

2020 ANNUAL TRR WELL FIELD REPORT

Prepared for

Inscription Canyon Water Company

Prepared by

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PURPOSE OF THE REPORT

This report serves as part of an annual series of reports for the Talking Rock Ranch (TRR) well field dating back to 2013. It is intended to provide a description of current conditions at the well field including pumpage, water levels, yields of individual wells, and the water demand and use of water by the subdivisions served.

INSCRIPTION CANYON WATER COMPANY

The Inscription Canyon Water Company is a private, non-profit water company providing water to the Inscription Canyon Ranch, Whispering Canyons, Preserve at the Ranch, and Talking Rock subdivisions as well as the Talking Rock golf course. The first three subdivisions obtain water from the ICR well field which consists of two wells and constitutes the ICR groundwater system while the Talking Rock subdivision and Talking Rock golf course obtain water from the TRR well field which consists of three wells and constitutes the TRR groundwater system. The two systems are not connected. The company is regulated by the Arizona Corporation Commission. In 2020, ICWC provided water to 329 residential customers in Talking Rock Ranch, an increase of 38 customers since 2019 and 139 customers since 2013 (table 1). In addition to providing water to residential customers, ICWC serves several commercial entities located within the subdivisions and provides water for irrigation of the common areas in the subdivisions as well as for home construction purposes within the subdivisions.

Table 1, Residential Customers served December 2013-December 2020

Subdivision	2013	2014	2015	2016	2017	2018	2019	2020
TRR	190	208	216	222	230	255	291	329

TOTAL WELL FIELD DEMAND: 2013-2020

The total TRR annual well field demand and Talking Rock Golf Course annual water demand for 2013 through 2020 is shown in table 2.

Table 2, TRR Annual Well Field Demand and Talking Rock Golf Course Annual Water Demand, 2012-2020, in gallons

Demand	2013	2014	2015	2016	2017	2018	2019	2020
TRR well field	107,520,000	107,033,000	94,270,000	103,893,000	111,343,000	118,216,388	119,569,150	139,829,975
TR golf course	96,138,000	90,289,000	81,941,000	84,581,000	88,782,000	94,805,000	90,569,000	103,711,000

The 2020 TRR annual well field demand was 139,829,975 gallons. Out of the 139,829,975 gallons, Talking Rock Golf Course annual demand accounts for 103,711,000 gallons, representing 74% percent of the total annual pumpage from the TRR well field.

The TRR well field's total demand has increased 36,118,975 million gallons from 2019 to 2020 and the golf course demand has increased by 13,142,000 million gallons over the same time period; however, the percentage of golf course

demand decreased by 2%, indicating that water demand from the well field in 2020 for purposes other than the golf course has slightly increased during the last year. This increase would reflect, at least in part, the increase of 38 residential units from 2019 to 2020.

2020 RESIDENTIAL, COMMERCIAL, AND LANDSCAPE DEMAND

The monthly and annual water demands shown in table 3 are for all major users served by the TRR well field, excluding construction purposes. The values are based on monthly billing records that run on a mid-month billing cycle rather than a calendar basis. The billing records date from December 16, 2019 to December 15, 2020. Column 2 in table 3 reflects monthly residential water demand in gallons; column 3 shows the number of residential units served; column 4 shows the number of residential units that had zero water usage for the month; column 5 and 6 show monthly demand for commercial and landscape use in gallons; column 7 shows total residential, commercial, and landscape demand in gallons per day per residence (gpd/r) for each month and for the year.

These values demonstrate the significant variation of monthly demand, increasing during the drier, pre-monsoon months in response to increased drip irrigation of residential and common area landscape. The annual average use in gallons per day per residence in the TRR system, including commercial and landscape demand, increased from 222 gpd/r in 2019 to 239 gpd/r in 2020.

