REPORT TO THE WATER COMMISSION

YEAR 2018

WATER, WASTEWATER, REUSE AND STORMWATER

Annual Report

CITY OF FLAGSTAFF
WATER SERVICES DIVISION

REPORT TO THE WATER COMMISSION

INFORMATION YEAR 2017

WATER, WASTEWATER, REUSE and STORMWATER Annual Report

Including Historical Data & Graphical Trends

May 14, 2018

CITY OF FLAGSTAFF
WATER SERVICES DIVISION

Registered Geologist
CERTIFICATE NO.
49661
ERIN MARIE YOUNG
DATE SIGNED 14 MAY 2018
ARIZONA, U.S.A.
Expires 6/30/2018

FLAGSTAFF
WATER SERVICES
We are Water

REGISTERED GEOLOGIST
CERTIFICATE NO.
25371
BRADLEY M. HILL
Date Signed 14 MAY 2018
ARIZONA, U.S.A.
EXPIRES 3/31/2021

Water Services Team on May 9, 2018—Rio de Flag WRP

We are Water

TABLE OF CONTENTS

ACKNOWLEDGEMENTS III
1 OPERATIONAL OVERVIEW 1
2 PRODUCTION & TREATMENT SUMMARY 2
2-1 POPULATION 2
2-2 2017 POTABLE WATER PRODUCTION SUMMARY 2
2-3 2017 WASTEWATER TREATMENT SUMMARY 3
2-4 2017 RECLAIMED WATER DELIVERIES SUMMARY 4
3 WATER PRODUCTION PLAN 5
4 2017 SUMMARY 6
4-1 2017 NOTABLE EVENTS & IMPROVEMENTS 6
4-2 2017 WATER MANAGEMENT SUMMARY 9
5 WATER CONSUMPTION & PROJECTED NEEDS 10
5-1 PROJECTED WATER DELIVERIES FROM 2017-2070 10
5-2 2017 POTABLE WATER USE BY CUSTOMER CLASS 10
5-3 WATER METERS 11
5-4 DESIGNATION OF ADEQUATE WATER SUPPLY 12
5-5 WATER SUPPLY ALTERNATIVES ANALYSIS 12
5-6 ADVANCES IN STATE LAW 14
6 WATER PRODUCTION 15
6-1 WATER WELLS PEAK CAPACITY 15
6-2 HISTORICAL PRODUCTION BY SOURCE DATA 16
6-3 2017 WEEKLY PRODUCTION BY SOURCE 18
6-4 MOST RECENT DISTRIBUTION SYSTEM WATER QUALITY AT EACH EPDS 20
6-5 CITY SUPPLY WELLS & REGISTRATION INFORMATION 21
6-6 POWER COST - CY 2017 22
7 WELL FIELDS 23
7-1 WELL FIELDS & INFRASTRUCTURE 23
7-2 CITY OF FLAGSTAFF WELL PRODUCTION HISTORY 1996- PRESENT 24
7-3 WATER SUPPLY SOURCES & SPECIFIC CAPACITY 26
7-4 WATER LEVEL HYDROGRAPHS 27
8 UPPER LAKE MARY 33
8-1 UPPER LAKE MARY MONITORING - NEWMAN CANYON 33
8-2 UPPER & LOWER LAKE MARY WATERSHEDS 35
8-3 UPPER LAKE MARY MONITORING - FLOWTOGRAPHY 36
8-4 CLIMATE MONITORING 38
8-5 UPPER LAKE MARY AVERAGE- MONTHLY COMPARISON (1960-2017) 39
8-6 UPPER LAKE MARY INFLOW REPORT & PREDICTED WATER BUDGET 40

9 WATER CONSERVATION 41
9-1 PROGRAM OVERVIEW 41
9-2 2017 PROGRAM ACCOMPLISHMENTS 42
9-3 NON-REVENUE WATER TRACKING 42
9-4 2017 WATER FESTIVAL SUMMARY 43
9-5 WATER CONSERVATION TRENDS 44
9-6 WATER CONSERVATION CODE ENFORCEMENT 45
9-7 DROUGHT PERPAREDNESS—WATER AVAILABILITY STRATEGIES 46
10 WATER STORAGE & DISTRIBUTION 47
10-1 WATER STORAGE RESERVOIRS 47
10-2 FLAGSTAFF WATER PRESSURE ZONES 48
11 RECLAIMED WATER 49
11-1 2017 RECLAIMED WATER USED BY CUSTOMER CLASS 49
11-2 RECLAIMED WATER DISTRIBUTION SYSTEM 50
11-3 WATER RECLAMATION PLANT FLOW REPORT 51
12 STORMWATER MANAGEMENT 52
12-1 SUMMARY OF WORK TASKS 52
13 REGULATORY COMPLIANCE 56
13-1 MAP SHOWING SIGNIFICANT INDUSTRIAL USERS 57
14 RED GAP RANCH 58
14-1 RED GAP RANCH UPDATES 58
14-2 RED GAP RANCH WELL DATA 59
14-3 RED GAP RANCH HYDROGRAPHS 61
15 MISCELLANEOUS INFORMATION 63
15-1 STATISTICS 63
15-2 WATER SERVICES DIVISION ORGANIZATIONAL CHART 64
15-3 CITY OF FLAGSTAFF WATER RATES AND FEES 65
15-4 RADIO BASE STATIONS AND WATER SERVICES PERSONNEL CONTACT INFORMATION 68

The City of Flagstaff was awarded the 3CMA (City-County Communications & Marketing Association) Savvy Award, in the Special Event One-Time Project category, on September 7, 2017. The award recognized the City's educational campaign and winning pledge success for the National Mayor's Challenge for Water Conservation during the month of April, 2017. The Award was submitted by Meg Roederer, the City's Interim Communications Manager. Pictured to Meg's right is Erin Young, Water Resources Manager.

Water Services Director, Brad Hill, was awarded the 2017 AZ Water Association Environmental Stewardship Award. This award recognizes a person who has contributed significantly to the protection and/or enhancement of the environment along with energy management and sustainable practices in the Arizona water/wastewater industry.

ACKNOWLEDGEMENTS

2018 Water Commission

John Malin
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Kira Russo

Ward Davis
Vice Chair

Ben Ruddell

Elizabeth Christy

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Hanna Cortner

Staff Contributions

To acknowledge those responsible for providing data and assembling the 2018 Annual Report to the Water Commission

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TEAM FLAGSTAFF
SERVING OUR COMMUNITY
CITY OF FLAGSTAFF
SERVICE
COMMUNICATION
RESPONSIVE
BETTER
QUALITY
TEAM
ACCOUNTABILITY
CULTURE OF SERVICE
WE MAKE THE CITY BETTER

WYLAND NATIONAL MAYOR'S CHALLENGE FOR WATER CONSERVATION
WINNING CITIES, APRIL 1-30, 2017
TOYOTA
FLAGSTAFF, AZ

Charly's Pub
Open
Gopher Hole
Open

1 OPERATIONAL OVERVIEW

Water Services is responsible for water production and distribution, wastewater collection and treatment, reclaimed water distribution, and stormwater management. The Division is also responsible for water resource management, water conservation, engineering, and regulatory compliance programming. This report provides an annual summary of operations, planning, and programming and is distributed throughout the year in response to various requests for information on the Water Services Division's programs.

Water Services provides Master Planning documents for Water Policies, Water Resources, Infrastructure, SCADA, and Solids Handling. These documents can be found at the Water Services website at *www.flagstaff.az.gov/waterservices*

For several decades, our water production plan for the coming year was determined by the status of Upper Lake Mary in March or April. Water Services used to operate under "wet" or "dry" year condition. A "wet year" was classified as a year when Upper Lake Mary reached 65% or more of capacity and the lake could be utilized to its maximum.

However, in 2016, water quality in Upper Lake Mary caused an issue of disinfection by -products within the City's water distribution system. Even though the lake reached full capacity in March, 2017, the strategy was to minimize the production of disinfection by-products by utilizing only 30% of the water supply in 2017.

The primary determining factor for 2018 is to leave at least 20% of ULM is reserved for 2019. A moderate and optimized approach to water supply will be adopted for 2018, very similar to that of 2017.

By dividing supply between available sources, we will optimize capital investments and maintain surface water near 25% or less of the water supply in 2018. Optimizing the water supplies in this manner will make it possible to respond quickly to unplanned needs, utilize equipment investments, manage system wide disinfection and water age, meet EPAs UCMR4 sampling requirements and reserve 20% of Lake Mary for 2019.

The Stonehouse Well is expected to be brought online in 2018, and a new well is scheduled to be drilled in 2018. The Capital Improvement Plan includes funds to drill and equip five new wells in the next 10 years.

MISSION STATEMENT OF THE WATER SERVICES DIVISION:

"Professionally and cost effectively providing water, wastewater and stormwater services that meet the present and future environmental, health, and safety needs of the community and our co-workers. Committed to a goal of 100% customer satisfaction achieved by a dedication to exceed customer expectations by continuously improving our operations."

2 PRODUCTION & TREATMENT SUMMARY

2-1 Population

Year	1990	1995	2000	2005	2010	2015	2017
Population	45,403	52,701[1]	52,894[2]	61,270[4]	65,870[3]	70,643[4]	72,961[4]

1. The Census Staff during a special census in 1995 completed the documented population count
2. Disputed census population
3. 2010 Census
4. Population estimate as of July 1 of that year from the Office of Economic Opportunity, as per City of Flagstaff Planning Section; includes NAU

2-2 Potable Water Production in the City of Flagstaff

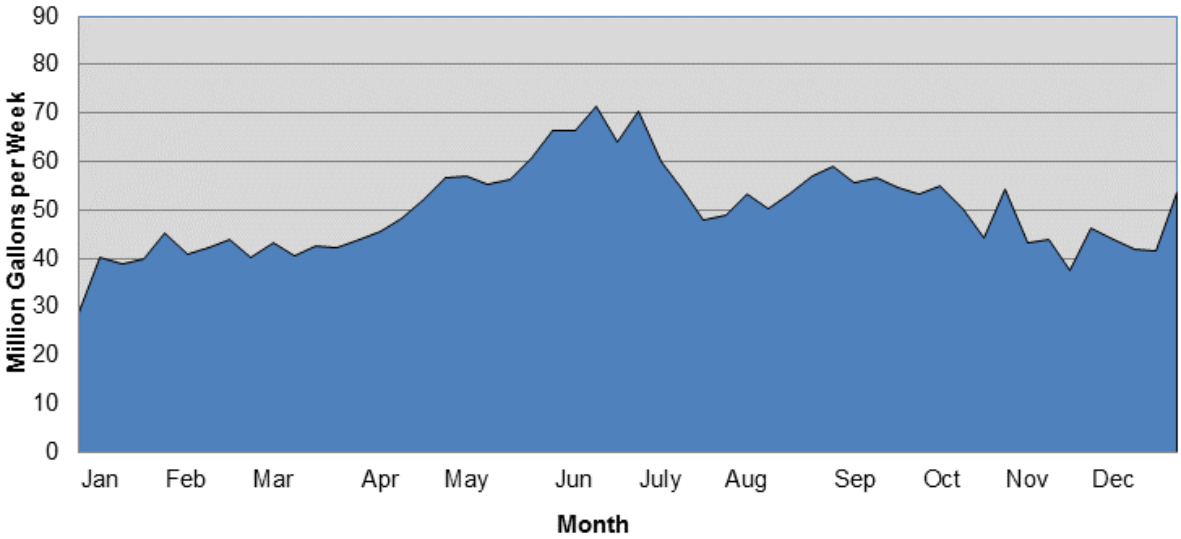
	Acre-Feet Per Year[1]	Average Day (MGD)[2]	Peak Day (MGD)[2]
2017	8,065	7.1	10.8
2016	7,979	7.1	11.4
2015	8,013	7.2	10.9

1. An acre-foot of water is equal to 325,851 gallons
2. MGD = million gallons of water per day

The peak day production occurred on July 6, 2017 with 10.8 million gallons (MG) produced. The sources of water used to meet peak production came from:

Peak Production Source	July 6, 2017
Local Wells	2.64
Woody Mountain Wells	2.35
Lake Mary Surface Water	3.35
Lake Mary Wells	1.20
Inner Basin Water	1.23
Total Produced	10.77

In a dry year, Water Services has a peak capacity of ~11.3 million gallons per day (details on page 13). This assumes 15% system redundancy (85% of the firm well capacity) and no surface water sources (Inner Basin and Upper Lake Mary). The wet year peak capacity is ~19 million gallons per day including the Inner Basin (2 MGD) and Upper Lake Mary (5.5 MGD).



Water demand increases from April to October due primarily to outdoor watering. Efforts by the community and the City's Water Conservation Program to switch landscaping to low water use will help to postpone the construction of new water supply facilities and development of new water resources.

2-3 Wastewater Treatment

Maximum Month & Day[1] Wastewater Volume Treated Water Reclamation Plants (WRP)				
Rio de Flag WRP Peak Month , MG | Peak Day, MGD		**Wildcat Hill WRP** Peak Month , MG | Peak Day, MGD		**Total Peak Day, MGD**
January 2017	64.8 MG | 2.2 MGD 1/15/17	February 2017	139.3 MG | 6.7 MGD 2/14/17	8.9 MGD
July 2016	62.7 MG | 2.3 MGD 7/20/16	August 2016	124.7 MG | 6.6 MGD 8/27/16	12.8 MGD
June 2015	62.5 MG | 2.4 MGD 7/3/15	March 2015	151.5 MG | 10.4 MGD 3/2/15	7.5 MGD

AVERAGE PER CAPITA INFLOW	**1990**	**105**	**GPCD**
	2017	**76[2]**	**GPCD**

1. Maximum day units are in million gallons per day (MGD) and maximum month are in million gallons (MG). Flows are based on the influent metering system.
2. Total influent (2.035 million gallons in 2017) divided by population (72961) divided by 365 days

The treatment capacity of the Wildcat Hill Water Reclamation Plant is 6.0 MGD and the Rio de Flag Water Reclamation Plant is 4.0 MGD. The combined treatment capacity of the two plants is 10 MGD. This capacity is projected to serve the City of Flagstaff until 2035 or approximately a population of 100,000 (Sewer Master Plan, 2015 Brown & Caldwell).

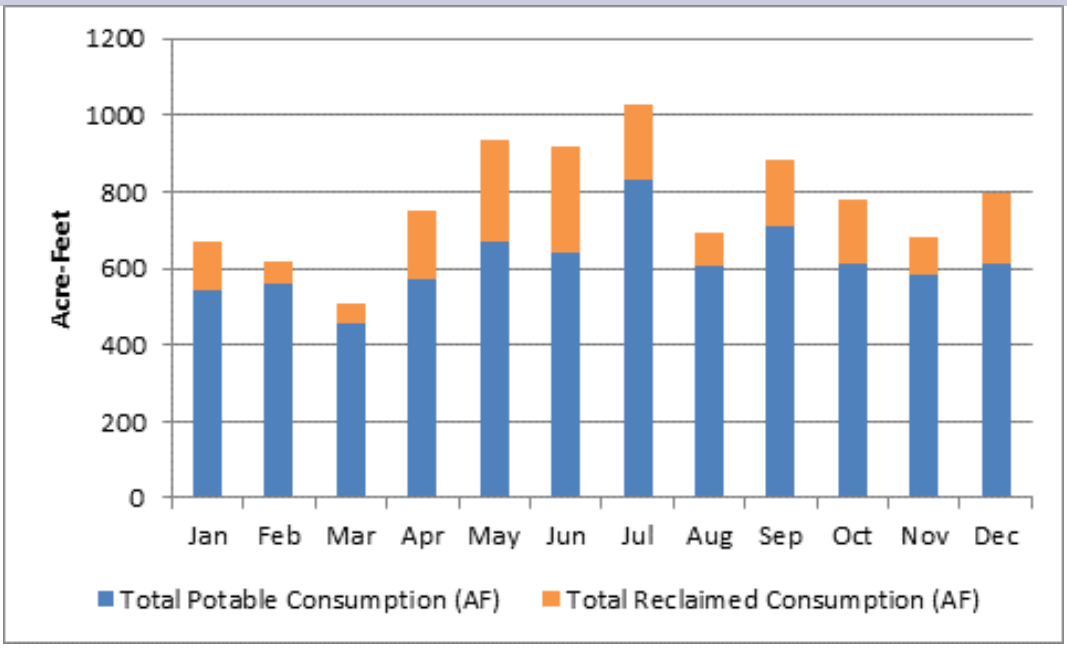
2-4 Reclaimed Water Deliveries

Maximum Month & Day Reclaimed Volume Delivered Water Reclamation Plants (WRP)				
Rio de Flag WRP Peak Month , MG | Peak Day, MGD		**Wildcat Hill WRP** Peak Month , MG | Peak Day, MGD		**Total Peak Day, MGD**
January 2017	64.8 MG | 2.5 MGD 2/28/17	February 2017	139.3 MG | 6.7 MGD 2/14/17	9.2 MGD
June 2016	39.3 MG | 1.9 MGD 4/22/16	June 2016	65.9 MG | 3.9 MGD 6/4/16	5.8 MGD
July 2015	40.4 MG | 1.7 MGD 6/29/15	June 2015	55.6 MG | 2.9 MGD 6/24/15	4.6 MGD

1. Maximum day units are in million gallons per day (MGD) and maximum month are in million gallons (MG). Direct deliveries to customers only, does not include discharge to Rio de Flag.

Currently, the maximum reclaimed water supply available from the Rio de Flag WRP is 1.8 MGD and 3.4 MGD from the Wildcat Hill WRP (see p. 46). The supply availability at the Rio de Flag WRP is limited by the amount of inflow into the plant. The supply availability from the Wildcat Hill WRP is limited by the capacity of infrastructure between the plant and the Buffalo Park Tank. Water Services is

Comparison of Reclaimed Water Billed to Potable Water Billed in 2017



The monthly production graph above demonstrates the importance of reclaimed water in reducing the demand on potable water during spring and summer months. In June, reclaimed water accounted for 31% of total water demand. Reclaimed water continues to account for ~ 20% of water supplies delivered to customers on an annual basis (see summary on Page 9).

3 2018 WATER PRODUCTION PLAN

This section describes the strategy Water Production will follow in order to meet anticipated water demands for 2018.

Due to a disinfection by-product (DBP) exceedance in 2015, a conservative approach of 25% ratio surface water to ground water was adopted during 2016 and 2017. After extensive monitoring over the past two years it has been shown that a higher ratio of surface water to ground water may be used without harmful levels of DBPs produced. In the first four months of 2018, as much as 40% of surface water was produced while maintaining DBPs well below maximum contaminant levels (MCLs).

In 2018, the City is required to sample under the Environmental Protection Agency's (EPA's) 4th round of Unregulated Contaminant Monitoring (UCMR4). This will require sampling at pre-scheduled dates of all 9 Entry Points to the Distribution System (EPDS) in the City. Water Production must ensure its EPDSs are pumping when needed for the sampling schedules of UCMR4.

Surface water production for the remainder of 2018 will be dictated by the amount of water remaining in Upper Lake Mary (ULM) after a significantly dry 2017/2018 winter. The primary determining factor for surface water production will be assuring that at least 20% of ULM is reserved for 2019. A moderate and optimized approach to water supply will be adopted for 2018, very similar to that of 2017.

By dividing supply between available sources, we will optimize capital investments and maintain surface water near 25% or less of the water supply in 2018. Optimizing the water supplies in this manner will make it possible to respond quickly to unplanned needs, utilize equipment investments, manage system wide disinfection and water age, meet EPAs UCMR4 sampling requirements and reserve 20% of Lake Mary for 2019.

2018 Quarterly Operations Plan

	1st Quarter (actual)			2nd Quarter (estimated)		
	Avg MGD	MG	AF	Avg MGD	MG	AF
Surface	2.1	190	583	2.5	228	700
LM Wells	0.8	75	230	1.8	164	503
WM Wells	0.8	76	233	1.8	164	503
Local Wells	2.3	205	629	2.3	209	641
IB	0	0	0	0.2	18	55
Total	**6.1**	**546**	**1676**	**8.6**	**783**	**2402**
	3rd Quarter (estimated)			**4th Quarter (estimated)**		
	Avg MGD	MG	AF	Avg MGD	MG	AF
Surface	2.0	184	565	1.0	110	338
LM Wells	1.7	156	479	1.1	101	310
WM Wells	1.7	156	479	2.0	184	565
Local Wells	2.3	212	651	2.3	212	650
IB	0.5	46	141	0	0	0
Total	**8.2**	**754**	**2315**	**6.4**	**607**	**1863**

Peak Day and Total Annual Operations Plan

	Peak	Annual Estimate	
Source	Day MGD	MG	AF
Upper Lake Mary	5.5	712	2185
Local Wells	4.9	496	1523
Lake Mary Wells	3.4	580	1780
Woody Mountain Wells	5.2	838	2572
Inner Basin	1.5	63	193
Total	20.6	2.689	8286
Minus 15% Well Redundancy	17.5		

Photo by Brad Hill—IB Well #9

4 2017 SUMMARY

4-1 2017 Notable Events & Improvements

Wastewater Operations - Wildcat Water Reclamation Plant

1. Rebuilt Reclaim Booster Pump #2
2. Replaced Grit Washers; this equipment was over 25 years old and had failed.
3. Rebuilt Primary Effluent Pump 3.
4. Installed more security systems, including door locks and cameras.
5. Replaced centrifuge#2 with a disc thickener#2. This new technology has improved our digester operations by thickening the solids sent to digester, reducing liquid volume by 8 million gallons.
6. Repaired all of the overhead cranes.
7. Calibrated all flow meters and gas detection systems.
8. Installed a PLC (programmable logic controller) in Secondary effluent pump station.
9. Improved solids handling operations by using the remote control on new dredge.

Wastewater Operations - Rio Water Reclamation Plant

1. Aeration Blower and Air Pipeline replacement has demonstrated about 77,700 Kwhr or $6750.14 saving in power monthly.
2. Repaired all of the overhead cranes.
3. Calibrated all flow meters and gas detection systems.
4. Installed more security systems at the Influent Pump Station.
5. Replaced the Influent Pump Station Check Valves.
6. Cleaned the influent piping prior to the influent pump station.
7. Improved the Atrium multi-use meeting space with sound panels and projection system.

Water Production Operations

1. Completed electrical upgrade of 65 year old original equipment at the Lake Mary Water Treatment Plant to current standards with new outdoor & indoor transformers, motor controls and switchgear.
2. Installed new heating system in historic Lake Mary buildings primarily to keep load out functional for water hauling customers.
3. Cleaned the inside bottom of 12mg Main Reservoir.
4. Installed new submersible Shop Well pump.
5. Cleaned and installed new and resized Woody Mtn #10 pump and motor.
6. Rebuilt Woody Mountain #7 softstart with new transformers and SCRs (silicone controlled rectifiers).
7. Reprogrammed PLC (programmable logic controller) in Filter Building at the LMWTP.
8. Installed new VFD (variable frequency drives) and one motor in LMWTP flocculation chambers.
9. Completed a 27” pipe repair of surface water transmission main.
10. Bladed (levelled and smoothed) roads at Red Gap Ranch.
11. Painted/Stained all of Woody Mountain & Inner Basin Well Houses and historic Lake Mary WTP buildings.

12. Installed new MIOX chlorination system at Continental Well.
13. Repaired surge tower at RWPS (Raw Water Pump Station).
14. Installed 4 new soft-starts on RWPS pump drives.
15. Installed new town pump at Foxglenn/Sinagua Well House.
16. Installed new meters at Interchange, Shop, LM#8 and WM#6 wells.

Engineering

1. Aging Water Infrastructure Replacement (AWIR)

- Replaced 5,585 linear feet (LF) of undersized water line & 2,335 LF of sewer line in Sunnyside neighborhood. The majority of waterlines replaced were 2-inch, and 4 inch in diameter, inadequately sized for fire flows and over 62 years old. Infrastructure replacement included all pavement, curb & sidewalk and edge improvements. Sunnyside neighborhood, between Izabel Street and Fourth Street, Cedar Avenue and 2nd Street.
- Replaced 1075 LF of 8-inch cast iron water main originally installed in 1901 and 1000 ft. of 8-inch vitrified clay pipe sewer main in Beaver Street from Columbus Avenue to Dale Avenue.
- Replaced 2,690 LF of 1947 14-inch cast iron water transmission main along Grand Canyon Avenue from Sante Fe Avenue to Observatory Mesa. Infrastructure replacement included all pavement, curb & sidewalk and edge improvements.
- Replaced 3,400 linear feet (LF) of water line & 2,300 LF of sewer line, over 98 years old. Infrastructure replacement included all pavement, curb & sidewalk and edge improvements. Brannen neighborhood replacement phase 2 covered between Cottage Avenue and Butler Avenue, O'Leary Street & Colorado Street.
- Replaced 2,650 LF of 1906 6-inch cast iron water main & 1,425 LF of sewer line, as old as 100 years old along Mikes Pikes from Phoenix Avenue to Milton Avenue. New pavement, curb & sidewalk included.
- Replaced approximately 5,500 LF of 1964 6-inch asbestos cement water main, 675 LF of sewer main, stormwater drainage and full street reconstruction of Zuni Drive from Cochise Drive to Leupp Drive. The key focus of this project was improvement infrastructure and removal stormwater flooding issues that existed in the Bow & Arrow neighborhood.
- Replaced 180 LF of deteriorating 8-inch cast iron sewer main and rehabilitated 800 LF within Milton Avenue from Phoenix Avenue to Butler Avenue. This section of sewer pipe was fully deteriorated, failing and required immediate repair. The remainder of repair involved installing 800 LF of cured in place pipe (CIPP) liner that was installed through existing manholes with no excavation required and provides a corrosion resistant replacement pipeline material. This sewer rehabilitation technique saved the City of Flagstaff over $250,000 in replacement costs.

2. Westside Sewerline Extension: Water Services extended the Westside sewer interceptor 4830 LF along the clay avenue wash in order to serve new development and infill on the Westside of Flagstaff, including WL Gore Woody Mountain Campus, Timber sky, Railroad Springs neighborhood and the City of Flagstaff public works facility.

Stormwater

1. Constructed two major stormwater conveyance systems. Upgraded drainage conveyance in Fanning and Bow & Arrow Washes.
2. Performed 1,200 construction site inspection at 50 individual sites.
3. Conducted 73 drainage investigations.
4. Reviewed 37 concept and site plan submittals.
5. Completed 74 flood zone determinations.
6. Processed 37 floodplain use permits.

Regulatory Compliance

1. Selected to represent Flagstaff in the ADEQ Recycled Water Rule Revision Workgroup. This workgroup provided recommendations to ADEQ to assure reclaimed water quality standards are adequate for their end uses.
2. Completed a 5 year collaborative work study conducted by the Flagstaff City Manager's compounds of emerging concern (CEC). After 5 years, the Advisory Panel, organized by the Flagstaff City Manager, concluded that there were no data to suggest that the continued use of reclaimed water provides undue risk to human health.
3. Completed a two-year monitoring event under the surface water treatment rule for Cryptosporidium and Giardia. Neither compound was detected in the Upper Lake Mary or Inner Basin raw water source water.
4. Successfully transitioned to electronic pretreatment reports for field staff.
5. Completed another successful year with no drinking water monitoring violations or missed monitoring events.
6. Completed another successful year with no wastewater exceedances or missed monitoring events.

Water Resources & Conservation

1. Flagstaff won Wyland's National Mayor's Challenge for Water Conservation in the 30,000 -100,000 population category.
2. Collected additional geophysical information in and adjacent to the city boundary (Controlled Source Audio Magnetotellurics). The Well Siting Study was completed in May 2018. Staff plan to execute the next City's water well drilling project in 2018.
3. Carollo Engineers completed a high-level cost analysis of water supply alternatives that include direct and indirect potable reuse options.
4. Coordinated the Arizona Pure Water Brew Challenge in Flagstaff. Water purification occurred at the Rio WRP. Mayor, Council and staff, attended this important event, Arizona's first Direct Potable Reuse project. Delivered pure water to breweries including Oak Creek, Granite Mountain, Wanderlust, Dark Sky, and Historic.
5. Water Conservation Manager, Tamara Lawless, Water Resources manager, Erin Young, and Felix Parham, MSW Water Production, participated in the annual STEM City Earth's Spheres Field Trip to Upper Lake Mary in November, 2017. This was our 4th year participating.
6. Presentations at AZWater, National WateReuse Annual Meeting, Arizona Hydrological Society, and a Flagstaff Community Water Forum.

