# Chapter 7

# Summary and Conclusions

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This study provides a summary of the historical and future water withdrawals for four different water-demand sectors: 1) public water supply and self-supplied domestic, 2) self-supplied thermoelectric power generation 3) self-supplied commercial and industrial, and 4) self-supplied agriculture and irrigation. The purpose of this study is to examine water demand on a regional basis and provide water demand information to the East-Central RWSPC to begin the water-supply planning process.

Future water withdrawals were estimated with a regional approach. We collected historical data on all water suppliers/users in the region, created regional models for each sector based upon the aggregated historical data, and used the models to estimate future withdrawals. The future water withdrawals generated from this study will be distributed to existing points of withdrawal for use by the ISWS in groundwater and surface water models to analyze whether the water supplies can meet the water demands from now until 2050.

## 7.1 Regional results

The baseline scenario estimates the total water withdrawal to increase by 8.0% by the year 2050, from 1,654.6 MGD in 2005 to 1,788.4 MGD (Table 7.1 and Figure 7.1). In all water demand sectors, except power generation, water withdrawals are expected to increase (Table 7.1). The power generation sector decreases water withdrawals in the baseline scenario because of the replacement of the Lakeside Plant with a new Dallman 4 Plant in Sangamon County which uses less water. Because power generation withdraws close to 80% of this total, it is useful to look at the changes in water withdrawals without including the power sector.

The water demand sectors, other than power generation, when totaled, increase by 173.6 MGD (51%) from 2005 to 2050 in the baseline scenario. This number is reduced to 119.7 MGD (35%) in the LRI scenario and increased to 232.5 MGD (69%) in the MRI scenario. These values underscore the importance of analyzing water demand and planning for the future. By including demand these increases in groundwater and surface water supply models, as the ISWS is going to do, the region will have a greater understanding of the demand placed on the regional water supply and the potential impacts to the resource and the region.

The percent of the total withdrawals is shown for each sector in 2005 and 2050 in Figure 7.2. Power generation withdraws the most of all the water sectors, 71% of the total in 2050. In 2050, both IR&AG and PWS will withdraw approximately 10% of the total water in the region. The withdrawals for C&I will increase from approximately 4% in 2005 to 8% of the total in 2050. Domestic water withdrawals will remain less than 1% of the total water withdrawals in the region.

Table 7.1: Summary of water withdrawals in East-Central Illinois (in MGD).

| Scenario/ Sector | 2005 Normal (MGD) | 2050 Modeled (MGD) | Change from 2005 (Normal) - 2050 (MGD) | (%) |
|---|---|---|---|---|
| Baseline Scenario (BL) | | | | |
| Public Supply | 127.24 | 176.88 | 49.64 | 39.0 |
| Self-supplied C&I | 63.70 | 137.51 | 73.81 | 115.9 |
| Self-supplied domestic | 8.86 | 12.01 | 3.15 | 35.6 |
| Irrigation and agriculture | 139.40 | 186.46 | 47.06 | 33.8 |
| Subtotal (w/o power) | 339.20 | 512.86 | 173.66 | 51.2 |
| Power generation | 1,315.35 | 1,275.54 | -39.81 | -3.0 |
| TOTAL | 1,654.55 | 1,788.40 | 133.85 | 8.1 |
| Less Resource Intensive Scenario (LRI) | | | | |
| Public Supply | 127.24 | 153.50 | 26.26 | 20.6 |
| Self-supplied C&I | 63.70 | 116.17 | 52.47 | 82.4 |
| Self-supplied domestic | 8.86 | 12.01 | 3.15 | 35.6 |
| Irrigation and agriculture | 139.40 | 177.21 | 37.81 | 27.1 |
| Subtotal (w/o power) | 339.20 | 458.89 | 119.69 | 35.3 |
| Power generation | 1,315.35 | 1,217.78 | -97.57 | -7.4 |
| TOTAL | 1,654.55 | 1,676.67 | 22.12 | 1.3 |
| More Resource Intensive (MRI) | | | | |
| Public Supply | 127.24 | 185.36 | 58.12 | 45.7 |
| Self-supplied C&I | 63.70 | 178.52 | 114.82 | 180.2 |
| Self-supplied domestic | 8.86 | 12.01 | 3.15 | 35.6 |
| Irrigation and agriculture | 139.40 | 195.77 | 56.37 | 40.4 |
| Subtotal (w/o power) | 339.20 | 571.66 | 232.46 | 68.5 |
| Power generation | 1,315.35 | 1,342.37 | 27.02 | 2.1 |
| TOTAL | 1,654.55 | 1,914.03 | 259.48 | 15.7 |

C&I = Commercial and industrial water sector; w/o = without;

Note: All withdrawal values reported in million gallons per day (MGD)

