Water Resources of Central Iron County and Washington County

An Alternative to the Lake Powell Pipeline Project

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INTRODUCTION

Utah is allocated approximately 1.37 million acre-feet (MAF) of water each year out of the Colorado River. Currently, Utah is using about 70% of that. The Lake Powell Pipeline Project is a proposed plan which will divert the remaining 30% of the allocated water to three water districts: 20,000 acre-feet per year (AFY) to Central Iron County, 4,000 AFY to Kane County, and 69,000 AFY to Washington County. The water from this project is believed to be enough to supply water for each district's population in the year 2060.

In 2008, the "Water Needs Assessment Phase 1 Report" was published with the design criteria of the project. The report includes water use projections for the year 2060 and the project total cost. Most of the controversy from the report has to do with the cost. The current proposed plan consists of nearly 180 miles of pipe with several pumps and cost approximately $1.5 billion. This would place a huge amount of debt on the districts and will have a very long repayment period.

Another point of debate is the necessity of the project. Diverting water from a source 139 miles away may not be necessary. Using local sources would cancel the need of the pipeline and reduce the cost.

This report will propose a cheaper alternative to the Lake Powell Pipeline Project by utilizing local water sources. Since the largest amount of water will go to Central Iron County and Washington County Water Conservancy Districts, only those two districts will be analyzed. The analysis was done using AcrGIS to see how much water from local sources is available in each district.

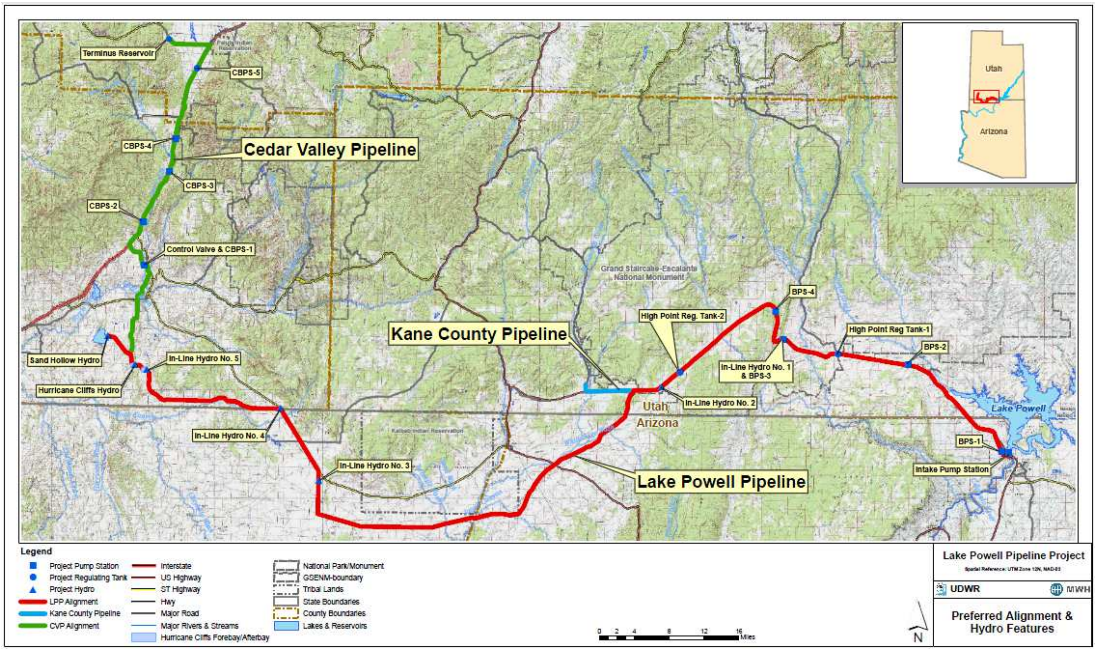


Figure 1 - Map of the Proposed Lake Powell Pipeline Project

DESCRIPTIONS OF WATER DISTRICTS

Washington County covers 2,425 square miles of the southwestern corner of Utah. The terrain is a mixture of mountain and desert with one of the largest elevation ranges in the state (from 2,200 feet to 10,365 feet above sea level). Its warm climate, popular tourist sites, and close access to major freeways contribute to its very high growth rate.

The Central Iron County Water Conservancy District includes only the central portion of Iron County. It covers an area of 1,390 square miles in south central Utah. Although Enoch City and Kanarraville are within the district boundaries, they have their own water supply and are not included in this water district.

