Regional

Report

Projected Water Demand

for the Twin Cities Metropolitan Area

February 2001

Metropolitan Council
Building communities that work

Metropolitan Council Members

Ted Mondale, Chair

Saundra Spigner – District 1
Todd Paulson – District 2
Mary Hill Smith – District 3
Julius C. Smith – District 4
Phil Riveness – District 5
Frank Hornstein – District 6
Matthew Ramadan – District 7
Carol A. Kummer – District 8
Natalie Haas Steffen - District 9
Jim Nelson – District 10
Roger Williams – District 11
Marc Hugunin – District 12
Fred Perez – District 13
Lee Pao Xiong – District 14
Carolyn Rodriguez - District 15
John Conzemius – District 16

The mission of the Metropolitan Council is to improve regional competitiveness in the global economy so that this is one of the best places to live, work, raise a family and grow a business.

The Metropolitan Council coordinates regional planning and guides development in the seven-county area through joint action with the public and private sectors. The Council also operates regional services, including wastewater collection and treatment, transit and the Metro HRA, an affordable-housing service that provides assistance to low-income families in the region. Created by the legislature in 1967, the Council establishes policies for airports, regional parks, highways and transit, sewers, air and water quality, land use and affordable housing, and provides planning and technical assistance to communities in the Twin Cities region.

Publication no. 32-01-010

Contents

Figures

Tables

Appendix

EXECUTIVE SUMMARY

The Metropolitan Council conducted water demand forecasting for the Twin Cities metropolitan area (TCMA) as part of an update of the *Long-Term Water Use and Supply Plan* mandated by the Minnesota State Legislature in 1990. The Institute for Water Resources, Municipal And Industrial Needs water demand modeling software and information submitted to the Council in local water supply plans were used to generate forecasts of water use in the residential, non-residential, and unmetered/unaccounted sectors. Information from the Minnesota Department of Natural Resources on reported water use was used to generate forecasts for the major crop irrigation, special categories, power generation, water level maintenance, and air conditioning categories.

Total water demand in 2040 in the TCMA is forecasted to reach over 1.2 billion gallons a day. This is a net increase of approximately 21.5 percent or 100 mgd, not including power generation, from 2000 to 2040. A reduction in water use for water level maintenance, once-through air conditioning, and major crop irrigation use categories is expected during the forecast period. The combined use in the residential, nonresidential (commercial, industrial and institutional) and unmetered/unaccounted categories is expected to reach 517 million gallons per day in 2040, a 35 percent or 133 mgd increase from 2000 to 2040.

It is generally accepted that available water resources are sufficient to supply the increased demand. However, large increases are forecasted in areas where, because of the sensitive natural features or geologic characteristics, additional water supply is of special concern. The Council is evaluating the water supply source in these parts of the TCMA to ensure that adequate water supplies are available for future generations.

ABOUT THIS REPORT

This report was prepared as part of an assessment of the water supply for the Twin Cities metropolitan area. The report was prepared by Christopher Elvrum (651-602-1066) of the Metropolitan Council's, Environmental Services Division, Environmental Planning and Evaluation Department. Questions about the content of this report can be referred directly to him or to Gary Oberts (651-602-1079) of the same department.

Copies of this report can be obtained from the Metropolitan Council's Regional Data Center (651) 602-1000 or TYY (651) 291-0904. This report is Publication No. 32-01-010.

INTRODUCTION

Legislative Charge

In response to the drought of the late 1980s, the Minnesota State Legislature passed a law (Minn. Stat., § 473.156) requiring the Metropolitan Council to prepare "a short-term and long-term plan for existing and expected water use and supply in the Metropolitan Area." As a result, a short-term plan was completed on February 1, 1990, and a long-term plan was completed on February 1, 1992. The long-term plan is to be "continually updated as the need arises." This report details water demand modeling that was conducted for the Twin Cities metropolitan area (TCMA) as part of an update of the long-term water supply plan.

Chapter 186 of the 1993 legislative session laws mandates that a water supply plan be prepared for each of the communities in the metropolitan area with a municipal water supply system. Communities must submit these plans, as components of their comprehensive plans, to the Metropolitan Council for review. Information contained in the local water supply plans was used to calibrate the residential, non-residential, and unaccounted/unmetered categories of the current water demand modeling for many of the communities.

Background

Water demand projections were made for each community in the TCMA. Projections were made for several categories of use including: residential, non-residential, unaccounted/unmetered, major crop irrigation, special categories, water level maintenance, power generation, and air conditioning. Non-residential uses include commercial, industrial and institutional (public) uses, whether they are supplied by a municipal supply or obtain their water through their own well system. Data from various sources including household and employee count data generated by the Metropolitan Council, were used to project future water demand. Current modeling efforts indicate the need for nearly 59 mgd in additional water capacity between 2000 and 2020 and over 100 mgd additional capacity by 2040. This projection includes a significant increase in demand in some rapidly growing locations where access to high-yielding groundwater units is limited. Cooperative efforts among suppliers and government regulatory and planning agencies will be necessary to assure that water is distributed where needed.

Surface Water Communities

The Minneapolis Water Works obtains all of its water from the Mississippi River, while the St. Paul Regional Water Utility obtains about 70 percent of its water from the river, and the remainder from four high capacity groundwater wells, the Rice Creek Chain of Lakes (Centerville Lake) and tributaries to Vadnais Lake. Both surface water intakes on the Mississippi River are located in Fridley; St. Paul's is at river mile 862.8 (75th Avenue North), while Minneapolis has two intakes at river miles 858.6 and 857.9, both upstream of the Camden Avenue Bridge. Together, in 2000 the two cities will be the primary

water supply for a total population of approximately 856,690 (32.8 percent of metropolitan area population). This does not include Bloomington, which supplements its groundwater source with water supplied from Minneapolis, nor a small amount of service to Edina Morningside.

The Minneapolis Water Works provides all of the water used by the Joint Water Commission (Crystal, Golden Valley and New Hope), and the cities of Columbia Heights and Hilltop. The Water Works also supplies water to the Morningside community in Edina, and up to 30 million gallons per day (mgd) to the City of Bloomington. It also serves the Minneapolis-St. Paul International Airport and Fort Snelling. The total population served by municipal systems that will rely directly on the Minneapolis Water Works in 2000 is estimated to be 457,180, not including Edina's Morningside neighborhood or Bloomington.

The St. Paul Regional Water Services (formerly the St. Paul Water Utility) supplies water on a wholesale basis to Arden Hills, Little Canada and Roseville. These three wholesale communities handle distribution and billing after water is delivered by St. Paul. Several other cities are retail customers of St. Paul, meaning that St. Paul does all of the distribution and billing for the cities. Retail customers include Falcon Heights, Lauderdale, Maplewood (except for 3,000 customers served by North St. Paul), Mendota, Mendota Heights, and West St. Paul. St. Paul also serves the Minnesota State Fair Grounds. The total population that will be served by municipal systems that rely directly on the St. Paul Regional Water Service in 2000 is estimated to be 399,510.

Groundwater Communities

There are a total of 117 communities in the TCMA served to some degree by municipal systems that rely on groundwater, including those served by St. Paul Regional Water Services. Groundwater is obtained from over 550 high-capacity municipal wells located in several prolific aquifers found in the Twin Cities Basin up to 1,000 feet below ground. Figure 1 illustrates the aquifers in a cross-section view. Figure 2 shows the locations of the municipal wells in the TCMA.

The aquifers that provide large enough volumes to be used for municipal systems include, in order of volume used, the Prairie du Chien-Jordan, the Mt. Simon-Hinckley, the Drift and the Franconia-Ironton-Galesville.

Groundwater is the primary source of water to municipal systems supplying approximately 1,392,419 people (53.4 percent of the metropolitan area population). This total does not include the St. Paul Regional Water Service (381,686), which uses groundwater as a supplemental source to the Mississippi River, but does include Bloomington, which uses groundwater as a primary source. In addition to the groundwater used by municipal systems, approximately 381,061 people in the seven-county region (14.6 percent) rely on private groundwater wells to obtain domestic water. Specifics on the aquifers from which most of these low capacity wells draw are available from the counties in which the wells are located. As a primary source, groundwater

Figure 1

Generalized Twin Cities Metropolitan Area Geologic Cross-Section

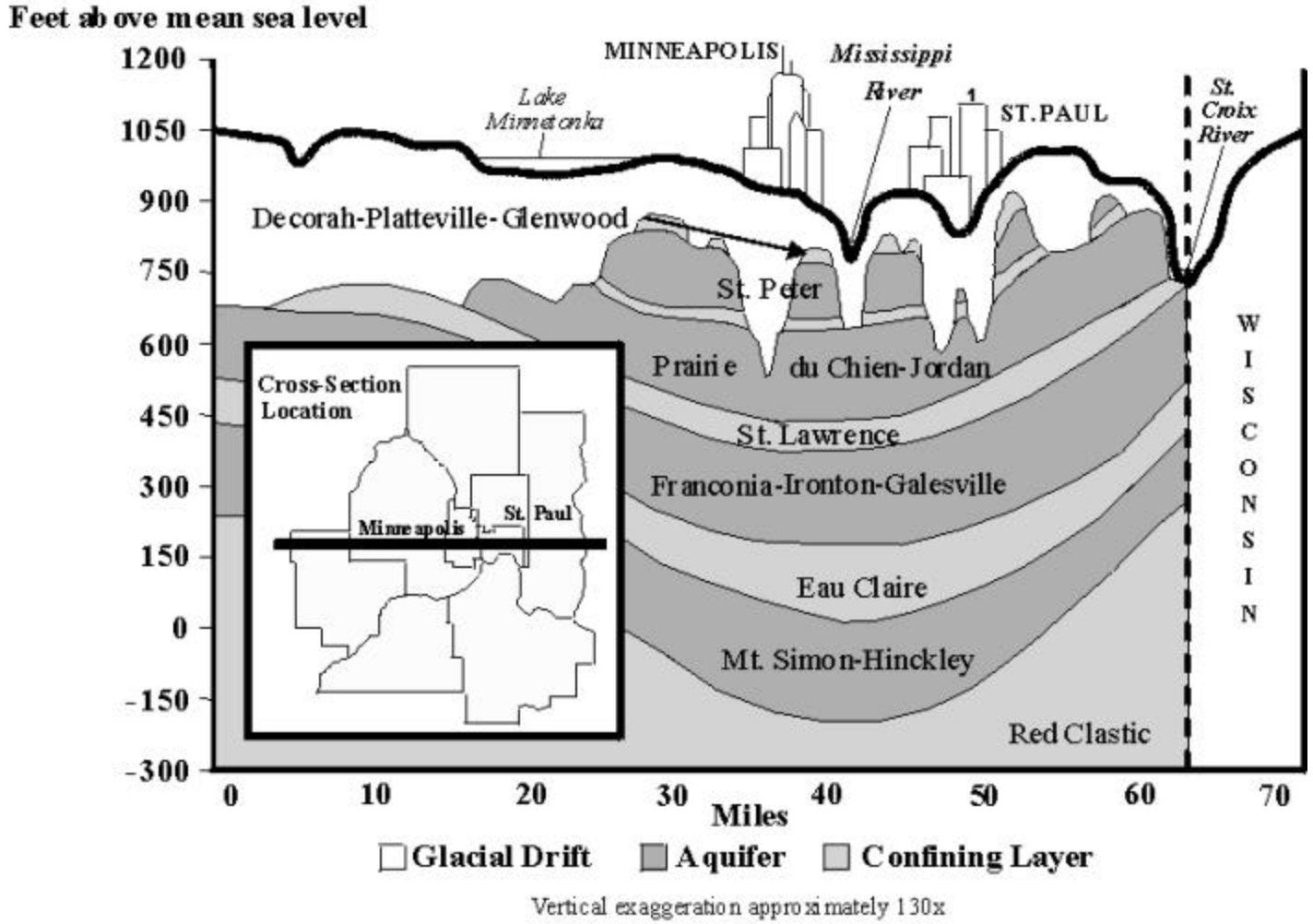
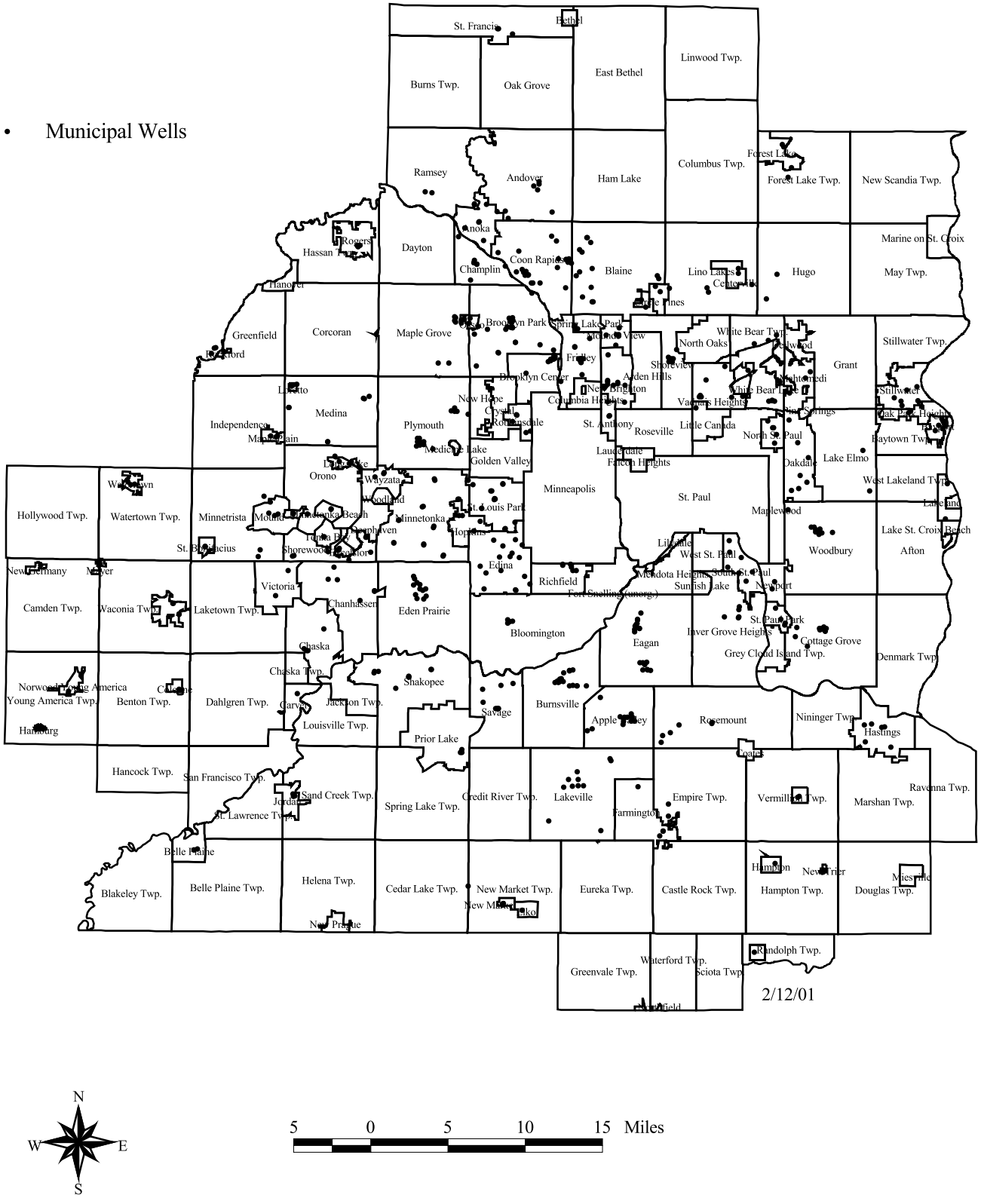


Figure 2
Metropolitan Area Municipal Wells



supplies over 1.75 million people. When the communities that use groundwater as a supplement to surface water are included, the number served jumps to over 2.15 million people in the TCMA.

METHODS

Previously, Council staff made water demand projections using statistical methods based on water use information obtained from several state and local sources (Hartsoe 1991). The current modeling was based in part on subsequent forecasting that was conducted by the Council with Version 6.1of the Institute for Water Resources, Municipal And Industrial Needs (IWR-MAIN) water demand forecasting software. A Windows-based version of the IWR-MAIN software was released in 1999 by Planning and Management Consultants, Ltd. (PMCL). The current water demand forecasts were generated primarily with this software and from reported water use from the Minnesota Department of Natural Resources (DNR) State Water Use Data System (SWUDS) database for the years 1988 to 1998 as well as demographic information generated by the Council and other state agencies.

In some cases, combined demand projections were generated for more than one community with IWR-MAIN version 6.1, such as two or more townships in rural, sparsely populated areas, or some of the systems that supply multiple communities. Most of these combinations were maintained for the current modeling due to employment projections having already been generated as described below. Once the water demand for these combined communities was generated, the residential and total use categories were divided based on percent of the total population in each of the communities or specific known uses in the communities.

Demand forecasts were generated for the following use categories: residential, non-residential, unmetered/unaccounted, major crop irrigation, air conditioning, temporary, water level maintenance, special categories, and power generation. Residential use includes both municipally supplied and self-supplied, and non-residential use includes all commercial, industrial and institutional demand. The IWR-MAIN model was used to forecast water demand in the residential, non-residential, and unmetered/unaccounted categories. Water demand forecasts for the remaining categories were made from use data obtained from the SWUDS as described below.

The base year for the IWR-MAIN modeling was 1990 for most forecasts and 1995 for a few cases. Projection years included 1995, 2000, 2010, 2020, 2030, and 2040. The model was calibrated to reported 1990 use in most cases or to 1995 when more complete or accurate data for that year were available.

Description of the IWR-MAIN Modeling

As previously stated, IWR-MAIN was used to forecast residential, non-residential, and unmetered/unaccounted demand. The residential category included all the projected

water demand for residential use regardless if the supply was from a municipal or private source. The non-residential category included all commercial, industrial, and public (if metered) uses. It did not include water used in the major crop irrigation, power generation, air conditioning, temporary, special categories, or water level maintenance categories. The unmetered/unaccounted category was the amount of water each municipal supplier reported as not accounted for through metering.

The IWR-MAIN model used was a multiplicative predictive model. The model estimated water demand in gallons per unit per day for a given month as a function of a constant (model intercept), multiplied by a set of explanatory variables. The units were Council projections of households for the residential category and employee counts for the non-residential category. The model intercepts were initially chosen during the IWR-MAIN version 6.1 modeling. These were adjusted as a means of calibration as discussed later.

