United States Department of Agriculture

Natural Resources Conservation Service

Arizona Basin Outlook Report February 15, 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.

For more water supply and resource management information, contact:

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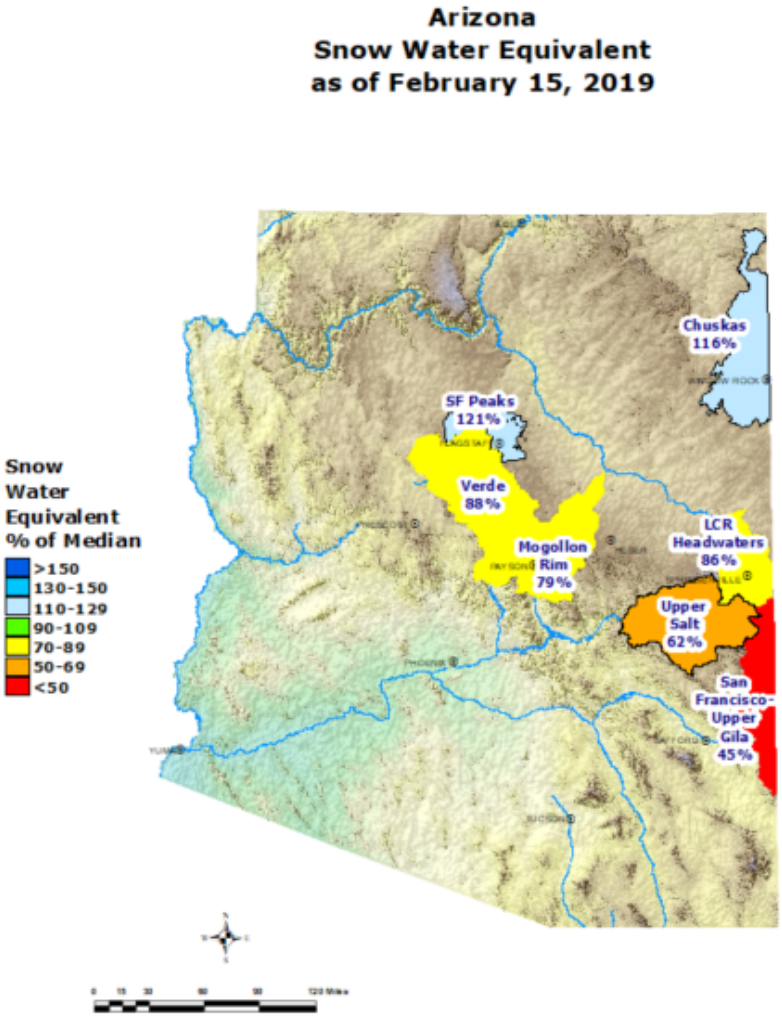
ARIZONA Basin Outlook Report
as of February 15, 2019

SUMMARY

As of February 15, snowpack levels are well below normal to below normal throughout the major basins of the state. Precipitation for the first half of February was well above normal in the major river basins. The Salt and Verde River reservoir system stands at 55 percent of capacity, while San Carlos Reservoir is at 5 percent of capacity. The mid-month forecast calls for well below normal to well above normal runoff in all basins for the spring runoff period.

SNOWPACK

Snow water equivalent levels in the state's major river basins are well below normal to below normal, ranging from 45 percent of median in the Gila River Basin, to 88 percent of median in the Verde River Basin. The statewide snowpack is slightly below normal at 89 percent of median.

