JOINT WATER UTILITY FEASIBILITY STUDY

City of Lexington

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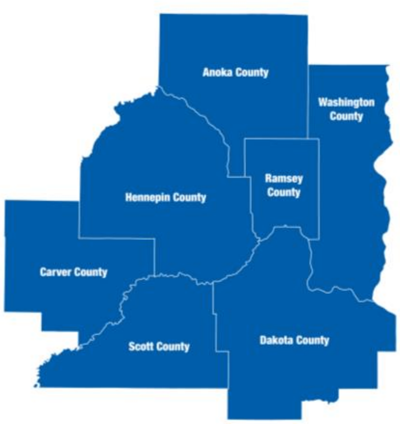

The Metropolitan Council is the regional planning organization for the seven-county Twin Cities area. The Council operates the regional bus and rail system, collects and treats wastewater, coordinates regional water resources, plans and helps fund regional parks, and administers federal funds that provide housing opportunities for low- and moderate-income individuals and families. The 17-member Council board is appointed by and serves at the pleasure of the governor.

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About this Report

The Metropolitan Council recognizes that water supply planning is an integral component of long-term regional and local comprehensive planning. The Council has implemented a number of projects to provide a base of technical information needed to make sound water supply decisions.

This report summarizes the result of work to assist in water supply planning for the Metropolitan Area which meets the requirements of Minnesota Statutes, Section 473.1565, Subdivision 1, which calls for the Council to “carry out planning activities addressing the water supply needs of the metropolitan area as defined in Section 473.121, Subdivision 2.”

The report is organized into 11 sections. The introduction (Section 1.0) provides an overview of the Council and the need for the project. The following 10 sections discuss methods and results. There are also five appendices, which include maps and supporting data.

Special funding for this project was provided through the Clean Water Fund.

CLEAN WATER LAND & LEGACY AMENDMENT

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1.0 Introduction

This report is a high level feasibility study reviewing the potential for combining municipal potable water systems in the northeast Twin Cities metropolitan area. Six cities requested that the Metropolitan Council investigate the costs and benefits of combining the construction and operation of their potable water systems. The six-city coalition is an existing collaborative effort between the cities of Centerville, Circle Pines, Columbus, Hugo, Lexington and Lino Lakes. The purpose of this coalition is to identify opportunities for efficiency and cost savings in the public water system services they provide. The geographic planning area is shown in Figure A1 (located in Appendix A).

This concept aligns with the Metropolitan Council's goal to ensure sustainable water supply for current and future generations of the Twin Cities metropolitan area. The purpose of this study is to support sustainable water supply planning for the northeast metropolitan area.

The Metropolitan Council authorized Barr Engineering to conduct a preliminary investigation of a combined or joint water utility. The three system configurations considered are:

Joint Utility Option 1: Jointly constructed, owned and operated supply, storage and treatment system. Independently constructed, owned and operated distribution systems.

Joint Utility Option 2: Jointly constructed, owned and operated supply, storage, treatment and distribution system.

Independent Utilities Option 3: Make no changes. Operate as independent utilities.

This study examines in a preliminary way the effects of a joint system on the existing and future drinking water systems. This report identifies the preliminary advantages and disadvantages of combining systems, how the collaborative effort might be managed, and possible financial impacts to each city. This study includes the gathering of existing and future water utility data, development of feasibility and cost/benefit analyses, and recommendations for future work.

1.1 Report Organization

The remainder of the report is organized into the following sections:

- Section 2.0 Executive Summary
- Section 3.0 Background and Purpose
- Section 4.0 Water System Performance Criteria
- Section 5.0 Water Demand and Supply
- Section 6.0 Water Storage
- Section 7.0 Water Distribution
- Section 8.0 System Operations and Maintenance
- Section 9.0 Evaluation of Development Options 1-3
- Section 10.0 Recommendations

2.0 Executive Summary

2.1 Location

The cities of Centerville, Circle Pines, Columbus, Hugo, Lexington and Lino Lakes are located approximately 20 miles northeast of Saint Paul in Anoka and Washington counties. The region is situated amongst many lakes and includes a substantial amount of undeveloped land. The geographic location of the six cities is depicted in Figure A1. Figure A2 depicts current land use and Figure A3 depicts future land use. These figures are located in the Appendix A of this report.

2.2 Existing Water Systems

Municipal water supply systems provide both potable drinking water and fire protection. The systems consist of supply, treatment, storage, and distribution piping to deliver water to customers. Each of the six cities currently owns and operates its own potable water system, and all six cities use groundwater for their water supply. However, the number and size of distribution watermain, number of groundwater supply wells, water quality, water treatment, and number of storage tanks varies between cities. There are several existing small diameter interconnections between some of the cities that allow water to flow between the separate systems for emergency uses.

The age of the water system components also vary since the systems are at varying stages of development. There are two general groups in this regard, those that are can be classified as a developed city with little to no expected additional growth and those that can be classified as a growing city which have large undeveloped parcels and anticipate future growth.

- Those classified as a *developed city* include: Lexington, Circle Pines and Centerville. These communities have more mature water systems which supply most or all of the developable area in their respective cities.
- Those classified as a *growing city* include: Hugo, Lino Lakes and Columbus. They are projecting growth and new infrastructure to accommodate future populations.

A depiction of the existing water systems is provided in Figure A4 in Appendix A.

A key potential benefit of joining the systems together is that each of these groups has assets that can benefit the other. Generally, the fully developed cities' water systems have supply and storage that, when combined with the growing cities, can be used to meet future development needs. Conversely, the growing communities are able to generate capital via developers' fees and assessments. This creates a condition where a potential buyer with capital (growing city) can join up with a potential seller who has assets (developed city) needed by the buyer. The creation of a Joint Utility would connect the growing communities with the fully developed communities via a purchase of the needed assets. They would then enter into a long term relationship beneficial to both groups.

2.3 Summary of Joint System Analysis

At a high level, the key advantages of a Joint Water Utility under Option 1—a jointly constructed, owned and operated supply, storage and treatment system, or Option 2—a jointly constructed, owned and operated supply, storage, treatment and distribution system are:

For the growing cities:

- Less expensive supply
- Less expensive storage
- Need to hire fewer future staff

For the developed cities:

- Influx of capital as growing communities, via the Joint Utility, purchase access to existing infrastructure
- Less expensive well maintenance as more communities share in the expense of maintenance
- Less expensive tower maintenance as more communities share in the expense of maintenance

For the Joint Water Utility communities as a whole:

- Need for fewer groundwater wells
    - Lower life cycle maintenance costs for the wells due to fewer installations
- Need for fewer storage tanks
    - Lower life cycle maintenance costs for storage due to fewer installations
- Delay in infrastructure needs
- Efficient use of resources
- Potentially improved purchasing leverage
- Strategic infrastructure siting potentially resulting in easier and less costly permitting
- Capital cost savings through shared infrastructure and reduced redundancy
- Operational cost savings through shared operations, maintenance, management staff and equipment

Opportunities for cost sharing may be realized through more efficient use of infrastructure, shared labor and shared maintenance and operations. Cost savings can also be realized through reduced need for future investment in water system infrastructure. The most important costs and benefits identified in this study are outlined below.

2.3.1 Capital Costs

For large capital projects, it is estimated that a joint system of the six cities would eliminate the need for 3 million gallons of water storage and seven (7) future groundwater wells over the course of the planning period through 2030, as compared to individual city development. This translates to a cost savings of $12 million as compared to individual development.

2.3.2 Operational Costs

The formation of a joint utility would provide cost savings in administrative and operations staffing and equipment. Much of this savings would be dependent on how the joint utility would be governed and operated. Maximum savings would occur under Option 2 with the completely joined system. Billing and distribution system maintenance would be combined under one entity, and distribution system maintenance could be the responsibility of one joint utility crew. Since most Minnesota cities hire maintenance staff to meet snow plowing demands, cities may also need to share this responsibility to see the maximum savings. Savings would be reduced if billing and distribution system maintenance were to stay with individual cities. Given the high level scope of this study and the number of options available, cost savings are not quantified for specific operational benefits; however, it can be concluded that significant savings could be made by combining into a single utility.

2.3.3 Financial and Organizational Structure

Based on the high level findings of this study, the potential for resource and rate efficiencies in forming a joint utility exists. Financially, capital costs and projected water rates are reduced overall by forming a joint utility. However, individual savings will vary for each member city depending on how the joint utility is formed and how the joint utility costs are proportioned to each city.

In Option 1, where a Joint Utility does not own and operate the distribution system, there may initially be more benefit to cities with older water systems that are near full development, as they would not need to share the new development costs of trunk mains in other cities. However, as cities with older water systems age and need repair this initial benefit would be offset by the fact that the larger Joint Utility would not help fund the repair and replacement of the aging distributions systems. Under Option 2 the Joint Utility would share increased maintenance costs associated with aging watermain. There should be more discussion between the member cities as to how the Joint Utility costs would be allocated to each city, and whether there would be buy-in costs to help make membership more equitable across the varied maturity of the member cities.

2.4 Overall Recommendations

Detailed recommendations are discussed in Section 10.0; however, a summary of our recommendations is as follows:

- Continue to investigate forming a Joint Utility under Option 2
- Plan for joint development now before the opportunity is lost as each city builds out more infrastructure that might not be needed in a Joint Utility setting
- Investigate which cities should be in the Joint Utility, and consider removing Columbus due to geographic reasons
- Negotiate initial buy-in for asset and capital sharing between cities
- Refine cost estimates based on new comprehensive planning and other studies

2.5 Recommendations for Future Work

As this study included only a high-level preliminary analysis, three subsequent studies are recommended to move the project forward. A detailed list of these studies is shown in Section 11 in the order in which they should occur. The studies include:

1. Study 1 Water Quality Analysis. This study would quantify the impacts of mixing different qualities of water to help finalize the correct combination of cities for a joint utility.
2. Study 2 Facility Plan. This study would define in greater detail the physical facilities needed to create a Joint Utility. This would include the size of interconnecting watermain, the location of new storage, and whether or not pressure zones would need to be managed with pump stations and pressure reducing valves.
3. Study 3 Financial and Governance Plan. This study would review the financial and organizational aspects of the Joint Utility to add more certainty to the final costs that each community would see as a result of the formation of a Joint Utility.

3.0 Background and Purpose

The Metropolitan Council commissioned Barr Engineering to conduct a preliminary joint water utility feasibility study for the cities of Centerville, Circle Pines, Hugo, Lexington, Lino Lakes and Columbus. The goal of this study is to perform a high level evaluation of the feasibility of combining municipal water systems with two options for joint utility ownership, construction and operation, as compared to individual development.

Joint Utility Option 1:	Jointly constructed, owned and operated supply, storage and treatment system. Independently constructed, owned and operated distribution systems.
Joint Utility Option 2:	Jointly constructed, owned and operated supply, storage, treatment and distribution system.
Independent Utilities Option 3:	Make no changes. Operate as independent utilities.

This study examines the impacts of both Option 1 and Option 2 and recommends whether the idea of a collaborative system is worthwhile and merits further investigation, as compared to Option 3. The time period for this study runs through 2030 and compares future infrastructure investment and maintenance costs.

3.1 Tasks

In order to evaluate the water system development options, the following steps were completed:

1.0 Data Collection and Evaluation

Collect necessary information—including relevant reports, operational and planning information—from the cities/townships involved in the study.

2.0 Estimate Current and Future System Demands

Determine current and projected water demand through 2030, with data provided by the cities. Future demands are based on projected populations, zoning and planning, relying heavily on the existing city 2030 Comprehensive Plans. Water systems were mapped for infrastructure locations, geologic setting of their water supply, and future land use.

3.0 Estimate Future Infrastructure

Based on current and future water demands, the necessary supply, treatment, storage and distribution infrastructure was evaluated to meet average, peak day and fire flow demands.

4.0 Cost Estimates and Analysis

Using the data gathered above on the existing and future systems, cost estimates were developed to compare the two joint options for utility operation with a status quo option of making no changes. These costs were used along with figures to help compare the advantages and disadvantages to combining water systems.

5.0 Meetings

The Metropolitan Council and Barr staff met with representatives of the six cities at the kickoff of this project and to review the draft report. City staff and Metropolitan Council staff were given the opportunity to review and comment on the draft report in September 2014 before the final report was completed.

3.2 Assumptions

To analyze the data and prepare feasibility study recommendations, several assumptions had to be made as part of the process. Below is a list of assumptions made in the creation of this report. These assumptions are based on the 2012 Great Lakes Upper Mississippi River Board Recommended Standards for Water Works (Ten States Standards[1]), and our engineering judgment and experience working with municipal water supply systems.

Assumptions made in this report are as follows:

1.0 The existing system is assumed to be the year 2013 water system, and the future system is assumed to be the year 2030 water system.

2.0 Population estimates were taken from the existing city comprehensive plans, which detailed infrastructure needs through 2030, and from the Metropolitan Council's "Thrive MSP 2040". Comprehensive Plan population projections for 2030 were adjusted to match the Metropolitan Council's 2030 estimate if there was a large discrepancy between the two projections.

3.0 Future development boundaries, land use, and infrastructure locations were taken from the existing city 2030 Comprehensive Plans.

4.0 Per capita water use (average and peak) for each city was estimated based on the average per capita use for the most recent 5 years (2009-2013) of data available. For cities where all five years of data was not available, an average was computed from what data was available from 2009-2013.

5.0 There is no upward or downward trend in per capita water use. Future per capita water use is assumed to reflect current historical per capita water use. Future studies may want to look at the emerging trends that show some reduction in per capita use for many cities across the region.

6.0 There is no upward or downward trend in percent of water unaccounted for. The percent of water unaccounted for is calculated as the average of the most recent five years of data reported in Minnesota Department of Natural Resources (DNR) water use reports.

7.0 The population served by cities' water supply systems is based on city reported data and historical patterns. No future assumptions are made for increased or decreased service areas beyond what cities have projected in their comprehensive plans.

8.0 The City of Columbus's existing water demand is generated primarily by industrial and commercial users. Therefore, per capita water use is much higher than the other cities, and is unlikely to reflect demand added by future residential customers. Future demand for the City of Columbus was taken from the City's existing comprehensive plan rather than predicted by population projections and existing per capita use.

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[1] **Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. 2012.** *Recommended Standards for Water Works .* Albany : Health Research Inc., 2012**.**

9.0 It is assumed that the future ratio of peak day water use to average day water use will reflect the previous historical five year average for each of the cities. The average peaking factor of the joint utility was computed by taking a population-weighted average of the six cities' individual peaking factors. This is likely conservative as a larger population base of a Joint Utility should result in a lower peaking factor.

10.0 The required fire flow for the City of Lino Lakes is 4,500 gpm for four hours. As this is the highest known fire flow requirement for any of the six cities, 4,500 gpm for four hours was also assumed to be the requirement of the combined utility. Lino Lake's fire flow is relatively large in comparison to what would be normally expected for cities of similar size; in the absence of city-specific data for the remaining five cities, fire flow requirements were assumed to be 3,500 gpm for three hours for the cities of Centerville, Circle Pines, Columbus, Hugo and Lexington.

11.0 For the purposes of this preliminary analysis it is assumed that pressure zones are compatible for connecting water systems, sharing elevated storage and pumping stations. Further detailed analysis would be needed to determine the compatibility of the various systems with regards to pressure zones and operating pressures.

12.0 Cost estimates in this study are preliminary, high-level estimates intended only for comparison purposes within this study. A more detailed review of the costs to install and maintain various system components is needed to increase the accuracy of the predicted costs of the future systems and reduce uncertainty.

13.0 All future development within the cities will utilize groundwater for water supply. Surface water options were not considered in this study.

14.0 New groundwater wells would have a nominal capacity of 1,000 gpm. Note that some locations within the study area may reliably supply greater amounts and this could be considered in a future study to better analyze the benefits of a joint supply system.

15.0 We did not assume any regional water treatment plants as part of this study. It is assumed that water quality issues would be handled by chemical addition or small treatment plants at the well. If all cities plan to treat for iron and manganese then large regional treatment plants will almost always prove to be more cost effective than small distributed local plants. This is actually a potential benefit of a Joint Utility as many communities tend to move towards treated water as they mature. Doing so in a Joint Utility setting would add even more benefit by reducing the number of plants needed to meet the quality needs.

16.0 Infrastructure repair and replacement costs were estimated as a percent of total capital costs. The following assumptions were made regarding annual maintenance costs: 1% per year for watermain replacement, 2% per year for storage and wells maintenance and replacement, 3% per year for SCADA system replacement and repair.

17.0 Specific projections of future joint utility operational costs are not accounted for in this study. It was assumed that operational costs such as power and labor would be the same for the given total future water use, regardless of the specific system ownership or configuration.

18.0 Staffing is discussed at a high level in Section 8.0; however, staffing would be largely dependent on how the joint utility is formed. Thus, staffing costs for Options 1-3 are not directly compared.

19.0 For the creation of comparative future water costs it was assumed that the developers would pay for 100% of new watermain costs, and all other capital costs would be funded 80% through development and water availability charges, and 20% by rate payers.

4.0 Water System Performance Criteria

This section of the report forms the criteria for evaluating the existing water system, its ability to meet future demand, and opportunities for efficiency in infrastructure and operations. These criteria provide a framework for the analysis of past, current and projected populations, historical water use, categorical water use, peak demand use, water policy, and capital improvement plans. A glossary of frequent terms for water system design and planning is located in Appendix E.

4.1 Design Period

This evaluation is based on conditions anticipated through the year 2030. This design period was chosen as the most recent city comprehensive plans detail projected capital improvements through 2030. Since the costs of a joint system are compared to the cities' individual capital improvement plans, it is necessary to follow the same timeline.

This report should be updated at least on a ten year basis in conjunction with master planning and reviewed every five years for adjustments prior to any major capital expenditure, to ensure that outcomes are based on the best information available at the time. Deviations from expected development will occur and should be accounted for in planning for and execution of a joint system.

4.2 Planning Area

An important aspect in the analysis of the joint water utility system is the area included in the planning process. For the purposes of this preliminary study, the planning area is defined as the six-city area within the boundaries of Centerville, Columbus, Circle Pines, Hugo, Lexington and Lino Lakes. The planning area is depicted in Figure A1.

Note that the planning area has a significant impact on the outcome. Different combinations of cities may be desired for a Joint Utility. For example, Columbus is spatially removed from the other cities and this fact impacts costs related to trunk watermains considerably. In addition to this, Lexington already receives treated water from Blaine and Circle Pines filters its water while the remaining communities do not filter their water. This creates the possibility that mingling filtered and unfiltered water will result in unanticipated and undesirable interactions. A study (Study 1 in the recommendations) to determine the results of mixing these waters should be done before finalizing any Joint Utility agreement and determining member cities.

4.3 Population

Water use is closely linked to population so the accuracy of predicted water demand largely depends on the accuracy of population projections. Population projections are comprised of City reported projections and the Metropolitan Council's Thrive MSP 2040 forecasts. The City's current projections from their 2030 Comprehensive Plans were used unless they differed greatly from the Thrive MSP 2040 forecasts. In that case, the Thrive MSP 2040 forecasts for 2030 were used instead. Population across the six-city area is expected to increase 50% from 2013 to 2030. Figure 4.1 and Table 4.1 summarize current and projected populations served by the water system. Please note that the City of Columbus currently serves a very small portion of their residents with potable water.