The explanatory variables for the residential category included household income, housing density, persons per household, marginal price, temperature and rainfall. Elasticities utilized in the modeling were taken from the IWR-MAIN version 6.1 manual and are consistent with the ranges set forth in the Windows-based version manual. An "elasticity" is a dimensionless measure of the relationship between quantity (water use) and any explanatory variable (e.g., price, income). The elasticity is interpreted as the percent change in quantity (e.g., water use) that is expected from a 1 percent change in the explanatory variable. For example, an elasticity of +0.4 on income in a water demand equation indicates that a 1 percent increase in income will cause a 0.4 percent increase in water use (PMCL 1996).

The non-residential category was divided into several sub-sectors: construction, finance, government, manufacturing, retail, services, transportation and wholesale. Water demand modeling for the non-residential category was based on employee counts (counting unit) for each sub-sector. The employee counts for each non-residential sub-sector for 1990 and 1995 were obtained from the Minnesota Department of Economic Security. The employee counts for the projection years (2000, 2010,… etc.) were based on the Council's projected total employee count for each community. The percentage of the total employee count in each sub-sector in 1995 was assumed to be constant for forecast years and employee counts for each subsector were estimated for the forecast years. This was initially completed during the modeling with IWR-MAIN version 6.1 and resulting employment numbers were used for this modeling. Factors (model intercepts) of gallons per employee per day were provided in IWR-MAIN version 6.1. Elasticities for variables in the non-residential category have not been determined. Therefore, for this modeling effort, water demand was calculated as gallons per employee per day for each of the sub-sectors. In order to satisfy the requirements of the software, marginal price was entered as a variable, but the elasticity was set to zero so it did not affect water demand.

The unmetered/unaccounted category was taken from the community water supply plan as the percent unmetered and/or unaccounted reported in 1990 and 1995, if available. An average of the data provided was used for forecast years. Water in this category could be

due to unmetered public uses such as hydrant flushing or rink flooding, unauthorized uses, leakage or any other unmetered use. In some cases if the community planned on reducing the amount unaccounted through improved metering or system improvements, this was taken into consideration for forecast years. In areas with no municipal water supply system this category was set to zero.

Model Variables

As previously mentioned, the model variables, which were used to determine projected residential water demand, include: household income, housing density, persons per household, marginal price, temperature, and rainfall. These variables were chosen to match the IWR-MAIN version 6.1 modeling effort. Elasticities for each of these variables were obtained from the version 6.1 manual.

The household income was determined for 1990 and held constant for forecast years. Because the elasticity for this variable was positive (0.4) the model predicts that as income increases, water demand will increase. This is a relatively high elasticity so the model is fairly sensitive to changes in income. A comparison of past water use to household income in the TCMA communities did not show a correlation between water use and income. Those cities with the highest average household income did not necessarily have the highest per capita residential water demand. Therefore, it was decided to keep income constant in forecast years for this modeling effort. Because the income was held constant, there was no change in water demand forecasts as a result of income. If in the future a correlation between income and water demand is noted, changes in income can be incorporated into the model for future forecasts.

Housing density was calculated for 1990 during the version 6.1 modeling from land use area calculations and household data. In order to forecast the change in housing density, it would be necessary to determine the number of households per residential land use area for each of the forecast years. This would be highly speculative and would only result in a marginal change in the density. For this reason, housing density was also held constant for forecast years resulting in no effect from this variable on water demand forecasts. The elasticity for this variable was –0.3 indicating that if an increase in density was predicted, a decrease in water demand would result. The model is fairly sensitive to this variable due to the –0.3 elasticity value.

Persons per household (pph) was calculated from population and housing numbers for each of the communities. In the version 6.1 modeling the pph was kept constant for projections. The current modeling used projected pph numbers based on the Council's projections of households and populations. The positive elasticity (0.45) indicates that an increase in pph results in an increase in water demand. With an elasticity of 0.45 the model is fairly sensitive to significant changes in pph. Because the change in pph is marginal for most of the communities in the area, this factor does not affect the water demand projection to any large extent.

The marginal price was calculated for each municipal supplier during the version 6.1 modeling work for the residential and non-residential categories for 1990. Marginal price is the price (or quantity charge) in effect for the last unit of water used plus any wastewater volume charges or other volume related surcharges (PMCL 1996). This was also held constant for projections. An accurate change in the price in 1990 dollars may be difficult to determine unless a community has a proposed conservation-oriented water rate. This could be adjusted to estimate the effects of price on water demand. For non-municipally supplied communities, the marginal price was set to $1. The elasticity for marginal price is negative (-0.04) indicating an increase in marginal price would result in a decrease in water demand. The relatively low elasticity 0.04 indicates that the model is not very sensitive to changes in marginal price. Because marginal price was held constant, it had no effect on water use projections.

Temperature and rainfall data were obtained from the Minnesota State Climatology Office. The 1990 and 1995 data were based on the actual records. The projected weather data was based on averages of data over 30 years. The elasticity for temperature (0.5) indicates that an increase in temperature results in an increase in water demand. The rainfall elasticity is negative (-0.02) indicating a decrease in water demand resulting from an increase in rainfall. The temperature elasticity is relatively high indicating that the model is fairly sensitive to this factor. Conversely the rainfall elasticity is relatively low which shows that the model is not very sensitive to this variable. Because the forecast years have constant temperature and rainfall values based on past averages, there is no effect of weather on predicted water demand. In future revisions, temperature and rainfall values could be changed to evaluate the potential effect of a drought or other weather extremities on water demand.

Calibration

Actual or an estimate of actual water use for 1990 or 1995 was determined for each of the communities for the residential and non-residential categories as described below. This use was compared to the use predicted by the IWR-MAIN model and the model intercepts were adjusted in order to calibrate the model for each community.

Residential

For most of the communities, the water use for 1990, as determined from the water supply plans or estimated based on 1990 populations and gallon per capita per day values, was used for residential calibration. In cases where the city is not completely served by the municipal system, the per capita use for the residential category was determined from the water supply plan and multiplied by the total population to get total residential use regardless if they were privately or municipally supplied. In a few cases, 1995 data was used when it was more complete. In rural communities with no municipal supply or where water supply plans were incomplete or unclear, the residential use was estimated from an estimated TCMA average of 79 gallons per capita per day (gpcd) residential use for municipally supplied populations, multiplied by the 1990 population.

Non-Residential

There were several factors taken into consideration for calibration of the non-residential component of water demand. For municipalities with a public water supply system and the entire population served by the municipal system, the non-residential use was taken from data provided in the water supply plans. This was added to water use from non-municipally supplied, non-residential use, taken from the DNR SWUDS database (use reported in the non-crop irrigation and industrial categories). Other categories from the SWUDS database, (major crop irrigation, water level maintenance, air conditioning, power generation, special categories, and temporary) were not added to the non-residential category and forecasted demand was evaluated separately. It was assumed that these categories did not constitute a significant portion of the employee counts.

For communities with a public water supply system and only a portion of the population served, the non-residential use was estimated as the total gpcd use multiplied by the total population, served and unserved, minus the total estimated residential use and unaccounted water, if applicable. In other words, the non-residential use was based on total population, in order to add small businesses that have small-capacity wells and are not served and are not required to have DNR source water use permits. This estimated use was added to the use from the non-crop irrigation and industrial categories from the SWUDS database as described above.

For communities with no public water supply system, the non-residential use was estimated using average gallon per employee per day (GED) numbers from communities with no DNR permitted users. An estimate based on employee counts was made using these averages, then any water used by DNR permitted users was added to the calculated water use and new GED coefficients were determined.

Description of Non-IWR-MAIN Modeling

Several categories of water use were not included in the estimates made through IWR-MAIN. These include major crop irrigation, air conditioning, temporary, water level maintenance, special categories, and power generation.

Major crop irrigation volume was taken from the reported use on the SWUDS database for 1990 and 1995 and an average of 1988 to 1998 reported water use was used for projection years. Each community with reported major crop irrigation demand was compared to the projected 2020 and 2040 MUSAs. The projected major crop irrigation was lowered according to Council estimates of how much of the rural area was potentially going to be urban reserve or within the MUSA in 2020 and 2040.

Air conditioning and water level maintenance volumes were taken from the reported use on the SWUDS database for 1990 and 1995. An average of 1988 to 1998 reported use was used for 2000 for the once-through air conditioning. This category was assumed to go to zero by 2010 due to statutory limits set by M.S. 103G.271, Subd. 5. There are

likely some exceptions where permits will be issued beyond 2010 for air conditioning. This will be assessed in future revisions.

Most of the permits for lake level maintenance under the water level maintenance category have already been eliminated through M.S. 103G.271, Subd. 5a. The forecasted use in this category is primarily for quarry dewatering. The expected duration of individual quarry operations was considered for forecasting this category.

Water demand permitted through temporary permits was not included in the estimation of total water demand. Likely, there will be temporary permits periodically issued throughout the forecast period although it would be difficult to predict when and where these will be issued. There was no reported water use in this category prior to 1996. The total water use reported in this category in 1996 was 0.018 mgd. In 1998 it was 3.7 mgd. The trend in this category should be monitored to assess changes in future use in this category.

Water demand in the special categories category was taken as reported volumes for 1990 and 1995 from the SWUDS database. The volume used for forecast years was the average of 1988 to 1998 reported use. Most of the permits in this category were for pollution confinement, which is typically groundwater withdrawal as a means to control the migration of a plume of contaminated groundwater and/or remove contaminated groundwater for treatment. There were a few permits in this category for aquaculture, peat fire control, livestock watering, and snow making. There are some permits that will not likely continue throughout the forecast period and new ones that will be issued. As an estimate, it was assumed that the average past usage would remain constant for the forecast period.

Power generation use was taken from reported volumes for 1990 and 1995 and an average of 1988 to 1998 reported use was used for forecast years. This category represents a large portion of the water used in the TCMA. Most of the water is not consumed but returned to the source after used for cooling. Approximately 1 percent is consumed during the cooling process. Water demand at power generation sites is not anticipated to change significantly during the forecast period.

RESULTS

General Water Use Trend

Residential and non-residential water demand in 2000 is projected to account for approximately 43 percent and 33 percent, respectively, of the total demand, not including power generation. Power generation is projected to account for nearly 60 percent of the water use in 2000 in the TCMA. Because the amount used for power generation constitutes a large portion of the water used in the area and a majority of it is returned to its source in nearly the same location, much of the following discussion will not include the water used in this category unless otherwise noted.

Overall, water use in the TCMA is forecasted to increase by 21.5 percent from 2000 to 2040. The bulk of the projected water use increase is in the residential category, which is expected to increase by nearly 80 mgd over the 40-year period. Water demand in the nonresidential category is projected to increase by approximately 44 mgd during this period. The unmetered/unaccounted category is projected to increase by 9.5 mgd or 33 percent. Table 1 shows the projected water demand for the TMCA. The projected demand is shown in Figure 3. Appendix A contains the projected water demand for each of the communities in the TCMA.

Table 1

Metro Area Projected Water Demand

	1990	1995	2000	2010	2020	2030	2040	Percent Change 2000 to 2040
Residential	177.8	193.2	201.8	226.3	252.0	266.7	281.4	39.4
Nonresidential	119.7	139.3	153.4	174.7	188.4	192.8	197.2	28.5
Major Crop Irrigation	13.8	12.6	16.6	16.5	15.9	15.9	15.4	-7.4
Special Categories	8.0	13.4	16.0	16.0	16.0	16.0	16.0	0
Water Level Maintenance	23.9	34.3	32.1	25.4	16.4	16.4	16.4	-49.0
Unmetered/Unaccounted	28.1	29.6	28.6	31.9	35.0	36.5	38.1	33.0
Air Conditioning	14.7	13.3	15.8	0.0	0.0	0.0	0.0	-100
Power Generation	650.5	689.8	680.3	680.3	680.3	680.3	680.3	0
Total	1036.4	1125.4	1144.6	1171.0	1203.9	1224.5	1244.7	8.7

Million gallons per day

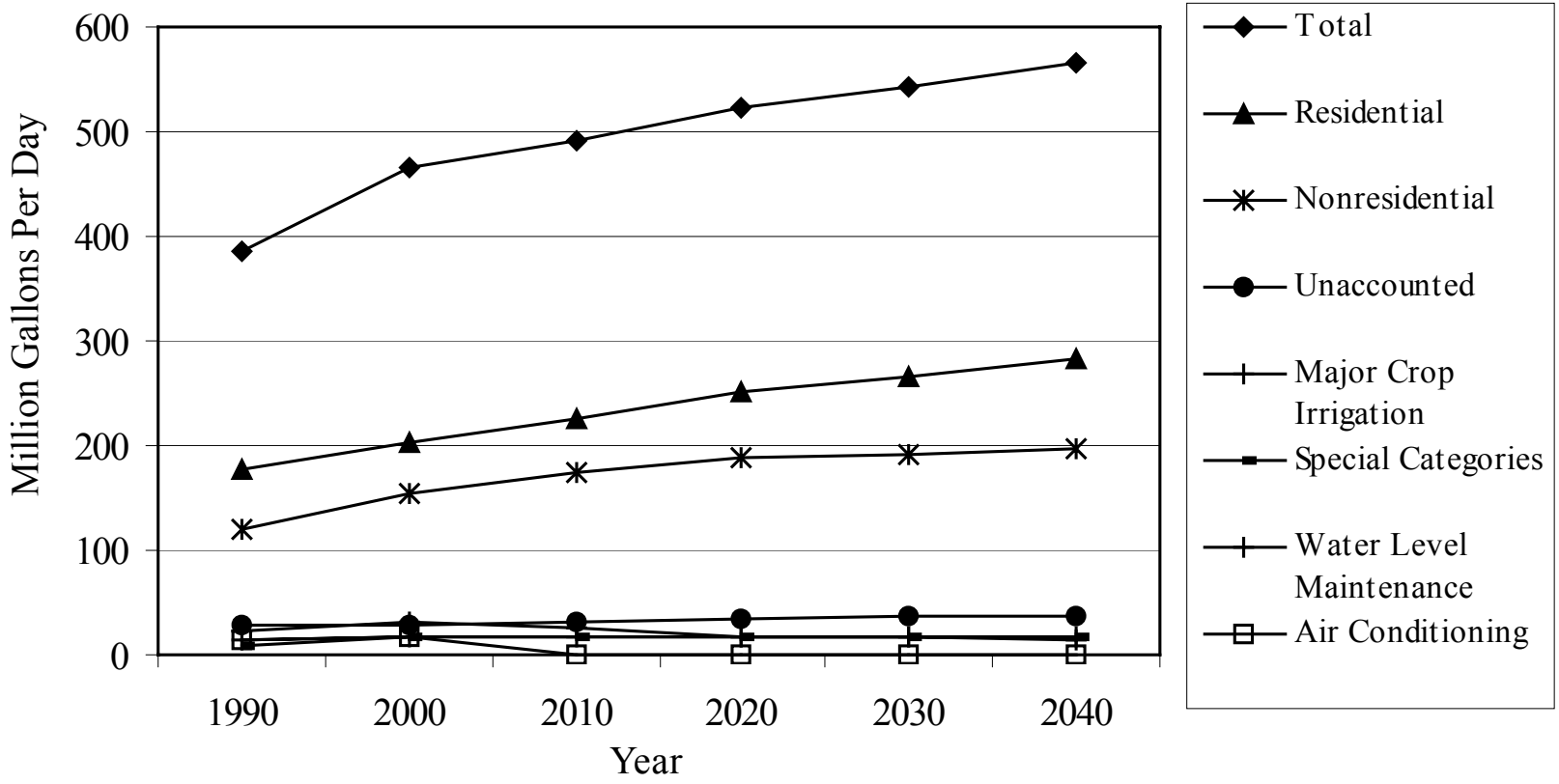
Water demand in the major crop irrigation, water level maintenance, and air conditioning categories are projected to decrease from 2000 to 2040 by 1.2, 15.7, and 15.8 mgd, respectively, for a total reduction of 32.7 mgd. The DNR is eliminating water use permits for once-through air conditioning and lake level maintenance by 2010 due to statutory limits under M.S. 103G.271, Subd. 5 and 5a. Because of this, estimated water use after this time was set to zero for most uses in these categories. The reduction in water use in the major crop irrigation category was due in part to the reduction in agricultural land as development occurs in the TCMA.

Water use in the special categories and power generation categories is estimated to remain constant for the forecast period. The values used for the forecasts were the averages of the reported use from 1988 to 1998 for each of these categories.

Comparison of Modeling Results to Trends in Reported Use

The modeling results were compared to water use for 1990 and 1995 from the DNR SWUDS database. Water use is reported to the DNR on an annual basis for each permitted user in the state. DNR water use permits are issued for users of at least 10,000 gallons per day or 1 million gallons per year. Not including water used for power

Figure 3
Metropolitan Area Projected Water Demand



generation, a reported 372.5 mgd was used in 1990 in the TCMA. The current modeling estimated 1990 use to be 385.9 mgd or 13.4 mgd (3.5 percent) higher than reported use. The 1995 water use based on the DNR database was 393.9 mgd. The current modeling estimated 435.6 mgd, 41.7 mgd (9.6 percent) higher than the reported use. As a comparison, the use from the DNR database was 404.8 mgd and 421.8 mgd for 1994 and 1996, respectively, which is closer to the projected 1995 demand. The higher modeled use was likely related to the fact that the current modeling effort was conducted to take into consideration all water users in the TCMA, including small users who would not be required to have a DNR permit.

A best fit line was generated through regression analysis for the water use reported from DNR permitted water users from 1990 to 1998 in the TCMA. There was fairly close correlation of the total water demand for the forecast years (Figure 4). A comparison of reported water use in the waterworks category from the SWUDS database, to the projected water demand in the residential, nonresidential and unmetered/unaccounted categories, also shows a strong correlation (Figure 5). The waterworks category would include all of the municipal suppliers and other suppliers to residential users in the TCMA who were required, due to their volume, to have a permit. In the current modeling, the sum of the residential, non-residential, and unmetered/unaccounted categories approximately represents the SWUDS waterworks category. The projected water demand based on the current modeling is higher than the reported water use in the waterworks category. Again, this is likely due to the users who, because of their relatively low volume, are not required to obtain a permit. Because the modeling is based on housing units and employee counts, the projected water demand includes these users and therefore is higher than what was reported to the DNR.