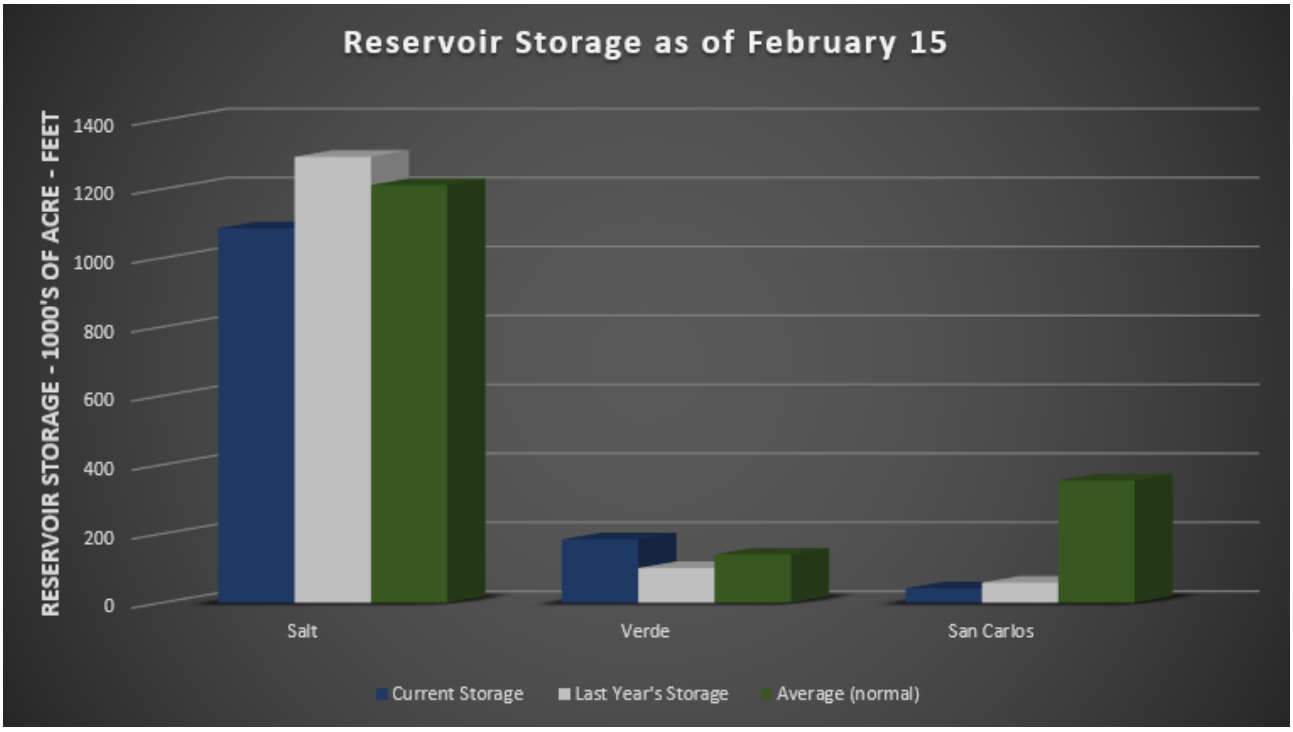


PRECIPITATION

Mountain data from NRCS SNOTEL sites and NWS Cooperator gages show that precipitation for the first half of February was above to well above average in the major river basins. Cumulative precipitation since October 1 ranges from below 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 February 15, the Salt and Verde River reservoir system stands at 55 percent of capacity. San Carlos Reservoir is currently at 5 percent of capacity.

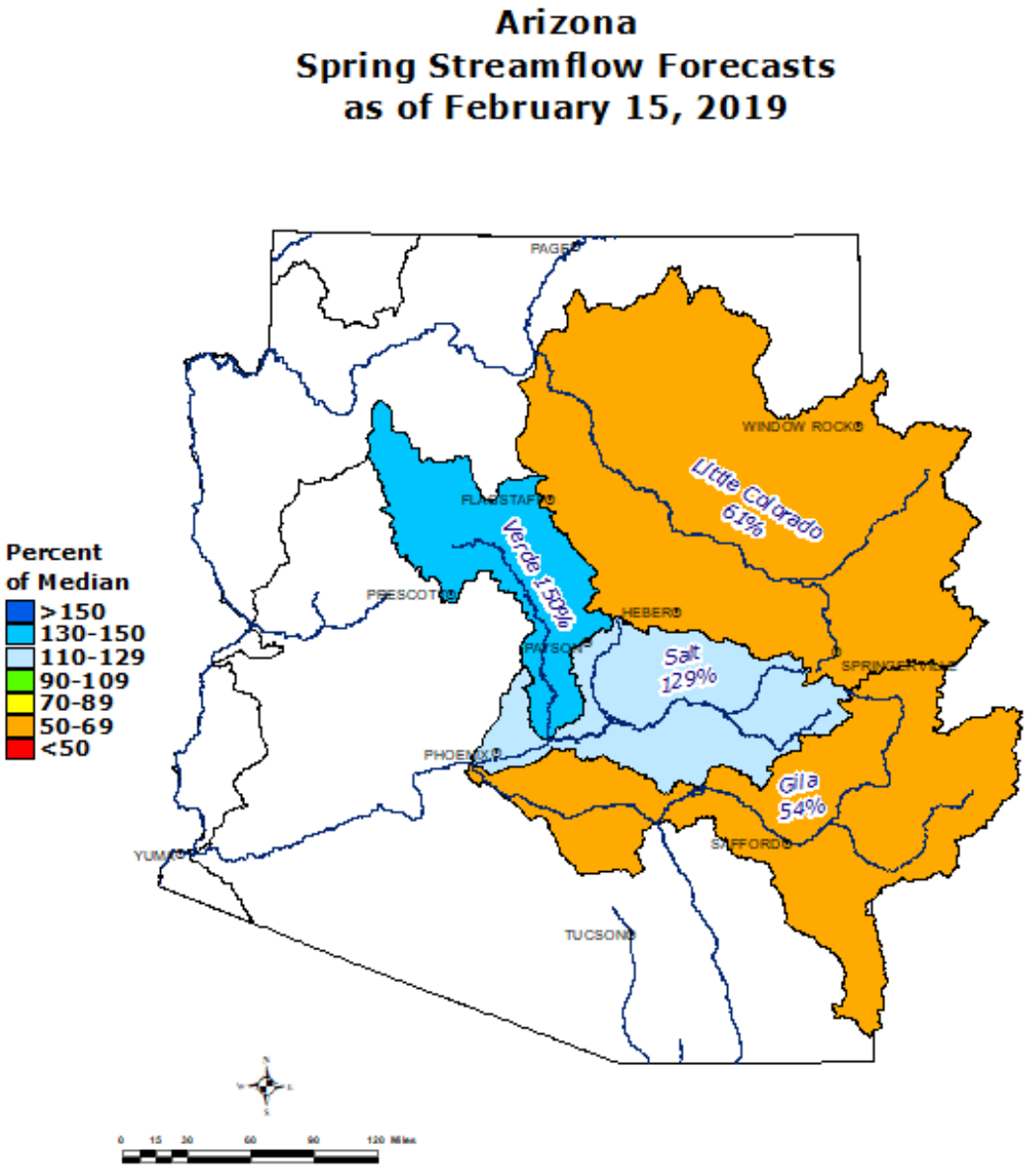


Key storage volumes displayed in thousands of acre-feet (x1000):

Reservoir	Current Storage	Last Year Storage	30-Year Average	Storage Capacity
Salt River System	1086.5	1294.0	1212.0	2025.8
Verde River System	184.1	101.0	140.2	287.4
San Carlos Reservoir	42.1	58.8	355.0	875.0
Lyman Lake	3.6	11.1	12.0	30.0
Lake Havasu	595.7	564.7	561.2	619.0
Lake Mohave	1732.0	1689.9	1659.0	1810.0
Lake Mead	10507.0	10673.0	20361.0	26159.0
Lake Powell	9431.0	13515.0	17553.0	24322.0