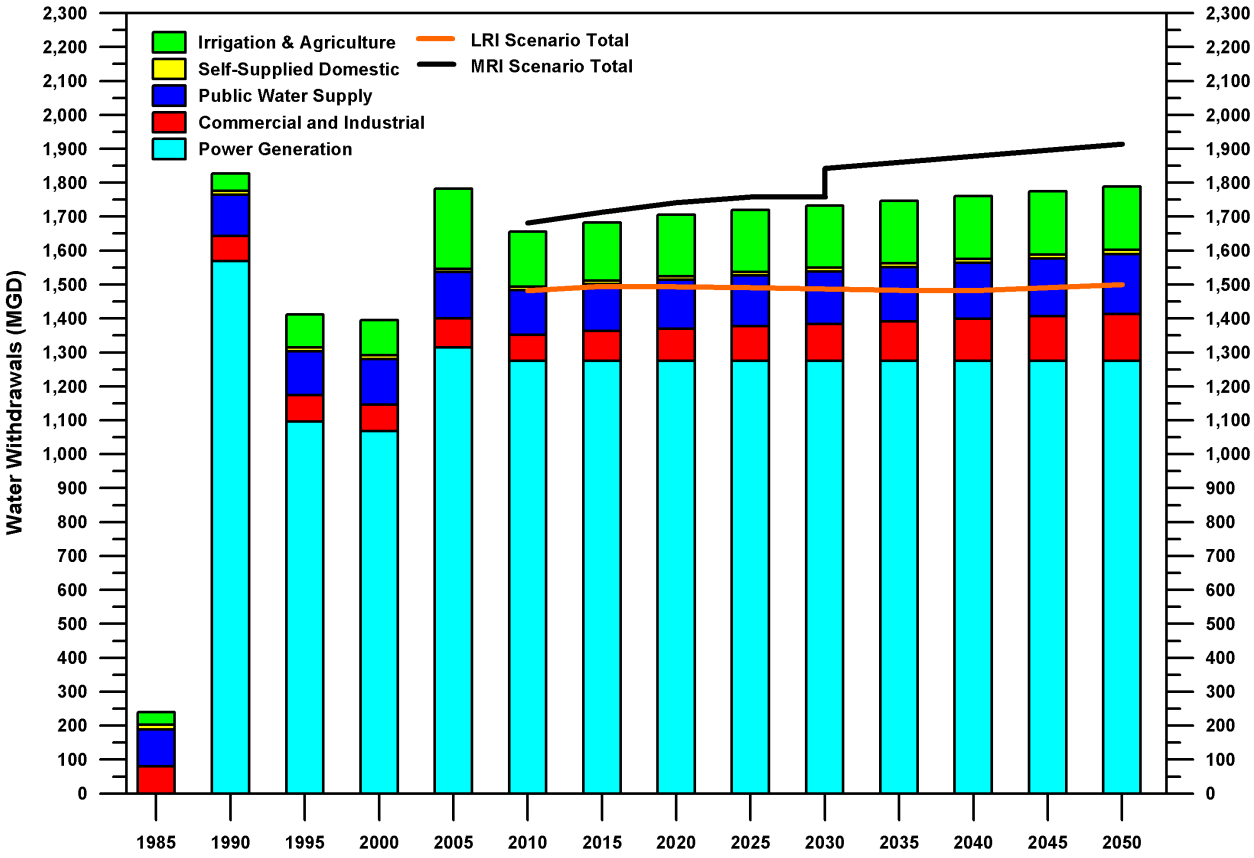
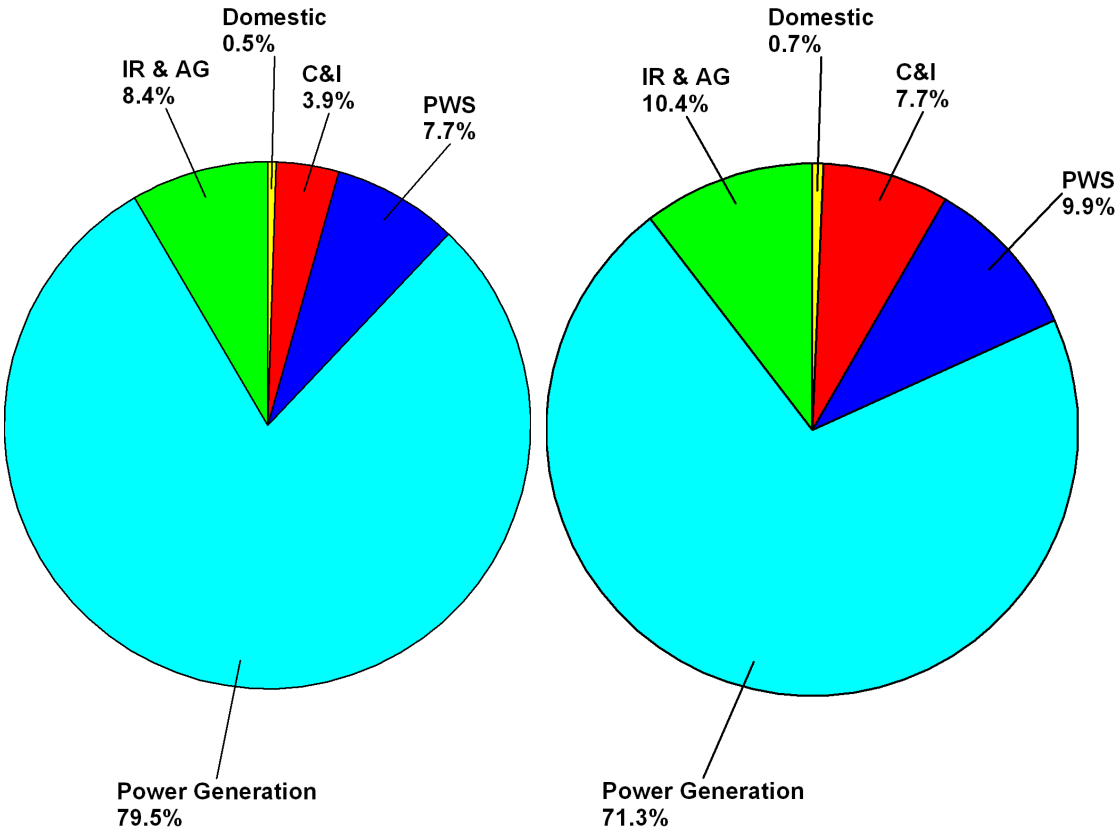



