LUMOS & ASSOCIATES

MEMORANDUM

DATE:	4/3/2024
TO:	Ed James
FROM:	Chelsea Cluff, P.E.
CC:	Tim Russell, P.E., WRS; Jonathan Lesperance, P.E.
SUBJECT:	Lyon County Purveyor Data

1.0 Background Information

Lumos & Associates (Lumos) was contracted by the Carson Water Subconservancy District (CWSD) to assist the United States Geological Survey (USGS) with the data collection and analysis of 13 water purveyors within the Carson River Watershed as part of the Carson River Watershed 30-Year Regional Drought and Water Sustainability Plan. The intended purpose of this document is to identify potential deficiencies in water supply (both quantity and/or quality) over a 30-year planning horizon with a focus on existing and future municipal water production, water quality, and water rights for Lyon County. Where deficiencies are noted or anticipated, potential mitigation measures will be provided for future consideration. Existing well pumping rates, future well pumping rates and well locations will be provided to USGS for use in modeling groundwater and surface water impacts across the watershed. Tabulated data including monthly production for each well over the current 5-year period of record, will be made available to USGS, CWSD, and the water purveyor.

Lyon County is directly east of Carson City and includes 1.3 million acres of land, eight (8) communities, and approximately 61,585 people per 2022 U.S. Census Data and a 2011 Fact Sheet published by Lyon County. Of the communities located in the county, four (4) are located adjacent to the Carson River Watershed: Mound House, Dayton, Stagecoach, and Silver Springs. Lyon County Utilities manages the water supply and distribution for the Mound House and Dayton communities. Mound House is an unincorporated community located approximately 6.5 miles northeast of Carson City, along State Route 50 and adjacent to the Carson River. Similarly, Dayton is an unincorporated community located approximately 12 miles northeast of Carson City, along State Route 50 and adjacent to the Carson River. The Dayton and Mound House communities are considered the service area for this memorandum. Lyon County uses nine (9) existing, active municipal supply wells that service 7,053 connections, of which 6,304 are residential. The Dayton community accounts for approximately 5,811 residential connections and 402 commercial connections; whereas the Mound House community accounts for 493 residential connections and 347 commercial connections.

2.0 Existing and Future Demands

2.1 Existing Production

Lyon County obtains its potable water from eight (8) active groundwater wells and one (1) induction well. Monthly total well production from each individual well varies from 0.2 million gallons per month to 35.4 million gallons per month. Rolling A Well #20 is the highest producing well with a pumping capacity of 3,500 gallons per minute (gpm) and a max daily production of 4,536,000 gallons per day (gpd). Rolling A Well #20 is an induction well and thus pumps surface water rights and operates under the Alpine Decree. The highest producing groundwater well in the Lyon County system is Well #21 with a capacity of 3,200 gpm and a max daily production of 4,147,200 gpd. For a breakdown of each well with pumping capacity and max daily

production capacity see Table 1. The existing locations and associated permit numbers for each well are listed within Table 7 in the Supplemental Information.

Table 1: Well Pumping Capacity & Max Daily Production Capacity

Well Name	Well Pumping Capacity (gpm)[1]	Max Daily Production Capacity (gpd)[2]
Dayton Well #2	380	492,480
Dayton Well #3	800	1,036,800
Dayton Well #4	650	842,400
Rolling A Well #20[3]	3,500	4,536,000
Rose Peak Well #6	65	84,240
Rose Peak Well #7	90	116,640
Rose Peak Well #5	900	1,166,400
Cardelli Well #8	1,200	1,555,200
Well #21	3,200	4,147,200
Total	10,785	13,977,360

Notes:
[1] Well pumping capacity is based on the 2017 Water Facility Plan Update for Lyon County, Well #21 was drilled after 2017 and is based on a Lyon County provided well driller report.
[2] Maximum daily production was estimated by using a 21.6-hour (90%) pumping cycle. The 21.6-hour (90%) pumping cycle was determined based on discussion with Lyon County Public Works.
[3] Rolling A Well #20 is an induction well and usage is controlled by the Alpine Decree. An induction well pumps from a surface water source as opposed to a groundwater source.

