

**WATER NEEDS ASSESSMENT
FOR
SOUTHERN IOWA RURAL WATER ASSOCIATION
NOVEMBER 2013**

PURPOSE AND INTRODUCTION

The Southern Iowa Rural Water Association (SIRWA) authorized the completion of this Water Needs Assessment (study) to determine the drinking water supply needs of the multi-county water utility. Drinking water demands by SIRWA customers for the years 2007 through 2012 are tabulated in this study, and projected drinking water needs during the study planning period ending in the year 2035 are presented herein.

This study considers the SIRWA Service Area existing level of development, water use trends, population dynamics, and service connection trends, and formulates future needs based upon the data considered. Population and housing records were provided by the U.S. Department of Commerce, Census Bureau; service connection and water usage records for the six (6) year period ending in 2012 were provided by SIRWA.

Figure 1 presents the overall SIRWA Service Area, showing boundaries of currently developed and planned pressure zones within the rural water distribution system. The SIRWA Service Area includes all of Ringgold and Union Counties; the majority of Adair, Adams, Cass, Clarke, Decatur, and Taylor Counties; the Southwest 29% of Madison County; and very small portions of Lucas, Montgomery, Page, and Warren Counties. For the purposes of this study, population and economic development patterns identified for Adair, Adams, Clarke, Decatur, Ringgold, Taylor, and Union Counties are considered to fairly and accurately reflect those same patterns within portions of the SIRWA Service Area located in Cass, Madison, and other partially served counties.

At year-end 2012, there were 10,896 SIRWA water service connections, in addition to 'bulk water service' connections to eight (8) Iowa cities with a 2010 census population of 6,551; Grant City, Missouri (92 population) is also a bulk water service connection. Water utility for the cities of Corning, Creston, Greenfield, Leon, and Osceola is not provided by SIRWA; instead each of these cities own and operate water supplies that provide drinking water to their residents and provides drinking water to SIRWA customers. Each of the above referenced water supplies were developed and/or expanded with the assistance of SIRWA and in turn a contracted percentage of capacity within each water supply is reserved for SIRWA. Water utility for the cities of Anita, Atlantic, Cumberland, Fontanelle, Griswold, Lamoni, Lewis, Massena, New Market, and Wiota, is also not provided by SIRWA.

Surface water sources furnish the vast majority of drinking water within the SIRWA Service Area. Ground water sources within the study area have been found to be unreliable and generally more costly to develop and treat for human consumption.

POPULATION TRENDS AND PROJECTIONS

The area served by SIRWA consists primarily of small towns, business enterprises, and rural residences. Population records and trends identified to exist within the seven (7) Counties: Adair, Adams, Clarke, Decatur, Ringgold, Taylor, and Union, were reviewed, projected, and are believed to accurately represent the entire SIRWA Service Area. Population records were adjusted to exclude cities not served by SIRWA within the seven (7) county area; Corning, Creston, Fontanelle, Garden Grove, Greenfield, Lamoni, Leon, Leroy, New Market, and Osceola populations were removed from population projections.

Table 1 presents population records by the U.S. Bureau of Census and population projections prepared by Woods & Poole Economics, Inc. (W&P). As seen in this table, the adjusted population within the SIRWA Service Area encountered 14.6% population decline between 1980 and 1990, a 0.3% decline between 1990 and 2000 and 5.6% decline between 2000 and 2010.

Based on W&P projected growth rates and U.S. Census historical data, there is expected to be a total decrease of 3.8% in population within the SIRWA Service Area between the years 2010 and 2035. It is noted that W&P performs population and economic growth modeling throughout the entire United States of America; their models are prepared based on the employment outlook for each county; their models are analyzed and updated annually.

Figure 2 presents the adjusted population estimates and projections for the seven (7) listed counties in the SIRWA Service Area, excluding communities not served by SIRWA. As seen in this graphical illustration, based on historical data and future projections by W&P, a modest decrease in population is predicted to occur within the SIRWA Service Area in upcoming years.

