Utah FOUNDATION Executive Summary

Report Number 667, August 2004

UTAH'S WATER SITUATION

A Deseret Morning News article from August 8, 2004 stated that, based on flow data of the Colorado River, the current drought is considered the worst in 500 years. This statistic is alarming, but while the Colorado River is an important part of Utah's overall landscape, residents in the most populous parts of the state utilize very little of the river's water. The flow rates of the Colorado have a greater impact downstream in Nevada and California.

DROUGHT CYCLES & WATER LOCALITY

Figure 1 shows a summary of Palmer Index data for each of the Division of Natural Resources' seven divisions, which roughly correspond to Utah's eleven drainage basins. The Palmer Index has been used since 1895 to determine monthly precipitation relative to the area's "normal" or "average" amount. The Palmer Index ranges from +4 to -4, with a +4 being extremely moist and a -4 extremely dry. For each of the seven divisions, Utah Foundation examined the Palmer Index for five year intervals from 1985-2000 as well as the last complete year of data, 2002. The years examined correspond with the US Geological Service water use data by state, which is discussed later in this report.

The Palmer Index data in Figure 1 tallies the number of moderately dry, severely dry, and extremely dry months for each division and each year noted. For each division, the year that had the largest number of extremely dry months is highlighted. As the data show, with the exception of Divisions 2 and 6, 1990 had more extremely dry months than 2002. Utah Foundation then tallied the division totals into one "grand total" in the last column. This grand total shows there were more moderately dry months in 2002 on an aggregate state basis than in 1990, but fewer severely and extremely dry months.

From this grand total, Utah Foundation created a weighted drought index for the entire state. This index weights extremely dry months more heavily than those of less severity. By dividing this weighted figure against the "worst case scenario," twelve months of extremely dry conditions in all seven districts, a drought severity index can be calculated. An index reading of 100 would reflect the worst case

Figure 1: Palmer Indices and Utah Foundation Statewide Drought Rating for Selected Years

Division 1-West Desert*

	Moderate	Severe	Extreme
1985	1	0	0
1990	0	5	7
1995	2	0	0
2000	5	3	4
2002	0	4	3
Extreme	1954		

Division 2-Southwest Corner

	Moderate	Severe	Extreme
1985	0	0	0
1990	4	6	2
1995	0	0	0
2000	5	5	0
2002	0	3	9
Extreme	1900		

Division 3-Wasatch Front

	Moderate	Severe	Extreme
1985	0	0	0
1990	0	0	12
1995	0	0	0
2000	4	3	0
2002	10	2	0
Extreme	1934		

Division 4-South Central

	Moderate	Severe	Extreme
1985	0	0	0
1990	0	2	10
1995	0	0	0
2000	1	0	0
2002	5	2	3
Extreme	1902		

Division 5-Northeast Mtn.

	Moderate	Severe	Extreme
1985	0	0	0
1990	6	6	0
1995	0	0	0
2000	5	0	0
2002	10	2	0
Extreme	1931-1935		

Division 6-Central Highlands

	Moderate	Severe	Extreme
1985	0	0	0
1990	2	10	2
1995	0	0	0
2000	4	3	0
2002	0	6	6
Extreme	1900-02		

Division 7-Southeastern

	Moderate	Severe	Extreme
1985	0	0	0
1990	1	4	7
1995	0	0	0
2000	5	4	0
2002	5	3	4
Extreme	1900-04		

Statewide Total

	Moderate	Severe	Extreme	Drought Rating
1985	1	0	0	0.6
1990	13	33	40	85.6
1995	2	0	0	1.2
2000	29	18	4	38.4
2002	30	22	25	67.9

*2002 data for Division 1 is incomplete

Source: Utah Division of Water Resources

For the complete report on this topic and other reports, please visit our website at www.utahpriorities.net or www.utahfoundation.org

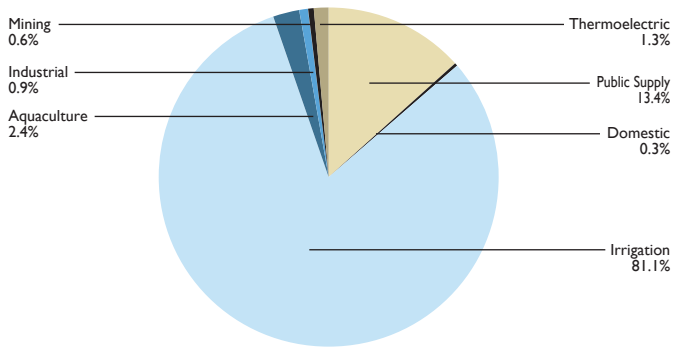
scenario, while an index reading of zero would mean no drought conditions exist. For the years 1985, 1990, 1995, 2000, and 2002, the index rating for each year is shown in the very last column in the statewide total section. The index shows that at the aggregate state level, the drought during 1990 was more severe than during 2002. However, the rapid increase in the ratings between 2000 and 2002 is cause for concern. The current drought began in 1999, but vigorous population growth during 1990-2000 raises concerns about demand outstripping supply even when drought conditions don't exist.

