WATER DEMAND IN THE TWIN CITIES METROPOLITAN AREA

Working Paper No. 2

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By

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The Metropolitan Council coordinates the planning and development of the seven-county Metropolitan Area. The Council is authorized by state and federal laws to plan for highways and transit, sewers, parks and open space, airports, land use, air and water quality, health, housing, aging and arts.

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ABOUT THIS REPORT

This report is Working Paper No. 2 in a series of eight. The reports are being prepared as background technical studies for the preparation of a long-term water supply plan for the Twin Cities Metropolitan Area. The long-term plan preparation was required by the 1989 legislature and must be presented to the legislature on February 1, 1992.

The other technical reports in the series are:

- No. 1 Alternative Sources of Water for the Twin Cities Metropolitan Area. Metropolitan Council Report No. 590-91-011.
- No. 3 Water Availability in the Twin Cities Metropolitan Area: The Water Balance. Council Report No. 590-91-008.
- No. 4 The Public Water Supply System: Inventory and the Possibility of Subregional Interconnection. Council Report No. 590-91-010.
- No. 5 Water Conservation in the Twin Cities Metropolitan Area. Council Report No. 590-91-020.
- No. 6 The Effects of Low Flow on Water Quality in the Metropolitan Area. Council Report 590-91-054.
- No. 7 The Economic Value of Water. Council Report No. 590-91-065.
- No. 8 The Institutional Framework for Water Supply Management. Council Report No. 590-91-064.

The report was prepared by Judith A. Hartsoe of the Metropolitan Council Natural Resources and Parks Division. Questions on the content of the study can be directed to her at (612) 291-6323.

Well permit records for the years 1984 - 1989 were obtained from the Minnesota Department of Natural Resources (MDNR) with the help of Nina Langoussis.

INTRODUCTION

Purpose

October 1986 was the beginning of a three year drought in the state of Minnesota. A Twin Cities Water Supply Task Force, formed on Sept. 23, 1988, recommended ways to meet future water demands during low-flow periods on the Mississippi River. A series of recommendations were made in January 1989 by the task force. One of these recommendations suggested the Metropolitan Council prepare a long-term water supply plan for the Twin Cities Metropolitan Area. In response to the task force recommendations, the 1989 state legislature passed a bill requiring the Council to prepare both short- and long-term water use and supply plans for the Metropolitan Area. The short-term water supply plan was completed in February of 1990. The water demand paper is the second of eight technical papers investigating issues pertinent to the long-term water supply. The long-term water supply report will be completed by February of 1992.

The severe drought during the summer of 1988 was one of the catalyst that instigated the study to evaluate water demand in the Metropolitan Area. Effects of potential chemical spills on the Mississippi River, the main source of water to Minneapolis and St. Paul, and increased drawdown of hydraulic head on current groundwater wells (Corrigan, 1991) are several other factors that influenced the implementation of the water demand study in the Metropolitan Area.

This report examines current and projected water use. Significant components of a water demand study, population served and water use data, were collected from the Metropolitan Waste Control Commission (MWCC), the Minnesota Department of Health public water supply reports, the Minnesota Department of Natural Resources (MDNR) Metropolitan Area water use reports, and by direct contact between Council staff and Metropolitan Area cities.

The diverse types of water users in each city throughout the Metropolitan Area dictated the need for a water demand study focusing on individual cities as well as regional demand. Initially, the U.S. Army Corps of Engineers (USCE) IWR-MAIN model was used to determine water demand for the 113 municipally supplied cities in the Metropolitan Area. After several months of data collection and various difficulties with the model, IWR-MAIN (MAIN) was replaced with a statistical model.

The statistical model was designed to forecast water use by city for the Metropolitan Area. The primary focus of the model was to project water use of the 113 municipally supplied cities for residential and commercial/industrial/institutional water users. Separate forecasts were also completed for six other water use categories: sewage treatment, private waterworks, power generation, major crop irrigation, water level maintenance, and miscellaneous uses. All eight forecasts were combined to yield an overall forecast of the municipally supplied cities. Water demand was projected on a per capita basis for the 76 non-municipally supplied cities, rural cities without a central water supply. The overall total municipal and non-municipal water use for the region was determined from the sum of water use for the 113 municipally supplied cities and the 76 non-municipally supplied cities in the Metropolitan Area.

METHODS

Data Collection

Data collection and subsequent modeling began in March of 1990. A municipal water supply survey (Appendix A) was mailed by the Metropolitan Council to 111 of the 113 cities served by municipal water systems. White Bear Lake serves Willernie and Birchwood, so surveys were not sent to these cities. Lakeland is currently in the process of developing a municipal water system, which will be operable in September of 1991. For the purposes of this study, Lakeland was included with the non-municipally supplied cities. The survey included general system background questions and specific questions relating to information needed by the MAIN model. Survey responses were obtained for 109 of the 111 municipally supplied cities.

Pertinent information for modeling water use obtained from the surveys included the percent of the city's water supply that was for residential versus commercial/industrial/institutional use; water and sewer rates in $/1000 gallons; water use by car washes, parks, irrigation systems in gallons/day/unit; leakage in gallons/day/unit; and current conservation measures utilized by the cities.

City water pricing methods were determined from the surveys (Appendix B). Fifty-four cities use single block water rates, 45 cities use declining block rates, seven cities use increasing block rates and five cities use flat rates. The price per unit decreases with the amount purchased in a "declining block" rate system, while the price per unit increases with the amount purchased in an "increasing block" rate system. The price per unit of water is constant no matter how much is consumed in a "single block" rate system, and each customer pays one price for any amount of water consumed in a "flat charge" rate system. Working Paper No. 1 contains further details on water pricing methods.

The breakdown of the percent of water used by commercial, industrial, institutional and residential water users was also indicated by the survey (Appendix C). The majority of the cities reported commercial, industrial and institutional use together. The percent commercial/industrial column portrays this combined water use category. For the cities not responding to this question, the residential and commercial/industrial/institutional water use percentages were obtained from either the Minnesota Department of Health or from the city comprehensive plans.

Other information needed for the modeling was collected from a variety of sources. Commercial and industrial data were obtained from Marketing Information Services, Inc. Contacts Influential and from the Council report on Twin Cities Area Average Covered Employment, First Quarter 1988.

The percent of water used by commercial and industrial users was obtained from the cities, from comprehensive city plans, or from the Council's 1984 updated report Water Use in the Twin City Metropolitan Area.

Year-round housing units, sewer and source of water information were compiled from the 1980 Census of Housing - General Housing Characteristics and from the 1980 Census of Housing - Detailed Housing Characteristics.

Population, employment and housing numbers were collected from an updated version of the Council's Forecasts of Population, Households and Employment 1990 and 2000. The population and housing densities were collected from the Council's report Population and Housing Density in the Metropolitan Area by Community and Census Tract, 1980. The number of houses by value range were adjusted from the 1980 Census to reflect 1988 values.

Median household income data used in the model were derived from the Council's report Income Data for 1979 by Metropolitan Area City Source - 1980 Census of Population and Housing. The median household income was adjusted to reflect 1988 values.

Evaporation, precipitation and maximum evapotranspiration data were obtained from the Climatologist's office of the Minnesota Department of Natural Resources (MDNR).

Other information gathered from the surveys included conservation measures used by cities, population served and water use data. Population served and water use data were also obtained from the MWCC, the Minnesota Department of Health and the MDNR.

The most important data for the statistical model were population served, total population, commercial, industrial and institutional water use, residential water use, and total number of employees by city.

Data collection was a very time consuming and labor intensive process. Most of the data collected for MAIN were applicable to the statistical model.