Table 3, 2020 TRR Groundwater System Residential, Landscape, and Commercial Water Demand, in gallons

Month	Residential Demand	Residential Customers	Zero Use Residential Customers	Commercial Demand	Landscape Demand	Total Demand	Average Residential Use (gpd/r)
January	770,970	311	14	78,370	700	1,289,955	2,479
February	787,440	318	24	102,320	820	2,037,453	2,476
March	901,744	318	24	89,210	3,340	2,505,546	2,836
April	1,202,430	322	25	62,590	320,320	4,732,387	3,734
May	2,119,570	319	25	181,190	469,200	14,330,195	6,644
June	2,562,910	325	25	200,430	501,700	16,081,206	7,886
July	2,832,670	333	13	200,830	564,340	22,520,975	8,507
August	2,851,290	333	13	205,360	566,020	20,700,000	8,562
September	2,963,580	340	13	233,050	539,950	20,333,400	8,716
October	2,541,230	349	13	207,920	421,760	16,323,233	7,281
November	2,081,530	344	13	162,640	328,250	12,627,363	6,051
December	1,366,670	337	12	119,940	121,510	5,806,455	4,055
Total	22,982,034	329¹	18¹	1,843,850	3,837,910	139,288,168	5,769¹

¹ average annual value.

THE TRR WELL FIELD

The Talking Rock Ranch (TRR) well field consists of three wells, TRR 1, 2, and 3. Construction of TRR 1 was completed on February 5, 2001; construction of TRR 2 was completed April 20, 2002; construction of TRR 3 was completed May 15, 2002. The wells are located at the eastern edge of the Mint Wash floodplain, immediately east of Williamson Valley Road. The well field services the Talking Rock subdivision and the Talk Rock Golf Course and is owned by the Inscription Canyon Water Company.

The aquifer tapped by the wells consists of medium-to-coarse intermixed with small amounts of gravel, layers of gravel and sand mixed with minor amounts of silt and clay, and interbedded with a layer of basalt occurring at depths ranging from 70 ft, 108 ft, and 118 ft below land surface at wells 1, 2, and 3 respectively. The base of the aquifer is confined by crystalline basement rock, occurring at a depth of 300 ft at well 1, 262 ft at well 2, and 240 ft at well 3.

The regional water table lies in the unconsolidated sands and gravel above the basalt. The water table elevation naturally fluctuates in response to seasonal patterns of precipitation. At the time of completion for each well, the measured depth to water was 20 ft, 57 ft, and 23 ft below land surface at wells 1, 2, and 3 respectively. While wells 1 and 3 are at about the same elevation above sea level, well 2 is about 10 ft higher. Because of this, non-pumping measurements at the well field indicate depth-to-water at well 2 is 8-10 ft. greater than that at wells 1 and 3, consistent with the difference in elevation.

Pumping capacity at all three wells has been downsized due to an unacceptable decline in water levels and air entrainment at all three wells. Well 3's pump was downsized from 430 gpm to about 260 gpm, well 2's pump was downsized from approximately 530 gpm to approximately 285 gpm in 2009, and well 1's pump was downsized to 330 gpm. Each well has been highly reliable since; however, due to increased demand over the years, the TRR well field is no longer running at optimal efficiency.

The well field historically has been managed so that wells are called up sequentially as demand increases; only one well is initially in service until demand requires an additional well. Standard operating procedure of alternating well 1 and well 2 as the primary well while using well 3 as a backup has proven sufficient except during the drier summer months where golf course and irrigation demand is at its highest, during which the golf course lake operates as a reservoir, compensating for the well field's pumping deficit. However, due to increased demand and falling lake levels, the standard operating procedure was determined to be inadequate during the recent dry seasons. In August 2020, the standard operating procedure changed to pumping wells 1 and 2 simultaneously while keeping well 3 offline for months April through September. This change has enabled the system to provide sufficient yield to meet near-future dry seasons and increasing demand. However, with future residential development in addition to golf course demand, the projected required yield for 2025 will surpass the TRR well field's sustainable capacity. If golf course demand reaches its maximum demand of 575,000 gpd prior to 2025, there is potential to surpass the well field's sustainable capacity as early as the summer of 2021. In order to meet future requirements, an alternative water source is recommended as a long-term solution.