Combined, the nine (9) wells have a total pumping capacity of 10,785 gpm and a max daily production of 13,977,360 gpd assuming a 21.6 hour per day pumping cycle (90% of a 24-hr period). Overall, the production capacity of a system as identified in this report is summer-time capacity since water demand increases three (3) to four (4) times in the summer when compared to winter-time demands. Therefore, the capacity analysis is focused on the high production months. The maximum monthly production for all five (5) years analyzed occurred between July and August with the overall highest production month being July of 2021 at 141.6 million gallons (MG).

The maximum monthly production was used to calculate the average day max month (ADMM) by dividing the absolute maximum month for each year throughout the five years of data and dividing by the number of days within that month.

The ADMM was used along with the maximum pumping capacity (based on a 21.6 hour a day pumping cycle) to evaluate production deficiencies in the system. Figure 1 illustrates the difference in summer demand versus the capacity by illustrating the average five-year ADMM to the available production capacity. For a breakdown of the combined production of all the wells through the summer period see Table 2, and for the yearly production of all wells broken down by month, reference Table 8 in the Supplemental Information.

Table 2: Historical Monthly Well Production

Month	Monthly Well Production (MG)					
	2018	2019	2020	2021	2022	2018 – 2022 Average Day Max Month (ADMM)
Jun	108.49	98.65	111.83	120.99	120.79	4.03
Jul	126.01	119.45	132.85	141.57	116.80	4.79
Aug	139.10	127.56	124.41	124.97	125.60	4.49
Sep	105.19	111.58	110.24	117.97	121.41	4.05

= Maximum Month

Lyon County will practice conjunctive use management utilizing all sources, both surface and groundwater. Under the Alpine Decree the Carson River is administered in segments. Each segment of the river is treated autonomously. The Watermaster determines when there is not enough water to serve the most junior priority and will notify all water users that the segment is under regulation. The Watermaster will begin to direct the distribution of water based on priority. Under the Alpine Decree "No user entitled to the use of water under this Decree shall be allowed to divert more than 40% of his total entitlement in any one calendar month." A user does not have to divert 40% of their entitlement in any one calendar month, they can divert less and receive water throughout the season. All diversions occur April through September.

Lyon County's Rolling A Well #20 is located in Segment 7B of the Carson River. There is one other diversion in this segment which is located upstream of the Rolling A well. When the Watermaster places Segment 7B on regulation, Lyon County is limited to the amount of water recorded at the Six Mile stream gage. (communication with Dave Wathen).