Model Descriptions

After it was determined that the MAIN model could not meet the needs we had for a regional water supply model, a statistical regression model approach was chosen to project water use in the Twin Cities Metropolitan Area. The most commonly used statistical technique has been a multiple regression analysis where cross-sectional data for a sample of cities representing the region are regressed against water use. Statistical studies of aggregated or total municipal water demands are also popular since aggregated water production data are easy to obtain. Table 1 compares the different model types considered for this study.

Survey data on water use, demographics and water pricing were entered into a SAS (SAS Institute Inc., 1985) program for analysis. The regression technique was used to project the water demand for residential and commercial/industrial/institutional water use by city. A statistical analysis was used to test for several residential and commercial/industrial/institutional variables. After it was determined that a multivariate analysis did not produce more significant correlations than a univariate analysis, a single variable (univariate) equation was selected to project water use.

Table 1

PROS AND CONS OF THE DIFFERENT MODEL TYPES

MODEL TYPE	PROS	CONS
IWR-MAIN MODEL	• uses extrapolative and causal forecasting models • mix of 2 methods yields more reliable results	• data tedious and difficult to obtain • time consuming • not calibrated for Midwest • lack of choice for base year
MULTIVARIATE MODEL	• data easily obtained • accurate results with less time involved • use any year for base year • calibrations minimal	• have to know which are important variables to use
UNIVARIATE MODEL	• data easily obtained • accurate results with less time involved • use any year for base year • calibrations minimal	• only uses 1 variable • cannot be sure if output is based on most important variable

Data Management

Detailed demographic and water supply information were collected for 111 municipally supplied cities. The data was compiled by city in a spreadsheet which made future calculations and manipulations of the data more efficient. It was necessary to duplicate some of the spreadsheet data and enter it into SAS data files to develop the statistical model and produce the water use projections. Results of the data manipulations were entered into a graphics package to produce several charts. The time involved in data entry was minimal compared to the time involved in the actual data collection.

Immense amounts of data were collected to run the regional water use model. Data was collected for demographic and socioeconomic determinants of water use for the base year and projected values of selected determinants for forecast years. The following is a sample of the types of information collected for the regional statistical model:

- Resident population of city
- Population served by city
- Median household income of city
- Total employment of city for the base year and for 5 years prior to base year
- Total number of housing units for city
- Number of multi-family units for city

- Number of single-family units for city
- Housing density for city
- Population density for city
- Summer and winter water and sewer prices for city
- Employment numbers for any of 23 Standard Industrial Classification (SIC) categories
- Manufacturing employment numbers for any of 198 three-digit SIC codes.

The Council's study involved collecting this data for 111 cities.

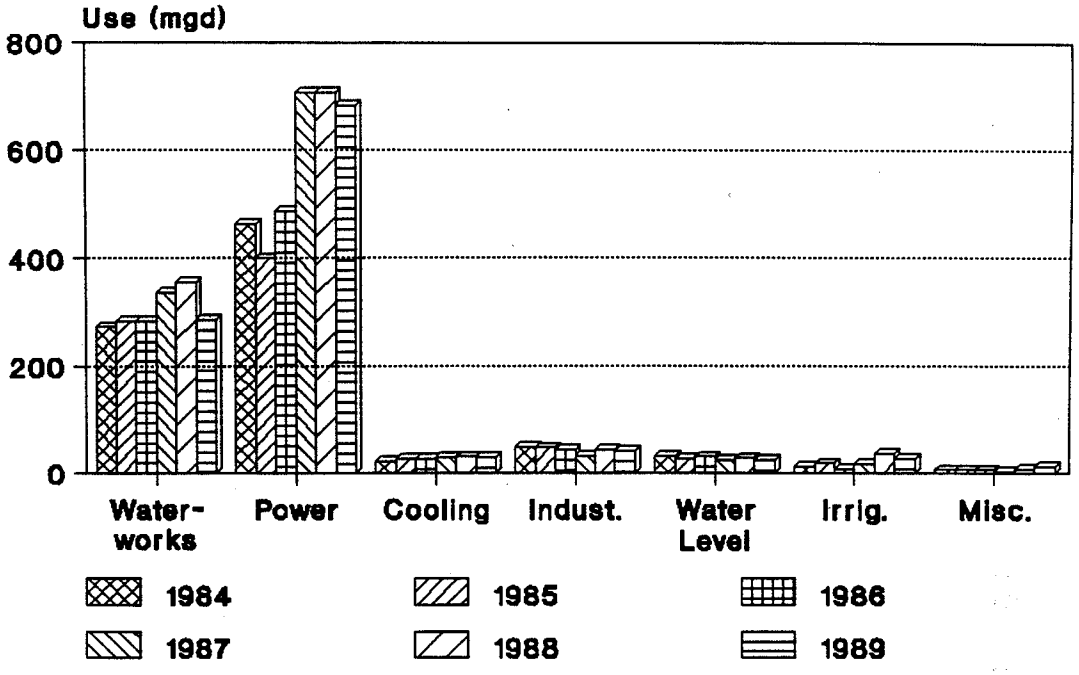
WATER USE MODELS AND PROJECTIONS

The amount of water used in the Twin Cities Metropolitan Area is critical to the planning and development of the area. Figure 1 illustrates the water use changes of the MDNR permitted water use for the years 1984 to 1989. The majority of user types have increased water use since 1984. Waterworks and power generation are the primary users of water. Water use is synonymous with "withdrawal" and is therefore different than water consumption. Water use includes all water used by a facility or entity whether it is used and returned to the system or used and consumed. Water consumption includes water that is used and 100% consumed.

Power generation uses approximately 258 billion gallons of water per year (BGY) but consumes only about 1% or 2.58 BGY. Most of the water used for power generation is used by the facility and returned to the river. Still, power generation along with waterworks and industry use so much water overall that their consumed volumes are high enough to account for over 60% of the region's water consumption. Waterworks and industry are the main components of water consumption in the Metropolitan Area emphasized in the modeling.

The collected data were divided into residential and commercial/industrial/institutional water use. Separate models were developed for residential and commercial/industrial/institutional water use projections. A statistical analysis was also completed to determine the effects of the four water pricing rate systems on the overall water use.

Figure 1
Water Use Changes, 1984-1989



Data from DNR

Residential Water Use Model

Residential water use includes all water used by multi-family and single-family households. Single-family residences include mobile homes and houses while multi-family residences include apartment complexes and townhouses. Detailed individual city data used in the residential statistical analysis are included in Appendix D.

The Pearson Correlation (PROC CORR in SAS) procedure determined statistical correlations among a set of variables that contained sufficient information for computing regressions. Residential water use (rwater) was correlated with population served, number of single-family and multi-family buildings, median household income, price of water, number of connections, housing density, total number of units, water rate structure, and population density. The PROC CORR procedure produced a significant correlation, ranging from $r^2 = 0.951$ to 0.979, between

residential water use and population served, number of single-family buildings, number of multi-family buildings, and number of connections.