Table 2 presents the recorded housing units and occupancy numbers for each of the seven (7) listed counties in the SIRWA Service Area for the years 1990, 2000 and 2010; these numbers were adjusted to exclude the cities of Corning, Creston, Greenfield, Lamoni, Leon, and Osceola from consideration (no data was available for the other cities not served by SIRWA within this area). County housing is shown to have changed between 2000 and 2010 as follows:

- Clarke County: 4.74% increase
- Adair County: 0.26% increase
- Union County: 5.10% increase
- Adams County: 5.53% decrease
- Taylor County: 2.88% decrease
- Ringgold County: 6.31% decrease
- Decatur County: 0.41% decrease

County housing in the SIRWA Service Area declined by 0.93% between years 2000 and 2010.

Figure 3 presents the adjusted number of County housing units for the period between 1990 and 2010. During the 20 year period it is estimated that housing units available within the SIRWA Service Area increased by approximately 61 units, or a total increase of 0.39%

Figure 4 presents the adjusted number of occupied County housing units for the period between 1990 and 2010. During the 20 year period it is estimated that the number of occupied housing units within the SIRWA Service Area decreased by approximately 224 units, or 1.65%.

For the purposes of this study, an overall population decrease of 3.00% is predicted to occur within the SIRWA Service Area during the study planning period. This rate of population reduction was selected while considering population projections presented in Table 1; considering the low rate of reduction in County housing units; and considering that the portion of Madison County excluded from population and housing tabulations is believed to follow growth trends established in Clarke County while the portion of Cass County excluded from population and housing tabulations is believed to follow growth trends established in Union County.

SIRWA WATER CUSTOMER TRENDS AND PROJECTIONS

Table 3 presents the reported number of SIRWA water services, which existed at year end 2007, 2008, 2009, 2010, 2011, and 2012, for the entire served portion of the SIRWA Service Area. Water service records are presented to reflect the number of individual water services located within each pressure zone and within each of the communities served by franchise located within the general boundary of each listed County. 'Bulk Customer' (bulk water service) connections to those cities or entities that buy water from SIRWA and then re-sell the water to their individual customers are listed in Table 3 along with the reported year 2010 population. Also listed in Table 3 is the number of inactive water services within each pressure zone; an 'inactive service' is a connection to the SIRWA water distribution system that is not currently delivering drinking water to a customer.

A review of Table 3 indicates there were 10,534 active service connections at year end 2007, and 10,896 active service connections at year end 2012. It is noted that the City of Ellston (28 connections) was added in 2010 and the City of Blockton (70 connections) was added in 2012; all other increase in the number of active service connections was a result of new connections or the activation of connections that were inactive at year end 2007.

The average annual rate of growth in the number of service connections within an established pressure zone or franchised community is also presented in Table 3. It is noted that the first year of service to a pressure zone or franchised community was excluded from growth rate calculations. The overall growth in the number of service connections within the SIRWA Service Area amounted to approximately 3.4% for the years of 2008 through 2012.

Figure 5 graphically presents the number of SIRWA water service connections, by year, categorized by county (general boundaries). It is noted that only Adair County experienced a loss of active service connections during this period.

Table 4 presents a summary of new 'Add-On' connections within each respective Service Area (pressure zone) during the year 2012; the date of pressure zone construction is also recorded adjacent to the Service Area name. 'Add-On' connections are new water customer connections occurring within an established pressure zone. A review of the information provided in this table indicates that SIRWA completed connections to 164 new water customers in the year 2012.

Table 5 presents a summary of new 'Add-On' connections categorized by county, year of connection, and type of water service (existing house, new house, pasture, animal confinement, or other). Figure 6 presents the same information in graphical form. A review of these documents indicates that new home construction within established portions of the SIRWA Service Area represented almost half (44.5%) of the total increase in new water service connections. Existing home connections accounted for 26.3%, followed by pasture at 20.0%.