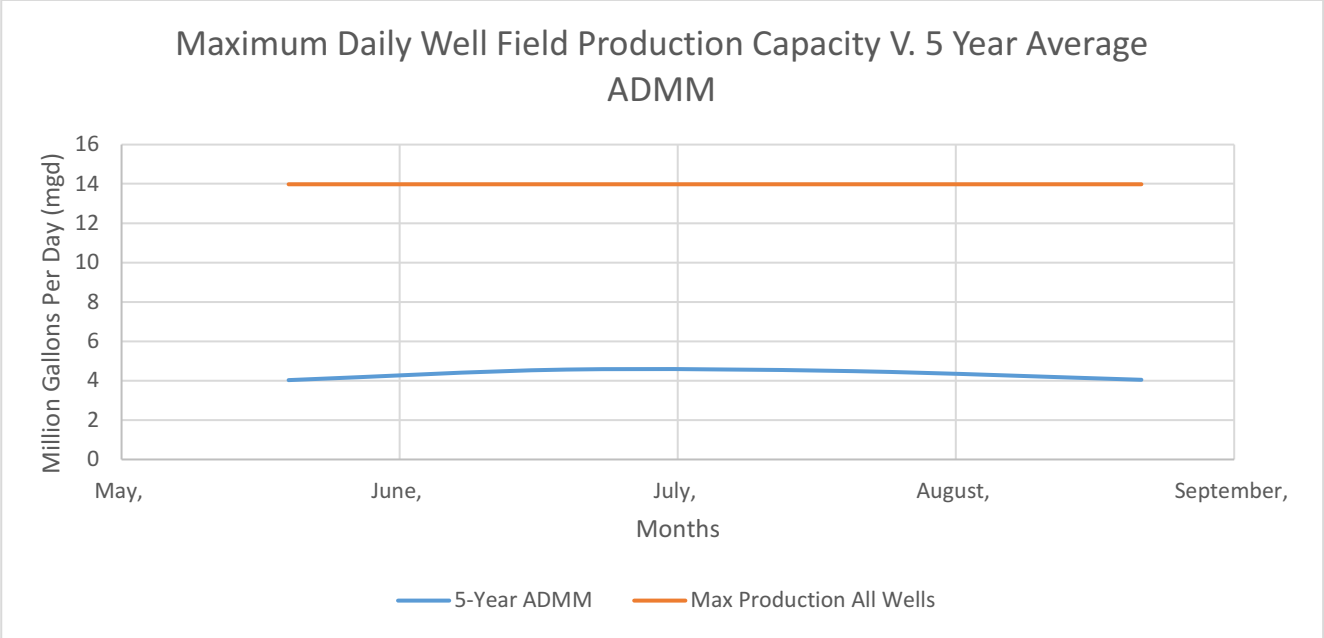


Figure 1: Maximum Daily Well Field Production Capacity

2.2 Growth Projections

To estimate the growth in water production for the Lyon County area, a planning period from 2021 through 2051 (30 years) was analyzed using the Nevada State Demographer's growth rates. These growth rates span from 2021 through 2042. For the purposes of this report, the growth rate was averaged and extended from 2042 to 2051 to cover the planning period. An average growth rate of 0.8% was used to estimate future water production in the area. Detailed growth considerations, such as developable land (receiving area), planned developments, and land use classifications were not considered since this is a high-level estimate of production growth and assumes that the projected growth rate can be accommodated within the Lyon County service territory.

Figure 2 illustrates the annual well production required using the growth rate from Lyon County over the 30-year planning horizon. Table 9, in the Supplemental Information, provides and in-depth breakdown of the growth rate and associated estimated production provided by Lyon County over the 30-year planning horizon.