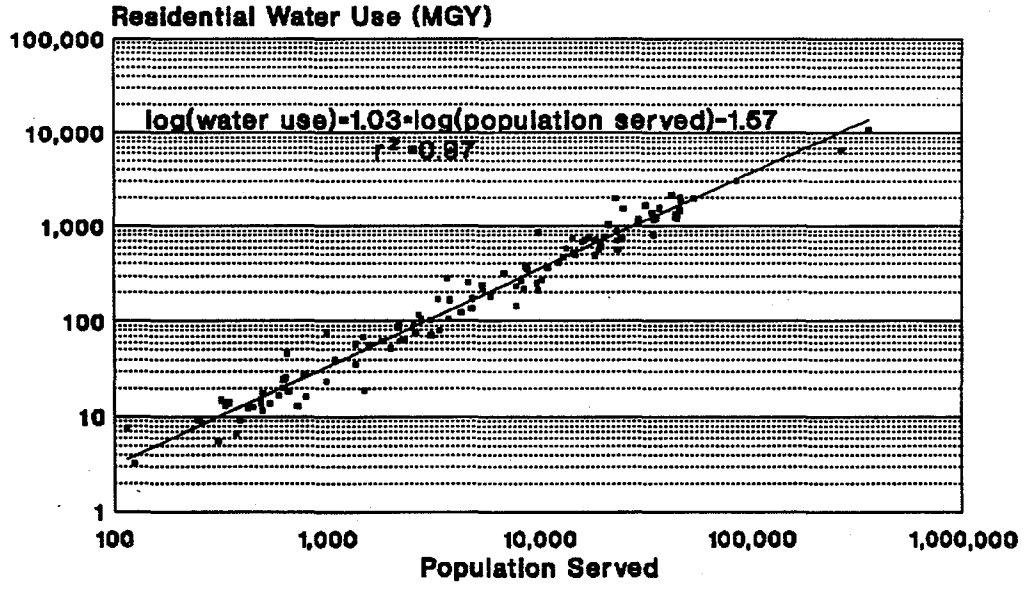
A multivariate regression analysis (PROC STEPWISE in SAS) identified population served as the only variable needed to statistically analyze residential water use. A univariate regression analysis (PROC REG in SAS) also identified population served (amhv) as the independent variable that best correlated with rwater. Because these data were not normally distributed, they were log-transformed to construct the following regression model:

$$\log (\text{rwater}) = 1.03 \log (\text{amhv}) - 1.57 \qquad \text{(Eq. 1)}$$
$$(n=111,\ r=0.97,\ p<0.001)$$

where rwater is in million gallons per year (MGY) and amhv is population served.

Figure 2 is the graph of the model used to project all future residential water use. Because the actual water use for each city deviated from the expected use according to the model, it was necessary to transform the model for each city's water use projections for 1990, 2000 and 2010. In this way, the model was used to predict future water use on a city-by-city basis.

Figure 2
1988 Residential Water Use and Population Served



Residential water use was projected for the region for 1990, 2000 and 2010. The following table lists the projected use in MGY and MGD for the Metropolitan Area. Appendix E details the residential water use projections for each city.

Projected Residential Water Use

YEAR	MGY	MGD
1990	71424	196
2000	79486	218
2010	83909	230

Note that the projections for the city of Rockford include the whole city and not just the portion in Hennepin County. The residential water use projections show a 17% increase in water use from 1988 to 2010. The largest increases occur in Centerville (71%), Chanhassen (56%), Eagan (46%), Eden Prairie (48%), Inver Grove Heights (42%), Lakeville (49%), Medina (65%), Plymouth (42%), Ramsey (51%), Rosemount (66%), and Savage (58%).

Commercial/Industrial/Institutional Water Use Model

Commercial/industrial/institutional water use includes all municipally supplied water used for commercial, institutional and industrial purposes, plus all self-supplied commercial/industrial/institutional uses. The self-supplied water uses were added to the municipally supplied uses to yield a total commercial/industrial/institutional water use before the regression analysis was run.

Because a 1990 state law requires all once-through commercial air-conditioning to be eliminated by the year 2010, commercial/industrial air-conditioning use was considered separately from the commercial/industrial water use projections. It was assumed air-conditioning use levels in 2000 would be half of the 1988 use levels and totally eliminated by 2010. The legislature has recently allowed several exemptions from the law eliminating all once-through air-conditioning use. The number of exemptions allowed to date are insignificant and warrant no change in procedures for projecting air-conditioning use. If, at some point, the number of exemptions increases significantly to warrant some attention, the model will need to be adjusted to better reflect this water use. Appendix F details all commercial/industrial/institutional water use data by city used in the statistical analysis.

PROC CORR (SAS) determined statistical correlations among a set of variables that contained sufficient information for computing regressions for the commercial/industrial/institutional water use data. The variables in Appendix F were correlated against commercial/industrial/institutional water use. The PROC CORR procedure produced a significant correlation, ranging from r^2 = 0.719 to 0.937, between commercial/industrial/institutional water use (cwater) and total employment, number of manufacturing employees, number of government employees, number of non-manufacturing employees, number of contract construction employees, number of transportation and public utilities employees, number of finance, insurance, and real estate employees, number of wholesale trade employees, number of retail trade employees, number of

services employees, acres of irrigable land, total number of car washes in the city, and number of agriculture, forestry and fisheries employees.

PROC REG (SAS) identified total employment (temp) as the independent variable that best correlated with cwater. Because these data were not normally distributed, they were log-transformed to construct the following regression model:

$$\log(\text{cwater}) = 1.10 \log(\text{temp}) - 1.96 \qquad \text{(Eq. 2)}$$
$$(n=111,\ r=0.76,\ p<0.001)$$

where cwater is in MGY and temp is the total number of employees (1988).

Figure 3
1988 Commercial/Industrial/Institutional Water Use and Total Employment

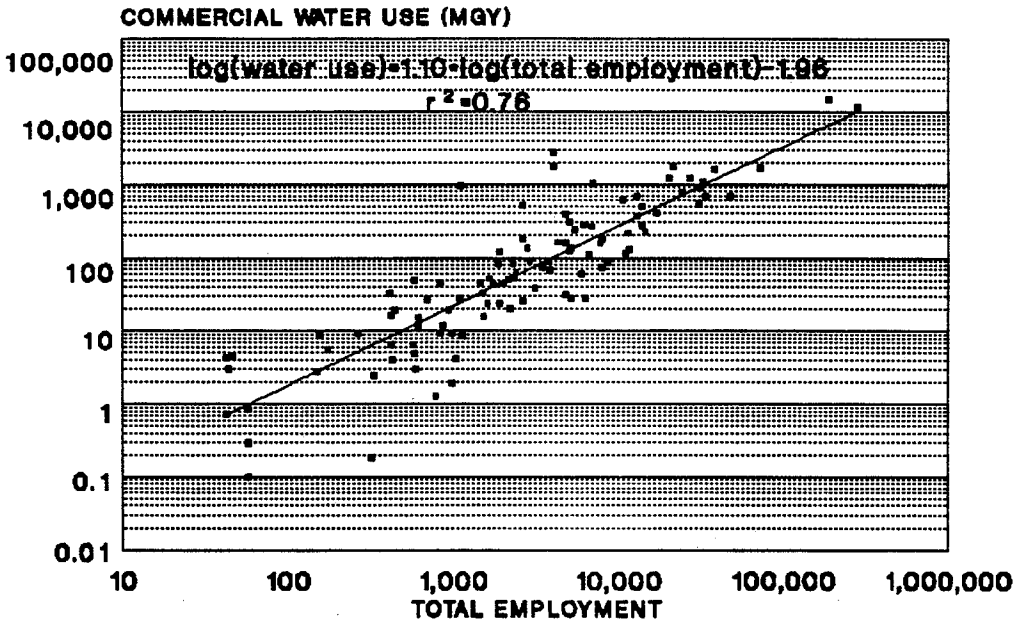


Figure 3 is the graph of the model used to project all future commercial/industrial/institutional water use. Because the actual water use for each city deviated from the expected use according to the model, it was necessary to transform the model for each city's water use projections for 1990, 2000 and 2010 similar to the technique described for residential water use. In this way, the model was used to predict future water use on a city-by-city basis.

Commercial/industrial/institutional water use was projected for the region for 1990, 2000 and 2010. The following table lists the projected use in MGY and MGD for the Metropolitan Area. Appendix G details the commercial/industrial/institutional water use projections for each city.

Projected Commercial/Industrial/Institutional Water Use

YEAR	MGY	MGD
1990	64471	176
2000	65986	181
2010	67407	185

The commercial/industrial/institutional water use projections show a 9% increase in water use from 1988 to 2010.