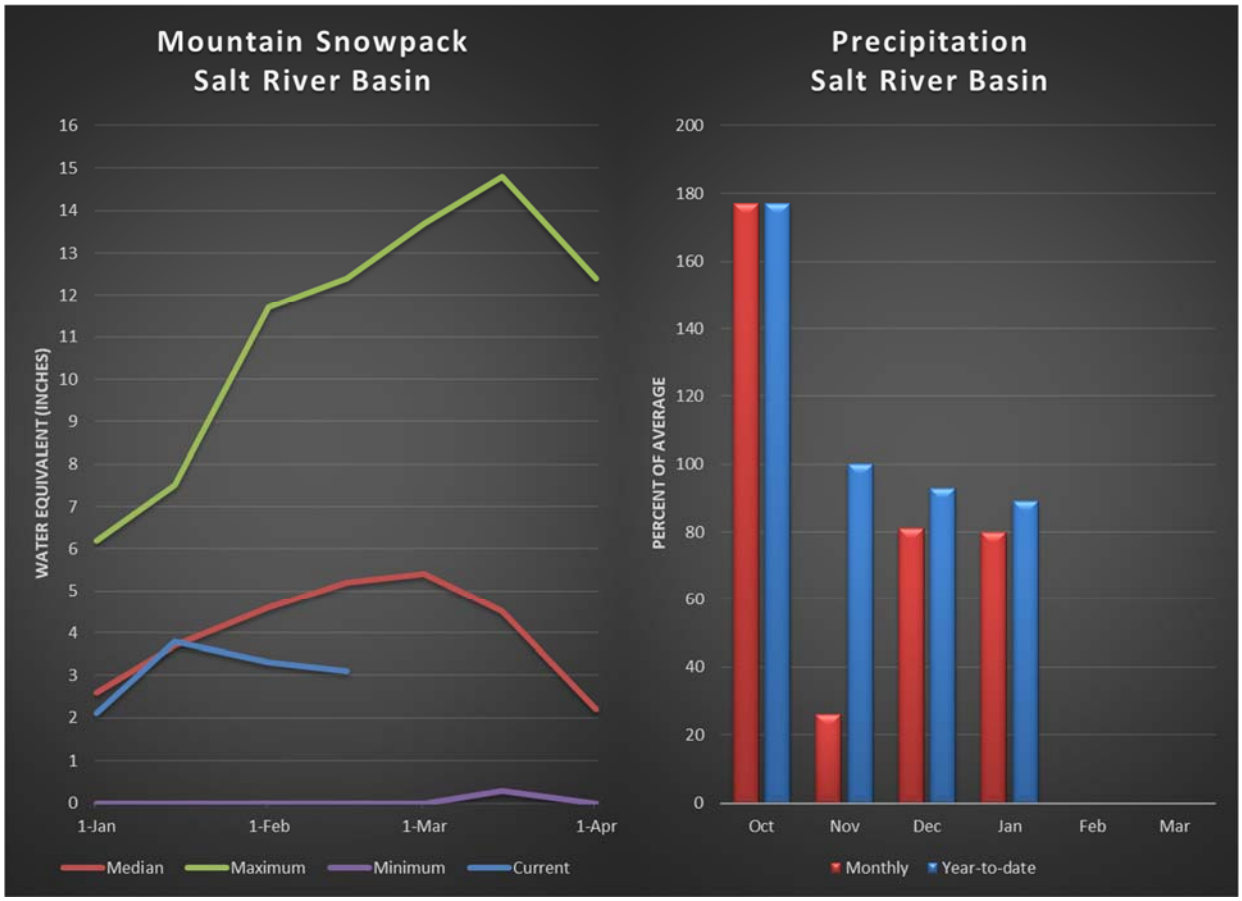
STREAMFLOW

As of February 15, the forecast calls for well below normal to slightly below normal streamflow for the spring runoff period, ranging from 54% percent of median in the Gila River near Solomon to 150 percent of median in the Verde River above Horseshoe Dam. Total precipitation since the beginning of the water year ranges from below normal to well above normal, resulting in improved soil conditions for runoff in the major basins. Please refer to the basin forecast tables found in this report for more information regarding water supply forecasts.



SALT RIVER BASIN as of February 15, 2019

Above normal streamflow levels are forecast for the basin. In the Salt River, near Roosevelt, the forecast calls for 129% of median streamflow through May, while at Tonto Creek, the forecast calls for 126% of median streamflow through May. Snow survey measurements show the Salt snowpack to be at 62% of median.



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Salt River Basin
Streamflow Forecasts - February 16, 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]								
	FEB			81	208%			39
	MAR-MAY	151	225	285	119%	355	480	240
	F15-MAY	189	270	335	129%	410	540	260
Tonto Ck ab Gun Ck nr Roosevelt[3]								
	FEB			16.8	163%			10.3
	F15-MAY	12.3	23	34	126%	47	73	27