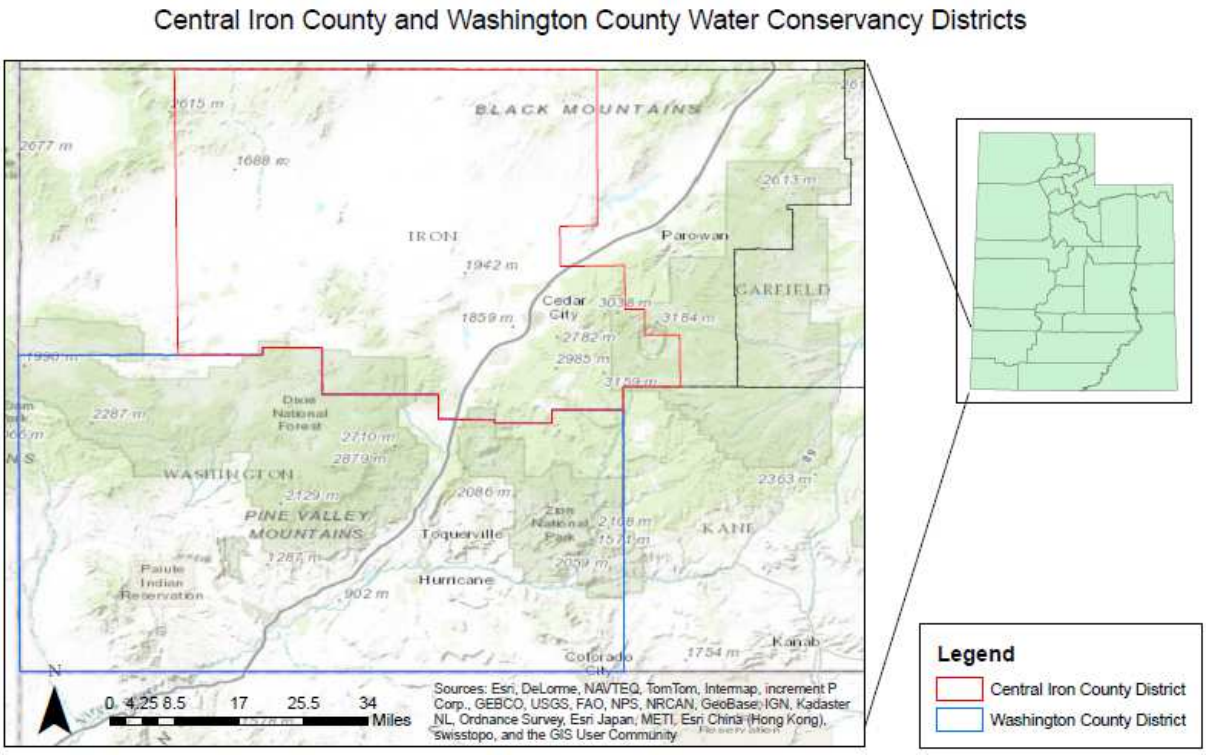


Figure 2 – Location of Central Iron County and Washington County Water Districts

WATER DEMAND PROJECTIONS

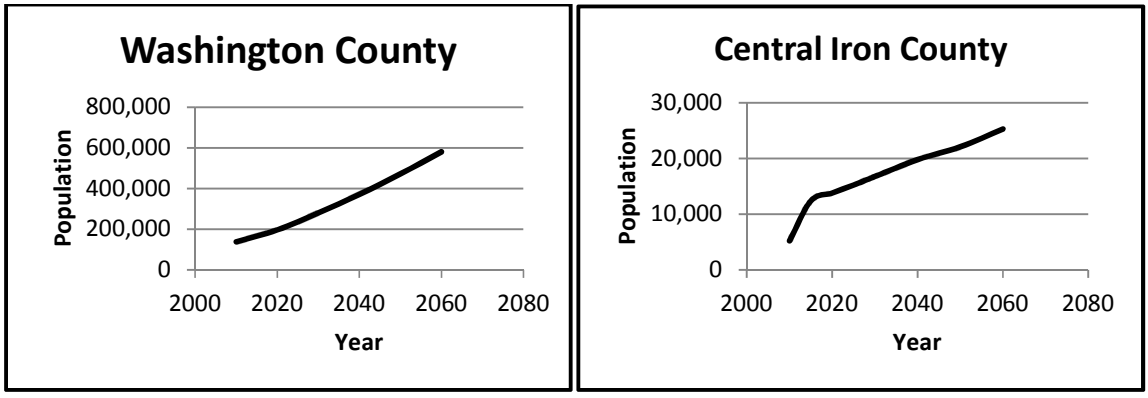
Washington County

In 2008, the Utah Governor's Office of Planning and Budget (GOPB) estimated that the population of Washington County in 2060 would be approximately 860,000. The Water Needs Assessment report for the Lake Powell Pipeline used this value in their estimate. However, at the end of 2012 the GOPB released new numbers based on the US Census 2010 survey. The population of Washington County is now estimated to be 581,731.