Projections

Table 2 summarizes the residential and commercial/industrial/institutional water use projections for 1990, 2000 and 2010. Appendix H details the commercial/industrial/institutional and residential water use projections. Figure 4 depicts the projected commercial/industrial/institutional and residential water use in the Metropolitan Area for 1990, 2000 and 2010. A 10% increase is expected in commercial/industrial/institutional and residential water use from 1990 - 2010.

Table 2
PROJECTED COMMERCIAL/INDUSTRIAL/INSTITUTIONAL AND RESIDENTIAL WATER USE

	Residential Use	Commercial/Industrial/ Institutional Use	Total Use
1990 MGY	71424	64471	135895
1990 MGD	196	176	372
2000 MGY	79486	65986	145472
2000 MGD	218	181	399
2010 MGY	83909	67407	151316
2010 MGD	230	185	415

Waterworks, industry, and power generation account for the majority of the water use in the Metropolitan Area, but there are several other permitted water use sources which must be considered when determining total water use. Figure 5 portrays the average permitted versus actual water use from 1984 - 1989 in the Metropolitan Area based on MDNR appropriation permit reporting data. For purposes of projection; power generation, private waterworks, sewage treatment, and miscellaneous uses water levels were assumed to remain constant through the year 2010. Sewage treatment includes water used for pollution confinement as well as water used for treatment at the sewage treatment plants, thus increases in population have an insignificant effect on the amount of water used for sewage treatment.

Figure 4
Projected Commercial/Industrial and Residential Water Use in the Twin Cities

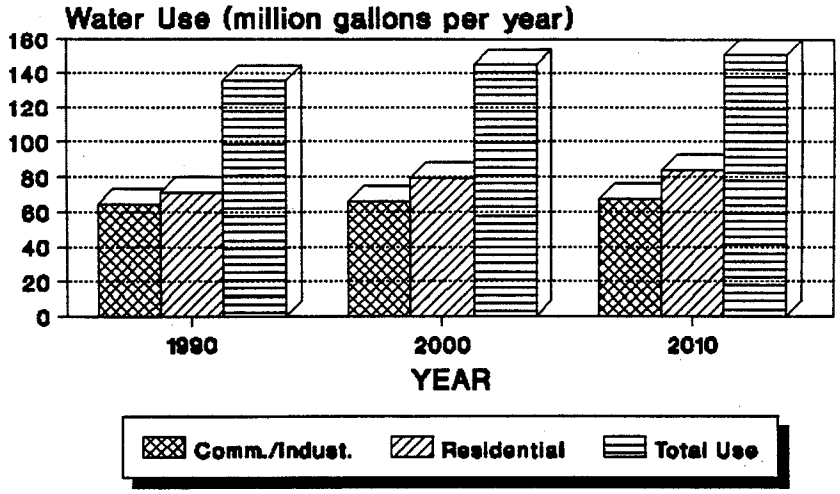
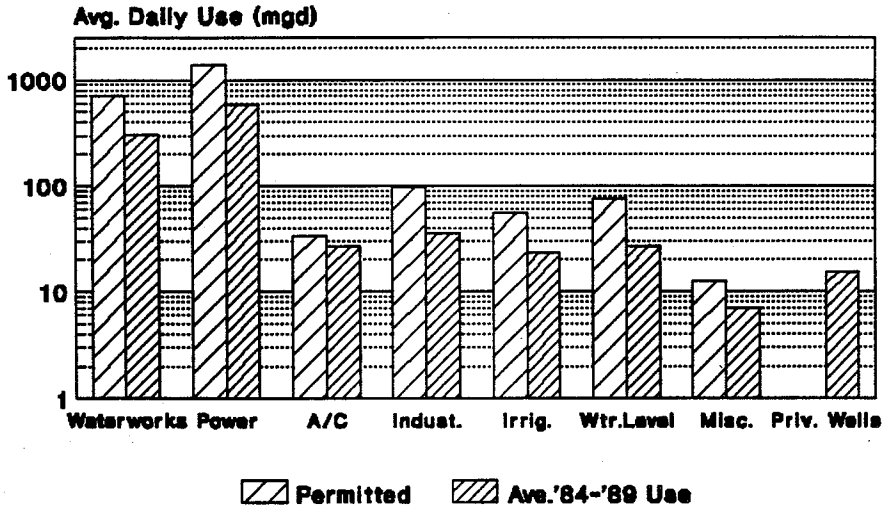


Figure 5
Metropolitan Actual and Permitted Water Use By Type



Source: DNR Appropriation Permits

Table 3 summarizes the 1988 self-supplied water uses reported to MDNR; private waterworks, major crop irrigation, power generation, sewage treatment, water level maintenance and miscellaneous uses. Appendix I details the complete list. Private waterworks, power generation, sewage treatment and miscellaneous uses were projected based on 1988 water use levels.

Table 3
ALL SELF SUPPLIED WATER USES FOR 1988 (MGY)

Irrigation	Power	Sewage	Water Level	Misc.	Private	Total
2201	258022	2797	8325	348	389	272082

Major crop irrigation water use levels were projected with a five year average of irrigation uses to account for wet and dry years and unusually high or low irrigating levels. The progressive loss of irrigable lands due to urban sprawl will effect the amount of water used for irrigation in the future. The prediction of actual amounts of land lost to urban sprawl was beyond the scope of this study. The amount of water used by irrigation was insignificant compared to the major water users. Therefore, it was assumed that by using a five year average of irrigation uses, a representative water use figure would be determined. This figure would then be used for all future water use predictions of irrigation water use.

MDNR policy has effectively eliminated the use of water for water level maintenance of lakes. Water level maintenance will be eliminated by 2010, similar to commercial/industrial air-conditioning use. There is the possibility that the legislature will reverse the MDNR policy and allow water to again be used for water level maintenance. For the purpose of this study, it was assumed that the volume of water will stay the same. Obviously, if they do reverse the law, more water will be used in this area and the model will need to be adjusted to reflect the change in policy.

Figure 6 shows the projected water level maintenance water use in the Metropolitan Area for 1990, 2000 and 2010. Figure 7 depicts the projected water use of the remaining four water use categories for 1990, 2000 and 2010.

Figure 6
Projected Water Level Maintenance Water Use in the Twin Cities

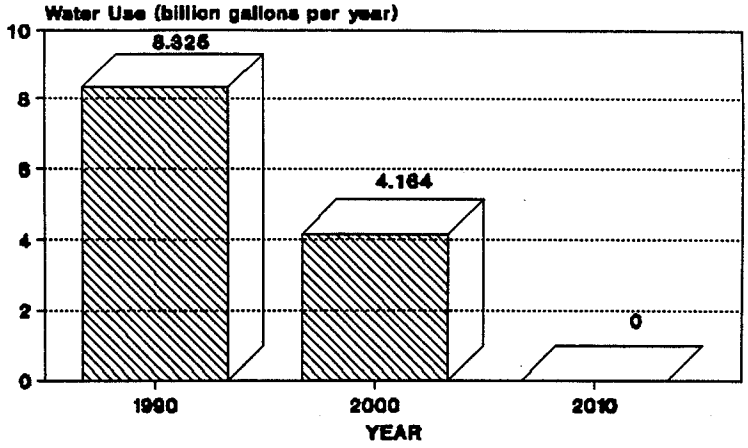
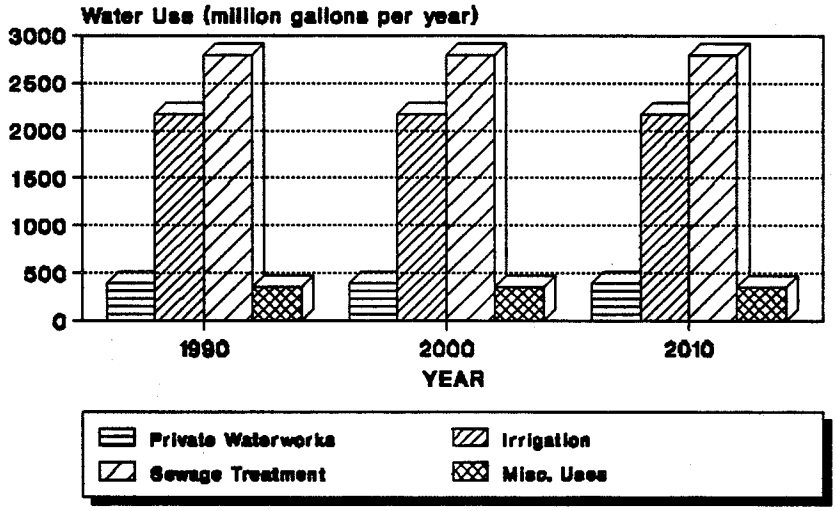