City of Flagstaff Water Management Summary 2017

WATER PRODUCTION			
I. C Aquifer Groundwater		**5,921 AF**	*(58% of Total Water Produced)*
Lake Mary wells*	1,129 AF		*(73% of Total Potable Produced)*
Woody Mtn wells*	2,178 AF		
Local wells	2,614 AF		
II. Upper Lake Mary Surface Water*		**1,776 AF**	*(17% of Total Water Produced)*
			(22% of Total Potable Produced)
III. Inner Basin Water		**368 AF**	*(4% of Total Water Produced)*
Inner Basin wells	0 AF		*(5% of Total Potable Produced)*
Inner Basin spring water	368 AF		
2017 TOTAL POTABLE PRODUCED			**8,065 AF**
III. Reclaimed water (direct delivered)		**1,860 AF**	*(21% of Total Water Produced)*
Golf Courses	926 AF	*(Pine Canyon 288 AF; Continental 638 AF)*	
Manufacturing	141 AF		
Municipal parks, schools	137 AF		
Commercial	105 AF		
Northern AZ University	144 AF		
Construction	77 AF	*(reclaimed hydrant meters & standpipes)*	
Residential	1 AF		
Snowbowl	329 AF	*(427 AF Nov '17– Feb '18 ski season)*	
Discharged to Rio de Flag	*4,517 AF*	*(not included in total)*	
2017 TOTAL WATER PRODUCED			**10,254 AF**
POTABLE WATER USED			
I. Residential		**4,153 AF (56 %)**	
Single-Family	2,471 AF		*(15,163 household meters)*
Multi-Family	1,682 AF		*(3,104 multi-family meters)*
II. Non-Residential		**3,250 AF (44 %)**	
Commercial	1,952 AF		*(2,042 non-residential meters)*
Manufacturing	267 AF		
Landscape/Lawn	260 AF		
Northern AZ University	551 AF		
Standpipe	220 AF		
2017 TOTAL WATER BILLED			**7,403 AF**
NON-REVENUE (L & U) WATER [produced – billed/produced]:			**662 AF or 8%**
Water main flushing	9 AF		
System leaks detected and repaired	163 AF		
Other	490 AF	*(i.e., system flushing, uncalibrated production meters)*	
AVERAGE WATER USE		**91 Total GPCD or 145 GPHD**	

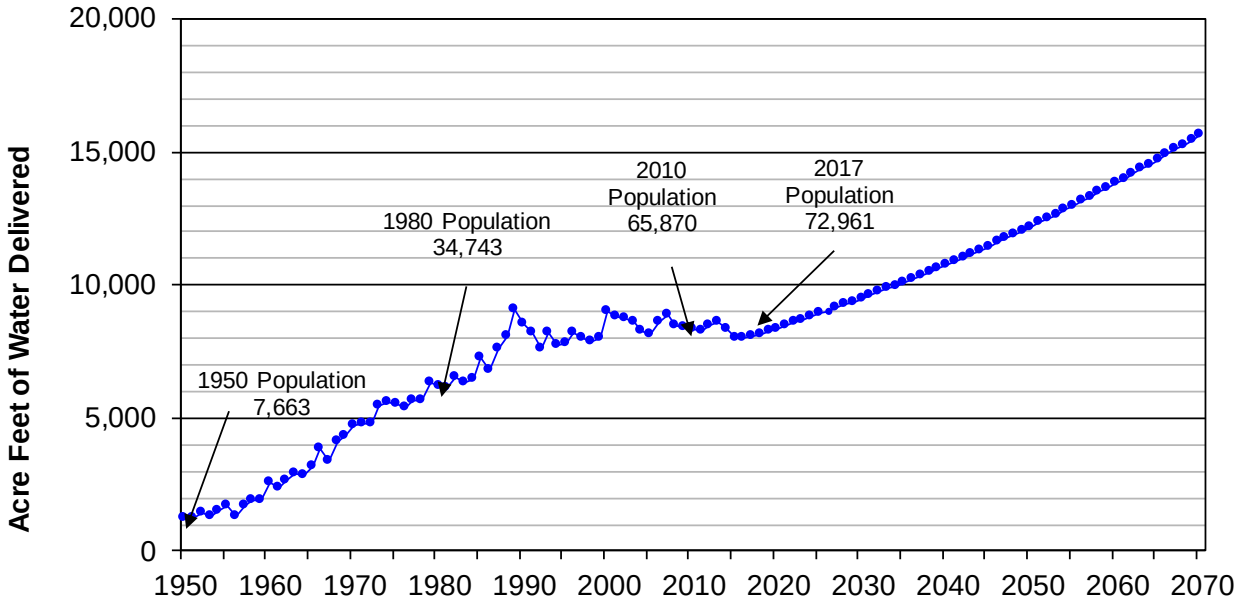
I. Gallons per Capita per Day (gpcd) is the potable water used in gallons / 72,961 population
Residential = 51 gpcd & Non-Residential = 40 gpcd = 91 Total gpcd (does not include Non-Revenue)
Total - 99 gpcd (includes Non-Revenue)

II. Single Family Residential Water Use: 0.16 AF/house/year or 145 gallons/house/day (GPHD)
[2,471 AF/15,163] (does not include non-revenue water)

* Annual volume equal to ending meter totalizer read on December 31, 2017 minus the beginning meter totalizer read on January 1st, 2017

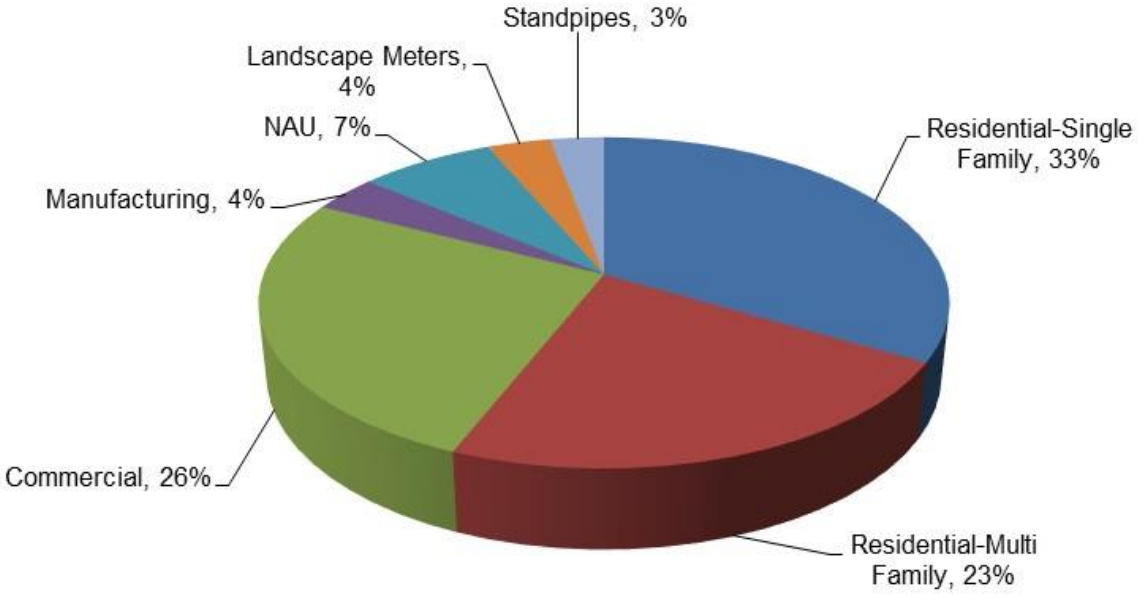
5 WATER CONSUMPTION & PROJECTED NEEDS

5-1 Projected Potable Water Deliveries from 2017 to 2070



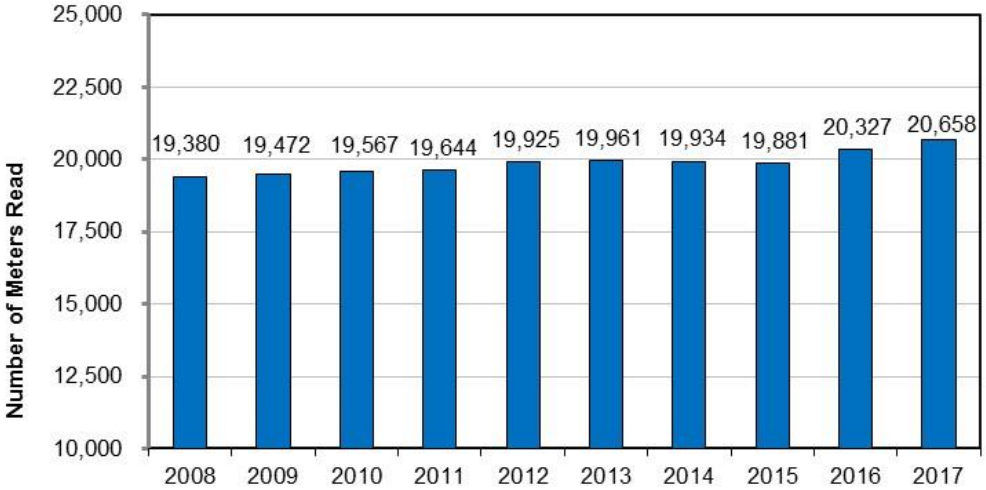
The graph above illustrates water production (in acre-feet per year) and population for the City of Flagstaff from 1950 through 2017. The annual percentage increase in population over the 68 year period has been 1.32% per year while water production has increased 1.24% per year over the same time period. Projected water demand assumes these growth rates and water use will continue.

5-2 2017 Potable Water Use by Customer Class



5-3 Water Meters

Meters Read—Highest Month Each Year for Last 10 Years



New Meter Sets in Last 10 Years

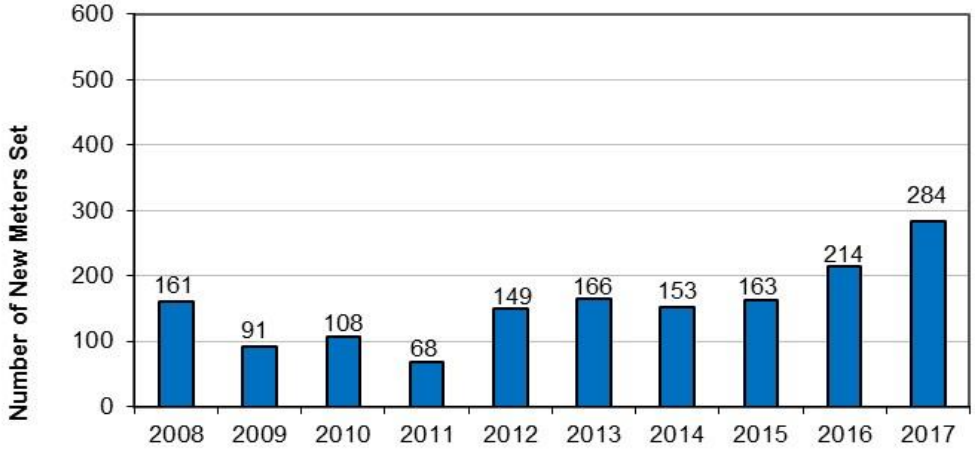


Photo by Brad Hill — Inner Basin Well #9

5-4 Designation of Adequate Water Supply

The Arizona Department of Water Resources (ADWR) issued the City a Designation of Adequate Water Supply in 2013. The Designation identified 9,913 AF/YR (acre-feet per year) of local groundwater (Lake Mary, Woody Mountain and Local well fields), 3,585 AF/YR from Upper Lake Mary, 16,500 AF/YR from Red Gap Ranch, and 2,212 AF/YR of reclaimed water as available supplies to meet 100 years of projected water demand. The supply from Red Gap Ranch is limited to 8,000 AF/YR after the City entered into an agreement with the Navajo Nation in 2011.

The Designation of Adequate Water Supply is based upon population growth projections from the voter-approved Regional Land Plan 2030, water supply availability as demonstrated using a groundwater computer model developed by the U.S. Geological Survey, and records of direct delivered reclaimed water use.

Flagstaff is required to provide annual updates to ADWR that document current, committed and projected water demands for the community.

Annual Tracking of Committed Demand (in acre-feet/year)

Reporting Year	Current Demand Potable	Current Demand Reclaimed	Total Current Demand[1]	Committed Demand[2]	10-Year Projected Demand[3]	Remaining Designation Volume[4]
2017	8,065	2,189	10,254	NA	11,830	NA
2016	7,979	1,817[5]	9,795[5]	686	11,300[5]	5,229[5]
2015	8,013	1,921	9,934	833	11,461	4,943
2014	8,347	1,934	10,281	1,058	11,629	4,371
2013	8,565	2,252	10,817	819	9,881	4,074
2012	8,384[6]	2,050	10,434[5]	707	9,673	4,569[5]
2011	8,249	2,212	10,461	859	9,517	4,390

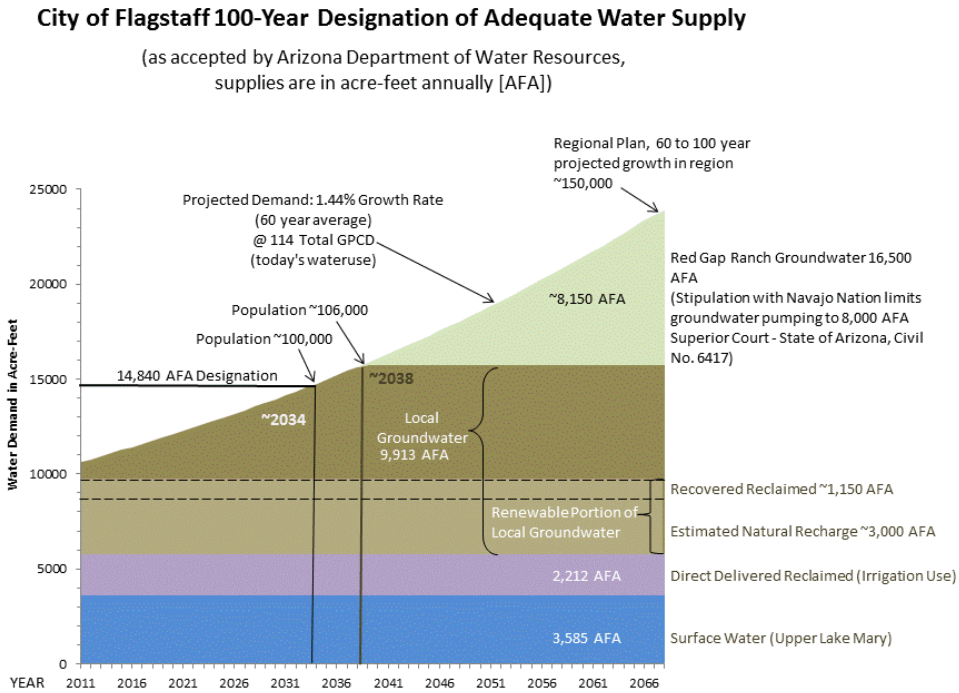
1. Total current demand reported to ADWR is the sum of potable and reclaimed water delivered in that calendar year.
2. Committed demand is Council-approved plats, building permits and rezones approved but not served.
3. Based on the historic 60-year growth rate of 1.44% at time DADE was submitted in 2011; includes reclaimed water.
4. Total Designation Volume (15,710 AF) - Total Current Demand - Committed Demand. This Total Designation Volume does not include the 8,000 AF/year available from Red Gap Ranch.
5. Corrected from 2016 Report to the Water Commission; corrected to the value submitted to ADWR.
6. Correction was made due to difference in individual meter totals reported to ADWR vs. master meter totals in 2012 Water Management Summary.

Data reported annually to ADWR by June 1. Information may vary prior to submittal.

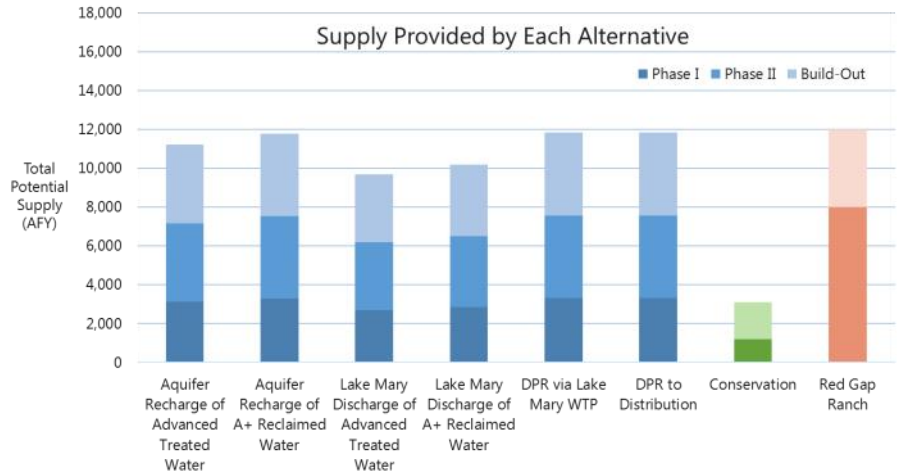
5-5 Water Supply Alternatives Analysis

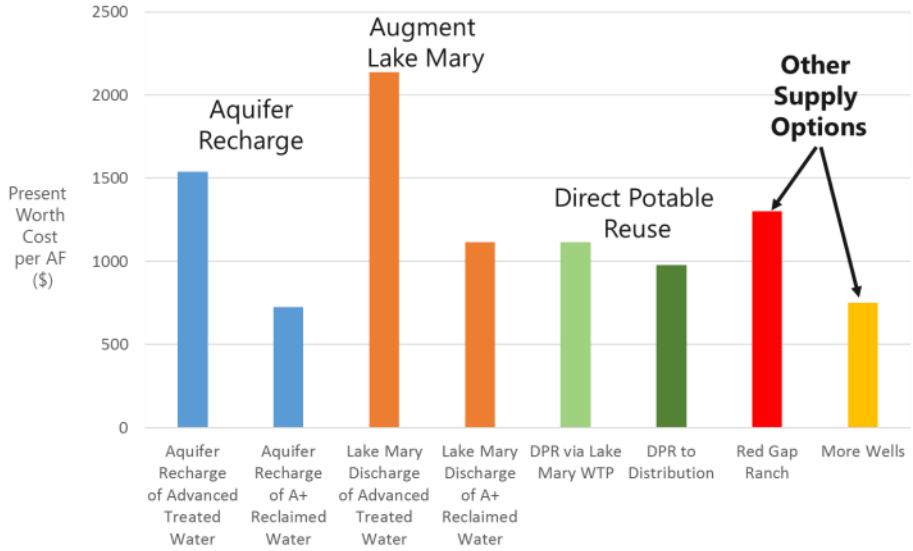
While Flagstaff has a Designation of Adequate Water Supply, there are several options being evaluated for meeting future demands beyond those supplies utilized today. The studies will determine the volume of water each supply should yield bring, and the cost per acre-foot of water. The first focus area is to utilize 100% of the reclaimed water generated at the Water Reclamation Plants. Currently, only 30% of reclaimed water is recycled in the community. The goal is to utilize the other 70% within the City's urban water management area. The second project is to provide a list of water supply

alternatives that explore the feasibility of a number of advanced treatment options of reclaimed water, including potable reuse. Results of these studies will be compared and contrasted to the costs to develop Red Gap Ranch.



Carollo Study—Water Supply Alternatives Costs, October, 2017





Carollo Engineers were retained by the City to provide a high-level cost estimate of reclaimed water alternatives along with potential water conservation savings and estimated costs to develop Red Gap Ranch. Assuming the direct potable reuse process does not include reverse osmosis, these alternatives (minus water conservation as those volumetric savings are not substantial) are not only cost competitive but could meet water needs at build-out. A more refined estimation process is being conducted by Brown & Caldwell in 2018.

5-6 Advances in State Law—Notices of Final Rulemaking Nov. 3, 2017

ADEQ last adopted a comprehensive revision of the reclaimed water reuse rules in January, 2001. Since 2001, however, the science and technology of treatment and monitoring have advanced, and new concerns and needs have arisen, including the need for clarification of ambiguities in the rules. In early 2016, ADEQ held informal listening sessions in Tucson, Phoenix, and Flagstaff to gather comments and feedback on the current rules. This rule is an outcome of that process and represents the first round of three planned rulemaking phases.

In addition to meeting stakeholders' water augmentation requests, this rulemaking furthers the goals of the Governor's Arizona Water Initiative's Augmentation Council, originated by Governor Ducey under Executive Order 2015-13 and the Governor's Blue Ribbon Panel on Water Sustainability, which was formed in 2009 by Governor Brewer. The Blue Ribbon Panel on Water Sustainability Final Report, November 30, 2010 contained recommendations to advance and expand the use of reclaimed water and other recycled waters. In The Arizona Water Initiative Annual Report, July 1, 2016, experts identified the need for water augmentation through expanding reclaimed water reuse. This rulemaking is the first phase in expanding the use of reclaimed and recycled waters to further these augmentation goals. For example, part of this rulemaking will allow for an exception to the prohibition against providing reclaimed water for human consumption in order to augment Arizona's water supply and to spark innovation.

Based on the need for augmentation and the listening sessions held in early 2016, future phases will likely involve updates and amendments to A.A.C. Title 18, Chapter 11, Article 3, Reclaimed Water Quality Standards and additional amendments to A.A.C. Title 18, Chapter 9, Article 7 regarding infrastructure and technology and potable use criteria.

ADEQ is planning a second rulemaking phase that will involve amending A.A.C. Title 18, Chapter 11, Article 3, Reclaimed Water Quality Standards. To assist ADEQ in revising the reclaimed water quality standards, ADEQ has convened an expert workgroup to review the suitability of existing standards in light of current knowledge and provide recommendations on revisions.

ADEQ has also convened a workgroup of experts to provide recommendations to ADEQ on infrastructure and technology for a third rulemaking phase. This work group is charged with two main tasks: (1) review the reclaimed water conveyance requirements (formerly A.A.C. Title 18, Chapter 9, Article 6 provisions, which have been proposed for incorporation into Part B of Article 7, and determine whether the current technical criteria are adequate, and (2) develop and recommend comprehensive criteria for advanced water treatment of reclaimed water for direct potable use. Comprehensive criteria for direct potable use would replace the interim criteria specified in Part E of this rulemaking. ADEQ intends to modify the reclaimed rules in phases, as opposed to all at once.

To get a flavor for advanced treatment, WateReuse AZ Members toured Pure Water San Diego, Orange County Groundwater Replenishment System, and Carlsbad Desalination Plant in March, 2017.

6 WATER PRODUCTION

6-1 Water Wells Peak Capacity

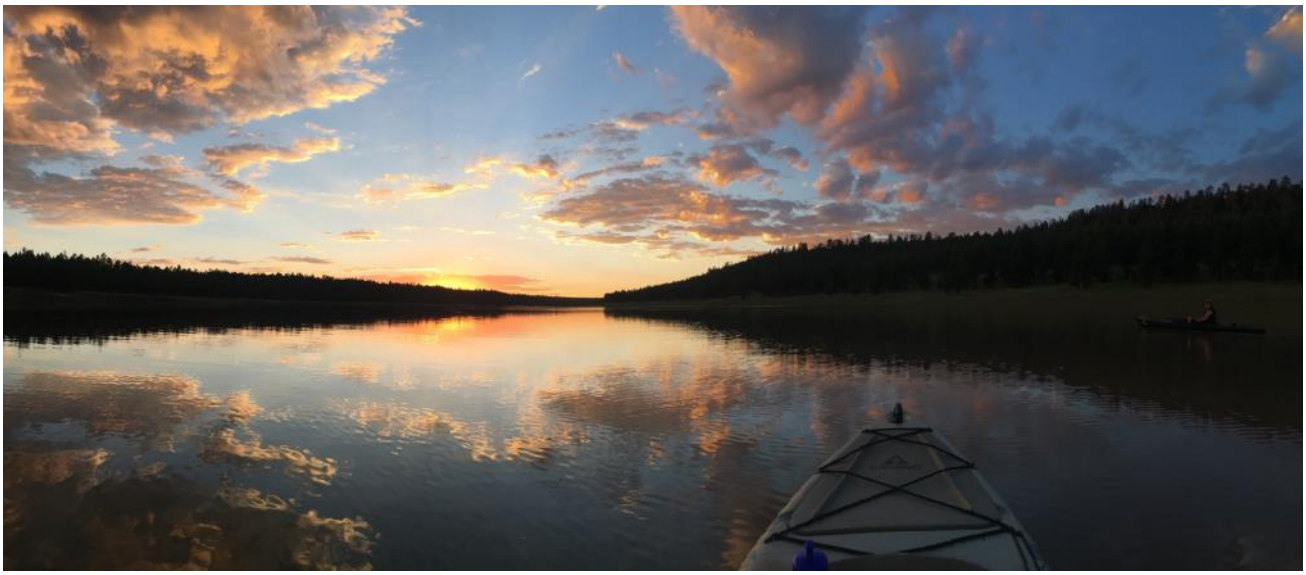


Photo by Peri Hill - Lake Mary at sunset

2018 Estimated Wells Peak Capacity					
Local Wells Maximum Production (gpm)		**Lake Mary Wells Maximum Production (gpm)**		**Woody Mountain Wells Maximum Production (gpm)**	
Continental-2	310	LM 1	155	WM 1	225
Foxglenn	350*	LM 2	390	WM 2	225
Sinagua	300*	LM 4	400	WM 3	565
Shop	920	LM 5	290	WM 4	320
Ft. Tuthill	1,225	LM 8	720	WM 5	280
Interchange	185	LM 9	240	WM 6	350
Rio	200			WM 7	550
McAllister	On Hold			WM 9	460
*Foxglenn/Sinagua pumphouse limited to max volume of 600 gpm				WM 10	280
				WM 11	355
Total gpm	**3,440 GPM**	**2,195 GPM**		**3,610 GPM**	
Total MGD	**4.95 MGD**	**3.16 MGD**		**5.20 MGD**	
		TOTAL PEAK WELL CAPACITY		**13.31 MGD**	
		WITH ONE HIGH-CAPACITY WELL REDUNDANCY (15%)		**11.31 MGD**	

6-2 Historical Production Data

HISTORICAL PRODUCTION BY SOURCE

YEAR	Lake Mary Surface		Inner Basin Spring		Inner Basin Wells		Woody Mtn. Wells		Lake Mary Wells		Local Wells		TOTAL		Calendar Precip in inches	Snow (Oct-April) inches
	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG		
1949	278.75	90.83	1077.98	351.26									1356.72	442.09	26.40	
1950	775.02	252.54	488.81	159.28									1263.83	411.82	10.76	63.30
1951	1131.68	368.76	102.90	33.53									1234.58	402.29	25.79	73.40
1952	210.89	68.72	1219.88	397.50									1430.78	466.22	20.60	105.90
1953	1044.71	340.42	262.08	85.40									1306.79	425.82	12.81	60.00
1954	1182.29	385.25	321.31	104.70									1503.60	489.95	19.55	89.00
1955	1488.75	485.11	190.27	62.00									1679.02	547.11	17.97	67.80
1956	825.35	268.94	114.47	37.30			383.70	125.03					1323.52	431.27	10.37	42.70
1957	1159.67	377.88	476.91	155.40			87.52	28.52					1724.10	561.80	24.59	53.00
1958	616.29	200.82	1191.65	388.30			97.90	31.90					1905.84	621.02	21.24	71.50
1959	1591.95	518.74	301.67	98.30			49.19	16.03					1942.82	633.07	21.46	63.80
1960	1745.37	568.73	547.49	178.40			275.99	89.93					2568.84	837.06	16.60	77.60
1961	1618.62	527.43	352.92	115.00			388.15	126.48					2359.70	768.91	18.95	53.90
1962	1519.44	495.11	890.59	290.20			209.79	68.36					2619.82	853.67	18.11	128.90
1963	1663.37	542.01	118.15	38.50			1145.58	373.29					2927.10	953.80	14.52	47.30
1964	1303.69	424.81	342.18	111.50			1184.19	385.87					2830.07	922.18	19.04	89.40
1965	1713.51	558.35	1164.34	379.40			291.54	95.00					3169.39	1032.75	36.59	166.70
1966	2361.39	769.46	919.13	299.50	2.15	0.70	598.56	195.04					3881.22	1264.70	20.58	83.40
1967	2906.82	947.19	444.99	145.00	3.38	1.10	34.74	11.32					3389.92	1104.61	22.27	63.10
1968	2988.54	973.82	772.75	251.80	165.32	53.87	213.63	69.61					4140.24	1349.10	16.53	150.40
1969	2722.07	886.99	930.18	303.10	324.20	105.64	296.76	96.70	42.41	13.82			4315.62	1406.25	23.41	134.70
1970	3206.56	1044.86	686.51	223.70	477.49	155.59	349.24	113.80	0.00	0.00			4719.80	1537.95	24.02	95.70
1971	2600.39	847.34	188.12	61.30	497.56	162.13	999.87	325.81	477.06	155.45			4763.01	1552.03	21.01	56.60
1972	1953.04	636.40	235.69	76.80	538.56	175.49	1625.50	529.67	459.69	149.79			4812.48	1568.15	24.67	50.30
1973	3594.59	1171.30	1043.42	340.00	366.00	119.26	464.63	151.40	0.00	0.00			5468.63	1781.96	19.71	210.00
1974	3999.44	1303.22	189.26	61.67	411.45	134.07	821.51	267.69	144.79	47.18			5566.44	1813.83	17.41	70.00
1975	2209.84	720.08	711.52	231.85	429.64	140.00	1038.27	338.32	1160.65	378.20			5549.93	1808.45	20.10	141.10
1976	3415.92	1113.08	489.00	159.34	543.19	177.00	942.15	307.00	0.00	0.00			5390.26	1756.42	20.12	131.60
1977	2606.99	849.49	66.66	21.72	518.92	169.09	1755.96	572.18	744.63	242.64			5693.15	1855.12	18.77	70.20
1978	2754.63	897.60	629.12	205.00	480.31	156.51	1197.45	390.19	602.42	196.30			5663.94	1845.60	30.72	116.20
1979	3782.83	1232.64	1049.90	342.11	449.35	146.42	773.42	252.02	288.32	93.95			6343.82	2067.14	19.68	145.50
1980	3863.91	1259.06	1128.12	367.60	652.05	212.47	512.38	166.96	56.19	18.31			6212.66	2024.40	29.30	177.10
1981	3308.75	1078.16	181.77	59.23	740.92	241.43	1041.95	339.52	865.12	281.90			6138.51	2000.24	23.37	92.40
1982	3775.56	1230.27	796.47	259.53	603.65	196.70	741.14	241.50	611.32	199.20			6528.14	2127.20	31.09	96.90
1983	2892.27	942.45	1148.93	374.38	427.22	139.21	1038.05	338.25	858.46	279.73			6364.93	2074.02	29.47	142.60

HISTORICAL PRODUCTION BY SOURCE (continued)

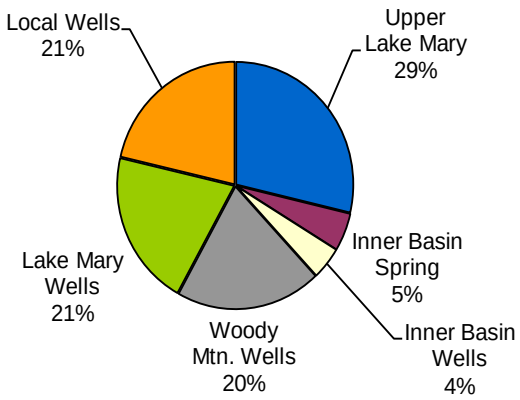
YEAR	Lake Mary Surface		Inner Basin Spring		Inner Basin Wells		Woody Mtn. Wells		Lake Mary Wells		Local Wells		TOTAL		Calendar Precip in inches	Snow (Oct-April) inches
	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG	AF	MG		
1984	2770.16	902.66	253.52	82.61	726.25	236.65	1967.28	641.04	717.87	233.92			6435.09	2096.88	20.09	32.00
1985	4540.94	1479.67	721.16	234.99	398.83	129.96	663.86	216.32	934.45	304.49			7259.24	2365.43	26.67	136.00
1986	4235.89	1380.27	541.35	176.40	715.70	233.21	268.40	87.46	1055.05	343.79			6816.40	2221.13	32.39	105.40
1987	5701.38	1857.80	467.27	152.26	637.16	207.62	7.55	2.46	822.58	268.04			7635.94	2488.18	23.98	121.60
1988	5339.25	1739.80	86.91	28.32	778.52	253.68	125.30	40.83	1731.71	564.28			8061.69	2626.91	21.68	104.50
1989	355.99	116.00	0.00	0.00	839.71	273.62	3371.79	1098.70	4539.10	1479.07			9106.59	2967.39	14.44	77.70
1990	101.89	33.20	35.11	11.44	279.27	91.00	3411.38	1111.60	4713.35	1535.85			8540.99	2783.09	25.67	113.40
1991	3512.34	1144.50	134.69	43.89	38.36	12.50	2313.33	753.80	2217.88	722.70			8216.61	2677.39	21.83	127.90
1992	3012.42	981.60	214.82	70.00	293.69	95.70	1267.14	412.90	2817.55	918.10			7605.62	2478.30	34.71	159.40
1993	4130.42	1345.90	550.56	179.40	194.26	63.30	1624.06	529.20	1718.27	559.90			8217.56	2677.70	35.25	147.10
1994	3428.87	1117.30	236.00	76.90	271.90	88.60	1901.18	619.50	1903.94	620.40			7741.88	2522.70	21.91	149.20
1995	3400.02	1107.90	432.71	141.00	303.51	98.90	1426.73	464.90	2256.55	735.30			7819.52	2548.00	17.79	109.50
1996	1900.41	619.25	0.00	0.00	345.13	112.46	3115.60	1015.22	2849.19	928.41			8210.32	2675.34	11.81	33.70
1997	1784.04	581.33	0.00	0.00	730.52	238.04	2709.37	882.85	2835.01	923.79			8058.93	2626.01	16.40	132.20
1998	3363.19	1095.90	482.15	157.11	129.60	42.23	1510.20	492.10	2393.12	779.80			7878.26	2567.14	27.36	137.00
1999	1186.49	386.62	151.20	49.27	240.11	78.24	3189.77	1039.39	3224.05	1050.56			7991.63	2604.08	15.79	63.00
2000	784.78	255.72	23.07	7.52	681.13	221.95	4013.39	1307.77	3410.12	1111.19			8912.49	2904.14	15.40	74.40
2001	946.75	308.50	162.25	52.87	267.42	87.14	3530.60	1150.45	3690.57	1202.58	206.55	67.30	8804.14	2868.84	17.59	125.10
2002	195.67	63.76	0.00	0.00	24.77	8.07	4779.91	1557.54	3334.68	1086.61	432.90	141.06	8767.93	2857.04	12.88	38.90
2003	615.77	200.65	18.81	6.13	188.71	61.49	4136.09	1347.75	3111.45	1013.87	543.47	177.09	8614.31	2806.98	17.91	54.90
2004	900.96	293.58	0.00	0.00	200.67	65.39	3625.86	1181.49	2213.25	721.19	1308.51	426.38	8249.26	2688.03	23.61	50.30
2005	3670.33	1195.98	302.65	98.62	325.06	105.92	1775.60	578.58	1108.45	361.19	945.46	308.08	8127.55	2648.37	24.01	138.00
2006	1553.51	506.21	73.89	24.08	508.75	165.78	2551.64	831.46	2576.73	839.63	1324.73	431.66	8589.25	2798.82	15.59	44.50
2007	294.70	96.03	38.82	12.65	336.00	109.49	4050.78	1319.95	2591.47	844.43	1573.15	512.61	8884.92	2895.16	17.46	49.90
2008	2929.50	954.58	265.22	86.42	161.01	52.47	2352.76	766.65	1502.99	489.75	1273.19	414.87	8484.67	2764.74	18.85	90.80
2009	3744.16	1220.04	262.09	85.40	0.00	0.00	1662.50	541.73	1412.75	460.35	1317.95	429.45	8399.44	2736.97	11.65	138.20
2010	3987.93	1299.47	198.67	64.74	0.00	0.00	1460.55	475.92	1132.62	369.07	1571.85	512.19	8351.63	2721.39	27.89	140.50
2011	3416.24	1113.19	0.00	0.00	0.00	0.00	1536.10	500.54	1109.53	361.54	2234.85	728.23	8296.72	2703.49	20.67	103.60
2012	934.52	304.51	0.00	0.00	0.00	0.00	3063.61	998.28	1439.86	469.18	3020.44	984.21	8458.42	2756.19	14.89	69.70
2013	1572.73	512.48	99.00	32.26	0.00	0.00	2774.00	903.91	1680.86	547.71	2518.33	820.60	8644.92	2816.96	24.79	44.00
2014	1037.90	338.17	18.00	5.87	237.60	77.42	2574.60	838.87	1726.80	562.64	2752.10	896.70	8347.00	2719.67	20.67	57.00
2015	1854.16	604.18	175.97	57.34	66.99	21.83	2096.88	683.27	1524.47	496.75	2294.61	747.70	8013.08	2611.07	27.25	62.90
2016	1625.08	529.53	90.27	29.41	110.48	36.00	2064.12	672.60	1453.76	473.71	2634.98	858.61	7978.69	2599.86	25.80	95.50
2017	1782.60	580.86	367.74	119.83	0.00	0.00	2126.15	692.81	1101.49	358.92	2613.75	851.69	7991.74	2604.12	18.00	37.40
Historic Average	**2259.43**	**733.99**	**393.90**	**128.35**	**339.66**	**110.68**	**1574.30**	**512.99**	**1615.56**	**526.43**	**1680.40**	**547.56**	**5878.28**	**1915.44**	**21.31**	**94.81**
Percent of total	28.7%		5.0%		4.3%		20.0%		20.5%		21.4%					
Historic Median	1900.41	619.25	783.39	85.40	324.63	105.78	1346.93	438.90	1439.86	469.18	1571.85	512.19	6435.09	2096.88	20.60	90.10
Ave of last 5 yrs	1467.83	478.29	125.16	40.78	69.18	22.54	2449.89	798.29	1487.87	484.82	2639.03	859.92	8238.98	2684.64	21.90	61.08
Percent of total		19.2%		1.8%		1.0%		28.4%		18.3%		31.3%				