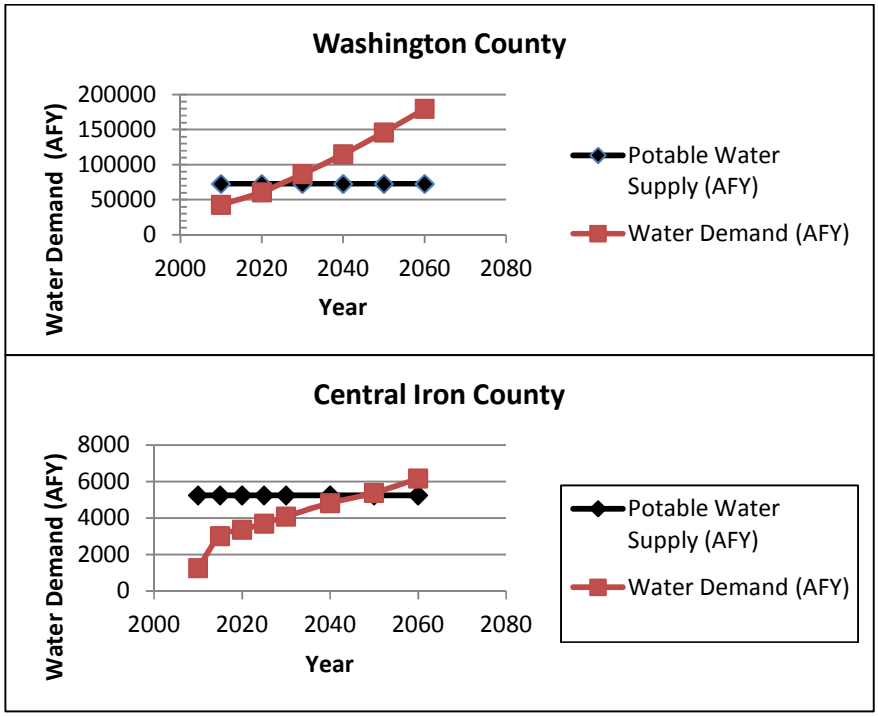
The average per capita water use for Washington County between 2000 and 2010 is 275 gallons per day. Both the water district and the State of Utah have set goals to lower the per capita water use by 25% by 2025. This would lower the per capita water use to as low as 206 GPD. However, because of the uncertainty of that goal being met, the current average value instead of the goal value is used in this analysis. Multiplying the per capita water use by the projected population gives a value of 179,860 acre-feet per year (AFY) of water will be needed by 2060. This value includes agricultural use and urban use. Presently, Washington County only produces 75,000 AFY.

Central Iron County

Central Iron County has projected their population growth and per capita water usage up to the year 2050. Based on those values, the population in 2060 was projected to be 25,317. The average water use per capita is 217 gpcd. As mentioned before, Utah has set a goal to reduce that value in the future. However, for this analysis, the current value will be used. This means that approximately 6,200 AFY will be needed by the year 2060. This value includes agricultural use and urban use. Presently, Central Iron County only produces 5,800 AFY of drinking water.



Figures 3 and 4 – Population projections for Washington County and Central Iron County.



Figures 5 and 6 – Water demand projections for Washington County and Central Iron County.

AVAILABLE WATER SOURCES

Agricultural Use

Most of the water use in both counties goes to agriculture. In Iron County, 1.5 AFY of water is used to irrigate one acre of crop. In Washington County, 4.5 AFY is used per acre of crop. The difference in the values comes from the type of irrigation. Iron County uses sprinklers while Washington County uses mostly flood irrigation.

Western Resources Advocates proposes to use converted agricultural water for drinking water use as a future source. As the districts urbanize, the land is converted from agricultural use to urban use. Most of the population growth will occur in the agricultural areas surrounding the cities.

Using ArcGIS, an analysis was done to see how much agricultural land is available to be converted to urban use. In Central Iron County, the city expecting to experience the most growth is Cedar City. In Washington County, St. George, Hurricane, Santa Clara, and Rockville are expected to contribute the most growth to the county. Maps of each of these cities were made. (In this report, only maps of Cedar City and St. George are included as samples.) The area of agricultural land in and around those cities was found from the attribute tables. An estimated 70% of the agricultural land surrounding these major cities is expected to be converted to urban use by 2060. This amounts to 137 acres and 3,020 acres in Central Iron County and Washington

County respectively. This greatly increases the amount of available water for future use by 206 AFY and 13590 AFY in Central Iron County and Washington County respectively.