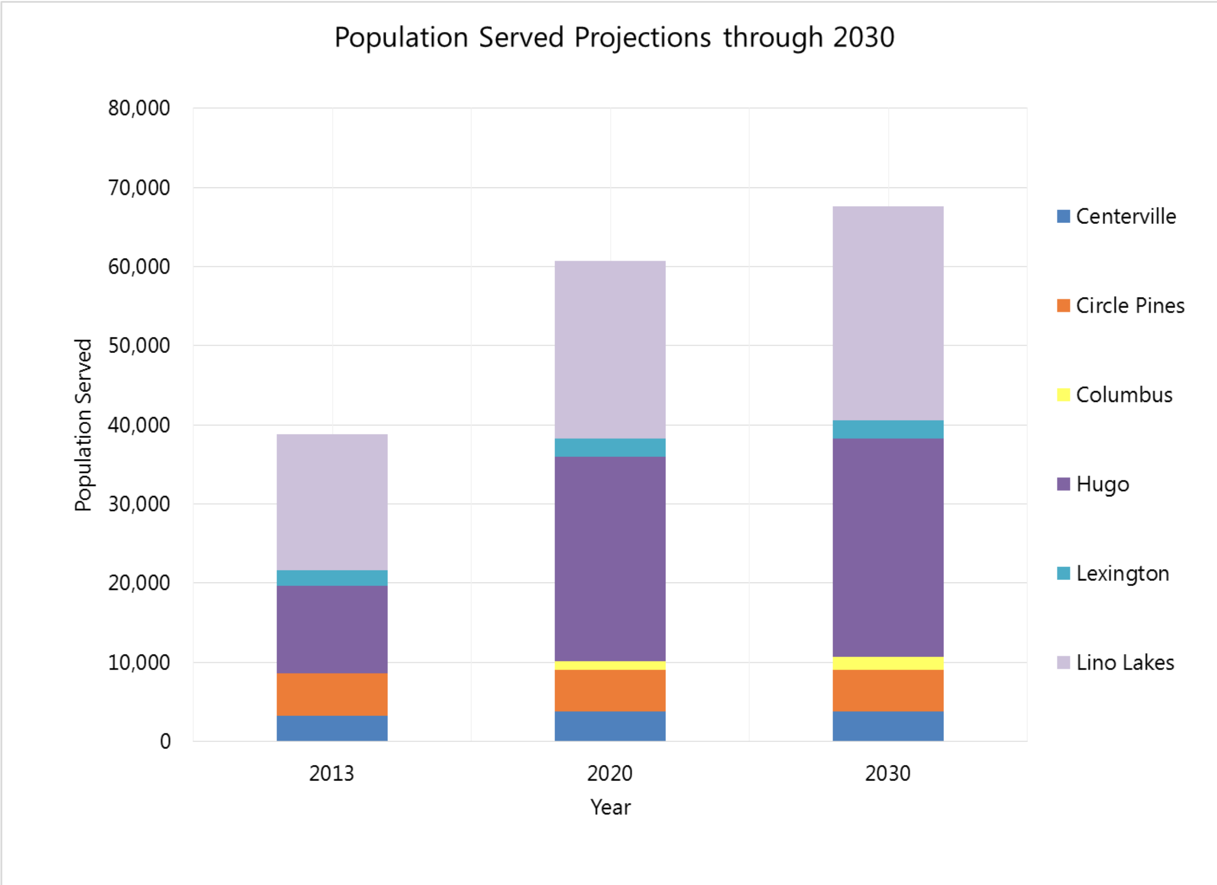


Figure 4.1 Population projections for the six-city region

Table 4.1 Populations projections for the six-city region

	Total	Population		Population	Served	
Year	**2013**	**2020**	**2030**	**2013**	**2020**	**2030**
Centerville	3,800	4,200	4,200	3,282	3,750	3,750
Circle Pines	5,300	5,300	5,300	5,300	5,300	5,300
Columbus	3,949	5,150	5,850	4	1,040	1,620
Hugo	13,834	29,000	30,750	11,024	25,900	27,650
Lexington	2,021	2,250	2,300	2,020	2,249	2,299
Lino Lakes	21,000	25,000	27,000	17,228	22,516	27,000
Joint System	49,904	70,900	75,400	38,858	60,755	67,619

4.4 Existing System

A summary of the existing water system of each city is located in Appendix D. A map of all the individual existing water systems is depicted in Figure A4.

5.0 Water Supply and Demand

The major components of the various water systems were analyzed to determine existing performance and future needs, both as a joint utility and individually. Water supply and demand was the first quantity examined. Historical data showing water pumped in previous years provides a useful tool for predicting future water demand. The last five years of well pumping data for each city was reviewed in order to establish general trends and per capita use. Water demand projections are based on average historical water use patterns from 2009 to 2013, along with expected population growth for the region. Most of the data is from city documents such as comprehensive plans, DNR Water Conservation Plans and DNR annual reports. Missing data was estimated on a case by case basis.

5.1 Well Supply Requirements

Well supply or production is a measure of the water system's ability to supply water needed to sustain demand. Per "Ten State Standards" a water system should be designed with sufficient firm capacity to supply the peak day demand of the system. Firm capacity is the amount of water that would be available if the highest capacity well was out of service (in case of maintenance or emergency). Peak day demand is the day of highest demand over the course of a year. It is usually calculated as a multiple of the average day demand based on historic trends. This is a key factor in understanding the potential benefit of a Joint Utility. In a Joint Utility fewer wells are needed to meet firm pumping capacity. As independent cities each would require one extra well to meet firm pumping capacity. In a Joint Utility those same six communities would only need one extra well to meet firm pumping capacity.

5.2 Unaccounted-for Water Use

Water systems lose water through leaks in watermains, flushing, or other un-metered activities such as firefighting, street cleaning, construction, unauthorized water use and improper meter calibration. The amount of water pumped will always be greater than the amount of water sold. The Minnesota Department of Natural Resources (DNR), which regulates groundwater appropriations, recommends that the amount of unaccounted water should be less than 10% of the total water pumped in order to minimize lost water. For this study each city's unaccounted for water use was assumed to remain constant and meet historical averages through the future study period.

Figure 5.1 shows unaccounted for water as a percent of total water pumped from the most recent five years of data available for each of the six cities. As a joint utility, the amount of water unaccounted for is less than 10%, meeting the DNR benchmark. However, some cities have unaccounted water greater than or close to 10%. It would be beneficial for these cities to begin taking steps to reduce the amount of unaccounted water regardless of whether a joint utility is created or not.

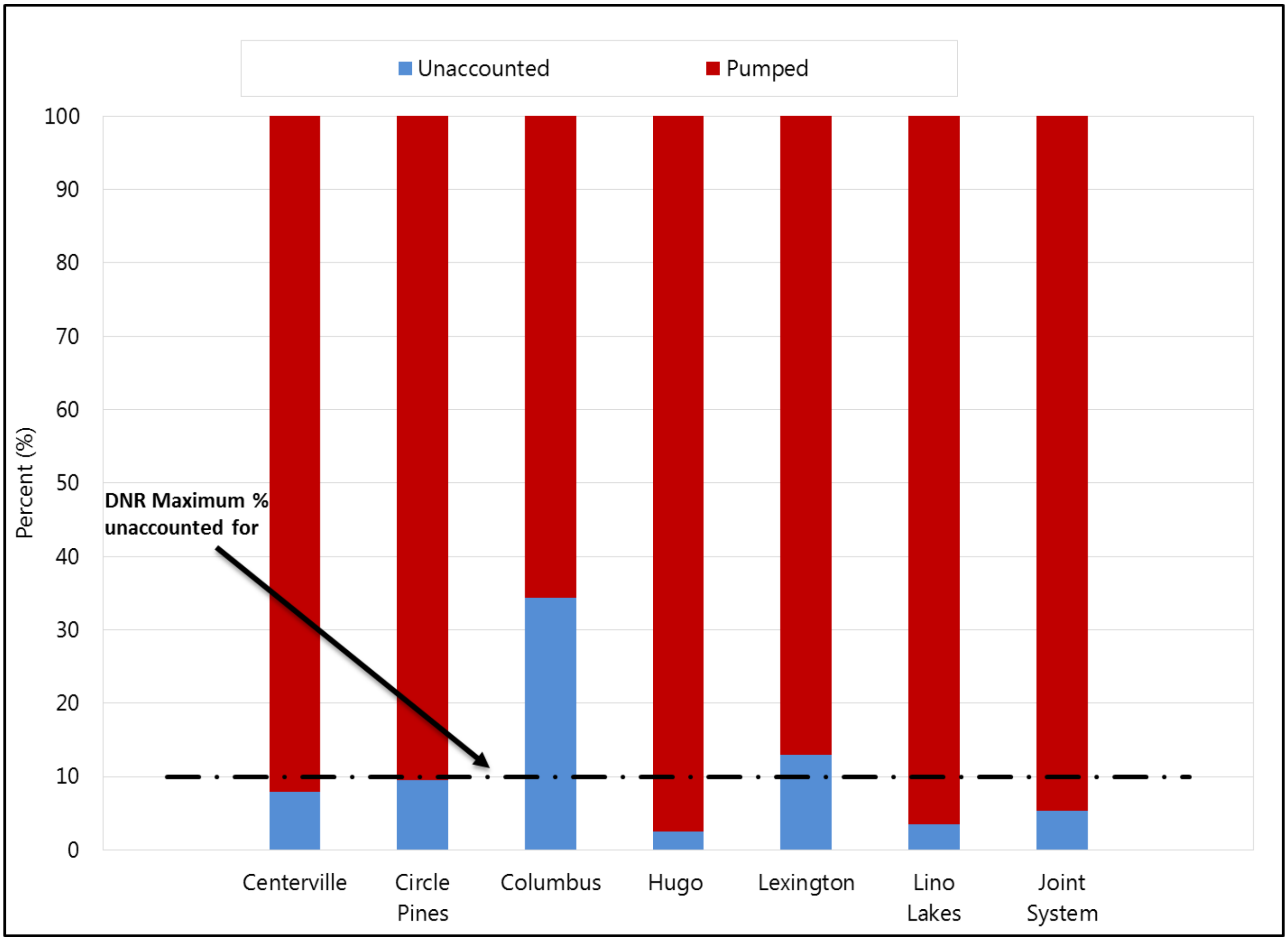


Figure 5.1 **Average percent of water pumped and water unaccounted for by city from 2009-2013**

5.3 Existing Water Supply and Projected Demands

The cities' combined total well capacity is 26 million gallons per day (mgd) and the firm well capacity is 23 mgd. This capacity (23 mgd) is more than enough to meet the 2013 estimated peak day demand of 13 mgd for the Joint Utility. Peak day demand and available well capacity are shown in Figure 5.2 and Table 5.1. Required firm well capacity versus available firm well capacity is shown in Figure 5.3 and Table 5.1.

As shown in Figure 5.2, capacity in excess of peak day demand is a result of the requirement for each individual city to maintain its own firm well capacity. In a combined utility, this excess capacity can be harnessed to reduce the total number of wells needed to meet future demand. One of the most immediate benefits of this excess firm capacity is that future capital investment could shift from drilling wells to interconnecting the communities with adequately sized trunk watermain. If the water distribution systems are properly interconnected to allow enough water to flow between the cities, no new wells would need to be drilled in the six-city Joint Utility until 2021 or later if demand trends continue to decline.

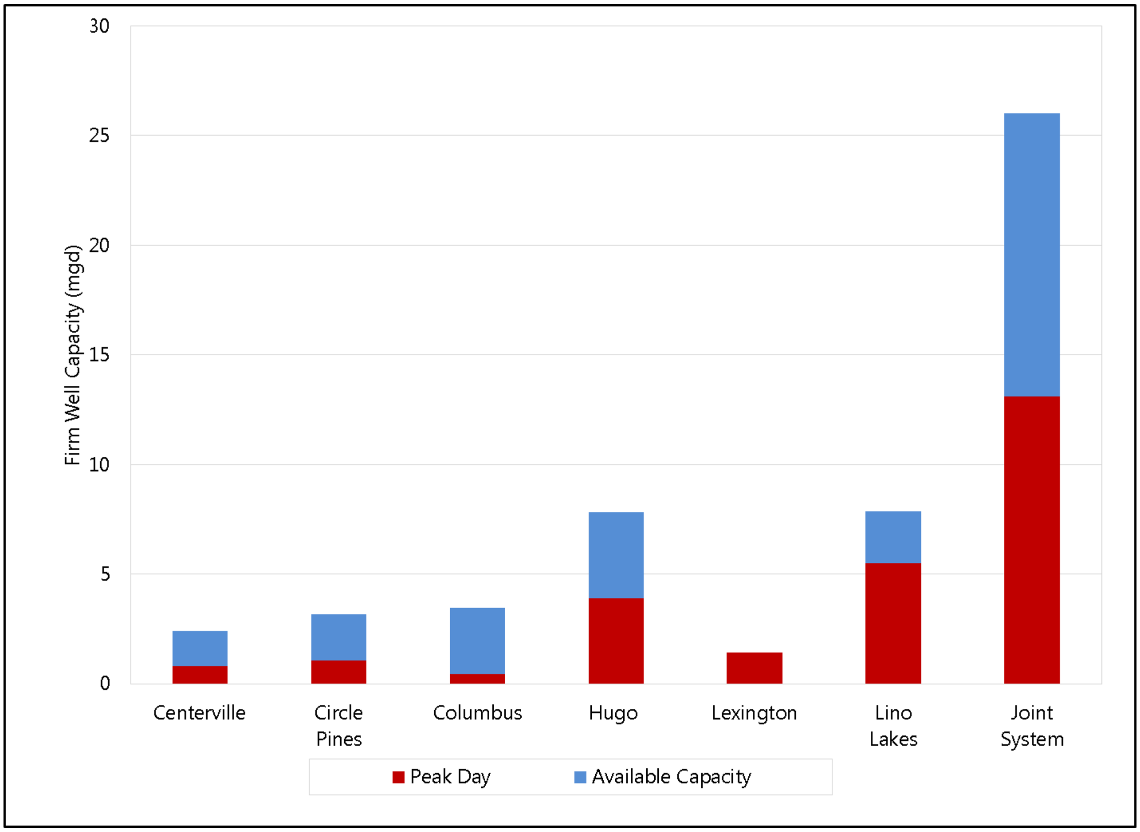


Figure 5.2 **Available well capacity and peak day water demands**

Table 5.1 **Available firm well capacity and peak day demand**

	Peak day (mgd)	Total well capacity (mgd)	Available firm capacity (mgd)	Excess firm capacity (mgd)
Centerville	0.8	2.4	0.8	0.0
Circle Pines	1.0	3.2	1.4	0.4
Columbus	0.4	3.5	2.0	1.6
Hugo	3.9	7.8	6.1	2.2
Lexington	1.4	1.4	0.0*	0.0
Lino Lakes	5.5	7.9	5.3	0.0
Joint System	13.1	26.0	23.4	10.3

* Lexington maintains reliability in water supply through interconnection with the City of Blaine.

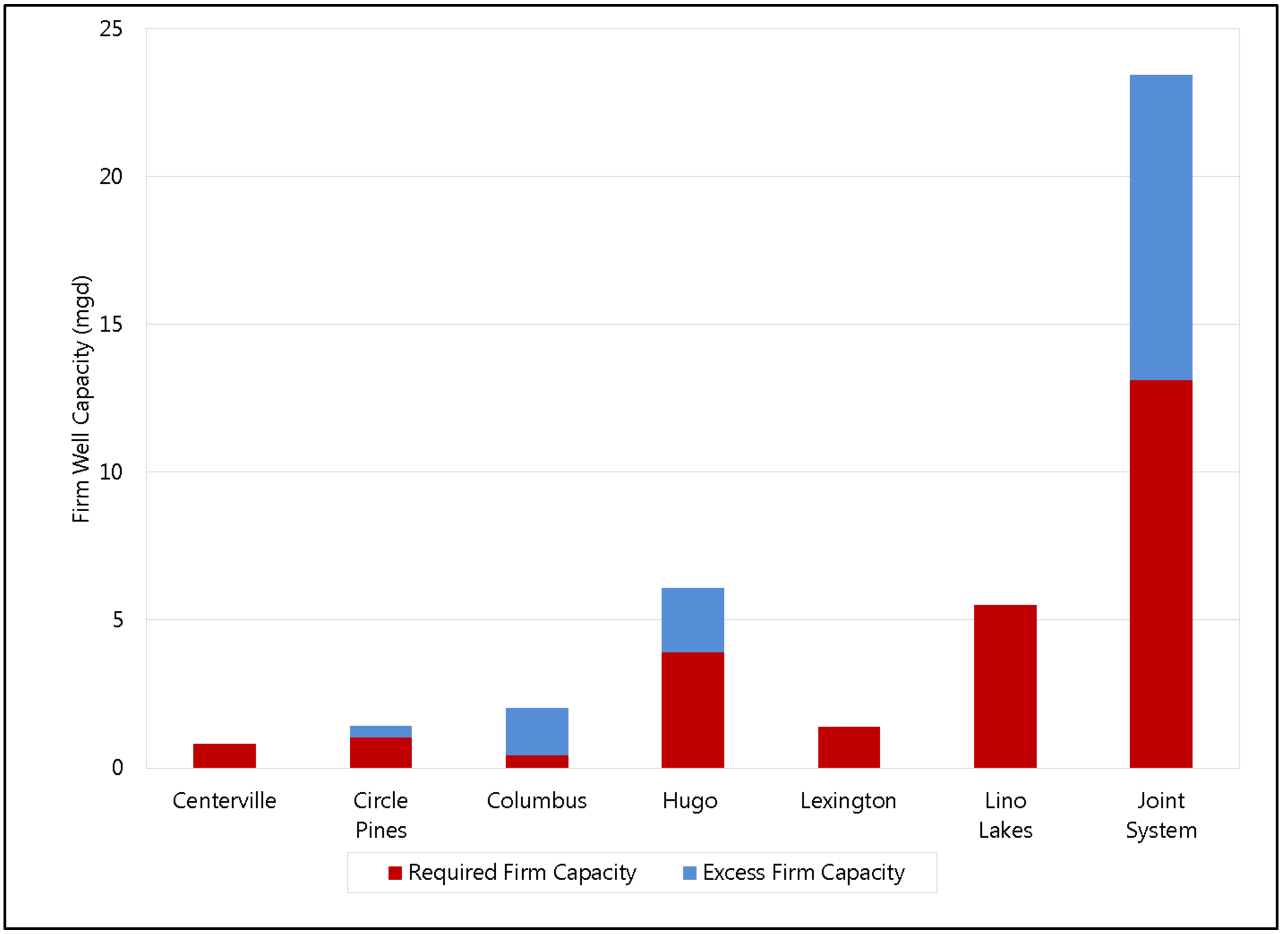


Figure 5.3 **Required and excess firm well capacity for 2013 systems**

Since there are no known major water users planning to relocate to the six-city region at this time, future demand growth is based on population forecasts and historical per capita water use. The population is expected to increase 50% by 2030 which is likely to have a large impact on demand. Figure 5.4 and Table 5.2 show projected average and peak day demand for the six-city region through 2030. It should be noted that that the major increases in demand are expected to come from development in Hugo and Lino Lakes. To arrive at peak day demand the average day demand was multiplied by the peaking factor of 3.6 from Table D2.1 (Appendix D). The 2030 Average Day Demand is 6.8 mgd and the 2030 Peak Day is 25 mgd. Figure 5.4 shows that the existing firm well capacity is almost enough to meet demand needs through 2030.

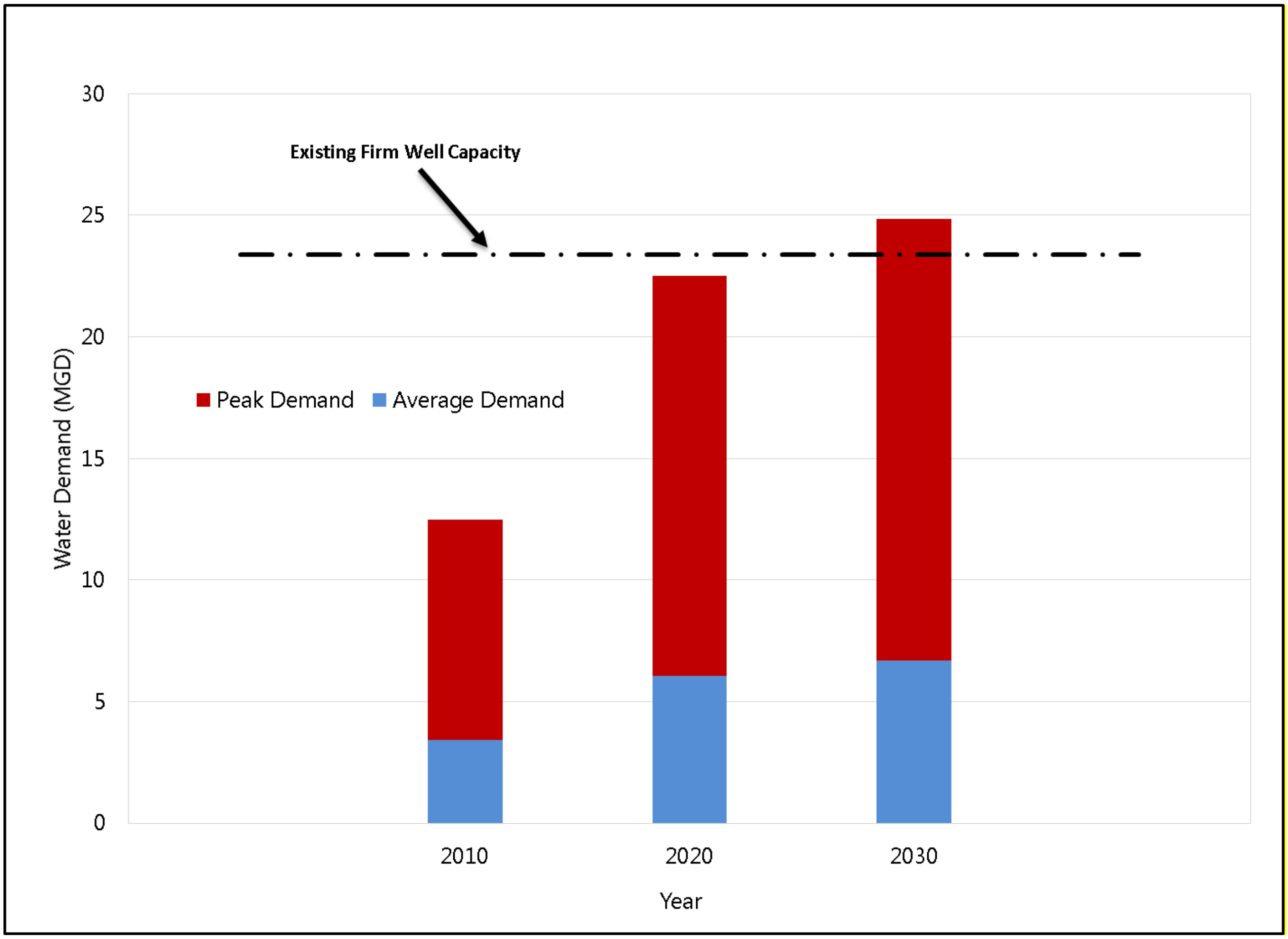


Figure 5.4 **Projected water demand for the six-city region through 2030**

Table 5.2 **Projected water demand for the six-city region through 2030**

Year	Joint Utility Average Day (mgd)	Joint Utility Peak Day (mgd)
2010	3	13
2020	6	23
2030	7	25

To allow the existing wells to serve the needs of a Joint Utility, properly sized interconnections will need to be installed that allow the existing wells to deliver water from the fully developed communities to the growing communities. It is possible that some trunk watermain improvements may also be needed to ensure to that high flows can make it from the source to the point of use without excessive head loss. Under this scenario the communities needing supply would purchase a portion of the wells currently owned by the communities who have excess supply. The cost of the wells would be a negotiated item that would be resolved during the formation of the Joint Utility.