6-3 2017 Weekly Production By Source (Million Gallons)

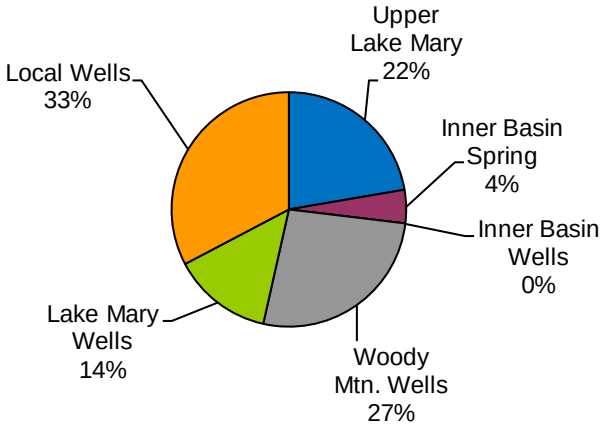
MONTH	WEEK	TOTAL	LM SURFACE	LM WELLS	WM WELLS	R F P	LOC WELLS
January	1	28.88	8.164	5.754	6.842	0.000	8.123
	2	40.06	9.946	8.209	9.570	0.000	12.334
	3	38.77	4.518	8.760	9.448	0.000	16.044
	4	39.75	0.253	9.807	8.813	0.000	20.873
	5	45.35	4.899	9.397	9.876	0.000	21.180
February	1	40.99	10.314	8.093	9.592	0.000	12.994
	2	42.11	13.453	7.967	9.945	0.000	10.748
	3	43.95	11.722	7.374	10.062	0.000	14.792
	4	40.28	10.976	6.665	9.330	0.000	13.310
March	1	43.32	12.466	4.709	9.934	0.000	16.213
	2	40.67	11.220	4.984	10.061	0.000	14.402
	3	42.67	11.639	5.459	11.323	0.000	14.250
	4	42.07	10.640	5.414	12.152	0.000	13.863
April	1	43.83	11.642	5.718	10.198	0.000	16.272
	2	45.43	13.136	6.064	9.872	0.000	16.354
	3	48.32	12.668	5.275	13.481	0.000	16.896
	4	52.24	15.259	5.374	13.410	0.000	18.200
	5	56.66	17.061	5.543	13.542	1.922	18.591
May	1	57.16	15.971	4.979	13.738	5.690	16.779
	2	55.24	15.034	4.259	13.243	6.392	16.308
	3	56.41	14.146	5.278	13.667	6.140	17.181
	4	60.60	14.895	5.414	13.605	7.980	18.705
June	1	66.49	18.592	5.651	13.960	9.766	18.521
	2	66.54	16.453	5.366	13.662	13.493	17.563
	3	71.57	18.157	5.374	14.885	13.848	19.306
	4	64.02	12.817	6.975	16.612	12.420	15.194
July	1	70.31	16.533	7.909	15.976	10.085	19.804
	2	60.08	4.131	13.594	16.385	7.439	18.529
	3	54.15	9.954	11.445	13.755	5.529	13.469
	4	48.00	8.894	10.510	12.594	3.965	12.038
	5	48.95	14.834	7.244	9.714	3.998	13.157
August	1	53.30	13.023	6.591	14.412	3.451	15.826
	2	50.32	14.903	7.146	12.188	2.678	13.402
	3	53.34	17.185	7.029	11.326	2.777	15.027
	4	56.88	16.282	7.092	13.124	2.256	18.122
September	1	58.95	17.824	7.321	13.168	0.000	20.636
	2	55.59	8.067	5.611	18.848	0.000	23.063
	3	56.71	0.000	0.000	30.888	0.000	25.819
	4	54.74	3.471	6.933	26.585	0.000	17.750
	5	53.40	11.223	7.693	18.905	0.000	15.575
October	1	54.97	10.383	7.653	17.632	0.000	19.303
	2	50.42	5.586	8.102	16.912	0.000	19.820
	3	44.36	8.438	5.911	14.719	0.000	15.287
	4	54.17	10.805	6.624	19.766	0.000	16.973
November	1	43.31	3.794	3.141	18.702	0.000	17.668
	2	44.06	5.662	3.291	19.037	0.000	16.065
	3	37.68	6.539	7.666	9.857	0.000	13.615
	4	46.29	8.972	9.231	13.090	0.000	14.992
December	1	43.84	11.765	9.072	8.813	0.000	14.186
	2	41.78	11.323	8.532	8.412	0.000	13.510
	3	41.64	10.280	8.694	8.250	0.000	14.412
	4	53.56	14.955	11.025	8.928	0.000	18.651
Total year, 2017 (MG)		**2604.11**	**580.86**	**358.92**	**692.81**	**119.83**	**851.69**
	Acre-Feet	**7991.73**	**1782.60**	**1101.49**	**2126.15**	**367.74**	**2613.75**
Total year, 2016 (MG)		**2599.86**	**529.533**	**473.710**	**672.597**	**65.415**	**858.609**
		TOTAL	**LM SURFACE**	**LM WELLS**	**WM WELLS**	**RFP**	**LOC WELLS**
2017 % of 2016		**100%**	**110%**	**76%**	**103%**	**183%**	**99%**
2017 % By Source			**22%**	**14%**	**27%**	**5%**	**33%**
AVG DAILY (mgd)		**7.13**	**1.59**	**0.98**	**1.90**	**0.33**	**2.33**

RFP = Reservoir Filtration Plant
Difference between total and sum of individual wells on page 19 & 20 is due to meter inaccuracies.

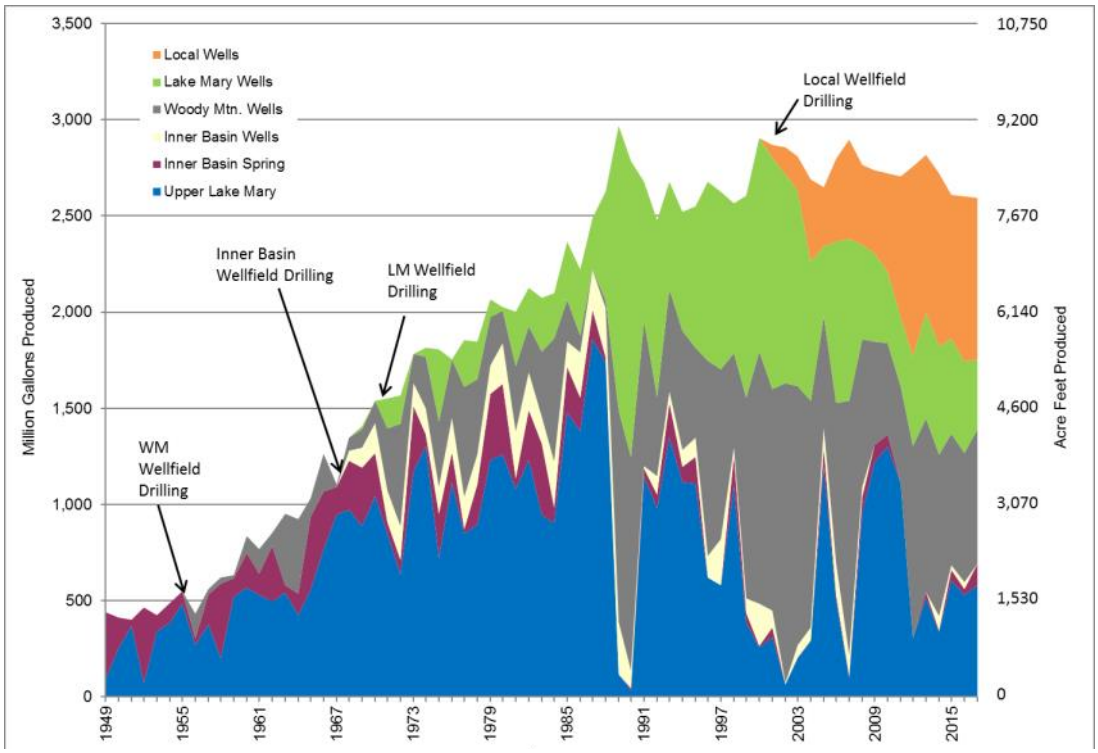
Historic Average (1949-2017)



Potable Water Supply 2017



Production by Source (1949-2017)



Mark Richardson, Operations Manager, during a staff site visit to the spigot on Waterline Road. Water Production shut off flow at the spigot in 2017 due to concerns that the site is not designated as an Entry Point into the Distribution System.

6-4 Most Recent Distribution System Water Quality at Each EPDS (Entry Point to the Distribution System)

	unit	MCL	Year	EPDS 001 Woody Mtn.	Year	EPDS 002 N. Res. Plant	Year	EPDS 003 Lake Mary	Year	EPDS 004 Foxglenn	Year	EPDS 005 Continental	Year	EPDS 006 Interchange	Year	EPDS 007 Shop	Year
Arsenic	mg/L	**0.01**	**2017**	0.0075	**2017**	<0.001	**2015**	0.0026	**2015**	0.003	**2015**	0.0017	**2015**	0.0021	**2017**	0.0017	**2015**
Barium	mg/L	**2**	**2017**	0.64	**2017**	0.007	**2015**	0.18	**2015**	0.18	**2015**	0.52	**2015**	0.28	**2017**	1.1	**2015**
Cadmium	mg/L	**0.005**	**2017**	<0.0005	**2017**	<0.0005	**2015**	<0.0005	**2015**	<0.0005	**2015**	<0.0005	**2015**	<0.0005	**2017**	<0.0005	**2015**
Chromium	mg/L	**0.01**	**2017**	0.0013	**2017**	<0.001	**2015**	<0.001	**2015**	0.0023	**2015**	0.0029	**2015**	0.0023	**2017**	0.0014	**2015**
Fluoride	mg/L	**4**	**2017**	0.09	**2017**	0.097	**2015**	0.087	**2015**	0.056	**2015**	0.12	**2015**	0.093	**2017**	0.1	**2015**
Mercury	mg/L	**0.002**	**2017**	<0.0002	**2017**	<0.0002	**2015**	<0.0002	**2015**	<0.0002	**2015**	<0.0002	**2015**	<0.0002	**2017**	<0.0002	**2015**
Nitrate	mg/L	**5**	**2017**	0.14	**2017**	<0.1	**2017**	0.15	**2017**	0.29	**2017**	1.9	**2017**	0.58	**2017**	0.98	**2017**
Nitrite	mg/L	**0.5**	**2017**	<0.05	**2017**	<0.05	**2016**	<0.05	**2017**	<0.05	**2016**	<0.05	**2016**	<0.05	**2017**	<0.05	**2016**
Selenium	mg/L	**0.05**	**2017**	<0.005	**2017**	<0.005	**2015**	<0.005	**2015**	<0.005	**2015**	<0.005	**2015**	<0.005	**2017**	<0.005	**2015**
Antimony	mg/L	**0.006**	**2017**	<0.001	**2017**	< 0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2017**	<0.001	**2015**
Beryllium	mg/L	**0.004**	**2017**	<0.001	**2017**	<0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2017**	<0.001	**2015**
Cyanide	mg/L	**0.2**	**2017**	<0.005	**2017**	<0.005	**2015**	<0.005	**2015**	<0.005	**2015**	<0.005	**2015**	<0.005	**2017**	<0.005	**2015**
Nickel	mg/L	**0.1**	**2012**	<0.005	**2017**	<0.005	**2013**	<0.005	**2012**	<0.005	**2015**	<0.005	**2015**	<0.005	**2017**	<0.005	**2015**
Thallium	mg/L	**0.002**	**2017**	<0.001	**2017**	<0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2015**	<0.001	**2017**	<0.001	**2015**
Sodium	mg/L	**NA**	**2017**	5.3	**2017**	2.2	**2015**	6.6	**2015**	7.4	**2015**	8.3	**2015**	4	**2017**	5.3	**2015**
Asbestos	MFL	**7**	**2012**	<0.2	**2008**	<0.2	**2011**	<0.2	**2012**	<0.2	**2012**	<0.2	**2015**	<0.2	**2012**	<0.2	**2015**
Adjusted Gross Alpha	pCi/L	**15**	**2017**	3.0 ± 0.7	**2016**	0.6 ± 0.5	**2012**	<1.0	**2015**	1.8 ± 0.8	**2012**	< 1.0	**2012**	1.3 ± 0.7	**2017**	1.7 ± 0.6	**2015**
Combined Uranium	µg/L	**30**	**2017**	0.9 ± 0.4	**2016**	< 0.5	**2012**	1.8 ± 0.7	**2015**	1.2 ± 0.5	**2012**	1.5 ± 0.5	**2012**	1.5 ± 0.5	**2017**	1.0 ± 0.5	**2015**
Combined Radium	pCi/L	**5**	**2017**	0.6 ± 0.2	**2016**	<0.3	**2012**	0.4 ± 0.1	**2015**	0.5 ± 0.2	**2012**	< 0.4	**2012**	<0.4	**2017**	< 0.6	**2015**

mg/L = milligrams per liter
MFL = million fibres per liter
pCi/L = picocuries per liter. Picocuries per liter is a measure of the radioactivity in water.
µg/L = micrograms per Liter
Drinking water regulations only call for sampling every couple of years depending on the EPDS.

6-5 City Supply Wells & Registration Information

CADASTRAL	NAME	ADWR REGISTRATION NUMBER	DATE OF COMPLETION
A (21-06) 35 cbd	Woody Mtn Well #1	55-606201	Dec-54
A (21-06) 35 ccb	Woody Mtn Well #2	55-606202	Jul-56
A (21-06) 35 bcc	Woody Mtn Well #3	55-606203	Oct-57
A (21-06) 35 ccc	Woody Mtn Well #4	55-606204	Nov-57
A (20-06) 02 bbc	Woody Mtn Well #5	55-606205	Jun-63
A (20-06) 02 bdb	Woody Mtn Well #6	55-606206	Mar-68
A (20-06) 11 bab	Woody Mtn Well #7	55-606207	Apr-78
A (20-06) 11 cab	Woody Mtn Well #9	55-509026	Nov-85
A (20-06) 02 bcb	Woody Mtn Well #10	55-548560	Mar-96
A (20-06) 11 baa	Woody Mtn Well #11	55-559574	Jun-98
A (20-08) 18 bbb	Lake Mary Well #1	55-606195	Oct-62
A (20-08) 18 ccb	Lake Mary Well #2	55-606196	Dec-64
A (20-07) 12 dda	Lake Mary Well #3	55-606197	Sep-65
A (20-08) 19 aba	Lake Mary Well #4	55-606198	Jan-72
A (20-08) 20 dbc	Lake Mary Well #5	55-606199	Dec-75
A (20-08) 27 bdc	Lake Mary Well #7	55-606200	Dec-78
A (20-08) 20 cca	Lake Mary Well #8	55-501228	Mar-82
A (20-08) 30 cdb	Lake Mary Well #9	55-532282	Sep-91
A (23-07) 33 aab	Inner Basin Well #9	55-606209	Aug-68
A (23-07) 27 cca	Inner Basin Well #11	55-606210	Aug-71
A (23-07) 28 ddb	Inner Basin Well #14	55-606211	Aug-70
A (21-07) 24 aac	Foxglenn Well (EPDS 4)	55-559572	Jan-97
A (21-08) 17 bca	Continental Well-2 (EPDS 5)	55-560805	Feb-97
A (21-08) 07 dbb	Interchange Well (EPDS 6)	55-588998	Nov-02
A (21-08) 05 dca	Shop Well (EPDS 7)	55-588257	Dec-02
A (21-07) 23 cbb	Rio Well (EPDS 8)	55-599535	Nov-03
A (20-07) 06 adc	Ft. Tuthill Well (EPDS 9)	55-907084	Jan-08
A (21-07) 24 acd	Sinagua Well (EPDS 4)	55-907085	May-08
A (21-07) 19 bbd	McAllister Well	55-908260	Apr-09

* EPDS – Wells that are tested as an entry point to the distribution system (EPDS). See page 18 for drinking water quality data regulated by the Arizona Department of Environmental Quality. Other EPDS points include the Woody Mountain booster site (EPDS 001), Inner Basin water at the North Reservoir Plant (EPDS 002), and water from Upper Lake Mary (EPDS 003).

6-6 Potable & Reclaimed Power Cost—CY 2017

Water Source	Source	Electricity $/Kgal Raw Pump	Booster	Final Cost	Total Power Cost	Water Produced (MG)	Total Megawatt	Cost Per Acre-foot
Lake Mary Plant	$0.29	$0.09		$0.38	$219,933.36	578.772	2057.498	$124
Lake Mary Wells	$0.47	$0.09		$0.56	$206,094.56	368.026	1680.361	$182
Local Wells	$1.00		$0.04	$1.04	$885,760.72	851.693	8428.979	$339
Woody Mountain Wells	$0.75		$0.04	$0.79	$560,565.83	709.577	5703.993	$257
Inner Basin Springs	$0.00		$0.04	$0.04	$4,793.16	119.829	28.377	$13
Weighted Avg				**$0.71**				**$233**
Total					**$1,877,148**	**2,627.90**	**17,899.21**	

- Total electricity cost = Electricity Cost Data from Sustainability + Booster Station Cost Data from Water Production Section.
- Costs do not include operation and maintenance, staffing, or chemical treatment.
- Electrical charges to boost the water to homes in Flagstaff were distributed across WM, IB, and Local Wells only.
- No well water was produced from the Inner Basin in 2017.

Water Reclamation Plant	2017 Electricity Used to Treat Influent to Plants (kWh)			Electricity Used to Deliver Reclaimed Water (kWh)	Total Reclaimed Delivered (gallons)
	APS	Solar	Co-Gen		
Wildcat Hill	5,119,727	1,364,443	0	354,548	269,033,000
Rio de Flag	3,229,120	324,924		174,402	309,647,000
Totals	8,348,847	1,689,367	0	528,950	578,680,000
Cost to Utility	$854,570	$132,731		$58,185	

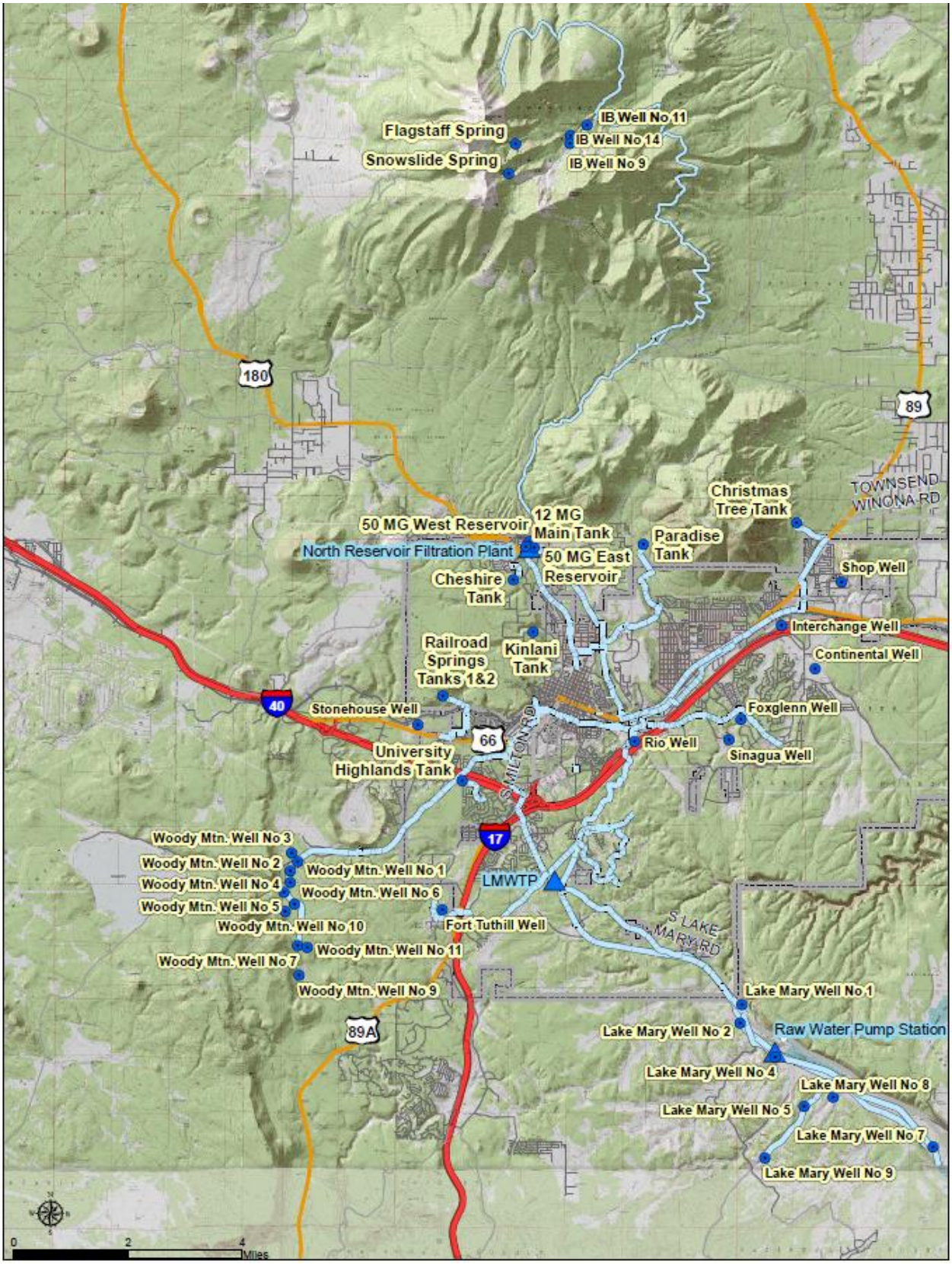
- Data from Water Services Division, Wastewater Treatment Section, April, 2018
- Note the energy cost above for reclaimed water is only that to pump into the reclaimed water system. Staff can not differentiate out the portion of the overall cost to treat wastewater from that to produce reclaimed water

Corrected Reclaimed Power Cost for CY 2015

Water Reclamation Plant	2015 Electricity Used to Treat Influent to Plants (kWh)			Electricity Used to Deliver Reclaimed Water (kWh)	Total Reclaimed Delivered (gallons)
	APS	Solar	Co-Gen		
Wildcat Hill	5,291,155	1,450,681	305,120	493,637	271,883,000
Rio de Flag	3,260,039	525,097		348,445	355,155,000
Totals	*8,551,194*	*1,975,778*	*305,120*	*842,081*	*627,038,000*
Cost to Utility	*$897,302*	*$277,844*	*$61,582*	*$92,629*	

7 WELL FIELDS

7-1 Well Fields & Infrastructure



7-2 City of Flagstaff Well Production History 1997-Present (million gallons)

YEAR	FOXGLN	CONTL	SHOP	INTRCH	RIO	SINAGUA	TUTHILL	LOCAL	IB9	IB11	IB14	IB TOTAL
1997									55.870	59.120	14.460	129.450
1998									8.550	19.330	15.340	43.220
1999	5.010	3.230						8.240	51.380	26.080	0.780	78.240
2000	0.000	29.565						29.565	77.189	90.945	46.294	214.428
2001	66.149	1.560						67.709	0.000	31.323	55.815	87.138
2002	56.860	77.748						134.608	0.000	3.004	2.145	5.149
2003	72.821	67.674	17.909	18.683				177.087	0.000	51.057	10.435	61.492
2004	35.972	49.939	243.317	97.148				426.376	0.000	35.240	27.951	63.191
2005	34.637	23.189	196.500	53.758				308.084	64.602	39.444	1.870	105.916
2006	47.892	87.574	195.908	100.290				431.664	32.675	78.434	54.667	165.776
2007	126.331	63.106	217.610	69.060	45.310			521.417	0.000	45.476	64.011	109.487
2008	1.507	26.311	283.149	40.980	62.926			414.873	0.000	16.209	36.257	52.466
2009	0.000	0.000	400.700	6.860	28.494			436.054	0.000	0.000	0.000	0.000
2010	0.916	3.530	332.100	13.360	33.151	9.816	119.317	512.190	0.000	0.000	0.000	0.000
2011	29.726	8.138	339.660	7.360	16.680	18.389	308.334	728.287	0.000	0.000	0.000	0.000
2012	46.527	22.945	341.300	6.820	8.999	81.859	475.765	984.215	0.000	0.000	0.000	0.000
2013	20.172	16.327	270.500	3.800	16.848	65.110	427.843	820.600	8.163	24.695	0.000	32.858
2014	40.430	53.900	271.510	12.170	8.960	44.330	465.440	896.740	0.000	33.914	43.493	77.407
2015	20.840	21.580	273.880	16.720	34.730	20.200	359.740	747.690	21.835	0.000	0.000	21.835
2016	30.280	29.235	240.546	23.215	13.567	76.801	444.966	858.609	0.000	19.744	16.257	36.001
2017	16.100	20.043	299.298	4.391	6.334	100.669	404.856	851.691	0.000	0.000	0.000	0.000

YEAR	LM1	LM2	LM4	LM5	LM7	LM8	LM9					LM TOTAL
1997	0.000	84.540	147.960	135.620		511.090	107.590					986.800
1998	17.590	2.460	85.860	92.270		487.110	135.370					820.660
1999	8.800	46.210	213.470	120.000		530.750	85.290					1004.520
2000	18.049	171.246	256.658	95.156		548.086	109.017					1198.212
2001	31.236	193.036	331.506	48.201		533.297	110.915					1248.191
2002	18.043	141.507	303.165	100.531	3.155	532.376	65.262					1164.039
2003	18.062	124.797	259.479	92.900	0.000	453.701	100.860					1049.799
2004	5.457	124.023	79.160	130.041	0.000	338.451	176.190					853.322
2005	11.002	44.665	63.565	24.370	0.000	200.544	40.717					384.863
2006	10.895	80.049	189.037	89.718	0.000	334.613	117.689					822.001
2007	33.275	91.488	233.631	100.913	16.447	305.751	72.482					853.988
2008	3.977	26.072	103.224	109.768	6.941	249.638	8.788					508.408
2009	4.103	35.694	112.210	3.526	0.000	252.675	49.133					457.341
2010	0.000	0.000	103.180	31.535	0.000	186.186	38.731					359.632
2011	0.000	0.000	134.570	22.095	0.000	133.152	65.001					354.818
2012	0.000	0.000	217.764	121.153	0.000	58.394	73.206					470.517
2013	0.000	0.000	149.343	59.407	0.000	251.275	83.193					543.218
2014	0.000	0.630	224.490	18.930	0.000	245.160	73.450					562.660
2015	0.000	61.929	128.494	55.409	0.000	186.722	63.372					495.926
2016	0.000	72.512	139.961	33.554	0.000	154.823	70.649					471.499
2017	0.000	30.883	46.956	22.451	0.000	206.451	49.245					355.986

YEAR	WM1	WM2	WM3	WM4	WM5	WM6	WM7	WM9	WM10	WM11		WM TOTAL
1997	37.560	127.310	161.340	94.810	63.410	184.890	102.720	123.810	74.100			969.950
1998	0.000	28.860	31.080	34.190	67.490	104.280	221.090	52.740	20.630			560.360
1999	72.130	47.830	167.510	105.150	107.960	142.730	228.990	113.670	91.210			1077.180
2000	108.875	98.554	222.164	106.091	145.106	212.489	181.241	111.777	138.465			1324.762
2001	79.803	139.872	283.900	109.490	70.137	187.515	91.275	57.525	125.001	101.162		1245.680
2002	107.903	101.841	288.102	153.620	88.919	154.482	223.042	153.087	122.189	166.234		1559.419
2003	54.234	48.651	48.651	62.113	14.955	98.042	286.197	322.218	140.888	147.873		1223.822
2004	70.978	55.726	293.108	108.986	38.876	124.902	164.845	116.272	114.012	78.764		1166.469
2005	28.143	10.887	117.863	77.798	20.303	49.420	119.721	141.219	24.155	16.429		605.938
2006	65.498	80.910	142.982	25.047	55.920	128.174	74.025	125.994	79.033	37.299		814.882
2007	31.433	118.277	285.269	103.927	62.540	113.881	170.067	150.048	113.680	137.164		1286.285
2008	1.197	46.644	149.636	34.252	8.789	61.866	151.793	114.561	13.991	160.537		743.266
2009	3.199	3.249	100.105	7.054	1.615	123.519	147.408	120.969	1.788	19.648		528.554
2010	0.379	12.449	78.100	2.430	0.509	50.999	116.248	132.377	11.759	11.759		417.009
2011	4.499	2.902	120.155	6.948	2.975	65.582	178.185	70.566	0.000	39.779		491.591
2012	0.000	29.521	301.868	8.292	45.413	144.554	146.182	111.161	34.845	150.802		972.638
2013	0.000	18.430	169.470	31.094	11.720	158.563	272.729	94.067	34.211	91.083		881.367
2014	0.000	52.290	170.170	38.250	31.940	101.290	119.240	137.980	22.400	165.310		838.870
2015	0.000	59.110	93.718	11.118	20.983	155.571	89.978	120.278	17.909	109.322		677.987
2016	0.000	4.723	231.889	0.000	0.000	158.761	144.885	86.199	13.086	43.066		682.608
2017	0.000	4.428	242.207	0.000	14.277	83.479	84.253	129.472	51.962	69.683		679.762