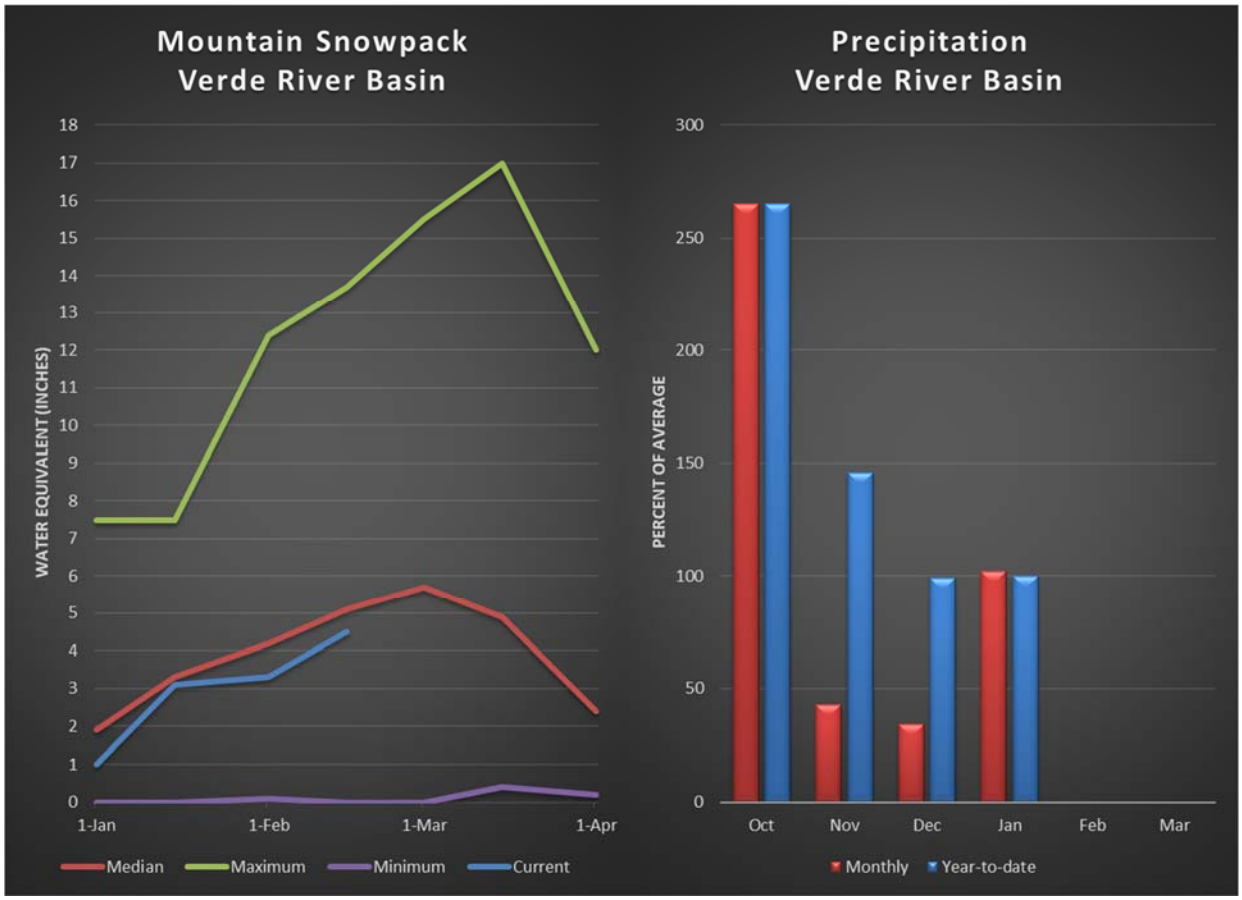
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage Middle of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Salt River Reservoir System	1086.5	1294.5	1272.0	2025.8
Basin-wide Total	1086.5	1294.5	1272.0	2025.8
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 16, 2019	# of Sites	% Median	Last Year % Median
SALT RIVER BASIN	10	62%	13%

VERDE RIVER BASIN as of February 15, 2019

Well above normal streamflow levels are forecast for the basin. In the Verde River above Horseshoe Dam, the forecast calls for 150% of median streamflow through May. Snow survey measurements show the Verde snowpack to be at 88% of median.



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Verde River Basin
Streamflow Forecasts - February 16, 2019

VERDE RIVER BASIN	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						
Verde R bl Tangle Ck ab Horseshoe Dam[3]								
	FEB			133	380%			35
	F15-MAY	82	136	185	150%	245	350	123

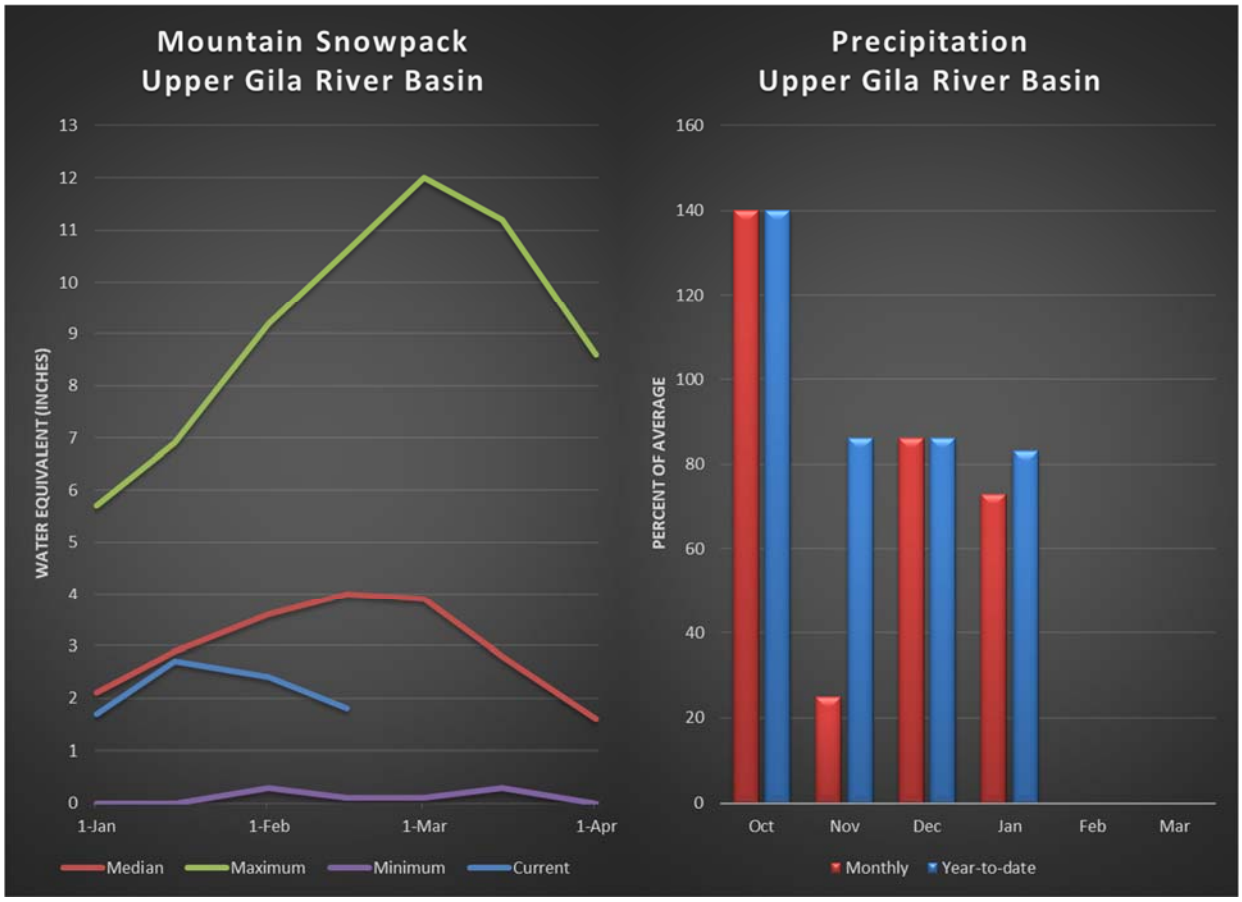
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage Middle of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Verde River Reservoir System	184.1	101.1	160.8	287.4
Basin-wide Total	184.1	101.1	160.8	287.4
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 16, 2019	# of Sites	% Median	Last Year % Median
VERDE RIVER BASIN	12	88%	24%