5.4 Future Water Supply

With development expected to occur between now and 2030, additional water supply will be needed to sustain growth of the water system and maintain adequate firm capacity. The trigger chart shown in Figure A5 was used to determine the future needs of the six-city area. By 2030 it is estimated that the joint utility would require an additional 2,000 gpm (2.9 mgd) of well pumping capacity. This relates to two (2) new 1,000 gpm wells. After Lino Lakes Well No. 6 is online, the joint utility would only need one (1) additional well at 1,000 gpm. Please note that these new wells are not shown in Figure A6, Joint System 2030 Watermain—particular well sites are not identified in this report, only the number and comparative cost of the future wells. Figure 5.5 shows the required and existing well capacities for joint and individual development. The reduced need for additional wells is one of the most significant benefits of a joint system. With the increase in new efficient plumbing fixtures and rising awareness of conservation, per capita demand has been steadily declining in recent years. If this trend continues It is possible that no new wells would be needed between now and 2030.

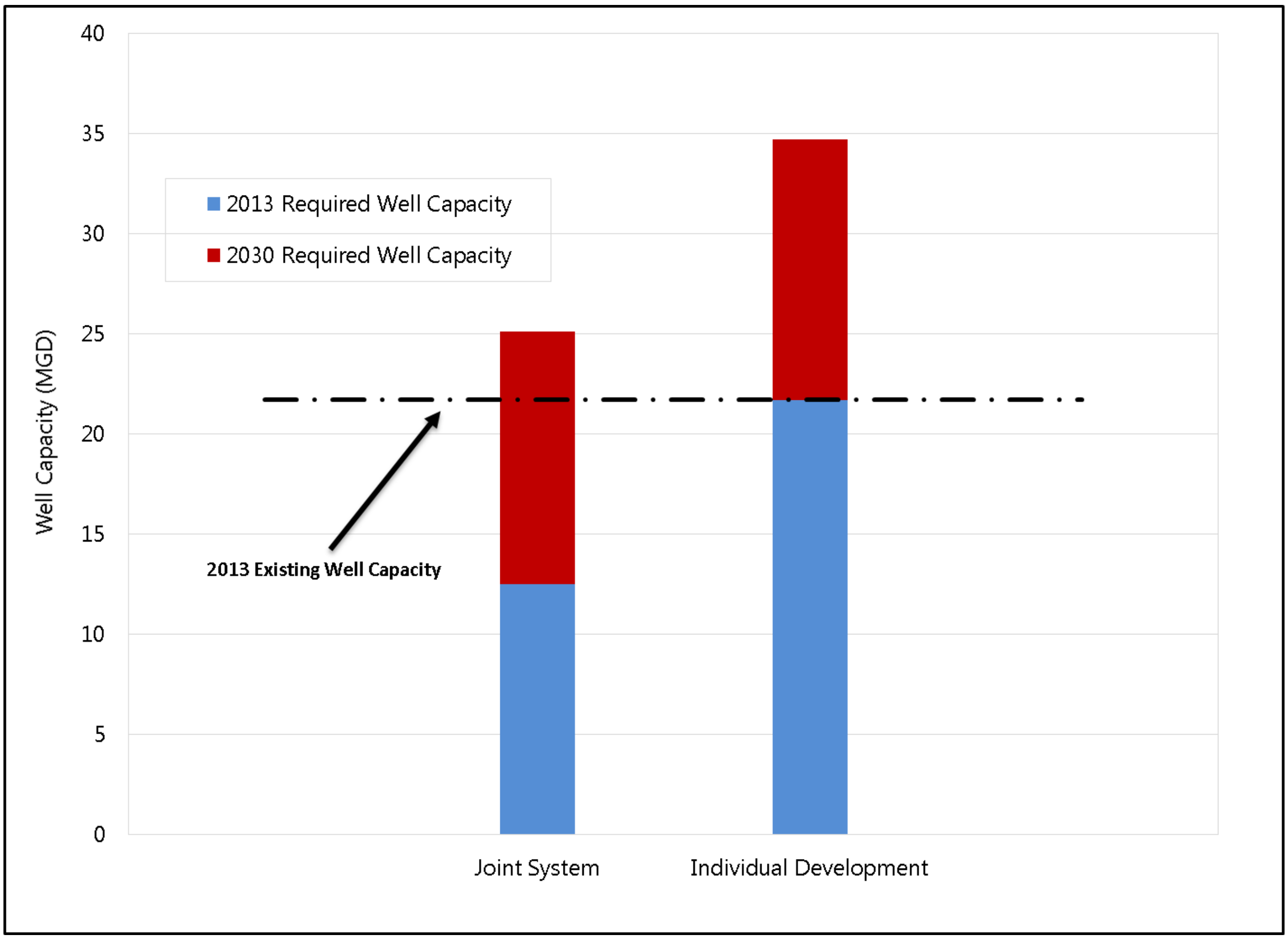


Figure 5.5 Existing and future well capacity requirements for joint and individual development

5.5 Well Contamination

No serious contaminants have been detected in any of the wells to date. However, this may change as new land is developed in the future. A large area such as the area represented by the Joint Utility offers a significant advantage in diversifying supply in areas unlikely to be contaminated. In addition to this, the clay layer present west of Highway 35 offers some protection from activities at the surface reducing the risk of contamination to wells located there.

5.6 Water Quality and Treatment

Existing water quality meets the primary standards set by the MDH, so no additional treatment is required. However, a key component of the planning for a Joint Utility will be to study and understand the interaction of the different water qualities present in the member communities. Lexington receives treated water from Blaine most of the year and Circle Pines also treats its water. Mixing the different water qualities may result in undesirable results. A study to determine the impacts of mixing the different water qualities should be undertaken to allow proper planning and protection of water quality.

Additional water treatment is not expected to be necessary unless specific wells or mixing creates water quality issues. Contamination is not expected to be an issue as there are no known groundwater contamination plumes in the area of this study. If contamination is discovered, wells should be placed strategically so as to avoid contamination and associated treatment costs. A larger system such as the Joint Utility allows for much easier placement of wells to avoid contamination should plumes be discovered that affect existing wells.

Another benefit of a joint utility is that if treatment is desired in the future, as often happens when water systems mature, then fewer, more cost effective treatment facilities could be planned to meet the treatment demand. This again would result in lower upfront costs and lower life cycle costs.

6.0 Water Storage

6.1 Storage Requirements

Water storage facilities serve several important functions including providing reserve to meet peak demands when well capacity is exceeded, maintaining constant pressure on the system, providing fire flow reserves, and reducing maintenance by preventing frequent pump stopping and starting. Storage facilities are also important during emergency scenarios such as fires, power outages and facility breakdowns.

Minimum water storage requirements are outlined in “Ten State Standards.” According to this document, “storage volume must be greater than or equal to the average daily consumption, and should include a reasonable fire-fighting reserve.” Storage volumes can be decreased if adequate backup generators would allow for wells to be pumped during a power outage. Future water system storage was planned to meet average day demand plus firefighting volumes outlined in Section 3.2 (assumption 10). Again, storage is a place where a joint utility offers efficiency. By combining communities, larger storage structures may become feasible. Larger storage structures are more cost effective from both a construction and operations standpoint. Furthermore, dependent on detailed hydraulic modeling, cities may not have to each individually maintain fire flow reserves which could reduce overall storage volume requirements.

6.2 Water Storage Facilities

Figure 6.1 and Table 6.1 depict existing storage volumes and deficits for individual cities and the joint system. The average day demand for the combined six-city region was about 3.5 million gallons over the most recent five years[2]. Combined, the cities would only need to maintain one volume of fire flow, rather than individual fire flow volumes for each city. Incorporating the required fire flow of 1.08 million gallons (the maximum fire flow volume required for the six cities), the minimum recommended storage volume for a Joint Utility (in 2013) is 4.6 million gallons. The available storage capacity of 5.0 million gallons is sufficient to provide the recommended storage volume for a 2013 joint system.

An immediate benefit of a Joint Utility is that construction of water storage facilities could possibly be delayed in favor of trunk watermain interconnections. Sizing of the interconnecting watermains would need to be carefully modeled to ensure that adequate fire flow could be conveyed from the storage facilities to the endpoints of the system.

[2] Based on DNR Annual Water Use Reports, and City records.

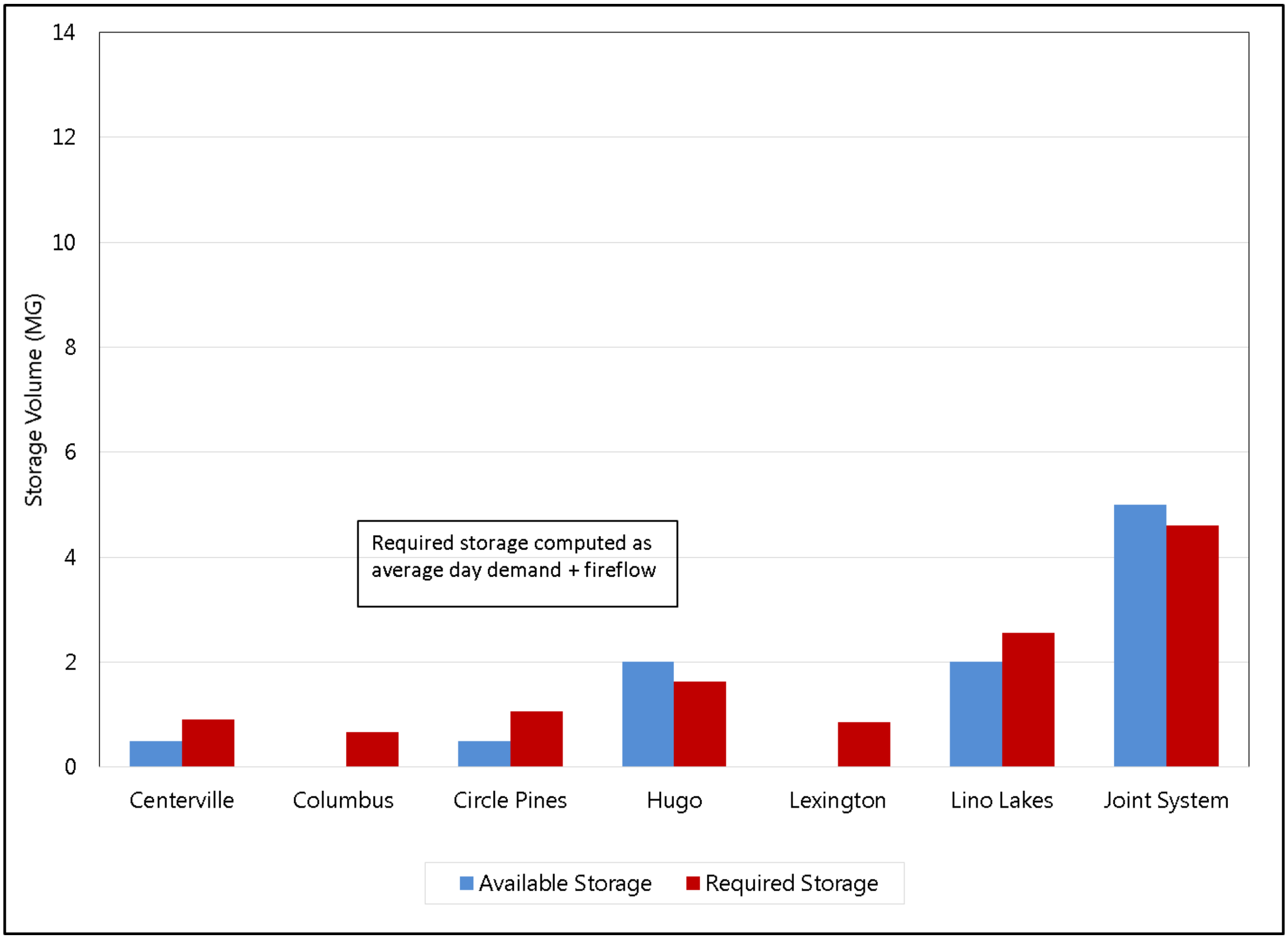


Figure 6.1 **Available and required storage volumes for 2013 systems**

Table 6.1 **Available and required storage capacity**

City	Storage Capacity (MG)	Required (MG)
Centerville	0.5	0.9
Columbus	0	0.7
Circle Pines	0.5	1.1
Hugo	2.0	1.6
Lexington	0	0.9
Lino Lakes	2.0	2.6
Joint System	5.0	4.6

Figure A7 in Appendix A shows the calculations used to estimate required storage capacities for a joint utility system through 2030. Siting of additional storage is not within the scope of this study. These estimates show that by 2030 the joint system would need an additional 3 million gallons of storage capacity. The existing and required storage for years 2013 and 2030 is shown in Figure 6.2 for both joint and individual development.

It should be noted that storage should not be planned without considering the impact of supply. Additional recommended storage could be eliminated with the addition of backup power generation at several of the existing wells. In some cases, backup power may be more economical than additional elevated storage.

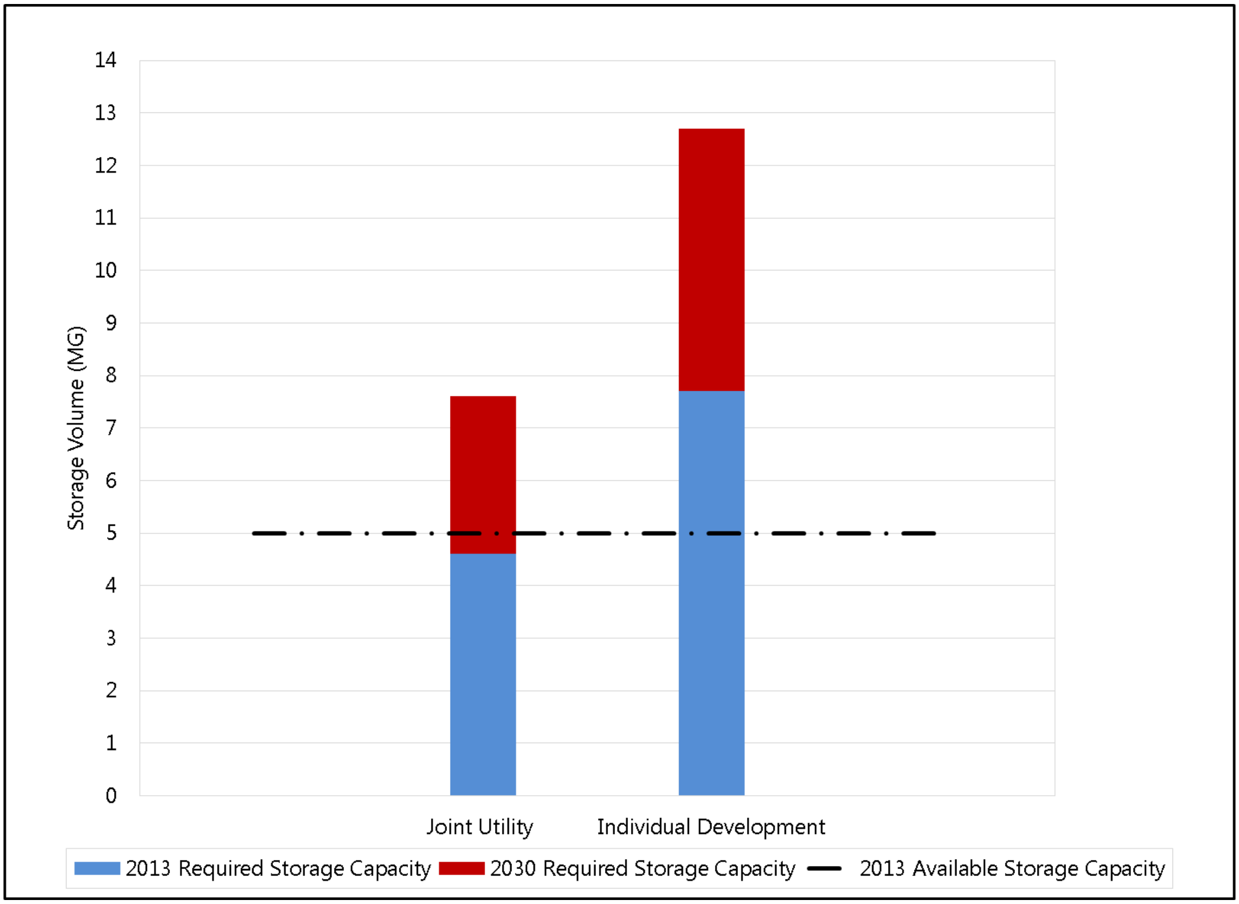


Figure 6.2 **Required storage capacity for joint and individual development**

7.0 Water Distribution System

This report analyzes the water distribution system layout based on approximate flows and a well-looped system, but does not include a hydraulic analysis of systems and pressure zones. The existing distribution systems were evaluated based on watermain size, percentage of unaccounted water, and operational capabilities.

7.1 Water System Interconnects

Individual city distribution systems should have multiple interconnections with other cities to provide backup supply water in case of an emergency. This is one of the main benefits of the joint utility. The joint system would have more interconnections and larger diameter connections. Joint system interconnections would be part of the trunk system interconnecting the member communities rather than the small diameter pipe connections at the perimeter of the systems that currently exist between some communities in the study area. This significantly strengthens the ability to transfer water between communities and enhances the community's resiliency in the face of catastrophic events where a portion of one community may be damaged by a tornado or other significant event that would otherwise limit its ability to produce, treat, store or distribute water to its constituents.

The size and location of the interconnections should be planned out in a future study using water distribution system computer modeling. If done correctly the modeling should allow for a net reduction in the length of large diameter main since approximately a quarter to half of the larger diameter outer loops would be eliminated in the growing communities through interconnections.

7.2 Watermain Size

Existing watermain size and layout is depicted in Figure A4. For the purposes of this report, it is assumed that existing watermain is able to provide adequate flow to meet current needs, and there are no significant hydraulic issues within the existing systems. Watermain will need to be upgraded to accommodate increased flow across municipal boundaries if cities are connected.

7.3 Watermain Layout

Watermain layout was analyzed geographically for its ability to distribute water throughout the six-city region and for its ability to provide looping. The piping network was not analyzed for its ability to provide required fire flows, however this analysis should also be included as part of future hydraulic modeling for detailed design.

Watermain recommended for the development of a joint utility is shown in Figure A6. Future watermain for individual development (according to cities' comprehensive plans) is shown in Figure A8. The location of some watermain intended for future development as shown in Figure A8 was changed in Figure A6 to provide connections between the cities. These location changes are merely to illustrate one possible layout for connecting the cities. Were a joint utility created, the location of future watermain would be optimized to best suit the cities' development needs. Cities should work together to identify the layout that works best for them.

There are several existing interconnections between the six cities. Additional large diameter interconnections between the existing water systems will be needed to provide better connectivity between all cities in the Joint Utility. The details of these interconnections play a large part in the costs associated with a Joint Utility. For this effort a simple high level approach was taken. This joint utility cost is estimated to be the same as individual 2030 trunk watermain costs, but the future watermain would be in slightly different locations or slightly larger in diameter.