Per Capita Use

The projected residential gallon per capita per day (gpcd) for the TCMA shows a slight increasing trend for the forecast years from 78 gpcd in 1990 to an estimated 82 gpcd in 2040. The overall per capita use is projected to decrease from 169 to 164 gpcd in this period. The projected decreasing trend in the overall gpcd is due in part to the elimination of water used for lake level maintenance and once-through air conditioning, and the reduction in major crop irrigation due to urbanization. These trends do not take into account the effect that conservation measures may have on consumption except in communities where a program to reduce unaccounted/unmetered water was outlined in a water supply plan. For those communities, the unaccounted/unmetered percentage was reduced for forecast years according to the community's projected reduction. Per capita demand is a measure of water demand and is affected by conservation measures and weather. A water conservation plan is a requirement of the water supply plans prepared by the communities with municipal supplies. As a result, most of the municipally supplied communities (120 of 123) have some form of water conservation plan. This may help to decrease TCMA per capita residential water consumption in the future. Table 2 shows the projected gpcd use for the TCMA.

Figure 4
IWR-MAIN Modeling vs. Regression Model Totals

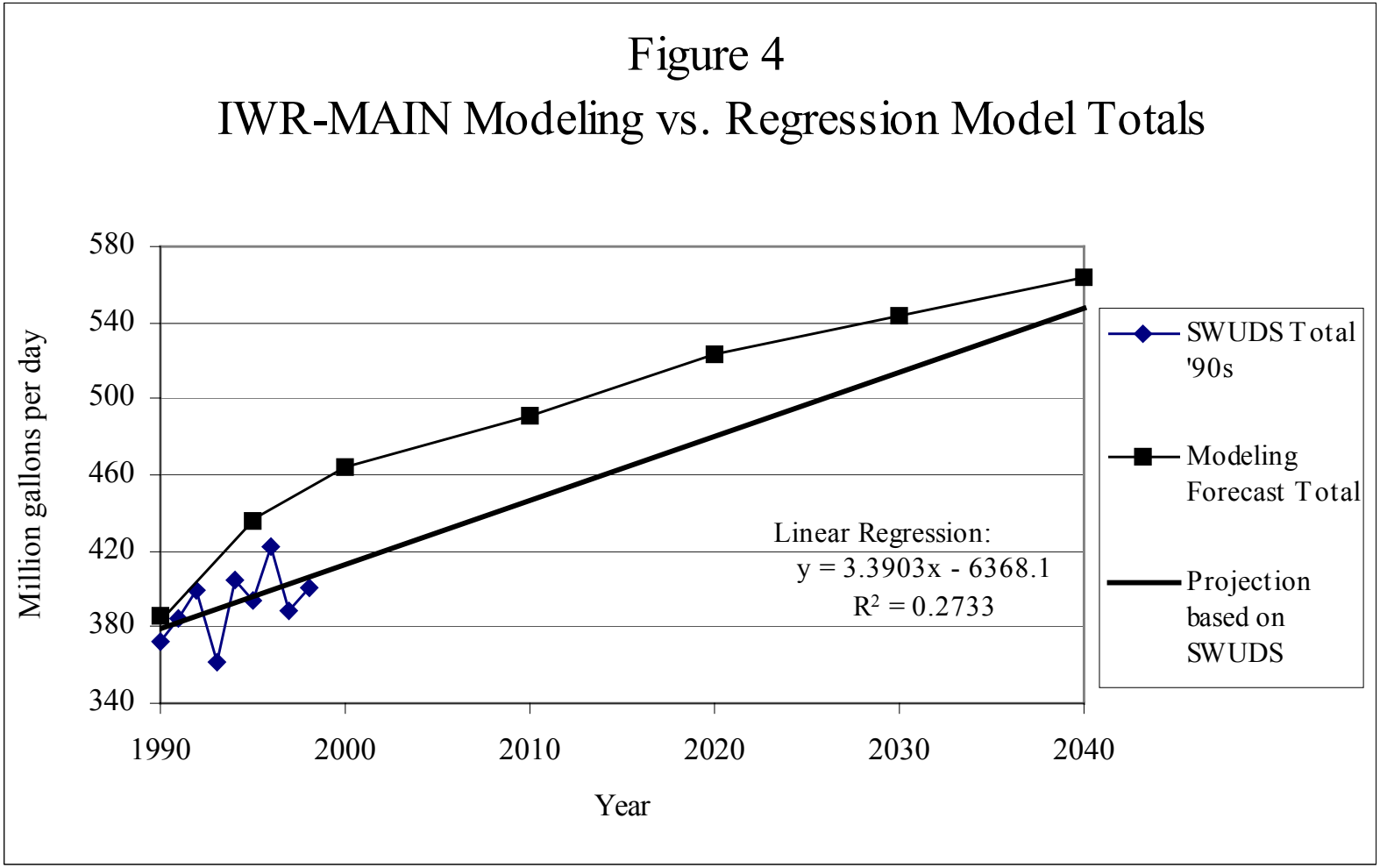


Figure 5
State Water Use Data System Waterworks vs. IWR-MAIN Residential/Nonresidential Categories

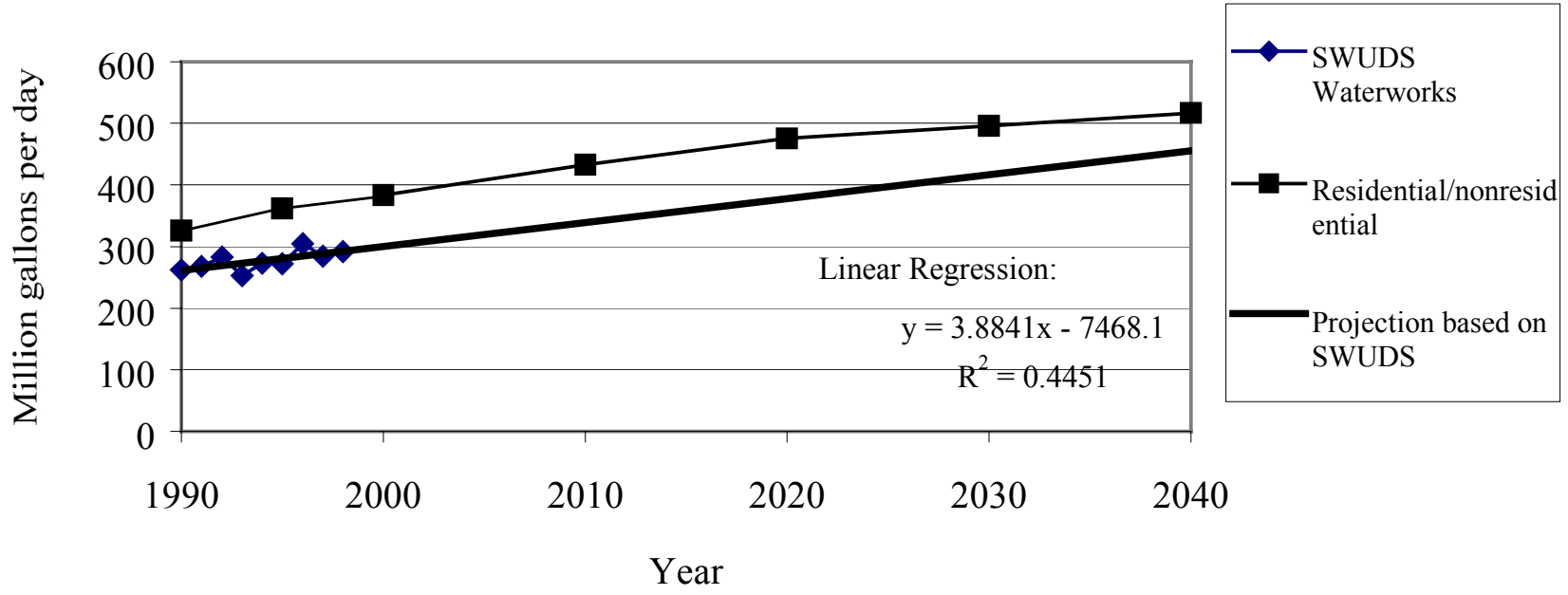


Table 2

Metro Area Projected Gallon Per Capita Demand

	1990	1995	2000	2010	2020	2030	2040
Residential	77.8	79.0	77.5	79.9	81.7	81.8	81.9
Overall	168.8	178.1	178.2	173.2	169.7	166.9	164.2

Gallons per capita per day

Projected Water Demand by Geography

Residential and overall water demand is predicted to increase by approximately 25 percent and 13 percent, respectively, from 2000 to 2020, and by 39 percent and 22 percent, respectively from 2000 to 2040. The highest percent increase is expected to take place in the middle- and outer-ring communities. Projected percent water demand increase is expected to be lowest in the inner ring and central cities along with the rural areas. This would be expected for areas that have experienced the bulk of the growth allowed by the constraints of the available land. The projected residential and overall percent increase in water demand is relatively consistent in most areas of the TCMA. A notable exception is in Shakopee where a relatively high increase in residential demand is predicted and a relatively low overall increase in demand is predicted. This is due to the cessation of quarry operations that are consuming large amounts of water for quarry dewatering. Figures 6 and 7 show the projected residential and overall percent water demand increase, respectively, from 2000 to 2020 in the TCMA.

Increase in residential water demand is expected to be highest primarily in the central cities and inner ring. This is due to the high populations in these areas where a low percent increase in water demand results in a relatively high volume increase. The overall projected increase in water consumption mirrors the projected residential increase except in the inner core where the reduction of water used for once-through air conditioning lowers the total increase in water demand. Figures 8 and 9 show the projected residential and overall change in water demand, respectively, in million gallons per day from 2000 to 2020 in the TCMA.

The overall highest water demand is primarily concentrated in the inner core and suburbs with higher populations. This is not expected to change over time. As the second ring suburbs grow, water demand in these areas will increase. Overall, water use in forecast years is projected to remain highest in the inner core and large suburbs with a slight shift outward to some of the growing suburbs.

Areas of Concern

As the TCMA continues to grow, additional sources of water will be necessary to meet the increasing demand. The Council will continue to study regional water supply and the