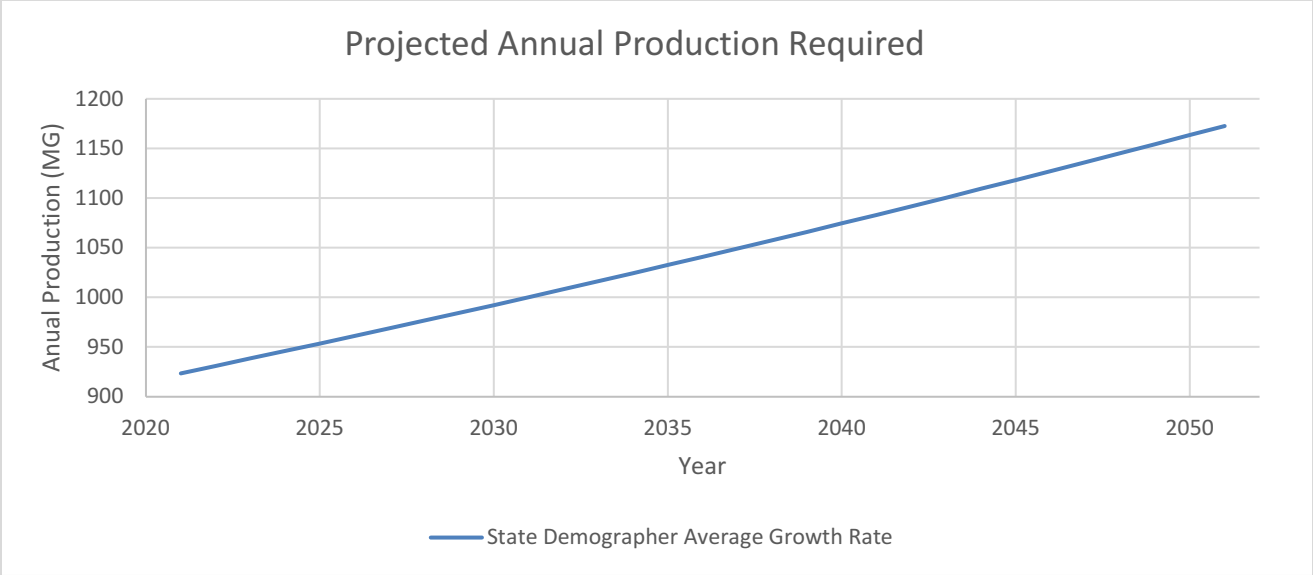


Figure 2: Projected Annual Production

2.3 Estimated Future Demand v. Existing Available Production

To estimate future well production necessary to meet anticipated water demand, the growth projection discussed in Section 2.2 was used to project the maximum daily production demand required for Lyon County. The calculated, annual required production for Lyon County in 2051 was approximately 1,173 MG based off Lyon County's growth rate, as described in Section 2.2. To get the monthly future demand in 2051 for each of the high production months (June through September), the estimated annual future demand for 2051 was multiplied by the 5-year average percentage of the high production months. The five-year average percentage was found by taking the monthly total and dividing it by the total annual production for each year between 2018 to 2022 and then averaging across all five years. In Figure 3, the future estimated ADMM for the State Demographer growth rate is compared against current available production capacity. If all wells are operating, there is sufficient capacity to meet estimated growth for the planning period.