TOTAL ALL SOURCES

YEAR	MG	YEAR	MG	YEAR	MG	YEAR	MG	YEAR	MG	YEAR	MG
1996	2204.590	2000	2766.967	2004	1342.889	2008	1719.013	2012	2427.370	2016	2048.717
1997	2086.200	2001	2648.718	2005	1404.801	2009	1421.949	2013	2278.043	2017	1887.439
1998	1424.240	2002	1303.796	2006	2234.322	2010	1288.831	2014	2375.677		
1999	2168.180	2003	1288.378	2007	2771.177	2011	1574.696	2015	1943.438		

Totals will not necessarily match cumulative well field master meters due to unknown meter inaccuracies

City of Flagstaff Well Production History 1997-Present (acre-feet)

YEAR	FOXGLN	CONTL	SHOP	INTRCH	RIO	SINAGUA	TUTHILL	LOCAL	IB9	IB11	IB14	IB TOTAL
1997								0	171.46	181.43	44.38	397.27
1998								0	26.24	59.32	47.08	132.64
1999	15.38	9.91						25.29	157.68	80.04	2.39	240.11
2000	0	90.73						90.73	236.88	279.10	142.07	658.06
2001	203.00	4.79						207.79	0	96.13	171.29	267.42
2002	174.50	238.60						413.10	0	9.22	6.58	15.80
2003	223.48	207.68	54.96	57.34				543.46	0	156.69	32.02	188.71
2004	110.39	153.26	746.71	298.14				1308.50	0	108.15	85.78	193.93
2005	106.30	71.16	603.04	164.98				945.48	198.26	121.05	5.74	325.04
2006	146.98	268.75	601.22	307.78				1324.73	100.28	240.71	167.77	508.75
2007	387.70	193.66	667.82	211.94	139.05			1600.17	0	139.56	196.44	336.00
2008	4.62	80.75	868.95	125.76	193.11			1273.20	0	49.74	111.27	161.01
2009	0	0	1229.70	21.05	87.44			1338.20	0	0	0	0
2010	2.81	10.83	1019.18	41.00	101.74	30.12	366.17	1571.85	0	0	0	0
2011	91.23	24.97	1042.38	22.59	51.19	56.43	946.24	2235.03	0	0	0	0
2012	142.79	70.42	1047.41	20.93	27.62	251.22	1460.07	3020.44	0	0	0	0
2013	61.91	50.11	830.13	11.66	51.70	199.81	1313.00	2518.33	25.05	75.79	0	100.84
2014	124.08	165.41	833.23	37.35	27.50	136.04	1428.38	2751.99	0	104.08	133.48	237.55
2015	63.96	66.23	840.51	51.31	106.58	61.99	1104.00	2294.58	67.01	0	0	67.01
2016	92.93	89.72	738.21	71.24	41.64	235.69	1365.55	2634.98	0	60.59	49.89	110.48
2017	49.41	61.51	918.51	13.48	19.44	308.94	1242.46	2613.74	0	0	0	0

YEAR	LM1	LM2	LM4	LM5	LM7	LM8	LM9	LM TOTAL
1997		259.44	454.07	416.20		1568.48	330.18	3028.38
1998	53.98	7.55	263.49	283.17		1494.89	415.44	2518.51
1999	27.01	141.81	655.12	368.27		1628.81	261.75	3082.76
2000	55.39	525.53	787.65	292.02		1682.01	334.56	3677.18
2001	95.86	592.41	1017.35	147.92		1636.63	340.39	3830.56
2002	55.37	434.27	930.38	308.52	9.68	1633.80	200.28	3572.30
2003	55.43	382.99	796.31	285.10	0	1392.36	309.53	3221.71
2004	16.75	380.61	242.93	399.08	0	1038.67	540.71	2618.75
2005	33.76	137.07	195.07	74.79	0	615.45	124.96	1181.10
2006	33.44	245.66	580.13	275.33	0	1026.89	361.17	2522.63
2007	102.12	280.77	716.99	309.69	50.47	938.32	222.44	2620.79
2008	12.20	80.01	316.78	336.87	21.30	766.11	26.97	1560.25
2009	12.59	109.54	344.36	10.82	0	775.43	150.78	1403.53
2010	0	0	316.65	96.78	0	571.38	118.86	1103.67
2011	0	0	412.98	67.81	0	408.63	199.48	1088.90
2012	0	0	668.29	371.80	0	179.20	224.66	1443.96
2013	0	0	458.32	182.31	1.00	771.13	255.31	1668.07
2014	0	1.93	688.93	58.09	0	752.37	225.41	1726.74
2015	0	190.05	394.33	170.04	0	573.03	194.48	1521.94
2016	0	222.53	429.52	102.97	0	475.13	216.81	1446.98
2017	0	94.78	144.10	68.90	0	633.57	151.13	1092.48

YEAR	WM1	WM2	WM3	WM4	WM5	WM6	WM7	WM9	WM10	WM11	WM TOTAL
1997	115.27	390.70	495.13	290.96	194.60	567.41	315.24	379.96	227.40		2976.67
1998	0	88.57	95.38	104.93	207.12	320.02	678.50	161.85	63.31		1719.68
1999	221.36	146.78	514.07	322.69	331.32	438.02	702.74	348.84	279.91		3305.74
2000	334.13	302.45	681.80	325.58	445.31	652.10	556.21	343.03	424.93		4065.55
2001	244.91	429.25	871.26	336.01	215.24	575.46	280.11	176.54	383.61	310.45	3822.85
2002	331.14	312.54	884.15	471.44	272.88	474.09	684.49	469.81	374.98	510.15	4785.68
2003	166.44	149.31	149.31	190.62	45.90	300.88	878.31	988.85	432.37	453.81	3755.77
2004	217.82	171.02	899.52	334.47	119.31	383.31	505.89	356.83	349.89	241.72	3579.76
2005	86.37	33.41	361.71	238.75	62.31	151.66	367.41	433.39	74.13	50.42	1859.56
2006	201.01	248.30	438.80	76.87	171.61	393.35	227.17	386.66	242.54	114.47	2500.78
2007	96.46	362.98	875.46	318.94	191.93	349.49	521.92	460.48	348.87	420.94	3947.46
2008	3.67	143.15	459.22	105.12	26.97	189.86	465.84	351.57	42.94	492.67	2281.00
2009	9.82	9.97	307.21	21.65	4.96	379.07	452.38	371.24	5.49	60.30	1622.07
2010	1.16	38.20	239.68	7.46	1.56	156.51	356.75	406.25	36.09	36.09	1279.75
2011	13.81	8.91	368.74	21.32	9.13	201.26	546.83	216.56	0	122.08	1508.64
2012	0	90.60	926.40	25.45	139.37	443.62	448.62	341.14	106.94	462.79	2984.92
2013	0	56.56	520.08	95.42	35.97	486.61	836.97	288.68	104.99	279.52	2704.82
2014	0	160.47	522.23	117.38	98.02	310.85	365.93	423.45	68.74	507.32	2574.40
2015	0	181.40	287.61	34.12	64.39	477.43	276.13	369.12	54.96	335.50	2080.67
2016	0	14.49	711.64	0	0	487.22	444.64	264.54	40.16	132.16	2094.85
2017	0	13.59	743.31	0	43.82	256.19	258.56	397.33	159.47	213.85	2086.11

TOTAL ALL SOURCES (ACRE-FEET)

YEAR	AF	YEAR	AF	YEAR	AF	YEAR	AF	YEAR	AF	YEAR	AF
1996	6765.64	2000	6653.90	2004	4121.18	2008	5275.46	2012	7449.32	2016	6287.28
1997	6402.31	2001	8491.51	2005	4311.18	2009	4363.80	2013	6991.06	2017	5792.34
1998	4370.83	2002	4001.20	2006	6856.88	2010	3955.28	2014	7290.69		
1999	6653.90	2003	3953.89	2007	8504.43	2011	4832.56	2015	5964.19		

Totals will not necessarily match cumulative well field master meters due to unknown meter inaccuracies

7-3 Water Supply Sources & Specific Capacity

LAKE MARY SURFACE WATER PRODUCTION DESIGN CAPACITY	8.0 MGD
RESERVIOR FILTRATION PLANT CAPACITY	2.0 MGD

2015

LAKE MARY WELLS (year last modified)	Surface Elevation (feet)	Static Level (feet)	Dynamic Level (feet)	yield (gpm)	yield (MGD)	Drawdown (feet)	Specific Capacity (gpm/ft)
LM #1, 2002 Pump & Motor	6838	6178	5938	158	0.23	240	0.7
LM #2, 2008 Pump & Motor	6837	6249	5994	423	0.61	255	1.7
LM #4, 2009 Pump & Motor	6809	6242	5954	395	0.57	288	1.4
LM #5,	6816	6267	6182	272	0.39	85	3.2
LM #8, 2016 250 HP Pump and Motor	6818	6292	6071	623	0.90	221	2.8
LM #9, 2009 Pump & Motor	6875	6485	6095	230	0.33	390	0.6
MAXIMUM YIELD FOR WELLFIELD (MGD)				3.03			

2016

LAKE MARY WELLS (year last modified)	Static Level (feet)	From Surface (feet)	Dynamic Level (feet)	From Surface (feet)	Current yield (gpm)	Current yield (MGD)	Yield Gains and Losses	Drawdown (feet)	Specific Capacity (gpm/ft)
LM #1, 2002 Pump & Motor	***	***	***	***	***	***	***	***	***
LM #2, 2008 Pump & Motor	6240	-597	5941	-896	399	0.57	-6%	299	1.3
LM #4, 2009 Pump & Motor	6233	-576	5965	-844	438	0.63	11%	268	1.6
LM #5,	6297	-519	5899	-917	306	0.44	13%	398	0.8
LM #8, 2016 250 HP Pump and Motor	6291	-527	6033	-785	713	1.03	14%	258	2.8
LM #9, 2009 Pump & Motor	6502	-373	6140	-735	243	0.35	6%	362	0.7
MAXIMUM YIELD FOR WELLFIELD (MGD)					3.02				

2017

LAKE MARY WELLS (year last modified)	Static Level (feet)	From Surface (feet)	Dynamic Level (feet)	From Surface (feet)	Current yield (gpm)	Current yield (MGD)	Yield Gains and Losses	Drawdown (feet)	Specific Capacity (gpm/ft)
LM #1, 2002 Pump & Motor	***	***	***	***	***	***	***	***	***
LM #2, 2008 Pump & Motor	6242	-595	5949	-888	365	0.53	-9%	293	1.2
LM #4, 2009 Pump & Motor	6249	-560	6005	-804	407	0.59	-7%	244	1.7
LM #5,	6289	-528	6160	-657	292	0.42	-5%	129	2.3
LM #8, 2016 250 HP Pump and Motor	6244	-574	5986	-832	688	0.99	-4%	258	2.7
LM #9, 2009 Pump & Motor	5772	-368	5417	-723	231	0.33	-5%	355	0.7
MAXIMUM YIELD FOR WELLFIELD (MGD)					2.86				

2015

WOODY MTN. WELLS (year last modified)	Surface Elevation	Static Level	Dynamic Level	yield	yield	Drawdown	Specific Capacity
WM #1,	7137	5840	5618	228	0.33	222	1.0
WM #2,	7167	5885	5842	203	0.29	43	4.7
WM #3, 2015 Pump & Motor	7129	5909	5830	565	0.81	79	7.2
WM #4,	7163	6015	5946	300	0.43	69	4.3
WM #5,	7186	6041	5916	287	0.41	125	2.3
WM #6,	7201	6062	5801	375	0.54	261	1.4
WM #7, 2009 Pump & Motor	7171	6043	5888	561	0.81	155	3.6
WM #9, 2014 Pump & Motor	7088	6092	5746	429	0.62	346	1.2
WM #10, 2017 pump &motor	7240	6016	5852	278	0.40	164	1.7
WM #11, 2011 Pump & Motor	7170	6034	5755	353	0.51	279	1.3
MAXIMUM YIELD FOR WELLFIELD (MGD)				5.15			

2016

WOODY MTN. WELLS (year last modified)	Static Level	From Surface	Dynamic Level	From Surface	Current yield	Current yield	Gains and Losses	Drawdown	Specific Capacity
WM #1,	***	***	***	***	***	***	***	***	***
WM #2,	5886	-1281	5852	-1315	219	0.32	8%	34	6.4
WM #3, 2015 Pump & Motor	5910	-1219	5808	-1321	576	0.83	2%	102	5.6
WM #4,	6049	-1114	5847	-1316	410	0.59	37%	202	2.0
WM #5,	6073	-1113	5839	-1347	294	0.42	2%	234	1.3
WM #6,	6100	-1101	5849	-1352	394	0.57	5%	251	1.6
WM #7, 2009 Pump & Motor	6174	-997	5877	-1294	556	0.80	-1%	297	1.9
WM #9, 2014 Pump & Motor	6092	-996	5738	-1350	438	0.63	2%	354	1.2
WM #10, 2017 pump &motor	6102	-1138	5834	-1406	284	0.41	2%	268	1.1
WM #11, 2011 Pump & Motor	6034	-1136	5746	-1424	348	0.50	-1%	288	1.2
MAXIMUM YIELD FOR WELLFIELD (MGD)					5.07				

2017

WOODY MTN. WELLS (year last modified)	Static Level	From Surface	Dynamic Level	From Surface	Current yield	Current yield	Gains and Losses	Drawdown	Specific Capacity
WM #1,	5878	-1259	***	***	***	***	***	***	***
WM #2,	5883	-1284	5851	-1316	208	0.30	-5%	32	6.5
WM #3, 2015 Pump & Motor	5912	-1217	5805	-1324	558	0.80	-3%	107	5.2
WM #4,	6050	-1113	5946	-1217	303	0.44	-26%	104	2.9
WM #5,	6043	-1143	5942	-1244	288	0.41	-2%	101	2.9
WM #6,	6114	-1087	5884	-1317	399	0.57	1%	230	1.7
WM #7, 2009 Pump & Motor	6036	-1135	5891	-1280	577	0.83	4%	145	4.0
WM #9, 2014 Pump & Motor	6089	-1001	5733	-1357	406	0.58	-7%	356	1.1
WM #10, 2017 pump &motor	6074	-1166	5886	-1354	282	0.41	-1%	188	1.5
WM #11, 2011 Pump & Motor	6016	-1145	5767	-1394	344	0.50	-1%	249	1.4
MAXIMUM YIELD FOR WELLFIELD (MGD)					4.85				

2015

LOCAL WELLS (year last modified)	Surface Elevation	Static Level	Dynamic Level	yield	yield	Drawdown	Specific Capacity
Continental, 2006 Pump&Motor	6751	5436	5317	270	0.39	119	2.3
Foxglenn, 1997	6775	5442	5356	300	0.43	86	3.5
Shop, 2016 Motor, 2017 pump	6799	5332	5175	784	1.13	157	5.0
Sinagua, 2016 Pump & Motor	6770	5478	5287	236	0.34	191	1.2
Ft. Tuthil, 2016 Pump & Motor	7000	5878	5525	1140	1.64	353	3.2
*McAllister, Design Completed 2016	7060	*	*	*	0.00	*	*
Interchange, 2003	6790	5387	5220	187	0.27	167	1.1
Rio, 2006	6858	5744	5290	204	0.29	454	0.4
MAXIMUM YIELD FOR WELLFIELD (MGD)				4.49			

2016

LOCAL WELLS (year last modified)	Static Level	From Surface	Dynamic Level	From Surface	Current yield	Current yield	Gains and Losses	Drawdown	Specific Capacity
Continental, 2006 Pump&Motor	5401	-1350	5305	-1446	289	0.42	7%	96	3.0
Foxglenn, 1997	5429	-1346	5316	-1459	303	0.44	1%	113	2.7
Shop, 2016 Motor, 2017 pump	5350	-1449	5090	-1709	854	1.23	9%	260	3.3
Sinagua, 2016 Pump & Motor	5478	-1292	5250	-1520	294	0.42	25%	228	1.3
Ft. Tuthil, 2016 Pump & Motor	5881	-1119	5525	-1475	1209	1.74	6%	356	3.4
*McAllister, Design Completed 2016	*	*	*	*	*	0.00	*	*	*
Interchange, 2003	5387	-1403	5219	-1571	194	0.28	4%	168	1.2
Rio, 2006	5744	-1114	5100	-1758	206	0.30	1%	644	0.3
MAXIMUM YIELD FOR WELLFIELD (MGD)					4.82				

2017

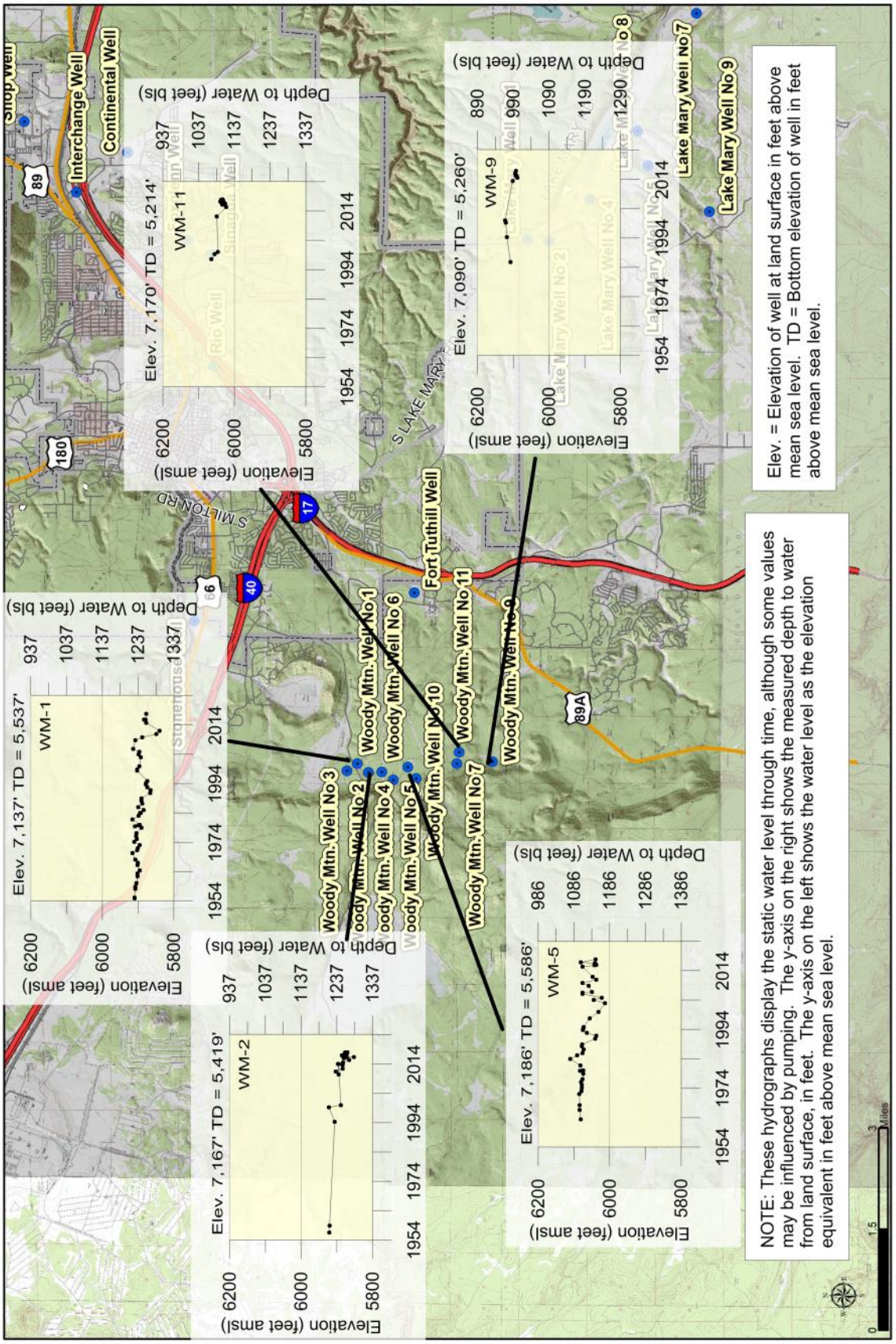
LOCAL WELLS (year last modified)	Static Level	From Surface	Dynamic Level	From Surface	Current yield	Current yield	Gains and Losses	Drawdown	Specific Capacity
Continental, 2006 Pump&Motor	5436	-1316	5316	-1436	241	0.35	-17%	120	2.0
Foxglenn, 1997	5428	-1348	5350	-1426	298	0.43	-2%	78	3.8
Shop, 2016 Motor, 2017 pump	5337	-1463	5162	-1638	919	1.32	8%	175	5.3
Sinagua, 2016 Pump & Motor	5482	-1288	5411	-1359	300	0.43	2%	71	4.2
Ft. Tuthil, 2016 Pump & Motor	5878	-1122	5807	-1193	1193	1.72	-1%	71	16.8
*McAllister, Design Completed 2016	*	*	*	*	*	0.00	*	*	*
Interchange, 2003	5384	-1406	5216	-1574	190	0.27	-2%	168	1.1
Rio, 2006	5744	-1114	5097	-1761	209	0.30	1%	647	0.3
MAXIMUM YIELD FOR WELLFIELD (MGD)					4.82				

* Not Equipped - Pump test only

** Not calculated

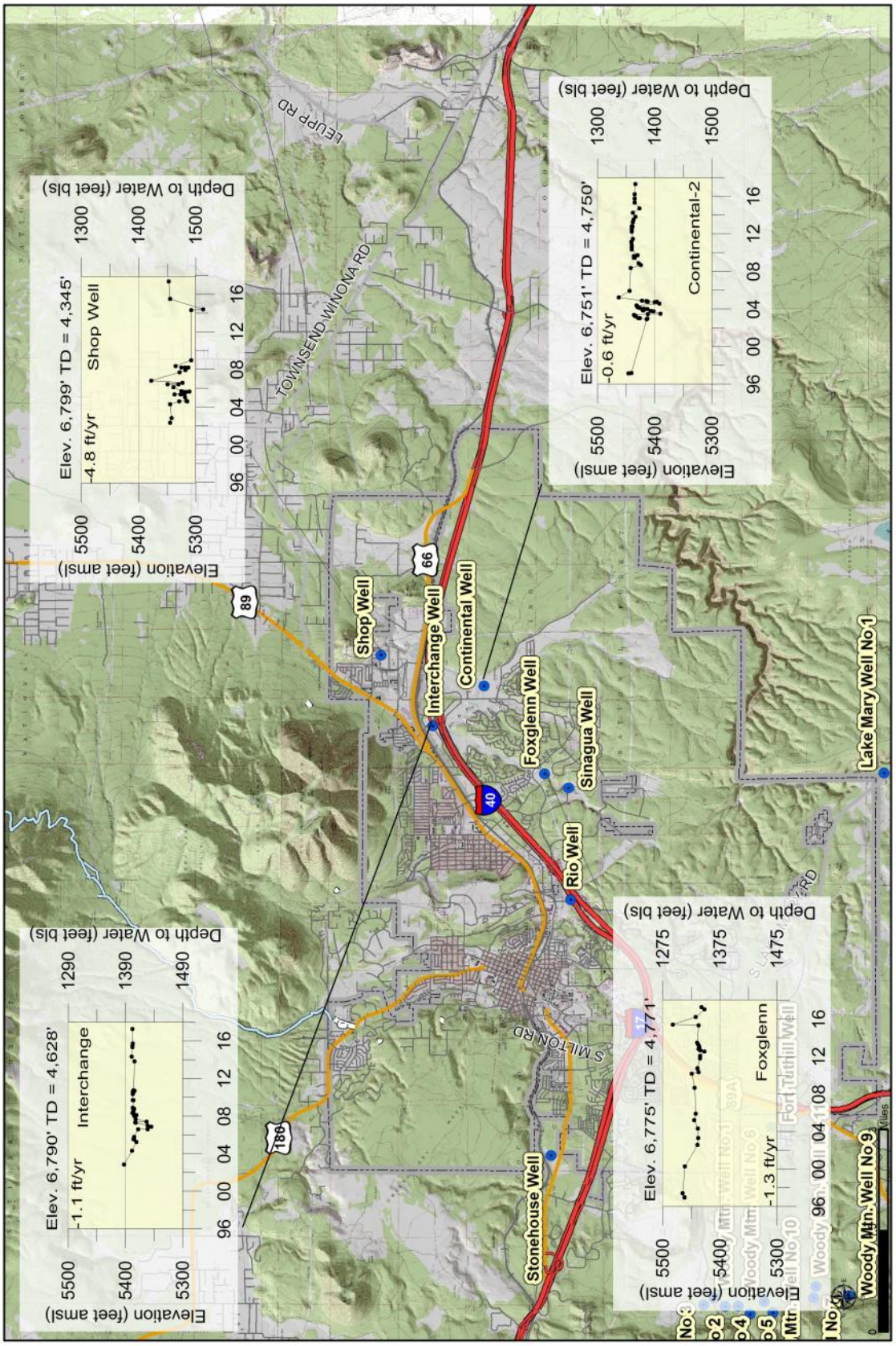
*** Not Run

7-4 Water Level Hydrographs Woody Mountain Wells



Water Level Hydrographs

Local Wells East

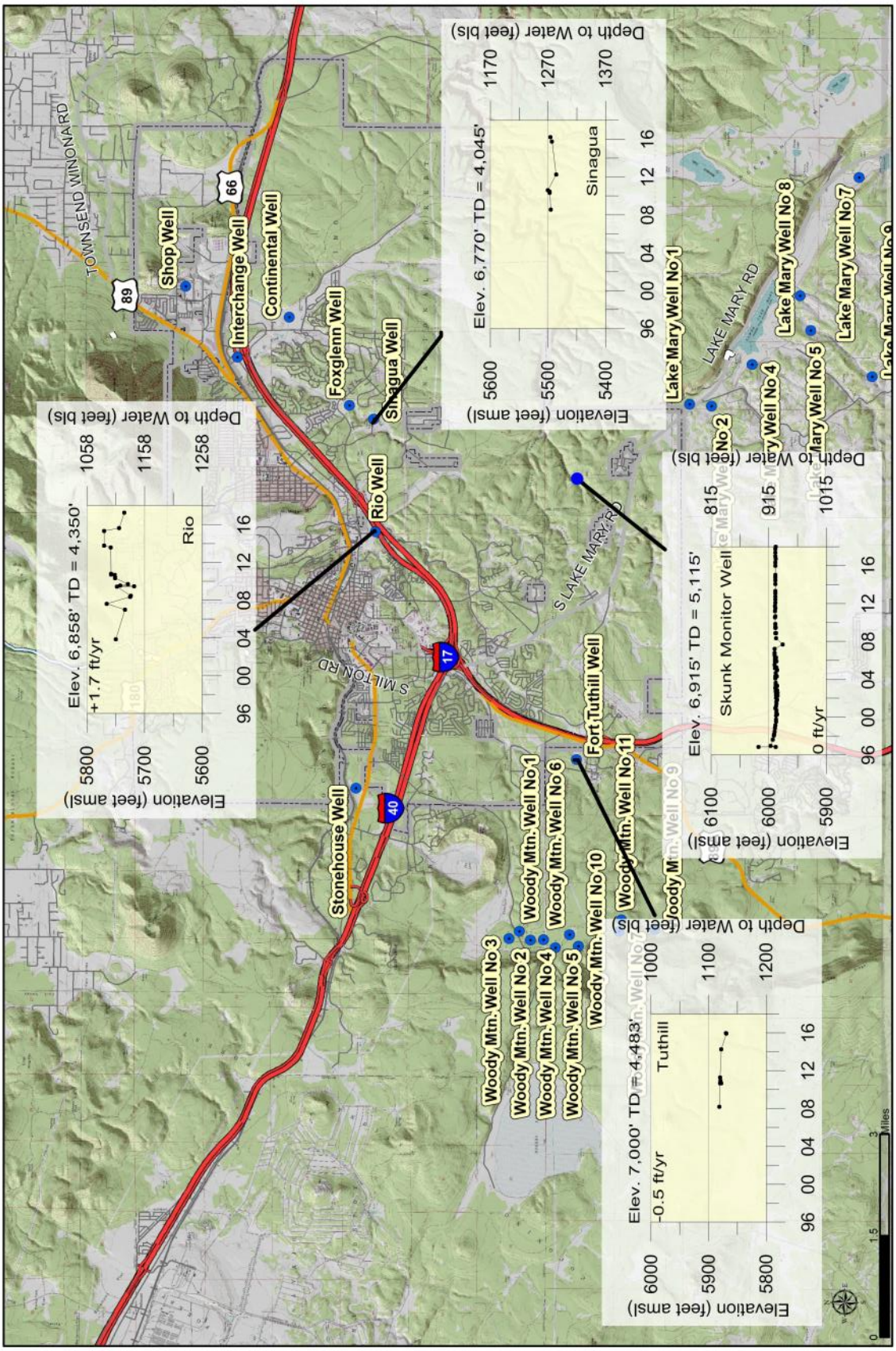


NOTE: These hydrographs display the static water level through time, although some values may be influenced by pumping. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level.

Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.