During the years 2008 through 2012, on average, a gain of 130 new water connections was reported per year. This reported net gain excludes water customers resulting from newly franchised communities within the SIRWA Service Area. On average per year, the following number of new connections by category were completed:

- 34 existing homes
- 58 new homes
- 26 pastures
- 5 animal confinements
- 7 other

There are no records that show the composition of the water service connections that were inactivated or removed during this same time period.

WATER USE

The majority of SIRWA service connections provide water service to residences; approximately 27% of total connections are located in franchised cities and rural housing subdevelopments. The remaining residential connections are to individual houses located throughout the SIRWA Service Area.

SIRWA also provides water to eight (8) Iowa cities and a Missouri water district through 'bulk water service' connections; other water service connections include schools, businesses, animal confinements, pasture connections, recreational facilities, and campgrounds.

Tables 6A and 6B present a summary of SIRWA water customers that are designated as 'Large Users', meaning they were each reported to use in excess of 50,000 gallons during any month in 2012. Table 6A lists the eight (8) Iowa cities that are Bulk Customers and the water district serving parts of Worth County Missouri (Grant City) that purchase drinking water from SIRWA for resale to their customers; the 2010 population of these cities, excluding the Grant City water system, was reported to be approximately 6,643. It is noted there are also businesses located within many of these communities. Based upon metering records for the year 2012, average monthly water use by these 'bulk water service' connections totaled approximately 22.7 million gallons and is calculated to total nearly 745,976 gallons per day on average, and approximately 112 gallons per capita per day.

Table 6B presents the other large users identified in the December 2012 query of the SIRWA billing system. A total of 610 other large users were reported to use approximately 25.6 million gallons during the month; this is calculated to total approximately 842,775 gallons per day on average. A review of average monthly water use for all the above referenced animal confinements (hogs, cattle, and poultry) indicates average water use of approximately 21.1 million gallons in the month, or 694,517 gallons per day on average.

Table 6C presents the annual water use by the other large users for 2012. Approximately 319.6 million gallons was billed to these customers during the year; this is calculated to total approximately 26.6 million gallons per month on average. A review of water use for all the above referenced animal confinements (hogs, cattle, and poultry) indicates monthly water use of approximately 21.3 million gallons.

Table 7 presents reported monthly and annual total water purchases by SIRWA from the five (5) Water Purchasing Agencies for the period of January 2007 through December 2012. The average monthly quantity of water purchased for 2012 was approximately 140.6 million gallons. The maximum total monthly amount of water purchased during this period was approximately 174.4 million gallons. Table 7 also presents the calculated ratio between maximum reported monthly water purchases and average monthly water purchases on an annual basis to indicate the degree of fluctuation in water use that occurs seasonally within the SIRWA Service Area.

Utilizing the information for the year 2012 provided in Tables 3, 6A, 6B, and 7, and removing the 610 Large Users (cities and Others), it is estimated that 10,286 active connections used 91.2 million gallons (64.9%) of SIRWA's drinking water during the average month, equating to approximately 292 gallons per user per day on the average day during the 12 months of 2012.

Figure 7 presents the comparison between SIRWA's total annual water purchases and the number of water service connections in each of the years 2007 through 2012. As shown on the graph, the annual growth rate of water purchases is calculated to be 5.08% while the annual growth rate of water service connections is calculated to be 0.68%. This five (5) year comparison indicates that drinking water use increased at a higher rate than the number of connections; water use per customer increased.

Table 8 presents the average daily water purchase, and maximum daily water purchase, on a monthly basis, for the period January 2007 through December 2012. Monthly operating reports furnished by SIRWA were reviewed and data was tabulated. The average ratio between maximum day and average day water purchase, on an annual basis, was for the entire SIRWA Service Area. The average ratio between maximum day and average day water purchase ratios ranged between approximately 1.45 and 2.07; higher ratios were shown to exist in portions of the SIRWA Service Area with the fewest connections; lower ratios were shown to exist in those portions of the SIRWA Service Area that serve a larger number of customers. A weighted ratio of average day to maximum day demands for the six (6) years reviewed was calculated considering the percentage of purchased from each source in 2012 and the average ratio for each; this average day to maximum day ratio was calculated to be 1.54. An average day to maximum day demand ratio of 2.0 is used for 'bulk water service' to the identified cities.