The final piece of information gleaned from the Palmer Index is the last historical point during which conditions were at least as severe in each region as the highlighted time period in Figure 1. For Divisions 2 and 6, the division that have experienced the greatest impact from the current drought cycle, one has to go back to the turn of the last century to find years in which they had more extremely dry months than they had in 2002. For Division 2, the year was 1900 and for Division 6, it was 1902.

STATEWIDE WATER USAGE

Every five years, the U.S. Geological Survey releases data on water usage by state. The data detail the amount of water used for agriculture, municipal and industrial uses (M&I- public or private water utility providers), mining, private industrial wells, and thermoelectric generation. The data also provide a look at the sources of water within the state, either surface sources, such as lakes, reservoirs, and rivers, or ground sources –such as wells and springs. The release of these data is slow, and data from 2000 have just recently been published. Along with previous reports from 1985, 1990, and 1995, these data provide a time series of water usage in Utah and other states. This is the longest state by state data series that can be generated from USGS data. Prior to 1985, state comparisons are not possible because data were released by basin. According to the 2000 data, Utahns used 4.76 billion gallons of water per day. Figure 2 shows the breakout of water use by category in percentage terms. Irrigation remains Utah's largest use category, and the percentage of water used for this purpose is up slightly from 79.2% in 1995.

Figure 2: Utah Fresh Water Use by Category, 2000



Source: United States Geological Survey (USGS)

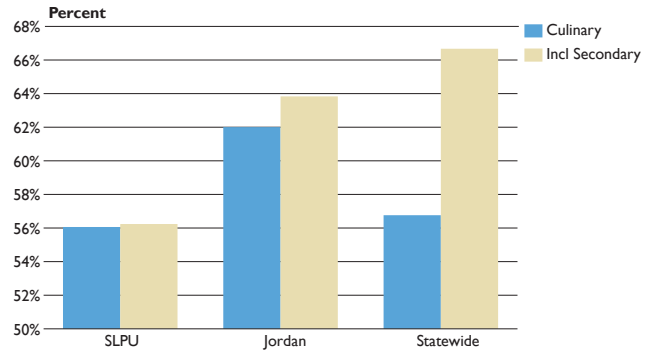
In addition to the increase in the percentage of water used for irrigation purposes, the consumption of municipal water per capita in Utah also increased from 1995 to 2000. In 1995, 269 gallons were used per person per day in the state. In 2000, that climbed to 293 gallons. This was one of the largest increases in the country. Only four states, Colorado, Hawaii, Texas, and Louisiana had larger increases in the amount of municipal water used per person. All four states were experiencing drought conditions in 2000 and increased demand by residents for outdoor water may explain the increase in overall M&I water consumption.

Utah's per capita usage fluctuates greatly between drought and non-drought years. In 1990, the rate was 308 gallons per day. In 2000, when the current drought started to become of greater concern statewide, the rate was 293 gallons per capita daily. When comparing the gallons per capita daily from 1985 through 2000 to the drought index for each of those years, there is a correlation between the two sets of data. Since there are only five data points to each set, the correlation should be used with caution, but the Pearson's R squared that is returned when the calculations are performed is 0.829. This means that approximately 83% of the variance in the amount of gallons per capita daily for 1985-2000 can be explained by the point at which the state finds itself in the drought cycle. To test the true validity of this correlation, further research into other states' water usage and Palmer Indices is necessary.