SAN FRANCISCO-UPPER GILA RIVER BASIN as of February 15, 2019

Well below normal streamflow levels are forecast for the basin. In the San Francisco River, at Clifton, the forecast calls for 61% of median streamflow levels through May. In the Gila River, near Solomon, the forecast calls for 54% of median streamflow levels through May. At San Carlos Reservoir, inflow to the lake is forecast at 60% of median through May. Snow survey measurements show the snowpack for this basin to be at 45% of median.



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San Francisco-Upper Gila River Basin
Streamflow Forecasts - February 16, 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]								
	F15-MAY	12.9	20	27	66%	35	49	41
Gila R bl Blue Ck nr Virden[3]								
	F15-MAY	7.7	18.8	29	55%	41	64	53
San Francisco R at Glenwood[3]								
	F15-MAY	3.3	7	10.6	63%	15.3	24	16.8
San Francisco R at Clifton[3]								
	F15-MAY	8.2	18.5	28	61%	39	60	46
Gila R nr Solomon[3]								
	FEB			15	65%			23
	F15-MAY	14.5	36	56	54%	81	125	103
San Carlos Reservoir Inflow[3]								
	F15-MAY	1.42	18	40	60%	71	131	67

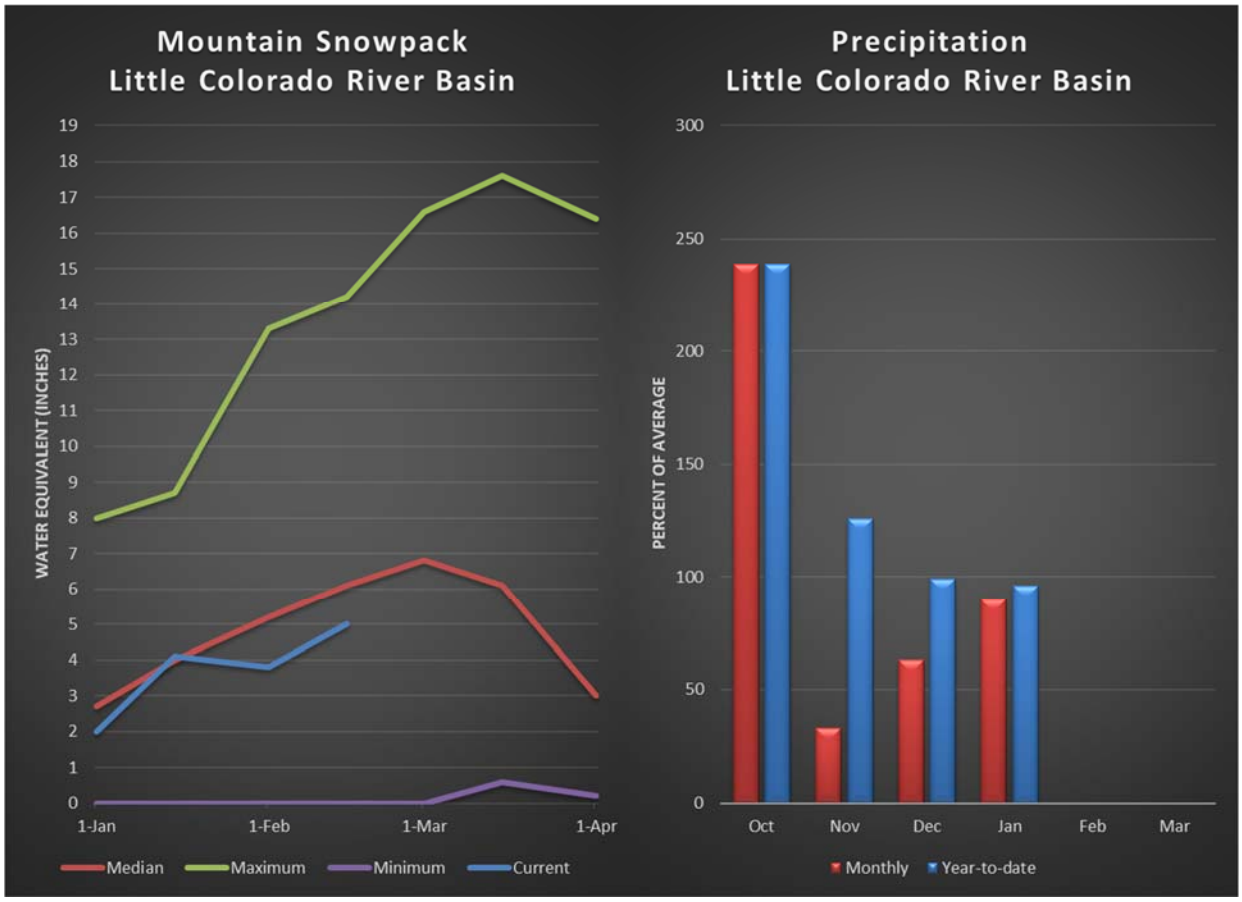
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage Middle of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
San Carlos Reservoir	42.1	58.8	385.7	875.0
Basin-wide Total	42.1	58.8	385.7	875.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 16, 2019	# of Sites	% Median	Last Year % Median
SAN FRANCISCO-UPPER GILA RIVER BASIN	9	45%	9%

