENTRAL MOGOLLON RIM	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	24	6.8	5.2	131%	2.1	40%
Baker Butte No. 2	SC	7700	44	12.1	10.5	115%	4.4	42%
Baker Butte Smt	SNOTEL	7700	56	15.1			6.0	
Heber	SNOTEL	7640	21	6.7	4.5	149%	0.5	11%
Promontory	SNOTEL	7930	44	14.1	11.3	125%	3.9	35%
Basin Index						**126%**		**35%**
# of sites						4		4
CHUSKA MOUNTAINS	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Beaver Spring	SC	9220	42	11.2	10.0	112%	2.6	26%
Beaver Spring	SNOTEL	9200	44	12.7			1.5	
Bowl Canyon	SC	8980	44	11.3	8.7	130%	2.8	32%
Hidden Valley	SC	8480	39	9.8			0.8	
Missionary Spring	SC	7940	22	5.6	4.1	137%	0.4	10%
Tsaile Canyon #1	SC	8160	38	9.7	6.4	152%	1.0	16%
Tsaile Canyon #3	SC	8920	52	10.6	8.8	120%	2.0	23%
Whiskey Creek	SC	9050	46	13.4	9.3	144%	2.6	28%
Navajo Whiskey Ck	SNOTEL	9050	45	13.0			0.0	
Basin Index						**131%**		**24%**
# of sites						6		6
DEFIANCE PLATEAU	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Fluted Rock	SC	7800	19	6.3	3.6	175%	0.7	19%
Basin Index						**175%**		**19%**
NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	44	9.4	8.7	108%	1.5	17%
Grand Canyon	SC	7500	12	3.5	1.4	250%	0.0	0%
Basin Index						**128%**		**15%**

Arizona Snow Survey Data Sites



Legend

- Snow Course Sites
- SNOTEL (Snowpack Telemetry) Sites
- SNOTEL and Snow Course Sites
- Basin Boundaries

January 2017
Data Sources: NRCS / ALRIS
Projection: UTM Zone 12 Datum: NAD83

0 12.5 25 50 75 100 Miles

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NRCS
Natural Resources Conservation Service