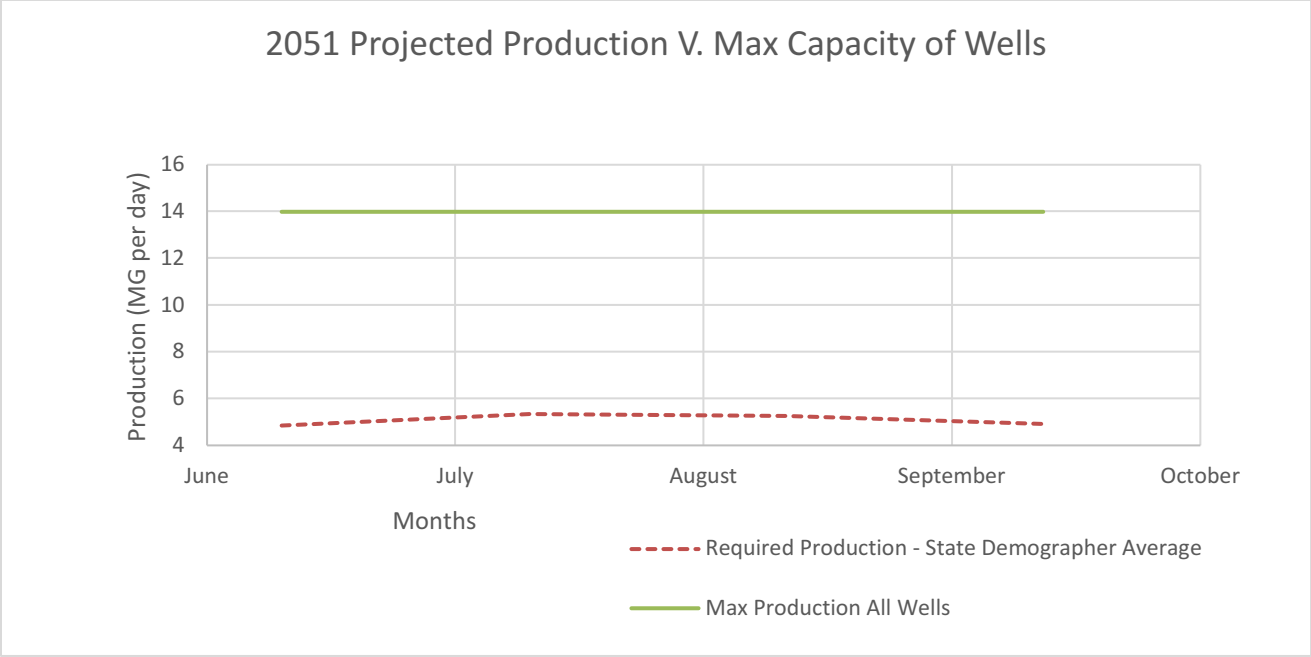


Figure 3: Projected 2051 ADMM Production versus Max Capacity of Wells

3.0 Water Quality

Water quality was analyzed using purveyor-provided data from 2019 through 2023. The yearly concentrations for the nine (9) active wells are shown in Table 3. The data provided analyzes existing water quality per well for three (3) constituents: Total Dissolved Solids (TDS), Arsenic, and Nitrogen. The maximum contaminant level (MCL) and secondary maximum contaminant level (SMCL) for each constituent is provided in Table 3 as well. The nine (9) Lyon County wells with contaminant data have low or non-detectable concentration levels for the monitored contaminants.

Table 3: Contaminants Concentration

Well	Well Tag	Sample Year	TDS (ppm) SMCL = 500	Arsenic (ppb) MCL = 10	Nitrogen (as Nitrate) (ppm) MCL = 10
Dayton Well #2	2	2019	260	3.4	1.2
		2020	---	---	1.6
		2021	---	---	1.2
		2022	350	3	1.2
Dayton Well #3	3	2019	340	5.9	1.4
		2020	---	5.5	1.5
		2021	---	5.7	1.5
		2022	---	5.7	1.5
		2023	---	5.4	1.6
Dayton Well #4	4	2019	450	6.2	0.8
		2020	---	5.8	0.7
		2021	---	6.9	0.75
		2022	---	6	0.75
		2023	450	6.2	0.96
Rolling A Well #20	20	2019	---	4.7	0
		2020	---	---	0
		2021	---	---	0
		2022	250	2.5	0
		2023	---	---	0
Rose Peak Well #6	6	2020	---	---	1.9
Rose Peak Well #7	7	2019	---	2.3	1.6
		2020	---	---	1.8
		2021	---	---	1.8
		2022	260	0	1.8
		2023	260	0	2.2
Rose Peak Well #5	5	2019	---	3.4	0
		2020	---	---	0.015
		2021	---	---	0
		2022	---	3.5	0
		2023	770	3.5	0
Cardelli Well #8	8	2019	---	---	0.27
		2020	440	---	0.18
		2021	---	2.7	0.27
		2022	---	---	0.3
		2023	400	2.3	0.28
Well #21	21	2019	---	4.7	0.39
		2020	---	---	0.43
		2021	---	---	0.47
		2022	350	2.8	0.45

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4.0 Water Rights

Lyon County has a total of 13,869.18 acre-feet per year (AFA) of water rights. A conjunctive use plan has been approved by the Department of Water Resources (DWR).

5.0 Summary

For the beginning of the planning period (2021), Lyon County currently has adequate well production capacity (13.98 MG/day) to meet the demands of its community (4.57 MG/day) and negligible water quality issues impacting their system. Based on the planning horizon of 30-years (2021 to 2051) and the growth rate (0.8%) used in the analysis, Lyon County has sufficient water rights (13,869.18 AFA) to account for future growth in 2051 (3599 AFA). As development continues and the population grows within their district, the future required well production capacity will be 5.36 MG/day still below the current capacity of 13.98 MG/day from the nine (9) active wells. However, it is critical to reanalyze future water supply to ensure demands can be met in case growth is higher than 0.8% year over year. For an in-depth look at all considerations and groundwater modeling scenarios, see Section 5.1 and Section 5.2. For a more detailed breakdown of projected well production required capacity and the surplus, see Table 4.