Water Level Hydrographs

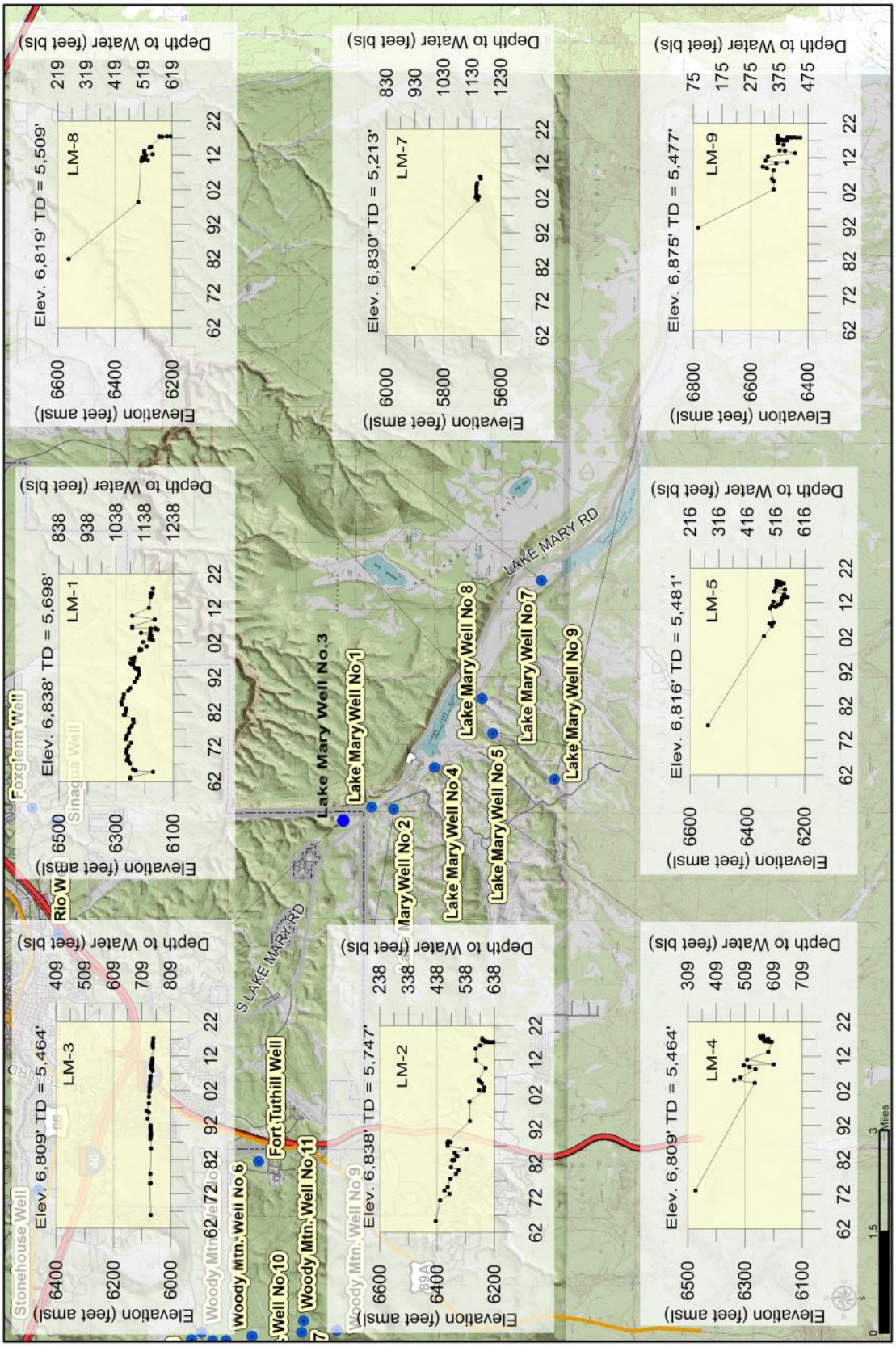
Local Wells West



NOTE: These hydrographs display the static water level through time, although some values may be influenced by pumping. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level.

Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.

Water Level Hydrographs Lake Mary Wells

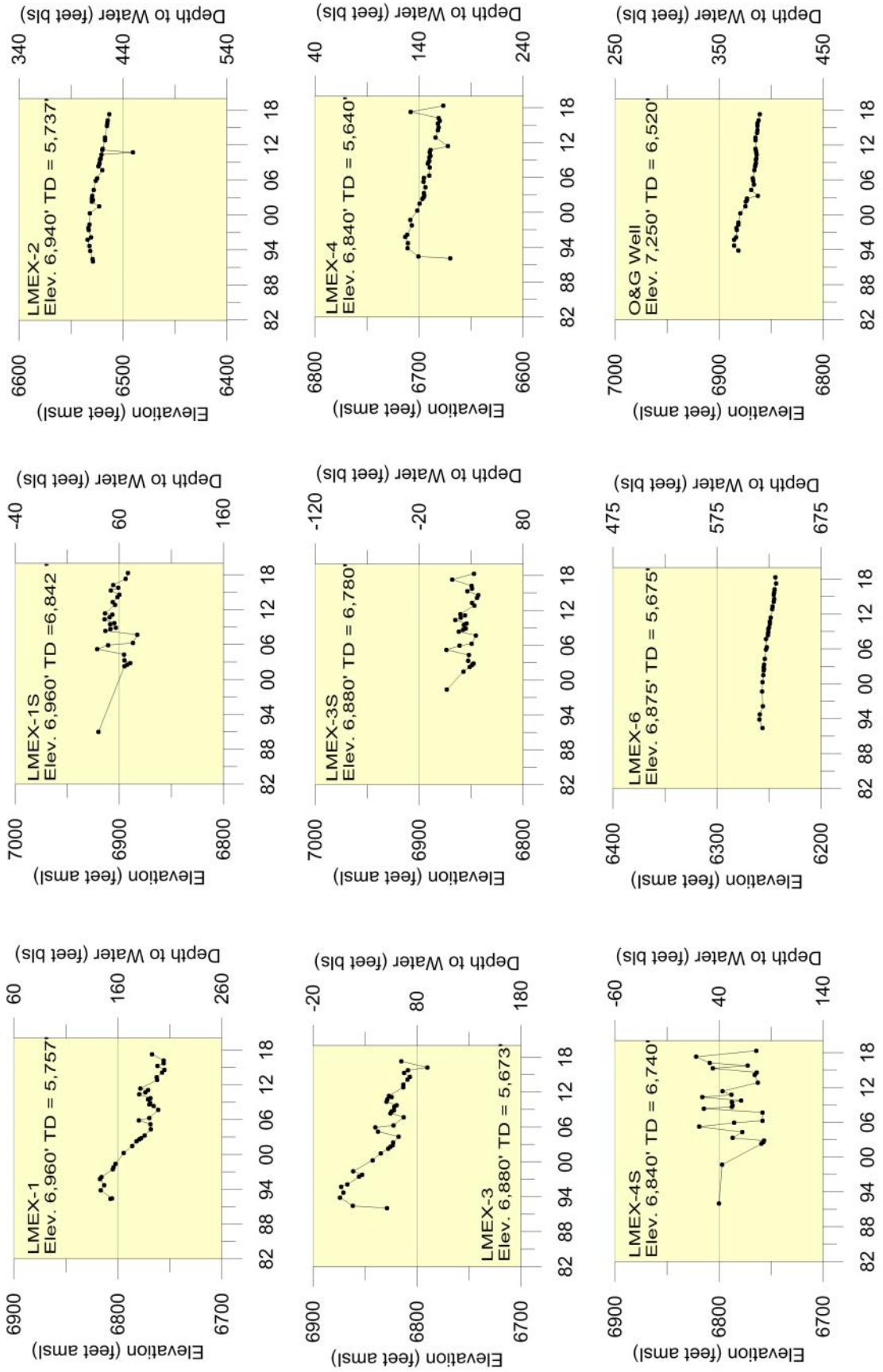


NOTE: These hydrographs display the static water level through time, although some values may show the influence of pumping. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level. The y-axis spread on all graphs is 400 feet.

Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.

Water Level Hydrographs

Lake Mary Observation Wells

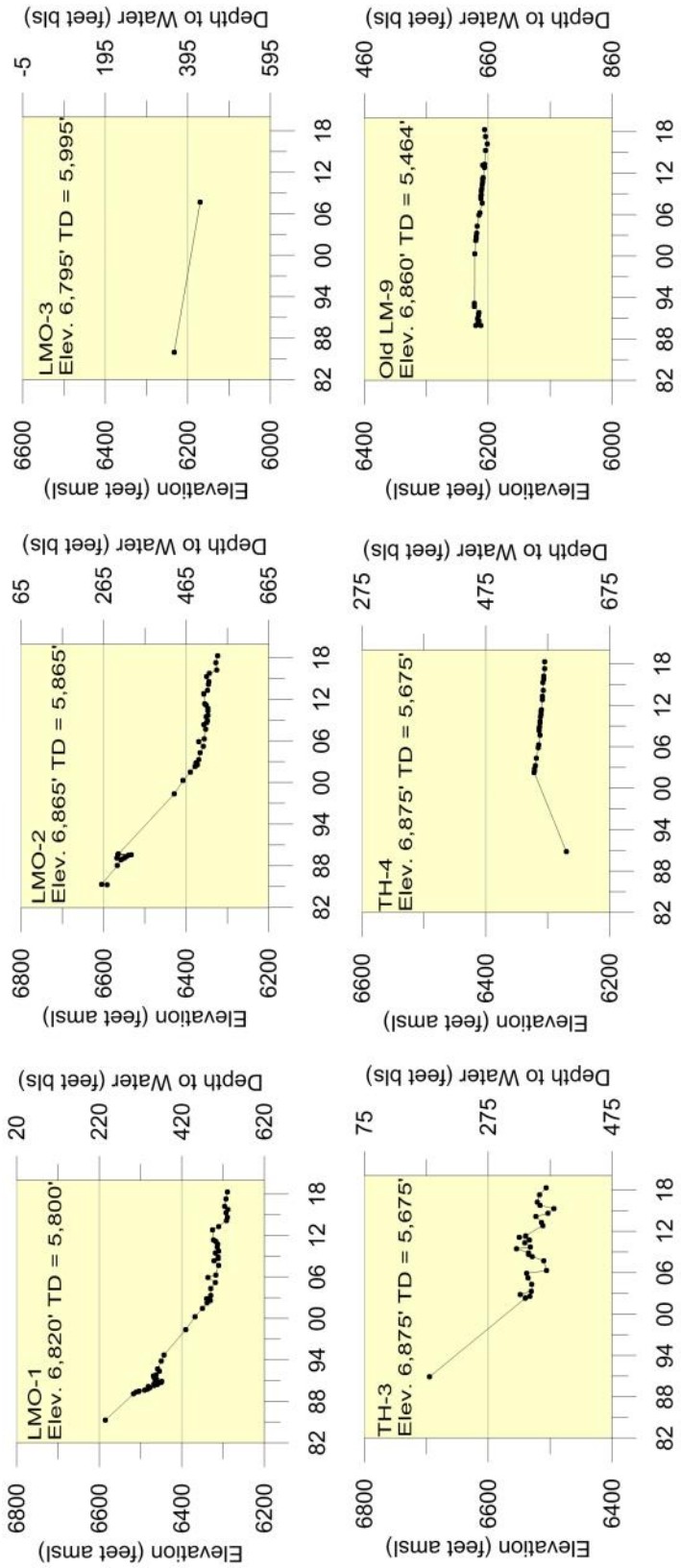


NOTE: These hydrographs display the static (non-pumping) water level through time. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level.

Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.

Water Level Hydrographs

Lake Mary Observation Wells (continued)

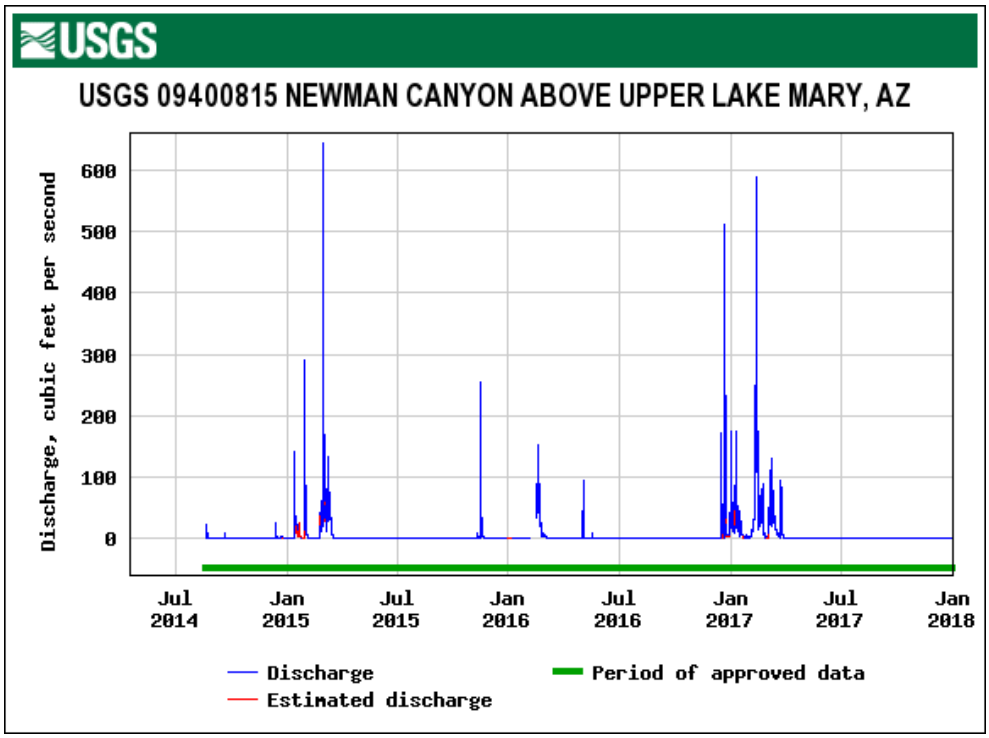


NOTE: These hydrographs display the static (non-pumping) water level through time. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level.

Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.

8 UPPER LAKE MARY

8-1 Upper Lake Mary Monitoring at Newman Canyon—2017 Summary



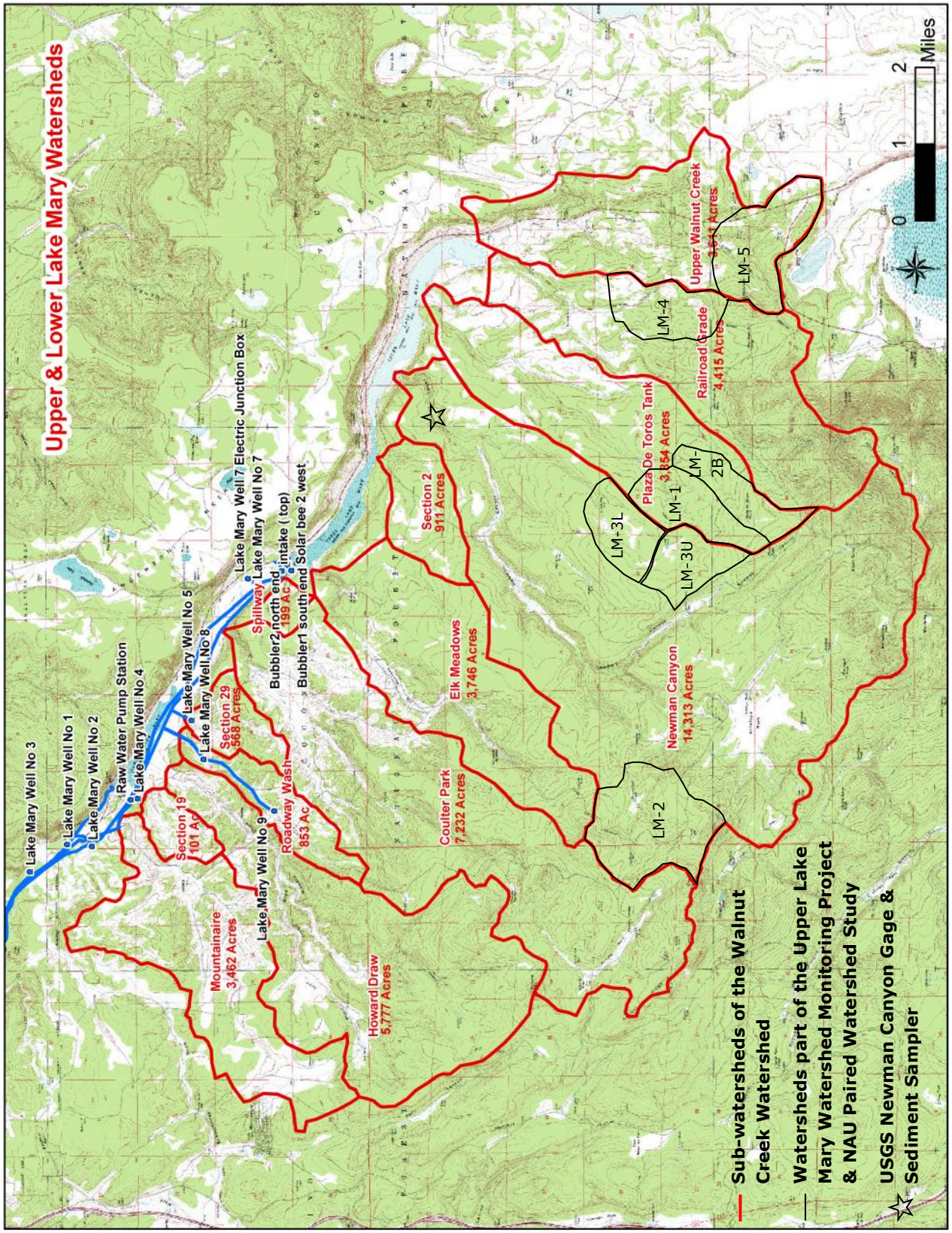
The Water Services Division, Flagstaff Watershed Protection Project & the Lake Mary Walnut Canyon Technical Advisory Committee partnered with the US Geological Survey to install a flow gage and sediment sampler in Newman Canyon in 2014 (see location on page 37). Newman Canyon is the largest single contributing tributary to Upper Lake Mary. Sediment data are available at http://cida.usgs.gov/sediment/ and stream gage data are available at http://waterdata.usgs.gov/nwis/rt Stream Gage 09400815

All Photos courtesy of the USGS Field Office. Photo at left: Mouth of Newman Canyon, Upper Lake Mary. Photo at right: Looking downstream from standing above the stream gauge.

Aerial photos taken by USGS in 2016. Clockwise upper left and upper right: Newman Canyon at ULM; lower right: ULM and LLM; lower left: Newman Canyon with Mormon Mountain to the south.

Field Day with SRP Staff, April, 2017. Left, Water Services Intern, Mellisa Yin, at Precip Gauge. Below: Mellisa, Luis Hernandez, Brad Hill, Lee Ester, Heather Jayo, Hector Buenrostro

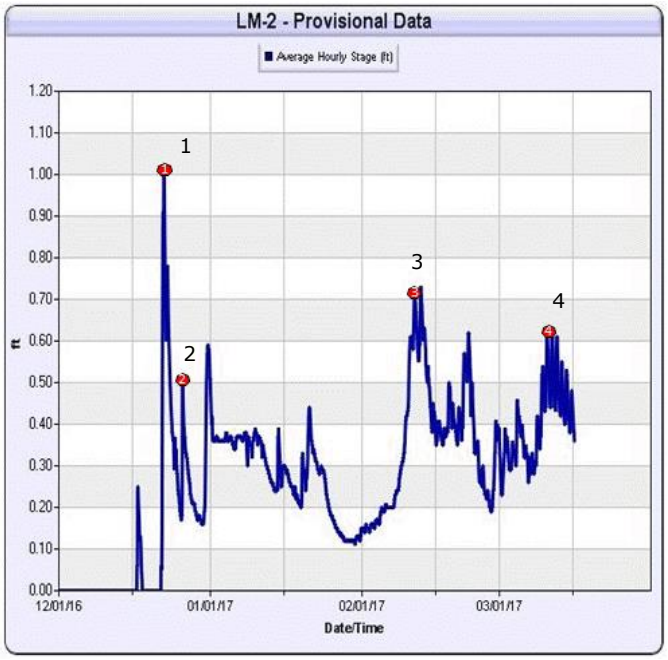
8-2 Upper & Lower Lake Mary Watersheds



8-3 Upper Lake Mary Monitoring - Flowtography ™

In 2015 the Water Services Division partnered with Salt River Project to provide ongoing operations and maintenance and data collection for six Flowtography™ sites within the 4FRI (Four Forests Restoration Initiative) area of the Upper Lake Mary Watershed (see map on page 37). Flowtography consists of a camera mounted in a tree that takes one photo every 15 minutes of a graduated rebar stake in the center of a channel. The channel has been surveyed for slope, cross-sectional area, and roughness such that flow can be calculated using Manning's equation. The height of water on the stream gage is recorded off of photographs taken during flow events. The flow record will be used as baseline data to compare with flow data collected after forest treatments. These data will help to answer the question of how or if forest treatment and maintenance effects surface water runoff into Upper Lake Mary.

Six Flowtography™ sites were installed in November 2014 and all six sites were equipped with a pressure transducer in 2016. Two additional Flowtography™ sites were installed at the Newman Canyon USGS gage site and LM-2B, in 2017.



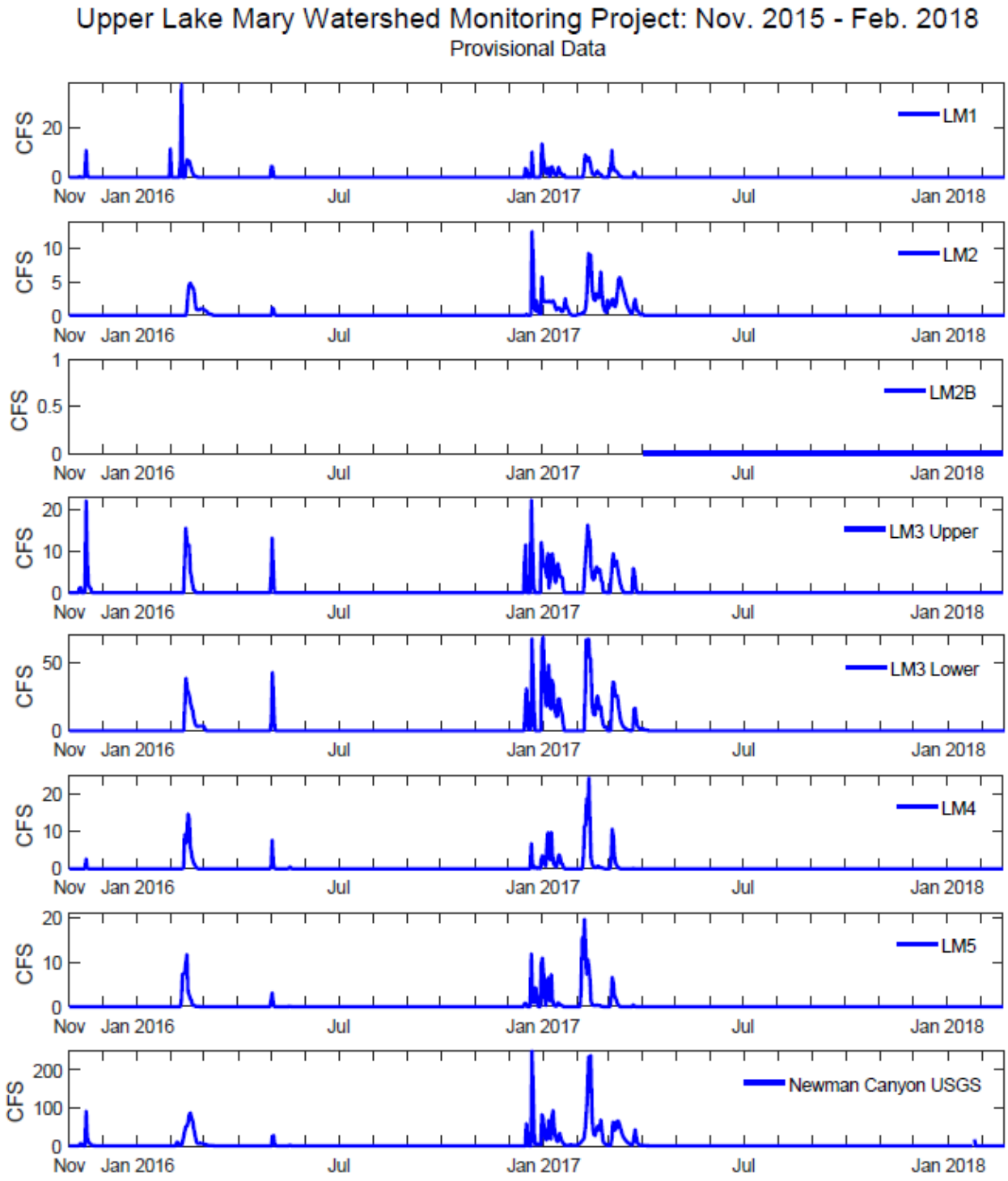
Picture #1 Peak flow

Picture #2 Snow melt beginning

Picture #3 Peak snow melt

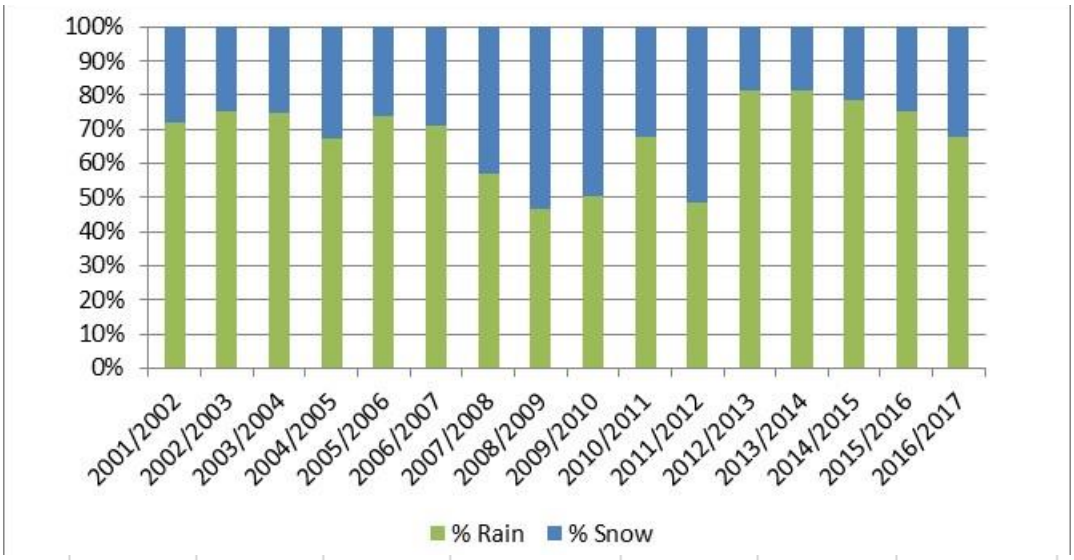
Picture #4 Flows receding

Flowtography ™ Results - Newman Canyon (Nov 2015—Feb 2018)



8-4 Climate monitoring

The Water Services Division is interested in snowpack and summer precipitation patterns. The graph below shows the annual rain to snow relationship for the past 16 water years. In the last 5 of 10 water years our annual precipitation has shifted to be more dominated by rain. A warming climate is a concern for the southwestern US as winter snowpack is significant for aquifer recharge and surface water reservoirs. Water Services will incorporate this and other climate scenario planning into its next Water Resources Master Plan. Data converted to determine rain/snow ratio assumes 1" of rain is equal to 12" of snow. The period of annual averages is from 90/91 to 16/17.



Annual Average	NWS Snow (inches)	NWS Monsoon Rainfall (inches)	NWS Total Precip (inches)	Winter Rain converted (calculated)	Total Rain converted (inches)	Snow as precip converted (inches)	% Rain	% Snow
2016/2017	96.50	8.19	25.07	8.84	17.03	8.04	68%	32%
2015/2016	78.30	10.47	26.31	9.32	19.79	6.53	75%	25%
2014/2015	62.90	7.06	24.42	12.13	19.18	5.24	79%	21%
2013/2014	44.4	12.73	19.98	3.55	16.28	3.70	81%	19%
2012/2013	58.9	15.67	26.39	5.81	21.48	4.91	81%	19%
2011/2012	102.9	6.3	16.73	1.86	8.16	8.58	49%	51%
2010/2011	88.4	8.43	22.82	7.02	15.45	7.37	68%	32%
2009/2010	140.5	10.29	23.71	1.71	12.00	11.71	51%	49%
2008/2009	86	2.51	13.38	3.70	6.21	7.17	46%	54%
2007/2008	99.5	5.44	19.27	5.54	10.98	8.29	57%	43%
2006/2007	50.4	8.32	14.59	2.07	10.39	4.20	71%	29%
2005/2006	44.6	8.14	14.14	2.28	10.42	3.72	74%	26%
2004/2005	131.7	6.38	33.49	16.14	22.52	10.98	67%	33%
2003/2004	48.1	7.94	15.9	3.95	11.89	4.01	75%	25%
2002/2003	54.9	9.05	18.33	4.71	13.76	4.58	75%	25%
2001/2002	38.9	7.61	11.63	0.78	8.39	3.24	72%	28%

8-5 Upper Lake Mary Average-Monthly Comparison (1960-2017)

	January	February	March	April	May	June	July	August	September	October	November	December
1960	15%	13%	12%	47%	43%	38%	34%	28%	26%	23%	21%	19%
1961	17%	16%	15%	22%	21%	17%	14%	13%	11%	9%	8%	7%
1962	6%	6%	35%	66%	68%	62%	55%	49%	43%	39%	35%	32%
1963	30%	28%	26%	23%	21%	18%	15%	12%	12%	10%	8%	7%
1964	7%	5%	5%	11%	24%	21%	17%	16%	14%	12%	10%	9%
1965	8%	21%	25%	43%	85%	81%	71%	67%	62%	56%	52%	79%
1966	100%	100%	99%	100%	97%	87%	80%	72%	65%	59%	53%	50%
1967	100%	95%	89%	84%	81%	74%	65%	64%	61%	55%	50%	46%
1968	44%	41%	62%	91%	99%	86%	78%	72%	66%	61%	56%	50%
1969	48%	86%	84%	100%	97%	88%	81%	75%	70%	65%	59%	56%
1970	52%	47%	46%	55%	57%	49%	43%	39%	35%	45%	39%	36%
1971	33%	29%	27%	26%	22%	18%	14%	11%	11%	9%	11%	10%
1972	38%	35%	33%	29%	26%	22%	20%	17%	16%	15%	64%	65%
1973	69%	66%	69%	87%	100%	99%	87%	82%	74%	66%	61%	55%
1974	51%	49%	45%	45%	40%	32%	25%	22%	18%	14%	12%	9%
1975	7%	5%	8%	24%	38%	34%	30%	28%	24%	22%	18%	16%
1976	14%	10%	33%	49%	62%	59%	51%	46%	40%	37%	33%	29%
1977	26%	24%	22%	19%	17%	14%	11%	8%	5%	3%	3%	3%
1978	2%	3%	57%	100%	96%	88%	77%	71%	65%	58%	54%	65%
1979	100%	97%	93%	100%	100%	95%	84%	76%	67%	60%	55%	51%
1980	48%	54%	100%	100%	100%	92%	84%	77%	67%	61%	55%	51%
1981	47%	42%	38%	38%	39%	33%	28%	23%	20%	18%	15%	13%
1982	12%	13%	40%	100%	96%	87%	78%	70%	66%	62%	56%	67%
1983	84%	83%	100%	100%	100%	94%	85%	79%	73%	82%	79%	76%
1984	91%	90%	85%	80%	74%	68%	59%	54%	51%	46%	43%	39%
1985	43%	41%	51%	100%	100%	92%	78%	70%	62%	59%	58%	60%
1986	57%	66%	84%	78%	71%	63%	57%	54%	52%	59%	53%	49%
1987	46%	57%	85%	87%	81%	71%	62%	56%	51%	45%	46%	43%
1988	38%	48%	50%	61%	54%	46%	39%	34%	31%	25%	23%	22%
1989	21%	26%	34%	32%	31%	23%	21%	20%	18%	17%	15%	15%
1990	15%	15%	19%	18%	17%	14%	14%	13%	13%	12%	12%	12%
1991	12%	14%	29%	52%	61%	54%	47%	40%	33%	29%	25%	21%
1992	21%	21%	42%	68%	66%	63%	56%	50%	48%	41%	38%	37%
1993	62%	100%	100%	100%	95%	87%	80%	71%	67%	59%	54%	53%
1994	49%	44%	46%	56%	58%	53%	43%	37%	33%	29%	26%	25%
1995	25%	25%	100%	97%	97%	91%	82%	75%	70%	66%	62%	56%
1996	54%	50%	46%	41%	36%	30%	26%	25%	23%	21%	20%	19%
1997	18%	23%	25%	45%	49%	44%	38%	33%	30%	28%	25%	23%
1998	22%	26%	21%	70%	91%	83%	73%	67%	57%	55%	51%	46%
1999	43%	40%	38%	37%	37%	34%	32%	30%	29%	40%	36%	33%
2000	30%	29%	49%	33%	32%	26%	22%	21%	18%	19%	19%	19%
2001	16%	16%	18%	38%	38%	34%	30%	27%	25%	24%	23%	22%
2002	19%	18%	17%	17%	15%	13%	11%	11%	9%	9%	9%	9%
2003	9%	9%	22%	39%	34%	32%	28%	28%	28%	27%	26%	26%
2004	26%	26%	26%	40%	37%	33%	28%	26%	25%	24%	23%	29%
2005	64%	100%	100%	100%	99%	91%	84%	76%	72%	67%	63%	58%
2006	54%	51%	48%	47%	44%	39%	35%	32%	30%	27%	25%	23%
2007	22%	22%	21%	21%	19%	17%	15%	14%	13%	12%	11%	12%
2008	25%	39%	55%	100%	98%	85%	76%	73%	70%	65%	62%	59%
2009	57%	56%	71%	75%	69%	62%	54%	49%	42%	38%	35%	32%
2010	30%	31%	32%	86%	99%	90%	82%	77%	70%	64%	59%	54%
2011	49%	53%	65%	61%	53%	46%	41%	36%	33%	31%	30%	29%
2012	28%	27%	30%	36%	32%	27%	24%	23%	22%	20%	19%	18%
2013	21%	29%	40%	41%	36%	31%	28%	27%	24%	33%	32%	31%
2014	30%	28%	41%	39%	36%	31%	28%	27%	27%	26%	24%	23%
2015	24%	32%	66%	66%	62%	57%	52%	48%	44%	42%	42%	43%
2016	42%	48%	55%	51%	50%	46%	41%	39%	36%	33%	31%	33%
2017	57%	82%	102%	98%	92%	82%	79%	75%	70%	66%	62%	58%
Historic Average	37.6%	40.5%	49.6%	59.7%	60.2%	54.3%	48.2%	44.1%	40.3%	38.0%	36.1%	35.1%
Historic Median	30.4%	31.5%	43.4%	53.6%	57.5%	50.9%	42.5%	38.9%	34.3%	34.9%	33.5%	32.0%