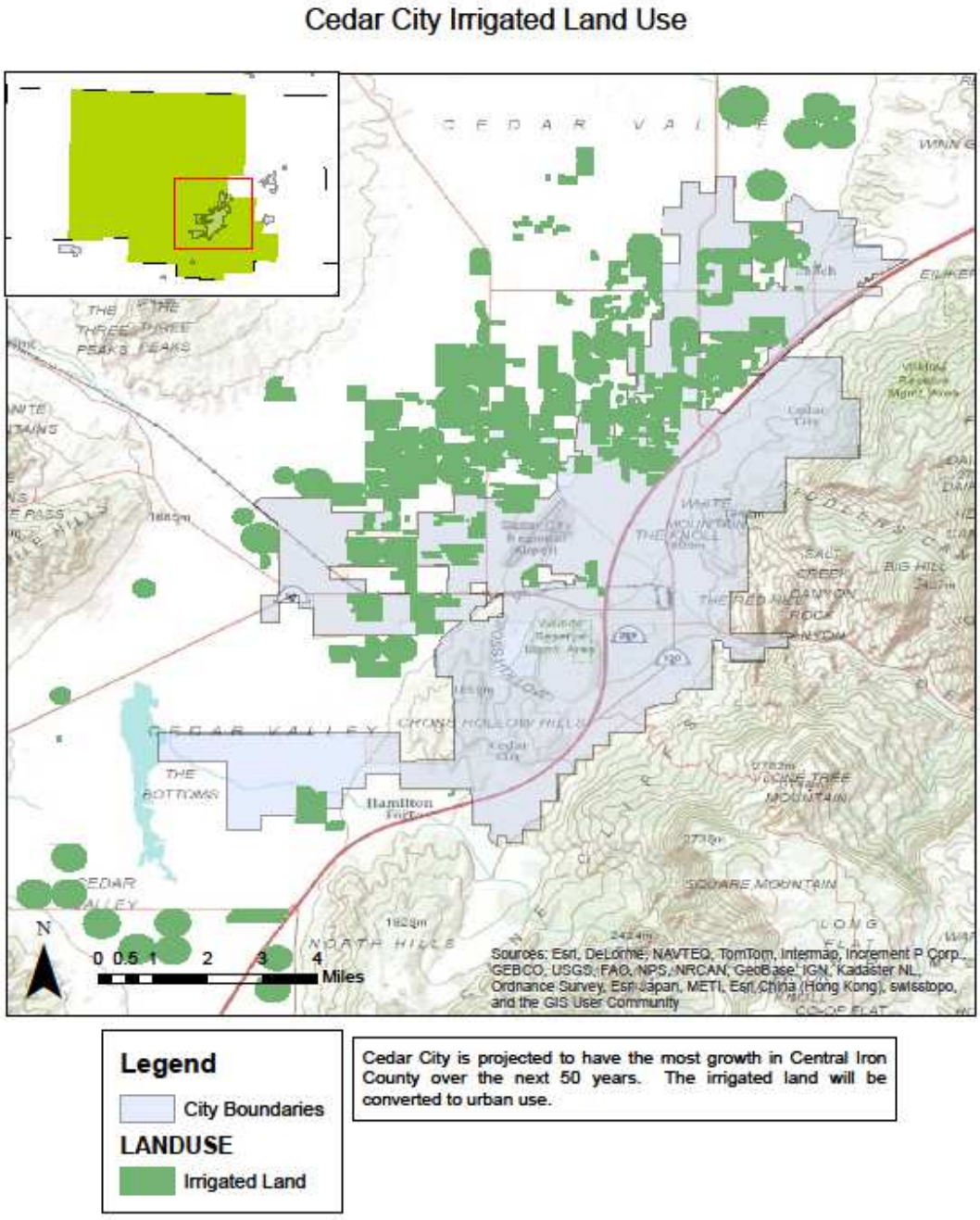


Figure 7 – Cedar City Irrigated Land Use

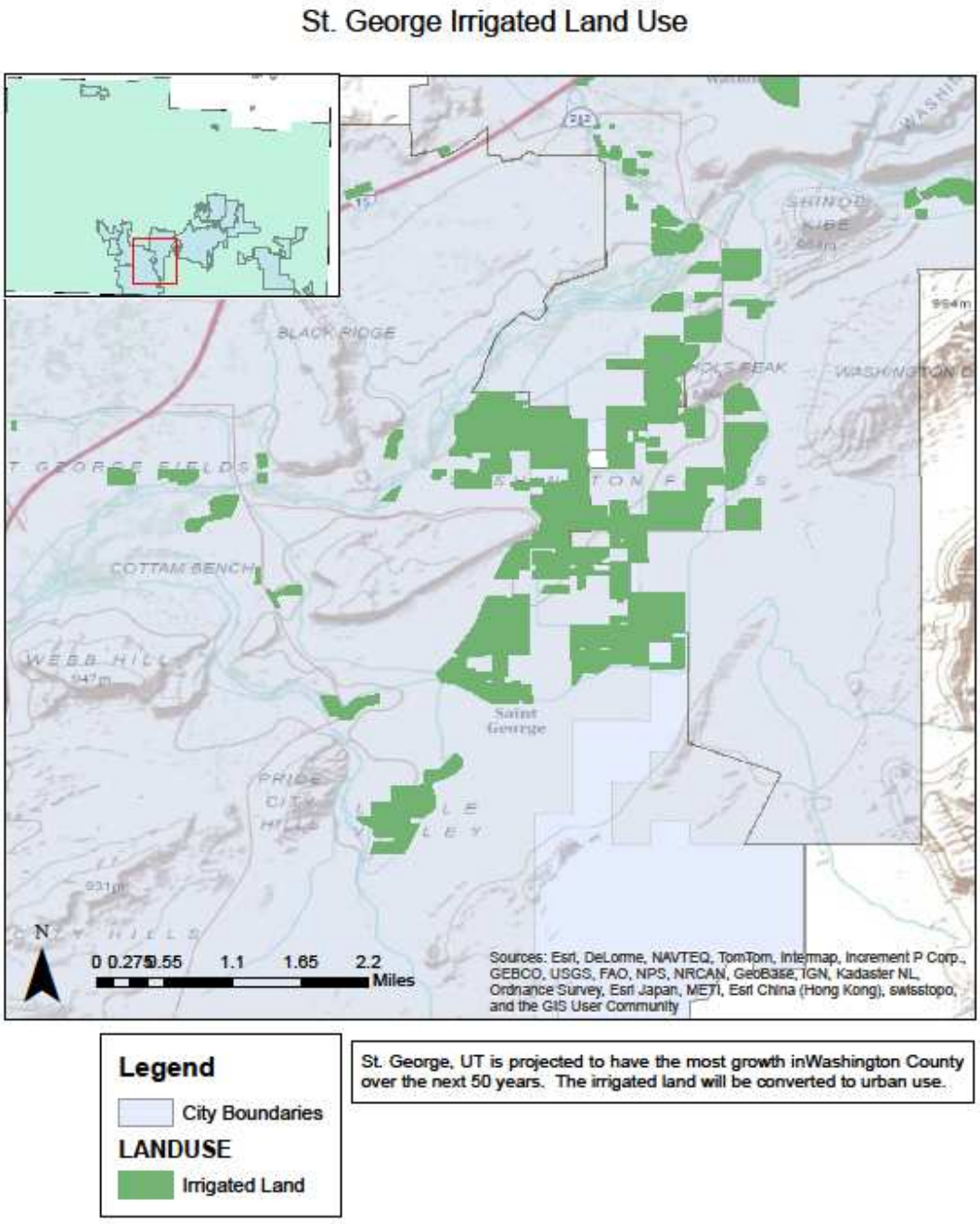


Figure 8 – St. George Irrigated Land Use

Groundwater Data

The agricultural data shows how much water could be changed from irrigation water to drinking water. However, this data does not show **total available** water. Reports show that the agricultural users are slowly depleting the groundwater sources. In other words, they are using more water than they receive by nature.