Table 9 presents daily drinking water purchases by SIRWA for the highest use period during the summer months of 2012. Daily water purchase records are tabulated for the period of time between July 14 through August 23. Based on the information, SIRWA's identified current maximum day water purchase equals 6,573,000 gallons, which is the sum of each individual maximum day occurring during the period reviewed.

WATER PURCHASE AGREEMENTS

SIRWA has purchased drinking water supply capacity totaling 7.7912 million gallons per day. Table 10 presents the amount of drinking water that SIRWA has contracted for with the five (5) Water Purchasing Agencies. Also listed is the calculated additional peak daily flow that SIRWA is committed to deliver to 'bulk water service' connections for eight (8) of the Large Users - Cities; the City of Davis City has a water purchase contract that states drinking water quantity will be delivered as required.

Also listed in Table 10 is the calculated flow for 80% of the existing houses located within the planned future pressure zones in SW Cass and NE Cass County. An average of 292 gallons per customer per day was applied to the number of connections, along with a peaking factor of 1.54, to estimate maximum daily water needs.

A review of Table 10 indicates that SIRWA would need to reallocate water from the Water Purchasing Agencies to select pressure zones in order to stay under the current maximum daily drinking water supply limits established in the water purchase contracts. Furthermore, it is indicated that SIRWA is in need of approximately 175,400 gallons per day in order to meet commitments to all of the 'bulk water service' connections, and to fulfill anticipated future demands occurring in the new pressure zones to be developed in Cass County.

As stated above, the Large Users - Cities use on average 746,000 gallons per day. Assuming a peak factor of 2.0 for the ratio between average day and maximum day water demand for these customers would indicate a peak day water demand totaling approximately 1,492,000 gallons per day. The calculated additional peak day water supply that should be anticipated, estimated to be 857,714 gallons per day (Table 6A) equates to approximately a 74% increase from the contracted amounts. This increase in water commitment does not factor in population or water use practices changes within the Large User - Cities, through the year 2035. It is noted that SIRWA does not currently monitor Large User - Cities connections for maximum day demand.

The above listed commitments do not provide any growth past December 2012 levels, for either additional customers or increased water use per connection, within the developed portions of the SIRWA Service Area.

ECONOMIC & DEMOGRAPHIC GROWTH WITHIN SIRWA SERVICE AREA

Information regarding the development of the Ethanol Industry within the State of Iowa was furnished by the Iowa Corn Growers Association. A map showing the existing Iowa Ethanol Facilities is furnished in Appendix A; this figure shows only one (1) Ethanol Plant within the SIRWA Service Area; this facility is located near Corning, Iowa. The map also shows there is a void of Ethanol facilities in the area between Corning, Eddyville, Nevada, and Menlo; approximately 35% of the area included in the apparent void falls within the SIRWA Service Area.

As a general rule, Iowa Dry Grain Ethanol Facilities are expected to require approximately 10 gallons per minute of water for each million gallons of ethanol produced per year. Accordingly,

a 100 million gallon per year dry grain ethanol plant would require approximately 1,000 gallons per minute of water, or approximately 1,440,000 gallons of water per day. Based on the predicted water demands of Ethanol Plants, it is believed that any facility developed within the SIRWA Service Area would likely be located adjacent to an established drinking water supply.

Information regarding the development of the Soy Biodiesel Industry within the State of Iowa was furnished by the Iowa Soybean Association. A map showing the existing Iowa Soy Biodiesel Facilities is furnished in Appendix B; this figure shows that no Soy Biodiesel Facilities exist within the SIRWA Service Area, and shows a void of facilities in southwestern Iowa. Based upon the general distribution of Soy Biodiesel Facilities throughout the state, it could be predicted that a new facility built in Iowa would be located within the SIRWA Service Area.