8-6 Upper Lake Mary Inflow Report & Predicted Water Budget (1949-2017)

YEAR	LOWEST LEVEL OCT-APRL	DATE	HIGHEST LEVEL SPRING	DATE	RUN-OFF GAIN	TOTAL YEARLY LOSS %	SURFACE WATER PROD	SW PROD LOSS OF LAKE	EVAP LOSS OF LAKE	CALENDAR YR PRECIP INCHES	SNOW SEASON, OCT-APRL
1960	11.1%	3/4/1960	46.4%	4/1/1960	35.3%	-32.9%	568.72	-11.17%	-21.73%	16.60	77.60
1961	13.5%	3/3/1961	21.8%	4/7/1961	8.3%	-16.6%	527.43	-10.36%	-6.24%	18.95	53.90
1962	5.2%	2/2/1962	66.9%	5/4/1962	61.7%	-39.3%	495.11	-9.73%	-29.57%	18.11	128.90
1963	27.6%	2/1/1963	27.6%	2/1/1963	0.0%	-23.7%	542.01	-10.65%	-13.05%	14.52	47.30
1964	3.9%	3/6/1964	23.5%	5/1/1964	19.6%	-15.8%	424.81	-8.34%	-7.46%	19.04	89.40
1965	7.7%	1/1/1965	82.1%	5/7/1965	74.4%	-30.8%	558.35	-10.97%	-19.83%	36.59	166.70
1966	51.3%	11/5/1965	100.0%	4/1/1966	48.7%	-51.0%	769.46	-15.11%	-35.89%	20.58	83.40
1967	49.0%	12/2/1966	95.6%	1/6/1967	46.6%	-54.8%	947.19	-18.61%	-36.19%	22.27	63.10
1968	40.8%	2/2/1968	94.5%	5/3/1968	53.7%	-46.4%	973.82	-19.13%	-27.27%	16.53	150.40
1969	48.1%	1/3/1969	100.0%	4/4/1969	51.9%	-53.6%	866.99	-17.03%	-36.57%	23.41	134.70
1970	46.4%	3/6/1970	56.8%	5/1/1970	10.4%	-27.5%	1044.86	-20.52%	-6.98%	24.02	95.70
1971	29.3%	2/5/1971	29.3%	2/5/1971	0.0%	-19.1%	847.34	-16.64%	-2.46%	21.01	56.60
1972	10.2%	12/3/1971	37.6%	1/7/1972	27.4%	-22.6%	636.40	-12.50%	-10.10%	24.67	50.30
1973	15.0%	10/6/1972	100.0%	5/4/1973	85.0%	-51.4%	1171.30	-23.01%	-28.39%	19.71	210.00
1974	48.6%	2/1/1974	48.6%	2/1/1974	0.0%	-43.6%	1303.22	-25.60%	-18.00%	17.41	70.00
1975	5.0%	2/7/1975	37.6%	5/2/1975	32.6%	-27.4%	720.08	-14.14%	-13.26%	20.10	141.10
1976	10.2%	2/6/1976	62.5%	5/7/1976	52.3%	-39.0%	1113.08	-21.86%	-17.14%	20.12	131.60
1977	23.5%	2/4/1977	23.5%	2/4/1977	0.0%	-21.2%	849.49	-16.69%	-4.51%	18.77	70.20
1978	2.3%	1/6/1978	100.0%	4/7/1978	97.7%	-46.0%	897.60	-17.63%	-28.37%	30.72	116.20
1979	54.0%	11/3/1978	100.0%	5/4/1979	46.0%	-52.3%	1232.64	-24.21%	-28.09%	19.68	145.50
1980	47.7%	1/4/1980	100.0%	5/2/1980	52.3%	-61.6%	1259.06	-24.73%	-36.87%	29.30	177.10
1981	38.4%	3/6/1981	38.7%	5/1/1981	0.3%	-26.2%	1078.16	-21.18%	-5.02%	23.37	92.40
1982	12.5%	1/8/1982	100.0%	4/2/1982	87.5%	-44.1%	1230.27	-24.17%	-19.93%	31.09	96.90
1983	55.9%	11/5/1982	100.0%	5/6/1983	44.1%	-24.0%	942.45	-18.51%	-5.49%	29.47	142.60
1984	76.0%	12/2/1983	90.7%	1/6/1984	14.7%	-52.0%	902.66	-17.73%	-34.27%	20.09	32.00
1985	38.7%	12/7/1984	100.0%	5/3/1985	61.3%	-43.2%	1479.67	-29.06%	-14.14%	26.67	136.00
1986	56.8%	1/24/1986	84.2%	3/28/1986	27.4%	-38.3%	1380.27	-27.11%	-11.19%	32.39	105.40
1987	45.9%	1/30/1987	86.9%	4/25/1987	41.0%	-49.3%	1857.80	-36.49%	-12.81%	23.98	121.60
1988	37.6%	1/24/1988	61.0%	4/28/1988	23.4%	-40.3%	1789.80	-35.16%	-5.14%	21.68	104.50
1989	20.7%	2/23/1989	34.8%	3/30/1989	14.1%	-19.6%	116.00	-2.28%	-17.32%	14.44	77.70
1990	15.2%	1/11/1990	19.2%	3/29/1990	4.0%	-7.1%	33.00	-0.65%	-6.45%	25.67	113.40
1991	12.1%	12/5/1990	63.4%	4/11/1991	51.3%	-42.4%	1144.50	-22.48%	-19.92%	21.83	127.90
1992	21.0%	1/30/1992	70.3%	4/9/1992	49.3%	-33.5%	981.60	-19.28%	-14.22%	34.71	159.40
1993	36.8%	12/28/1992	100.0%	4/15/1993	63.2%	-54.9%	1345.90	-26.44%	-28.46%	35.25	147.10
1994	45.1%	2/24/1994	58.7%	5/1/1994	13.6%	-34.9%	1117.30	-21.95%	-12.95%	21.91	149.20
1995	23.8%	2/12/1995	100.0%	4/27/1995	76.2%	-51.4%	1107.90	-21.76%	-29.64%	17.79	109.50
1996	48.6%	2/8/1996	48.6%	2/8/1996	0.0%	-30.2%	619.25	-12.16%	-18.04%	11.81	33.70
1997	18.4%	1/1/1997	51.8%	4/17/1997	33.4%	-30.9%	581.33	-11.42%	-19.48%	16.40	132.20
1998	20.9%	2/19/1998	90.7%	4/27/1998	69.8%	-53.5%	1095.90	-21.53%	-31.97%	27.36	137.00
1999	37.2%	4/1/1999	41.6%	4/15/1999	4.4%	-13.8%	386.62	-7.59%	-6.21%	15.79	63.00
2000	27.8%	9/9/1999	34.8%	4/4/2000	7.0%	-19.1%	255.77	-5.0%	-14.08%	15.40	74.40
2001	15.7%	1/1/2001	38.5%	4/16/2001	22.8%	-21.8%	308.50	-6.1%	-15.74%	17.59	125.10
2002	16.7%	3/30/2002	16.7%	3/30/2002	0.0%	-8.1%	63.76	-1.3%	-6.84%	12.88	38.90
2003	8.6%	2/6/2003	40.4%	3/27/2003	31.8%	-15.7%	200.650	-3.9%	-11.73%	17.91	54.90
2004	24.7%	2/22/2004	40.4%	3/26/2004	15.7%	-18.3%	293.579	-5.8%	-12.53%	23.61	50.30
2005	22.1%	10/20/2004	100.0%	4/7/2005	77.9%	-48.7%	1195.976	-23.5%	-25.20%	24.01	138.00
2006	51.3%	2/1/2006	51.3%	2/1/2006	0.0%	-30.6%	506.214	-9.9%	-20.66%	15.59	44.50
2007	20.7%	4/1/2007	20.7%	4/1/2007	0.0%	-10.2%	96.028	-1.8%	-8.4%	17.46	49.90
2008	10.5%	11/27/2007	100.0%	3/27/2008	89.47%	-45.7%	954.58	-17.94%	-27.76%	18.85	90.80
2009	54.3%	1/16/2009	76.7%	3/11/2009	22.40%	-47.2%	1220.038	-22.93%	-24.26%	11.65	138.20
2010	29.5%	1/8/2010	101.7%	4/11/2010	72.19%	-51.1%	1299.947	-24.44%	-26.66%	14.3	86.7
2011	50.6%	1/27/2011	65.8%	3/26/2011	15.19%	-38.9%	1113.1846	-20.92%	-17.97%	20.67	88.4
2012	26.9%	3/8/2012	37.3%	3/27/2012	10.40%	-19.6%	304.513	-5.72%	-13.88%	14.89	69.7
2013	17.7%	1/16/2013	43.6%	3/21/2013	25.90%	-16.2%	512.476	-9.63%	-6.53%	24.79	44.0
2014	27.4%	2/28/2014	42.3%	3/8/2014	14.85%	-20.3%	338.17	-6.36%	-13.93%	20.67	56.2
2015	22.0%	12/31/2014	69.9%	3/17/2015	47.9%	-28.5%	604.128	-11.36%	-17.14%	27.25	62.9
2016	41.4%	10/9/2015	55.8%	3/3/2016	14.4%	-26.8%	529.53	-9.95%	-16.88%	25.8	95.5
2017	29.0%	12/16/2016	100.0%	4/6/2017	71.0%	-54.1%	580.86	-10.92%	-43.18%	18.00	37.4
2018	45.9%	4/19/2018	45.9%	4/19/2018	0.0%	-25.9%	712	-13.38%	-12.52%		
2019	20.0%										
Historic Average %	29.7%		64.0%		34.3%	-34.1%	815.81	-15.9%	-18.3%	21.47	98.05
5 yr. average	0.33		0.63		30%	-31%	513.03	-10%	-20%	23.30	59.20

NOTES

Evaporation accounts for ~50% of total loss
Bold=low level occurred in fall of previous year

Cells highlighted in red are projected values used to determine approximate evaporation loss.
Stats on precip and snow amount are through 4/15/2017, National Weather Service Flagstaff
Surface water production is in million gallons

9 WATER CONSERVATION

9-1 Program Overview

The City recognizes water conservation as an important component of the overall Water Services water management program. In April, 2016, City Council suggested the program add focus to the commercial sector and added 0.1% to the increasing water rate dedicated to the Water Conservation Program. A full-time Water Conservation Specialist was added in FY18.

Water conservation has been an important proactive action to temper peak demand and to defer infrastructure costs of developing new supplies. In the last 25 to 30 years Flagstaff has seen an incredible reduction in water use per capita. Contributing factors include federal, state, and local plumbing code changes, rate structure and rate adjustments, fixture retrofit rebates, water education, distribution leak detection and reduction, and behavior change (all elements of the City's conservation program). Faced with a drought in 2002, Water Services created a full-time position, eventually expanding to 2 full time staff and 2 temporary staff, dedicated to water conservation. The program was cut during the recession in 2009 and 2010 and by FY16 the budget was back to match where it was pre-downturn.

A Water Conservation Strategic Plan is funded for FY18. This plan will provide the Water Conservation Program with program goals and actions, and will include input from the Flagstaff community.

The Water Conservation Program tightened up guidelines for high efficiency toilets, which has lowered the total number of dollars disbursed over the last two fiscal years. Participation for residents was made easier through utilization of the WaterWays software platform, which allows online submissions at www.waterrebates.com. There was only one household participant in the turf removal rebate program, which is being rebranded as the Low Water Landscape Rebate Program in 2018. This rebranding effort will accompany printouts of recommended plants for individual Flagstaff neighborhoods, and will budget for an hour of consulting for each property with staff from The Arboretum at Flagstaff. No residents participated in the rainwater harvesting rebate in 2017, though 15 households were given free 270 gallon rainwater harvesting containers through the Water Conservation Program's container reuse program.

9-2 2017 Program Accomplishments

9-3 Non-Revenue Water

In 2017, 92% of water produced was billed to customers. Non-revenue water equaled 662 acre-feet.

- Water main flushing—9 AF or 1%
- System leaks detected and repaired—163 AF or 25% (Leak Detection Phase III and IV)
- Other—undocumented flushing, undetected leaks, meter inaccuracies, billing inaccuracies

9-4 2017 Water Festival Summary

The City of Flagstaff Water Conservation Program once again partnered with Arizona Project WET (Water Education for Teachers) on hosting the popular fourth grade water festival on September 14, 2017 at Foxglenn Park. Over 1,000 fourth grade students from Flagstaff public, charter, and home schools participated in the event. Students used interactive models to discuss watersheds, the water cycle, groundwater flow and water conservation. The event was sponsored by the City of Flagstaff Water Conservation Program, Essity (formerly SCA), and Arizona Project WET.

This event would not have been successful without the help of volunteers from the City of Flagstaff, Northern Arizona University, Essity, and the Coconino Plateau Watershed Partnership. This event educates children about our most precious resource. Volunteers and staff were rewarded with pizza generously donated by Fratelli Pizza.

	2005	2006	2007	2008	2012	2013	2014	2015	2016	2017
Schools	17	17	15	17	10	11	ND		12	14
4th Grade Classes	37	39	36	38	22	26	ND		32	36
4th Grade Students	887	932	862	923	538	667	1,080	735	849	908
Teachers	40	40	36	42	47	28	39	28	67[3]	35
Teacher Training Hours	80	272	228[1]	111	190[2]	7	ND		14	70
Parent Volunteers	30	90	35	80	0	65	156	68	88	73
Festival Volunteers	148	59	59	68	40	37	60+		15	70

ND = no data
1. Includes a Project WET 6 hour workshop for 17 NAU student teachers-in-training, participating as instructors at the Water Festival and Project WET 6 hour workshop for 21 FUSD teachers.
2. Includes a Project WET 2 hour workshop for 23 NAU student teachers-in-training, participating as instructors at the Water Festival and Project WET 6 hour workshop for 24 FUSD teachers.
3. 36 NAU Preservice Teachers & 31 teachers

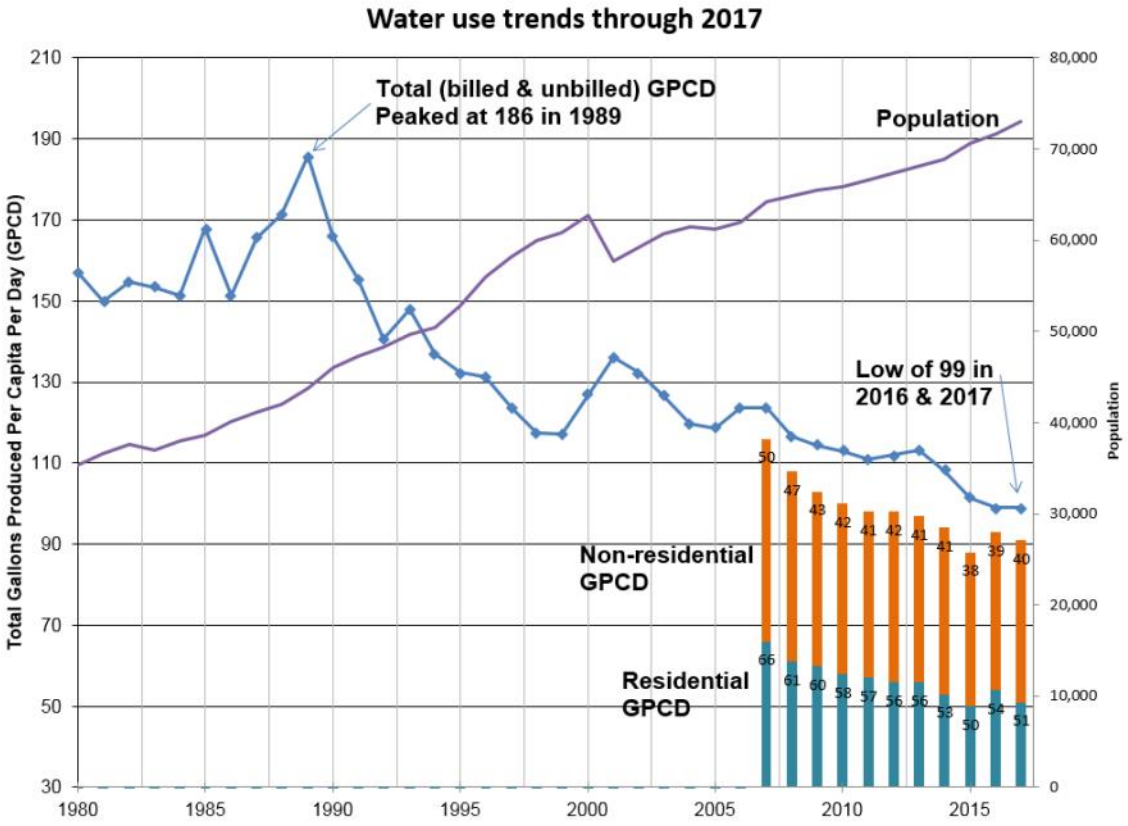
Below: Gabriel Barajas, 10, a fourth grade student at Marshall Elementary School explores a watershed table during the Flagstaff Water Festival in Foxglenn Park. Photo by Jake Bacon.

Right: Fourth grade students from across Flagstaff learn about water during the Flagstaff Water Festival Photo: City Staff

9-5 Water Conservation Program History & Customer Use Trends

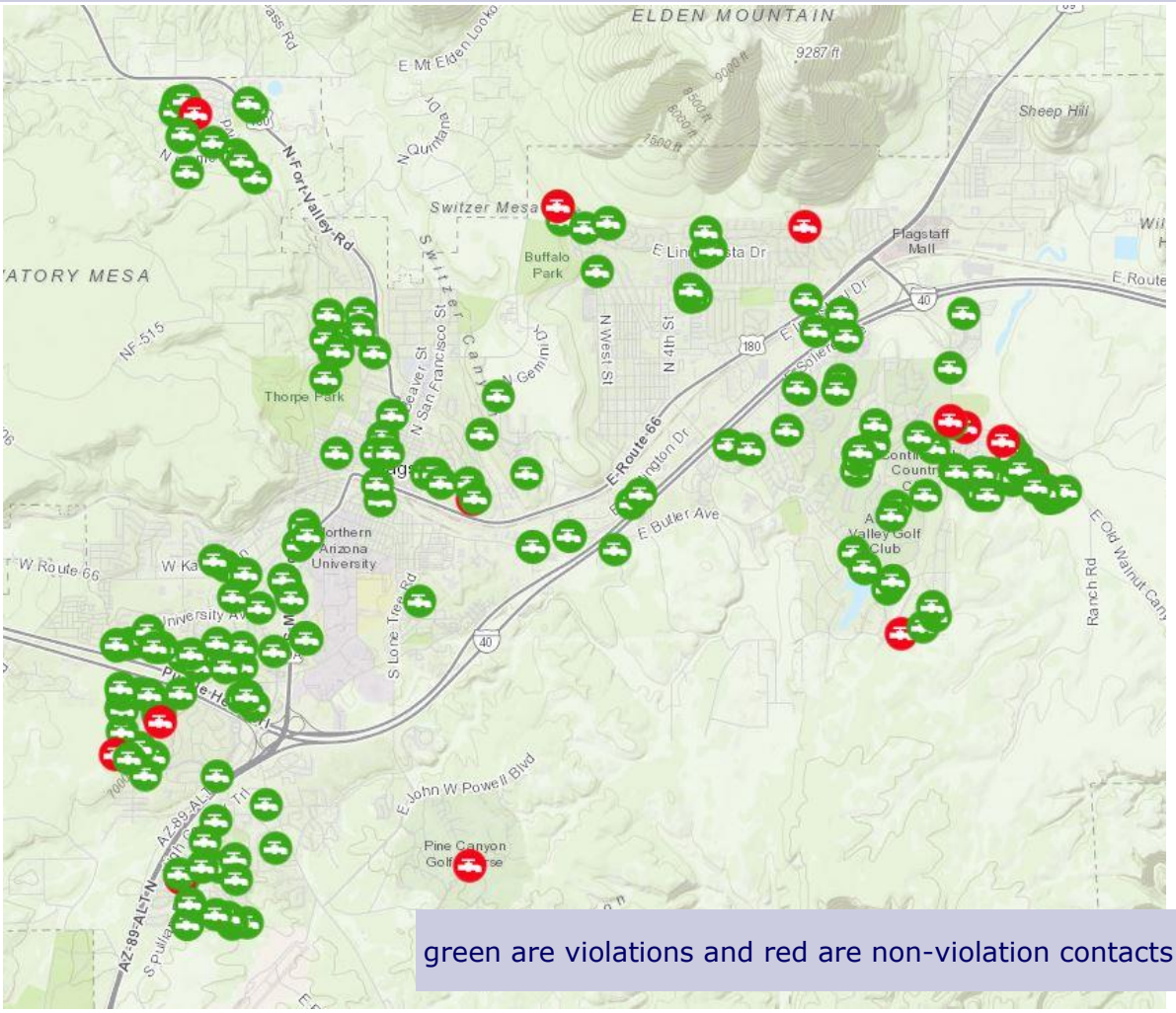
Since 1989, Flagstaff has seen a drop in total per capita water use by 47% (above). During this same time, population has almost doubled while annual water used is less than what it was in 1990 (below). Below is a summary bullet list of what's contributed to what's estimated as saving **95,800 AF of water in 25 years**:

- 1988 City Council adopted a Water Conservation Ordinance that included an odd/even watering day schedule & Water Availability Strategies (on page 51), developed in order to reduce peak summer demand
- 1990 Council adopted tiered residential rates (0-12K and >12K gallons) and created customer classes
- 1991 inception of Low Flow Toilet Rebate Program
- 1993 Rate increase adopted
- 1994 Rio Reclamation Plant online & reclaimed waterline constructed to serve summer irrigation
- Sometime between 1994 & 2003 tiered residential rate structure changed to 0-5K, 5-15K & >15K gallons & rate increase
- 2002 First and only time in history of the ordinance (see page 51) the Water Availability Strategy was elevated above Level I, Water Awareness. Level II went into effect May 10, 2002, Level III was in effect from June 21-Sept. 23, 2002. Ordinance was modified from 4 to 3 levels in May, 2003.
- 2003 Water Conservation Program established with program manager & 2 temporary enforcement staff positions
- 2005 Rebate program expansion to include turf removal & xeriscape, high-efficiency clothes washers, hot water re-circulators, pre-rinse spray nozzle installations, waterless urinal installations
- 2006 Rate structure tiered residential rate structure changed to 0-5K, 5-15K, 15-25K and >25K and rates increase



- 2009 & 2010 Water Conservation Program was cut from budget; from $191,500 to $21,000
- 2011 Rate structure tiered residential changed to 0-3.7K, 3.7-6.4K, 6.4-11.7K, >11.7K gallons
- 2011 Rebates for toilets, turf to xeriscape and rain water tanks funded since program was cut
- 2014 Two temporary enforcement staff added into the budget
- 2016 Program funding increased and added a full-time Water Conservation Specialist to staff
- 2016 Water rate increase adopted

9-6 Water Conservation Code Enforcement—2017



green are violations and red are non-violation contacts

ENFORCEMENT SUMMARY: During the 2017 enforcement season, our Water Conservation Enforcement Aides noted 212 watering violations, and made 12 non-violation contacts. The water enforcement season went smoother than usual, due to a new app developed by Water Services IT staff. The new app allowed enforcement staff to upload photos and notes directly to a GIS enabled map, removing the need for stops at the office to download the photos and notes onto a computer. The GIS map was available for review in real time, which allowed office personnel to keep track of the enforcement team's daily progress. Due to a problem in the City of Flagstaff billing software, fines were not given to repeat violators during 2017. The issue with the software system has been addressed for 2018.

9-7 Drought Preparedness—Water Availability Strategies

STRATEGY I

Water Awareness: In effect when water demand is equal to or less than safe production capability.

1. Implements Odd / Even Watering Schedule; Odd addresses are allowed to water T, Th, and Sa, even addresses on W, F, Su. No watering Mondays. Watering by hand allowed any day of the week. No watering between 9am and 5pm.
2. Prohibits unauthorized use of fire hydrants
3. Prohibits wasting water
4. Prohibits golf courses from irrigating with potable water
5. Provides for New Landscape Permits

STRATEGY II

Water Emergency: In effect when water demand exceeds safe production capability for five (5) consecutive days.

1. Continue rules established by Strategy I
2. New Landscape Permits not issued
3. Adds vehicle washing to watering schedule (exception for commercial car washes)
4. Prohibits washing buildings and paved areas
5. Prohibits filling fountains, ponds, pools with potable water
6. Prohibits use of potable water for construction activity
7. Implements Drought Rate Structure
   - Single Family Residential: Water Consumption between 6,401and 11,700 gallons billed at 150% the established rate. Water Consumption in excess of 11,700 gallons billed at 200% the established rate.
   - Multi-Family, Commercial, Industrial, and Institutional: Billed at 120% the established rate.
   - Standpipes: Billed at 130% the established rate. Use limited to 25 mile radius.

STRATEGY III

Water Crisis: In effect when water demand exceeds total production capability, and the amount of water in storage may impair fire protection for the City.

1. Continue rules established by Strategy I and Strategy II
2. Prohibits all outdoor water use
3. Authorizes additional measure as deemed necessary

Safe Production Capability: 90% of total water resources available measured in million gallons per day, based on potable water production and distribution components.