Table 4: Summarized Existing & Future Production

	Mgal/day	gal/min
Existing (2021) Water Supply Capacity [1]	13.98	10,785
Existing (2021) Water Demand	4.57	3,530
Existing (2021) Water Supply Deficit/Surplus [3]	9.41	7,255
Future (2051) Water Demand[2]	5.36	4,140
Future (2051) Water Supply Deficit/Surplus [3]	8.61	6,645

[1] Existing water supply capacity includes production from the following wells shown in Table 1
[2] The water demand in 2051 assumes the Lyon County growth rate, as discussed in Section 2.2
[3] The deficit/surplus calculation assumes no additional well development between 2021 and 2051 to analyze the additional well capacity needed to meet future demands. A negative number represents a water production deficit (and the need for additional water production) and a positive number represents a water production surplus (no additional water production necessary to meet future water demands)

5.1 Future Water Supply Considerations

The current (4.57 MG/day) and future demands in 2051 (5.36 MG/day) are below the maximum well capacities (13.98 MG/day). Based on the current data and methodology used for the analysis, Lyon County's current water supply of nine (9) wells is sufficient for the projected growth in the service area and will not require additional wells to meet the projected water demand. It is important to note that population growth in an area is dependent on many different factors that are not always able to be anticipated in a future growth analysis. Therefore, the population and expected community growth should be continually monitored in case an unanticipated population boom drives the water demand to be higher than the capacity of the existing water supply. For this reason, it is encouraged that all purveyors look at the benefits of water conservation.

1. Water Conservation
    - Pros: Reduce overall demand and production needs, inexpensive
    - Cons: Consumer buy in, does not fully accommodate long-term growth, loss of revenue

One additional well is recommended to be considered to account for the future growth of the system based on discussion with Lyon County. Information on the proposed well is summarized in Table 5.

Table 5: Proposed Well Locations

Parameter	Mira Vida Well #22
Nearby Street	Mira Vida
Well Depth (ft)	500
Casing Perforations Start Depth	205
Casing Perforations End Depth	480
Latitude	39.26
Longitude	-119.54
Elevation (ft)[3]	4,358

Notes:
[1] The proposed well location is based on the 2017 Lyon County Water Facilities Plan Update.
[2] Casing perforations start and end depths are estimated. No preliminary design data for this information was provided in the 2017 Lyon County Water Facilities Plan Update.
[3] Elevations were determined using Google Earth and approximate well locations.

5.2 Modeling Options

The base condition and an outlined option that would be recommended for modeling purposes has been summarized below and in Table 6. This is not a recommendation to the purveyor and purely an assumed option for modeling purposes. This option is based on the most-conservative condition within the 2017 Lyon County Water Facilities Plan Update and a growth rate of 0.8%.

Base Condition: Run existing wells with existing capacities for all nine (9) active wells.

Option 1: Run existing wells and the proposed well based on 2017 Lyon County Water Facilities Plan Update.

Table 6: Proposed Modeling Options

Options	DW #2[2]	DW #3[2]	DW #4[2]	RAW #20[2]	RPW #6[2]	RPW #7[2]	RPW #5[2]	CW #8[2]	Well #21	Well #22[3]	Total
Base Condition (gpm)	380	800	650	3,500	65	90	900	1,200	3,200	0	10,785
Option #1 (gpm)	380	800	650	3,500	65	90	900	1,200	3,200	1,000	11,785

Notes:
[1] Max well production was assumed that wells could run 21.6 (90%) hours of the day during the peak months of June through September.
[2] DW = Dayton Well; RAW = Rolling A Well; RPW = Rose Peak Well; CW = Cardelli Well
[3] Proposed well capacity for USGS modeling is using the Based Condition