A moderately sized Soy Biodiesel Facility is estimated to use drinking water at a rate of approximately 100 gallons per minute or approximately 150,000 gallons per day. At drinking water delivery rates near 100 gallons per minute, there are many locations within the SIRWA Service Area that could furnish water to a Soy Biodiesel Facility, if the drinking water supply was available.

Housing developments, including those that function as recreational or retirement communities are likely to continue to develop within the SIRWA Service Area. A community that doubles as permanent and recreational housing, similar to the Sun Valley Lake Development in Ringgold County, would likely contribute to sustained population growth in the region and increase drinking water needs within the SIRWA Service Area. As noted in Table 3, Sun Valley Lake water service connections increased by an average of 3.7% annually during the five (5) years ending in 2012, bringing the current number of SIRWA water connections in the development to approximately 522.

A Golf Course Community to be located adjacent to Lake Icaria, in Adams County, has been discussed for several years. The development is preliminarily planned to create 350 new home sights in and around an 18 hole golf course, including a Country Club. Excluding irrigation needs, a development of this size would likely be accompanied by average daily drinking water needs in the order of 100,000 gallons per day once fully developed; peak daily demands in the range of 200,000 gallons per day could be expected during summer weekends with visiting golfers and special activities. Golf course irrigation needs furnished by SIRWA, or supplements to irrigation water supplies, could total in excess of 200,000 gallons per day to achieve an irrigation rate of 1 inch per week applied to approximately 50 acres.

Animal operations served as Large Users – Others by SIRWA, use on average 3,350 gpd for Hogs, 650 gpd for cattle, and 7,500 gpd for poultry, as indicated by the water use data provided in Table 6B. Table 5 shows steady growth in the number of animal confinements served by SIRWA; for the purpose of this study it is assumed all newly connected animal confinements will be for hogs, will use an average of 3,350 gpd each, and will have a max day demand of 6,700 gallons. It is noted that a new single hog confinement building constructed in the year 2013 would typically accommodate 2,480 hogs and would require 7,440 gpd on a max day basis.

It is noted that the expansion of drinking water needs, resulting from economic or housing development within the cities of Anita, Atlantic, Corning, Creston, Cumberland, Fontanelle, Greenfield, Griswold, Lamoni, Leon, Lewis, Massena, New Market, Osceola, and Wiota are not considered in this study. Although these cities are located within the geographic boundaries of the SIRWA Service Area, SIRWA does not provide drinking water to the residences or businesses located within these cities.

It is also noted the expansion of drinking water needs, resulting from development (economic, housing) within the cities of Bedford, Davis City, Diagonal, Grant City, Kellerton, Lenox, Mt Ayr, Murray, and Orient, are not considered in this study. Although these cities have their drinking water needs supplied by SIRWA, there is approximately 857,700 gallons per day of contracted additional water supply that SIRWA is to furnish under existing agreements.

PREDICTED WATER NEEDS THROUGH THE YEAR 2035

As detailed above and presented in Table 10, SIRWA has purchased drinking water supply capacity totaling 7.7912 million gallons per day, and SIRWA would need to reallocate water from the existing Water Purchasing Agencies in order to stay under the current maximum daily drinking water supply limits established in the water purchase contracts. **Additionally, it is projected that SIRWA is in need of approximately 0.1754 million gallons per day in order to meet commitments to all of the 'bulk water service' connections, and to fulfill anticipated future demands occurring in the new pressure zones to be developed in Cass County.**

For the purposes of this study, one (1) Dry Grain Ethanol Facility rated to produce 100 million gallons per year is predicted to be developed in the SIRWA Service Area during the study planning period. **The predicted new Ethanol facility would require approximately 1.440 million gallons during the maximum water demand day.**

For the purposes of this study, one (1) moderately sized Soy Biodiesel Facility is predicted to be developed in the SIRWA Service Area during the study planning period. **The predicted new Soy Biodiesel facility would require approximately 0.1500 million gallons during the maximum water demand day.**