Figure 7
Projected Water Uses For Sewered Cities



The water use projections were divided into two parts. Part 1 projects water use for the "sewered" cities and Part 2 adds in the projections for the "non-sewered" cities. Table 4 summarizes the projected "sewered" cities water use for residential, private waterworks, major crop irrigation, commercial/industrial/institutional, power generation, sewage treatment, water level maintenance and miscellaneous water uses for 1988, 1990, 2000 and 2010. The table shows that

1103, 1118, 1133 and 1137 million gallons per day (MGD) are used by the 111 "sewered" cities for 1988, 1990, 2000 and 2010, respectively. Appendices J, K, L and M detail the projected water use for 1988, 1990, 2000 and 2010 by cities supplied by municipal water systems. Projected total water use in the region with these water use sources increased 3% from 1988 - 2010.

The majority of the cities (85%) are supplied by one of three aquifers while the remaining (15%) of the cities are supplied by surface water. Lauderdale, Falcon Heights, West St. Paul, Mendota Heights, Maplewood, Little Canada, Arden Hills, Roseville and St. Paul are supplied by the St. Paul Water Utility, which receives 90% of its water supply from surface water. The Minneapolis Water Works is supplied solely from surface water and supplies water to New Hope, Crystal, Golden Valley, Columbia Heights, Hilltop, Minneapolis and parts of Bloomington and Edina. Table 5 shows the predicted surface and ground water use for 1988, 1990, 2000 and 2010 for the "sewered" cities.

Table 4

PROJECTED WATER USE FOR 1988, 1990, 2000 AND 2010 FOR SEWERED CITIES

	Resid. Use	Comm'l. Use	Private Works	Irri-gation	Power Gen.	Sewer Treat.	Water Level Maint.	Misc Uses	Total Use
1988 MGY	69354	61172	389	2201	258022	2798	8325	348	402611
1988 MGD	190	167	1	6	707	8	22	1	1103
1990 MGY	71424	64471	389	2201	258022	2798	8325	348	407979
1990 MGD	196	176	1	6	707	8	22	1	1118
2000 MGY	79486	65986	389	2201	258022	2798	4164	348	413395
2000 MGD	218	181	1	6	707	8	11	1	1133
2010 MGY	83909	67407	389	2201	258022	2798	0	348	415075
2010 MGD	230	185	1	6	707	8	0	1	1137

* The MDNR policy eliminating water level maintenance may be suspended.

Table 5
PROJECTED SURFACE AND GROUND WATER USE FOR 1988, 1990, 2000 AND 2010 FOR SEWERED CITIES

	1988 MGY	1988 MGD	1990 MGY	1990 MGD	2000 MGY	2000 MGD	2010 MGY	2010 MGD
Surface Water	309000	847	309200	847	303000	831	297000	814
Ground Water	93611	256	98779	271	110395	302	118075	323
Total Water Use	402611	1103	407979	1118	413395	1133	415075	1137

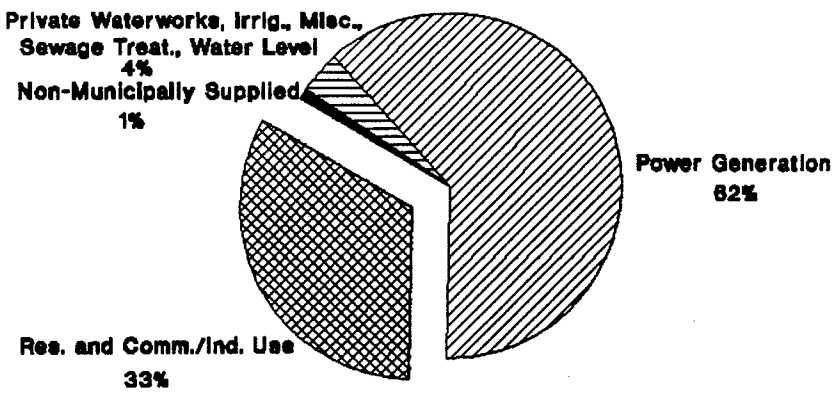
Part 2 projects the water use by the cities not connected to a municipal system. This includes 76 cities and townships. Table 6 summarizes current and projected water use by the 76 cities and townships in the region that are not municipally supplied. All water used for non-municipal purposes is supplied from ground water sources. Appendix N details the water use by city and township. Projections of non-municipal water use are calculated on a per capita basis, assuming average per capita use of 102 gallons (based on data in Working Paper No. 4). Overall the "non-sewered" cities water use projections for the region are 13 MGD, 14 MGD and 15 MGD for 1990, 2000 and 2010, respectively.

Table 6
WATER USE PROJECTIONS FOR THE NON-SEWERED CITIES

	Total Use (MGY)	Total Use (MGD)
1988	4860	13
1990	4871	13
2000	5239	14
2010	5608	15

The overall water use projections for the Metropolitan Area were computed by adding all nine water use categories together for sewered and non-sewered parts of the region. Figure 8 details the breakdown of total water use. Total water use consists of non-sewered supplied water use, residential and commercial/industrial water use, and six other water use categories. As previously mentioned, power generation is the largest water user but only consumes approximately 1% of the water it uses.

Figure 8
Breakdown of Overall Water Use



The final analysis yields a total of 1116 MGD of water use in 1988. Projection years of 1990, 2000 and 2010 yield total water use rates of 1131, 1147, and 1152 MGD, respectively, for an overall increase in use for 1988 - 2010 of only 3%. Figure 9 portrays the overall projected water use for the Metropolitan Area for 1990, 2000 and 2010 in MGD.

Figure 9
Projected Overall Water Use for the Twin Cities Metropolitan Area

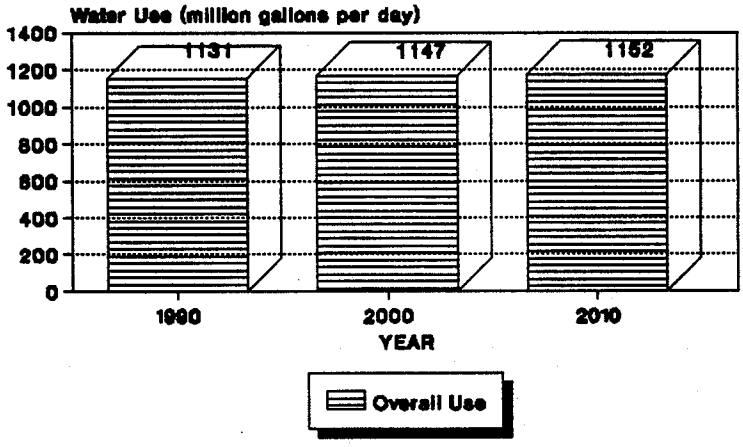
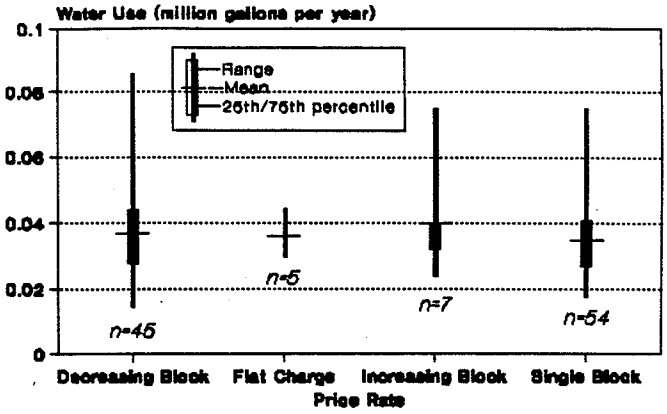


Figure 10
TWIN CITIES METROPOLITAN AREA
PER CAPITA WATER USE BY PRICE RATE



Data is for portion of population served by municipal systems only.