Figure 7.1: Historical and future water withdrawals in East-Central Illinois from 1985 to 2050.




(a) 2005 (Normal) (b) 2050

Figure 7.2: Percent of total water withdrawals by demand sector in East-Central Illinois in 2005 (Normal) and 2050 for the baseline scenario.

The following summarizes the baseline scenario for each sector in the demand analysis.

**Public water supply** - The public supply sector accounts for approximately 9.9% of the 2050 withdrawals in East-Central Illinois. Not including the power generation withdrawals, public supply accounts for 34.5% of the 2050 withdrawals. The baseline scenario estimates an 39% increase, from 127.2 MGD to 176.9 MGD by 2050.

**Self-supplied domestic** - The smallest water-demand sector, domestic supply accounts for approximately 0.7% of the 2050 withdrawals in East-Central Illinois. Not including the power generation withdrawals, domestic supply accounts for 2.3% of the 2050 withdrawals. The baseline scenario estimates an 35.6% increase from 8.9 MGD to 12.0 MGD in 2050.

**Self-supplied power generation** - Power generation is the largest water demand in the region accounting for 71.3% of total withdrawals. However, the water withdrawals are expected to decline in the baseline and LRI scenarios and increase only 2.1% in the MRI scenario. The baseline scenario estimates a 3.0% decrease, from 1,315.4 MGD to 1,275.5 MGD, by 2050.

**Self-supplied commercial and industrial** - The commercial and industrial sector accounts for approximately 7.7% of the 2050 withdrawals in East-Central Illinois. Not including the power generation withdrawals, C&I accounts for 26.8% of the 2050 withdrawals. The baseline scenario estimates a 115.9% increase, from 63.7 MGD to 137.5 MGD, by 2050. This sector is estimated to have the largest increase in demand. This increase is due, in part (approximately 10 MGD), because of proposed water intensive industries, included as ethanol plants, in the scenarios.

**Self-supplied irrigation and agriculture** - Irrigation and agriculture accounts for approximately 10.4% of the 2050 withdrawals in East-Central Illinois. Not including the power generation withdrawals, IR&AG accounts for 36.4% of the 2050 withdrawals. The baseline scenario estimates a 33.8% increase, from 139.4 MGD to 186.5 MGD, by 2050.

## 7.2 County results

The total withdrawals for each county are shown in Table 7.2. To compare the relative amounts withdrawn in each county in 2050, the percent of each demand sector are shown graphically in Figure 7.3. DeWitt, Mason, Tazewell, and Sangamon counties all have withdrawals over 150 MGD. These large withdrawals are primarily due to the power generation plants within those

counties. Ford, Iroquois, Logan, Menard, Piatt, and Woodford counties are all expected to have withdrawals less than 10 MGD.

Figure 7.3 shows that public water supply is the primary withdrawal sector in Champaign, McLean, Macon, and Vermilion counties, whereas irrigation and agriculture are the primary withdrawals in Cass, Mason, and Menard counties. Commercial and industrial water withdrawals are focused within Macon and Tazewell counties. Self-supplied domestic remains a very small portion of each county.

Because the power generation withdrawals are relatively large compared to the other sectors and there are plants in only five of the fifteen counties, it is insightful to look at withdrawals without power generation. When you exclude power generation, Mason and Tazewell counties have the largest total withdrawals (Figure 7.4), but for different reasons. In Mason County the withdrawals are primarily for irrgation and agriculture. In Tazewell County, the withdrawals are mostly commercial and industrial, but also have significant withdrawals for public water supply and irrigation and agriculture. The next tier of counties, in the 40-60 MGD range, are Champaign, Macon, and Sangamon. These withdrawals are in large part public water supply and commercial and industrial water sectors. The remaining counties are all expected to have withdrawals less than 30 MGD by 2050.

Tables and figures showing the individual county results, by water sector for every year of interest are provided in Appendix G.