WATER USE AT THE LOCAL LEVEL

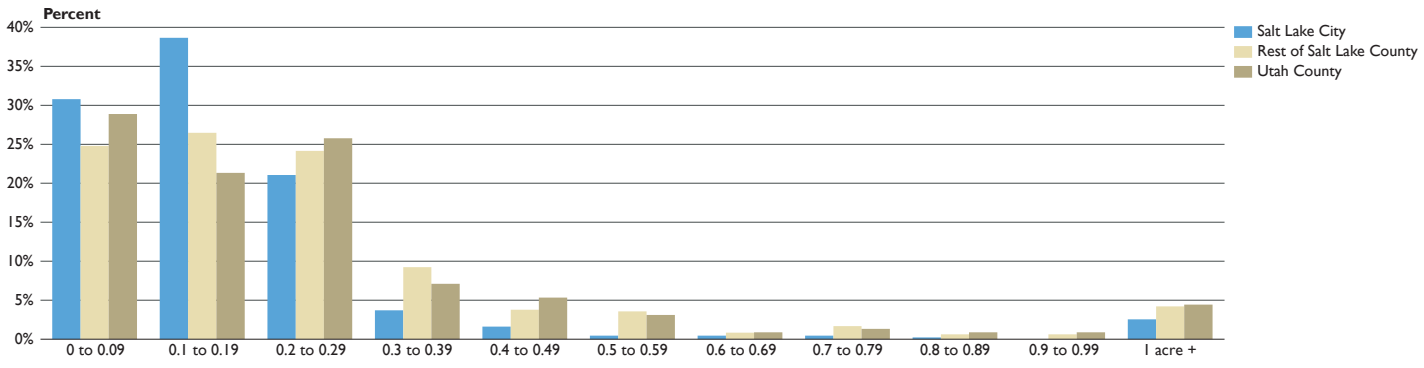
While statewide data are important, they are totals and aggregates of the water usage that occurs in each of the state's eleven basins and each of these eleven basins can be viewed as discrete water use areas. Within these basins, there are also differences in water use among municipalities. Figure 3 details the percentage of water used outdoors for residential customers that are part of the Salt Lake City Public Utility system relative to their counterparts in the rest of the Jordan Valley Basin and statewide figures. As the data show, homeowners that are part of SLPU have a lower percentage of outdoor water use, and secondary water use is almost negligible. Residential customers in the rest of the Jordan Valley Basin are more reliant on secondary water than SLPU customers and they also expend a larger percentage of their water outside. Lot sizes, pricing and lack of access to secondary

Figure 3: Outdoor Use as a Percent of Total Residential GPCD 2000



Source: Utah Division of Water Resources

Figure 4: Residential Property for Sale by Lot Size



Source: Wasatch Front Regional Multiple Listing Service (MLS), Calculations by Utah Foundation

irrigation water may have much to do with the differences between SLPU customers' utilization of outdoor water and the utilization by customers in the rest of the Jordan Valley Basin.

A cursory examination of residential property for sale on a large statewide real estate website that accessed Utah's multi-listing service revealed an interesting trend in lot sizes that is highlighted in Figure 4. Properties listed for sale were grouped by two variables- location and lot size. Location was defined as Salt Lake City, other cities within Salt Lake County, and Utah County. Lot sizes were placed into categories by 1/10 of an acre increments. In order to understand more fully the limitations of these data, a couple of caveats are necessary. First, the data do not include homes that are for sale by owner. Second, condominiums, townhouses and other multi-family units for sale are included in the category 0.0 to 0.9. The decision to include these dwellings was made because most multi-family homes do have common landscaped areas and lawns that draw on municipal water. However, there were also some single-family detached dwellings in all three areas that were situated on lots less than 1/10 of an acre. Within Salt Lake City, there were 17 homes (3.9% of total homes for sale) that had lot sizes smaller than 0.10 of an acre. For the rest of the county, there were 11 homes (2.3% of the total homes for sale) that had lot sizes smaller than 0.10 of an acre. In Utah County, the figures were three homes or 1.3% of the total.

Even with these limitations on the data, the story shown by Figure 4 is compelling. The percent of Salt Lake City lots that are between 0.10 of an acre to 0.19 of an acre are significantly higher than other cities in the county or in Utah County. Additionally, Salt Lake City has a smaller percentage of lots that are above 0.20 of an acre than the other two areas. Additionally it appeared that houses of higher price ranges ($350,000 and up) were just as likely in Salt Lake City to be on small lots as lower priced houses. This was not true in the rest of Salt Lake County or in Utah County.

Combining this information with the data in Figure 3 infers that smaller lot sizes lead to a lower proportion of outside water use. However, smaller lots also usually mean more households (water users) per acre, and it is not clear whether this increased density would lead to aggregate reductions in water use.

CONCLUSION

Utah's water use has been largely dependent on the drought cycle. A comparative analysis of drought conditions versus statewide water usage confirms that in times of scarce precipitation, residents rely more heavily on water stored in reservoirs and from wells. Much of Utah's M&I water is still used outdoors; however more of it is coming from secondary systems. This approach has mixed results, and may encourage residents to use more water outdoors than necessary, since most secondary systems charge less for water than culinary systems, and rate structures for secondary water are usually flat, creating no incentive to conserve.

Water usage overall, and outdoor use specifically, varies from basin to basin in Utah. Even within basins, there can be significantly different patterns of water usage. Policymakers need to be aware that efforts towards conservation in one area may not be successful in another; depending on the mix of customers, some basins may need to focus on customers other than residential homes in order to reduce water use. While pricing has been shown to be an effective tool in conservation efforts, local officials may want to consider land use regulations as well.

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