Interconnections will be used to convey water from the existing sources and storage facilities in developed communities to those communities that are growing and need more water supply. The development of a detailed hydraulic model to plan strategically placed interconnections is recommended as a next step. In general, the cost of interconnecting the communities is considered to be at no additional cost to implement in the long run. All interconnections would be recommended in locations where existing watermains would have been placed anyway. The sizes would be increased in some cases but the benefits of interconnecting the systems would actually reduce other watermain sizes within each of the growing communities. In most cases watermain was already planned to be installed in the areas shown in Figure A6. However, some of the planned watermain would be installed as new trunk main interconnecting the communities.

For areas where dead-end watermain exists, additional watermain is recommended to be installed to loop the piping for improved circulation and water quality. A benefit of a joint utility is that dead end lines could be more easily looped with pipes in neighboring communities rather than looped back to another main in the same community. In some cases joining the pipes would be a few feet of additional watermain as opposed to hundreds needed to loop back to another main within the same community.

A key factor in analyzing a joint utility will be planning the future watermains so that there is no net increase in cost over the cities developing independently. If planned properly and early, there should be opportunity to actually reduce costs over independent development. Cost reductions could be realized through the elimination of dead end watermain by interconnections at city boundaries (rather than looping watermain within each city), as well as eliminating the need to provide perimeter trunk main (medium to large diameter watermain around the perimeter of a city) for each individual city. Interconnections would eliminate the need for each community to carry large diameter trunks along their municipal border parallel to similar large diameter main in the adjacent community. In other words, perimeter trunk main could be provided for the joint utility as a whole, thus reducing redundancies created by individual adjacent systems.

8.0 System Operations and Maintenance

Routine maintenance and infrastructure replacement is important for preventing system failures and lowering the cost of system repairs. Replacement costs are assumed to be 1% of capital costs per year for watermain, 2% per year for wells and storage and about 3% per year for SCADA systems.

Analysis of specific operational maintenance needs based on the age and condition of existing infrastructure is not within the scope of this study but is recommended as future work on this project. Operational and maintenance needs of the six cities could be combined to provide efficiency and costs savings. For example, the creation of a joint utility could eliminate the need for up to seven additional wells. Since each well requires roughly $150,000 of rehabilitation work every 7-10 years, this leads to a $1,000,000 reduction in maintenance costs over the same time span. This equates to about $100,000 per year of well maintenance savings for the remaining life of the Joint Utility. Similar maintenance savings would be seen for storage infrastructure. Combined fleets could also require fewer total vehicles. Shared emergency equipment could reduce the overall need in this area as well. Shared staff could also provide a reduction in cost. Finally, larger entities can pool their influence in bargaining for price on certain bulk purchases. A larger system would provide cushion against disruption when taking system components, such as wells or pumps, out of service. Operational and further maintenance considerations should be analyzed in greater detail in future work.

9.0 Evaluation of Development Options 1-3

9.1 Cost Estimates

Based on the analysis of the future individual and Joint Utility water system needs in the previous sections of this report, this section provides preliminary estimated costs associated with each development path as well as an evaluation of the options and recommendations for future work.

Three options for development of the future water supply systems were considered in this report.

Joint Utility Option 1:	Jointly constructed, owned and operated supply, storage and treatment system. Independently constructed, owned and operated distribution systems.
Joint Utility Option 2:	Jointly constructed, owned and operated supply, storage, treatment and distribution system.
Independent Utilities Option 3:	Make no changes. Operate as independent utilities.

A summary of the comparative capital costs and annual maintenance costs are provided in Table 9.1, through Table 9.3 for the three options considered in this report. Capital costs include, groundwater supply wells, water storage facilities, and control systems. Repair and replacement costs of infrastructure are estimated including storage tanks, wells, watermain and SCADA systems.

A preliminary estimate of capital improvement and replacement costs were detailed for each option. The same unit costs were applied to the different alternatives. Detailed cost estimates are provided in Appendix B and will be presented in the subsequent sections in greater detail. The decision as to the proportion each city would pay of the total cost to the Joint Utility has not been determined. However, at the start of the Joint Utility the growing communities would pay a negotiated price to access the existing assets now owned by the fully developed communities. A portion of the cost savings realized by the growing communities would be applied to installing needed interconnection piping or upsizing existing interconnections.

Once the initial opt-in costs for the growing communities are determined, capital costs for additional infrastructure or maintenance costs should be recovered from development fees or distributed across the joint utility members. The exact costs paid for existing and new infrastructure would be negotiated but would result in the growing communities purchasing access to the existing infrastructure at a discount over the price of a new installation thereby providing incentive to them to participate.

Since Lino Lakes Well 6 was not yet constructed at the beginning of this study, a future well is still included in the future costs to Lino Lakes and the joint utility, and this is not shown as existing infrastructure.

A key assumption is that developers would pay for all distribution related capital costs (new watermain and interconnections), so no distribution costs are included in the capital cost estimates (Table 9.1 and Table 9.2). A more detailed look at this item may result in some reconstruction of existing interconnections to up size them to meet conveyance needs. The costs of these types of upgrades would need to be borne by the benefiting community to a large extent but not entirely since an interconnection is valuable to all parties.

9.1.1 Capital Costs

As shown in Table 9.1 and Table 9.2 below, total capital costs are decreased by $12 million through the formation of a joint utility (Options 1 and 2) as compared to individual development (Option 3). The formation of a joint utility would reduce the need for 7 wells and 3 million gallons of storage. In addition to this the maintenance of the reduced infrastructure will be spread out over a larger population base. The total number of wells per person in a joint utility will be less than for individual cities. The total gallons of storage per person will also be less in a joint utility than for the individual cities. If the total benefit of the excess supply can be realized through the installation of back up generation at key wells, storage can be further reduced. If declining per capita use trends continue it is possible that zero new wells are needed at all through the remainder of the planning period.

Table 9.1 Summary of capital costs for Options 1 and 2 – Joint Utility development

	Storage	Supply	Contingency	Legal and Engineering	Combined Infrastructure Costs
Centerville	$0	$0	$0	$0	$0
Circle Pines	$0	$0	$0	$0	$0
Columbus	$0	$0	$0	$0	$0
Hugo	$0	$0	$0	$0	$0
Lexington	$0	$0	$0	$0	$0
Lino Lakes	$0	$0	$0	$0	$0
Joint Utility Cost	$6,900,000	$4,200,000	$3,300,000	$2,900,000	$17,400,000
Total	**$6,900,000**	**$4,200,000**	**$3,300,000**	**$2,900,000**	**$17,400,000**

Table 9.2 Summary of capital costs for Option 3 – individual city development

	Storage	Supply	Contingency	Legal and Engineering	Combined Infrastructure Costs
Centerville	$1,500,000	$800,000	$700,000	$600,000	$3,600,000
Circle Pines	$1,500,000	$200,000	$500,000	$400,000	$2,700,000
Columbus	$2,150,000	$200,000	$700,000	$600,000	$3,700,000
Hugo	$4,600,000	$3,300,000	$2,400,000	$2,100,000	$12,300,200
Lexington	$0	$200,000	$60,000	$50,000	$300,000
Lino Lakes	$2,080,000	$2,100,000	$1,200,100	$1,100,000	$6,500,000
Joint Utility Cost	$0	$0	$0	$0	$0
Total	**$11,800,000**	**$6,800,000**	**$5,600,000**	**$4,900,000**	**$29,000,000**

9.1.2 Repair and Replacement Costs

Repair and replacement costs, shown in Table 9.3, are divided based on ownership. Maintenance costs are likely to be lower for a joint utility compared to individual development since less infrastructure will need to be maintained and administrative costs can be combined.

Table 9.3 Summary of annual repair and replacement costs for Options 1, 2, and 3

	Option 1	Option 2	Option 3
Centerville	$300,000	$0	$500,000
Circle Pines	$300,000	$0	$500,000
Columbus	$200,000	$0	$300,000
Hugo	$1,600,000	$0	$2,200,000
Lexington	$200,000	$0	$200,000
Lino Lakes	$1,700,000	$0	$2,100,000
Joint Utility	$1,400,000	$5,700,000	$0
Total	**$5,700,000**	**$5,700,000**	**$5,800,000**

9.1.3 Anticipated Water Costs

Anticipated water costs are shown in Table 9.4. The average cost of 1,000 gallons (kgal) of water sold in the six-city region in 2010 was $2.07. The cost of water is expected to increase in both Individual Development and Joint Development scenarios as more infrastructure is needed to accommodate growth and maintenance costs. However, the increase in costs is less for joint development as less infrastructure is required per person served.

Table 9.4 Average cost of water per 1000 gallons sold

	Cost per thousand gallons
2010 (average)	$2.07
2030 Joint Development	$2.77
2030 Individual Development	$2.95

9.2 Analysis of Options 1, 2 and 3

9.2.1 Comparison of Capital Costs

9.2.1.1 Capital Costs for Option 1 – jointly owned supply, storage and treatment system

The cost estimates for Option 1 were developed using population projections and historical water use data. Using this data, the trigger charts in Figures A5 and A7 were created. The trigger charts were used to estimate when additional wells and storage would be needed. Future watermain was adapted from cities' comprehensive plans and additional watermain was added to connect all of the cities and provide looping to improve circulation where it was needed. The joint system would need specific locations of trunk watermain installed to facilitate interconnections and combine the separate distribution systems. This cost is estimated to be the same or less than individual 2030 trunk watermain costs, but the future watermain would be in slightly different locations or slightly larger in diameter. Some of the future watermain locations from the cities' comprehensive plans were changed in order to accommodate connections between the cities.

Initial construction of key interconnections would be needed as soon as a growing community needed access to an existing fully developed community's existing asset. The timing of the construction of the interconnections would need to be planned based on projected supply and storage need. Maintenance of the new interconnection would remain the responsibility of the community in which the interconnection exists.

If an existing interconnection must be upsized to facilitate appropriate conveyance then a portion of the costs of the interconnection would be borne by the community in which the interconnection exists based on depreciated value of the existing watermain being upsized for the interconnection and the road above it if applicable. Beyond this, additional watermain and interconnections would be added as communities naturally developed. In some cases, when a specific interconnection is needed the Joint Utility could work with the member communities and their planners to create appropriate incentives for a given area where an interconnection is needed to develop first so that the needs of the Joint Utility as a whole could be met.

9.2.1.2 Capital Costs for Option 2 – jointly owned supply, storage, treatment and distribution system

The quantity and timeline of future infrastructure was estimated as described for Option 1. The only difference between Option 1 and Option 2 is ownership of the distribution system and sharing of all repair and replacement costs. Developers would provide the funds for additional watermain as the cities develop, but once the watermain is installed the Joint Utility, rather than the individual cities would retain ownership and associated costs of the distribution system.

As in Option 1, initial construction of key interconnections would be needed as soon as a community needed access to another community's existing asset. The timing of the construction of the interconnections would need to be planned based on projected supply and storage need. In this case the costs of these interconnections would be shared by the Joint Utility as a whole rather than being split between the community needing access to the existing asset and the community in which the interconnection exists. Maintenance of the new interconnection would then be the responsibility of the Joint Utility.

Beyond this, additional watermain and interconnections would again be added as communities naturally developed. As in Option 1, when a specific interconnection is needed the Joint Utility could work with the member communities and their planners to create appropriate incentives for a given area where an interconnection is needed to develop first so that the needs of the Joint Utility as a whole could be met.

9.2.1.3 Capital Costs for Option 3 – individual development

Costs for Option 3 were primarily developed using city comprehensive plans. Since these plans are slightly outdated, trigger charts were created using the most recent population projections and water use data. Where cities' capital improvement plans differed significantly from the trigger charts created for this study, engineering judgment was used to determine which scenario was most likely to represent future needs.

In its current arrangement, the formation of a joint utility would reduce the cities' capital investment in new infrastructure by about 40%. The joint utility system is estimated to cost $12 million (41%) less than individual development. Lengthy interconnections and the associated costs could be reduced by removing the City of Columbus from the joint system as it is not geographically close enough to make its inclusion economical. There are existing interconnections between most of the other cities considered in this study which may make a joint system financially feasible though some would need to be upsized. Reducing the length of interconnections by removing the City of Columbus from the joint utility is likely to reduce the annual repair and replacement costs for a joint utility under Option 2 and for Columbus itself under Option 1.

The main difference between Options 1 and 2 is the distribution of repair and replacement costs for watermain. This difference may be insignificant if maintenance costs are distributed according to city population. However, fully developed communities with aging watermain will have disproportionately higher maintenance costs in the near term under Option 1 than the newer cities with larger populations and newer systems. Under Option 2 the growing communities would end up subsidizing watermain repair and replacement costs for the older cities with smaller populations if costs are distributed by population. This is an incentive for older cities with little forecasted development to join the joint utility, and ultimately leads to mutual benefit for all cities involved—growing communities benefit by obtaining access to the older cities' supply and storage as they continue to develop. In return, they purchase access to those assets and help to fund the repair and replacement of aging infrastructure in the smaller cities. This mutual benefit would be reduced if distribution infrastructure is not jointly owned as in Option 1. For this reason, Option 2, joint ownership of the entire water system, is likely to be more equitable for all cities involved than Option 1.

9.3 Benefits of a Joint Utility (Option 1 and 2)

9.3.1 Future Watermain Efficiencies

For the distribution system, the joint system would need specific locations of large watermain installed to facilitate interconnections and combine the separate distribution systems that now exist. It is assumed that the majority of this cost would be fully paid for by developers per current policies of the growing cities. Some larger diameter connecting watermains needed to access existing infrastructure in fully developed communities may be shared trunk main costs that cannot be fully billed to developers but should still allow for real savings. Creation of a joint utility is not expected to provide a cost savings in large trunk watermain, but the total amount of large diameter looped watermain installed within each community should be reduced to some extent. The reason for this is that each community would typically have a large diameter main looped around its perimeter to ensure adequate fire protection to the fringes of the community. Two communities bordering each other would each have larger diameter mains running roughly parallel to each other in relatively close proximity. If the communities are joined together, only a single main would be needed to accomplish the same level of fire protection. The large diameter main would continue across community borders rather than turning to follow a border thus reducing the need for parallel mains. Furthermore, when looking at member cities, the amount of required additional watermain could be reduced if the City of Columbus is not included in the joint utility or if the communities were realigned based on proximity and existing interconnections to other large communities such as the City of Blaine.

9.3.2 Supply and Storage Savings

Additional advantages of a joint system include the ability to share water supply and storage under Options 1 and 2. As each city is currently required to provide firm well capacity to meet peak demand, a joint system would eliminate the need for up to seven (7) future wells and generators. Furthermore, wells could be sited in areas with greater productivity, to target certain aquifer capture zones, or areas with less connectivity to surface contamination.

For example, Hugo is anticipated to need 5 additional wells before 2030 due to expected development. Figures A9 and A10 depict the bedrock geology and location of impermeable clay layers. In Figure A10 it can be seen that although Hugo has relatively productive wells, the clay layer is spotty within Hugo's boundaries. It may be beneficial to site additional wells in Lino Lakes rather than Hugo due to better coverage by an impermeable layer.

The costs associated with additional wells and storage would be reduced as part of a joint system. It is estimated that the cities would save about $12 million through the sharing of storage and wells. Seven (7) wells and three (3) million gallons of additional storage would not be needed as a result of the development of a joint system.

9.3.3 Optimized Water Supply Siting

In terms of groundwater supply, Figure A9 shows that groundwater well productivity is not observed to vary significantly across the region. However, as Figure A9 also shows, different groundwater aquifers are available in different geographic regions of the study area. There will be benefits in terms of well siting in order to increase or decrease the use of certain aquifers to create a more sustainable groundwater supply, or to manage the impact that withdrawal from a given aquifer may have on surface water features of high value. Given the large geographic area of the hypothetical Joint Utility there would be many opportunities to site wells in a way to better manage impacts while also providing opportunities for enhanced recharge or aquifer storage and recovery systems.

For example, the existence of a relatively continuous clay layer in the geographic region generally west of Highway 35E, and the absence of a clay layer east of Highway 35E, as shown in Figure A10, suggests that groundwater wells west of Highway 35E are more protected. Groundwater wells needed for future development east of the highway could be placed in the western areas to reduce potential impact to surface waters.

Conversely, areas east of Highway 35E offer greater opportunities to directly enhance recharge into the aquifers west of Highway 35E from which the withdrawals are occurring. While infiltration of clean runoff in a planned way is good, doing so in areas where infiltration can directly improve the drinking water source aquifer is even better. Infiltration in the areas west of Highway 35E is still beneficial but it largely benefits the water table aquifer rather than the drinking water aquifer. While some will slowly infiltrate through the clay layer and into the underlying drinking water aquifers, much will move laterally to a groundwater fed stream and ultimately exit the local system. Infiltration in areas east of Highway 35E where the clay layer is generally absent will have a more pronounced and immediate impact upon the actual source water aquifers. Existing surface water runoff that currently leaves the region through ditching and piping networks may be better managed to infiltrate into the source water aquifers in the areas east of Highway 35E.

9.3.4 Operations and Maintenance

Although not within the scope of this study additional benefits of a joint system could be realized through labor and maintenance sharing. Administrative staff could be shared in a way to reduce total cost of running a joint utility as compared to running each one independently. Shared accounting and professional services can result in reduced costs as well. Maintenance staffs are often governed by the need to plow streets so to truly leverage a joint utility there may also need to be cooperation in other areas of municipal maintenance including things like plowing. Staff reduction does not have to occur when a Joint Utility is formed if this is not politically acceptable. Rather, the optimum staff can be achieved through attrition and not replacing staff who retire or leave for other opportunities. A more detailed look into this aspect of the benefits of a Joint Utility is warranted in a future study if the communities elect to continue to pursue this course of action.

9.4 Benefits of Individual Development (Option 3)

The main deterrent to a Joint Utility are the upfront costs it will take to plan and implement the combined system. Though not easily captured in terms of cost, the political issues associated with forming a Joint Utility also need to be considered. Communities will need to agree to create incentive for each other to make a joint utility work. This will mean negotiating the purchase price related to sharing existing infrastructure, equipment, and staff and finding a way to equitably share maintenance costs. While these prices and costs can all be “determined” using financial and engineering tools and analysis, in the end they will likely be a result of negotiations. This will mean sitting down and agreeing how much some of the communities will pay to the others for the rights to access their assets. If the communities want to make this happen and are looking for a way to create mutual benefit this may be relatively easy. Obviously there can be places where these types of negotiations can be more difficult. In most cases this is a single time up front issue. Once the communities have agreed to join and the prices are negotiated then ongoing operations are usually less challenging. A summary of the costs and benefits to each city under the three development options is shown in Table 9.5 below.

9.5 Summary of Costs and Benefits to each City

Table 9.5 Summary of costs and benefits for Options 1, 2, and 3

City	Benefit to combining	Cost to combining
Centerville	• Gain firm well capacity • Meet recommended water storage volumes • Gain an interconnect • Shares cost of rehabilitation of aging infrastructure	• Share capital costs of new development
Circle Pines	• Meet recommended water storage volumes • Share costs of watermain replacement • Shares cost of rehabilitation of aging infrastructure	• Share capital costs of new development
Hugo	• Lower cost to meet future supply and storage needs • Share costs of new trunk watermain • Shares costs of new infrastructure	• Share replacement costs for older systems
Lexington	• Gain firm well capacity • Meet recommended water storage volumes • Improved water quality • Shares cost of rehabilitation of aging infrastructure	• Share capital costs of new development
Lino Lakes	• Lower cost to meet future supply and storage needs. • Gain firm well capacity • Meet recommended water storage volumes • Share costs of new trunk watermain • Shares costs of new infrastructure	• Share replacement costs for older systems
All cities	• Optimized well siting • Improved water circulation in the distribution system • Decreased new water storage and number of wells • Increased backup supply and interconnections • Some small cost savings • More resilient system	• Development may need to be moved to areas which are more convenient to serve as part of a joint system • Operational and logistical challenges to combining systems

10.0 Recommendations

This study suggests that a joint system would provide benefits to each of the member communities, but that more information is needed before making a decision on forming a joint utility.

The recommendations of this study are as follows:

- **Continue to investigate forming a Joint Utility under Option 2**

  According to the analysis performed in this study, the formation of a joint utility appears to be mutually beneficial to all cities involved so long as the Joint Utility is constructed alongside the cities' natural development. Option 2, joint ownership of the entire system is recommended as the best ownership structure as it is more equitable for all cities involved, providing more benefit to the older, smaller cities than Option 1.