2020 MONTHLY WELL FIELD DEMAND

Table 4 below reflects the total pumpage at the TRR wells 1, 2, and 3 in 2020. Total pumpage at well 1 for the year was 78,044,155 gallons, total pumpage at well 2 for the year was 40,921,418 gallons, and total pumpage at well 3 for the year was 20,864,402 gallons (table 4). Monthly demand on the well field in 2020 increased approximately 1,289,955 gallons in January to a high of 22,520,975 gallons in July when pumpage peaked. Demand then slowly decreased, falling to 5,806,455 gallons in December.

Table 4, 2020 TRR Wells 1, 2, and 3 Monthly and Annual Pumpage, in gallons

Month	Well 1	Well 2	Well 3	Total
January	1,100,392	55,761	133,802	1,289,955
February	1,697,182	0	340,271	2,037,453
March	2,505,562	0	540,791	3,046,353
April	3,911,256	0	821,131	4,732,387
May	10,676,500	179,395	3,474,300	14,330,195
June	7,363,156	4,506,235	4,212,815	16,082,206
July	9,579,644	10,373,800	2,567,531	22,520,975
August	11,504,100	9,195,900	0	20,700,000
September	11,906,100	8,427,300	0	20,333,400
October	6,082,079	6,814,900	3,426,254	16,323,233
November	6,862,983	1,332,268	4,432,112	12,627,363
December	4,855,201	35,859	915,395	5,806,455
Total	78,044,155	40,921,418	20,864,402	139,829,975

2013-2020 MONTHLY WELL FIELD DEMAND

Table 5 shows the variation in monthly demand at the TRR well field from January 2013 to December 2020. Minimum demand occurs in the winter months, with the lowest generally occurring in January and February. The highest demand occurs during the drier summer months, the highest typically occurring in July. The difference between maximum and minimum for a given year averages about 15,333,878 million gallons and has been as much as 21,231,020 million gallons.

The well field's annual demand during this time period has ranged from a low of 647,000 gallons in February 2017 to a high of 22,520,975 gallons in July 2020. These rates correspond to an average daily pumping rate ranging from 505 gallons per minute to 16 gallons per minute. The capacity of TRR well 1 is approximately 325 gpm, well 2 is approximately 257 gpm, and well 3 is approximately 225 gpm.

Table 5, Monthly and Annual TRR Well Field Water Demand, Jan 2013-Dec 2020, in gallons.

Month	2013	2014	2015	2016	2017	2018	2019	2020
January	6,554,000	6,041,000	2,176,000	951,000	875,000	4,276,000	2,332,000	1,289,955
February	1,130,000	4,805,000	3,078,000	2,668,000	647,000	6,189,000	840,000	2,037,453
March	6,648,000	8,162,000	4,349,000	7,804,000	912,000	2,049,000	848,000	2,505,546
April	12,076,000	12,214,000	12,537,000	10,098,000	6,829,000	11,139,000	8,070,682	4,732,387
May	14,674,000	14,255,000	11,789,000	11,894,000	14,019,000	16,306,000	12,566,913	14,330,195
June	15,433,000	15,584,000	13,142,000	17,698,000	15,412,000	15,956,388	11,717,692	16,081,206
July	10,726,000	13,072,000	11,093,000	17,930,000	17,376,000	14,679,000	16,429,109	22,520,975
August	12,199,000	6,243,000	10,572,000	7,920,000	7,925,000	13,435,000	16,873,994	20,700,000
September	7,447,000	7,133,000	8,922,000	8,454,000	15,213,000	10,635,000	17,926,002	20,333,400
October	10,927,000	7,138,000	10,264,000	10,281,000	12,690,000	10,567,000	12,894,581	16,323,233
November	6,679,000	6,809,000	4,513,000	5,736,000	11,504,000	8,098,000	14,397,727	12,627,363
December	3,027,000	5,577,000	1,835,000	2,459,000	6,411,000	4,887,000	4,671,622	5,806,455
Total	107,520,000	107,033,000	94,270,000	103,893,000	109,813,000	118,216,388	119,568,322	139,288,168

MAXIMUM DAILY DEMAND

The maximum average daily residential demand for 2020 occurred in September at 2,963,580 gallons. There were 340 residences served during this time, with an average daily use equaling 291 gpd/r.