Figure 6
Projected Residential Percent Water Demand Change 2000 to 2020

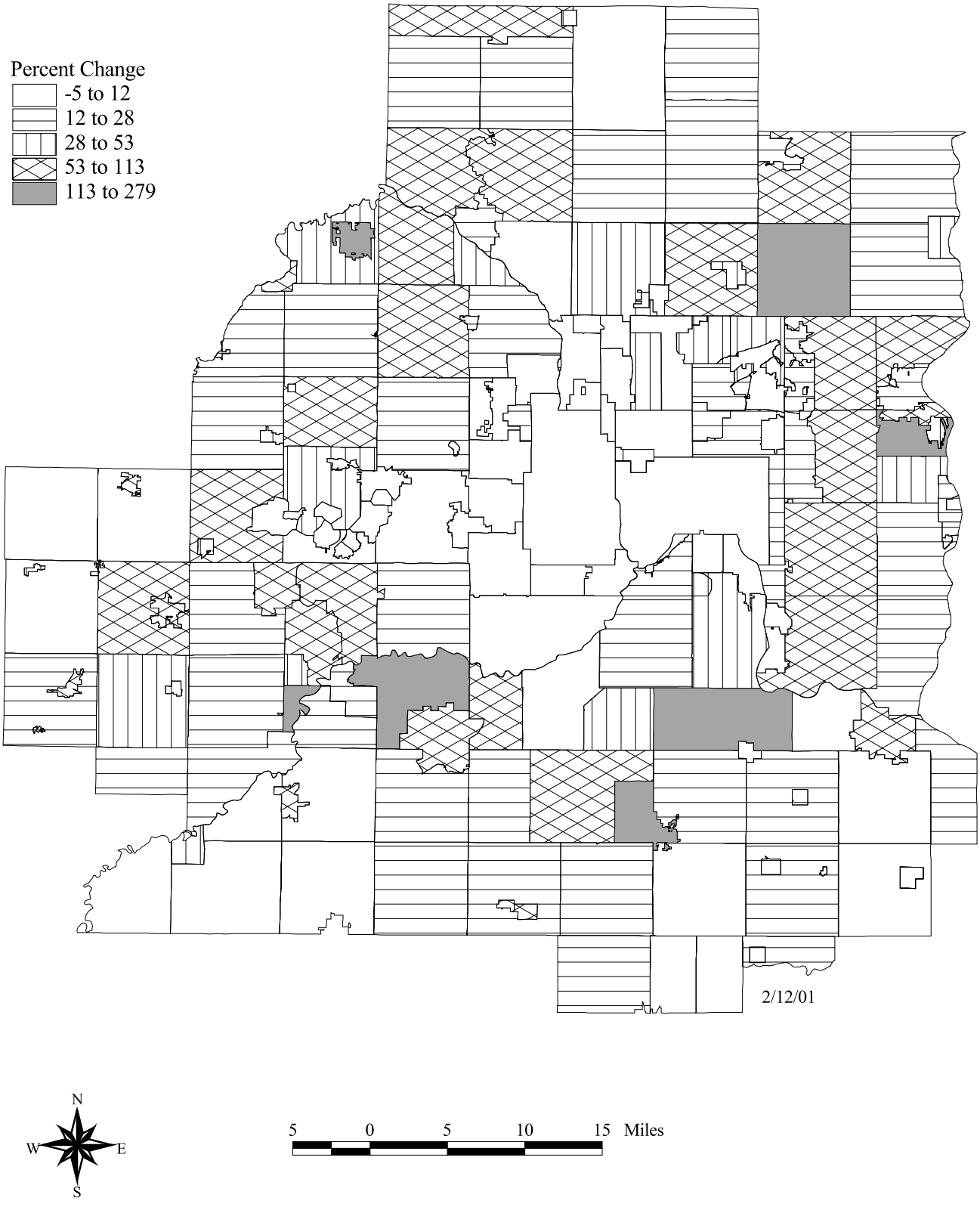


Figure 7
Projected Total Percent Water Demand Change 2000 to 2020

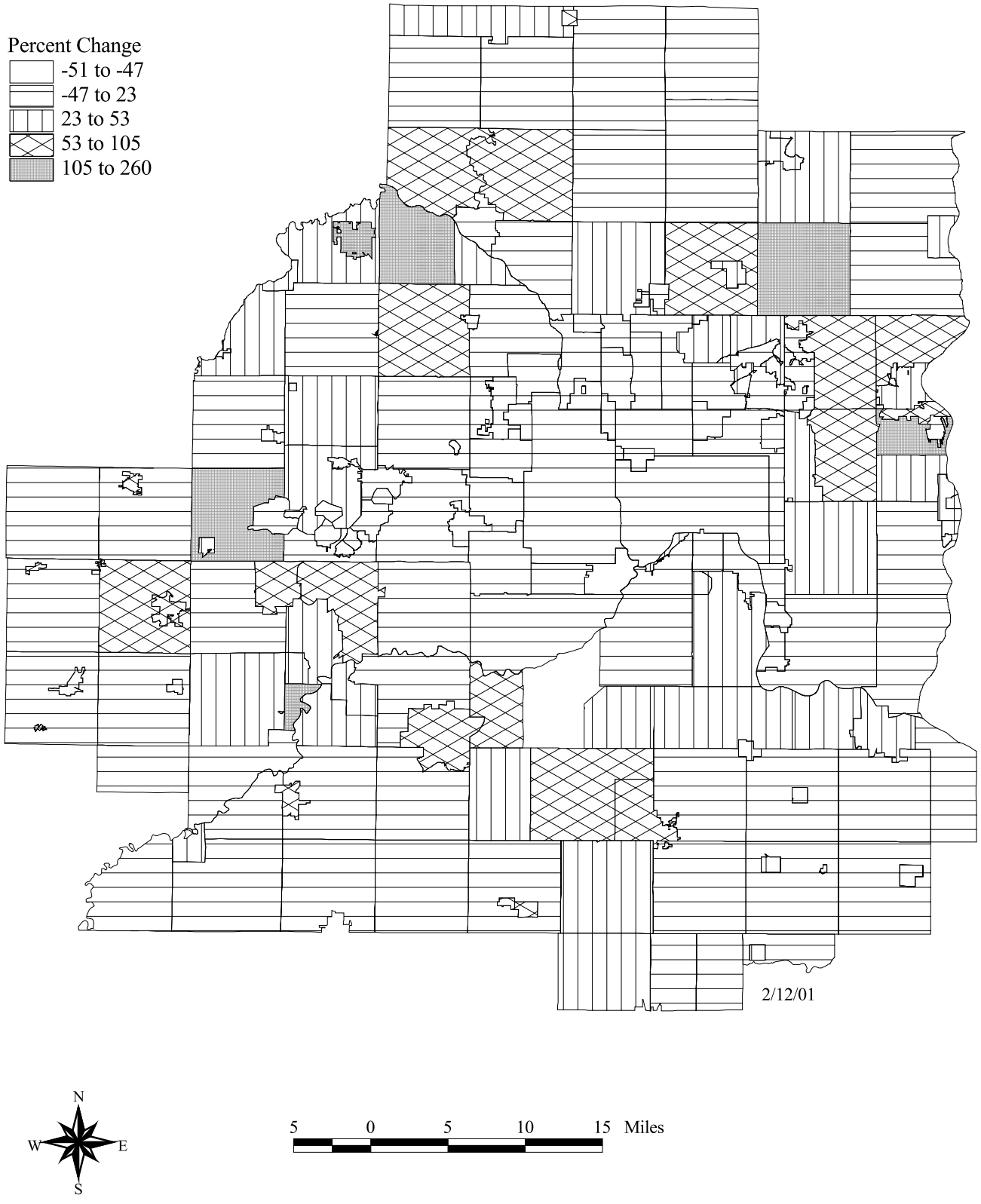


Figure 8
Projected Residential Water Demand Change 2000 to 2020

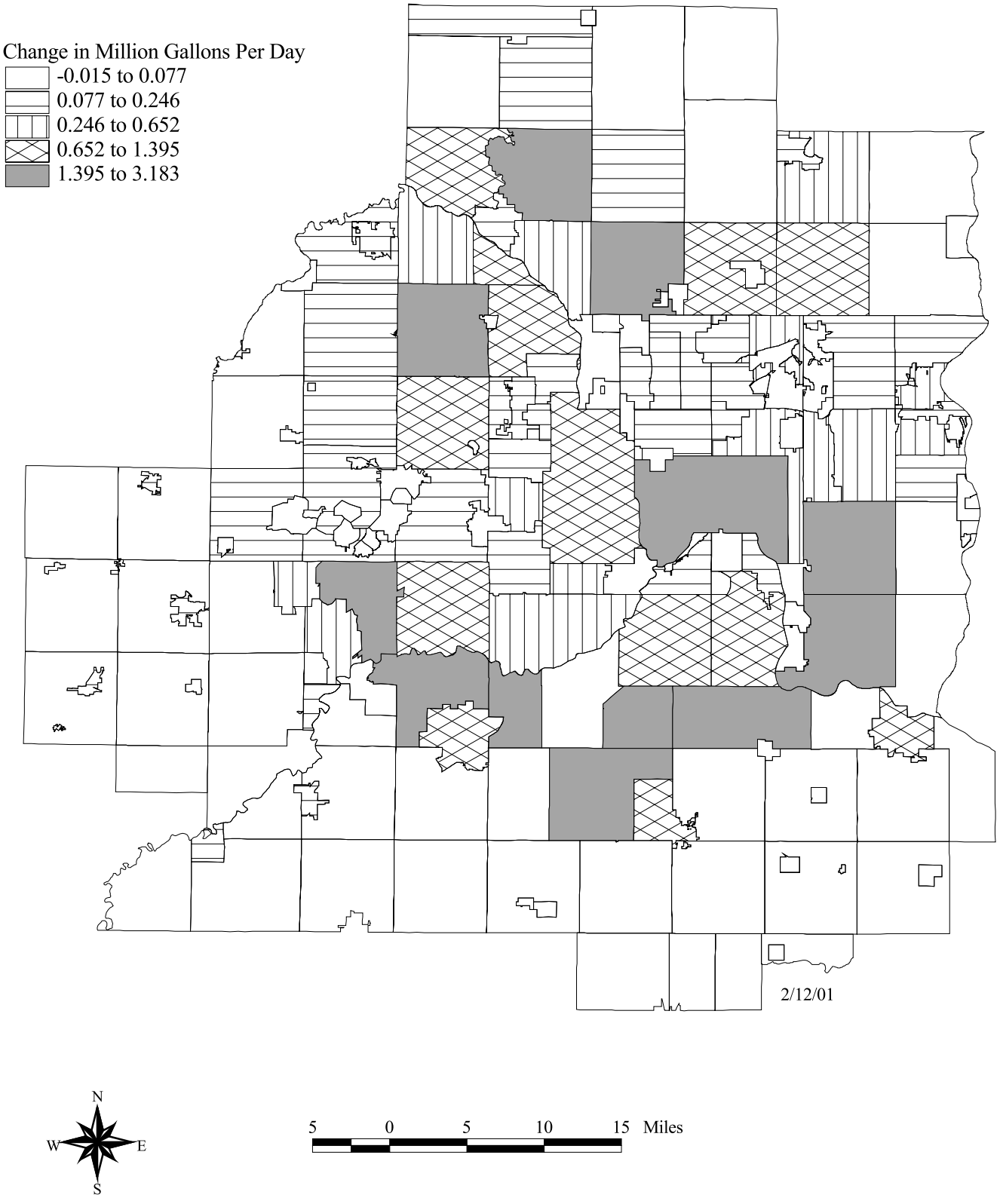


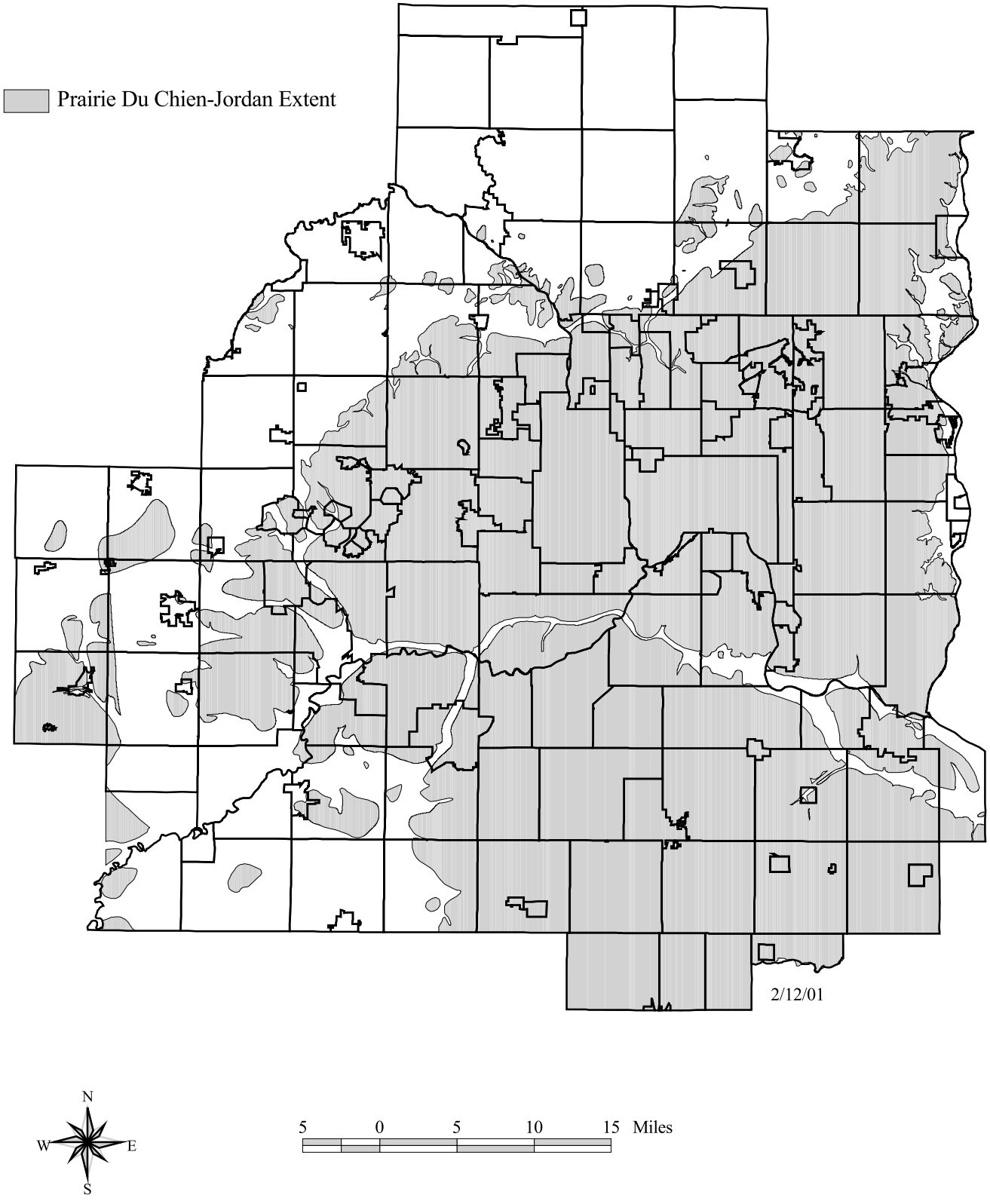
Figure 9
Projected Total Water Demand Change 2000 to 2020

ability of the supply sources to meet increasing demand, and will continue to address specific areas in the metropolitan area where water supply issues arise. Two areas where supply is currently of concern are the southwest and northwest metro areas. In the rapidly developing southwest metropolitan area, there are natural features that are sensitive to groundwater withdrawal. In the northwest metropolitan area, another region experiencing rapid growth, the prolific Prairie du Chien-Jordan aquifer is absent. Other potential areas of concern include areas where groundwater quality is degraded due to the natural conditions or human influence. The communities that are supplied solely by surface waters, which are more easily susceptible to contamination and drought, continue to be a concern.

In the southwest metropolitan area, residential water demand in the City of Savage is forecasted to increase by 96 percent between 2000 and 2020 and total demand by 63 percent during this period. In Shakopee, residential demand is forecasted to increase 134 percent during this period. The overall use in Shakopee is forecasted to decrease due to the closing of a quarry in the area. Because the quarry used privately owned wells for dewatering, the closing will not reduce the need for additional municipal wells. However, the potential decline in groundwater levels due to the additional municipal wells may be offset to some degree by the discontinuation of the quarry dewatering. Water demand in the City of Prior Lake is forecasted to increase 94 percent and 82 percent in the residential and total water categories, respectively, between 2000 and 2020. There are several environmentally unique features in the southwest metropolitan area that are sensitive to groundwater withdrawal. The Savage Fen Wetland Complex contains a calcareous fen, which is a rare type of wetland that develops where calcium-magnesium-bicarbonate-rich groundwater discharges to the surface. It supports several uncommon, sensitive, plant species that grow only in the unique hydrogeochemical conditions found in calcareous fens. Because of its rarity and sensitivity, the Savage Fen, in addition to other calcareous fens in the state, has been the focus of several studies and is protected by the DNR under a state statute. Also present near the Savage Fen is the Boiling Springs, a naturally bubbling spring which is a sacred site to the Shakopee Mdewakanton Sioux Community. This spring is part of the headwaters of Eagle Creek, which is a trout stream managed by the DNR. Because of the hydrogeologic setting of these features, additional groundwater withdrawal from the Prairie du Chien-Jordan Aquifer is a concern. As the population grows in this area, additional sources of water will be necessary to meet an increasing demand. A group of representatives from the communities, local and state government agencies, and other interested parties facilitated by the Council, known as the Southwest Metro Groundwater Work Group has been meeting since 1997 to address the water supply issues in the area. The Council is conducting groundwater modeling to explore different scenarios of groundwater withdrawal and the impact of each on the area.

Another area of concern is the northwestern area of the TCMA where the Prairie du Chien-Jordan Aquifer is absent. Residential water demand in Andover, Dayton, Hassan Township, Ramsey, and Rogers is expected to increase by an average of 94 percent from 2000 to 2020. Total demand is forecasted to increase by an average of 81 percent during this period. Figure 10 shows the extent of the Prairie du Chien-Jordan Aquifer. The most viable alternatives for water supply sources are the Franconia-Ironton-Galesville (FIG) or

Figure 10
Extent of Prairie Du Chien-Jordan Aquifer in the Metropolitan Area



Mt. Simon-Hinckley (MTSH) aquifers. These units typically provide lower yields than the Prairie du Chien-Jordan aquifer. Minnesota Statutes 103G.271, subd. 4a., restricts the issuance of permits by the DNR for appropriation from the MTSH aquifer unless the appropriation is for potable water use and there are no other alternatives. This unit is considered a last resort reservoir for use in the TCMA. The glacial drift, which is made up of the unconsolidated sediments on top of the bedrock, is a potential source of groundwater in this area. Locally, this aquifer can yield high volumes of water but, because typically no impermeable layer exists above it, the aquifer can be highly susceptible to contamination. Due to its proximity, the Mississippi River may be a potential source of water for the area, although use of surface waters requires additional treatment that may be cost prohibitive. Another alternative is community interconnections to share the available resources. Many communities maintain interconnections for emergency purposes. Others buy or sell water to neighboring communities on a wholesale or retail basis. Typically these interconnections are for convenience and/or emergency purposes, but in the future may be necessary for everyday water supply and/or the protection of an available resource.

Contamination of source waters is a constant concern for water suppliers. It is generally agreed that surface waters are more susceptible to contaminants although contaminants in groundwater are often more persistent. There are some areas in the TCMA where there has been contamination of groundwater sources because of land use practices and/or the natural compounds in the geologic materials. According to the Minnesota Department of Health (MDH), bacterial contamination was detected in two communities in the TCMA in 1999: Lake Elmo and North St. Paul. These systems were disinfected and re-tested. Nitrate above the maximum contaminant level (MCL) of 10 parts per million was detected in a well in Hastings during 1999. This well was taken out of service. Subsequent re-testing showed the nitrate concentration to be below the MCL and the well is now back in service. Nitrate has been detected at levels below the MCL in other wells used for water supply in the TCMA. Studies are currently underway to determine the source and extent of nitrate contamination in some impacted areas. Radium 226 and 228 were detected above the MCL in 1999 in the Norwood-Young America and Savage water supplies. The Savage supply also exceeded the MCL for gross alpha emitters. The residents of these communities were told that this is not an emergency situation and the communities are currently studying alternatives to correct the problem (MDH 2000).

SUMMARY AND CONCLUSIONS

Water in the TCMA is obtained from a combination of surface waters and groundwater. Municipalities supply much of the water used in the region. Other users of large volumes of water also obtain water from surface or groundwater through permits issued by the Minnesota DNR. Smaller users, including households not supplied by municipalities, obtain water often from private wells and are not required to have a DNR permit.

The Metropolitan Council conducted water demand modeling for the TCMA as part of an update of the *Long-Term Water Use and Supply Plan*. Residential, nonresidential, and

unaccounted/unmetered demand was projected using the IWR-MAIN water demand forecasting model. Projections in other categories of water demand (major crop irrigation, power generation, air conditioning, temporary, special categories, and water level maintenance) were made using data collected from the DNR SWUDS database.

Total water demand in the TCMA is forecasted to increase by approximately 21.5 percent or 100 mgd from 2000 to 2040. This includes a net reduction of use in the water level maintenance and once-through air conditioning use categories. Combined use in the residential, nonresidential (commercial, industrial and institutional) and unmetered/unaccounted categories is expected to increase by 35 percent or 133 mgd from 2000 to 2040. Large increases are forecasted in areas where, because of the geologic characteristics, additional water supply is of special concern. Continued planning is necessary to ensure that adequate water supplies are available for future generations. As the TCMA continues to grow, conservation and coordination among suppliers will become more important to protect the natural resources and valuable water supplies currently available.

REFERENCES

Hartsoe, Judith A., 1991. Water Demand In The Twin Cities Metropolitan Area. St. Paul: Metropolitan Council.

PMCL, 1996. IWR-MAIN Water Demand Analysis Software Version 6.1, Users Manual and System Description. Carbondale, Illinois: Planning and Management Consultants, Ltd.

MDH, 2000. Safe Drinking Water in Minnesota, A Partnership with the People, A Summary of Drinking Water Protection Activities in Minnesota for 1999. St. Paul: Minnesota Department of Health.

APPENDIX A

Water Demand Projections for Twin Cities Metropolitan Area Communities

Anoka County

Projected Water Use In Million Gallons Per Day

Andover	1990	1995	2000	2010	2020	2030	2040
Residential	1.466528	2.066491	2.455057	3.351619	4.288238	5.043264	5.806455
Total Nonresidential	0.186312	0.221166	0.312434	0.430479	0.496788	0.557142	0.617845
Unmetered/Unaccounted	0.016695	0.146021	0.176648	0.241411	0.305427	0.357473	0.410062
Major Crop Irrigation	0.023548	0.017941	0.067256	0.067256	0.053804	0.053804	0.044837
Special Categories	0.000000	0.098732	0.104946	0.104946	0.104946	0.104946	0.104946
Total	1.693083	2.550351	3.116341	4.195710	5.249203	6.116628	6.984144

Anoka	1990	1995	2000	2010	2020	2030	2040
Residential	0.992429	1.000419	1.035358	1.083528	1.163303	1.197123	1.229215
Total Nonresidential	1.246298	1.396167	1.473656	1.641122	1.683232	1.720153	1.743202
Unmetered/Unaccounted	0.426424	0.456493	0.477907	0.302739	0.316282	0.324142	0.330268
Special Categories	0.000000	0.209278	0.151669	0.151669	0.151669	0.151669	0.151669
Total	2.665151	3.062357	3.138590	3.179057	3.314485	3.393087	3.454353

Bethel	1990	1995	2000	2010	2020	2030	2040
Residential	0.031206	0.034542	0.035532	0.046670	0.053395	0.056181	0.058734
Total Nonresidential	0.011454	0.014152	0.018804	0.026867	0.031493	0.031493	0.031493
Unmetered/Unaccounted	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Total	0.042660	0.048695	0.054337	0.073537	0.084888	0.087674	0.090227

Blaine	1990	1995	2000	2010	2020	2030	2040
Residential	3.603226	3.960675	4.184288	5.079927	5.841744	6.249396	6.667039
Total Nonresidential	0.595894	0.921849	1.031258	1.144858	1.196679	1.238158	1.279728
Unmetered/Unaccounted	0.129870	0.151006	0.161306	0.192519	0.217683	0.231574	0.245776
Major Crop Irrigation	0.000000	0.000000	0.080548	0.080548	0.040274	0.040274	0.000000
Total	4.328989	5.033530	5.457400	6.497853	7.296379	7.759401	8.192543

Burns Township	1990	1995	2000	2010	2020	2030	2040
Residential	0.189676	0.243750	0.268475	0.295514	0.320574	0.353514	0.386559
Total Nonresidential	0.013180	0.015439	0.017398	0.020056	0.021164	0.021164	0.021164
Major Crop Irrigation	0.040981	0.020564	0.056926	0.056926	0.056926	0.056926	0.056926
Total	0.243837	0.279753	0.342799	0.372496	0.398664	0.431605	0.464649

Centerville	1990	1995	2000	2010	2020	2030	2040
Residential	0.101510	0.138961	0.179091	0.218908	0.255950	0.281534	0.303892
Total Nonresidential	0.012062	0.015315	0.018962	0.028768	0.032648	0.032648	0.032648
Unmetered/Unaccounted	0.001147	0.001558	0.002001	0.002502	0.002915	0.003174	0.003399
Total	0.114719	0.155834	0.200054	0.250178	0.291513	0.317356	0.339940

Circle Pines	1990	1995	2000	2010	2020	2030	2040
Residential	0.404129	0.421557	0.413261	0.418449	0.443425	0.443425	0.443425
Total Nonresidential	0.025613	0.021520	0.022497	0.023818	0.024469	0.024469	0.024469
Unmetered/Unaccounted	0.047749	0.072129	0.070937	0.071997	0.076169	0.076169	0.076169
Total	0.477490	0.515206	0.506695	0.514264	0.544063	0.544063	0.544063

Columbus Twp./ Linwood Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.574996	0.671294	0.706040	0.768156	0.820741	0.899698	0.979104
Total Nonresidential	0.014586	0.037054	0.039602	0.040902	0.043159	0.043159	0.043159
Special Categories	0.177534	0.177534	0.177534	0.177534	0.177534	0.177534	0.177534
Total	0.767117	0.885882	0.923176	0.986593	1.041434	1.120391	1.199797

Columbia Heights	1990	1995	2000	2010	2020	2030	2040
Residential	1.177561	1.169956	1.151278	1.163697	1.196732	1.196732	1.196732
Total Nonresidential	0.326626	0.423122	0.427072	0.434421	0.448493	0.448493	0.448493
Total	1.504188	1.593078	1.578350	1.598118	1.645225	1.645225	1.645225

Coon Rapids	1990	1995	2000	2010	2020	2030	2040
Residential	4.539319	5.327670	5.400905	5.708617	5.838143	5.923146	6.007916
Total Nonresidential	1.059820	1.270729	1.476549	1.684185	1.763193	1.781757	1.792987
Unmetered/Unaccounted	0.056557	0.066650	0.069469	0.074675	0.076781	0.077827	0.078797
Major Crop Irrigation	0.000000	0.000000	0.068562	0.000000	0.000000	0.000000	0.000000
Water Level Maintenance	0.014737	0.005909	0.000000	0.000000	0.000000	0.000000	0.000000
Total	5.670433	6.670959	7.015485	7.467476	7.678117	7.782731	7.879700