This information falls under City Code 7-03-001-0014 Water Conservation

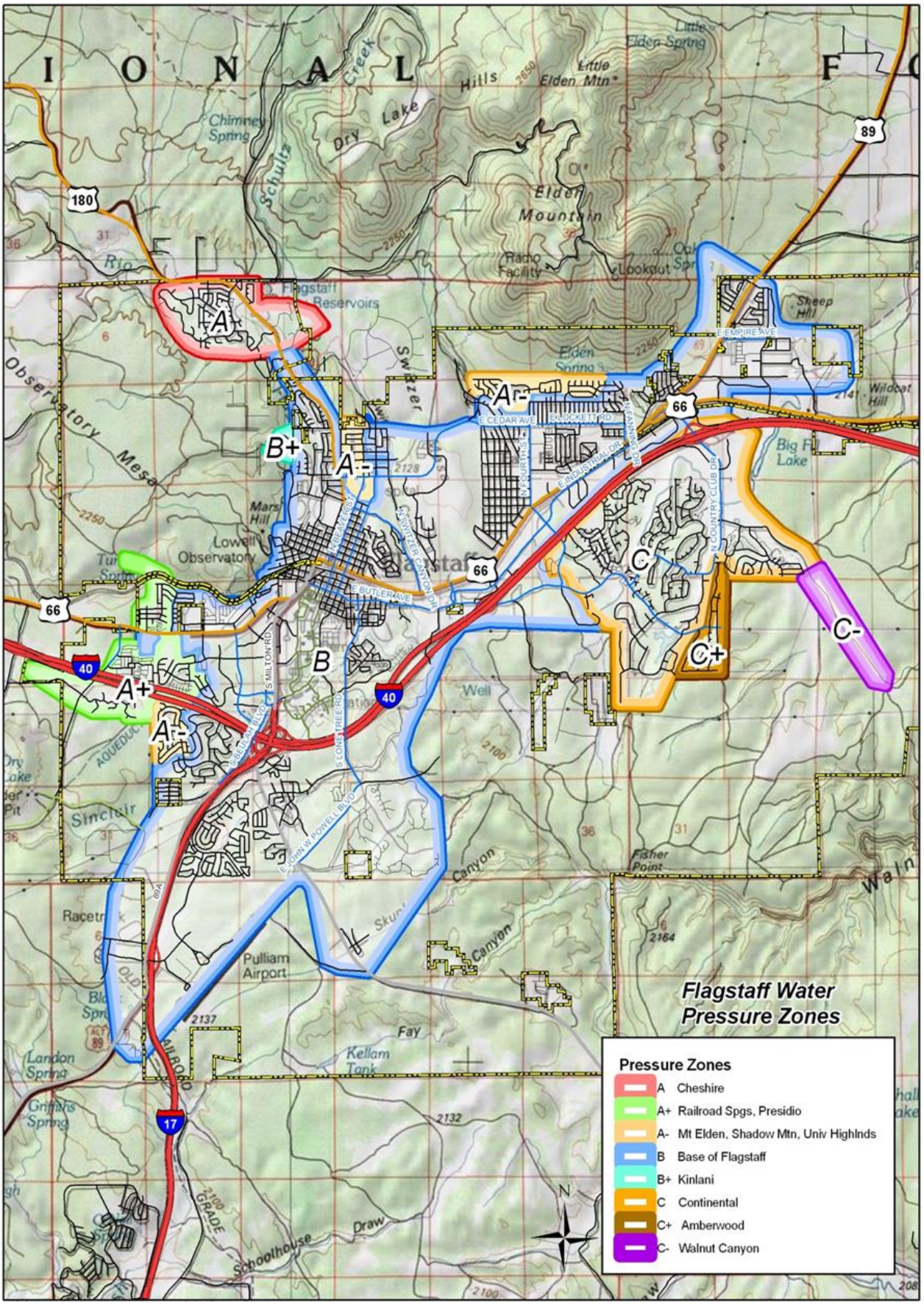
10 WATER STORAGE & DISTRIBUTION

10-1 Water Storage Reservoirs

Name	Type	Dimensions	Tank Capacity	Floor Elv	HWL	Range
Main	circular, concrete	260d x 30h	12 MG	7106.00	7136.14	30.14
Christmas Tree	circular, concrete	210d x 20h	5.0 MG	7120.33	7139.11	18.78
Airport	circular, steel	48d x 24h	300 KG	6989.00	7012.17	23.17
Railroad Springs	circular, steel	86d x 24h	1.0 MG	7301.00	7324.00	23.00
Railroad Springs #2	circular, steel	86d x 24h	1.0 MG	7301.00	7324.00	23.00
Cheshire	circular, steel	90d x 24h	1.3 MG	7235.00	7260.00	25.00
Paradise	circular, concrete	132dx 25h	2.5 MG	7235.75	7260.33	24.58
Kinlani	circular, steel	34d x 24h	156 KG	7220.00	7243.00	23.00
Other Storage						
University Highlands	circular, steel	60d x 24h	500 KG	7057.50	7081.10	23.60
Raw Water Pump Station	square, concrete	35w x 18h	140 KG	6791.83	6806.00	14.17
LMWTP Clearwell	circular, concrete	130d x 16h	1.2 MG	6952.00	6967.00	15.00
LMWTP Backwash Tank	sphere, steel	36d x 30h	200 KG	7000.50	7030.50	30.00
LMWTP Filter Wetwell	rectangle, concrete	17w x 24L x 9h	32 KG	6952.45	6964.93	12.48
Woody Mtn. Clarifier	circular, concrete	70d x 16h	304KG	7173.25	7192.00	18.75
Woody Mtn. Forbay	circular, steel	21d x 24h	60 KG	7165.00	7189.50	24.50
Reservoir Filtration Plant, Clearwell	rectangle, concrete	47w x 70L x 10h	240 KG	7103.50	7115.67	12.17
Sinagua/Foxglenn	circular, steel	25w x 10h	33 KG	6804.00	6993.00	7.00
Ft. Tuthill	circular, steel	25	33 KG	6984.00	6993.00	7.00
Shop Well	rectangle, concrete	12w x 27L x 8h	19.5 KG	6791.00	6799.25	8.25
Interchange Well	rectangle, concrete	12w x 27L x 8h	19.5 KG	6784.66	6793.00	8.34
Rio Well	rectangle, concrete	12w x 27L x 8h	19.5 KG	6852.17	6860.50	8.33

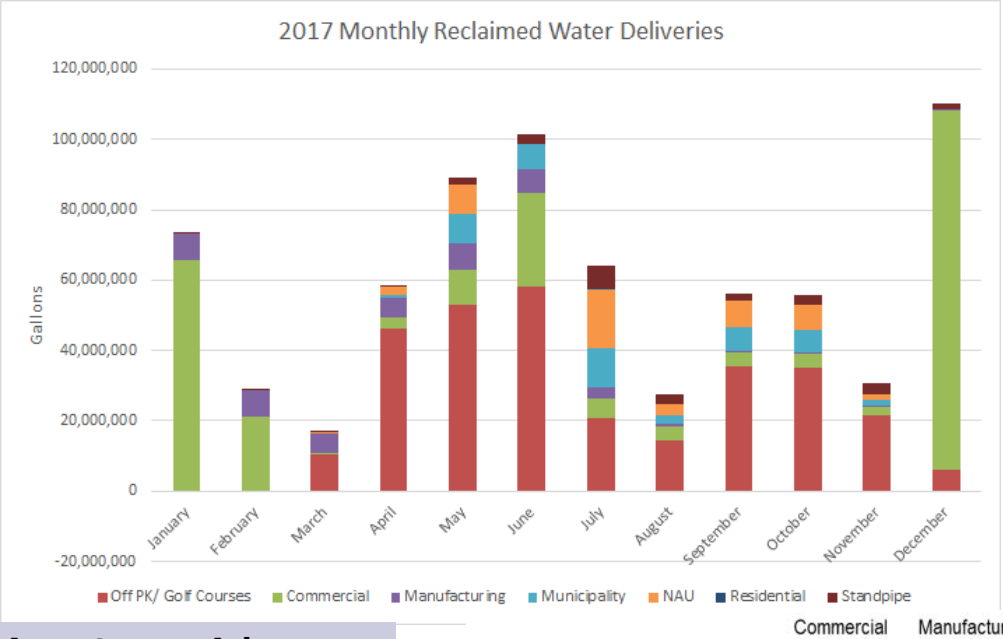
Summer Intern, Laura Garcia, observes water draining from Lower Lake Mary into a sink hole. July 11, 2017. Photo by Erin Young

10-2 Flagstaff Water Pressure Zones

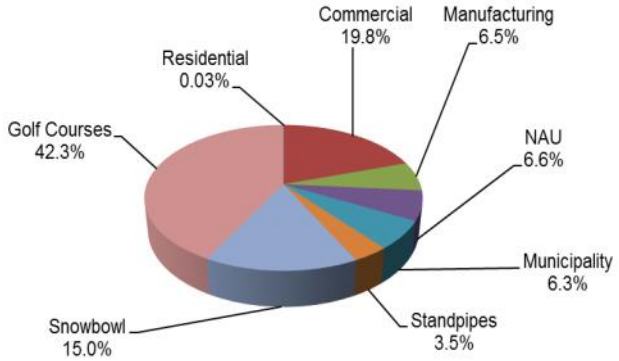


11 RECLAIMED WATER

11-1 Reclaimed Water Used by Customer Class



Community Acceptance—Arizona Pure Water Brew Challenge



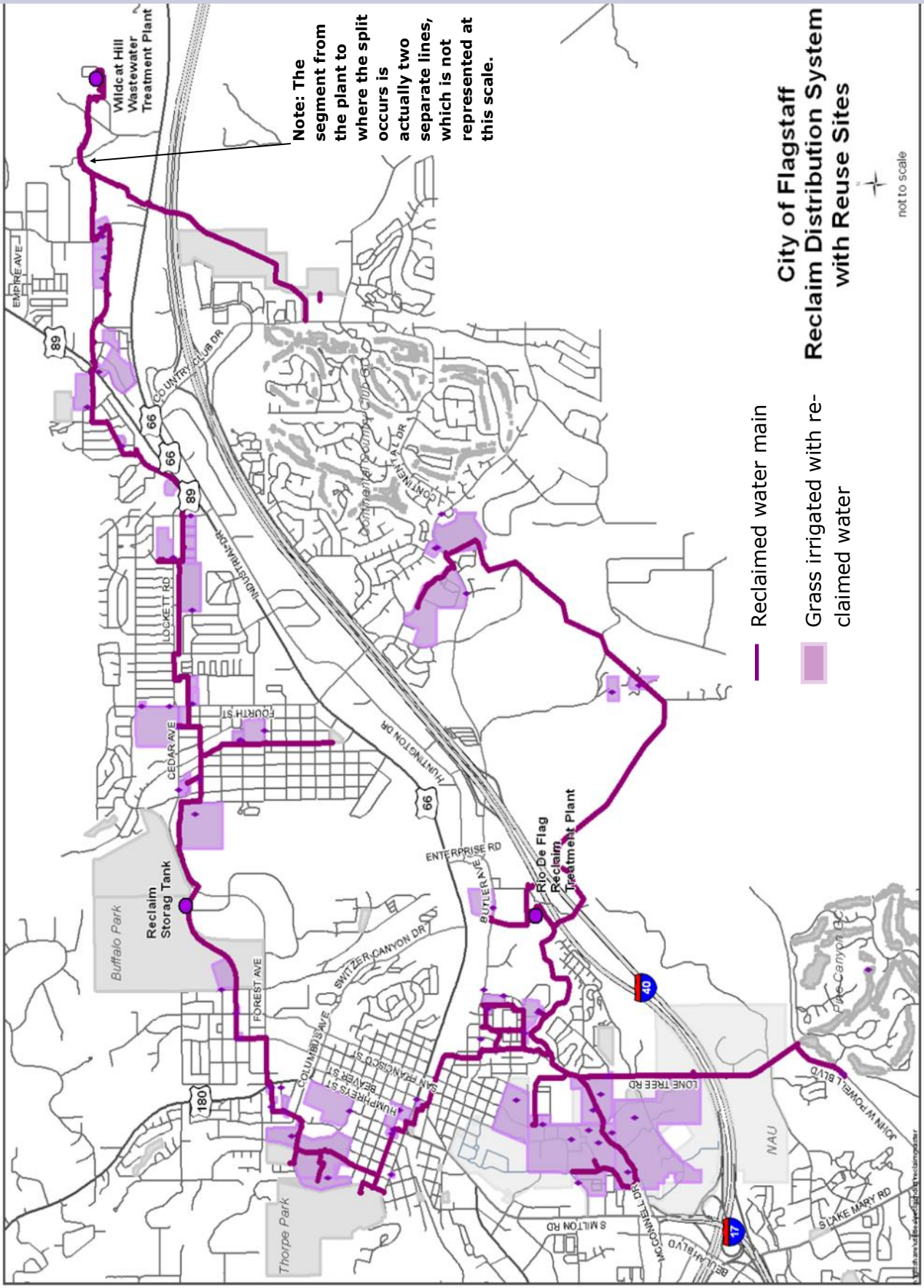
Flagstaff is one of three municipalities in Arizona that provided purified reclaimed water, as part of the Arizona Pure Water Brew Challenge. This project is Arizona's first multi-barrier advanced treatment facility...and it's on a semi truck! This public outreach campaign is aimed at educating about water treatment technology: judge water by its quality, not its history.

Getting water to local breweries was a two part process: first, the advanced water treatment truck and water quality team came to the Rio de Flag Water Reclamation Plant on June, 26th to process water and collect purified reclaimed water samples for extensive sampling and quality verification. The truck came back to Flagstaff on August 3 & 4 to make water that was provided to local brewers including Dark Sky, Wanderlust, Historic, Oak Creek and Granite Mountain! Beer from these breweries was submitted for professional judging at the National Water Reuse Symposium in Phoenix last September.

City Staff helping at outreach event

Council, staff & community members toured the truck on June 26th.

11-2 Reclaimed Water Distribution System



11-3 2017 Water Reclamation Plant Flow Report

WILDCAT PLANT	PLANT INFLUENT FLOW (GAL)	TOTAL OF ALL TREATED EFFLUENT (GAL)	PLANT DISCHARGE RIO DE FLAG (GAL)	RECLAIM DELIVERED REUSE SYSTEM FLOW (GAL)	RECLAIM DELIVERED CONTINENTAL FLOW (GAL)
MONTH					
JAN	124,845,000	128,451,000	128,451,000	0	0
FEB	139,269,000	147,842,000	147,842,000	0	0
MAR	137,160,000	143,027,000	131,930,000	1,989,000	9,108,000
APR	117,675,000	125,473,000	91,662,000	5,485,000	28,326,000
MAY	103,244,000	111,583,000	68,084,000	9,982,000	33,517,000
JUNE	93,991,000	95,056,000	34,146,000	22,219,000	38,691,000
JULY	114,772,000	114,158,000	90,184,000	7,332,000	16,642,000
AUG	109,904,000	112,893,000	100,579,000	147,000	12,167,000
SEPT	105,411,000	106,765,000	76,310,000	6,831,000	23,624,000
OCT.	108,571,000	108,955,000	77,200,000	6,587,000	25,168,000
NOV.	92,288,000	86,326,000	71,014,000	225,000	15,087,000
DEC	90,886,000	89,570,000	83,664,000	442,000	5,464,000
	1B	**2B = 3B+4B+4B1**	**3B**	**4B**	**4B1**
WCH TOTAL	**1,338,016,000**	**1,370,099,000**	**1,101,066,000**	**61,239,000**	**207,794,000**

RIO PLANT	PLANT INFLUENT FLOW (GAL)	TOTAL OF ALL TREATED EFFLUENT (GAL)	PLANT DISCHARGE RIO DE FLAG (GAL)	RECLAIM DELIVERED REUSE SYSTEM FLOW (GAL)
MONTH				
JAN	64,831,000	78,527,000	63,650,000	14,877,000
FEB	63,624,000	81,743,000	74,257,000	7,486,000
MAR	60,823,000	60,874,000	52,524,000	8,350,000
APR	53,291,000	45,894,000	19,994,000	25,900,000
MAY	61,912,000	56,810,000	13,131,000	43,679,000
JUNE	57,973,000	49,991,000	6,930,000	43,061,000
JULY	52,562,000	51,301,000	28,929,000	22,372,000
AUG	60,969,000	51,861,000	29,846,000	22,015,000
SEPT	52,949,000	47,319,000	13,285,000	34,034,000
OCT.	51,307,000	41,983,000	16,128,000	25,855,000
NOV.	58,083,000	56,654,000	32,830,000	23,824,000
DEC	58,998,100	57,445,000	19,251,000	38,194,000
	1A	**2A = 3A+4A**	**3A**	**4A**
RIO TOTAL	**697,322,100**	**680,402,000**	**370,755,000**	**309,647,000**
	1 = 1A + 1B	**2 = 2A + 2B**	**3 = 3A + 3B**	**4 = 4A + 4B + 4B1**
TOTAL (2) PLANTS	**2,035,338,100**	**2,050,501,000**	**1,471,821,000**	**578,680,000**
Acre-Feet	**6,246**	**6,293**	**4,517**	**1,776**

Notes: Total Reuse Delivered (1,776 AF) does not match Utility billing data of total "billed" (1,860 AF)

Wildcat no longer has site specific load out stations for city or county haulers. All reclaim users, except Continental, get water from the reclaim distribution system.

Total Processed/Unmetered = 1 - 2 = 2,035,338,100 - 2,050,501,000 = 15,162,900 gallons

a) Rio Plant Sludge/Septage - Not metered on main influent flow meter and self reported by haulers. Calculated at Wildcat.

b) Septage/Grease/Mud Sump - Grease received does not enter the wastewater treatment process. Mud is deposited into a drying bed and allowed to settle out, then any water is drained off into the treatment process.

c) Wildcat Unmetered - During the winter WC decants the water off the top of the Solids Stabilization Basins/SSBs and return it to the treatment plant to maintain acceptable levels in the SSBs. That could account for some 10 to 15 MGY unmetered. Unmetered stormwater also enters the SSBs, the 60 acre sludge injection field, and some smaller areas around the plant.

d) Wildcat flow meter(s) - In 2017, the Continental flow meter failed and flows were estimated for about one month. Starting in 2018, flow meters will be calibrated on an annual basis. A discrepancy in flow totals may occur after the meters are calibrated.

12 STORMWATER MANAGEMENT

The City's Stormwater Management program includes projects and programs that address stormwater quantity (flood control), stormwater quality (AZPDES Municipal Permit), and watershed management and restoration.

The Stormwater Section is funded by the stormwater utility that was established in 2003. The Utility currently operates a Capital Improvements Program (CIP) funded at $600,000 a year

12-1 Key Program Summary (descriptions are provided on subsequent pages)

1. Capital Improvements Program (CIP)
2. Construction Site Inspections
3. Drainage Investigation Response
4. Development Review
5. Floodplain Administration

1 Capital Improvements Program (CIP)

City Stormwater staff are responsible for maintaining Stormwater's Capital Improvements Program, which is funded at $600,000 per year. In addition to the annual funding for capital projects the Stormwater Section received funding though the Road Repair and Safety Tax Initiative.

Activities during 2017 included:

Fanning Wash Drainage Improvements

Fanning wash was a $1.7M drainage rehabilitation project located between Linda Vista Dr and Bushmaster Park. This project was constructed in conjunction the Locket Road Improvements Project, which upgraded the roadside drainage infrastructure along both sides of the road. The project increased the capacity of the open channel section of the wash between Linda Vista Dr and Locekt Rd and replaced the existing culverts under Lockett Rd. with a new concrete box culvert. The open channel section was lined a layer of interconnected concrete blocks to reduce erosion risk to the channel.

Zuni Dr. Drainage Improvements

The Zuni Drive project was funded by the Road Repair and Safety Tax and rehabilitated the Bow and Arrow Wash located adjacent to the roadway. This area of the City experiences flooding on a regular basis. The project installed two new 57”x 38” squashed pipes and one new 30” in diameter pipe.. The new arched culverts were installed in the foot print of an existing open channel and the circular culvert on the opposite side to the roadway. The new system was designed to convey the 10 year storm event within the new underground system. This improvement will result in less water in the road travel lanes and reduce private property flooding for the 10 year event.

2 Construction Site Inspections

The Stormwater Section is tasked with conducting onsite inspection of each commercial construction project approved with in the City. These inspection are intended to insure compliance with stormwater development requirements and to provided direction on appropriate Best Management Practices (BMP) installation and maintenance. This past year the Stormwater Inspector provided these inspections on 50 individual site with a total of 1,200 individual inspections.

3 Drainage Investigation Response

The Stormwater Section conducted 73 drainage investigation during the last year. These investigations include illicit discharge, floodplain, private and public flooding reports. One of these investigation resulted in the identification of a local road flooding issue at West Benton Ave and South Leroux St. This issue will be addressed with a design by Stormwater and construction by the Streets Sections next year. Other investigation were conducted on private property with advice on how to improve the current situation given by Stormwater Staff.

4 Development Review

The rate of development continued at a fast pace during the last year. The Stormwater Section participates in the City Interdivision Staff (IDS) process reviewing all site plans submitted to the City. The Stormwater Section reviewed 37 new site plans this year. Each site plan goes through a multiple review process that starts with concept plan and ends with a approved site plan. The Stormwater Section also reviews all Civil Plan submittals. This review process requires a detailed review of all civil construction drawings and submitted engineering reports for compliance with City Code.

5 Floodplain Administration

The Stormwater Section is tasked with the administration of the FEMA floodplains throughout town. We participate in the National Flood Insurance Program (NFIP), which reduces flood insurance premiums by 25% for our residents. The Stormwater Section also administers the Floodplain Regulations adopted by City Council. In addition, stormwater provides assistance to citizens considering development in the floodplain in the form of Flood Zone Determination. These determination provide specific information in writing to the customer allowing them to better understand the restriction on projects proposed in the floodplain. This past year the Section completed 74 flood zone determinations. Stormwater also issues floodplain use permits for allowed activities within the floodplain. This effort requires review of submitted construction documents and reports to determine compliance with floodplain codes. The section issued 37 floodplain use permits this last year.

13 REGULATORY COMPLIANCE

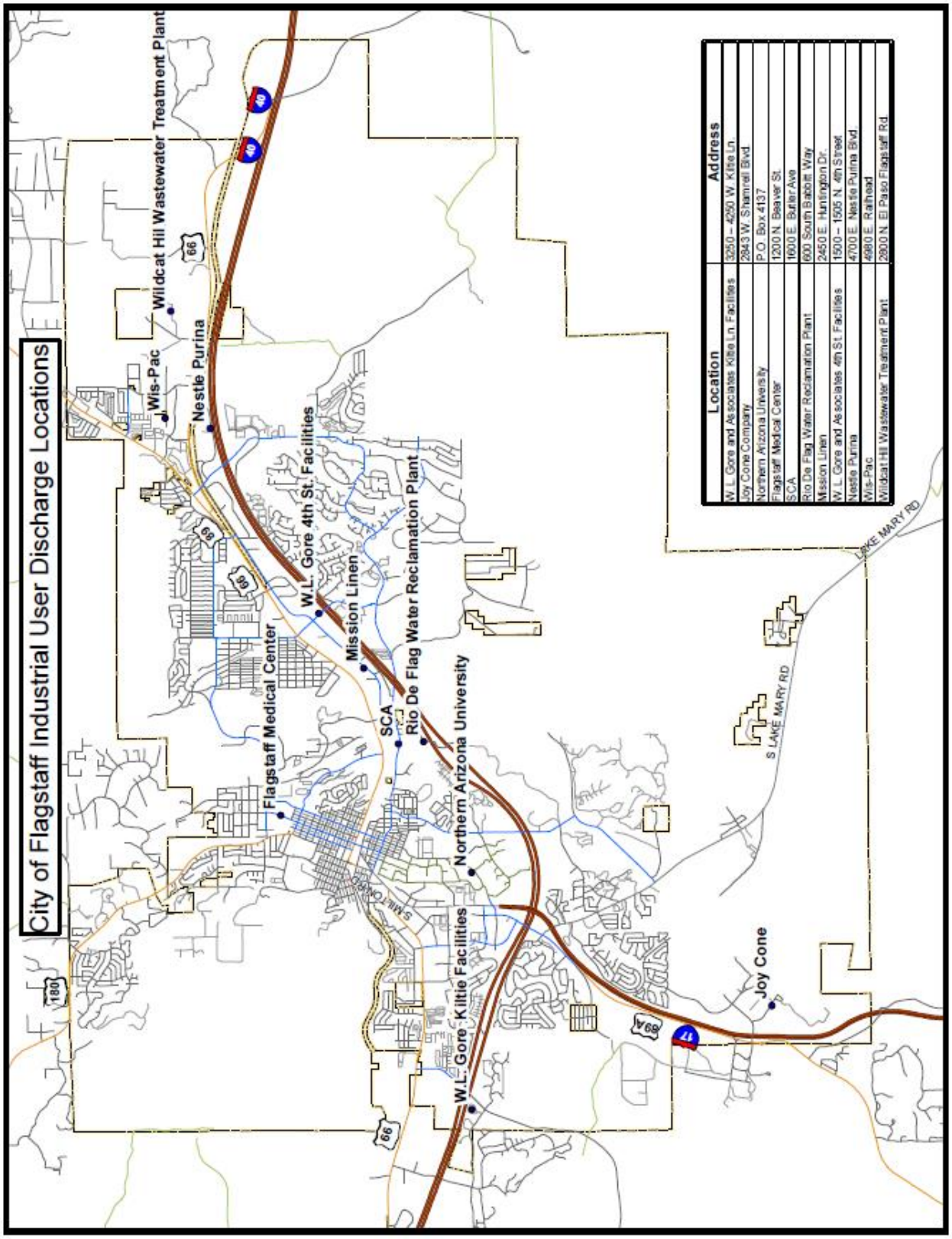
The mission of the Regulatory Compliance Section of the Water Services Division is to ensure that the City of Flagstaff is compliant with all sampling and reporting requirements and best management practices (BMPs) as directed under state and federal regulations and permits for our drinking water, wastewater, reclaimed water, surface water, stormwater, industrial pretreatment and backflow programs. The Regulatory Compliance Section is also responsible for ensuring each facility in Water Services is properly permitted and any discharge is correctly reported to the state Arizona Department of Environmental Quality. Staff philosophy is responsiveness, performing duties with honesty and integrity, and a commitment to meeting industry standards of excellence.

In addition, we are committed to a goal of 100% customer satisfaction. This is achieved by dedication to exceeding customer expectations and by continuously improving our programs. We value co-worker input and strive to maintain high motivation by providing an environment that encourages improvement and teamwork.

Core functions of the Regulatory Compliance Section include sampling, testing, documenting and reporting the quality of the City's drinking water, wastewater, reclaimed water, and industrial pretreatment and backflow systems as directed under state and federal regulations and permits. The Section manages two (2) State licensed laboratories and permits at the Lake Mary Water Treatment Plant, Wildcat Water Reclamation Plant and the Rio de Flag Water Reclamation Plant. The Section also administers the Multi-Sector General Permit (MSGP) at the Wildcat Hill and Rio de Flag Wastewater Reclamation Plants, administers the Municipal Separate Storm Sewer System (MS4) permit for the City, and works with regulatory agencies to update permits.

The Regulatory Compliance Section represents the City by maintaining relationships with other professionals in the water and environmental compliance field and participating in or hosting meetings and workshops. The section is a liaison with numerous outside agencies and organizations that include the United States Environmental Protection Agency (USEPA), Arizona Department of Environmental Quality (ADEQ), Arizona Department of Water Resources (ADWR), Advisory Panel on Emerging Contaminants, and Environmental Laboratory Advisory Committee. In addition, staff review proposed water quality legislation and provide input to State Agencies, City Council and Legislators. Staff also provides water quality regulatory permit administration for all programs within the Regulatory Compliance Section for various Federal (USEPA) and State (ADEQ) programs including: Safe Drinking Water Act, Clean Water Act, Clean Air Act, National Pollutant Discharge Elimination System (NPDES), Arizona Pollutant Discharge Elimination System (AZPDES), Arizona Aquifer Protection Permit (APP), Reclaimed Water Permit, Multi-Sector General Permit (MSGP), Municipal Separate Storm Sewer System (MS4), and Emergency Operations and Safety Programs as required.

13-1 Industrial Waste Significant Industrial Users



14 RED GAP RANCH

14-1 Update on Red Gap Ranch

Red Gap Ranch was identified and purchased as a City water resource in 2005. The City commissioned a pipeline feasibility study by Jacobs Engineering in June of 2008 to analyze alternative pipeline alignments to convey water from the ranch to the City. This feasibility study is currently in Phase 2, involving environmental resource evaluation and excavating geological test pit at 41 locations and 4 pump station sites, additional full time monitoring at test pit locations and additional public outreach support. This pipeline feasibility study is scheduled for completion in Spring 2019.

Wells sampled, showing well depth, depth to water, and volume pumped

Well Name	Depth (ft)	Water (ft)	d Thicknes	Diameter (in)	Volume (cu-ft)	Volume (gal)	Volumes (gal)
RGRSW1	435	287	148	16	206.64	1,546	4,637
RGRSW2	420	234.4	185.6	16	259.14	1,938	5,815
RGRSW3	475	418	57	16	79.58	595	1,786
RGRSW4	640	481	159	16	222.00	1,661	4,982
RGRSW5	700	542	158	16	220.60	1,650	4,950
RGRSW6	445	318	127	16	177.32	1,326	3,979
Twin Tanks Well	1100	249	851	5	116.00	868	2,603
Outpost Well	1160	571	589	5	80.28	600	1,801
RGRMW-2S	500	236	264	5	35.98	269	807

General Parameters Tested. For detailed results (metals, inorganics, organics, radionuclides) see report.

Description	RGRSW 1	RGRSW 2	RGRSW 3	RGRSW 4	RGRSW 5	RGRSW6	Twin Tanks	Outpost	RGRMW S
Date	10/04/16	10/04/16	10/06/16	10/07/16	10/10/16	10/05/16	10/03/16	10/04/16	10/09/16
Static Water Level (ft)	287.00	234.40	418.00	481.00	541.50	318.00	249.00 (A)	571.00	236.00
Pump Setting (ft)	400	388	460	577	661	400	460	640	360
Well Volume (gal)	1,546	1,938	595	1,661	1,650	1,326	868	600	269
Well Volume 3x's (gal)	4,637	5,815	1,786	4,982	4,950	3,979	2,603	1,801	807
Flow Rate (gpm)	170	200	50	98	71	179	17 (B)	17 (B)	21
Pumping Level (ft)	320.00	247.50	453.00	518.00	590.00	320.00	*****	573.20	240.00
Drawdown (ft)	33.00	13.10	35.00	37.00	58.50	2.00	*****	2.20	4.00
Specific Capacity (gpm/ft)	5.15	15.27	1.43	2.65	1.46	89.50	*****	7.73	5.14
Sample Time (24-hour)	1030	1900	1530	1300	1640	1600	1440	1015	1400
Temperature (°C)	17.6	16.7	17.5	17.0	17.3	16.5	17.7	17.4	17.3
pH	7.46	7.45	7.61	7.37	7.42	7.45	7.00	7.43	7.42
Electrical Conductivity (µS)	782	766	1,020	891	841	1,050	1,138	817	903
Total Gallons Pumped	12,720	12,020	4,900	6,840	6,370	15,250	3,825	2,550	1,440
Total Time (minutes)	75	60	98	70	90	85	225	150	70
A - Estimated from HSI, 2011									
B - Provided by City of Flagstaff, 2016									

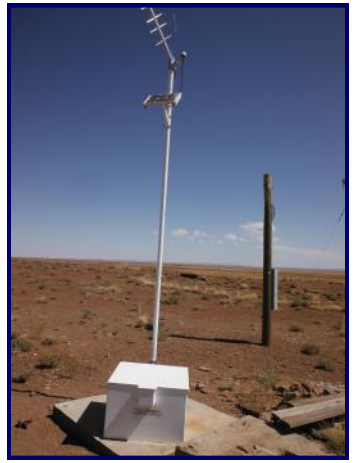
14-2 Red Gap Ranch Well Data

Local Name	Reg. Number	Surf. Elevation (feet amsl)	Most Recent Depth to Water (feet)	Most Recent Water Elevation (feet amsl)	Data[1] Source	Date Measured	Well Depth (feet)	Diameter (inches)	Perf. Interval (feet)	Date Complete
Sunshine Well	601277	5230								
Outpost Well[4]	597831	5330	571	4759	COF	10/4/2016	930	5	690-890	2003
Lake Tank Well	590957	4870	171.24	4699	H.S.I.	11/19/2002	570	6		2002
Twin Tanks Well[4]	597832	4950	251.7	4698	COF	8/19/2015	880	5	660-860	2003
Red Sands Well	601276	4951	240.53	4710	H.S.I.	11/18/2002				
Stone-1	601273	5045								
Stone-2	601274	5065								
Stone-3	601275	5055	316.44	4739	H.S.I.	5/15/2003				
Stone-4	601272	5045								
Stone-5	809401	5055	342.4	4713	COF	9/13/2012				
Cedar Well	597833	5180	438.5	4742	H.S.I.	5/15/2003	910	5	590-690, 790-890	2003
Headquarters Well	601278	5030	287.55	4742	H.S.I.	11/19/2002				
RGR - Well-1	590153	4835					180	12	OPEN	Incomplete
RGR - Well -2	590823	4970	220	4750	COF	4/1/2015	695	12	380-460, 540-600, 640-660	2002
MW-2W	590821	4970	242.5	4728	COF	5/11/2016	500	5	380-480	2002
MW-2S[4]	590822	4970	236	4734	COF	10/9/2016	500	5	380-480	2002
RGR - Well -3	590338	5030	278.5	4752	COF	5/11/2016	840	12	460-520, 660-720, 760-800	2002
RGR - Well -7[2]	601271	4832	167.8	4664	ADWR	1/7/2015	440	4.5	OPEN	Deepened in 2002
RGR SW Well 1[3]	912928	5037	287	4750	COF	10/4/2016	435	16	OPEN	2011
RGR SW Well 2	912929	4948	234.4	4714	COF	10/4/2016	420	16	OPEN	2011
RGR SW Well 3	912930	5173	418	4755	COF	10/7/2016	475	16	OPEN	2011
RGR SW Well 4	912931	5314	481	4833	COF	10/7/2016	640	16	OPEN	2011
RGR SW Well 5	912932	5314	541.5	4773	COF	10/10/2016	700	16	OPEN	2011
RGR SW Well 6	912933	5063	318	4745	COF	10/5/2016	445	16	OPEN	2011
RGR SW Well 7	913556	4995	N/A				38	24		Incomplete
RGR SW Well 8	913557	4996	N/A				38	24		Incomplete
RGR SW Well 9	913560	5012	N/A				38	24		Incomplete
RGR SW Well 10	913561	4964	N/A				38	24		Incomplete