The July 2020 pumpage of 22,520,975 gallons exceeds that of all other months during the recorded time period. This demand equates to an average daily demand of approximately 726,483 gallons per day at an average rate of 550 gpm for a daily maximum run time of 22 hours.

2013-2020 GOLF COURSE DEMAND

The TRR well field’s demand, historically and for the foreseeable future, is the Talking Rock Golf Course. The monthly and annual golf course demand from 2013 through 2020 are shown below in table 6. The golf course demand has ranged from a high of 103,711,000 gallons in 2020 to a low of 81,941,000 gallons in 2015. The golf course demand for 2020 was 103,711,000 gallons, an increase of 13,142,000 gallons from 2019.

Table 6, Golf Course Demand 2013-2020, in gallons

Month	2013	2014	2015	2016	2017	2018	2019	2020
January	4,929,000	2,688,000	3,723,000	16,000	48,000	3,151,000	1,194,000	0
February	3,556,000	4,699,000	1,898,000	642,000	0	4,931,000	0	884,000
March	2,003,000	5,357,000	1,105,000	4,088,000	0	1,158,000	112,000	1,902,000
April	9,493,000	9,807,000	9,365,000	7,945,000	5,535,000	9,163,000	6,155,000	2,948,000
May	12,514,000	11,308,000	10,529,000	9,773,000	12,222,000	14,144,000	9,914,000	11,090,000
June	11,811,000	14,345,000	10,455,000	12,109,000	13,277,000	13,361,100	8,918,000	11,763,000
July	15,103,000	12,191,000	10,151,000	14,701,000	14,563,000	11,521,000	12,075,000	16,835,000
August	8,278,000	8,589,000	8,758,000	11,648,000	5,755,000	11,130,000	13,545,000	16,689,000
September	7,893,000	4,436,000	8,191,000	5,124,000	11,748,000	7,900,000	13,748,000	16,505,000
October	7,585,000	5,084,000	8,338,000	7,407,000	10,860,000	8,447,000	10,028,000	11,521,000
November	8,211,000	6,816,000	7,090,000	8,243,000	9,566,000	6,178,000	11,575,000	9,652,000
December	4,762,000	4,969,000	2,338,000	2,885,000	5,208,000	3,738,000	3,305,000	3,922,000
Total	96,138,000	90,289,000	81,941,000	84,581,000	88,782,000	94,822,100	90,569,000	103,711,000

WELL FIELD HOURS OF USE AND YIELD

TRR well 1 was pumped for approximately 4,040 hours during 2020 for an average daily use of about 11 hours per day. The maximum use occurred in September when the well was pumped for 616 hours for an average daily use of 20.5 hours. TRR well 2 was pumped for 2,706 hours during 2020 for an average daily use of about 7 hours per day. The maximum use occurred in July when the well was pumped for approximately 660 hours for an average daily use of about 21 hours. TRR well 3 was pumped for 1,492 hours during 2020 for an average daily use of about 4 hours per day. The maximum use occurred in November when the well was pumped for approximately 317 hours for an average daily use of 11 hours.

Average annual yield for TRR well 1 was approximately 322 gpm for 2020. Average annual yield for TRR well 2 was approximately 252 gpm for 2020. Average annual yield for TRR well 3 was approximately 220 gpm for 2020. Average annual yields for TRR well 1, well 2, and well 3 over the last 5 years are show below (table 7). The yields from the wells have remained relatively stable over the last 5 years.