Pricing

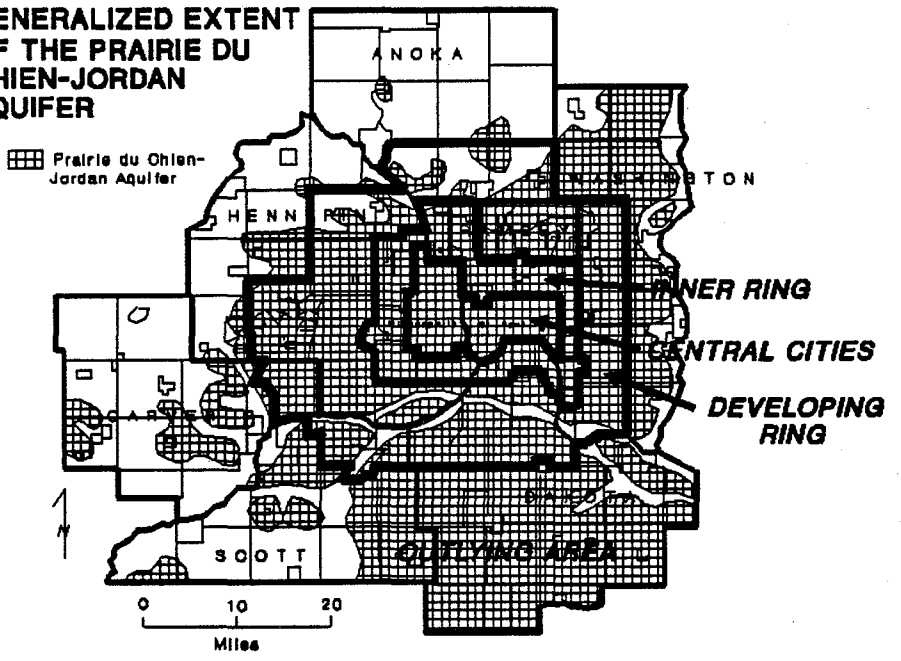
A separate analysis was completed to determine the effects, if any, of the four different pricing rate systems on overall water use. From the analysis clear correlations for the declining block, flat rate or single block rate pricing structures were not evident. The theory behind an increasing block pricing structure is that the more water you use the more you pay. If the rate structure increased significantly with the amount of water used, an obvious relationship between water use and price would occur. Due to the limited number of cities using this system (five) and the relatively minor increases in current water rates in this category, only a slight relationship was apparent with the increasing block structure and water use. Figure 10 illustrates the per capita water use by price rate. Fifty-four cities use the single block, 45 cities use declining block, seven use increasing block and five use the flat charge rate system. Despite the differing range values, the mean per capita water use by price rate is fairly consistent, ranging from 0.035 to 0.040 MGY.

DISCUSSION

The credibility and accuracy of a model relies on the quality of data available and/or statistically sound methods. The two models used to project commercial/industrial/institutional and residential water use relied primarily on population-served numbers supplied by the Minnesota Department of Health, total employment numbers supplied by the Council, percent residential water use and percent commercial/industrial/institutional water use supplied by the cities, and water use totals for 1988 supplied from the Minnesota Department of Health. This was the best data available for the model. The 1990 Census data will provide more current data for future use with the model.

The empirical models used for the projections produced the most statistically valid projections from the available data. Residential water use will increase by 17% from 1988 to 2010. The commercial/ industrial/institutional water use will increase by 10% and the overall water use of residential and commercial/industrial/institutional water use will increase 14%. Chaska, Chanhassen, Minnetonka, Eagan, Burnsville, Rosemount, Apple Valley, Maple Grove, Brooklyn Center, Brooklyn Park and Plymouth show the largest increases in water use from 1988 to 2010. Most of these cities lie in the developing ring and are served by the Prairie du Chien-Jordan Aquifer (Figure 11). Some of these cities lie beyond the extent of the Prairie du Chien-Jordan Aquifer and are supplied by the Mount Simon-Hinckley or drift aquifer. Corrigan (1991) details the aquifer layout of the Metropolitan Area in Working Paper No. 3.

Figure 11
GENERALIZED EXTENT OF THE PRAIRIE DU CHIEN-JORDAN AQUIFER



The projections indicate that most of the increase in water demand can be accommodated by more use of the Prairie du Chien-Jordan Aquifer. However, some of the water use increases by the cities will effect water levels in the Mount Simon-Hinckley and drift aquifers. Further studies are being completed on the effects of the increase in water use on these aquifers. A ground water model is being used to determine the effects, if any, of increased water use in the Plymouth, Brooklyn Park and Maple Grove areas.

Water in the region is easily accessible at a low cost. Working Paper No. 5 in the long-term water supply plan series is studying the effects of conservation measures on water use. It is clear that one very effective way to reduce water demand in the future is to institute conservation

measures. A first step could be to take a look at the present water system and policies and determine how well they conserve water. Conservation techniques that will be evaluated as part of the working paper include:

- Water-saving plumbing fixtures;
- Restriction of lawn watering to early morning hours;
- Uniform increasing block water rates;
- Low water use landscaping (Xeriscaping);
- Public education about conservation by television, radio, newsletters, etc.;
- Water metering in all cities;
- Commercial and industrial reuse/recycle;
- Elimination of once-through air-cooling systems;
- Elimination of lake level maintenance;
- Leak detection and repair policies;
- Moderate plumbing code; and
- Supply system pressure reduction.

Of all the conservation techniques listed above, it should be noted that the place to start is with mandatory water metering in all cities. Until metering is installed, it will be impossible to get an accurate picture of water use. A metering survey is summarized in Working Paper No. 4.

CONCLUSIONS

The drought of the late 1980s led the 1989 legislature to request a study of water supply and demand for the Twin Cities Metropolitan Area. Due to the cyclical nature of droughts, it is reasonable to conclude that the Metropolitan Area will eventually face another drought and all of the attendant problems in the future. Detailed water use behavior is needed to contend with a drought or contamination crisis that could limit the water supply.

The demand study determined that in 1988 the Metropolitan Area used 1116 MGD. Projections for 1990, 2000 and 2010 indicate water use of 1131, 1147, and 1152 MGD, respectively. This is an increase of 36 MGD (about 3%) from 1988 - 2010. This low net number is reflective of moderate residential and industrial/commercial/institutional increases in use and level or decreasing uses in six other categories. While the Metropolitan Area projections suggest there will be enough water in the region, it is clear that measures need to be undertaken to make sure enough water is available to protect against drought years and such disasters as chemical spills.

Conservation practices are an important area to be studied further. The water demand could be decreased substantially by implementing some form of conservation. Water rich areas cannot ignore water conservation anymore. Future growth and regional livelihood may depend on some form of conservation. Growth areas in the Metropolitan Area use water from aquifers which are highly susceptible to contamination or are very slow to recharge. Implementing such easily undertaken conservation measures as lawn watering restrictions or landscaping guidelines could prove beneficial to retaining a water supply for future use. Educating the public on water use and supply issues could also prove to be an effective way to reduce overall water use.