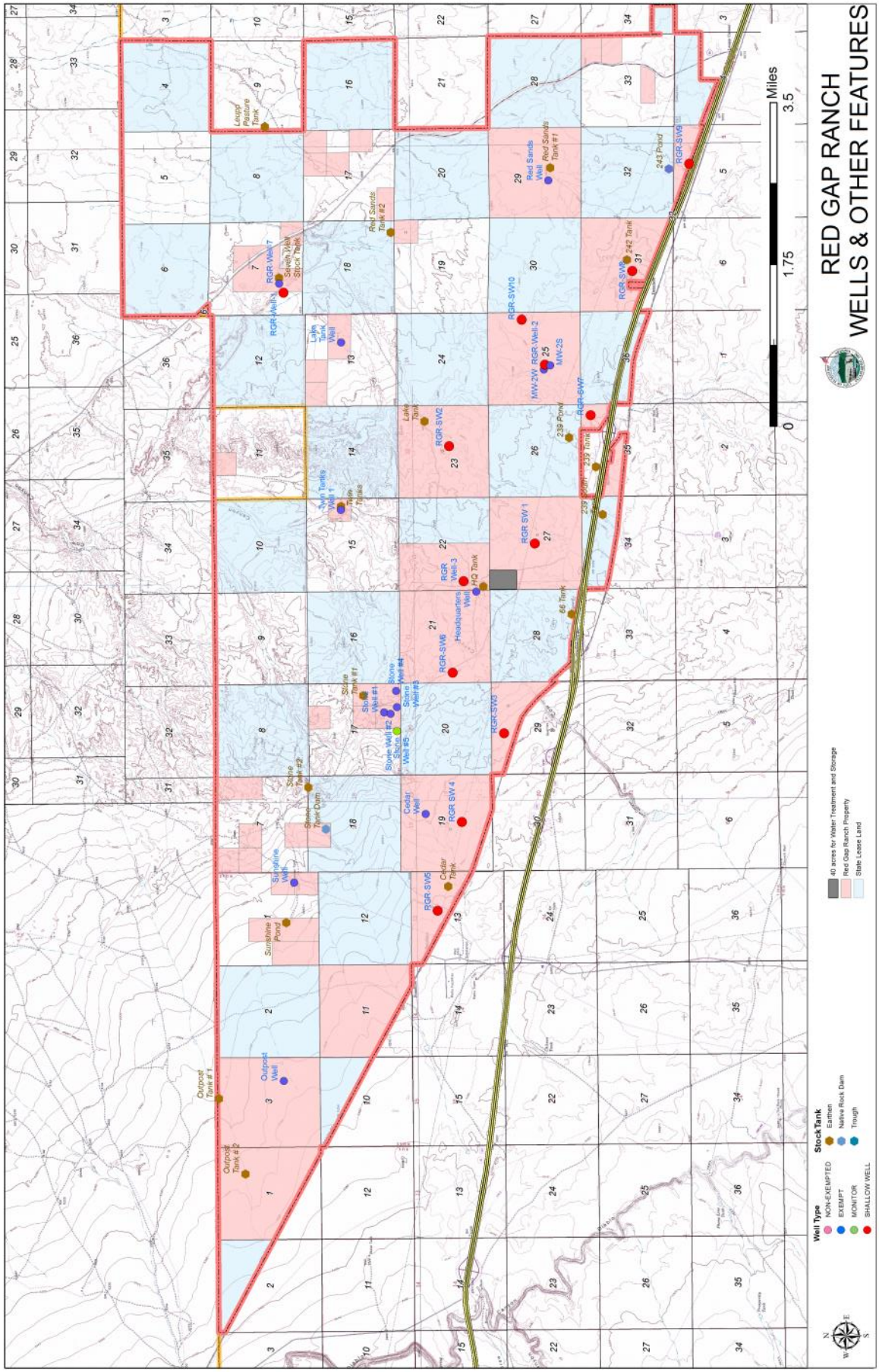
1. COF = City of Flagstaff; H.S.I=HydroSystems Inc
2. Pursuant to agreement with ADWR dated 2013, continuously monitoring water level
3. Red Gap Shallow Wells (SW)
4. Transducer installed and monitored by City of Flagstaff

*AMSL = Above mean sea level

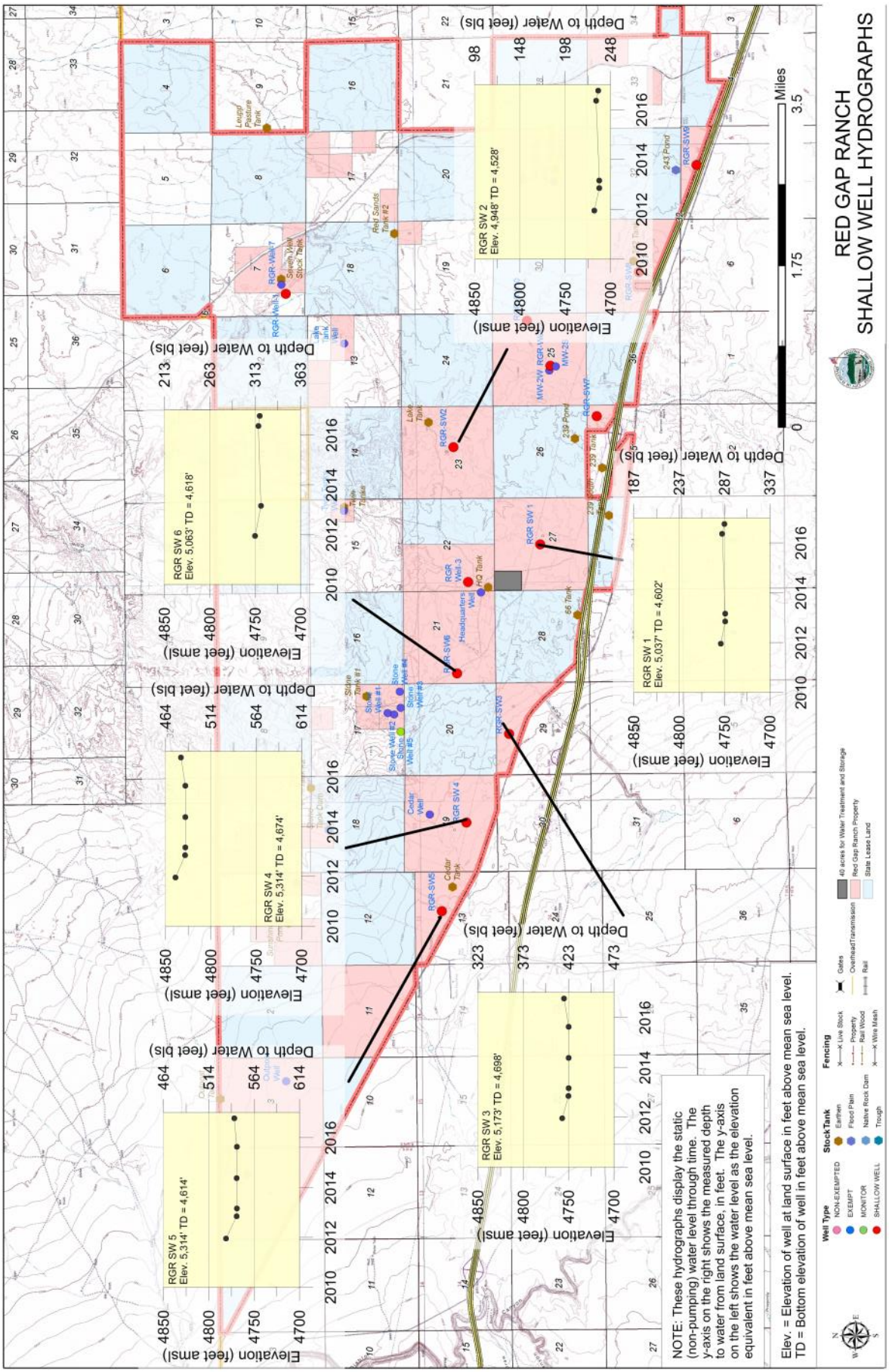
ADWR Groundwater Site Inventory (GWSI) Telemetry Monitoring Well at RGR Well-7

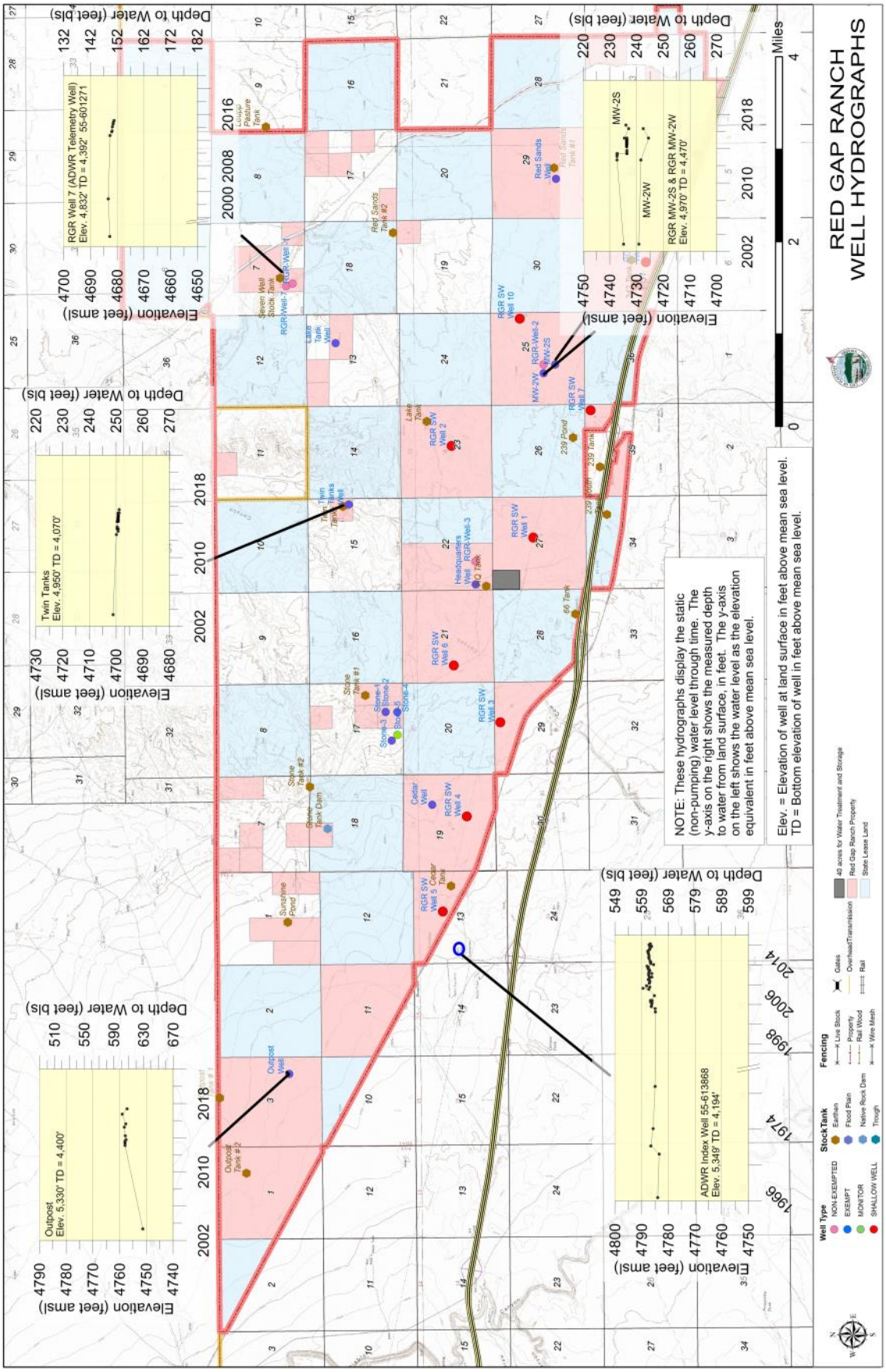


Red Gap Ranch Well Locations



14-3 Red Gap Ranch Hydrographs




RED GAP RANCH
WELL HYDROGRAPHS
Outpost
Elev. 5,330' TD = 4,400'
Twin Tanks
Elev. 4,950' TD = 4,070'
RGR Well 7 (ADWR Telemetry Well)
Elev. 4,832' TD = 4,392' 55-601271
RGR MW-2S & RGR MW-2W
Elev. 4,970' TD = 4,470'
ADWR Index Well 55-613868
Elev. 5,349' TD = 4,194'
Elevation (feet amsl)
Depth to Water (feet bls)
NOTE: These hydrographs display the static (non-pumping) water level through time. The y-axis on the right shows the measured depth to water from land surface, in feet. The y-axis on the left shows the water level as the elevation equivalent in feet above mean sea level.
Elev. = Elevation of well at land surface in feet above mean sea level.
TD = Bottom elevation of well in feet above mean sea level.
Miles
Well Type
NON-EXEMPTED
EXEMPT
MONITOR
SHALLOW WELL
Stock Tank
Earthen
Flood Plain
Native Rock Dam
Trough
Fencing
Live Stock
Property
Rail Wood
Wire Mesh
Gates
Overhead Transmission
Rail
40 acres for Water Treatment and Storage
Red Gap Ranch Property
State Lease Land

15 MISCELLANEOUS INFORMATION

15-1 Statistics

psi	Pounds per square inch	2.304 feet of water head
Acre-foot	Gallons in 1 acre, 1 foot deep	325,851 gallons
Cubic foot	Gallons in 1 cubic foot	7.48 gallons
Cubic foot per second (cfs)		450 gallons per minute
Million gallons per day		694 gallons per minute
Break horse power		(total lift x gpm)/3960
		0.67 kwh (kilowatt hours)
GPCD	Gallons per capita per day	
mg/L	milligram per liter or part per million	
TTHM	Total Trihalomethanes	

CITY PERMIT NUMBERS

WATER		**WASTEWATER**	
Lake Mary WTP	WT 002478	Wastewater System No.	330002
Type R Level IV Water Treatment		Wildcat Hill WWTP	AZPDES 0020427
Water System No.	403008		**APP 100760**
Water Distribution	AZ 0403008	WCH Air Quality Permit	59727, Place ID 1092
AWWA Membership No.	00033465	Rio De Flag WRF	APP 102421
ADWR Designation No.	41-900002.0002		

ADWR Community Water System ID: 91-000086.0000

REVENUES (FY= July thru June) Water, Sewer & Reclaimed Water Revenues.
FY 16 & 17 include capacity fees and interest.

FY 2017 WATER	$ 18,552,065	FY 2016	$ 16,207,073
FY 2017 SEWER	$ 11,649,860	FY 2016	$ 8,970,900
FY 2017 RECLAIM	$ 787,771	FY 2016	$ 1,067,114

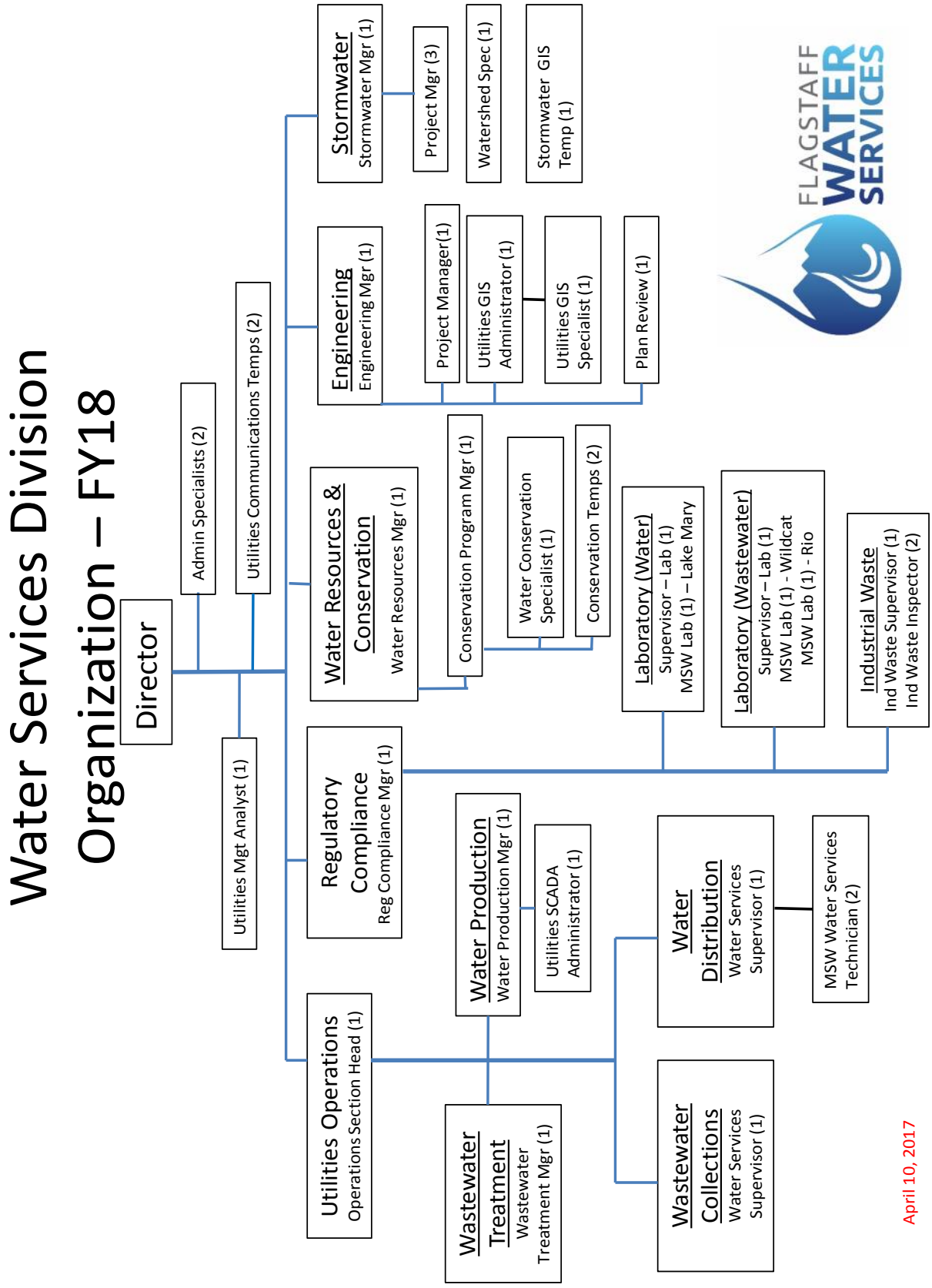
SYSTEM INFORMATION (2017)

Number of fire hydrants – 3263
Number of reclaim hydrants - 14
Number of manholes - 7520
Number of valves – Reclaim = 250, Water control valves= 416, Water system valves = 11,077
Number of wells – 26 active in 2017
Miles of sanitary sewer – 297.4
Miles of water main – 479.35
Miles of reclaim pipeline – 25.83 active
Miles of storm drain – 93.19
Average annual gallons per household in 2017 – 145 gallons per house per day
Average annual gallons per capita per day in 2017 – 91 gallons per person per day
Upper Lake Mary capacity – 16,300 acre feet (USGS OFR 2008-1098)
Year 2017, number of housing units – 18,267 (15,163 Single Family/3,104 Multi-Family)

KEY ELEVATIONS (Feet)

Pressure Zone A – 7,260
Presssure Zone B – 7,137
Inner Basin cabin -9,415
Lake Mary WTP – 6,960

15-2 Water Services Division Organizational Chart



15-3 City of Flagstaff Water Rates and Fees

CITY OF FLAGSTAFF WATER & SEWER RATES

Effective January 1, 2018 (Subject to Change**)**

MONTHLY FIXED CHARGE

Meter Size:	Customer Class	Inside City	Outside City Rate
3/4"	All	$15.27	$ 16.80
1"	All	17.98	19.78
1 1/2"	All	24.75	27.23
2"	All	32.89	36.18
3"	All	51.85	57.04
4"	All	78.95	86.85
6"	All	146.69	161.36
8"	All	227.97	250.77
10"	All	322.80	355.08

WATER RATES

POTABLE WATER: (per 1,000 gallons)		Customer Class	Water Rate	Water Energy	Total Inside	Outside City Rate
Single Family	Tier 1 (0 - 3,500 gallons)	R1 or R4	$ 3.15	$ 0.83	$ 3.98	$ 4.38
	Tier 2 (3,501 - 6,200 gallons)		4.09	0.83	4.92	5.41
	Tier 3 (6,201 - 11,500 gallons)		6.29	0.83	7.12	7.83
	Tier 4 (11,501+ gallons)		12.59	0.83	13.42	14.76
Multi-Family Units		R2 or R3	4.05	0.83	4.88	5.37
Commercial/Schools		C	4.30	0.83	5.13	5.64
Northern Arizona University		NA	3.95	0.83	4.78	N/A
Manufacturing		MN	4.24	0.83	5.07	5.58
Landscaping/Lawn Meters		LM	4.30	0.83	5.13	5.64
Hydrant Meter		HM	6.58	0.83	7.41	N/A
Standpipe*		SP	6.58	0.83	7.41	N/A

*Includes sales tax

RECLAIMED WATER: (per 1,000 gallons)		Customer Class	Inside City	Outside City Rate
Private Residential	Tier 1 (0 - 3,500 gallons)	R1	$ 1.30	$ 1.43
	Tier 2 (3,501 - 6,200 gallons)		1.60	1.76
	Tier 3 (6,201 - 11,500 gallons)		2.32	2.55
	Tier 4 (11,501+ gallons)		4.35	4.79
Commercial (no main Ext):		C	1.71	1.88
Commercial (w/ main Ext):		C	3.62	3.98
Manufacturing (no main Ext):		MN	1.69	1.86
Manufacturing (w/ main Ext):		MN	3.59	3.95
NAU (No main extension):		NA	1.59	N/A
NAU (with main extension):		NA	3.40	N/A
City Departmental		MU	1.71	N/A
Hydrant Meter		WR	3.70	N/A
Standpipe**		RS	3.70	N/A
Off Peak/Golf Course:	Tier 1 (0 - 150,000,000 gallons)	WR	1.47	1.62
	Tier 2 (150,000,001+ gallons)	WR	1.26	1.39

**Includes sales tax

SEWER RATES

SEWER: (per 1,000 gallons)	Customer Class	Inside City Rate	Outside City Rate
Residential			
Single- and Multi-Family	R1 - R4	$ 4.67	$ 5.14
Non-Residential			
Car Washes	CW	4.69	5.16
Laundromats	L	4.82	5.30
Commercial	C	4.95	5.45
Hotels & Motels	H	6.61	7.27
Restaurants	RF	7.93	8.72
Industrial Laundries	IL	7.29	8.02
Manufacturing	MN	5.31	5.84
Pet Food Manufacturers	PF	11.64	12.80
Soft Drink Bottling	SD	9.22	10.14
Ice Cream Cone Manufacturing	IC	14.39	15.83
NAU	NA	4.28	4.71

STORMWATER RATE (Effective February 1, 2018)

STORMWATER: (per ERU)	Customer Class	Inside City Rate	Outside City Rate
1 ERU	Residential	$ 2.26	$ 2.49

TRASH AND RECYCLING

RESIDENTIAL	Customer Class	Inside City Rate*	Outside City Rate*
One Trash and One Recycling Container (Each Container Serviced 1x per Week)	R1 - R4	$ 17.73	19.50
Each Additional Container		8.87	9.76

COMMERCIAL	Customer Class	Inside City Rate*	Outside City Rate*
Container Size and Scheduled Pickup May Vary	Please call (928) 213-2110		

PRIVATE FIRE PROTECTION

CONNECTION SIZE	Customer Class	Inside City Rate	Outside City Rate
4"	KS	$ 12.59	$ 13.85
6"		36.58	40.24
8"		77.96	85.76

CITY OF FLAGSTAFF WATER & SEWER SYSTEM FEES

Effective April 1, 2018 except as otherwise noted (Subject to Change**)**

WATER AND SEWER FEES

All Single Family Subdivisions: Residential and Townhomes (1 Meter, 1 Unit) EXCEPT as listed in next section

Any Meter Larger than a 3/4" Must have documentation approved by Water Services 928-213-2400

Meter Size	Meter Fee	Water Capacity Fee	Sewer Capacity Fee	Service Fee	Taxes	Total Fees
3/4"	$ 340	$ 5,728	$ 3,723	$ 24	$ 32.58	$ 9,847.58
1"	$ 520	$ 9,566	$ 3,723	$ 24	$ 48.69	$ 13,881.69
1 1/2"	$ 920	$ 19,074	$ 3,723	$ 24	$ 84.50	$ 23,825.50
2" or larger Call	Call	Call	Call	Call	Call	Call

Exceptions Single Family Residential Subdivisions (1 Meter, 1 Unit)

Linwood Heights & Rock Ridge West (1" Meter Required)						
1"	$ 520	$ 9,566	$ 3,723	$ 24	$ 48.69	$ 13,881.69
Pine Canyon (1 1/2" Meter Required)						
1" *(See Comment Below)*	$ 520	$ 9,566	$ 3,723	$ 24	$ 48.69	$ 13,881.69
1 1/2"	$ 920	$ 19,074	$ 3,723	$ 24	$ 84.50	$ 23,825.50

**** Meters <1 1/2" in Pine Canyon must be approved by the Fire Department as adequate to handle domestic & fire sprinkler system**

Multi-Family Residential, Condos, Mobile Homes (Sewer Fees are Per Unit) *Water Services Invoice Required 928-213-2400*

Meter Size	Meter Fee	Water Capacity Fee	Sewer Capacity Fee	Service Fee	Taxes	Total Fees
3/4"	$ 340	$ 5,728	$3,723 (Per Unit)	Based on # of Units		
1"	$ 520	$ 9,566	$3,723 (Per Unit)	Based on # of Units		
1 1/2"	$ 920	$ 19,074	$3,723 (Per Unit)	Based on # of Units		
2"	$ 1,070	$ 30,530	$3,723 (Per Unit)	Based on # of Units		
3"	$ 3,130	$ 57,279	$3,723 (Per Unit)	Based on # of Units		
4"	$ 4,130	$ 95,484	$3,723 (Per Unit)	Based on # of Units		
6" or Larger	Call					

WATER AND SEWER SYSTEM CONNECTION FEES

WATER FEES	Tap Size	Tap Fees	Taxes	Total Fees
Water Service Line Connection to Main - Residential Only	Call the Utilities Division at 928-213-2400			
Fire and Wet Taps (Contractor excavates to water main)	3/4" to 2"	$ 190	$ 17.01	$ 207.01
	3" to 12"	$ 310	$ 27.75	$ 337.75
Additional tap, same time and parcel, any size	3/4" to 12"	$ 125	$ 11.19	$ 136.19

SEWER FEES	Tap Size	Tap Fees	Taxes	Total Fees
Sewer Taps (Contractor excavates to sewer main)	All Sizes	$ 275	$ 24.62	$ 299.62

To determine if service line connections or if water and sewer taps are required, please contact the Utilities Division at 213-2400.

15-4 Radio Base Stations and Water Services Personnel Contact Information

RADIO BASE STATIONS

01	**CUSTOMER SERVICE** 211 W. Aspen 213-2231	**02**	**WAREHOUSE** 5447 E. Commerce 213-2279	**03**	**STREETS YARD OFFICE** 419 N. Mogollon 213-2165
04	**WATER DISTRIBUTION** 5401 E. Commerce 213-2444	**05**	**COMM DEVELOPMENT** 211 W. Aspen 213-2600	**06**	**ENGINEERING** 211 W. Aspen 213-2602
07	**VEHICLE SHOP** 419 N. Mogollon 774-6372	**08**	**SOLID WASTE** 419 N. Mogollon 213-2110	**09**	**WATER SERVICES ADMIN** 211 W. Aspen x2400 213-2400
10	**WASTE WATER COLLECTION** 5401 E. Commerce 213-2445	**11**	**WILDCAT HILL PLANT** 2800 N. El Paso 526-2520	**12**	**LANDFILL** N. Hwy 89 527-1927
13	**METER ROOM** 211 W. Aspen 213-2244	**14**	**LAKE MARY PLANT** 4500 S. Lake Mary 774-0262/556-1266	**15**	**PUBLIC WORKS ADMIN** 211 W. Aspen 213-2100
16	**PARKS/THORPE PARK BLDG** Thorpe Rd. 213-2161		**COF MAIN LINE 214-2400**		**BS FAX 213-2409**

RADIO CALL NUMBERS

(NOTE: ALL PAGERS/BEEPERS ARE DIGITAL)

WATER SERVICES ADMIN (213-2400)

	ADMIN FAX	**213-2409**	
201	**Bradley Hill**	**X 2420**	**814-2596**
202	Mark Richardson	X 2443	202-0666
09	Marion Lee	X 2406	
09	Debra Valencia	X 2407	
	Lisa Deem X 2471		

WATER SERVICES ENGINEERING

203	**Ryan Roberts**	**X 2410**	**606-3303**
	Jim Davis	X 2411	
	Justin Emerick	x 2437	607-2541

LAKE MARY PLANT (774-0262/556-1266)

(FAX 556-1267) (Plant Cell 853-2183)

210	Christopher Kulen	
211	Felix Parham	(853-1451 Maint.cell)
212	Lee Williams	
213	Ladd Steele	
214	Steven Morrison	
215	Dan Hickey	
217	Steve Flood	
218	Laney Stevens	
220	Lorne Cargill	
	Tim Harrington X 2408	

REGULATORY COMPLIANCE

	Steve Camp		**213-2475**
216	Brian Huntzinger		
	Krista Snow		
288	Jolene Hayes		
289	Lisa Adams		
	Janice Hakala		
250	James Boyer	x2117	(607-6778)
252	Kurt Novy	x2118	(853-6031)
251	Glenn Kuyper	x2119	(853-5904)

WATER DISTRIBUTION (213-2444)

237 Patrick O'Connor (699-61740) /213-2444

	Bag Phone #	**853-6136**
231	Tyler Boswell	
236	Jason Hoyungowa	
238	Richard Tsinnie	
239	Adam Nelson	
241	Jim Ellis	
242	Matt Anaya	
243	Randy Cody	
244	Christopher Cowan	
245	Robert Cunning	
246	Joseph Armijo	
	Chase Stoneberger	
	Jesse McKerracher	
	Juan Rubalcava	
205	Greg Sidwell	**699-3989 cell**

STORMWATER

Chris Kirkendall, SW Manager	x2473
Jim Janecek	x2472
Amanda Richardson	x2470
Chris Palmer	x2474

CUST SERV - FINANCE (779-7637/638)

01	**Sandy Corder**	**X 2252**
W 3-4	Ron Mead (X2244)	699-1489
	Bill Katlin	X 2244
	Scott Klotz	X 2244
	Manny Sierra	X 2244
	Richard Ransom	X 2244
W 3-9	Cust Serv	X 2231
01	Michele Bader	X 2267
01	Mia Trujillo	X 2246
01	Trina Begay	X 2241
013	Kim Burns	X 2233
01	Dorothy Watson	
01	Sue Miller	X 2251
013	Sabrina Schoenhard	X 2238

WATER COLLECTIONS (213-2445)

266	**Wastewater Collection Supervisor**	
	853-4876/213-2445 cell	
	Bag Phone #2	607-8841
260	Lorne Sampson	
262	William Atherton	
263	Lance Serrano	
264	Joe Almendarez	
265	Glenn Ross	
267	Ralph Hernandez	
268	Brian Smith	
269	Leonard Garcia	
	Jason Toback	

RIO DE FLAG PLANT (X1110)

Address 600 Babbitt Dr. (556-1301/1303)
(Cell 853-4584) (Fax 556-1302)

285	Cory Mueller
284	Paul Adams
286	Shawn McKee

WILDCAT HILL PLANT (526-2520)

(FAX 526-3526) (Plant Cell 699-8659)

281	**Jim Huchel (853-8715)**
292	Troy Dagenhart
293	Rick Norman
294	Bill Case
295	Greg Gede
296	Frederick Wright
	Matthew Black
	William Liebe
	Jeremy Meyers
	Kyle Nelson
	Septage Shack (527-1431)

WATER RESOURCES

Erin Young	**X 2405**	**(821-5952)**
Tamara Lawless	X 2404	(607-7674)
Audrey Kruse	X 2403	(890-7339)

CITY PERMIT NUMBERS

WATER

Lake Mary WTP	WT 002478
Type R Level IV Water Treatment	
Water System No.	403008
Water Distribution	AZ 0403008
AWWA Membership No.	00033465
ADWR DesignatioN No.	41-900002.0002
ADWR Community Water System ID:	91-000086.0000

WASTEWATER

Wastewater System No.	330002
Wildcat Hill WRP	AZPDES 0020427
	APP 100760
WCH Air Quality Permit	59727, Place ID 1092
Rio De Flag WRP	AZPDES 0023639
	APP 102421
ADEQ Type 3 Reuse Permit No.	R511384, LTF58397

Updated 4/18