LITTLE COLORADO RIVER BASIN as of February 15, 2019

Well below normal streamflow levels are forecast for the basin. In the Little Colorado River, above Lyman Lake, the forecast calls for 61% of median streamflow through June. At Blue Ridge (C.C. Cragin) Reservoir, inflow to the lake is forecast at 67% of median through May. Snowpacks along the southern headwaters of the Little Colorado River, and along the central Mogollon Rim, were measured at 86% and 79% of median, respectively.



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Little Colorado River Basin
Streamflow Forecasts - February 16, 2019

LITTLE COLORADO RIVER BASIN	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						
Little Colorado R ab Lyman Lake[3]	FEB-JUN	1.69	2.9	4	61%	5.3	7.8	6.6
Blue Ridge Reservoir Inflow[3]	FEB-MAY	3.5	7.3	11	67%	15.8	25	16.3
Lake Mary Reservoir Inflow[3]	FEB-MAY	1.17	2.1	3	70%	4.1	6.1	4.3

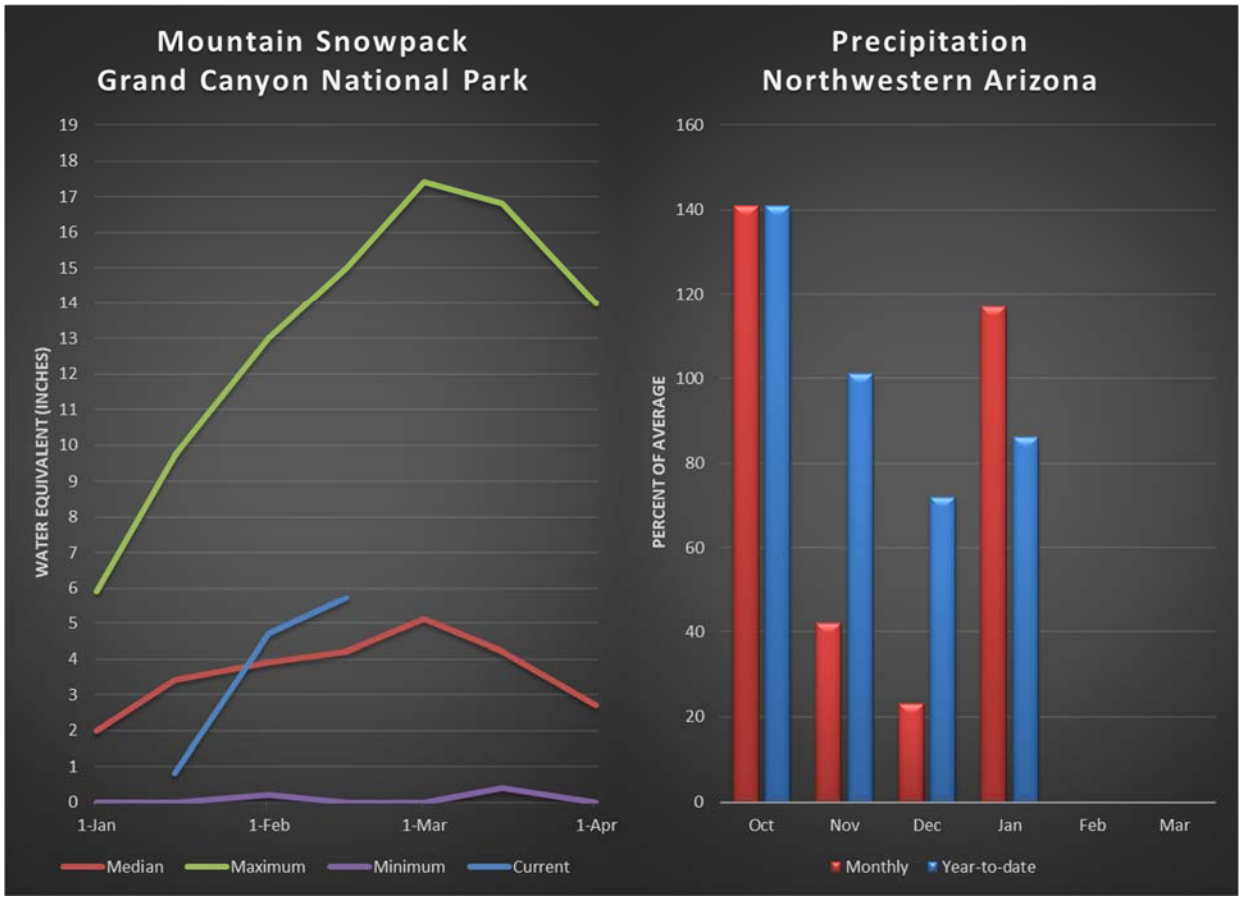
1) 90% and 10% exceedance probabilities are actually 95% and 5%
2) Forecasts are for unimpaired flows. Actual flow will be dependent on management of upstream reservoirs and diversions
3) Median value used in place of average

Reservoir Storage Middle of January, 2019	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lyman Reservoir	3.6	11.1	12.3	30.0
Basin-wide Total	3.6	11.1	12.3	30.0
# of reservoirs	1	1	1	1

Watershed Snowpack Analysis February 16, 2019	# of Sites	% Median	Last Year % Median
LITTLE COLORADO RIVER BASIN	9	86%	23%
CENTRAL MOGOLLON RIM	4	79%	24%

NORTHWESTERN ARIZONA as of February 15, 2019

On the Colorado River, normal inflow to Lake Powell is forecast at 101% 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 136% of median.