Table 7.2: Future withdrawals for each county, by demand sector, for the year 2050 (in MGD) for the baseline scenario.

| County | Public water supply (MGD) | Domestic (MGD) | Power generation (MGD) | Commercial & industrial (MGD) | Irrigation & agriculture (MGD) | Total (MGD) |
|---|---|---|---|---|---|---|
| Cass | 2.32 | 0.44 | – | 3.16 | 15.84 | 21.76 |
| Champaign | 33.62 | 2.56 | – | 9.74 | 6.15 | 52.07 |
| DeWitt | 1.83 | 0.4 | 810.44 | 0.03 | 0.94 | 813.64 |
| Ford | 2.25 | 0.25 | – | 6.54 | 0.92 | 9.96 |
| Iroquois | 3.3 | 0.96 | – | 1.48 | 3.25 | 8.99 |
| Logan | 3.99 | 0.71 | – | 2.82 | 2.08 | 9.59 |
| Macon | 31.33 | 0.21 | – | 26.59 | 0.41 | 58.54 |
| Mason | 0.95 | 0.55 | 105.00 | 7.48 | 108.26 | 222.24 |
| McLean | 24.07 | 1.55 | – | 2.07 | 2.15 | 29.85 |
| Menard | 1.04 | 0.02 | – | 0.00 | 3.09 | 4.16 |
| Piatt | 1.42 | 0.46 | – | 1.56 | 0.49 | 3.94 |
| Sangamon | 31.74 | 1.54 | 331.46 | 7.93 | 1.64 | 374.31 |
| Tazewell | 25.39 | 0.12 | 25.88 | 62.05 | 39.14 | 152.59 |
| Vermilion | 10.52 | 0.66 | 2.76 | 6.04 | 0.72 | 20.71 |
| Woodford | 3.08 | 1.58 | – | 0.02 | 1.39 | 6.06 |
| Total | 176.88 | 12.01 | 1,275.54 | 137.51 | 186.46 | 1,788.40 |

All data reported in million gallons per day (MGD).