East Bethel	1990	1995	2000	2010	2020	2030	2040
Residential	0.635854	0.736736	0.822180	0.873242	0.899373	0.977052	1.053676
Total Nonresidential	0.020593	0.080823	0.097867	0.119718	0.130159	0.145413	0.160166
Major Crop Irrigation	0.000000	0.000000	0.003909	0.003909	0.003909	0.003909	0.003909
Total	0.656447	0.817559	0.923956	0.996869	1.033442	1.126375	1.217751

Fridley	1990	1995	2000	2010	2020	2030	2040
Residential	2.224739	2.241300	2.225599	2.254388	2.293595	2.293595	2.293595
Total Nonresidential	2.199041	2.250914	2.400534	2.880614	3.072568	3.072568	3.072568
Unmetered/Unaccounted	0.384677	0.390627	0.402272	0.446522	0.466623	0.466623	0.466623
Special Categories	0.176123	0.895567	0.943859	0.943859	0.943859	0.943859	0.943859
Total	4.984580	5.778409	5.972264	6.525383	6.776644	6.776644	6.776644

Ham Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.704682	0.833804	1.003543	1.102926	1.217596	1.486660	1.755486
Total Nonresidential	0.306350	0.480617	0.506024	0.557620	0.578230	0.611548	0.645019
Major Crop Irrigation	0.005899	0.006026	0.119125	0.119125	0.119125	0.119125	0.119125

Total	1.016930	1.320447	1.628692	1.779671	1.914950	2.217333	2.519630

Hilltop	1990	1995	2000	2010	2020	2030	2040
Residential	0.052311	0.052932	0.050535	0.050205	0.050205	0.050205	0.050205
Total Nonresidential	0.022675	0.024024	0.028704	0.034353	0.039958	0.039958	0.039958
Unmetered/Unaccounted	0.007416	0.007611	0.007837	0.008363	0.008917	0.008917	0.008917
Total	0.082402	0.084567	0.087076	0.092921	0.099080	0.099080	0.099080

Lexington	1990	1995	2000	2010	2020	2030	2040
Residential	0.142009	0.143334	0.141926	0.147087	0.149730	0.152342	0.155210
Total Nonresidential	0.021353	0.044193	0.051655	0.058164	0.064619	0.064619	0.064619
Unmetered/Unaccounted	0.008598	0.009870	0.010188	0.010803	0.011282	0.011419	0.011570
Total	0.171960	0.197398	0.203769	0.216054	0.225631	0.228380	0.231399

Lino Lakes	1990	1995	2000	2010	2020	2030	2040
Residential	0.594905	0.897994	1.057830	1.407280	1.788332	2.235415	2.682499
Total Nonresidential	0.060396	0.124888	0.171443	0.200598	0.217423	0.253551	0.289813
Unmetered/Unaccounted	0.089359	0.139484	0.167628	0.219256	0.273512	0.339404	0.405315
Major Crop Irrigation	0.001512	0.002515	0.013123	0.013123	0.004374	0.004374	0.003281
Total	0.746173	1.164881	1.410024	1.840257	2.283642	2.832745	3.380907

Oak Grove Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.433267	0.506403	0.551364	0.609575	0.679631	0.748808	0.817984
Total Nonresidential	0.007029	0.025538	0.026026	0.027688	0.030781	0.034596	0.038340
Unmetered/Unaccounted	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Major Crop Irrigation	0.000000	0.026630	0.018520	0.018520	0.018520	0.018520	0.018520
Total	0.440296	0.558571	0.595909	0.655784	0.728932	0.801923	0.874845

Ramsey	1990	1995	2000	2010	2020	2030	2040
Residential	1.353037	1.786947	2.129430	2.775908	3.524635	3.977903	4.430819
Total Nonresidential	0.343688	0.494793	0.622727	0.996408	1.170291	1.232000	1.293801
Major Crop Irrigation	0.027222	0.016307	0.033351	0.033351	0.025013	0.025013	0.016675
Special Categories	0.000000	0.641024	0.689944	0.689944	0.689944	0.689944	0.689944
Total	1.723948	2.939071	3.475451	4.495610	5.409883	5.924859	6.431238

St. Francis	1990	1995	2000	2010	2020	2030	2040
Residential	0.203033	0.256306	0.334152	0.426882	0.553341	0.614247	0.674568
Total Nonresidential	0.079877	0.076662	0.085502	0.104089	0.107804	0.107804	0.107804
Unmetered/Unaccounted	0.038579	0.045405	0.057225	0.072405	0.090156	0.098461	0.106687
Major Crop Irrigation	0.038466	0.026926	0.059608	0.059608	0.059608	0.059608	0.059608
Total	0.359954	0.405299	0.536487	0.662985	0.810910	0.880120	0.948668

Spring Lake Park	1990	1995	2000	2010	2020	2030	2040
Residential	0.476629	0.502403	0.498849	0.482388	0.483933	0.497982	0.512291
Total Nonresidential	0.173655	0.247549	0.287412	0.372127	0.394107	0.394107	0.394107
Unmetered/Unaccounted	0.088675	0.039471	0.041382	0.044974	0.046213	0.046952	0.047705
Special Categories	0.000000	0.002505	0.004895	0.004895	0.004895	0.004895	0.004895
Total	0.738959	0.791929	0.832537	0.904384	0.929147	0.943936	0.958997

Carver County

Projected Water Demand In Million Gallons Per Day

Benton Twp./Cologne	1990	1995	2000	2010	2020	2030	2040
Residential	0.076262	0.087644	0.095300	0.111815	0.126300	0.129841	0.133060
Total Nonresidential	0.245588	0.347626	0.402600	0.426003	0.442200	0.442200	0.442200
Unmetered/Unaccounted	0.096137	0.130016	0.124475	0.134455	0.142125	0.143010	0.143815
Total	0.417988	0.565286	0.622375	0.672273	0.710625	0.715052	0.719075

Camden Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.071807	0.081680	0.081697	0.084390	0.086624	0.090532	0.094690
Total Nonresidential	0.002988	0.000976	0.002687	0.007569	0.009764	0.009764	0.009764
Special Categories	0.000000	0.095868	0.076694	0.076694	0.076694	0.076694	0.076694
Total	0.074795	0.178525	0.161078	0.168653	0.173082	0.176991	0.181148

Carver	1990	1995	2000	2010	2020	2030	2040
Residential	0.052331	0.057205	0.085535	0.142558	0.209387	0.217767	0.225870
Total Nonresidential	0.004123	0.004941	0.006095	0.007529	0.009430	0.009430	0.009430
Unmetered/Unaccounted	0.003603	0.003967	0.005849	0.009580	0.013967	0.014502	0.015019
Total	0.060057	0.066112	0.097478	0.159667	0.232784	0.241699	0.250319

Chanhassen	1990	1995	2000	2010	2020	2030	2040
Residential	1.044405	1.363871	1.638677	2.315992	3.257226	3.777349	4.294340
Total Nonresidential	0.410379	0.520497	0.633472	0.794403	0.871601	0.909075	0.946581
Unmetered/Unaccounted	0.126503	0.163858	0.197578	0.270469	0.359028	0.407515	0.455732
Total	1.581287	2.048226	2.469728	3.380864	4.487856	5.093938	5.696653

Chaska	1990	1995	2000	2010	2020	2030	2040
Residential	0.804830	0.998713	1.104932	1.437757	1.756922	2.084011	2.412166
Total Nonresidential	0.583291	0.874438	0.948300	1.082579	1.107693	1.136857	1.165789
Unmetered/Unaccounted	0.171565	0.231513	0.253770	0.280037	0.318291	0.357874	0.397551
Water Level Maintenance	0.000000	0.019383	0.000000	0.000000	0.000000	0.000000	0.000000
Total	1.559686	2.124047	2.307003	2.800373	3.182905	3.578741	3.975506

Chaska Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.013787	0.014953	0.015425	0.019067	0.022682	0.023196	0.023657
Total Nonresidential	0.003659	0.002660	0.005713	0.006690	0.008075	0.008075	0.008075
Total	0.017445	0.017612	0.021138	0.025757	0.030757	0.031271	0.031732

Dahlgren Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.102533	0.114636	0.120821	0.128489	0.136160	0.145436	0.154976
Total Nonresidential	0.051250	0.456116	0.507626	0.561727	0.692743	0.692743	0.692743

Total	0.153784	0.570752	0.628447	0.690216	0.828903	0.838179	0.847719
Hancock Twp./ San Francisco Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.089872	0.106826	0.113741	0.122544	0.128398	0.137357	0.146434
Total Nonresidential	0.001106	0.001871	0.002684	0.003648	0.004066	0.004066	0.004066
Major Crop Irrigation	0.007964	0.003468	0.008565	0.008565	0.008565	0.008565	0.008565
Total	0.098942	0.112165	0.124989	0.134758	0.141029	0.149988	0.159065
Hollywood Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.083699	0.091217	0.095152	0.099830	0.104366	0.108079	0.111826
Total Nonresidential	0.000582	0.003393	0.004475	0.004475	0.004475	0.004475	0.004475
Total	0.084281	0.094611	0.099627	0.104305	0.108842	0.112555	0.116301
Laketown Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.176149	0.190572	0.195821	0.212836	0.224412	0.237953	0.251558
Total Nonresidential	0.062760	0.030774	0.048328	0.056404	0.059651	0.059651	0.059651
Total	0.238908	0.221346	0.244149	0.269240	0.284063	0.297604	0.311209
Mayer	1990	1995	2000	2010	2020	2030	2040
Residential	0.028882	0.032254	0.033785	0.043495	0.053230	0.054549	0.056121
Total Nonresidential	0.007228	0.006901	0.009987	0.012936	0.016398	0.016398	0.016398
Unmetered/Unaccounted	0.004012	0.004350	0.004864	0.006270	0.007736	0.007883	0.008058
Total	0.040122	0.043505	0.048635	0.062702	0.077364	0.078830	0.080576
New Germany	1990	1995	2000	2010	2020	2030	2040
Residential	0.013471	0.014482	0.015109	0.018887	0.021653	0.022243	0.022864
Total Nonresidential	0.016882	0.012788	0.015323	0.024052	0.027499	0.027499	0.027499
Unmetered/Unaccounted	0.010664	0.009581	0.010693	0.015086	0.017270	0.017477	0.017695
Total	0.041017	0.036851	0.041125	0.058025	0.066421	0.067218	0.068058
Norwood/Young America	1990	1995	2000	2010	2020	2030	2040
Residential	0.164198	0.181548	0.189715	0.242520	0.298236	0.310649	0.322901
Total Nonresidential	0.087120	0.162169	0.177342	0.185158	0.193095	0.193095	0.193095
Unmetered/Unaccounted	0.107707	0.147307	0.157310	0.047520	0.054592	0.055971	0.057333
Total	0.359024	0.491024	0.524367	0.475198	0.545922	0.559715	0.573328
Victoria	1990	1995	2000	2010	2020	2030	2040
Residential	0.208148	0.292724	0.353782	0.512882	0.752957	0.886530	1.020489
Total Nonresidential	0.095331	0.203335	0.227728	0.284932	0.316993	0.353547	0.390733
Total	0.303478	0.496059	0.581510	0.797814	1.069950	1.240077	1.411222

Waconia/Waconia Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.275659	0.338851	0.432096	0.573406	0.723279	0.777029	0.831939
Total Nonresidential	0.288667	0.350748	0.389026	0.599014	0.702911	0.702911	0.702911
Unmetered/Unaccounted	0.159169	0.068202	0.081210	0.115954	0.141052	0.146368	0.151798
Total	0.723496	0.757800	0.902332	1.288374	1.567242	1.626309	1.686649

Watertown	1990	1995	2000	2010	2020	2030	2040
Residential	0.156066	0.169865	0.176953	0.229389	0.291148	0.303753	0.315946
Total Nonresidential	0.035141	0.037922	0.051959	0.074993	0.089463	0.089463	0.089463
Unmetered/Unaccounted	0.063736	0.042559	0.040396	0.033820	0.042290	0.043691	0.045045
Total	0.254943	0.250346	0.269308	0.338203	0.422901	0.436906	0.450454

Watertown Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.106437	0.117599	0.120085	0.119910	0.122844	0.127535	0.132225
Total Nonresidential	0.039975	0.043260	0.057286	0.061813	0.061813	0.061813	0.061813
Total	0.146412	0.160859	0.177372	0.181723	0.184657	0.189348	0.194038

Young America Twp./ Hamburg	1990	1995	2000	2010	2020	2030	2040
Residential	0.086349	0.090983	0.092398	0.099251	0.105825	0.109360	0.112107
Total Nonresidential	0.001552	0.003257	0.003976	0.004483	0.004686	0.004686	0.004686
Unmetered/Unaccounted	0.000888	0.000952	0.000973	0.001048	0.001116	0.001152	0.001180
Total	0.088789	0.095193	0.097348	0.104781	0.111627	0.115198	0.117972

Dakota County

Projected Water Use In Million Gallons Per Day

Apple Valley	1990	1995	2000	2010	2020	2030	2040
Residential	3.077525	3.740462	4.052243	4.796375	5.568389	5.820851	6.082784
Total Nonresidential	1.100907	1.648843	1.981627	2.198169	2.360079	2.432147	2.503689
Unmetered/Unaccounted	0.219917	0.283648	0.317572	0.368134	0.417288	0.434368	0.451920
Major Crop Irrigation	0.000685	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Air Conditioning	0.000000	0.019820	0.017943	0.000000	0.000000	0.000000	0.000000
Total	4.399034	5.692773	6.369385	7.362679	8.345756	8.687366	9.038392

Burnsville	1990	1995	2000	2010	2020	2030	2040
Residential*	4.497801	4.933314	5.134615	5.036037	5.133629	5.180260	5.226890
Total Nonresidential*	1.625568	1.917322	2.210336	2.584361	2.754434	2.817597	2.880696
Unmetered/Unaccounted*	0.605608	0.677535	0.227163	0.235682	0.243961	0.247356	0.250750
Water Level Maintenance	5.106926	12.688027	9.034693	9.034693	0.000000	0.000000	0.000000
Total	11.835903	20.216198	16.606807	16.890773	8.132024	8.245213	8.358336

*The City of Burnsville is projecting a higher demand based on higher forecasts of population.

Castle Rock Twp./ Sciota Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.136728	0.148264	0.151378	0.161925	0.169233	0.177629	0.186098
Total Nonresidential	0.053234	0.061384	0.078937	0.088458	0.098034	0.098034	0.098034
Major Crop Irrigation	1.328318	1.049924	1.372256	1.372256	1.372256	1.372256	1.372256
Total	1.518280	1.259572	1.602571	1.622640	1.639524	1.647920	1.656389

Coates	1990	1995	2000	2010	2020	2030	2040
Residential	0.014670	0.014705	0.015007	0.014397	0.016325	0.016480	0.016658
Total Nonresidential	0.005513	0.010361	0.012781	0.016509	0.019525	0.019525	0.019525
Total	0.020184	0.025066	0.027788	0.030906	0.035849	0.036005	0.036183

Douglas Twp./ Miesville	1990	1995	2000	2010	2020	2030	2040
Residential	0.063511	0.070104	0.071821	0.077523	0.078704	0.082993	0.087180
Total Nonresidential	0.004374	0.005857	0.007524	0.008995	0.009991	0.009991	0.009991
Major Crop Irrigation	1.467885	1.549070	1.871527	1.871527	1.871527	1.871527	1.871527
Total	1.535769	1.625030	1.950871	1.958044	1.960221	1.964510	1.968697

Eagan	1990	1995	2000	2010	2020	2030	2040
Residential	3.856594	4.662737	5.028026	5.409090	5.751075	6.041733	6.334364
Total Nonresidential	2.569011	4.148193	4.609149	5.309246	5.601007	5.641255	5.681491
Unmetered/Unaccounted	0.410145	0.367122	0.401549	0.446597	0.473003	0.486791	0.500661
Air Conditioning	0.030849	0.035271	0.024991	0.000000	0.000000	0.000000	0.000000
Water Level Maintenance	0.000000	0.768685	1.562035	1.562035	1.562035	1.562035	1.562035

Total	6.866599	9.982008	11.625750	12.726969	13.387121	13.731815	14.078551

Empire Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.106166	0.113928	0.119968	0.130452	0.137753	0.183065	0.228661
Total Nonresidential	0.060415	0.077477	0.091135	0.115082	0.143269	0.143269	0.143269
Major Crop Irrigation	0.308786	0.320522	0.487917	0.487917	0.487917	0.487917	0.487917
Special Categories	0.000000	0.000000	0.003315	0.003315	0.003315	0.003315	0.003315
Total	0.475368	0.511927	0.702334	0.736766	0.772253	0.817565	0.863162

Farmington	1990	1995	2000	2010	2020	2030	2040
Residential	0.549360	0.719564	1.085657	1.740962	2.403283	2.755594	3.107650
Total Nonresidential	0.556873	0.686696	0.796039	1.129343	1.419893	1.475004	1.530648
Unmetered/Unaccounted	0.109408	0.139081	0.186102	0.283876	0.378116	0.418411	0.458733
Major Crop Irrigation	0.122526	0.176844	0.157903	0.157903	0.078951	0.078951	0.118427
Total	1.338167	1.722185	2.225701	3.312084	4.280244	4.727961	5.215457

Greenvale Twp./ Eureka Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.165116	0.176235	0.186869	0.199654	0.213028	0.253402	0.294225
Total Nonresidential	0.089367	0.641592	1.039070	1.370191	1.655029	1.655029	1.655029
Major Crop Irrigation	0.141926	0.166566	0.207853	0.207853	0.207853	0.207853	0.207853
Total	0.396408	0.984393	1.433792	1.777698	2.075909	2.116283	2.157106

Hampton/ Hampton Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.060902	0.066363	0.071310	0.077017	0.082902	0.086011	0.089241
Total Nonresidential	0.055426	0.065030	0.092088	0.132249	0.159754	0.159754	0.159754
Major Crop Irrigation	0.967000	0.901000	1.267000	1.267000	1.267000	1.267000	1.267000
Total	1.083327	1.032393	1.430398	1.476266	1.509656	1.512765	1.515995

Hastings	1990	1995	2000	2010	2020	2030	2040
Residential	1.099292	1.190971	1.289113	1.633758	2.033476	2.157421	2.281366
Total Nonresidential	0.555837	0.600895	0.620323	0.666615	0.689615	0.698291	0.706790
Unmetered/Unaccounted	0.363321	0.393336	0.260378	0.255597	0.302566	0.317301	0.332017
Major Crop Irrigation	0.071781	0.047397	0.060274	0.060274	0.060274	0.060274	0.000000
Total	2.090231	2.232600	2.230088	2.616244	3.085930	3.233287	3.320173