Central Iron County gets most of its water from wells. The following map shows that groundwater is being used faster than it is regenerating. Four wells were chosen at inside the district boundaries as sample points. These four were chosen because of their varying locations and because they had the most data available for analysis. The data from USGS confirms that the depth to the water depth is steadily increasing. The deeper the water, the less there is available.

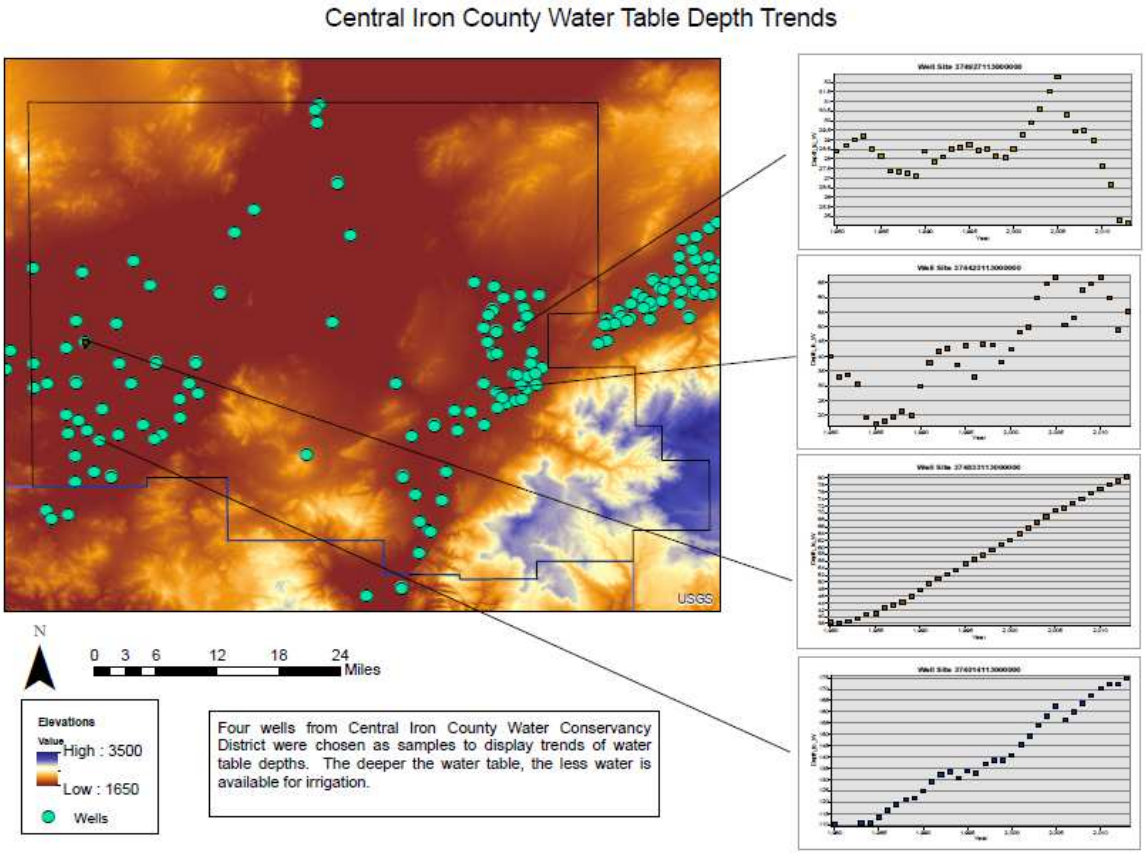
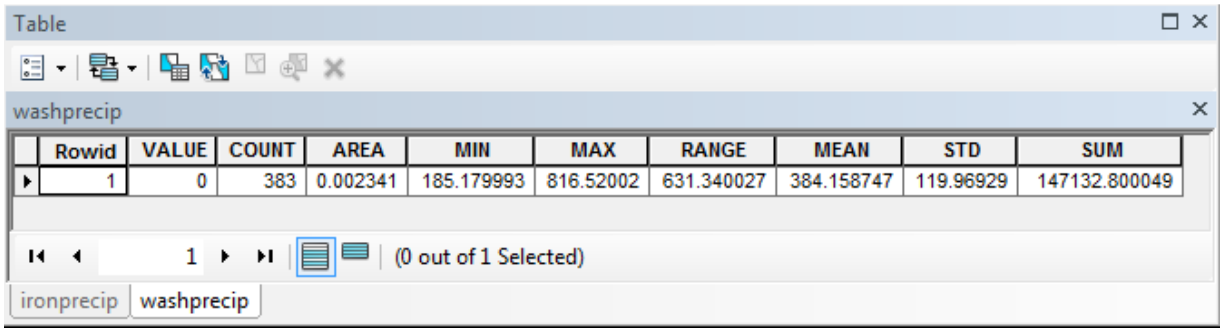


Figure 9 – Water Table Depth Trends since 1980.