6.0 Supplemental Information

Table 7: Existing Well Locations & Depths

Parameter	Dayton Well #2	Dayton Well #3	Dayton Well #4	Rolling A Well #20	Rose Peak Well #6	Rose Peak Well #7	Rose Peak Well #5	Cardelli Well #8	Well #21
Tag Number	Well #2	Well #3	Well #4	Well #20	Well #6	Well #7	Well #5	Well #8	Well #21
Application Number	56593	58931	62077	70656	58933	58932	62937	77662	87632
Capacity (GPM)	380	800	650	3,500	65	90	900	1,200	3,200
Latitude	39.24	39.25	39.24	39.28	39.25	39.25	39.26	39.29	39.3
Longitude	-119.57	-119.55	-119.57	-119.53	-119.59	-119.59	-119.47	-119.52	-119.51
Depth	405	566	515	190	96	130	208	620	520
Casing Perforations Start Depth	120	200	150	105	--	46	106	300	215
Casing Perforations End Depth	372	560	510	182	72	107	206	590	500
Elevation (ft)[1]	4,387	4,380	4,415	4,416	4,366	4,391	4,345	4,346	4,310

Notes:
[1] Elevations were determined using Google Earth and approximate well locations.

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Table 8: Historical Total Monthly Well Production

Month	Monthly Well Production (MG)					
	2018	2019	2020	2021	2022	2018-2022 Average
January	34.68	37.38	37.00	34.80	29.73	34.72
February	39.22	31.53	35.45	35.36	29.33	34.18
March	34.30	31.67	38.84	36.86	43.42	37.02
April	55.94	56.92	69.63	83.17	67.83	66.70
May	81.27	98.21	98.95	97.18	96.61	94.44
June	108.49	98.65	111.83	120.99	120.79	112.15
July	126.01	119.45	132.85	141.57	116.80	127.34
August	139.10	127.56	124.41	124.97	125.60	128.33
September	105.19	111.58	110.24	117.97	121.41	113.28
October	80.48	76.56	97.31	61.36	88.77	80.90
November	49.46	38.14	38.28	33.60	43.31	40.56
December	33.13	35.77	42.64	35.66	37.09	36.86
Total	887.27	863.42	937.45	923.49	920.70	906.47
Average Day (MG/day)	2.43	2.37	2.57	2.53	2.52	2.48
Max Month (MG)	139.10	127.56	132.85	141.57	125.60	128.33
ADMM (MG/day)	4.49	4.11	4.29	4.57	4.05	4.14

= Maximum Month

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Table 9: Future Well Production

Year	State Demographer – Lyon County Average Growth Rate	Future Production [1] –(MG)
2021 (base)	-	923
2022	0.8%	931
2023	0.8%	938
2024	0.8%	946
2025	0.8%	953
2026	0.8%	961
2027	0.8%	969
2028	0.8%	976
2029	0.8%	984
2030	0.8%	992
2031	0.8%	1,000
2032	0.8%	1,008
2033	0.8%	1,016
2034	0.8%	1,024
2035	0.8%	1,032
2036	0.8%	1,041
2037	0.8%	1,049
2038	0.8%	1,057
2039	0.8%	1,066
2040	0.8%	1,074
2041	0.8%	1,083
2042	0.8%	1,092
2043	0.8%	1,100
2044	0.8%	1,109
2045	0.8%	1,118
2046	0.8%	1,127
2047	0.8%	1,136
2048	0.8%	1,145
2049	0.8%	1,154
2050	0.8%	1,164
2051	0.8%	1,173

Notes:
[1] Total Projected Production is based off the State Demographer averaged growth rate described in Section 2.2 and is the total of all wells in million gallons.



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WELL LOCATIONS
LYON COUNTY

CWSD

30-YEAR REGIONAL DROUGHT PLAN

1 OF 1

LEGEND

- Proposed Lyon County Wells
- Lyon County Wells

Paper Size: 8.5" x 11"

0 0.5 1
Miles

Projection: Transverse Mercator
Grid: NAD 1983 UTM Zone 11N
Datum: North American 1983
Created by: dmarinrios

Date:	04/03/2024
Project #:	10974.000
Revision:	3