Inver Grove Heights/ Sunfish Lake	1990	1995	2000	2010	2020	2030	2040
Residential	1.533388	1.800709	2.112632	2.576883	3.180473	3.591357	3.999397
Total Nonresidential	0.522590	0.673512	0.811399	1.003044	1.162012	1.243761	1.325443
Unmetered/Unaccounted	0.307215	0.369711	0.324892	0.397770	0.482498	0.537235	0.591649
Special Categories	0.000441	0.000148	0.002183	0.002183	0.002183	0.002183	0.002183

Total	2.363635	2.844080	3.251106	3.979880	4.827166	5.374537	5.918672

Lakeville	1990	1995	2000	2010	2020	2030	2040
Residential	1.931409	2.688922	3.157800	4.813312	6.340388	7.474695	8.615440
Total Nonresidential	0.495262	0.671345	0.762680	0.875105	1.003514	1.110551	1.217459
Unmetered/Unaccounted	0.182653	0.252923	0.295090	0.428160	0.552767	0.646201	0.740111
Total	2.609324	3.613191	4.215570	6.116578	7.896669	9.231448	10.573009

Lilydale/Mendota	1990	1995	2000	2010	2020	2030	2040
Residential	0.068399	0.064004	0.094931	0.099179	0.101592	0.105756	0.110358
Total Nonresidential	0.027916	0.034989	0.043768	0.065245	0.077174	0.077174	0.077174
Total	0.096315	0.098993	0.138698	0.164424	0.178766	0.182930	0.187532

Marshan Twp./ Nininger Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.159449	0.176366	0.180458	0.191419	0.199431	0.209125	0.219086
Total Nonresidential	0.118908	0.094020	0.157389	0.441053	0.598212	0.598212	0.598212
Major Crop Irrigation	4.295564	3.859083	4.612021	4.612021	4.612021	4.612021	4.612021
Total	4.573922	4.129468	4.949868	5.244493	5.409664	5.419358	5.429319

Mendota Heights	1990	1995	2000	2010	2020	2030	2040
Residential	0.990793	1.175070	1.193148	1.269607	1.342184	1.456076	1.570677
Total Nonresidential	0.393440	0.417396	0.515705	0.566316	0.606815	0.613769	0.620735
Total	1.384233	1.592466	1.708853	1.835923	1.948999	2.069846	2.191412

New Trier	1990	1995	2000	2010	2020	2030	2040
Residential	0.006237	0.007524	0.007084	0.007084	0.006779	0.006902	0.007726
Total Nonresidential	0.001819	0.001936	0.001171	0.001171	0.001936	0.001936	0.001936
Total	0.008057	0.009460	0.008255	0.008255	0.008715	0.008838	0.009663

Randolph/ Randolph Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.058406	0.066194	0.068822	0.075609	0.080716	0.085811	0.090921
Total Nonresidential	0.026845	0.029729	0.035557	0.053929	0.062799	0.062799	0.062799
Major Crop Irrigation	0.535000	0.740000	0.868000	0.868000	0.868000	0.868000	0.868000
Total	0.620251	0.835923	0.972379	0.997538	1.011515	1.016611	1.021720

Ravenna Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.152010	0.181244	0.199811	0.219278	0.232223	0.261158	0.290266
Total Nonresidential	0.001183	0.001056	0.004471	0.005281	0.006747	0.006747	0.006747
Major Crop Irrigation	0.257849	0.192399	0.307216	0.307216	0.307216	0.307216	0.307216
Total	0.411042	0.374699	0.511498	0.531775	0.546186	0.575121	0.604229

Rosemount	1990	1995	2000	2010	2020	2030	2040
Residential	0.645847	0.884803	1.075477	1.849644	2.693587	3.146325	3.599279
Total Nonresidential	7.558586	8.626342	10.518575	12.840962	15.315981	16.903437	18.494844
Unmetered/Unaccounted	0.617538	0.715893	0.872671	1.105745	1.355559	1.509122	1.662999
Major Crop Irrigation	0.823792	0.382977	0.605887	0.605887	0.405944	0.405944	0.000000
Special Categories	0.000000	0.005732	0.443053	0.443053	0.443053	0.443053	0.443053
Total	9.645764	10.615747	13.515662	16.845290	20.214123	22.407881	24.200174

South St. Paul	1990	1995	2000	2010	2020	2030	2040
Residential	2.023136	2.042527	2.004363	2.072169	2.164076	2.188667	2.213259
Total Nonresidential	0.819549	0.898238	0.940200	0.993210	1.019625	1.019625	1.019625
Unmetered/Unaccounted	0.247190	0.255719	0.256049	0.266555	0.276844	0.278982	0.281120
Special Categories	0.000000	0.000000	0.000949	0.000949	0.000949	0.000949	0.000949
Total	3.089875	3.196484	3.201560	3.332882	3.461493	3.488223	3.514953

Vermillion/ Vermillion Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.141448	0.151079	0.154238	0.170367	0.188023	0.198961	0.209928
Total Nonresidential	0.001734	0.003204	0.004088	0.004336	0.005534	0.005534	0.005534
Unmetered/Unaccounted	0.002922	0.003149	0.003231	0.003565	0.003950	0.004173	0.004397
Major Crop Irrigation	2.876079	2.318584	3.220049	3.220049	3.220049	3.220049	3.220049
Total	3.022184	2.476016	3.381606	3.398317	3.417556	3.428718	3.439908

Waterford Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.038291	0.040908	0.040566	0.044019	0.045229	0.046361	0.047696
Total Nonresidential	0.004973	0.008022	0.008501	0.009253	0.009994	0.009994	0.009994
Major Crop Irrigation	0.226496	0.187266	0.247768	0.247768	0.247768	0.247768	0.247768
Total	0.269759	0.236196	0.296835	0.301040	0.302990	0.304122	0.305458

West St. Paul	1990	1995	2000	2010	2020	2030	2040
Residential	1.304108	1.321374	1.307109	1.329516	1.361743	1.361743	1.361743
Total Nonresidential	0.806721	0.794532	0.839084	1.058642	1.118823	1.118823	1.118823
Total	2.110829	2.115906	2.146193	2.388159	2.480567	2.480567	2.480567

Hennepin County

Projected Water Use In Million Gallons Per Day

Bloomington	1990	1995	2000	2010	2020	2030	2040
Residential	6.805141	6.949501	6.867468	7.047084	7.168256	7.223145	7.266413
Total Nonresidential	4.632337	6.119946	6.514670	7.149411	7.483554	7.487529	7.491380
Unmetered/Unaccounted	0.115530	0.132015	0.135173	0.143399	0.147998	0.148593	0.149069
Major Crop Irrigation	0.000000	0.008575	0.000000	0.000000	0.000000	0.000000	0.000000
Special Categories	0.118493	0.103654	0.109692	0.109692	0.109692	0.109692	0.109692
Water Level Maintenance	0.513403	0.205629	0.000000	0.000000	0.000000	0.000000	0.000000
Total	12.184905	13.519319	13.627004	14.449587	14.909500	14.968960	15.016554

Brooklyn Center	1990	1995	2000	2010	2020	2030	2040
Residential	2.732748	2.714309	2.676038	2.781743	2.858380	2.858380	2.858380
Total Nonresidential	0.827553	0.872335	0.931046	1.025187	1.072261	1.072261	1.072261
Unmetered/Unaccounted	0.110112	0.110927	0.111559	0.117740	0.121566	0.121566	0.121566
Special Categories	0.248132	0.206974	0.250315	0.250315	0.250315	0.250315	0.250315
Air Conditioning	0.011553	0.010912	0.010793	0.000000	0.000000	0.000000	0.000000
Total	3.930099	3.915457	3.979751	4.174985	4.302522	4.302522	4.302522

Brooklyn Park	1990	1995	2000	2010	2020	2030	2040
Residential	3.874437	4.166852	4.490277	5.027139	5.454747	5.806666	6.158585
Total Nonresidential	2.503758	3.100292	3.576290	4.120459	4.431613	4.576547	4.721342
Unmetered/Unaccounted*	0.407119	0.463860	0.514887	0.583889	0.631044	0.662758	0.694463
Major Crop Irrigation	0.003562	0.001439	0.000000	0.000000	0.000000	0.000000	0.000000
Total	6.788875	7.732443	8.581455	9.731488	10.517403	11.045971	11.574390

*The City of Brooklyn Park has reportedly reduced their unmetered/unaccounted use to below 1%.

Champlin	1990	1995	2000	2010	2020	2030	2040
Residential	1.617379	1.876609	2.052436	2.369578	2.791668	2.878254	3.007081
Total Nonresidential	0.065049	0.104348	0.139353	0.214737	0.243701	0.256569	0.269412
Unmetered/Unaccounted	0.088549	0.104261	0.115357	0.136017	0.159756	0.164991	0.172447
Major Crop Irrigation	0.000000	0.022927	0.025420	0.025420	0.000000	0.000000	0.000000
Total	1.770976	2.108145	2.332566	2.745751	3.195125	3.299814	3.448940

Corcoran	1990	1995	2000	2010	2020	2030	2040
Residential	0.410867	0.456451	0.464806	0.506174	0.568401	0.619616	0.670343
Total Nonresidential	0.085473	0.060887	0.074059	0.078465	0.083195	0.083504	0.083504
Major Crop Irrigation	0.003288	0.000844	0.001429	0.001429	0.001429	0.001429	0.000000
Total	0.499628	0.518182	0.540293	0.586068	0.653025	0.704549	0.753847

Crystal	1990	1995	2000	2010	2020	2030	2040
Residential	1.908221	1.916479	1.871795	1.882983	1.975928	1.975928	1.975928

Total Nonresidential	0.023837	0.022170	0.024148	0.027315	0.028698	0.028698	0.028698
Unmetered/Unaccounted	0.059754	0.059958	0.058637	0.059081	0.061999	0.061999	0.061999
Total	1.991812	1.998607	1.954581	1.969380	2.066625	2.066625	2.066625

Dayton	1990	1995	2000	2010	2020	2030	2040
Residential	0.346997	0.403427	0.417783	0.527077	0.845179	0.895886	0.946814
Total Nonresidential	0.091739	0.166804	0.247262	0.390495	0.520068	0.555727	0.590666
Total	0.438736	0.570231	0.665045	0.917571	1.365247	1.451612	1.537481

Eden Prairie	1990	1995	2000	2010	2020	2030	2040
Residential	3.264156	3.849902	4.439091	4.926317	5.352448	5.822142	6.304081
Total Nonresidential	1.563228	1.943688	2.177626	2.404523	2.563281	2.634230	2.705275
Unmetered/Unaccounted	0.363351	0.436077	0.498033	0.551784	0.595808	0.636501	0.678124
Total	5.190736	6.229667	7.114750	7.882623	8.511536	9.092874	9.687480

Edina	1990	1995	2000	2010	2020	2030	2040
Residential	5.782662	5.964064	5.875606	5.979880	6.036029	6.036029	6.036029
Total Nonresidential	1.856048	2.000036	2.049579	2.141035	2.196000	2.196000	2.196000
Unmetered/Unaccounted	0.402037	0.419163	0.417115	0.427417	0.433265	0.433265	0.433265
Special Categories	0.005425	0.010099	0.008112	0.008112	0.008112	0.008112	0.008112
Air Conditioning	0.524721	0.489936	0.448011	0.000000	0.000000	0.000000	0.000000
Water Level Maintenance	0.002712	0.013871	0.000000	0.000000	0.000000	0.000000	0.000000
Total	8.573605	8.897170	8.798422	8.556443	8.673405	8.673405	8.673405

Excelsior	1990	1995	2000	2010	2020	2030	2040
Residential	0.189762	0.188522	0.185970	0.185906	0.188819	0.188408	0.190045
Total Nonresidential	0.136051	0.112623	0.116806	0.119507	0.122260	0.122260	0.122260
Unmetered/Unaccounted	0.097321	0.089952	0.090440	0.091227	0.092920	0.092797	0.093286
Total	0.423133	0.391097	0.393216	0.396640	0.403999	0.403465	0.405591

Fort Snelling	1990	1995	2000	2010	2020	2030	2040
Residential	0.007673	0.007538	0.010377	0.010377	0.010377	0.010377	0.010377
Total Nonresidential	1.678641	1.682513	1.846495	1.928062	1.955224	1.955224	1.955224
Air Conditioning	1.547227	2.063256	1.868808	0.000000	0.000000	0.000000	0.000000
Total	3.233541	3.753307	3.725681	1.938439	1.965601	1.965601	1.965601

Golden Valley	1990	1995	2000	2010	2020	2030	2040
Residential	1.652863	1.667050	1.672830	1.745270	1.781301	1.781301	1.781301
Total Nonresidential	1.747485	1.943326	2.038976	2.315433	2.419152	2.419152	2.419152
Unmetered/Unaccounted	0.105165	0.111661	0.114798	0.125589	0.129911	0.129911	0.129911
Special Categories	0.010238	0.008570	0.010448	0.010448	0.010448	0.010448	0.010448
Total	3.515752	3.730607	3.837053	4.196739	4.340812	4.340812	4.340812

Greenfield/Rockford	1990	1995	2000	2010	2020	2030	2040
Residential	0.173903	0.196193	0.217485	0.244716	0.272341	0.288736	0.305216
Total Nonresidential	0.013351	0.018314	0.027138	0.042739	0.051061	0.051061	0.051061
Unmetered/Unaccounted	0.009855	0.011290	0.012875	0.015129	0.017021	0.017884	0.018751
Total	0.197110	0.225796	0.257498	0.302584	0.340423	0.357680	0.375028

Hanover	1990	1995	2000	2010	2020	2030	2040
Residential	0.021249	0.027819	0.029642	0.038926	0.050625	0.053375	0.056350
Total Nonresidential	0.009803	0.014209	0.015674	0.015674	0.018566	0.018566	0.018566
Total	0.031052	0.042029	0.045316	0.054600	0.069191	0.071942	0.074916

Hassan Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.154131	0.197750	0.229103	0.282086	0.334750	0.376594	0.419019
Total Nonresidential	0.003399	0.027693	0.034965	0.045319	0.049977	0.050041	0.050041
Water Level Maintenance	0.025825	0.005496	0.000000	0.000000	0.000000	0.000000	0.000000
Total	0.183355	0.230939	0.264067	0.327405	0.384727	0.426635	0.469060

Hopkins	1990	1995	2000	2010	2020	2030	2040
Residential	0.694516	0.691577	0.694644	0.697795	0.697795	0.697795	0.697795
Total Nonresidential	1.742969	1.615651	1.766141	1.965460	2.022419	2.022419	2.022419
Unmetered/Unaccounted	0.183467	0.173662	0.185220	0.200460	0.204747	0.204747	0.204747
Total	2.620952	2.480890	2.646005	2.863716	2.924962	2.924962	2.924962

Independence	1990	1995	2000	2010	2020	2030	2040
Residential	0.223018	0.248667	0.262813	0.281448	0.298742	0.323593	0.348072
Total Nonresidential	0.003555	0.006856	0.009053	0.009685	0.010363	0.010363	0.010363
Total	0.226573	0.255522	0.271865	0.291132	0.309105	0.333956	0.358435

Long Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.152962	0.153440	0.150530	0.161489	0.179592	0.184287	0.189012
Total Nonresidential	0.085592	0.057901	0.069783	0.079948	0.088206	0.088206	0.088206
Unmetered/Unaccounted	0.020744	0.018377	0.019158	0.020994	0.023287	0.023695	0.024106
Total	0.259298	0.229718	0.239471	0.262431	0.291085	0.296188	0.301325

Loretto	1990	1995	2000	2010	2020	2030	2040
Residential	0.032404	0.041310	0.041069	0.045730	0.055161	0.058819	0.062267
Total Nonresidential	0.009671	0.008043	0.009227	0.011399	0.012926	0.012926	0.012926
Unmetered/Unaccounted	0.005737	0.006730	0.006858	0.007790	0.009285	0.009783	0.010254
Total	0.047812	0.056083	0.057154	0.064920	0.077372	0.081529	0.085447

Maple Grove	1990	1995	2000	2010	2020	2030	2040
Residential	3.152647	3.668541	3.984076	5.156687	6.478713	7.029000	7.585233
Total Nonresidential	0.944706	1.614322	2.198865	2.931337	3.797755	4.095365	4.369361
Unmetered/Unaccounted	0.170723	0.220119	0.257623	0.337001	0.428186	0.463515	0.498108
Major Crop Irrigation	0.001904	0.000000	0.001730	0.001730	0.000000	0.000000	0.000000
Water Level Maintenance	0.154038	0.196893	0.000000	0.000000	0.000000	0.000000	0.000000
Total	4.424018	5.699876	6.442294	8.426755	10.704654	11.587880	12.452702

Maple Plain	1990	1995	2000	2010	2020	2030	2040
Residential	0.117823	0.127431	0.129409	0.161761	0.193013	0.208534	0.224010
Total Nonresidential	0.060944	0.038939	0.044779	0.059682	0.066332	0.066332	0.066332
Unmetered/Unaccounted	0.041933	0.055457	0.058062	0.073814	0.086448	0.091622	0.096781
Total	0.220700	0.221827	0.232250	0.295257	0.345793	0.366488	0.387123

Medina	1990	1995	2000	2010	2020	2030	2040
Residential	0.263872	0.303683	0.341846	0.441404	0.588011	0.675373	0.762735
Total Nonresidential	0.183275	0.272571	0.273547	0.278709	0.283830	0.300650	0.317309
Unmetered/Unaccounted	0.009125	0.011760	0.012559	0.014696	0.017793	0.019919	0.022042
Special Categories	0.000000	0.002615	0.002613	0.002613	0.002613	0.002613	0.002613
Total	0.456272	0.590629	0.630565	0.737422	0.892247	0.998555	1.104698

Minneapolis	1990	1995	2000	2010	2020	2030	2040
Residential	25.775166	25.460849	25.043323	25.851393	26.424596	26.545748	26.667053
Total Nonresidential	19.430769	20.224519	20.618185	21.249196	21.740228	21.755355	21.770427
Unmetered/Unaccounted	6.164446	6.229823	6.226569	6.422808	6.567931	6.586514	6.605111
Air Conditioning	6.412000	5.921000	6.781000	0.000000	0.000000	0.000000	0.000000
Special Categories	0.488000	0.081000	0.906800	0.906800	0.906800	0.906800	0.906800
Water Level Maintenance	3.546000	2.528000	0.000000	0.000000	0.000000	0.000000	0.000000
Total	61.816382	60.445191	59.575878	54.430197	55.639554	55.794416	55.949391