REFERENCES

1980 Census of Housing. Volume 1. Characteristics of Housing Units. U.S. Department of Commerce. Chapter A, Part 25. August 1982.

1980 Census of Housing. Volume 1. Characteristics of Housing Units. U.S. Department of Commerce. Chapter B, Part 25. July 1983.

Contacts Influential Marketing Information Directory, Minneapolis Metro 1990. Marketing Information Services, Inc. 1989.

Contacts Influential Marketing Information Directory, St. Paul 1990-1991. Marketing Information Services, Inc. 1990.

Corrigan, Sheryl. Water Availability in the Twin Cities Metropolitan Area: The Water Balance. Working Paper No. 3, Jan. 1991. St. Paul: Metropolitan Council. 1991.

Forecasts of Population, Households and Employment 1990 and 2000. For Cities, Townships and Counties in the Twin Cities Metropolitan Area. St. Paul: Metropolitan Council. October 1986.

IWR-MAIN Water Use Forecasting System. Version 5.1. Water Resources Support Center Institute for Water Resources. U.S. Army Corps of Engineers. June 1988.

Metropolitan Council Metropolitan Area Short-term Water Supply Plan. Metropolitan Council Report to the Legislature. St. Paul: Metropolitan Council. February 1990.

Myslajek, Florence. Water Conservation in the Twin Cities Metropolitan Area. St. Paul: Metropolitan Council. Projected publication date: March 1991.

Oberts, Gary. The Public Water Supply System: Inventory and the Possibility of Subregional Interconnections for the Long-term Water Supply Plan; Working Paper No. 4. St. Paul: Metropolitan Council. January 1991.

Oberts, Gary. Water Use in the Twin Cities Metropolitan Area: An Update. St. Paul: Metropolitan Council. May 1984.

Population and Household Estimates. For Cities and Counties in the Twin Cities Metropolitan Area. April 1, 1989. St. Paul: Metropolitan Council. August 1989.

Population and Housing Density in the Metropolitan Area by Community and Census Tract. Data-Log. St. Paul: Metropolitan Council. 1980.

SAS User's Guide: Statistics. Version 5 ed. SAS Institute Inc. 1985.

Twin Cities Area Average Covered Employment, First Quarter 1988. St. Paul: Metropolitan Council. 1988.

APPENDIX A

MUNICIPAL WATER SUPPLY SURVEY

MUNICIPAL WATER SUPPLY SURVEY

METROPOLITAN COUNCIL

May, 1990

Supplier _____

Contact (Phone #) _____

I. SYSTEM BACKGROUND

1. Does the enclosed inventory based on MDH data correctly describe the city system? If not, please provide corrections. Please enclose a map of your well locations so that we can prepare a map of these for the Metropolitan Area.

2. What percent of your city's water supply goes to commercial users? Industrial users?

3. In a water supply emergency, could commercial/industrial use be suspended, i.e., does your city have an inventory of commercial/industrial users?

4. How does your city determine water prices? Are the water prices different for residential, commercial and industrial users? What are your water prices in $/1000 gallons? What are your sewer prices in $/1000 gallons?

5. Does your city currently have an emergency contingency plan or program? If yes, please describe.

6. Has your city instituted any water use restrictions in recent years in response to the drought? What is the determining factor for instituting restrictions (for example, storage limitations or availability of water source)?

7. Did your city have any problems with well water levels in 1988? Please describe.

8. Has your city attempted to establish a protection program for recharge areas to municipal wells? If yes, how has this been accomplished?

9. Has your city prepared any projections on future water demand for the city? If yes, would you please provide them along with the criteria and methods upon which they are based?

10. Does the possibility exist for interconnection with neighboring suppliers for emergency back-up? If not, what are the reasons?

11. What problems, if any, would you like to see addressed in the Metropolitan Council's long-term water supply plan?

II. IWR-MAIN (CORPS OF ENGINEERS MODEL)

UNACCOUNTED PARAMETERS

Several public unaccounted water use parameters are listed below. Please answer the set of questions about each parameter as best as you can.

Car Washes
Are there any car washes in the area? _____ If yes, how many? _____ What is the average annual water use in gallons/day/unit of these car washes? _____ What is the maximum day water use in gallons/day/unit?_____

Parks
How many city or state parks are there in the city? _____ What is the total number of park restrooms in the city? _____ What is the average annual amount of water used in these restrooms in gallons/day/unit? _____ What is the maximum amount of water used in gallons/day/unit? _____

Fire Hydrants
How many fire hydrants are in the city? _____ How much water is used annually to flush the hydrants? _____ What is the maximum amount of water used to flush the hydrants in gallons/day/unit?_____ Do you have any historic information on water used for fires? _____

Irrigation Systems
How many public irrigation or watering systems are there in the city? _____ What is the average annual amount of water used in gallons/day/unit? _____ What is the maximum amount of water used in gallons/day/unit? _____

Leakage
Do you know the volume of water lost through leakage from your system? _____ If yes, what is the approximate volume of water lost? _____ Are there any other unaccounted water losses? _____

If the city uses water for any other reasons, please list the source and the amount of water required annually and daily. _____

CONSERVATION MEASURES

Please indicate if any of the following conservation measures have been used in the past. If they have been used, please indicate what year they were initiated. If use of the conservation measures is expected in the future, please indicate expected year of initiation. Measures 11, 12 and 15 are explained in detail after the list.

	Year Initiated	Future Use
1. Public Education Program	_____	_____
2. Metering	_____	_____
3. Pressure Reduction	_____	_____
4. Pricing Policy (Rate Reform)	_____	_____
5. Rationing (Per Capita)	_____	_____
6. Sprinkling Restrictions	_____	_____
7. Industrial Reuse/Recycle	_____	_____
8. Commercial Reuse/Recycle	_____	_____
9. Leak Detection and Repair	_____	_____
10. Retrofit of Showerheads and Toilets	_____	_____
11. Moderate Plumbing Code for Water Saving Devices	_____	_____
12. Advanced Plumbing Code for Water Saving Devices	_____	_____
13. Low-Water Use Landscaping (new)	_____	_____
14. Low-Water Use Landscaping (Retrofit)	_____	_____
15. Any Additional Conservation Measure	_____	_____

Moderate plumbing codes require low-flow showerheads using a maximum of 3.0 gallons per minute, low-flush toilets using 3.5 gallons per flush cycle, low-flow faucets using a maximum of 2.75 gallons per minute and water efficient dishwashers. Advanced plumbing codes require low-flow showerheads using a maximum of 0.5 gallons per minute and low-flush toilets using 0.5 gallons per flush cycle.

If the city has used any additional conservation measures not included in the list, please add them to the list and indicate the year they were initiated.

COMMERCIAL/INDUSTRIAL USAGE

1. Please identify major commercial/industrial water users in your city, and whether they are municipally- or self-supplied.

2. Please give the number of employees per user.

HISTORICAL RESIDENTIAL SEWER USE

Please supply sewer and housing information for the following four subgroups.
A key to the table headings follows the table.

Please fill in the following table for the year of 1988 and any previous year.
Required data includes year and number of occupied units in the respective value range group.

Residential -- Flat Rate-Unsewered(Septic tank) -- No. Housing Units

Year	Low Grp.	Grp. 2	Grp. 3	High Grp.	Total
____	____	_____	_____	_____	_____
____	____	_____	_____	_____	_____

Residential -- Metered and Sewered -- No. Housing Units

Year	Low Grp.	Grp. 2	Grp. 3	High Grp.	Total
____	____	_____	_____	_____	_____
____	____	_____	_____	_____	_____

Residential -- Master Metered Apartments -- No. Housing Units

Year	Low Grp.	Grp. 2	Grp. 3	High Grp.	Total
____	____	_____	_____	_____	_____
____	____	_____	_____	_____	_____

Low Grp. - total housing units in all value ranges having midrange values less than $25,000.