All sectors, except public water supply, are self-supplied

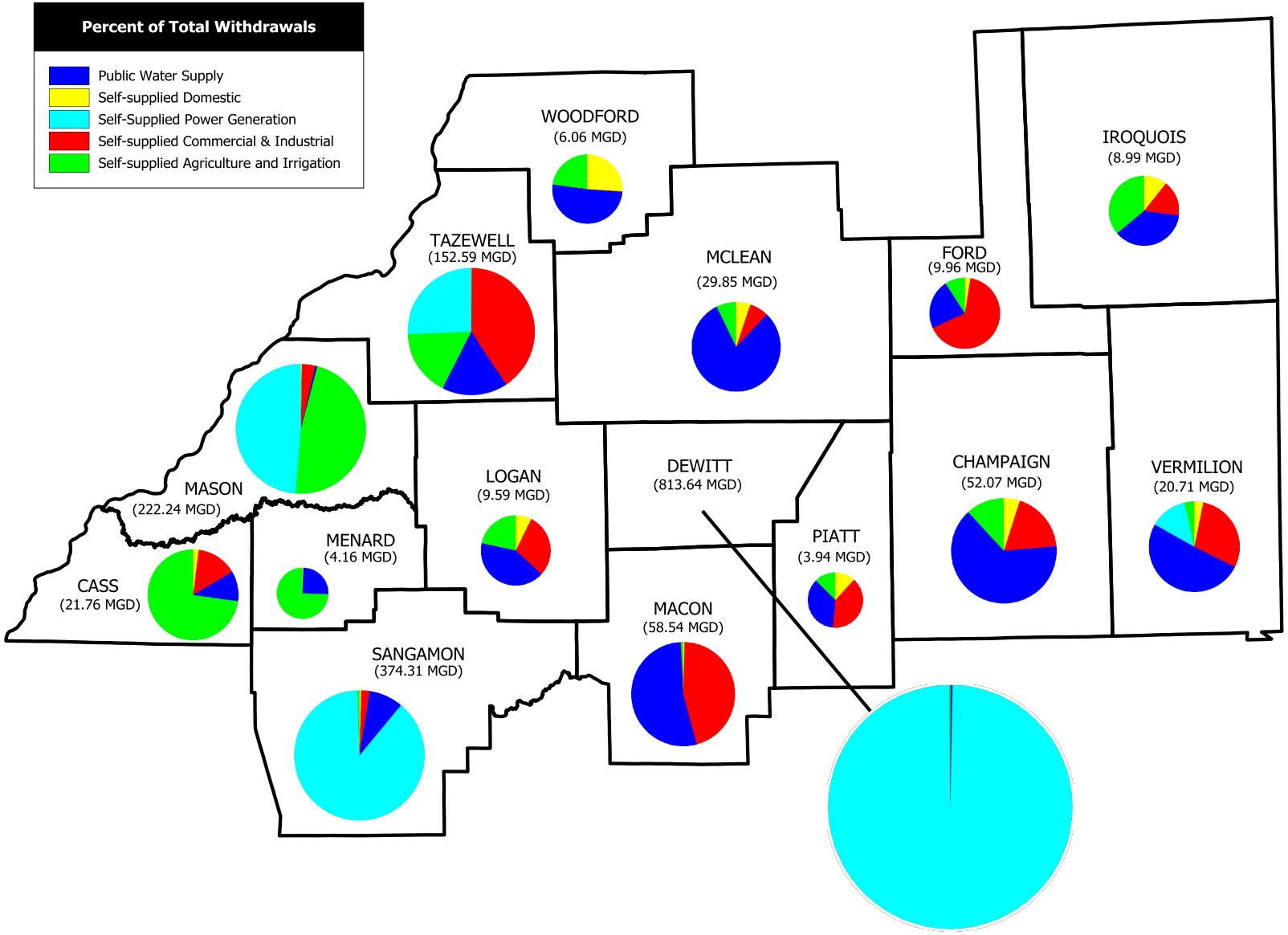



Figure 7.3: County water withdrawals in East-Central Illinois in 2050 by demand sector for the baseline scenario.

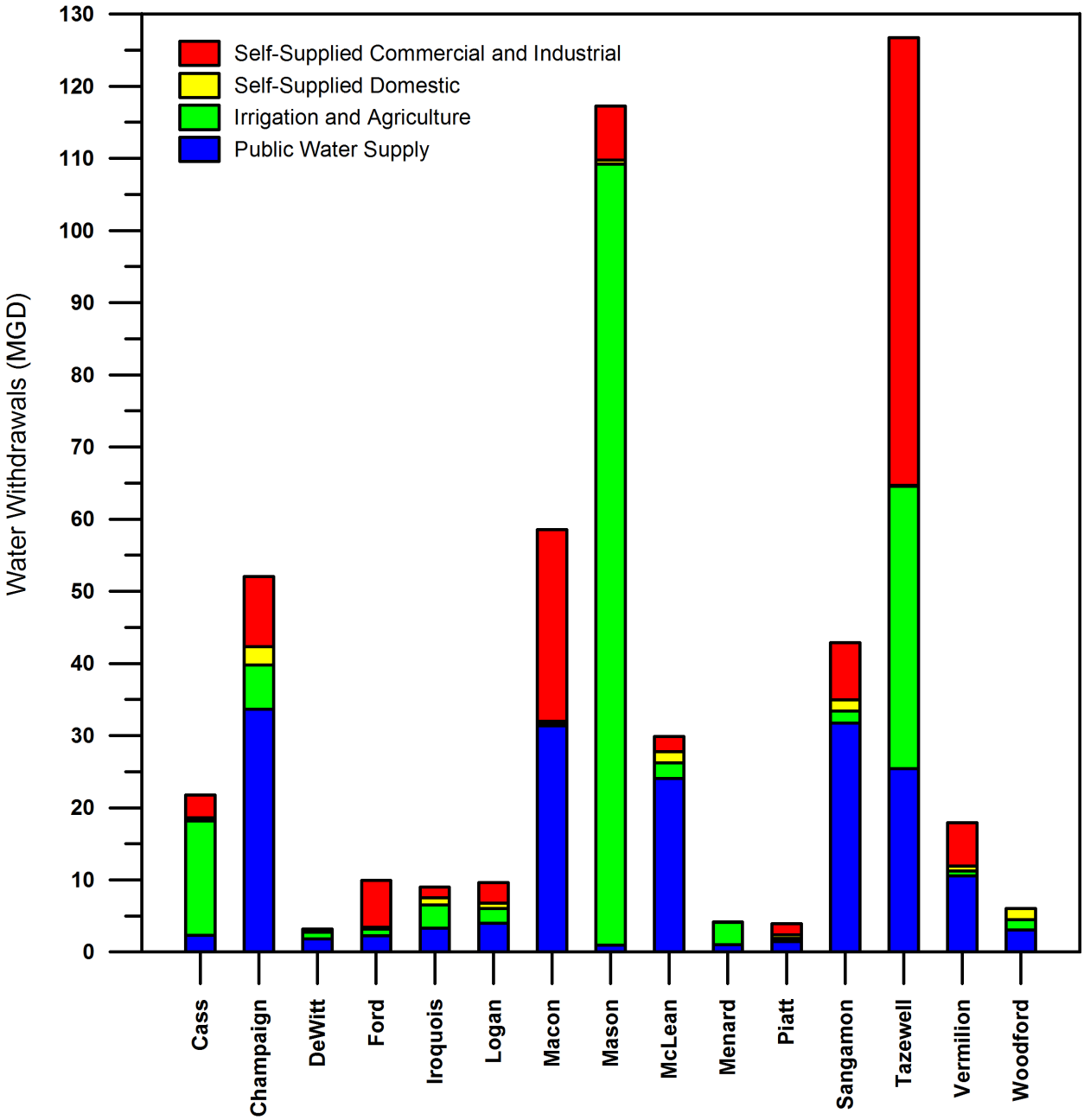



Figure 7.4: Future withdrawals for each county, by demand sector, for the year 2050 (in MGD) for the baseline scenario. *Power generation sector not included.*

## 7.3 Data issues

The goal of this study is to estimate the water withdrawals by water demand sector for the 15-county region in East-Central Illinois to the year 2050. This goal has been achieved with the best information available and the future withdrawal estimates are provided to the RWSPC with confidence. However, the process has not been without difficulty and we would like to inform the RWSPC about the data issues we confronted. The following are our recommendations to the RWSPC on how to improve the data so as to better enable water demands to be estimated in the future.