For the purposes of this study, 48 new home new connections will be assumed to occur during each year of the study planning period. It is believed this level of growth in 'Add-On' water connections can be sustained based upon established trends in new home construction in the SIRWA Service Area. **The connection of 1,104 new homes between January 2013 and December 2035 would require approximately 0.4642 million gallons during the maximum water demand day.**

For the purposes of this study it will be assumed that there will be no net change in the number of existing houses connected; it is predicted the number of existing houses newly connected will offset the impacts of an overall population decline during the study planning period. This assumption includes the established trend of an average annual number of 28 existing homes

becoming newly connected during each of the years for the period 2007 through 2012, and the predicted 3.0% decline in population within the SIRWA Service Area.

For the purposes of this study, five (5) animal confinement new connections will be assumed to occur during each year of the study planning period. It is believed this level of growth in 'Add-On' water connections can be sustained based upon established trends in the development of animal confinements in the SIRWA Service Area. **The connection of 115 new animal confinements between January 2013 and December 2035 would require approximately 0.7705 million gallons on the maximum water demand day.**

It is noted that drinking water use and water service connections generally increased within the SIRWA Service Area during the period 2007 through 2012. During this same time period, records indicate a decline in population occurred within the SIRWA Service Area.

The current average water use per connection, excluding Large Users, was calculated to equal approximately 292 gallons per day. The average water use per Large Users - Others was calculated based on the water use recorded during December 2012 for each of the 610 identified connections; this totaled approximately 1,380 gallons per day per large user.

A review of water use and customer connection records for the period 2007 through 2012 indicates that the SIRWA drinking water usage increased by approximately 5.08% per year (Figure 7) and the number of connections increased by 0.68% per year; subtracting the growth rate in number of connections from the water use per customer rate of increase yields a net gain water use per customer of approximately 4.40% per year. If this trend were to continue, total drinking water needs would more than double during the study planning period. The increase in water use per connection may be in part due to a change in the demographics, as the elderly residents are replaced with younger individuals, and also due to an increase in the number SIRWA water customers tending to livestock.

Extended periods of drought occurring simultaneously throughout the SIRWA Service Area will likely place significant additional demands on the supply of drinking water. High commodity (corn and soybean) prices may continue to support increased row-cropping and other agricultural activities within the SIRWA Service Area, and would likely lead to an increase in population served by SIRWA. No allowances have been made for the occurrence of either or both of these events.

Based on the above referenced predictions occurring during the study planning period, the additional water needs are as follows:

- 0.1754 million gallons per day to fulfill contracts to cities and serve Cass County areas
- 1.4400 million gallons per day to serve a future Ethanol facility
- 0.1500 million gallons per day to serve a future Soy Biodiesel facility
- 0.4642 million gallons per day to serve continued future new home construction
- 0.7705 million gallons per day to serve continued future new animal confinements

The predicted shortfall of drinking water for SIRWA in the year 2035, based on the above predictions and established customer growth rates is 3.0001 million gallons per day.

SUMMARY AND CONCLUSION

The predicted total drinking water needs for SIRWA customers within the SIRWA Service Area in the year 2035 is approximately 10.7913 million gallons per day. This total drinking water need projection is based upon the occurrence of the above described growth and development patterns leading to maximum day demands for each water purchasing agency in or near the end of the study planning period, the year 2035.

SIRWA is or will be committed to supply drinking water in quantities that currently exceed the capacity of three (3) of the SIRWA drinking water supplies. SIRWA's current total drinking water needs exceed the combined capacity supplied by the five (5) Water Purchasing Agencies. More water is needed immediately to meet the drinking water needs of the SIRWA Service Area.

Based on the review of the above listed information, and based upon projections described above, SIRWA has an additional drinking water need totaling 3.0001 million gallons per day for the SIRWA Service Area in the year 2035.

Respectfully submitted on this 18th Day of December 2013.
Garden & Associates, Ltd.