An analysis must be done to calculate how much total water is available in each district. These numbers will show if there is enough water for both urban and agricultural use without depleting the sources over time.

Precipitation and Snowfall

Prism data since the year 1980 was entered into ArcGIS. A new shapefile was created to represent Washington and Central Iron County Water Districts. Using the tool "Zone Statistics as Table" tool, the amount of precipitation data was extracted from those two districts separately.



Table

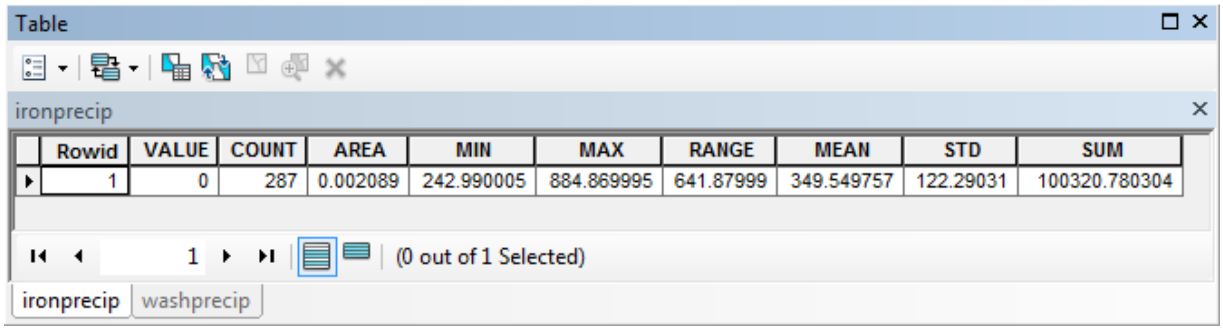
washprecip

Rowid	VALUE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	0	383	0.002341	185.179993	816.52002	631.340027	384.158747	119.96929	147132.800049

1 (0 out of 1 Selected)

ironprecip washprecip

Figure 10 - Washington County Precipitation Data



Table

ironprecip

Rowid	VALUE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM
1	0	287	0.002089	242.990005	884.869995	641.87999	349.549757	122.29031	100320.780304

1 (0 out of 1 Selected)

ironprecip washprecip

Figure 11 - Central Iron County Precipitation Data

The mean precipitation for Washington and Central Iron Counties were found to be 384mm (15.1 in) and 350mm (13.8 in) respectively as an average each year.