- **All water demand sectors should report water withdrawals -** Currently, three of the four water demand sectors report to the IWIP program of the ISWS; public water supply, commercial and industrial, and power generation. Because irrigation has significant withdrawals in the region, approximately 10% of the total, it is important that these withdrawals are accurately reported and accounted for in the water withdrawals database.

- **Reporting should be mandatory -** Reporting to the IWIP program of the ISWS is currently voluntary. In order to achieve accurate accounting of all water withdrawals, the reporting should be made mandatory.

- **All water withdrawals should be made public -** Under the current system, commercial & industrial and power generation withdrawals are not available to the public due to confidentiality agreements with the ISWS (although some data is available through other public records, such as the EIA). As a public resource, the public should be able to see how water in the region is being used.

- **Water withdrawals should be accurately reported as withdrawals, not total water produced or used -** It is evident in the data that water users are not all reporting the same way. Some water users report how much water was sold to customers. Some report how much water was produced. Some report how much water was used in the cooling process. Some report how much water was withdrawn from the source. These differences provide an inaccurate accounting system of water withdrawals.

- **Monthly withdrawals should be reported -** Currently, withdrawals are reported on an annual basis as an annual average. However, water is not used uniformly throughout the year; there is monthly variation. In some cases, the monthly withdrawals can be 2-3 times the average. And with seasonal uses, like irrigation, withdrawals only occur a few months out of

the year. By collecting monthly withdrawal data, the model will be better able to capture the relationship between the variables and water withdrawals. Monthly reporting provides more data and a more accurate portrayal of withdrawals. Reported water withdrawals should still be reported only annually, but should include monthly withdrawal data.

- **Population served should be accurately reported annually** The population served data supplied to the ISWS is inconsistent and often inaccurate. A lot of time and energy was spent trying to rectify this important dataset. Much of the problem was that not all PWSs were reporting the same way. For example, some reported census data one year and number of connections the next year leading to an inaccurate dataset.

- **Resident population estimates should be projected for the entire water supply planning period** - The county level resident population projections used in this study were provided by the Illinois Department of Commerce and Economic Opportunity (DCEO). These population projections were done for the years 2000 - 2030. Because the water demand study estimates withdrawals to the year 2050, we had to extend the state's projections. The RWSPC should request that when the state updates their population projections, they utilize the same projection years as the water supply planning process.

- **Employment populations should be projected for the entire water supply planning period -** The county level employment population projections used in this study were provided by the Illinois Department of Employment Security (IDES). These population projections were done for the years 2004 - 2014. Because the water demand study estimates withdrawals to the year 2050, we had to extend the state's projections. The RWSPC should request that when the state updates their employment projections, they utilize the same projection years as the water supply planning process.

- **Public water suppliers should report price annually -** Price, in this case marginal price, is an important demand variable for the public water supply sector. To better enable future studies, marginal price should be reported annually with the water withdrawals from each public water supply.

- **Significant changes (large increases or decreases in annual average) in water withdrawals should be explained -** Sometimes water suppliers or users, have large changes in water withdrawals from year to year. In some cases, the supplier may stop supplying water altogether. For example, in 2001 the City of Decatur sold one of its treatment plants to a local industrial user. In the water dataset, this was evidenced by a large decrease, 15 MGD,

in 2005. Significant changes, like this one, that effect the amount of water withdrawn should be noted in the annual reporting.

As water supply planning in Illinois matures, the hope is to streamline the process of data collection and analysis such that appropriate decisions can be made about water supply planning in each region and in the state. The recommendations outlined above will better enable the RWSPC to understand water demand and withdrawals in the future.

This study examined the future water demand on a geographic region. However, it didn't address the ability of the water resources in that region to supply the estimated demand or the impact of the increased demand on the ecological or hydrological resources. Water demand estimates are important to understanding how different areas are using water and how fast and where the region is growing. What these estimates do not reveal is if the regional water sources, both surface water and groundwater, can supply and sustain the demand placed upon them. But, as these water withdrawals are utilized in the water supply modeling analysis performed by the ISWS, the RWSPC will be able to plan for the future and ensure that all water users within the region have a safe and secure water supply.

# Bibliography

[Avery, 1999] Avery, C. (1999). Estimated water withdrawals and use in Illinois, 1992. Open-File Report 99-97, U.S. Geological Survey.

[Berk et al., 1980] Berk, R., Cooley, T., LaCivita, C., Parker, S., Sredl, K., and Brewer, M. (1980). Reducing consumption in periods of acute scarcity: the case of water. *Social Science Research*, Vol. 9(2):99–120.

[Boland et al., 1984] Boland, J. J., Dziegielewski, B., Bowman, D. D., and Opitz, E. M. (1984). Influence of price and rate structures on municipal and industrial water use. Technical report, Planning and Management Consultants, Ltd.

[City-Data.com, 2007] City-Data.com (2007). Statistics about all U.S. cities. http://www.city-data.com/. accessed September 18, 2007.