- **Plan for joint development now before the opportunity is lost as each city builds out more infrastructure that might not be needed in a Joint Utility setting**

  A preliminary timeline for the formation of a joint utility is shown in Appendix C as well as a timeline for individual development for comparison. At the conception of the Joint Utility, Hugo, Lino Lakes and Centerville would initiate interconnections and begin sharing resources until there is a need for more supply and storage. It is expected that within the next five years, the Joint Utility would add 2 wells and 2 million gallons of storage and initiate an interconnection with Circle Pines. As the cities continue to develop, they share infrastructure until capacity is reached and ultimately add an interconnection with Lexington. By 2030 it is expected that five cities (Hugo, Centerville, Circle Pines, Lino Lakes and Lexington) would share interconnections and the joint utility would have added a total of four wells and 2.5 million gallons of storage, saving roughly $11 million compared to individual development. Note that the timeline for development is merely a suggestion based on the population information available. Projections should be revised based on the most up-to-date population and development projections as they become available.

- **Investigate which cities should be in the Joint Utility, and consider removing Columbus due to geographic reasons**

  Due to its geographical separation from the other cities, Columbus should not be incorporated as part of the joint utility in the near future. Columbus does not have any existing interconnects with other cities and connecting it would require significant investment in new watermain along I-35 that would render the joint utility financially infeasible until development naturally occurs in this area. As development does occur along I-35 from Lino Lakes to Columbus, Columbus could be integrated into the joint utility. Removing Columbus from the joint utility for the foreseeable future requires the addition of two more wells and increases the total supply capital cost. However, storage needs are reduced so the total capital cost is roughly the same, albeit shared by fewer cities. The revised cost estimate without Columbus is shown in Table 10.1 below. Compare this to Table 9.1 and Table 9.2 in the previous section.

Table 10.1 Revised cost estimate WITHOUT the City of Columbus

	Storage	Supply	Contingency	Legal and Engineering	Combined Infrastructure Costs
Centerville	$0	$0	$0	$0	$0
Circle Pines	$0	$0	$0	$0	$0
Hugo	$0	$0	$0	$0	$0
Lexington	$0	$0	$0	$0	$0
Lino Lakes	$0	$0	$0	$0	$0
Joint Utility Cost without Columbus	$6,100,000	$5,476,000	$3,472,800	$3,009,760	$18,058,560
Total	**$6,100,000**	**$5,476,000**	**$3,472,800**	**$3,009,760**	**$18,000,000**

- **Negotiate initial buy-in for asset and capital sharing between cities**

  The final financial terms of a Joint Utility are open for negotiation. But assuming that all parties are interested in making it happen the benefits are straight forward. The fully developed communities have existing assets (wells and water towers) that are needed by the growing communities. The growing communities can either build them new on their own or purchase use of the existing assets from the fully developed communities as part of the formation of the Joint Utility. In this transaction, the assets would be valued at some fraction of the cost it would take to build them new. The "purchase price" paid by the Joint Utility to the fully developed communities would be based on remaining useful life and acknowledge the fact that the existing fully developed community still needs and uses the asset.

  In this way the growing communities get to access supply and storage at a fraction of the cost of buying new and the fully developed communities get an influx of capitol to either pay off bonds or use as they see fit. Once joined as a utility the costs of maintenance would be shared by a larger group. In addition to this fewer total items would need to be maintained.

- **Refine cost estimates based on new comprehensive planning, other studies**

  The formation of a joint utility appears to be beneficial as long as the cost of new trunk watermain does not outweigh the benefits to one municipality over another. As the costs reported in this study are considered high-level preliminary estimates, they should only be used for comparison purposes. Future work should include a more in-depth cost analysis using future 2018 Comprehensive Plans and other studies.

10.1 Future Studies

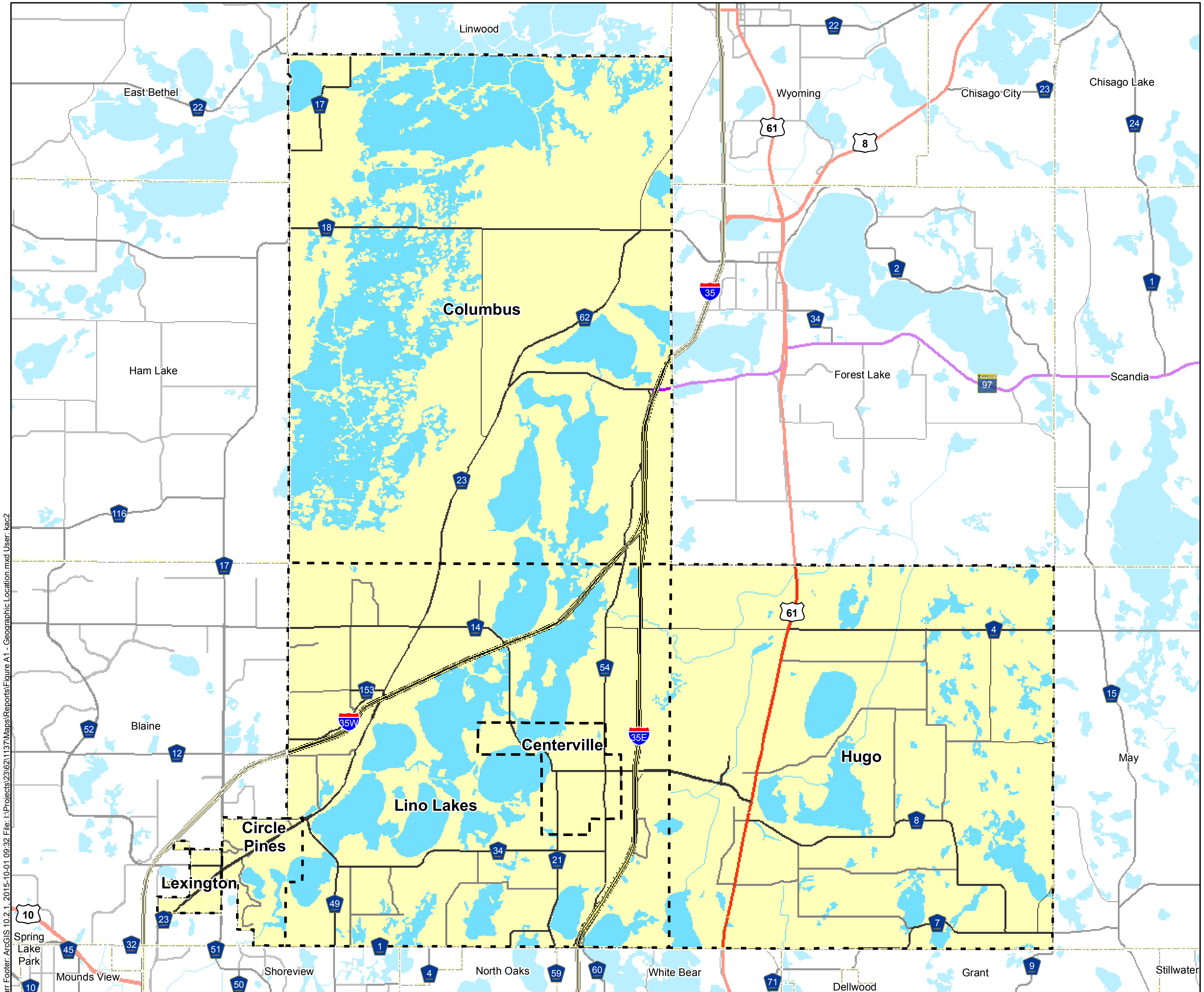
As this study included only a high-level preliminary analysis, several subsequent studies are recommended to move the project forward, as shown below in Table 10.2. Each recommended future study should use revised 2018 City Comprehensive Plans through 2040 that use the new population projections. Studies are shown in the order in which they should occur. The first two studies shown address if the water systems should be joined at all and if so which ones should actually be combined. The remaining studies provide guidance related to better defining the details of how city water systems would join together.

Table 10.2 Future studies

	Study Topics	Reason	Priority
Study 1 **Water Quality Analysis** **Specific objective: What is the correct combination of cities for a joint utility**	Water quality analysis to define the impacts of mixing filtered water from Circle Pines with unfiltered water from other communities.	This may be a deal breaker if mixing waters of differing qualities results in unacceptable impacts.	High
	Consider alternate alignment to capture proximity and existing relationships such as a group including Blaine, Circle Pines and Lexington. Consider if Columbus should be included at all. If so when.	This grouping includes communities that receive filtered water. It reduces the likelihood of unacceptable impacts resulting from mixing dissimilar water. It also leverages cities that already share water regularly (Blaine and Lexington).	High
Study 2 **Facility Plan** **Specific Objective: Define the remaining technical constraints guiding a Joint Utility**	Distribution system model of all communities to be joined together.	Create a tool needed to perform the study.	Medium
	Storage facility siting	Use of existing storage to benefit growing communities is a key benefit to joining the utilities together. Modeling is needed to make sure the existing facilities can be connected in a way to benefit the growing communities and that the minimum amount of future storage is added to reduce costs.	Medium
	Interconnection main sizing	This study should be done in conjunction with distribution modeling and storage siting since they all affect each other. Storage siting and utilization are both affected by the size of the interconnecting watermain.	Medium
	Pressure zone analysis	This study is needed to determine if pressure reducing valves or pump stations are needed to facilitate interconnecting the communities.	Low
	Well Siting	Use of existing wells to benefit growing communities is another key benefit to a joint utility. This study would ensure that the supply is available to meet needs while not impacting surface water features of value.	Medium

	Study Topics	**Reason**	**Priority**
Study 3 Financial and Governance Plan Specific Objective: Define the financial and governance parameters needed to create a Joint Utility	Infrastructure cost basis valuation	Determine the value of existing infrastructure. This will provide a starting point for the purchase price that would be paid by growing cities to developed cities.	Medium
	Analyze operational and staffing costs	This study is needed to help define staff needed to operate and maintain a joint utility. This would be needed in final rate determinations.	Medium
	Rate Analysis	Using different financing tools and payback periods analyze the resulting impacts to rates.	High
	Governance	Determine community representation and governance of the utility.	Medium

Appendix A: Figures



Joint Feasibility Study Cities

Municipal Boundary (Other Cities)

Lakes

Streams

Miles

0 1.5 3

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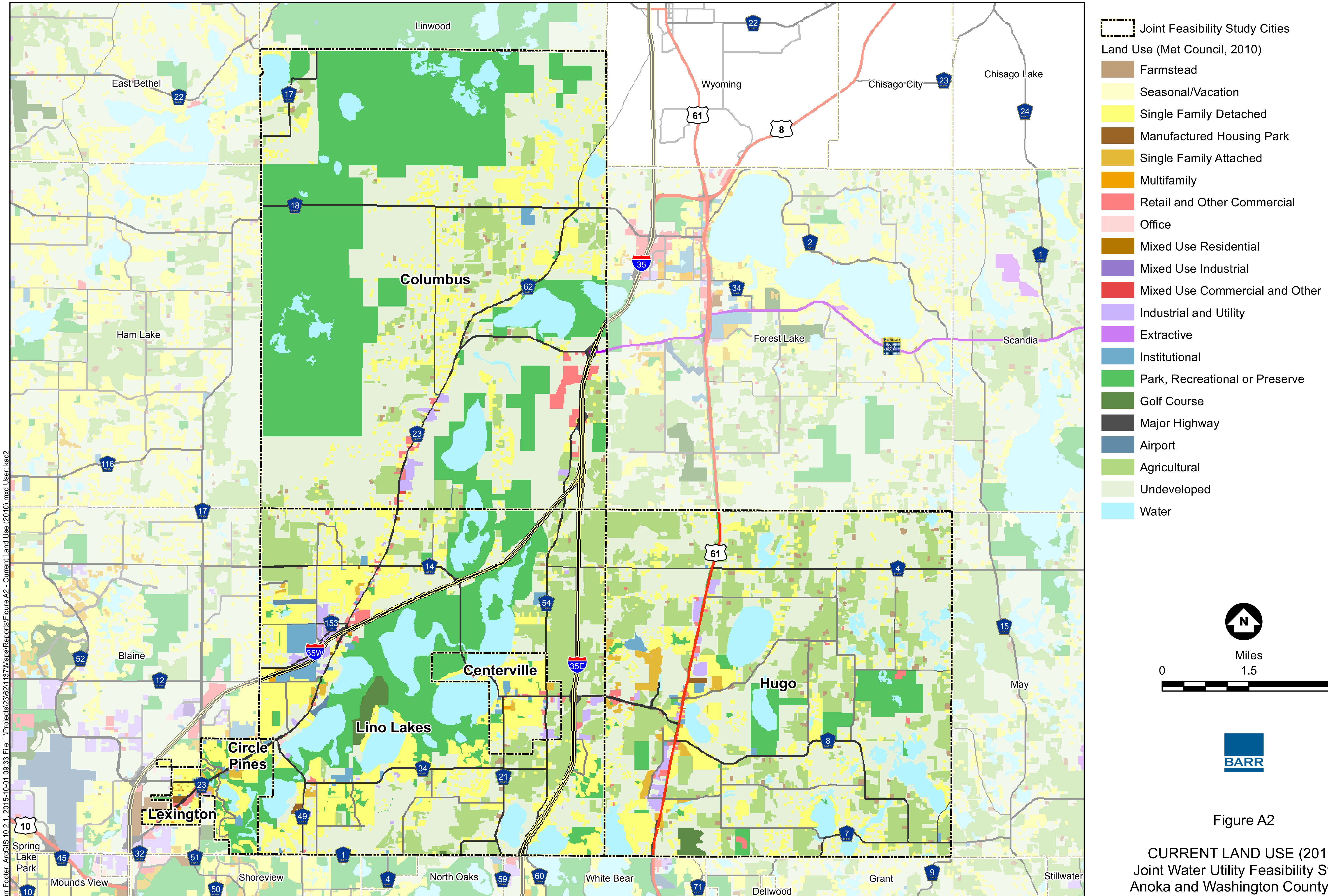
Figure A1

GEOGRAPHIC LOCATION

Joint Water Utility Feasibility Study

Anoka and Washington County, MN



Barr Footer: ArcGIS 10.2.1, 2015-10-01 09:33 File: I:\Projects\23\62\1137\Maps\Reports\Figure A2 - Current Land Use (2010).mxd User: kac2