Table 7, 2016-2020 Average Annual TRR Well Field Yields, in gpm

Well	2016	2017	2018	2019	2020
Well 1	325	332	326	340	322
Well 2	257	259	250	251	252
Well 3	225	226	219	233	220

WELL FIELD WATER LEVELS

For practical reasons, it is best to maintain the pumping water level in the wells at approximately two-thirds of the original thickness of the aquifer at each well. This will maximize production relative to the decline in the pumping water level and to pumping cost. Under this consideration, the maximum depth to water at well 1 should be 185 ft. For well 2, the maximum depth should be 155 ft. For well 3, the maximum depth should be 145 ft.

Another consideration is the requirement to maintain the pumping water level in a well above the intakes to limit risk of air entrainment. The pump intakes at TRR wells 1 and 2 are set at 262 ft. below land surface. Maintaining a pumping level of 165 ft. or less at well 1 assures at least 97 ft. of water above the pump intakes, a pumping level of 155 ft or less at well 2 assures at least 107 ft of water above the intakes while meeting the two-thirds rule. The pump intake at well 3 is set at approximately 230 ft. below land surface, maintaining a pumping level of 145 ft assures at least 85 ft of water above the intakes. Although these pumping levels do not maximize production relative to pumping cost, it reduces the risk of pump failure. Long-term viability of the well requires a pumping level above these depths.

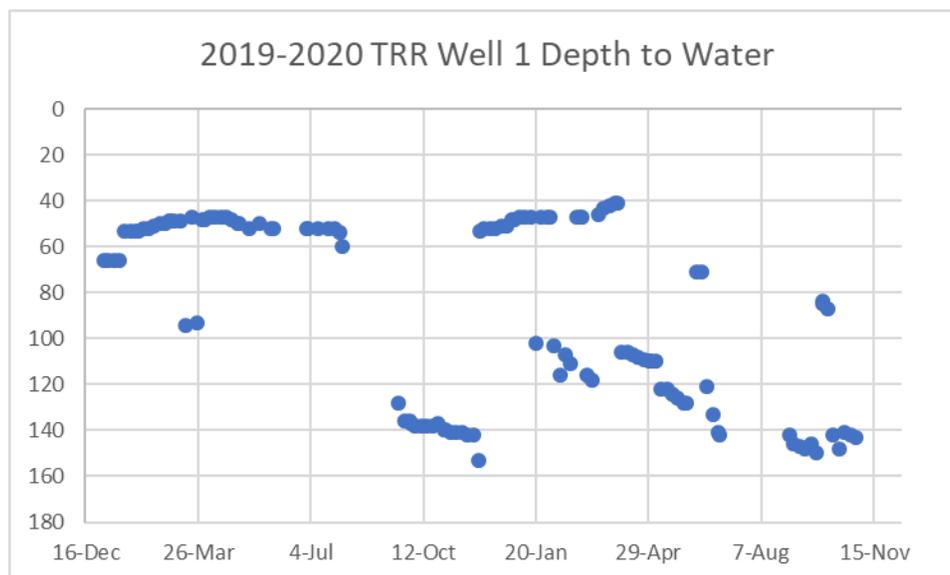
TRR WELL 1

Static (non-pumping) depths to water at TRR well 1 during 2019-2020 ranged from a low of 71 ft below land surface to a high of 41 ft below land surface (figure 1). The static water levels average about 50 ft below land surface during 2019-2020.

Pumping depths to water at the well during 2019-2020 ranged from a low of 153 ft below land surface to a high of 102 ft below land surface depending on the time of year and presence or absence of pumpage from the other wells.

Pumping depths at TRR well 1 are above the 165 ft below land surface required to preclude air entrainment. Pumping and non-pumping depths are consistent with continued viability of the well.

Figure 1.