[Davis et al., 1987] Davis, W., Rodrigo, E., Boland, J. J., Dziegielewski, B., Baumann, D., and Opitz, E. M. (1987). IWR-MAIN Water use forecasting system, Version 5.2: User's manual and system description. Technical report, Planning and Management Consultants, Ltd. Prepared for the USACE institute for Water Resources.

[DCEO, 2005] DCEO (2005). Population projections to 2030. http://www.commerce.state.il.us/dceo. Illinois Department of Commerce and Economic Activity accessed October 5, 2007.

[Dziegielewski and Kiefer, 2006] Dziegielewski, B. and Kiefer, J. C. (2006). U.S. Demand supply and allocation: Trends and outlook. Technical report, A white paper prepared for the U.S. Army Corps of Engineers.

[Dziegielewski et al., 2004] Dziegielewski, B., Kiefer, J. C., and Bik, T. (2004). Water rates and ratemaking practices in community water systems in Illinois. Technical report, Prepared un-

der Illinois Water Resources Center Matching Grants Program, Departent of Geography and Environmental Resources, Southern Illinois University.

[Dziegielewski et al., 2002a] Dziegielewski, B., Sharma, S., Bik, T., Margono, H., and Yang, X. (2002a). Project completion report. Analysis of water use trends in the United States: 1950-1995. Technical report, Prepared for the United States Geological Survey.

[Dziegielewski et al., 2002b] Dziegielewski, B., Sharma, S., Bik, T., Margono, H., Yang, X., and Sa., R. (2002b). Predictive Models of Water Use: An Analytical Bibliography. Technical report, U.S. Geological Survey, Southern Illinois University at Carbondale.

[Dzielgielewski and Yang, 2007] Dzielgielewski, B. and Yang, X. (2007). Determination of statistical relationships for different types of cooling systems.

[Dzielgielewski et al., 2005] Dzielgielewski, B., Yang, X., Bik, T., Margono, H., and Richey, M. (2005). County Level Forecasts of Water Use in Illinois: 2005-2025. Technical report, Southern Illinois University - Carbondale and Illinois State Water Survey.

[Earth Policy Institute, 2007] Earth Policy Institute (2007). Water Prices Rising Worldwide. Technical report, Earth Policy Institute.

[EIA, 2005] EIA (2005). Annual steam electric plant operation and design data. Energy Information Agency, EIA form 767 data.

[EIA, 2007] EIA (2007). Biofuels in the U.S. Transportation Sector. http://www.eia.doe.gov/oiaf/analysispaper/biomass.html. accessed February 15, 2008.

[Fedstats, 2007] Fedstats (2007). Official statistical information produced by the federal government. http://www.fedstats.gov. accessed September 27, 2007.

[Gloyna et al., 1975] Gloyna, E. F., Woodson, H. H., and Drew, H. R. (1975). Water management by the electric power industry. Technical report, Center for research in water resources, University of Texas at Austin.

[Griffin and Chang, 1990] Griffin, R. C. and Chang, C. (1990). Pretest analysis of water demand in thirty communities. *Water Resources Research*, Vol. 3(1):2251–2255.

[Haneman, 1998] Haneman, W. (1998). *Urban water demand management and plannning.*, chapter Determinants of urban water use., pages 31–76. McGraw Hill, New York.

[Harte and El-Gassier, 1978] Harte, J. and El-Gassier, M. (1978). Energy and Water. *Science*, 199(4329):623–634.

[Helsel and Hirsch, 1992] Helsel, D. and Hirsch, R. (1992). *Statistical Methods in Water Resources*. Elsevier, New York.

[Hewings, 1999] Hewings, G. J. (1999). Illinois region economic input-output model. Technical report, Summary of 1999 IREIM's projections.

[Hutson et al., 2004] Hutson, S., Barber, N., Kenny, J., Linsey, K., Lumia, D., and Maupin, M. (2004). Estimated use of water in the United States in 2000. http://water.usgs.gov/pubs/circ/2004/circ1268/. USGS Circular 1268 (released March 2004, revised April 2004, May 2004).

[IDES, 2005] IDES (2005). Illinois county-level employment population. http://lmi.ides.state.il.us/. Illinois Department of Employment Security, accessed September 25, 2007.

[IDES, 2007] IDES (2007). Employment projections by county, 2004-2014. http://lmi.ides.state.il.us/projections/employproj.htm. Illinois Department of Employment Security, accessed November 14, 2007.

[ISWS, 2004] ISWS (2004). Illinois State Water Inventory Program. Data Collection. Technical report, Illinois State Water Survey. Last modified April 05, 2004.

[ISWS, 2005a] ISWS (2005a). Center for Groundwater Science - Mahomet Aquifer general information. http://www.sws.uiuc.edu/gws/mahomet.asp. accessed January 25, 2006.

[ISWS, 2005b] ISWS (2005b). Illinois Water Inventory Program - Annual public water supply pumping data: 1979-2004.

[ISWS, 2007a] ISWS (2007a). Climate modeling - Illinois annual precipitation departure from 1971-2000 normal. Illinois State Water Survey unpublished data.