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Northwestern Arizona
Streamflow Forecasts - February 16, 2019

NORTHWESTERN ARIZONA	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)
Lake Powell Inflow [2]	APR-JUL	4460	6010	7200	101%	8490	10600	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 **Middle of January, 2019**	Current (KAF)	Last Year (KAF)	Average (KAF)	Capacity (KAF)
Lake Havasu	597.8	566.7	558.7	619.0
Lake Mohave	1731.0	1688.0	1685.0	1810.0
Lake Mead	10507.0	10673.0	20526.0	26159.0
Lake Powell	9430.9	13514.7	17170.0	24322.0
Basin-wide Total	22266.7	26442.4	39939.7	52910.0
# of reservoirs	4	4	4	4

Watershed Snowpack Analysis **February 16, 2019**	# of Sites	% Median	Last Year % Median
NORTHWESTERN ARIZONA	1	136%	30%

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Basinwide Summary: February 16, 2019
(Averages/Medians based on 1981-2010 reference period)

Snowpack Summary for February 16, 2019

SALT RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baldy	SNOTEL	9125	19	7.2	7.5	96%	0.8	11%
Beaver Head	SNOTEL	7990	2	0.4	3.6	11%	0.0	0%
Buck Spring	SC	7400	0	0.0	2.8	0%		
Coronado Trail	SNOTEL	8400	5	0.8	2.9	28%	0.0	0%
Hawley Lake	SNOTEL	8300	30	10.7			3.9	
Coronado Trail	SC	8350	0	0.0	2.2	0%	0.0	0%
Fort Apache	SC	9160	23	6.9	7.1	97%	2.5	35%
Hannagan Meadows	SNOTEL	9020	20	7.8	9.6	81%	1.6	17%
Maverick Fork	SNOTEL	9200	21	7.4	7.9	94%	1.3	16%
Nutrioso	SC	8500	0	0.0	1.0	0%	0.0	0%
Nutrioso	SNOTEL	8500	0	0.0			0.1	
Wildcat	SNOTEL	7850	1	1.1	3.4	32%	0.1	3%
Workman Creek	SNOTEL	6900	0	0.0	5.8	0%	0.1	2%
Basin Index						**62%**		**13%**
# of sites						10		10

VERDE RIVER BASIN	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	8	2.8	5.2	54%	1.5	29%
Baker Butte No. 2	SC	7700	25	7.9	8.3	95%	1.9	23%
Baker Butte Smt	SNOTEL	7700	28	8.9			4.4	
Bar M	SNOTEL	6393	1	0.3			0.0	
Chalender	SC	7100	3	1.0	2.0	50%	0.0	0%
Chalender	SNOTEL	7100	7	2.9			0.0	
Fort Valley	SC	7350	4	1.4	2.2	64%	0.2	9%
Fort Valley	SNOTEL	7350	1	0.4			0.0	
Fry	SNOTEL	7200	16	6.2	6.3	98%	3.5	56%
Happy Jack	SNOTEL	7630	13	5.0	5.3	94%	1.6	30%
Happy Jack	SC	7630	10	1.9	4.8	40%	1.1	23%
Mormon Mountain	SNOTEL	7500	8	4.0	4.3	93%	1.0	23%
Mormon Mountain Summit #2	SC	8470	32	10.4	7.8	133%	1.4	18%
Mormon Mtn Summit	SNOTEL	8500	24	8.7			2.4	
Newman Park	SC	6750	4	1.4	2.6	54%	0.0	0%
White Horse Lake	SNOTEL	7180	4	2.8	4.5	62%	0.8	18%
Williams Ski Run	SC	7720	27	8.7	7.5	116%	1.8	24%
Basin Index						**88%**		**24%**
# 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	51	12.8	14.9	86%	3.0	20%
Snowslide Canyon	SNOTEL	9730	51	20.4	12.5	163%	4.7	38%
Basin Index						**121%**		**28%**
# 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	2	0.4	3.6	11%	0.0	0%
Coronado Trail	SNOTEL	8400	5	0.8	2.9	28%	0.0	0%
Coronado Trail	SC	8350	0	0.0	2.2	0%	0.0	0%
Frisco Divide	SNOTEL	8000	1	0.7	2.9	24%	0.0	0%
Hannagan Meadows	SNOTEL	9020	20	7.8	9.6	81%	1.6	17%
Hummingbird - Aerial And Snow Course	SC	10550						

Lookout Mountain	SNOTEL	8500	1	0.0	2.5	0%	0.0	0%
Nutrioso	SC	8500	0	0.0	1.0	0%	0.0	0%
Nutrioso	SNOTEL	8500	0	0.0			0.1	
Signal Peak	SNOTEL	8360	0	0.0	4.1	0%	0.1	2%
Silver Creek Divide	SNOTEL	9000	18	6.5	7.4	88%	1.6	22%
State Line	SC	8000			2.0			
Whitewater - Aerial And Snow Course	SC	10750						
Basin Index						**45%**		**9%**
# of sites						9		9

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	8	2.8	5.2	54%	1.5	29%
Baker Butte No. 2	SC	7700	25	7.9	8.3	95%	1.9	23%
Baker Butte Smt	SNOTEL	7700	28	8.9			4.4	
Baldy	SNOTEL	9125	19	7.2	7.5	96%	0.8	11%
Buck Spring	SC	7400	0	0.0	2.8	0%		
Cheese Springs	SC	8700	15	4.5	5.0	90%	1.9	38%
Fort Apache	SC	9160	23	6.9	7.1	97%	2.5	35%
Heber	SNOTEL	7640	9	3.4	5.1	67%	0.8	16%
Lake Mary	SC	6930	6	1.6	2.6	62%	0.0	0%
Maverick Fork	SNOTEL	9200	21	7.4	7.9	94%	1.3	16%
Promontory	SNOTEL	7930	22	8.2	9.5	86%	2.5	26%
Basin Index						**86%**		**23%**
# of sites						9		9