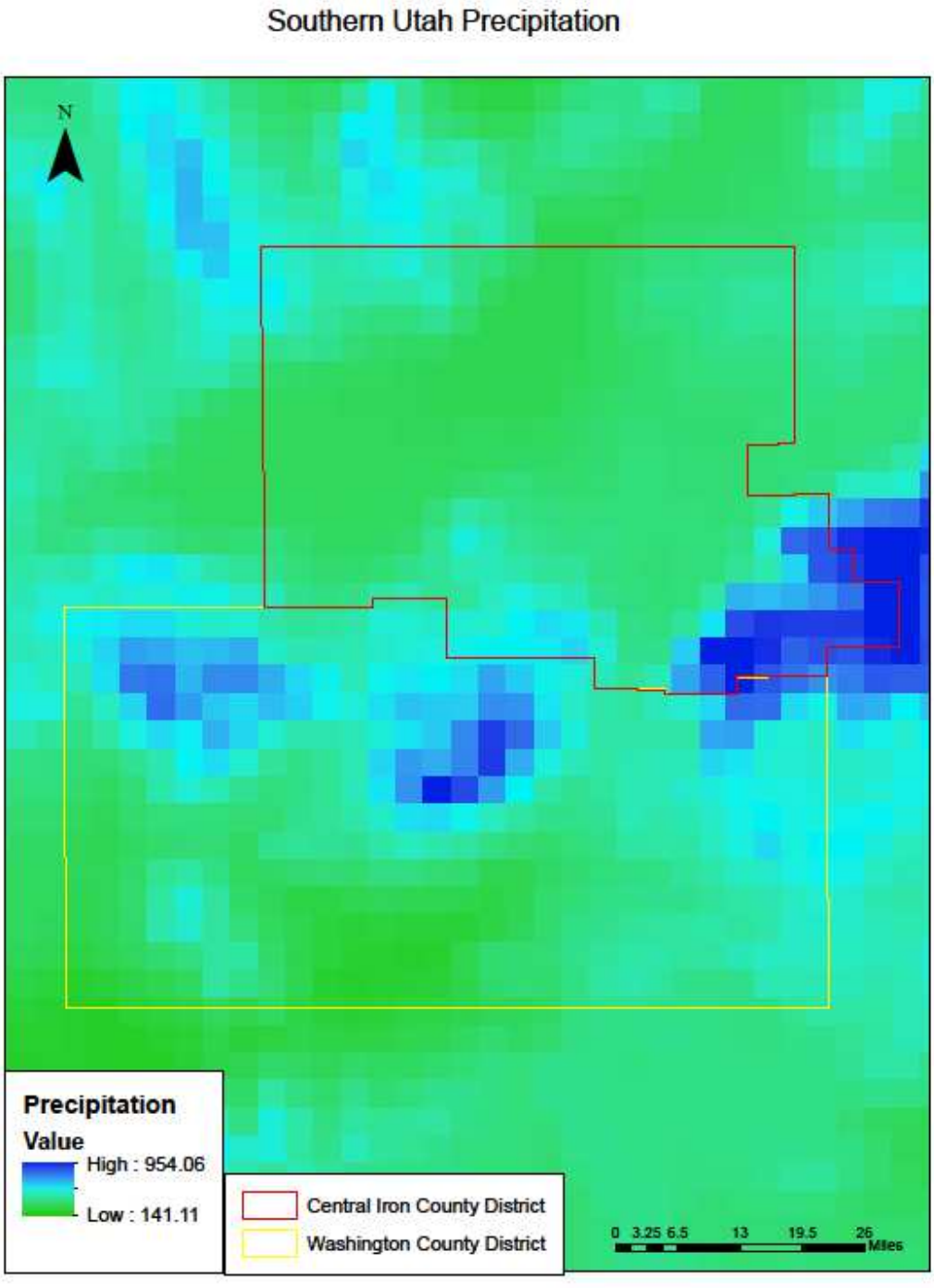


Figure 12 – Precipitation over Iron County and Washington County

Both districts have gages that measure snowfall. However, the gages are located in the mountain ranges and register several feet of snow per year. This cannot accurately show how much snowfall the entire district receives as a whole since the mountains receive much more than the valleys. For this reason, snowfall data was found by using average values for the counties as a whole from their respective county websites. The snowfall for Washington and Central Iron County is assumed to be 0.2 in and 3.7 in respectively as an average each year. These values are in terms of equivalent rainfall.

Stream Water

In order to calculate the amount of total water available, stream water must also be in the equation. Water is allowed to enter or leave the district in streams. There is also a minimum flow rate requirement. This limits how much water the districts are allowed to take out of them.

Stream gages were mapped and the streamlines were delineated in each district. The minimum flow requirement is assumed to be the minimum flow in the river over the last 30 years from USGS. These values are 60 cfs for the Virgin River, 10 cfs for the Santa Clara River, and 15 cfs for Coal Creek. Using these minimum flow rates and the total average amount of water flowing in the streams, the amount of surface water available was calculated in each district.