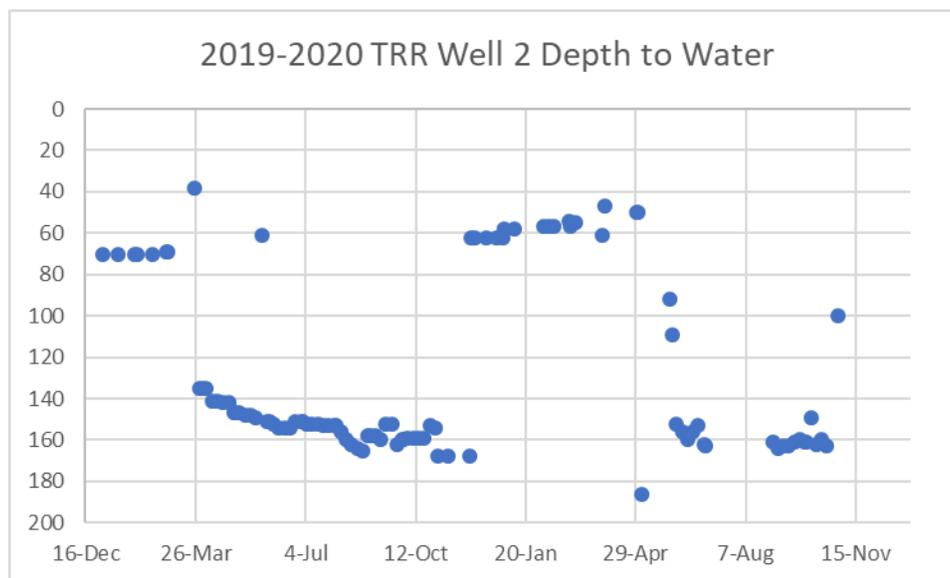
TRR WELL 2

Static depths to water at TRR well 2 during 2019-2020 ranged from a low of 92 ft below land surface to a high of 38 ft below land surface (figure 2). The static water levels average about 61 ft below land surface during 2019-2020.

Pumping depths to water at the well during 2019-2020 ranged from a low of 186 ft below land surface to a high of 100 ft below land surface depending on the time of year and presence or absence of pumpage from the other wells.

Non-pumping depths and stable well yields are consistent with the viability of the well; however, pumping depths are exceeding 155 ft below land surface required to preclude air entrainment. As you can see in figure 2, the lowest pumping depths are between 165-186 ft below land surface, which are inconsistent with long-term viability of the well. However, the lowest pumping depths occur when well 2 and well 3 are running simultaneously, as you can see by comparing figure 2 and figure 3. By running the two wells separately, the risk of well 2's pumping depth falling below 155 feet below land surface is reduced.

Figure 2.



TRR WELL 3

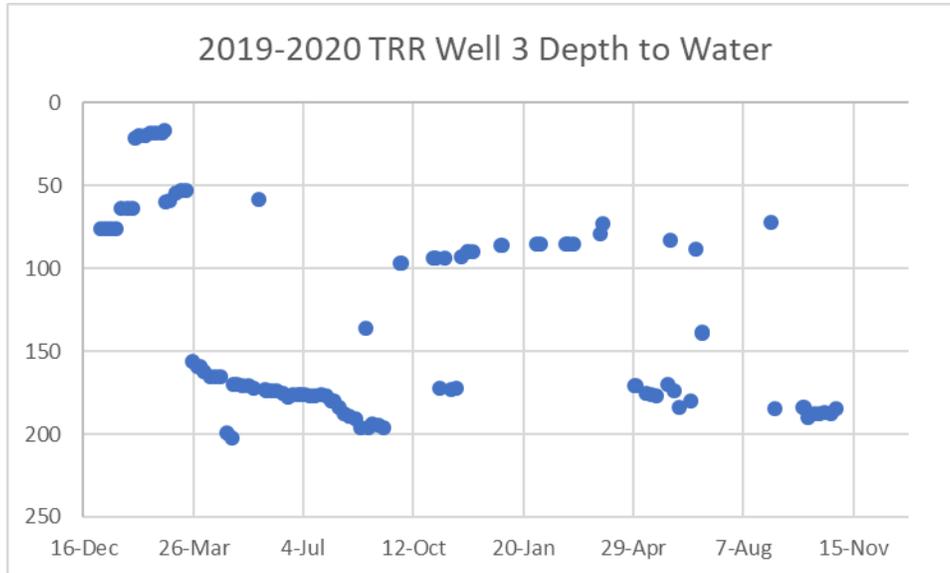
Static depths to water at TRR well 3 during 2019-2020 ranged from a low of 97 ft below land surface in October 2019 to a high of 17 ft below land surface in February 2019 (figure 3). The static water levels average about 66 ft below land surface during 2019-2020. Non-pumping water levels ranging from approximately 85 ft to 97 ft below land surface represents pumping from TRR well 1 or TRR well 2.