Figure A2

CURRENT LAND USE (2010)
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

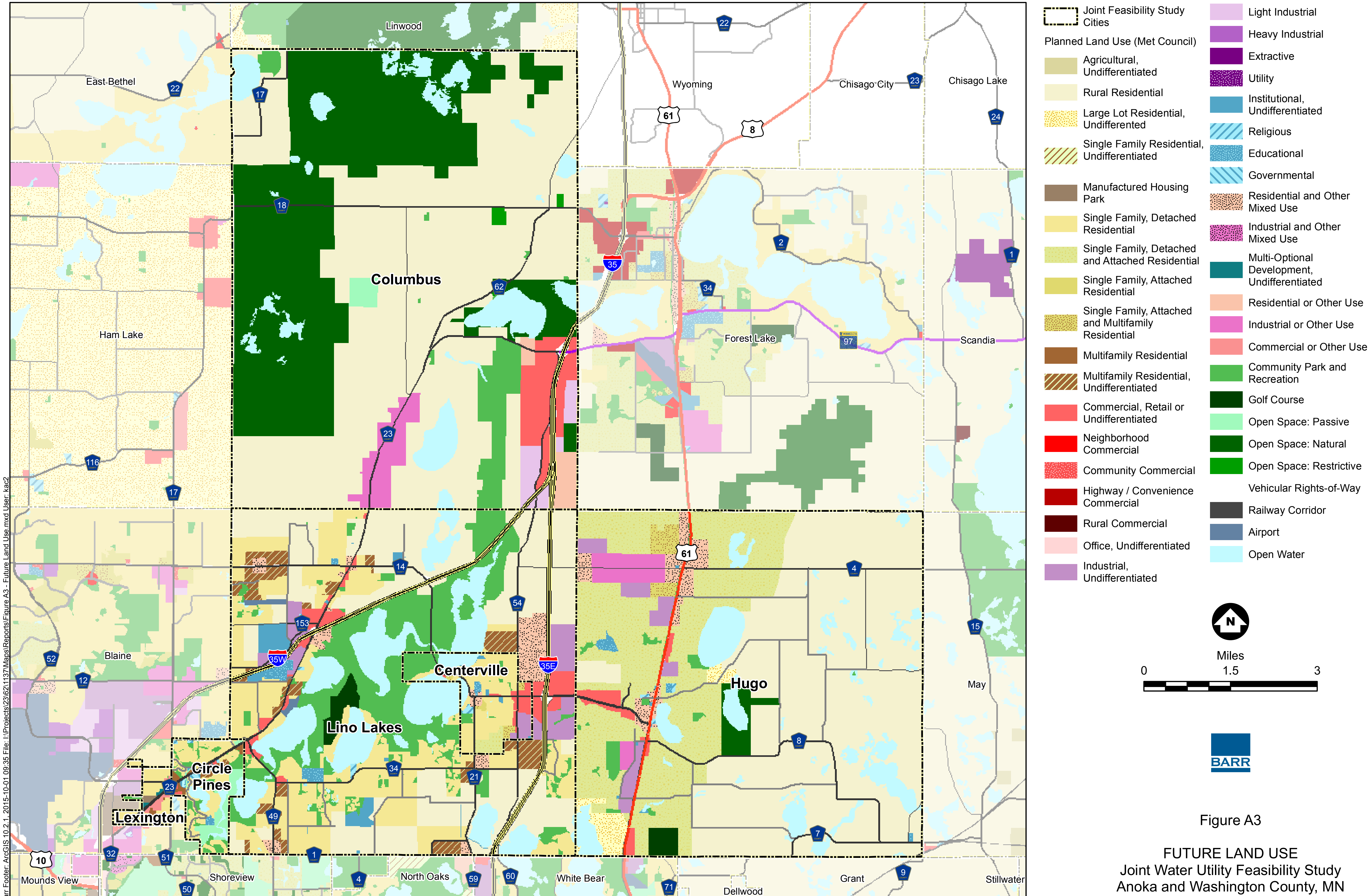


Figure A3

FUTURE LAND USE
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

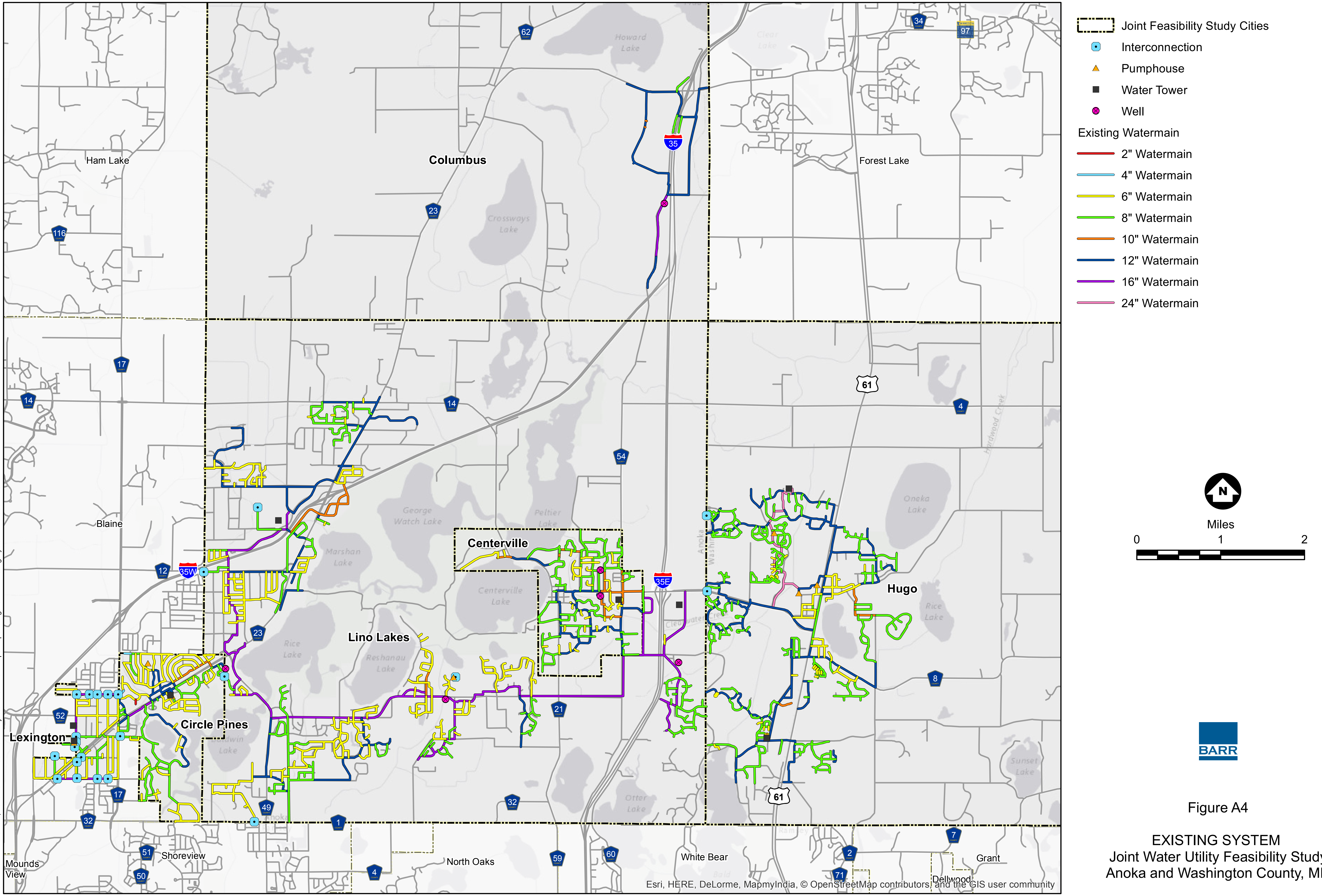


Figure A4

EXISTING SYSTEM
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

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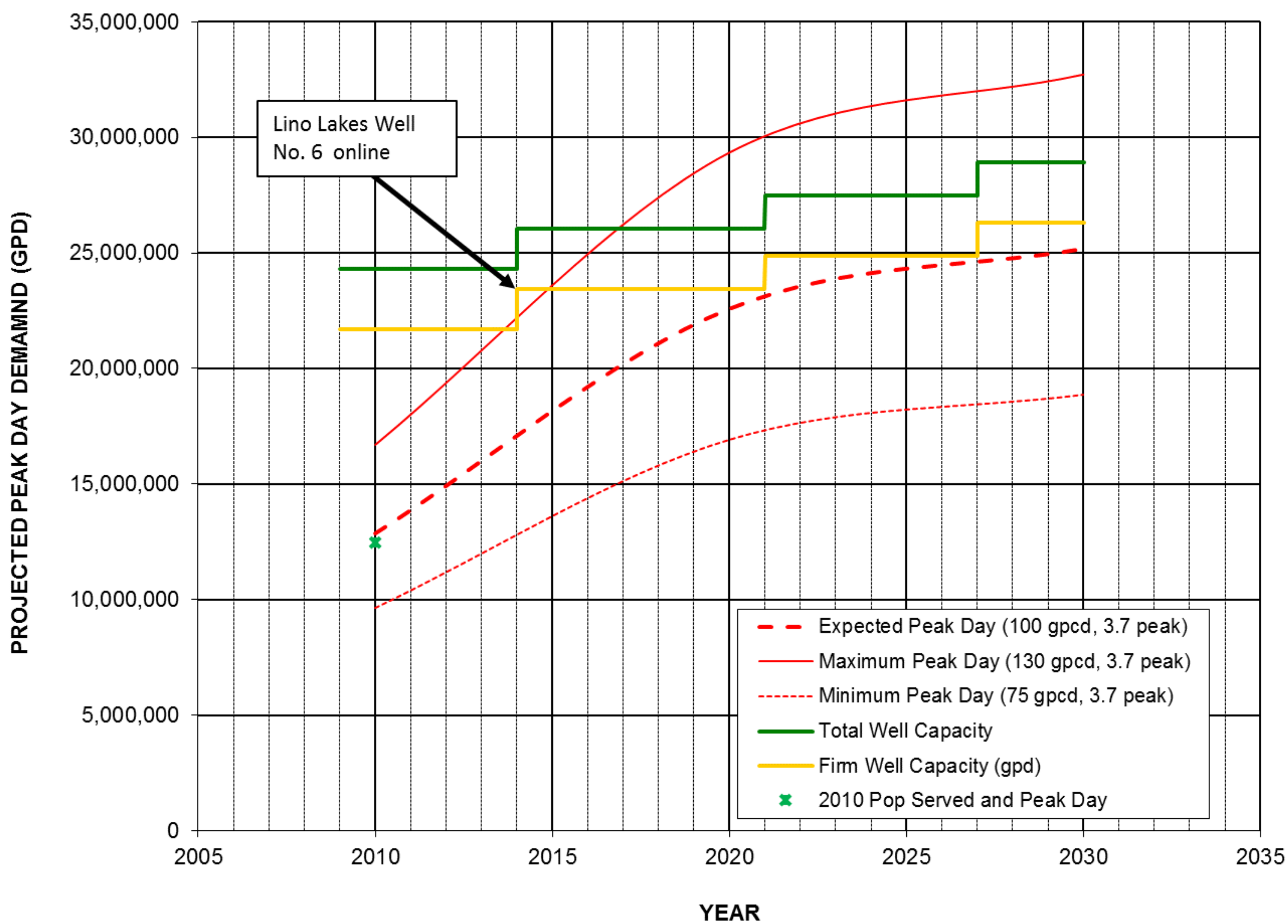
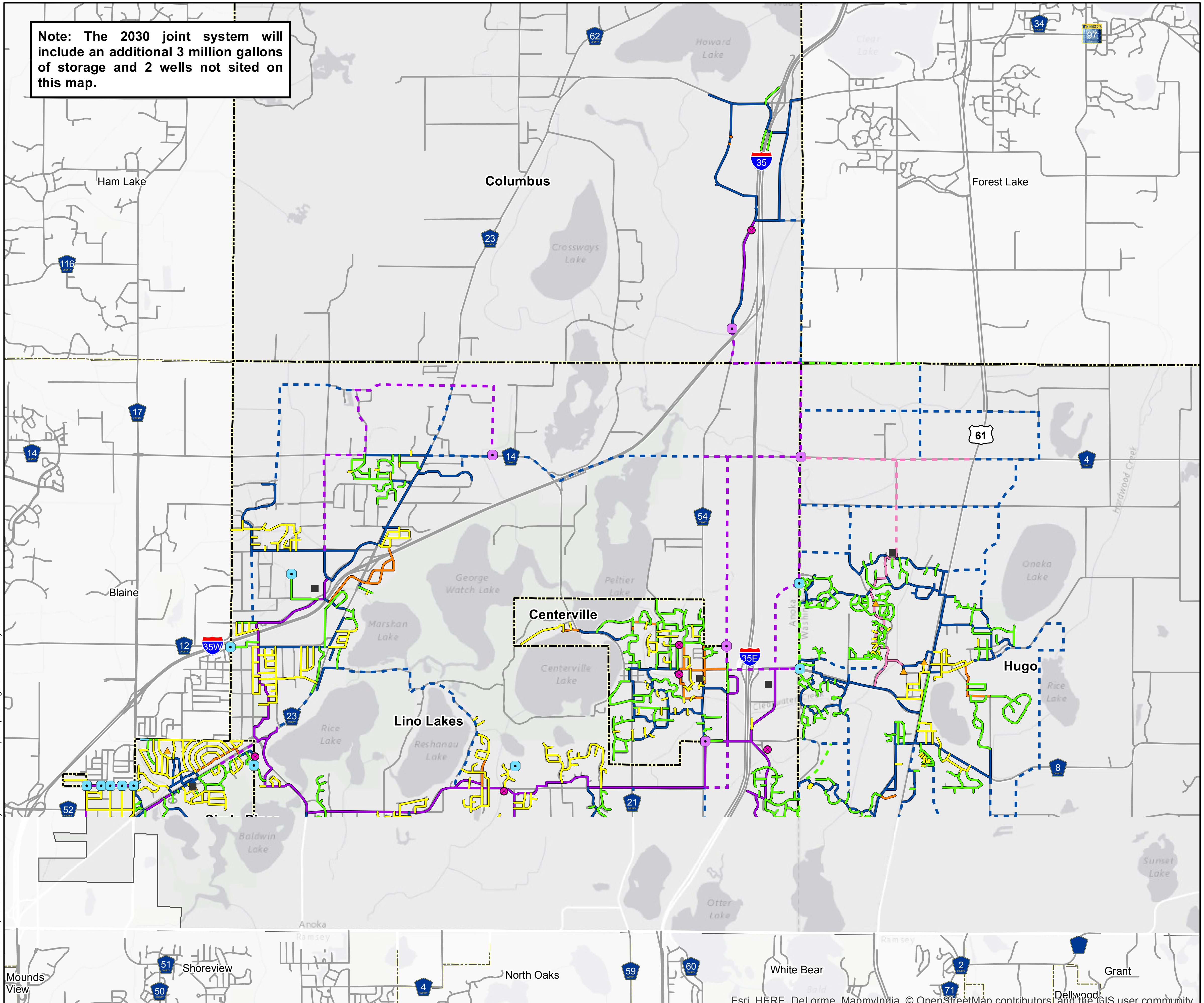
Barr Footer: ArcGIS 10.3, 2015-10-01 12:00 File: I:\Projects\23\62\1137\Maps\Reports\Figure A4 - Existing System.mxd User: kac2

Figure A5
TRIGGER CHART
WELL CAPACITY BY YEAR
Ten State Standards 3.2.1.1: Firm well capacity should equal Maximum Day Demand





- Existing Interconnection
- Proposed Interconnection
- Pumphouse
- Water Tower
- Well

Proposed Future Watermain

- 8" Watermain
- 12" Watermain
- 16" Watermain
- 24" Watermain

Existing Watermain

- 4" Watermain
- 6" Watermain
- 8" Watermain
- 10" Watermain
- 12" Watermain
- 16" Watermain
- 24" Watermain
- Joint Feasibility Study Cities

N

Miles

0 1 2

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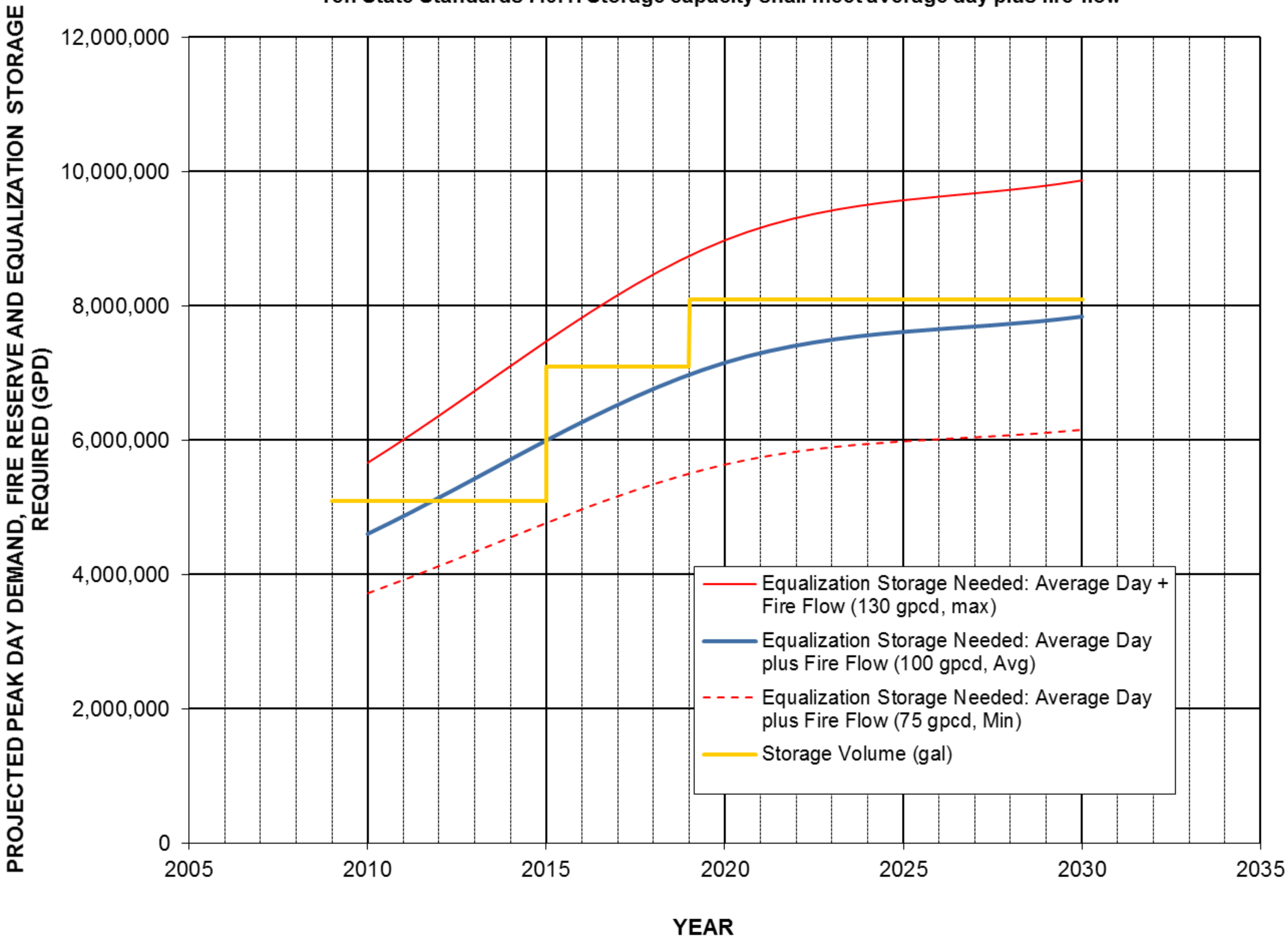
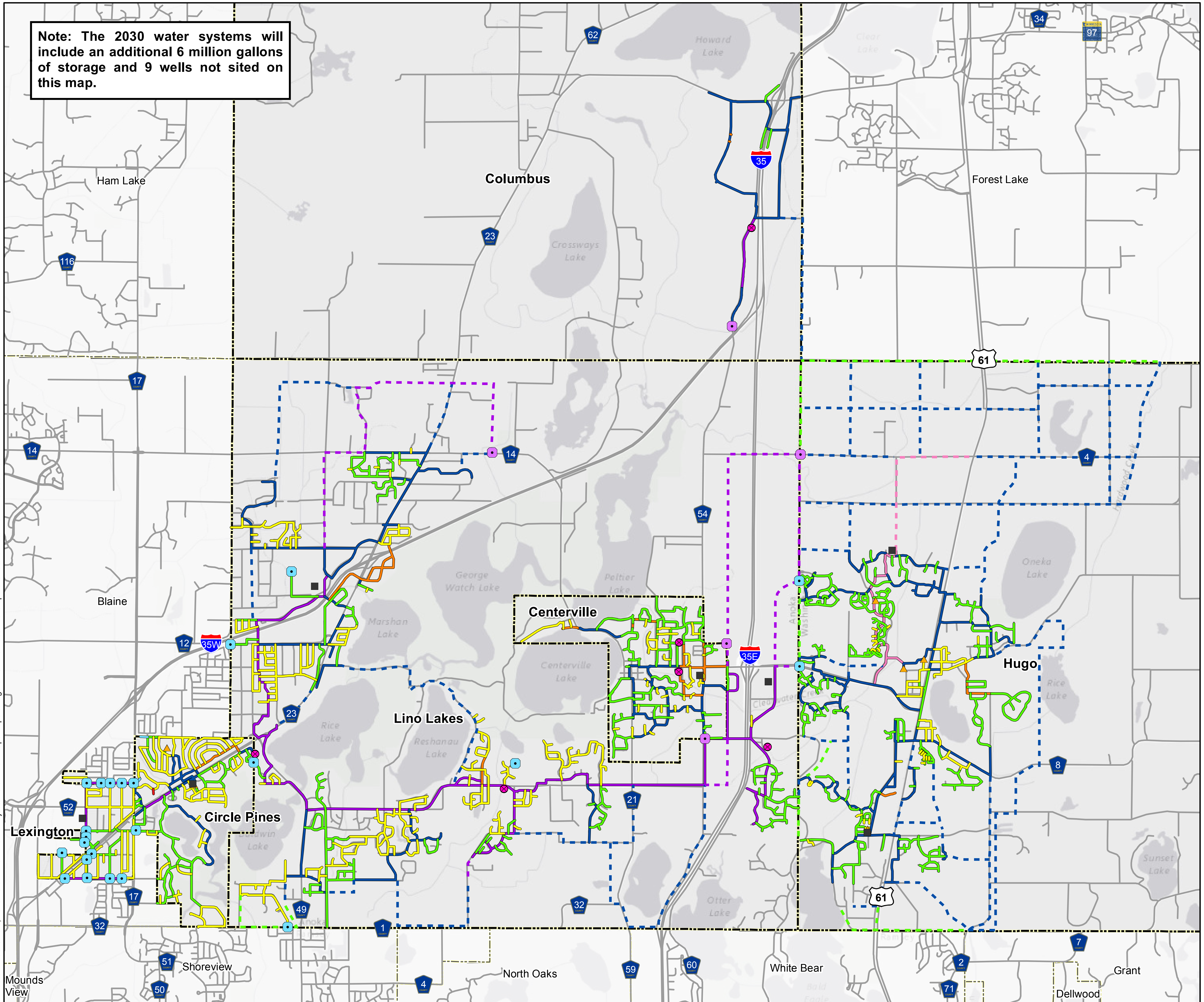
Figure A6

JOINT SYSTEM
2030 WATERMAIN
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

Figure A7
TRIGGER CHART
STORAGE CAPACITY BY YEAR
6/23/2014
Ten State Standards 7.0.1: Storage capacity shall meet average day plus fire flow





Existing Interconnection
Proposed Interconnection
Pumphouse
Water Tower
Well

Proposed Future Watermain
- 8" Watermain
- 12" Watermain
- 16" Watermain
- 24" Watermain

Existing Watermain
- 2" Watermain
- 4" Watermain
- 6" Watermain
- 8" Watermain
- 10" Watermain
- 12" Watermain
- 16" Watermain
- 24" Watermain