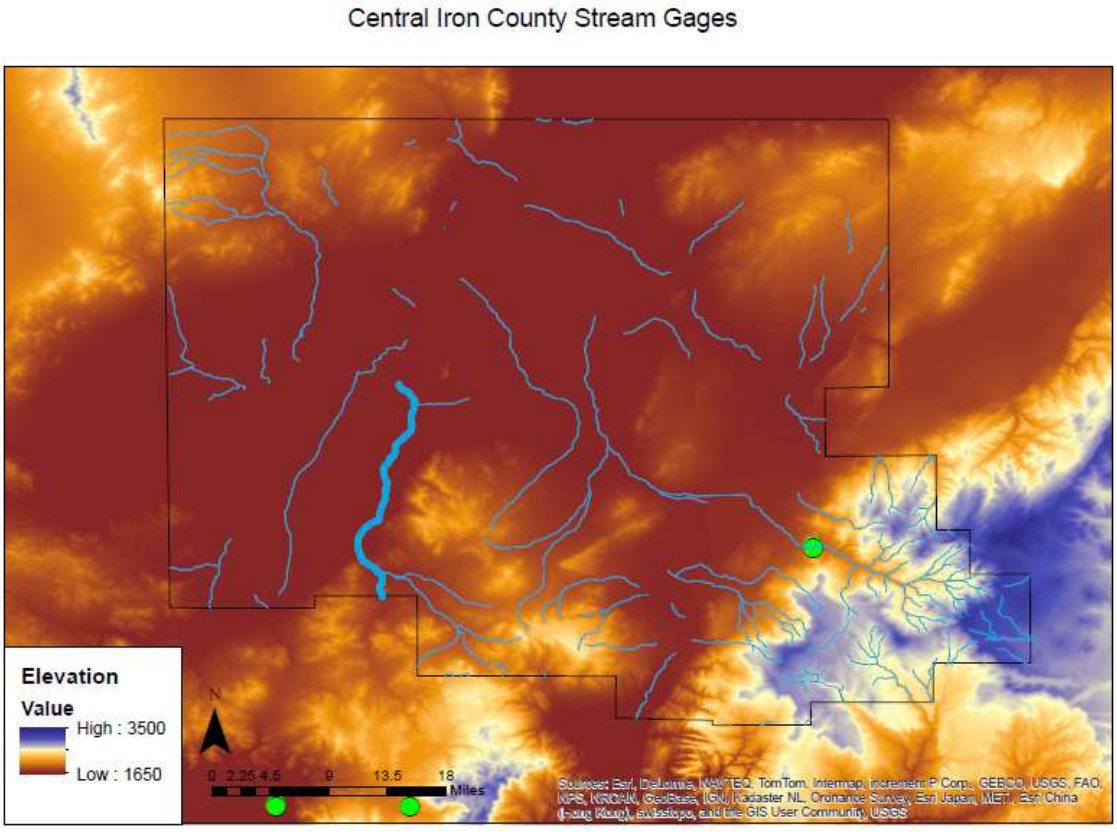


Figure 13 – Central Iron County Stream Gages

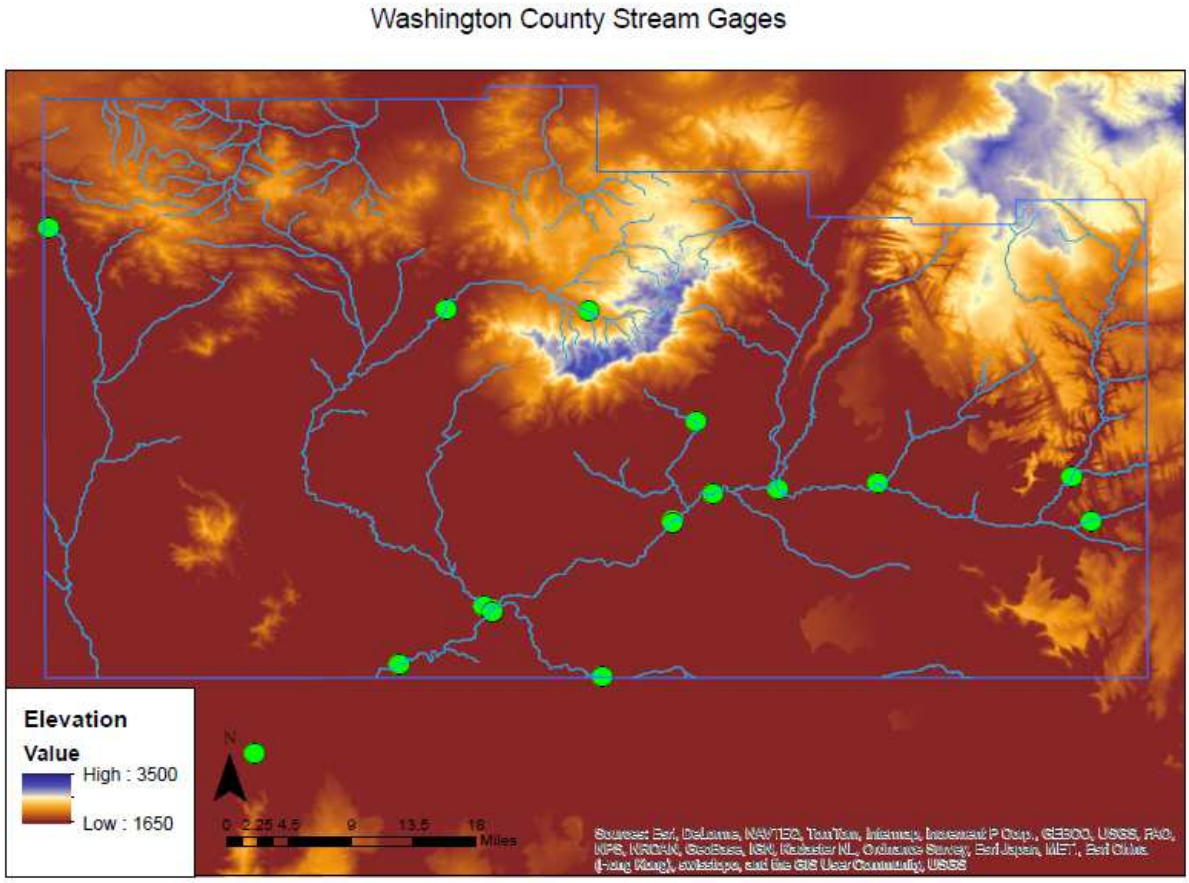


Figure 14 – Washington County Stream Gages

RESULTS

The total amount of available water for agricultural use and urban use was calculated using the following equation:

$$\text{Water Available} = \text{Precipitation} + \text{Equivalent Snowfall} + \text{Streamflow} - \text{Minimum Streamflow} \quad \textbf{(Eq. 1)}$$

From the calculated values, the total amount of water for Central Iron County and Washington County is 5480 AFY and 193,000 AFY. In Central Iron County, the amount of water is not sufficient to support a projected water demand of 6200 AFY in 2060. However, when combined with Washington County, the amount of water is sufficient to support both districts.

Uncertainty in these values comes from factors that were not included. These values assume that all of the rain and snowfall in their districts go solely to their own district. However, a small portion does flow out to other counties. Also, groundwater flows and evaporation rates were not included.

CONCLUSION

Combining water sources is not a new concept. Several places in Utah including parts of Salt Lake County, San Juan County, and Carbon County share water rights with surrounding sources. Central Iron County receives a total of 5480 AFY as an average. Washington County receives 193,000 AFY as an average. By combining the available water from both districts, both districts will have enough supply to meet both of their demands without the use of the Lake Powell Pipeline. Also, since these numbers are average values, it is possible to plan for ground water regeneration during high water years to store water for periods of drought.

REFERENCES

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5. Washington County Water Conservancy District. "Washington County Water Conservancy District." 04 Nov. 2013. http://www.wcwcd.org/