Minnetonka	1990	1995	2000	2010	2020	2030	2040
Residential	3.616990	3.906277	3.951938	3.978292	4.063639	4.190343	4.324542
Total Nonresidential	2.133839	2.741553	2.958156	3.408222	3.623513	3.610442	3.619828
Unmetered/Unaccounted	0.638981	0.738648	0.767788	0.820724	0.854128	0.866754	0.882708
Special Categories	0.000000	0.040006	0.060052	0.060052	0.060052	0.060052	0.060052
Total	6.389811	7.426483	7.737935	8.267290	8.601333	8.727592	8.887130

Minnetonka Beach	1990	1995	2000	2010	2020	2030	2040
Residential	0.045157	0.046157	0.044877	0.043980	0.044961	0.045911	0.046653
Total Nonresidential	0.026704	0.058223	0.058223	0.058223	0.058223	0.058223	0.058223
Total	0.071861	0.104380	0.103100	0.102203	0.103184	0.104133	0.104875

Minnetrista	1990	1995	2000	2010	2020	2030	2040
Residential	0.173768	0.197389	0.216956	0.297447	0.404380	0.438078	0.471057
Total Nonresidential	0.026823	0.084966	0.116133	0.182664	0.318218	0.318218	0.318218
Unmetered/Unaccounted	0.053322	0.075056	0.088543	0.127624	0.192083	0.201041	0.209807
Water Level Maintenance	0.106849	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Total	0.360762	0.357410	0.421632	0.607736	0.914681	0.957337	0.999082

Mound	1990	1995	2000	2010	2020	2030	2040
Residential	0.641557	0.647648	0.656924	0.679867	0.696726	0.697939	0.699148
Total Nonresidential	0.111114	0.127194	0.151458	0.175125	0.191884	0.191884	0.191884
Unmetered/Unaccounted	0.007603	0.007827	0.008165	0.008636	0.008976	0.008988	0.009000
Total	0.760274	0.782669	0.816547	0.863628	0.897586	0.898811	0.900032

New Hope	1990	1995	2000	2010	2020	2030	2040
Residential	1.806128	1.802889	1.762412	1.777394	1.853321	1.853321	1.853321
Total Nonresidential	0.532900	0.615584	0.626393	0.653073	0.666345	0.666345	0.666345
Unmetered/Unaccounted	0.072341	0.074798	0.073881	0.075169	0.077928	0.077928	0.077928
Special Categories	0.000000	0.005295	0.006588	0.006588	0.006588	0.006588	0.006588
Total	2.411369	2.498566	2.469273	2.512224	2.604182	2.604182	2.604182

Orono	1990	1995	2000	2010	2020	2030	2040
Residential	0.585874	0.611976	0.626801	0.715686	0.829009	0.889734	0.952171
Total Nonresidential	0.093626	0.305757	0.318658	0.358291	0.358291	0.358291	0.358291
Unmetered/Unaccounted	0.035659	0.048323	0.050201	0.058051	0.064967	0.068345	0.071734
Special Categories	0.003195	0.003807	0.002427	0.002427	0.002427	0.002427	0.002427
Air Conditioning	0.005562	0.011348	0.013091	0.000000	0.000000	0.000000	0.000000
Total	0.723915	0.981212	1.011178	1.134455	1.254694	1.318796	1.384622

Osseo	1990	1995	2000	2010	2020	2030	2040
Residential	0.184564	0.178832	0.180389	0.179388	0.205014	0.208244	0.212283
Total Nonresidential	0.128319	0.093600	0.105055	0.121077	0.127977	0.127977	0.127977
Unmetered/Unaccounted	0.006385	0.002752	0.031716	0.033385	0.036999	0.037358	0.037807
Total	0.319268	0.275183	0.317160	0.333850	0.369990	0.373578	0.378066

Plymouth/Medicine Lake	1990	1995	2000	2010	2020	2030	2040
Residential	3.798183	4.446387	4.655489	5.335541	5.873234	6.375859	6.878670
Total Nonresidential	2.887585	3.814482	3.976695	4.180129	4.302662	4.401535	4.500670
Unmetered/Unaccounted	0.826331	1.021006	1.066899	1.176094	1.257695	1.332038	1.406435
Water Level Maintenance	0.037964	0.028682	0.000000	0.000000	0.000000	0.000000	0.000000
Total	7.550063	9.310558	9.699084	10.691764	11.433591	12.109432	12.785775

Richfield	1990	1995	2000	2010	2020	2030	2040
Residential	3.108236	3.088444	3.004282	3.187189	3.356366	3.356366	3.356366

Total Nonresidential	0.599815	0.524043	0.573507	0.642539	0.669013	0.669013	0.669013
Unmetered/Unaccounted	0.154502	0.150520	0.149075	0.159572	0.167724	0.167724	0.167724
Air Conditioning	0.001408	0.000792	0.000945	0.000000	0.000000	0.000000	0.000000
Total	3.863961	3.763799	3.727808	3.989300	4.193103	4.193103	4.193103

Robbinsdale	1990	1995	2000	2010	2020	2030	2040
Residential	1.145815	1.144556	1.117848	1.191150	1.289181	1.289181	1.289181
Total Nonresidential	0.218624	0.240265	0.233522	0.258389	0.272405	0.272405	0.272405
Unmetered/Unaccounted	0.056852	0.057701	0.056307	0.060397	0.065066	0.065066	0.065066
Total	1.421291	1.442522	1.407677	1.509937	1.626652	1.626652	1.626652

Rogers	1990	1995	2000	2010	2020	2030	2040
Residential	0.036805	0.062745	0.119220	0.203502	0.337626	0.361125	0.384489
Total Nonresidential	0.077550	0.141112	0.184915	0.331316	0.364679	0.371995	0.383881
Unmetered/Unaccounted	0.009944	0.022651	0.033793	0.059424	0.078034	0.081458	0.085374
Total	0.124299	0.226508	0.337928	0.594242	0.780339	0.814578	0.853745

St. Anthony	1990	1995	2000	2010	2020	2030	2040
Residential	0.618087	0.679359	0.670926	0.685661	0.715210	0.715210	0.715210
Total Nonresidential	0.213150	0.238663	0.266455	0.319812	0.355247	0.355247	0.355247
Unmetered/Unaccounted	0.113350	0.125185	0.127825	0.137110	0.145971	0.145971	0.145971
Total	0.944587	1.043207	1.065206	1.142583	1.216428	1.216428	1.216428

St. Bonifacius	1990	1995	2000	2010	2020	2030	2040
Residential	0.074638	0.076691	0.118314	0.151402	0.177872	0.186065	0.194481
Total Nonresidential	0.013654	0.012756	0.015221	0.015803	0.016202	0.016202	0.016202
Unmetered/Unaccounted	0.043487	0.025229	0.014837	0.018578	0.021564	0.022474	0.023409
Total	0.131779	0.114676	0.148372	0.185783	0.215637	0.224741	0.234093

St. Louis Park	1990	1995	2000	2010	2020	2030	2040
Residential	3.773055	3.769305	3.746495	3.922159	4.145131	4.145131	4.145131
Total Nonresidential	3.051617	3.080746	3.221853	4.037707	4.200827	4.200827	4.200827
Unmetered/Unaccounted	0.674967	0.360529	0.366755	0.418940	0.439261	0.439261	0.439261
Special Categories	0.370145	0.516899	0.575360	0.575360	0.575360	0.575360	0.575360
Total	7.869784	7.727480	7.910463	8.954166	9.360579	9.360579	9.360579

Shorewood	1990	1995	2000	2010	2020	2030	2040
Residential	0.738649	0.867645	0.892242	0.950779	0.995582	1.066959	1.139079
Total Nonresidential	0.107581	0.211763	0.259957	0.342947	0.381052	0.381052	0.381052
Total	0.846230	1.079408	1.152199	1.293726	1.376634	1.448010	1.520131

Spring Park	1990	1995	2000	2010	2020	2030	2040
Residential	0.108498	0.123519	0.126318	0.130497	0.134560	0.136462	0.138506
Total Nonresidential	0.075962	0.081967	0.089086	0.098978	0.100940	0.100940	0.100940
Unmetered/Unaccounted	0.032552	0.036262	0.023934	0.025497	0.026167	0.026378	0.026605
Total	0.217012	0.241748	0.239338	0.254972	0.261666	0.263780	0.266051

Tonka Bay/Greenwood	1990	1995	2000	2010	2020	2030	2040
Residential	0.245148	0.258771	0.259340	0.257739	0.256465	0.263708	0.272623
Total Nonresidential	0.024902	0.022885	0.020017	0.020765	0.021558	0.021558	0.021558
Total	0.270051	0.281656	0.279357	0.278504	0.278022	0.285266	0.294180

Wayzata	1990	1995	2000	2010	2020	2030	2040
Residential	0.445524	0.478925	0.501529	0.517096	0.541719	0.550656	0.560654
Total Nonresidential	0.278093	0.221551	0.234771	0.246156	0.250728	0.251394	0.252010
Unmetered/Unaccounted	0.030151	0.029186	0.030679	0.031802	0.033019	0.033419	0.033861
Total	0.753767	0.729662	0.766979	0.795054	0.825466	0.835469	0.846525

Woodland/ Deephaven	1990	1995	2000	2010	2020	2030	2040
Residential	0.310478	0.318717	0.314207	0.317978	0.323074	0.328708	0.333838
Total Nonresidential	0.182021	0.170268	0.188903	0.195285	0.209532	0.209532	0.209532
Unmetered/Unaccounted	0.054722	0.054332	0.055901	0.057029	0.059178	0.059804	0.060375
Total	0.547221	0.543316	0.559011	0.570293	0.591785	0.598044	0.603745

Ramsey County

Projected Water Use In Million Gallons Per Day

Arden Hills	1990	1995	2000	2010	2020	2030	2040
Residential	0.335862	0.350351	0.345516	0.409364	0.480974	0.503359	0.524930
Total Nonresidential	0.481674	0.505775	0.563207	0.715185	0.764364	0.767135	0.770002
Unmetered/Unaccounted	0.258169	0.151081	0.160363	0.198450	0.219766	0.224205	0.228517
Special Categories	0.015205	3.806488	4.597260	4.597260	4.597260	4.597260	4.597260
Air Conditioning	0.000000	0.034196	0.041545	0.000000	0.000000	0.000000	0.000000
Total	1.090912	4.847891	5.707892	5.920260	6.062364	6.091959	6.120710

Falcon Heights	1990	1995	2000	2010	2020	2030	2040
Residential	0.331556	0.334964	0.329905	0.334647	0.334647	0.334647	0.334647
Total Nonresidential	0.272825	0.268839	0.295011	0.310986	0.322902	0.322902	0.322902
Unmetered/Unaccounted	0.090310	0.090223	0.069435	0.071737	0.073061	0.073061	0.073061
Special Categories	0.172044	0.444762	0.387165	0.387165	0.387165	0.387165	0.387165
Total	0.866734	1.138788	1.081516	1.104534	1.117775	1.117775	1.117775

Gem Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.034807	0.036468	0.036044	0.039592	0.042828	0.044215	0.045546
Total Nonresidential	0.051388	0.165351	0.195730	0.228752	0.248916	0.248916	0.248916
Total	0.086195	0.201818	0.231774	0.268343	0.291744	0.293131	0.294462

Lauderdale	1990	1995	2000	2010	2020	2030	2040
Residential	0.204420	0.207661	0.204979	0.209859	0.209859	0.209859	0.209859
Total Nonresidential	0.033813	0.055809	0.044993	0.046328	0.046965	0.046965	0.046965
Unmetered/Unaccounted	0.035598	0.039369	0.027775	0.028465	0.028536	0.028536	0.028536
Total	0.273831	0.302839	0.277746	0.284652	0.285360	0.285360	0.285360

Little Canada	1990	1995	2000	2010	2020	2030	2040
Residential	0.539057	0.569297	0.584656	0.634942	0.671231	0.679527	0.687846
Total Nonresidential	0.213404	0.297265	0.345735	0.368077	0.381962	0.381962	0.381962
Unmetered/Unaccounted	0.112437	0.129486	0.103377	0.111447	0.117021	0.117943	0.118868
Total	0.864898	0.996047	1.033768	1.114466	1.170214	1.179432	1.188675

Maplewood	1990	1995	2000	2010	2020	2030	2040
Residential	2.411917	2.663623	2.726425	2.895760	3.062945	3.208559	3.349606
Total Nonresidential	1.807646	2.070081	2.401910	2.944268	3.176909	3.232681	3.288600
Unmetered/Unaccounted	0.630509	0.707335	0.569815	0.648892	0.693317	0.715693	0.737578
Special Categories	0.000000	0.000000	0.000418	0.000418	0.000418	0.000418	0.000418
Total	4.850073	5.441039	5.698567	6.489339	6.933589	7.157351	7.376203

Mounds View	1990	1995	2000	2010	2020	2030	2040
Residential	0.976732	0.990722	0.991486	1.000554	1.035214	1.058366	1.083400
Total Nonresidential	0.179273	0.285903	0.343638	0.433075	0.477603	0.479519	0.481272
Unmetered/Unaccounted	0.100522	0.081487	0.085221	0.091508	0.096563	0.098163	0.099873
Total	1.256527	1.358112	1.420344	1.525137	1.609381	1.636048	1.664544

New Brighton	1990	1995	2000	2010	2020	2030	2040
Residential	1.506484	1.516900	1.539234	1.588442	1.687947	1.725695	1.763444
Total Nonresidential	0.548087	0.516935	0.567272	0.675356	0.724005	0.724005	0.724005
Unmetered/Unaccounted	0.041930	0.041507	0.042990	0.046200	0.049223	0.049994	0.050764
Special Categories	0.003449	0.020608	0.029001	0.029001	0.029001	0.029001	0.029001
Total	2.099951	2.095950	2.178497	2.338999	2.490176	2.528695	2.567214

North Oaks	1990	1995	2000	2010	2020	2030	2040
Residential	0.349852	0.395652	0.420628	0.488953	0.572844	0.592858	0.612436
Total Nonresidential	0.010972	0.020675	0.023218	0.024011	0.024567	0.024567	0.024567
Total	0.360823	0.416328	0.443846	0.512964	0.597411	0.617425	0.637003

North St. Paul	1990	1995	2000	2010	2020	2030	2040
Residential	0.758727	0.792626	0.775369	0.775990	0.802332	0.815890	0.830868
Total Nonresidential	0.238304	0.245265	0.258096	0.283844	0.294992	0.294992	0.294992
Unmetered/Unaccounted	0.075045	0.054626	0.054393	0.055781	0.057754	0.058467	0.059256
Total	1.072076	1.092517	1.087858	1.115615	1.155078	1.169350	1.185116

Roseville	1990	1995	2000	2010	2020	2030	2040
Residential	2.051833	2.119474	2.125875	2.238584	2.278144	2.304008	2.329936
Total Nonresidential	2.009798	2.353255	2.546796	3.015775	3.149942	3.153482	3.156970
Major Crop Irrigation	0.023874	0.036268	0.024384	0.024384	0.024384	0.024384	0.024384
Total	4.085505	4.508998	4.697056	5.278743	5.452470	5.481875	5.511290

St. Paul	1990	1995	2000	2010	2020	2030	2040
Residential	20.294492	20.154302	19.828022	20.595136	21.359595	21.543767	21.727938
Total Nonresidential	23.170222	23.005101	23.694253	24.995986	25.777140	25.806025	25.834812
Unmetered/Unaccounted	6.494727	6.449106	4.835808	5.065680	5.237415	5.261088	5.284750
Special Categories	0.895970	0.429372	0.699772	0.699772	0.699772	0.699772	0.699772
Air Conditioning	6.019403	4.415567	6.425444	0.000000	0.000000	0.000000	0.000000
Total	56.874813	54.453449	55.483299	51.356574	53.073923	53.310652	53.547272

Shoreview	1990	1995	2000	2010	2020	2030	2040
Residential	1.845992	1.995074	2.031519	2.106484	2.208108	2.264156	2.320742
Total Nonresidential	0.742245	1.050049	1.145682	1.382055	1.506434	1.524214	1.541662
Total	2.588237	3.045123	3.177201	3.488538	3.714542	3.788370	3.862404

Vadnais Heights	1990	1995	2000	2010	2020	2030	2040
Residential	0.827351	0.943067	1.019954	1.107961	1.159640	1.206220	1.250938
Total Nonresidential	0.254690	0.434435	0.594411	0.747089	0.803279	0.813720	0.824066
Unmetered/Unaccounted	0.120227	0.153056	0.179374	0.206117	0.218102	0.224438	0.230556
Special Categories	0.002553	0.000000	0.002265	0.002265	0.002265	0.002265	0.002265
Air Conditioning	0.145397	0.254986	0.206551	0.000000	0.000000	0.000000	0.000000
Total	1.350219	1.785543	2.002555	2.063432	2.183285	2.246643	2.307825

White Bear Lake	1990	1995	2000	2010	2020	2030	2040
Residential	1.616686	1.714497	1.708168	1.684947	1.773388	1.786493	1.802632
Total Nonresidential	0.802537	0.799877	0.891203	0.996398	1.031010	1.040075	1.052426
Unmetered/Unaccounted	0.604806	0.443713	0.458713	0.473178	0.494894	0.498806	0.503834
Total	3.024028	2.958087	3.058084	3.154523	3.299291	3.325374	3.358891

White Bear Lake Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.920130	1.061765	1.125737	1.312469	1.445139	1.556643	1.669002
Total Nonresidential	0.081991	0.841906	1.221564	1.433916	1.487230	1.487230	1.487230
Total	1.002121	1.903671	2.347301	2.746385	2.932369	3.043874	3.156232

Scott County

Projected Water Use In Million Gallons Per Day

Belle Plaine	1990	1995	2000	2010	2020	2030	2040
Residential	0.278185	0.298275	0.318181	0.388871	0.486775	0.504986	0.524011
Total Nonresidential	0.083972	0.114166	0.127840	0.167439	0.193762	0.193762	0.193762
Total	0.362156	0.412442	0.446021	0.556310	0.680538	0.698748	0.717774

Belle Plaine Twp./ Blakely Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.090609	0.100693	0.107230	0.108757	0.113379	0.116697	0.119796
Total Nonresidential	0.003623	0.001609	0.002066	0.003487	0.004328	0.004328	0.004328
Major Crop Irrigation	0.003795	0.223167	0.039409	0.039409	0.039409	0.039409	0.039409
Total	0.098027	0.325470	0.148705	0.151653	0.157116	0.160433	0.163533