[ISWS, 2007b] ISWS (2007b). Climate modeling - Illinois annual temperature departure from 1971-2000 normal. Illinois State Water Survey unpublished data.

[ISWS, 2007c] ISWS (2007c). Historical water withdrawal data. Illinois Water Inventory Program.

[ISWS, 2007d] ISWS (2007d). Illinois climate data by weather station. Illinois State Water Survey, Illinois state climatologist.

[ISWS, 2007e] ISWS (2007e). Illinois State Water Inventory Program. Data Collection. Technical report, Illinois State Water Survey. Last modified April 05, 2007, http://www.sws.uiuc.edu/gws/iwip/default.asp.

[Kenny et al., 1978] Kenny, D. S., Goemans, C., Klein, R., Lowrey, J., and Reidy, K. (1978). Residential Water Demand Managment: Lessons from Aurora, Colorado. *Journal of the American Water Resources Association*, 44(1):192–207.

[Mason County Farm Service Agency, 2005] Mason County Farm Service Agency (2005). Mason and Tazewell county census of irrigated acres, 2005 provisional data. Personal communication.

[Mills, 2005] Mills, P. (2005). 2005 provisional data. United States Geological Survey, Written communication.

[Nebraska, 2007] Nebraska (2007). Ethanol production by state. http://www.neo.ne.gov/statshtml/121.htm. accessed February 15, 2008.

[NUS Consulting, 2007] NUS Consulting (2007). U.S. Water Costs Increase Once Again. *http://www.earthtimes.org*.

[Owenby et al., 2006] Owenby, J., Richard Heim, J., Burgin, M., and Ezell, D. (2006). Climatography of the U.S. No. 81 - Supplement No. 3: Maps of Annual 1961-1990 Normal Temperature, Precipitation and Degree Days. Last modified September 11, 2006, http://www.ncdc.noaa.gov/oa/documentlibrary/clim81supp3/clim81.html.

[Schneider and Whitlach, 1991] Schneider, M. L. and Whitlach, E. E. (1991). User-specific water demand elasticities. *Journal of Water Resources Planning and Management*, Vol. 17(1):52–73.

[Solley et al., 1988] Solley, W., Merk, C., and Pierce, R. (1988). Estimated use of water in the United States in 1985. Technical report, United States Geological Survey Circular 1004, 82.p.

[Solley et al., 1998] Solley, W., Perlman, H., and Pierce, R. (1998). Estimated use of water in the United States in 1995. Technical report, United States Geological Survey Circular 1200.

[Thom, 1954] Thom, H. (1954). The Regional Relationship between Heating Degree days and Temperature. *Monthly Weather Review*, Vol. 82(1).

[United States Census Bureau, 2000] United States Census Bureau (2000). United states census data. http://www.census.gov/main/www/access/html. accessed August 18, 2007.

[United States Census Bureau, 2005] United States Census Bureau (2005). County business patterns. http://www.census.gov/epcd/cbp/view/cbpview.html. accessed March 30, 2008.

[USBLS, 2000] USBLS (2000). Illinois labor productivity between 1977 and 2000. http://www.clevelandfed.org/Research/commentary/2005/June.pdf. U.S. Bureau of Labor Services, U.S. Department of Labor, accessed December 15, 2007.

[USBLS, 2007] USBLS (2007). Illinois employment data. http://www.bls.com. Department of Labor, Bureau of Labor Statistics, accessed September 3, 2007.

[USDA, 1987] USDA (1987). Illinois irrigated acreage by county. United States Department of Agriculture, The Census of Agriculture.

[USDA, 1992] USDA (1992). Illinois irrigated acreage by county. United States Department of Agriculture, The Census of Agriculture.

[USDA, 1997] USDA (1997). Illinois irrigated acreage by county. United States Department of Agriculture, The Census of Agriculture.

[USDA, 2002] USDA (2002). Illinois irrigated acreage by county. United States Department of Agriculture, The Census of Agriculture.

[USDA, 2008] USDA (2008). Agricultural baseline projections, U.S. livestock, 2008-2017. United States Department of Agriculture, Economic Research Service.

[USDOE, 2007] USDOE (2007). Net Generation by Energy Source by Type of Producer. Technical report, United States Department of Energy, Energy Information Administration.

[USEPA, 2004] USEPA (2004). Public drinking water systems programs: Public drinking water systems: Facts and figures. Technical report, United States Environmental Protection Agency.

[USGS, 2005] USGS (2005). Irrigation water use. Last modified August 30, 2005, http://ga.water.usgs.gov/edu/wuir.html.

[USGS, 2007] USGS (2007). Water use in the United States. http://water.usgs.gov/watuse/. United States Geological Survey, accessed October 17, 2007.

[van der Leeden et al., 1990] van der Leeden, F. et al. (1990). *The Water Encyclopedia*. Lewis Publishers, second edition.

[Wu, 2008] Wu, M. (2008). Analysis of the Efficienty of the U.S. Ethanol Industry 2007. Technical report, Argonne National Laboratory. Delivered to Renewable Fuels Association on March 27, 2008.