Joint Feasibility Study Cities

N

Miles
0 1 2

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Figure A8

INDIVIDUAL DEVELOPMENT
FUTURE WATERMAIN
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

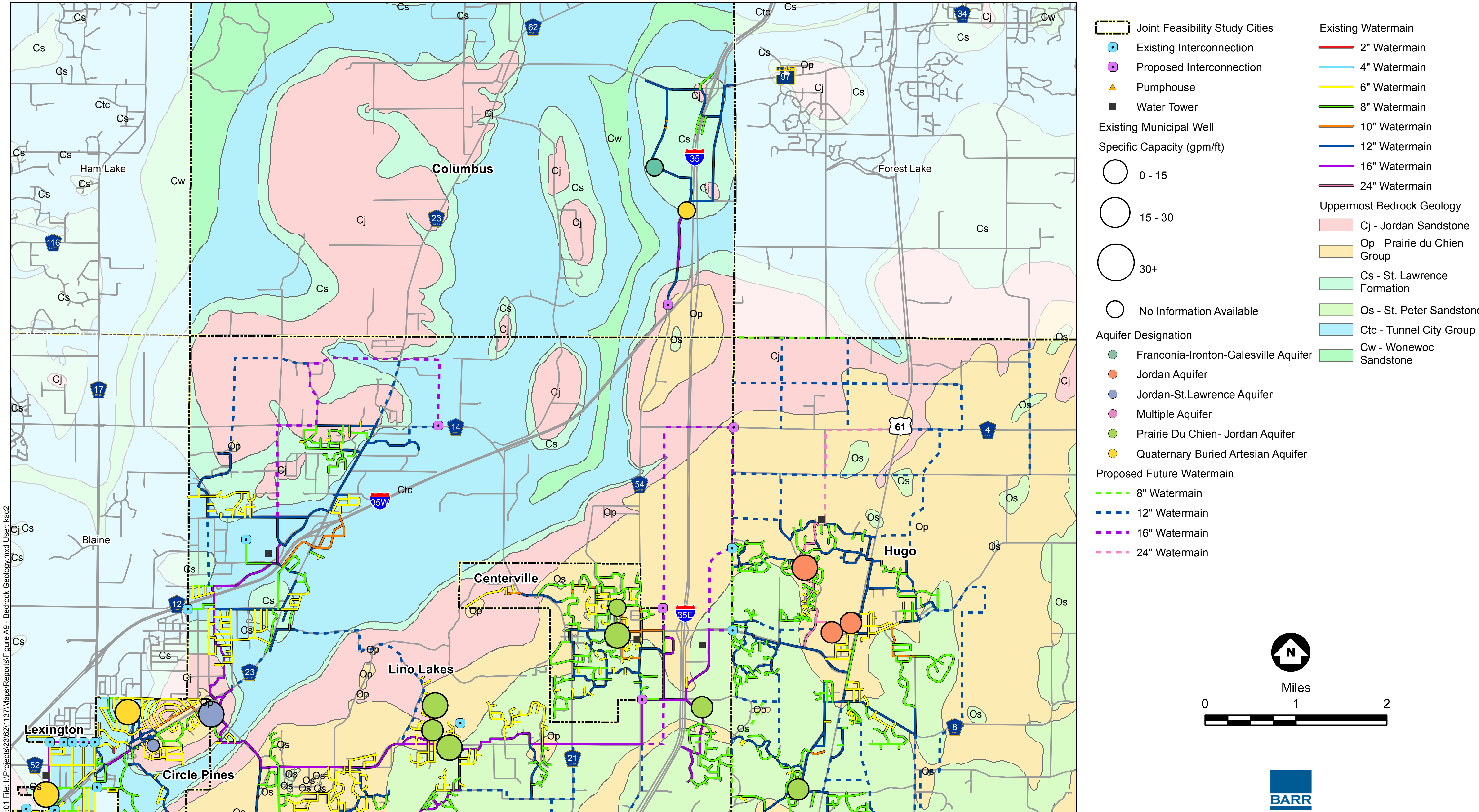


Figure A9

BEDROCK GEOLOGY
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

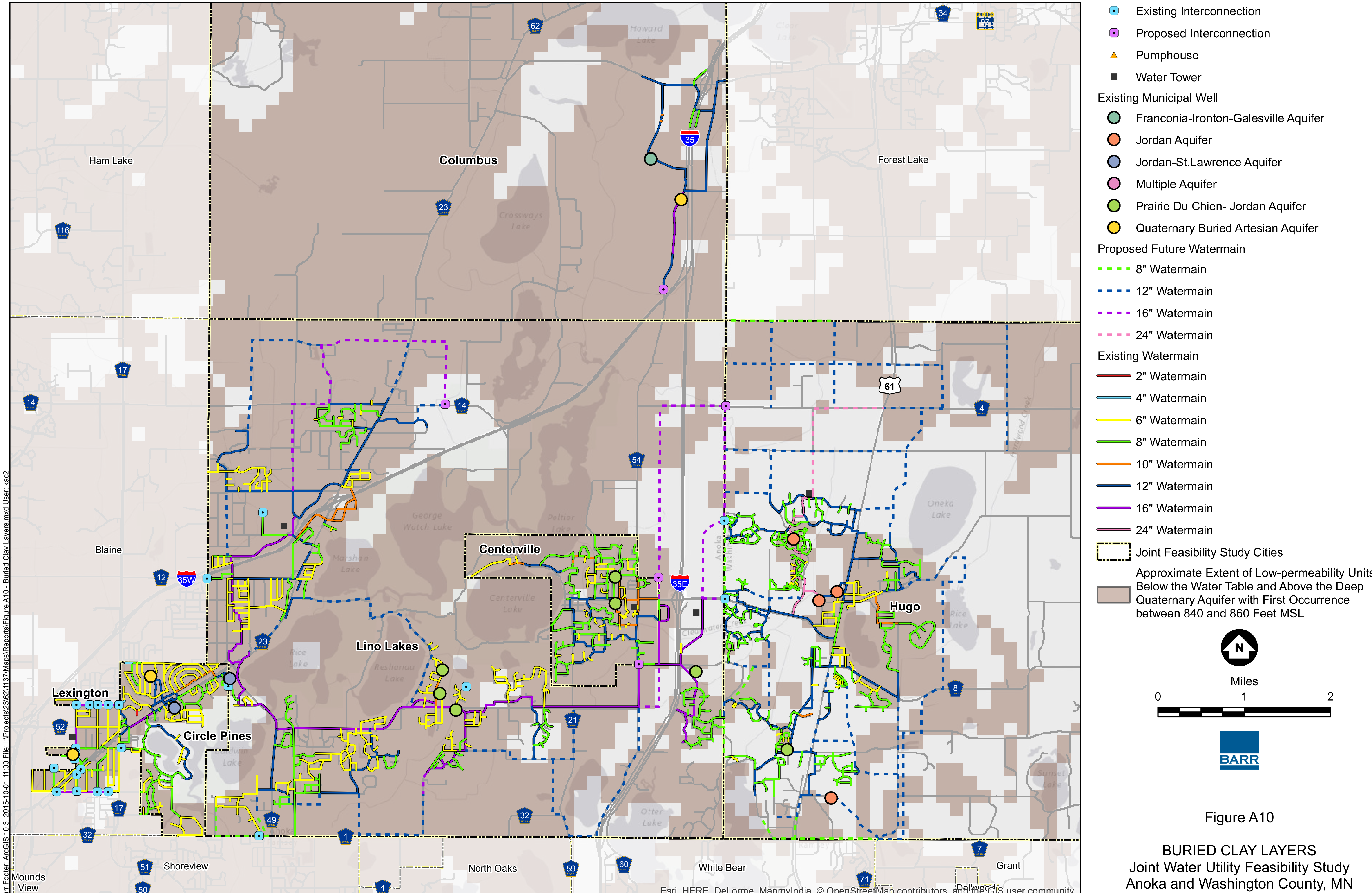


Figure A10

BURIED CLAY LAYERS
Joint Water Utility Feasibility Study
Anoka and Washington County, MN

Appendix B: Detailed Cost Estimates

Table B1 - Option 1 and Option 2, Joint Development Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
1	0.3 MG Storage Tank	N/A	N/A	N/A	N/A
2	0.4 MG Storage Tank	N/A	N/A	N/A	N/A
3	0.5 MG Storage Tank	N/A	N/A	N/A	N/A
4	0.75 MG Storage Tank	N/A	N/A	N/A	N/A
5	1.0 MG Storage Tank	3	EA	$2,300,000	$6,900,000
6	Wells + Wellhouse	2	EA	$490,000	$980,000
7	Generator (1 per well)	2	EA	$130,000	$260,000
8	SCADA system	1	EA	$3,000,000	$3,000,000
9	Contingency (30 %)	LS			$3,340,000
10	Legal and Engineering (20% of all costs)	LS			$2,900,000
	Distribution Subtotal				N/A
	Storage Subtotal				$6,900,000
	Supply Subtotal				$4,240,000
Subtotal,	**2030**				**$17,000,000**

Table B2- Option 1 and Option 2, Joint Development Capital Costs WITHOUT Columbus

Capital Improvements

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
1	0.3 MG Storage Tank	N/A	N/A	N/A	N/A
2	0.4 MG Storage Tank	N/A	N/A	N/A	N/A
3	0.5 MG Storage Tank	1	EA	$1,500,000	$1,500,000
4	0.75 MG Storage Tank	N/A	N/A	N/A	N/A
5	1.0 MG Storage Tank	2	EA	$2,300,000	$4,600,000
6	Wells + Wellhouse	4	EA	$490,000	$1,960,000
7	Generator (1 per well)	4	EA	$130,000	$520,000
8	SCADA system	1	EA	$3,000,000	$3,000,000
9	Contingency (30 %)	LS			$3,470,000
10	Legal and Engineering (20% of all costs)	LS			$3,010,000
	Distribution Subtotal				N/A
	Storage Subtotal				$6,100,000
	Supply Subtotal				$5,480,000
Subtotal,	**2030**				**$18,000,000**

Table B3 - Individual Development, Combined Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity Comp Plan	Unit	Unit Cost	Total Cost
1	0.15 MG Underground Storage Tank	1	EA	$650,000	$650,000
2	2.5 MG Underground Storage	1	EA	$2,080,000	$2,080,000
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	3	EA	$1,500,000	$4,500,000
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	2	EA	$2,300,000	$4,600,000
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	9	EA	$490,000	$4,410,000
11	Generator (1 per well)	9	EA	$130,000	$1,170,000
12	SCADA system	6	EA	$200,000	$1,200,000
13	Contingency (30 %)	LS			$5,580,000
14	Legal and Engineering (20% of all costs)	LS			$4,840,000
	Distribution Subtotal				N/A
	Storage Subtotal				$11,830,000
	Supply Subtotal				$6,780,000
Subtotal,	**2030**				**$29,000,000**

Table B4 - Individual Development, Centerville Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity Comp Plan	Unit	Unit Cost	Total Cost
1	0.15 MG Underground Storage Tank	N/A	N/A	N/A	N/A
2	2.5 MG Underground Storage	N/A	N/A	N/A	N/A
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	1	EA	$1,500,000	$1,500,000
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	1	EA	$490,000	$490,000
11	Generator (1 per well)	1	EA	$130,000	$130,000
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$640,000
14	Legal and Engineering (20% of all costs)	LS			$590,000
	Distribution Subtotal				N/A
	Storage Subtotal				$1,500,000
	Supply Subtotal				$820,000
Subtotal,	**2030**				**$4,000,000**

Table B5 - Individual Development, Circle Pines Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Comp Plan			
1	0.15 MG Underground Storage Tank	N/A	N/A	N/A	N/A
2	2.5 MG Underground Storage	N/A	N/A	N/A	N/A
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	1	EA	$1,500,000	$1,500,000
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	N/A	N/A	N/A	N/A
11	Generator (1 per well)	N/A	N/A	N/A	N/A
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$450,000
14	Legal and Engineering (20% of all costs)	LS			$430,000
	Distribution Subtotal				N/A
	Storage Subtotal				$1,500,000
	Supply Subtotal				$200,000
Subtotal,	**2030**				**$3,000,000**

Table B6 - Individual Development, Columbus Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Comp Plan			
1	0.15 MG Underground Storage Tank	1	EA	$650,000	$650,000
2	2.5 MG Underground Storage	N/A	N/A	N/A	N/A
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	1	EA	$1,500,000	$1,500,000
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	N/A	N/A	N/A	N/A
11	Generator (1 per well)	N/A	N/A	N/A	N/A
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$650,000
14	Legal and Engineering (20% of all costs)	LS			$600,000
	Distribution Subtotal				N/A
	Storage Subtotal				$2,150,000
	Supply Subtotal				$200,000
Subtotal,	**2030**				**$4,000,000**

Table B7 - Individual Development, Hugo Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Comp Plan			
1	0.15 MG Underground Storage Tank	N/A	N/A	N/A	N/A
2	2.5 MG Underground Storage	N/A	N/A	N/A	N/A
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	2	EA	$2,300,000	$4,600,000
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	5	EA	$490,000	$2,450,000
11	Generator (1 per well)	5	EA	$130,000	$650,000
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$2,310,000
14	Legal and Engineering (20% of all costs)	LS			$2,040,000
	Distribution Subtotal				N/A
	Storage Subtotal				$4,600,000
	Supply Subtotal				$3,300,000
Subtotal,	**2030**				**$12,000,000**

Table B8 - Individual Development, Lexington Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity Comp Plan	Unit	Unit Cost	Total Cost
1	0.15 MG Underground Storage Tank	N/A	N/A	N/A	N/A
2	2.5 MG Underground Storage	N/A	N/A	N/A	N/A
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	N/A	N/A	N/A	N/A
11	Generator (1 per well)	N/A	N/A	N/A	N/A
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$60,000
14	Legal and Engineering (20% of all costs)	LS			$50,000
	Distribution Subtotal				N/A
	Storage Subtotal				N/A
	Supply Subtotal				$200,000
Subtotal,	**2030**				**$300,000**

Table B9 - Individual Development, Lino Lakes Capital Costs

Capital Improvements

Payment Item	Description	Estimated Quantity Comp Plan	Unit	Unit Cost	Total Cost
1	0.15 MG Underground Storage Tank	N/A	N/A	N/A	N/A
2	2.5 MG Underground Storage	1	EA	$2,080,000	$2,080,000
3	0.3 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
4	0.4 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
5	0.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
6	0.75 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
7	1 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
8	1.5 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
9	2 MG Elevated Storage Tank	N/A	N/A	N/A	N/A
10	Wells + Wellhouse	3	EA	$490,000	$1,470,000
11	Generator (1 per well)	3	EA	$130,000	$390,000
12	SCADA system	1	EA	$200,000	$200,000
13	Contingency (30 %)	LS			$1,180,000
14	Legal and Engineering (20% of all costs)	LS			$1,060,000
	Distribution Subtotal				N/A
	Storage Subtotal				$2,080,000
	Supply Subtotal				$2,060,000
Subtotal,	**2030**				**$6,000,000**

Table B10 - Option 1 Joint Utility Annual Costs

Joint Utility Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$183,000	$183,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$172,000	$172,000
3	1% Annual Repair & Replacement of EXISTING watermain	N/A	N/A	N/A	N/A
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$450,000	$450,000
5	3.3% Annual Repair & Replacement of SCADA system	1	EA	$100,000	$100,000
6	Contingency (30%)	LS			$271,000
7	Legal and Engineering (20 % of all costs)	LS			$235,000
Subtotal					**$1,400,000**

Table B11 - Option 1 Centerville Annual Costs

Centerville Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	N/A	N/A
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$220,000	$220,000
3	Contingency (30%)	LS			$66,000
4	Legal and Engineering (20 % of all costs)	LS			$57,000
Subtotal					**$300,000**

Table B12 - Option 1 Circle Pines Annual Costs

Circle Pines Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$1,000	$1,000.00
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$200,000	$200,000
3	Contingency (30%)	LS			$60,000
4	Legal and Engineering (20 % of all costs)	LS			$52,000
Subtotal					**$300,000**

Table B13 - Option 1 Columbus Annual Costs

Columbus Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$23,000	$23,000.00
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$90,000	$90,000
3	Contingency (30%)	LS			$34,000
4	Legal and Engineering (20 % of all costs)	LS			$29,000
Subtotal					**$200,000**

Table B14 - Option 1 Hugo Annual Costs
Hugo Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$402,000	$402,000.00
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$600,000	$600,000
3	Contingency (30%)	LS			$301,000
4	Legal and Engineering (20 % of all costs)	LS			$260,000
Subtotal					**$1,600,000**

Table B15 - Option 1 Lexington Annual Costs

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	N/A	N/A	N/A	N/A
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$120,000	$120,000
3	Contingency (30%)	LS			$36,000
4	Legal and Engineering (20 % of all costs)	LS			$31,000
Subtotal					**$200,000**

Table B16 - Option 1 Lino Lakes Annual Costs

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$349,000	$349,000.00
2	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$750,000	$750,000
3	Contingency (30%)	LS			$330,000
4	Legal and Engineering (20 % of all costs)	LS			$286,000
Subtotal					**$1,700,000**

Table B17 - Option 2 Joint Utility Annual Costs

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$958,000	$958,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$172,000	$172,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$1,980,000	$1,980,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$450,000	$450,000
5	3.3% Annual Repair & Replacement of EXISTING SCADA system	1	EA	$100,000	$100,000
6	Contingency (30%)	LS			$1,098,000
7	Legal and Engineering (20 % of all costs)	LS			$951,000
Subtotal					**$5,700,000**

Table B18 - Individual Development, Centerville Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	N/A	N/A	N/A	N/A
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$42,000	$42,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$220,000	$220,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$50,000	$50,000
5	3.3% Annual Repair & Replacement of SCADA system	1	EA	$17,000	$17,000
6	Contingency (30%)	LS			$99,000
7	Legal and Engineering (20 % of all costs)	LS			$86,000
Subtotal					**$500,000**

Table B19 - Individual Development, Circle Pines Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$1,000	$1,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$30,000	$30,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$200,000	$200,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$50,000	$50,000
4	3.3% Annual Repair & Replacement of SCADA system	1	EA	$17,000	$17,000
5	Contingency (30%)	LS			$89,000
6	Legal and Engineering (20 % of all costs)	LS			$77,000
Subtotal					**$500,000**

Table B20 - Individual Development, Columbus Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$23,000	$23,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$43,000	$43,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$90,000	$90,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$40,000	$40,000
5	3.3% Annual Repair & Replacement of EXISTING SCADA system	1	EA	$17,000	$17,000
6	Contingency (30%)	LS			$64,000
7	Legal and Engineering (20 % of all costs)	LS			$55,000
Subtotal					**$300,000**

Table B21 - Individual Development, Hugo Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$575,000	$575,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$154,000	$154,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$600,000	$600,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$150,000	$150,000
5	3.3% Annual Repair & Replacement of EXISTING SCADA system	1	EA	$17,000	$17,000
6	Contingency (30%)	LS			$449,000
7	Legal and Engineering (20 % of all costs)	LS			$389,000
Subtotal					**$2,300,000**

Table B22 - Individual Development, Lexington Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	N/A	N/A	N/A	N/A
2	2% Annual Repair & Replacement of NEW storage and wells	N/A	N/A	N/A	N/A
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$120,000	$120,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$10,000	$10,000
5	3.3% Annual Repair & Replacement of EXISTING SCADA system	1	EA	$17,000	$17,000
6	Contingency (30%)	LS			$44,000
7	Legal and Engineering (20 % of all costs)	LS			$38,000
Subtotal					**$200,000**

Table B23 - Individual Development, Lino Lakes Annual Costs

Combined System Option 1, Year 2030

Payment Item	Description	Estimated Quantity	Unit	Unit Cost	Total Cost
		Annual Costs			
1	1% Annual Repair & Replacement of NEW watermain	1	EA	$388,000	$388,000
2	2% Annual Repair & Replacement of NEW storage and wells	1	EA	$79,000	$79,000
3	1% Annual Repair & Replacement of EXISTING watermain	1	EA	$750,000	$750,000
4	2% Annual Repair & Replacement of EXISTING storage and wells	1	EA	$150,000	$150,000
5	3.3% Annual Repair & Replacement of EXISTING SCADA system	1	EA	$17,000	$17,000
6	Contingency (30%)	LS			$415,000
7	Legal and Engineering (20 % of all costs)	LS			$360,000
Subtotal					**$2,200,000**

Appendix C: Development Timelines

Individual Development Timeline

2015 - 2020

- Centerville adds 1 well
- Lino Lakes adds 2 wells
- Hugo adds 4 wells
- Hugo adds 1 MG storage
- Columbus adds 750,000 gal storage
- Centerville adds 500,000 gal storage
- Circle Pines adds 600,000 gal storage
- Lino Lakes adds 1.75 MG storage

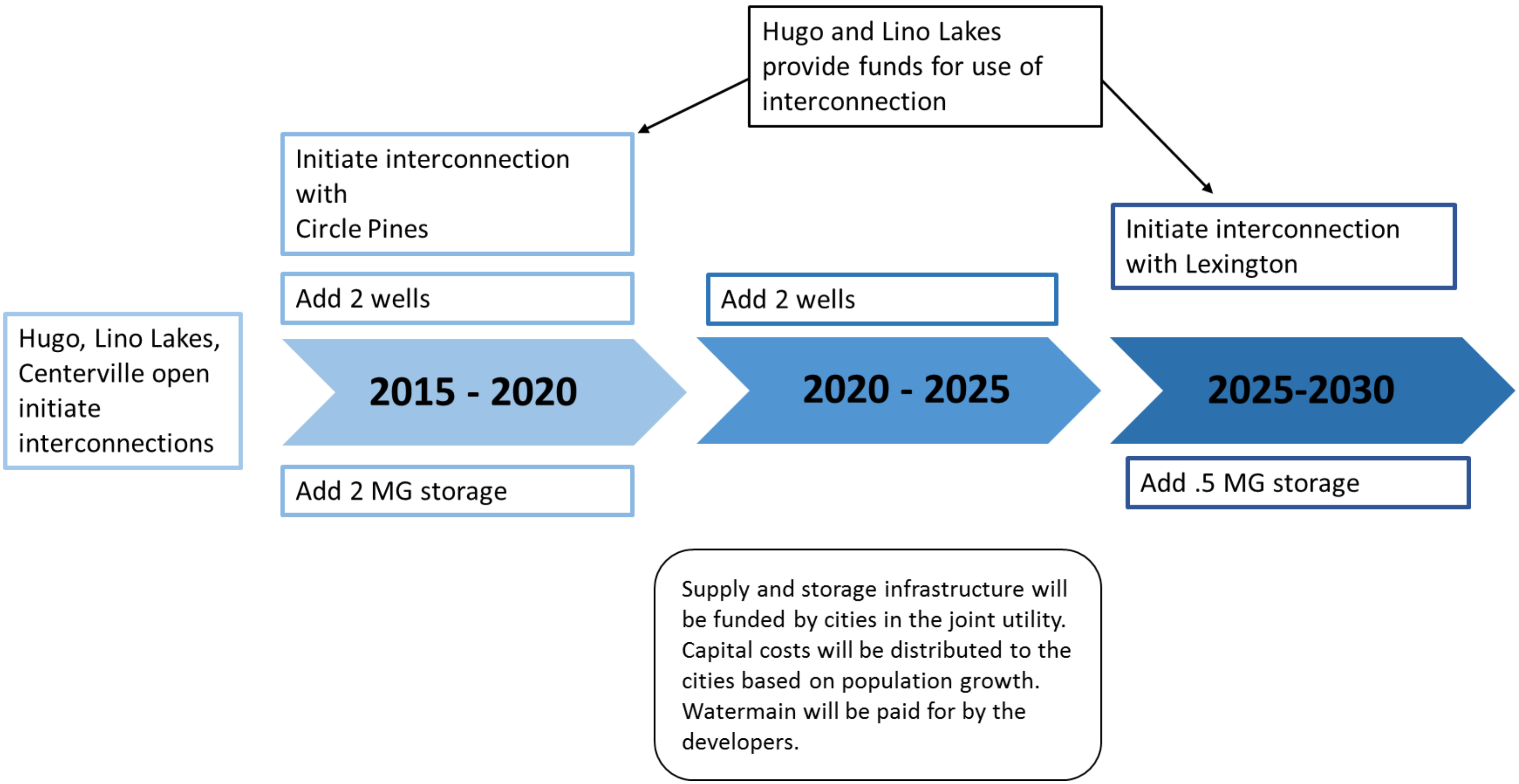
2020 - 2025

- Lino Lakes adds 1 well
- Hugo adds 1 well
- Columbus adds 300,000 gal storage

2025-2030

Joint Utility Timeline

Without Columbus



Appendix D: Existing Water Systems

D Existing Water Systems

The existing water infrastructure and use for each of the cities is described in the sections below. A map of all the individual existing water systems is depicted in Figure A4.