Cedar Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.133271	0.163991	0.180101	0.202927	0.219410	0.239267	0.259230
Total Nonresidential	0.000382	0.000932	0.001739	0.002212	0.003132	0.003132	0.003132
Total	0.133653	0.164923	0.181840	0.205139	0.222542	0.242398	0.262362

Credit River Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.225502	0.295879	0.327912	0.354579	0.397678	0.434848	0.471911
Total Nonresidential	0.017703	0.029999	0.041479	0.080083	0.103980	0.106889	0.110082
Total	0.243205	0.325878	0.369390	0.434662	0.501658	0.541737	0.581993

Elko/New Market	1990	1995	2000	2010	2020	2030	2040
Residential	0.025404	0.028387	0.031263	0.039382	0.055528	0.057491	0.059401
Total Nonresidential	0.003220	0.002509	0.003846	0.008008	0.011108	0.011108	0.011108
Total	0.028624	0.030895	0.035109	0.047389	0.066636	0.068598	0.070509

Helena Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.087548	0.103306	0.110028	0.120497	0.123106	0.129636	0.136276
Total Nonresidential	0.002966	0.014830	0.014830	0.015665	0.017670	0.017670	0.017670
Total	0.090514	0.118136	0.124858	0.136162	0.140776	0.147306	0.153946

Jordan	1990	1995	2000	2010	2020	2030	2040
Residential	0.169767	0.176417	0.196243	0.256061	0.341415	0.355538	0.369918
Total Nonresidential	0.068887	0.058152	0.081751	0.096451	0.113957	0.113957	0.113957
Unmetered/Unaccounted	0.048881	0.048044	0.030888	0.039168	0.050597	0.052166	0.053764
Total	0.287534	0.282613	0.308882	0.391679	0.505969	0.521662	0.537640

Jackson Twp./ Louisville Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.179040	0.198131	0.203440	0.222362	0.241041	0.250386	0.260021
Total Nonresidential	0.008581	0.016788	0.024710	0.043820	0.054269	0.054269	0.054269
Special Categories	0.000000	0.000000	0.000694	0.000694	0.000694	0.000694	0.000694
Total	0.187621	0.214918	0.228844	0.266875	0.296004	0.305349	0.314984

New Market Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.158602	0.204022	0.220761	0.247855	0.274647	0.299007	0.323206
Total Nonresidential	0.000983	0.054361	0.050693	0.052202	0.054444	0.054444	0.054444
Total	0.159585	0.258383	0.271455	0.300057	0.329091	0.353451	0.377649

Prior Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.792192	0.921589	1.054901	1.526091	2.045867	2.266770	2.492131
Total Nonresidential	0.092304	0.281607	0.317751	0.425852	0.452829	0.462003	0.473897
Unmetered/Unaccounted	0.098277	0.133689	0.152517	0.216883	0.277633	0.303197	0.329559
Total	0.982772	1.336885	1.525169	2.168826	2.776329	3.031970	3.295587

St. Lawrence/ Sand Creek Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.152415	0.171956	0.175494	0.185845	0.187078	0.200660	0.213702
Total Nonresidential	0.010840	0.018634	0.020856	0.023165	0.026091	0.026091	0.026091
Major Crop Irrigation	0.003279	0.002877	0.006953	0.006953	0.006953	0.006953	0.006953
Total	0.166535	0.193466	0.203303	0.215963	0.220122	0.233704	0.246747

Savage	1990	1995	2000	2010	2020	2030	2040
Residential	0.911599	1.350671	1.698470	2.489122	3.327888	3.727589	4.129554
Total Nonresidential	0.260759	0.323129	0.364839	0.516856	0.559947	0.615050	0.665501
Unmetered/Unaccounted	0.159867	0.185978	0.229257	0.333998	0.431982	0.482515	0.532784
Water Level Maintenance	0.000000	0.308712	0.356291	0.000000	0.000000	0.000000	0.000000
Total	1.332225	2.168490	2.648857	3.339976	4.319817	4.825154	5.327838

Shakopee	1990	1995	2000	2010	2020	2030	2040
Residential	1.034773	1.229967	1.531356	2.563699	3.590535	4.195306	4.794801
Total Nonresidential	3.497526	4.358492	5.229182	6.812416	7.579932	7.941944	8.305973
Unmetered/Unaccounted	0.737816	0.909749	1.100553	1.526344	1.818448	1.975831	2.132684
Major Crop Irrigation	0.013816	0.009691	0.038120	0.038120	0.025540	0.025540	0.012580
Special Categories	0.000000	0.000000	0.009861	0.009861	0.009861	0.009861	0.009861
Water Level Maintenance	4.468427	7.406400	6.344638	0.000000	0.000000	0.000000	0.000000
Total	9.752360	13.914300	14.253710	10.950441	13.024318	14.148483	15.255899

Shakopee Mdewakanton Sioux Community	1990*	1995	2000	2010	2020	2030	2040
Residential	0.013474	0.023329	0.047718	0.060968	0.065018	0.069787	0.073458
Nonresidential	0.074018	0.128159	0.262139	0.334926	0.357179	0.383373	0.403540
Total	0.087491	0.151488	0.309857	0.395893	0.422197	0.453159	0.476997

* 1993 use

Spring Lake Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.225459	0.272202	0.291460	0.315374	0.329741	0.355628	0.381945
Total Nonresidential	0.001023	0.005407	0.006689	0.009755	0.013016	0.013016	0.013016
Total	0.226482	0.277609	0.298149	0.325129	0.342757	0.368644	0.394961

Washington County

Projected Water Use In Million Gallons Per Day

Afton	1990	1995	2000	2010	2020	2030	2040
Residential	0.208904	0.233744	0.237980	0.253576	0.270434	0.285789	0.301406
Total Nonresidential	0.026579	0.026432	0.030275	0.043095	0.048286	0.048286	0.048286
Total	0.235483	0.260177	0.268255	0.296672	0.318720	0.334075	0.349692

Bayport	1990	1995	2000	2010	2020	2030	2040
Residential	0.212380	0.221171	0.216230	0.240646	0.277083	0.286340	0.295667
Total Nonresidential	0.808526	1.084902	1.257969	1.463055	1.558765	1.558765	1.558765
Unmetered/Unaccounted	0.113434	0.145119	0.163800	0.189300	0.203983	0.205012	0.206048
Special Categories	0.145066	0.223336	0.192524	0.192524	0.192524	0.192524	0.192524
Total	1.279406	1.674529	1.830523	2.085526	2.232356	2.242641	2.253004

Baytown Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.074256	0.099578	0.117929	0.228046	0.446274	0.493259	0.540283
Total Nonresidential	0.007903	0.011058	0.012779	0.019474	0.023490	0.023490	0.023490
Total	0.082159	0.110636	0.130708	0.247520	0.469763	0.516749	0.563773

Birchwood	1990	1995	2000	2010	2020	2030	2040
Residential	0.085215	0.085925	0.082580	0.082332	0.084345	0.084485	0.084624
Total Nonresidential	0.000418	0.000717	0.001792	0.001792	0.001792	0.001792	0.001792
Total	0.085633	0.086642	0.084372	0.084124	0.086138	0.086277	0.086416

Cottage Grove	1990	1995	2000	2010	2020	2030	2040
Residential	2.049572	2.570925	2.936744	3.877321	4.918997	5.319896	5.720521
Total Nonresidential	4.464454	5.212034	5.736903	6.343547	7.045786	7.449316	7.851648
Unmetered/Unaccounted	0.566437	0.676779	0.754230	0.888771	1.040416	1.110366	1.180189
Major Crop Irrigation	0.162227	0.141733	0.429972	0.429972	0.214986	0.214986	0.322479
Special Categories	0.327408	0.394532	0.334639	0.334639	0.334639	0.334639	0.334639
Water Level Maintenance	6.670521	6.878466	10.698197	10.698197	10.698197	10.698197	10.698197
Total	14.240619	15.874468	20.890686	22.572447	24.253022	25.127401	26.107673

Dellwood	1990	1995	2000	2010	2020	2030	2040
Residential	0.070066	0.073207	0.080736	0.087869	0.096126	0.104561	0.113088
Total Nonresidential	0.085624	0.109126	0.165901	0.175452	0.185598	0.185598	0.185598
Total	0.155690	0.182333	0.246638	0.263321	0.281724	0.290159	0.298686

Denmark Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.092594	0.106753	0.114006	0.123082	0.128934	0.137738	0.146671
Total Nonresidential	0.049582	0.051262	0.024615	0.026933	0.030720	0.030720	0.030720

Special Categories	0.318137	0.000000	0.262891	0.262891	0.262891	0.262891	0.262891
Total	0.460313	0.158015	0.401513	0.412906	0.422545	0.431349	0.440282

Forest Lake	1990	1995	2000	2010	2020	2030	2040
Residential	0.327451	0.371971	0.386480	0.440313	0.480079	0.504083	0.528087
Total Nonresidential	0.191527	0.205704	0.233905	0.272811	0.294473	0.294473	0.294473
Unmetered/Unaccounted	0.129744	0.144419	0.155096	0.178281	0.193638	0.199639	0.205640
Total	0.648722	0.722094	0.775481	0.891406	0.968190	0.998195	1.028200

Forest Lake Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.528598	0.590135	0.643281	0.879425	1.169617	1.280145	1.388945
Total Nonresidential	0.108549	0.362620	0.445320	0.503147	0.541516	0.578374	0.616008
Major Crop Irrigation	0.000000	0.000123	0.000349	0.000349	0.000349	0.000349	0.000035
Special Categories	0.000000	0.150685	0.177534	0.177534	0.177534	0.177534	0.177534
Total	0.637147	1.103564	1.266485	1.560456	1.889016	2.036402	2.182522

Grant Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.298330	0.330970	0.341420	0.423189	0.551618	0.603655	0.655397
Total Nonresidential	0.147086	0.738565	0.915837	1.107841	1.620951	1.620951	1.620951
Major Crop Irrigation	0.002071	0.016063	0.017866	0.017866	0.015186	0.015186	0.014293
Water Level Maintenance	0.021918	0.027123	0.000000	0.000000	0.000000	0.000000	0.000000
Total	0.469405	1.112722	1.275123	1.548896	2.187756	2.239793	2.290642

Grey Cloud Is. Twp/ St. Paul Park	1990	1995	2000	2010	2020	2030	2040
Residential	0.397818	0.412558	0.401279	0.423190	0.436294	0.453214	0.469458
Total Nonresidential	1.982412	2.049301	2.252279	2.418072	2.499204	2.499204	2.499204
Unmetered/Unaccounted	0.235407	0.243481	0.262440	0.281004	0.290324	0.291997	0.293604
Special Categories	0.009660	0.181468	0.284873	0.284873	0.284873	0.284873	0.284873
Water Level Maintenance	3.252055	3.258164	4.090668	4.090668	4.090668	4.090668	4.090668
Total	5.877352	6.144972	7.291540	7.497808	7.601365	7.619958	7.637808

Lake Elmo	1990	1995	2000	2010	2020	2030	2040
Residential	0.288967	0.311861	0.331905	0.442839	0.646771	0.741860	0.838134
Total Nonresidential	0.128938	0.172351	0.181018	0.259634	0.319862	0.339118	0.357746
Unmetered/Unaccounted	0.073748	0.085449	0.090516	0.123966	0.170582	0.190761	0.211038
Special Categories	0.455866	0.455996	0.386355	0.386355	0.386355	0.386355	0.386355
Total	0.947519	1.025658	0.989794	1.212794	1.523571	1.658094	1.793272

Hugo	1990	1995	2000	2010	2020	2030	2040
Residential	0.438189	0.551876	0.641742	1.107876	1.644333	1.875269	2.108360
Total Nonresidential	0.054400	0.079008	0.089856	0.101423	0.107257	0.115436	0.123847
Unmetered/Unaccounted	0.130941	0.167703	0.194476	0.321459	0.465613	0.529175	0.593371
Major Crop Irrigation	0.003090	0.000000	0.003137	0.003137	0.002666	0.002666	0.000941

Total	0.626621	0.798587	0.929211	1.533895	2.219869	2.522546	2.826519

Lakeland Shores/ Lakeland/ Lake St. Croix Beach	1990	1995	2000	2010	2020	2030	2040
Residential	0.192161	0.203654	0.209721	0.232256	0.256811	0.263800	0.270807
Total Nonresidential	0.514363	0.504999	0.533799	0.682505	0.811386	0.811386	0.811386
Unmetered/Unaccounted	0.021851	0.021917	0.022995	0.028292	0.033037	0.033253	0.033470
Total	0.728375	0.730569	0.766516	0.943053	1.101234	1.108439	1.115663

Mahtomedi/ Pine Springs	1990	1995	2000	2010	2020	2030	2040
Residential	0.396794	0.462287	0.520693	0.565557	0.597901	0.653176	0.708631
Total Nonresidential	0.028801	0.033705	0.039295	0.061186	0.066932	0.070473	0.073950
Unmetered/Unaccounted	0.069283	0.080743	0.091161	0.102028	0.108229	0.117803	0.127397
Total	0.494877	0.576735	0.651149	0.728770	0.773063	0.841452	0.909978

Marine-on-St. Croix	1990	1995	2000	2010	2020	2030	2040
Residential	0.047556	0.049518	0.053938	0.063361	0.073371	0.075976	0.078279
Total Nonresidential	0.021150	0.012218	0.013908	0.017932	0.021875	0.021875	0.021875
Total	0.068706	0.061736	0.067846	0.081294	0.095246	0.097851	0.100154

May Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.200091	0.223743	0.230492	0.252636	0.271800	0.297425	0.323662
Total Nonresidential	0.000399	0.001899	0.002619	0.003555	0.004137	0.004137	0.004137
Total	0.200491	0.225642	0.233111	0.256191	0.275936	0.301562	0.327798

Newport	1990	1995	2000	2010	2020	2030	2040
Residential	0.228977	0.233662	0.233345	0.254649	0.273451	0.282298	0.291145
Total Nonresidential	0.074733	0.080431	0.098799	0.110554	0.119968	0.119968	0.119968
Unmetered/Unaccounted	0.112331	0.128291	0.135665	0.149167	0.160692	0.164306	0.167919
Major Crop Irrigation	0.000000	0.000296	0.003771	0.003771	0.000000	0.000000	0.000000
Special Categories	0.000000	0.000000	0.141520	0.141520	0.141520	0.141520	0.141520
Total	0.416040	0.442680	0.613100	0.659661	0.695632	0.708092	0.720553

New Scandia Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.252636	0.288077	0.299828	0.324651	0.338086	0.369396	0.400197
Total Nonresidential	0.011454	0.014152	0.018804	0.026867	0.031493	0.031493	0.031493
Major Crop Irrigation	0.034340	0.028547	0.049934	0.049934	0.049934	0.049934	0.049934
Total	0.298430	0.330776	0.368567	0.401452	0.419513	0.450823	0.481624

Oak Park Heights	1990	1995	2000	2010	2020	2030	2040
Residential	0.210397	0.230502	0.250785	0.324893	0.410742	0.440491	0.470021
Total Nonresidential	0.152969	0.173715	0.231011	0.309328	0.335427	0.335427	0.335427
Unmetered/Unaccounted	0.064123	0.076994	0.053533	0.070469	0.082908	0.086213	0.089494
Total	0.427489	0.481211	0.535329	0.704691	0.829077	0.862132	0.894943

Oakdale/Landfall	1990	1995	2000	2010	2020	2030	2040
Residential	1.437268	1.871898	2.120059	2.332784	2.601921	2.755471	2.909702
Total Nonresidential	0.161450	0.219451	0.318942	0.429002	0.495099	0.513592	0.532209
Unmetered/Unaccounted	0.177635	0.206837	0.241220	0.273144	0.306299	0.323314	0.340409
Special Categories	0.047907	0.054362	0.050141	0.050141	0.050141	0.050141	0.050141
Total	1.824260	2.352549	2.730362	3.085071	3.453460	3.642518	3.832461

St. Mary's Point	1990	1995	2000	2010	2020	2030	2040
Residential	0.026784	0.029953	0.030923	0.034688	0.038711	0.038942	0.039113
Total Nonresidential	0.002419	0.007055	0.007744	0.009138	0.009989	0.009989	0.009989
Total	0.029203	0.037008	0.038668	0.043826	0.048700	0.048931	0.049102

Stillwater	1990	1995	2000	2010	2020	2030	2040
Residential	1.244647	1.413660	1.456464	1.712104	1.826580	1.898706	1.973845
Total Nonresidential	0.254797	0.258141	0.286796	0.347745	0.381365	0.381365	0.381365
Unmetered/Unaccounted	0.224055	0.249809	0.260487	0.307793	0.329923	0.340700	0.351928
Total	1.723499	1.921611	2.003747	2.367642	2.537867	2.620771	2.707137

Stillwater Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.163149	0.202360	0.211110	0.287396	0.351538	0.394802	0.438003
Total Nonresidential	0.005791	0.007128	0.009585	0.016034	0.022474	0.022474	0.022474
Total	0.168940	0.209489	0.220696	0.303429	0.374012	0.417276	0.460477

West Lakeland Twp.	1990	1995	2000	2010	2020	2030	2040
Residential	0.137028	0.209273	0.251433	0.293551	0.345798	0.391952	0.437750
Total Nonresidential	0.030230	0.043474	0.049853	0.049853	0.055279	0.055279	0.055279
Total	0.167258	0.252748	0.301286	0.343405	0.401077	0.447231	0.493029

Willernie	1990	1995	2000	2010	2020	2030	2040
Residential	0.038074	0.037892	0.036650	0.037369	0.038049	0.038049	0.038049
Total Nonresidential	0.002876	0.003391	0.003795	0.003795	0.004039	0.004039	0.004039
Unmetered/Unaccounted	0.006666	0.006720	0.006584	0.006701	0.006852	0.006852	0.006852
Total	0.047615	0.048003	0.047030	0.047865	0.048940	0.048940	0.048940

Woodbury	1990	1995	2000	2010	2020	2030	2040
Residential	1.677642	2.635871	3.585444	4.805688	5.889400	6.835741	7.787445
Total Nonresidential	0.706235	1.290195	1.559211	1.907298	2.213605	2.400893	2.588350
Unmetered/Unaccounted	0.294636	0.485244	0.635856	0.829695	1.001495	1.141607	1.282402
Major Crop Irrigation	0.000000	0.060751	0.152942	0.152942	0.076471	0.076471	0.000000
Special Categories	3.973570	4.087995	3.910833	3.910833	3.910833	3.910833	3.910833
Total	6.652083	8.560055	9.844286	11.606456	13.091804	14.365545	15.569030