Pumping depths to water at the well during 2019-2020 ranged from a low of 196 ft below land surface to a high of 62 ft below land surface depending on the time of year and presence or absence of pumpage from the other wells.

Non-pumping depths and stable well yields are consistent with the viability of the well; however, pumping depths are significantly below the 155 ft below land surface required to preclude air entrainment and inconsistent with long-term

viability of the well. While the well's pumping depths are frequently lower than the recommended 155 ft, the lowest depths, ranging from 180-196 ft below land surface, occur when well 2 and well 3 are running simultaneously. It is recommended to run well 2 and well 3 separately; in addition, it is recommended to leave well 3 offline during the dry summer months

Figure 3.



SUMMARY

The Inscription Canyon Water Company is a private, non-profit water company providing water to the Inscription Canyon Ranch, Whispering Canyons, Preserve at the Ranch, and Talking Rock subdivisions as well as the Talking Rock golf course. The first three subdivision obtain water from the ICR well field which consists of two wells while the Talking Rock subdivision and Talking Rock golf course obtain water from the TRR well field which consists of three wells.

The 2020 TRR annual well field demand was 139,829,975 gallons. Out of the 139,829,975 gallons, Talking Rock Golf Course annual demand accounts for 103,711,000 gallons, representing 74% percent of the total annual pumpage from the TRR well field. The annual average use in gallons per day per residence in the TRR system, including commercial and landscape demand, increased from 222 gpd/r in 2019 to 239 gpd/r in 2020.

The maximum daily demand occurred in July with pumpage equaling 22,520,975 gallons. This demand equates to an average daily demand of approximately 726,483 gallons per day at an average rate of 550 gpm for a daily maximum run time of 22 hours. The maximum average daily residential demand for 2020 occurred in September at 2,963,580 gallons. There were 340 residences served during this time, with an average daily use equaling 291 gpd/r.

The Talking Rock Ranch well field consists of three wells: TRR 1, 2, and 3. The well field historically has been managed so that wells are called up sequentially as demand increases; only one well is initially in service until demand requires an additional well. However, standard operating procedure was determined to be inadequate during the recent dry seasons. In August 2020, the standard operating procedure changed to pumping wells 1 and 2 simultaneously while

keeping well 3 offline for months April through September. This change to the standard operating procedure has enabled the system to provide sufficient yield to meet near-future dry seasons and increasing demand.

TRR 1 was used for a total 4,040 hours during 2020 equaling an average daily use of approximately 11 hours per day. The average annual yield for the well was approximately 322 gpm. Total production from the well was 78,044,155 gallons.

TRR 2 was used for a total of 2,706 hours during 2020 for an average daily use of about 7 hours per day. The average annual yield for the well was approximately 252 gpm. Total production from the well was 40,921,418 gallons.

TRR 3 was used for only 2,706 hours during 2020 for an average daily use of about 7 hours per day. The average annual yield for the well was approximately 220 gpm. Total production from the well was 20,864,402 gallons.

Average yields for the TRR wells have remained relatively stable over the last 5 years. While well 1's pumping and non-pumping depths are consistent with long-term viability of the well, pumping depths for well 2 and well 3 are consistently below the recommended maximum pumping depth of 155 ft below land surface required to preclude air entrainment. The lowest pumping water levels occur when both wells are on line at the same time. Because of this, it is recommended to run well 2 and well 3 separately; in addition, it is recommended to leave well 3 offline during the dry summer months.