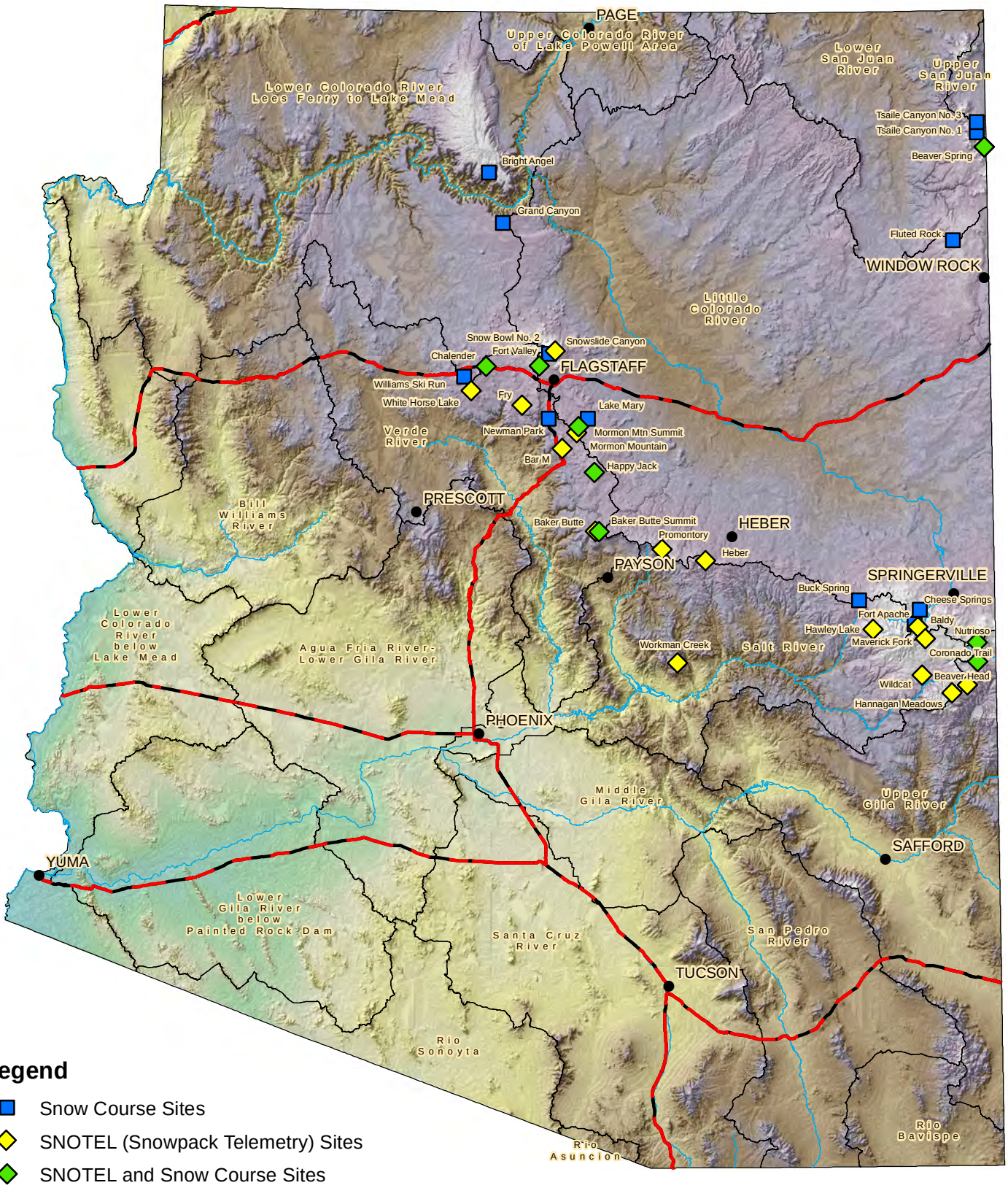
CENTRAL MOGOLLON RIM	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Baker Butte	SNOTEL	7300	8	2.8	5.2	54%	1.5	29%
Baker Butte No. 2	SC	7700	25	7.9	8.3	95%	1.9	23%
Baker Butte Smt	SNOTEL	7700	28	8.9			4.4	
Heber	SNOTEL	7640	9	3.4	5.1	67%	0.8	16%
Promontory	SNOTEL	7930	22	8.2	9.5	86%	2.5	26%
Basin Index						**79%**		**24%**
# 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	32	9.0	8.5	106%		
Beaver Spring	SNOTEL	9200	32	9.7			0.4	
Bowl Canyon	SC	8980	33	8.9	7.2	124%		
Hidden Valley	SC	8480	30	8.3				
Missionary Spring	SC	7940	16	4.0	4.0	100%		
Tsaile Canyon #1	SC	8160	28	8.3	6.0	138%		
Tsaile Canyon #3	SC	8920	36	9.7	9.0	108%		
Whiskey Creek	SC	9050	34	9.9	8.0	124%		
Navajo Whiskey Ck	SNOTEL	9050	32	9.7			0.2	
Basin Index						**116%**		
# of sites						6		0

DEFIANCE PLATEAU	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Fluted Rock	SC	7800	15	4.1	3.7	111%		

NORTHWESTERN ARIZONA	Network	Elevation (ft)	Depth (in)	SWE (in)	Median (in)	% Median	Last Year SWE (in)	Last Year % Median
Bright Angel	SC	8400	33	9.0	6.6	136%	2.0	30%
Grand Canyon	SC	7500			1.7			
Basin Index						**136%**		**30%**
# of sites						1		1

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

N

NRCS
Natural Resources Conservation Service