D.1 Water Supply

Water supply for the six-city area is comprised of 18 existing groundwater wells. These wells and the aquifers they are constructed in are shown in Figure A9, Bedrock Geology. The City of Lino Lakes is currently in the process of the design and construction of new Well No. 6. Additionally, the City of Lexington receives a significant portion of its water wholesale from the City of Blaine. Table DD.1.1 and Table DD.1.2 summarize well information for the six cities. The combined cities have a total well capacity of 18,080 gallons per minute (gpm) or 26 million gallons per day (MGD).

Table DD.1.1 Summary of existing water supply wells

City	City Well Number	Year Installed	Nominal Capacity (gpm)	Geological Unit	Well Considered Vulnerable to Source Water Contamination? (Y/N)
Centerville	1	1988	560	Prairie du Chien - Jordan	
Centerville	2	1993	1,100	Prairie du Chien - Jordan	No
Circle Pines	2	1961	1,000	Quaternary Sand and Gravel	No
Circle Pines	3	1967	1,200	Prairie du Chien - Jordan	No
Columbus	1	2006	400	Quaternary Sand and Gravel	No
Columbus	2	2007	1,000	Quaternary Sand and Gravel	No
Columbus	3	2007	1,000	Franconia-Ironton-Galesville	No
Hugo	2	1993	625	Prairie du Chien - Jordan	No
Hugo	3	2000	1,200	Jordan	No
Hugo	4	2002	1,200	Jordan	No
Hugo	5	2007	1,200	Jordan	No
Hugo	6		1,200	Jordan	No
Lexington	1		945	Quaternary Sand and Gravel	No
Lino Lakes	1	1971	675	Prairie du Chien - Jordan	No
Lino Lakes	2	1986	625	Prairie du Chien - Jordan	No
Lino Lakes	3	1995	1,800	Prairie du Chien - Jordan	No
Lino Lakes	4	1996	750	Prairie du Chien - Jordan	No
Lino Lakes	5	2005	1,600	Prairie du Chien - Jordan	No
Lino Lakes	6	*2015?*	*TBD*		

Table DD.1.2 Total well capacities for individual cities and a joint system

City	Total Well Capacity (gpm)	Total Well Capacity (mgd)	Firm Well Capacity (gpm)	Firm Well Capacity (mgd)
Centerville	1,660	2.4	560	0.8
Circle Pines	2,200	3.2	1,000	1.4
Columbus	2,400	3.5	1,400	2.0
Hugo	5,425	7.8	4,225	6.1
Lexington	945	1.4	0	0
Lino Lakes	5,450	7.9	3,650	5.3
Total	18,080	26.0	16,280	23.4

D.2 Water System Demands

Current average day and peak day water use for each city, and the combined cities, are summarized below in Figure DD.2-1 and Table DD.2.1. The City of Columbus has only four residential connections, so its gallons per capita water use is not a comparable metric for that municipality. Additionally, the peaking factor for the City of Lexington is unusually high which can most likely be attributed to incomplete historical data.

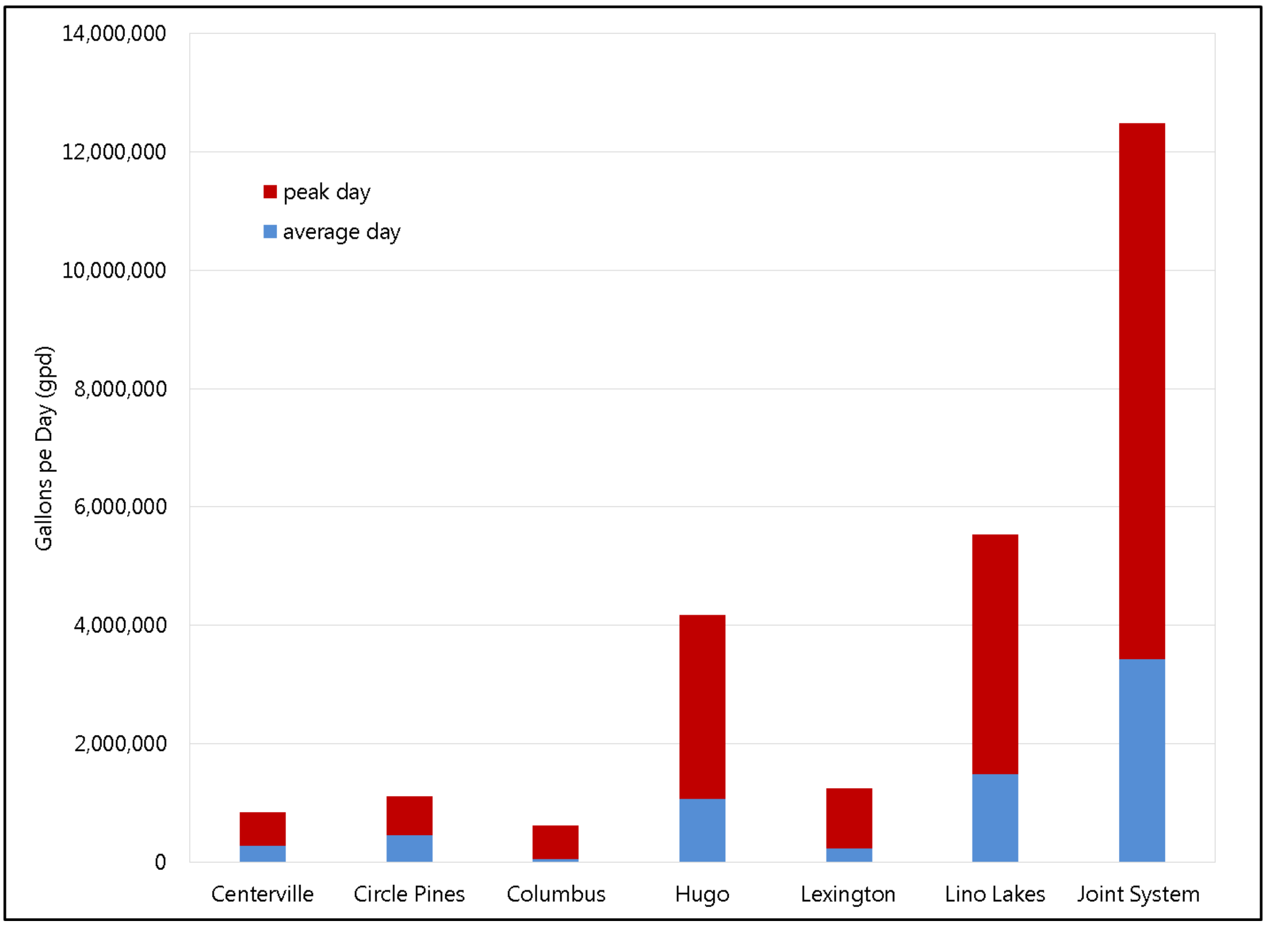


Figure DD.2-1 Five year average, average day and peak day water use

Table DD.2.1 Five year average of historical average day and peak day water use

	Average Day (gpcd)	Average Day (mgd)	Peak Day (gpcd)	Peak Day (mgd)	Peaking Factor (gpcd)
Centerville	84	0.28	258	0.85	2.9
Circle Pines	89	0.45	216	1.11	2.4
Columbus	11,560	0.05	154,300	0.62	14.0
Hugo	115	1.07	438	4.17	3.9
Lexington	114	0.23	616	1.25	6.0
Lino Lakes	91	1.48	338	5.53	3.7
Total	98	3.56	354	12.48	3.6

D.3 Water Use by Category

Categorical water use is helpful for understanding a city's demand needs and for predicting future demand for a city. Water sales by category for all the combined cities are provided in Figure DD.3-1. The vast majority of water demand across the six cities is from residential customers.

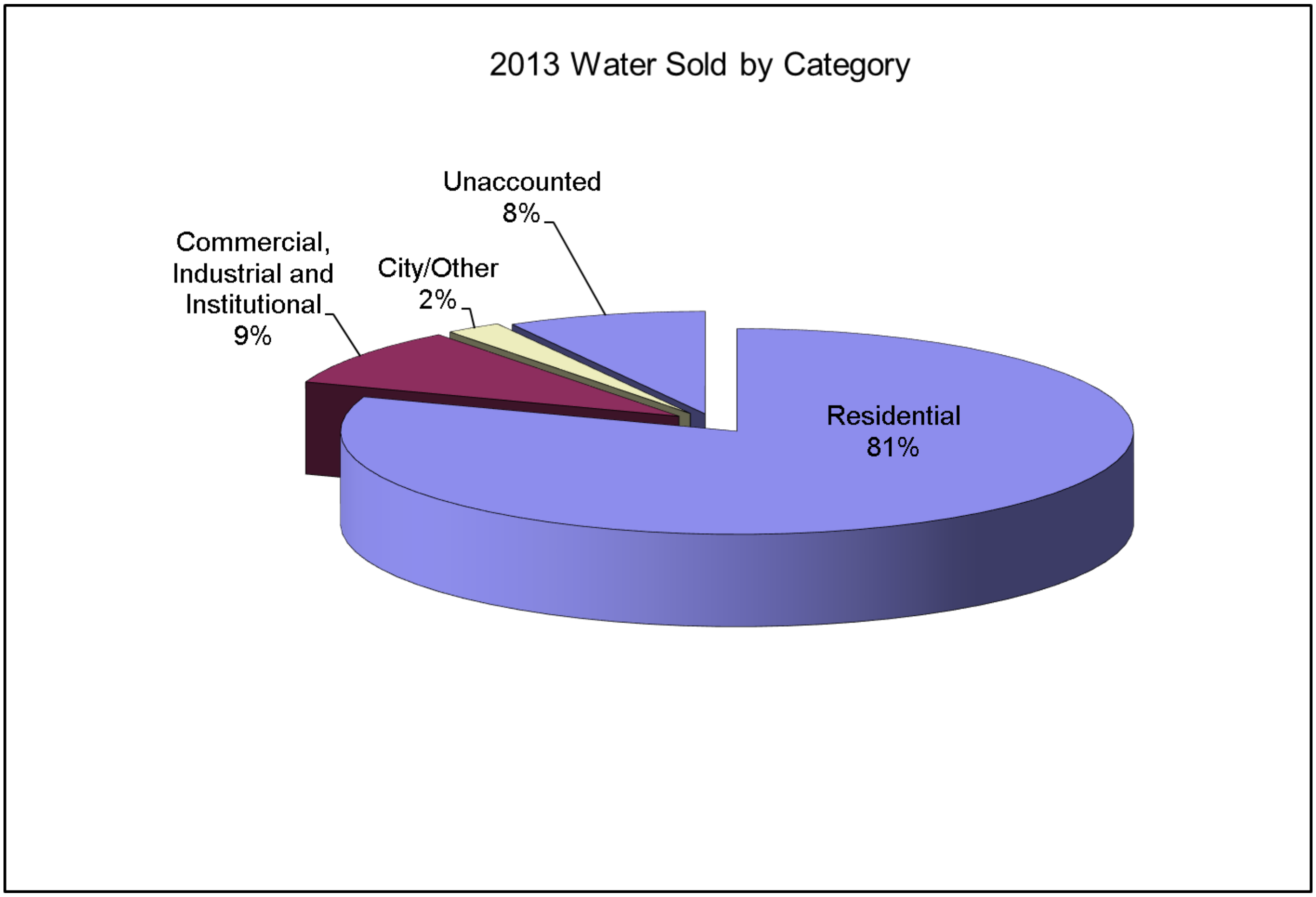


Figure DD.3-1 Categorical water use for the six-city area

D.3.1 City of Columbus Categorical Water use

Unlike the five cities, the City of Columbus has much higher commercial, industrial and institutional water use than most cities. Demand is generated by a few of major users and very few residential users are connected to the city's water system. Figure DD.3-2 shows categorical water use for the City of Columbus.

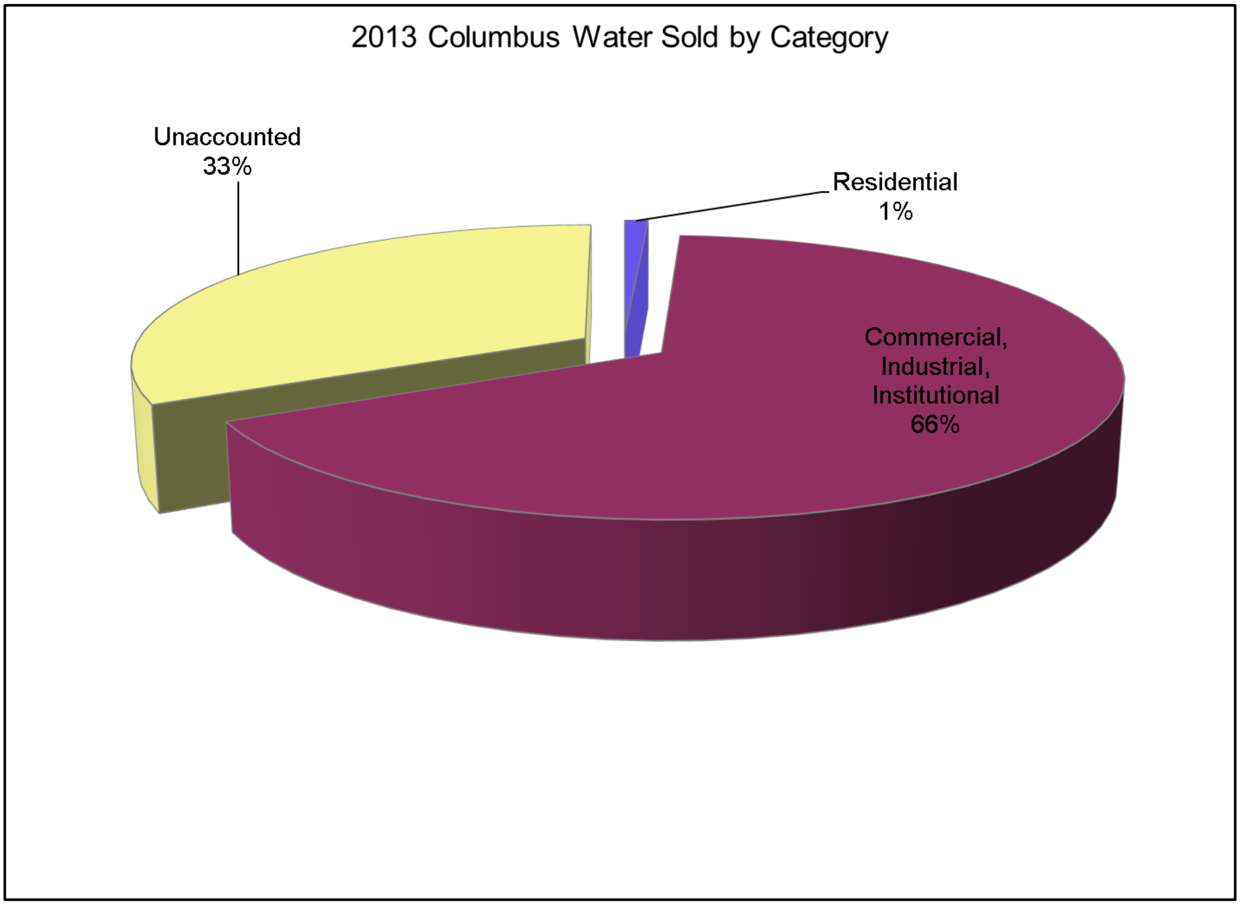


Figure DD.3-2 Categorical water use for the City of Columbus

D.3.2 Major Water Users

A major user is considered a customer which uses greater than 5% of the water sold. As a joint system, major water users would account for less than 1% of use. The City of Columbus presents an unusual circumstance as most of the city's demand comes from commercial/industrial use—the two most important consumers being Running Aces Harness Track and Ziegler, Inc. Together, these two users accounted for 66% of use.

D.4 Water Treatment

Since each City's water supply comes from groundwater wells, the six cities have similar raw water quality characteristics with the primary issue being iron and manganese. The City of Circle Pines is the only city which operates a treatment plant for iron and manganese removal. However, the City of Lexington receives treated water from Blaine during most of the year.

D.4.1 Iron and Manganese

Iron and manganese do not pose a health problem, however, they can adversely affect maintenance costs and water aesthetics and are considered a secondary treatment standard by the Minnesota Department of Health (MDH). Five of the six cities add polyphosphates at the wellhead in order to limit iron and manganese precipitation in the distribution system. The City of Circle Pines operates a water treatment plant at Well No. 2 which uses greensand filters to remove iron and manganese.

Before any two water systems are combined, further investigation is needed to determine whether combining and mixing water supplies would have negative effects to water quality. It is possible that combining the two treatment strategies may pose a problem in mixing water supply from Circle Pines with water from the rest of the cities.

D.4.2 Chlorine and Fluoride Addition

All six cities add chlorine and fluoride to their drinking water in accordance with the Minnesota Department of Health (MDH) guidelines.

D.4.3 Hardness

Hardness is considered a secondary drinking water standard and does not pose a health threat, however it may pose an economic problem as customers use more soap and detergent to overcome its effects. Water softening is not done by any of the six cities involved in this study.

D.5 Water Distribution System

The distribution system is comprised of buried watermain piping, hydrants, valves, service lines, meters and pumping facilities. The existing distribution system is depicted in Figure A4.

D.5.1 Piping Network

There are several areas in the existing watermain distribution system which are not looped, or connected back to each other, which results in dead end piping. Looping watermain systems helps to improve water quality and reduce water age in the system. Many of the dead end watermains are located near the municipal border. This is one opportunity for potential improvement through a joint water system.

D.5.2 Water System Interconnects

Most of the cities in this study have interconnections with one or more cities. Existing connections between the cities make a joint system easier to develop. However, additional interconnections are likely to be a component of the joint system to facility higher capacity water flow between the cities and better movement within the system. Existing interconnects are shown in Figure A4. The City of Columbus does not have any interconnects with another water system.

Existing interconnects are typically used for emergency scenarios, however, the City of Lexington shares an interconnection with the City of Blaine which it uses as a key component of its water supply. The City of Lexington operates their well only during the spring, summer and fall months and typically relies on Blaine for water during the winter months.

D.6 Water Storage

Most cities maintain their own storage space and several have plans to increase storage capacity before 2030. The opportunity to share storage facilities is another efficiency that can be provided by a joint water system. Existing storage is shown in Table DD.6.1.

The Cities of Lexington and Columbus are not shown in Table DD.6.1 as they do not currently have any storage. Lexington does not maintain storage, most likely due to its shared water supply with the City of Blaine. Columbus has plans to add 150,000 gallons of underground storage in the near future and uses a small hydropneumatic tank to maintain water pressure.

Table DD.6.1 Summary of existing storage facilities by city

City	Tank Number	Total Capacity (MG)	Type of Storage	Elevation
Centerville	1	0.5	Elevated	1054.5 ft
Circle Pines	1	0.5	Elevated	Not provided
Hugo	1	1.5	Elevated	Not provided
Hugo	2	0.5	Elevated	Not provided
Lino Lakes	1	1.0	Elevated	1054.5 ft
Lino Lakes	2	1.0	Elevated	1054.5 ft
Total		5.0		

Appendix E: Glossary

Term	Definition or Method of Calculation
GPCD	Gallons of water per capita per day
GPD	Gallons of water per day
MGD	Millions of gallons of water per day
MG	Million gallons
Average Day Demand (gpcd) – Calculated	The calculated average day demand (gpd) divided by the population served for a given year
Average Day Demand (gpd) – Minimum Projection	The population served multiplied by the DNR benchmark of 75 gpcd
Average Day Demand (gpd) – Design Projection	The population served multiplied by the average five year average use of 100 gpcd
Average Day Demand (gpd) – Maximum Projection	The population served multiplied by the maximum annual per capita (gpcd)
Peak Day Demand (gpd) – Calculated	The calculated average day demand multiplied by the peaking factor reported for a given year
Peak Day Demand (gpd) – Projection	The average day demand multiplied by the 5 year average peaking factor
Peaking Factor – Projection	The ratio of peak day water use to average day water use, projected as an average of the past 5 years
Population Served (gpd)	The population of the city or region minus those using a private water supply

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