Grp. 2 - total housing units in all value ranges having midrange values greater than $25,000 but less than $50,000.

Grp. 3 - total housing units in all value ranges having midrange values greater than $50,000 but less than $100,000.

High Grp. - total housing units in all value ranges having midrange values greater than $100,000.

Total - total number of housing units in the specified year.

APPENDIX B

CITY WATER PRICING METHODS

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Andover	Anoka	Single Block	.94 ($7.00 min)
Anoka	Anoka	Single Block	.53
Blaine	Anoka	Increasing Block	.35 (0-50) .39(50-250) .43(>250)
Centerville	Anoka	Single Block	1.50 ($15.00 min)
Circle Pines	Anoka	Single Block	.75 ($3.50 s.c)
Columbia Heights	Anoka	Declining Block	1.78(0-13.5) .85(>13.5)
Coon Rapids	Anoka	Single Block	.98
Fridley	Anoka	Declining Blocks	.69(1-10) .53(10-30) .47(30-50) .40(50-100) .38(100-200) .35(>200)
Hilltop	Anoka	Single Block	1.14
Lexington	Anoka	Declining Blocks	1.25(1-10) .75(>10)
Lino Lakes	Anoka	Single Block	1.20
Ramsey	Anoka	Single Block	1.0
St. Francis	Anoka	Single Block	1.3
Spring Lake Park	Anoka	Declining Block	.91 (0-18) .69 (>18)
Carver	Carver	Declining Block	2.7 (0-20) 1.7 (>20)
Chanhassen	Carver	Increasing Block	.80 (0-10) .85 (>10)
Chaska	Carver	Declining Blocks	.80(0-7) .65(>7)
Cologne	Carver	Single Block	1.75
Hamburg	Carver	Decreasing Block	2.25(0-4) 1.50(.4)

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Mayer	Carver	Declining Block	1.44(0-4) .70(>4)
New Germany	Carver	Declining Blocks	1.25(1-4) 1.0(4-5.5) .75 (.5.5)
Norwood	Carver	Declining Blocks	2.0 (0-5) 1.25 (>5)
Victoria	Carver	Declining Blocks	1.33(1-15) .96(>15)
Waconia	Carver	Declining Blocks	2.75(1-4) 1.10(>4)
Watertown	Carver	Single Block	1.25
Young America	Carver	Declining Block	3.0(0-5) 1.40 (>5)
Apple Valley	Dakota	Declining Blocks	.656(1-250) .606(>250)
Burnsville	Dakota	Increasing Block	.94(0-50) 1,20(>50)
Eagan	Dakota	Declining Blocks	1.45(1-10) .80(>10)
Empire	Dakota	Flat Charge	42.00/quarter
Farmington	Dakota	Flat Charge	$22/quarter
Hampton	Dakota	Single Block	.40
Hastings	Dakota	Single Block	.73
Inver Grove Heights	Dakota	Single Block	1.20
Lakeville	Dakota	Single Block	.77
Mendota Heights	Dakota	Declining Block	1.60 (0-374) 1.56 (>374)
New Trier	Dakota	Decreasing Block	$45/(0-10) 1.0(>10)
Randolph	Dakota	Decreasing Block	61.0(0-10) .70(>10)

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Rosemount	Dakota	Single Block	1.10
South St. Paul	Dakota	Decreasing Block	.62(0-30) .41(30-500) .23(>500)
Vermillion	Dakota	Single Block	.25
West St. Paul	Dakota	Declining Block	1.45 (0-374) 1.42 (>374)
Bloomington	Hennepin	Single Block	1.30
Brooklyn Center	Hennepin	Single Block	.47
Brooklyn Park	Hennepin	Declining Block	1.29 (0-6) .75 (>6)
Champlin	Hennepin	Declining Block	2.67 (0-2) .71 (>2)
Crystal	Hennepin	Single Block	1.04
Eden Prairie	Hennepin	Single Block	.95
Edina	Hennepin	Single Block	.56
Excelsior	Hennepin	Declining Block	1.70(1-13) 1.13(>13)
Golden Valley	Hennepin	Single Block	.98
Hopkins	Hennepin	Single Block	.85
Long Lake	Hennepin	Single Block	2.25
Loretto	Hennepin	Increasing Block	1.00 (1-4) 1.07 (>4)
Maple Grove	Hennepin	Single Block	.90 ($9.00 min)
Maple Plain	Hennepin	Declining Block	1.75(1-8) 1.55(8-9.2) 1.35(9.2-900) 1.25 >900)
Medina	Hennepin	Single Block	1.95
Minneapolis	Hennepin	Single Block	1.1

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Minnetonka	Hennepin	Single Block	.80
Minnetonka Beach	Hennepin	Single Block	1.27
Minnetrista	Hennepin	Declining Block	1.7 (0-10) 1.5 (>10)
Mound	Hennepin	Single Block	1.0
New Hope	Hennepin	Declining Blocks	3.60(1-1M) .95(>1M)
Orono	Hennepin	Single Block	1.17
Osseo	Hennepin	Declining Block	.85(0-10) .75(10-100) .70(>100)
Plymouth	Hennepin	Single Block	.75 (service charge $1.50/mo)
Richfield	Hennepin	Single Block	1.15
Robbinsdale	Hennepin	Declining Block	1.27 (0-10) 1.20 (>10)
Rockford	Hennepin	Single Block	1.15
Rogers	Hennepin	Declining Block	1.0 (0-10) .95 (>10)
St. Anthony	Hennepin	Single Block	.80
St. Bonifacius	Hennepin	Declining Block	1.55 (0-5) 1.0 (>5)
St. Louis Park	Hennepin	Declining Block	.72 (0-3M) .67 (>3M)
Shorewood	Hennepin	Declining Block	2.2(0-10) 1.4(>10)
Spring Park	Hennepin	Declining Block	1.5 (1-5) 1.0 (>5)
Tonka Bay	Hennepin	Single Block	1.80 ($5 min. charge)
Wayzata	Hennepin	Increasing Block	.70 (0-35) 1.50 (>35)

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Arden Hills	Ramsey	Declining Block	1.27
Falcon Heights	Ramsey	Declining Block	1.51 (0-374) 1.48 (>374)
Lauderdale	Ramsey	Declining Block	1.45(0-67) 1.42(67-670)
Little Canada	Ramsey	Single Block	1.50
Maplewood	Ramsey	Declining Block	1.74 (0-374) 1.70 (>374)
Mounds View	Ramsey	Single Block	.90
New Brighton	Ramsey	Single Block	.55
North St. Paul	Ramsey	Single Block	.70
Roseville	Ramsey	Single Block	1.09
St. Paul	Ramsey	Declining Block	1.27 (1-374) 1.23 (375-3739) 1.20 (>3740)
Shoreview	Ramsey	Single Block	.90
Vadnais Heights	Ramsey	Single Block	.90
White Bear Lake	Ramsey	Single Block	1.12
White Bear Twp.	Ramsey	Flat Charge	$45/quarter
Belle Plain	Scott	Flat Charge	$8.00/person/quarter
Elko	Scott	Single Block	2.0 $9 minimum/quarter
Jordan	Scott	Increasing Blocks	1.0(1-5) 1.54(>5)
New Market	Scott	Single Block	1.0
Prior Lake	Scott	Single Block	1.40
Savage	Scott	Single Block	1.0 3.50 service charge

CITY WATER PRICING METHODS

CITY	COUNTY	METHOD	PRICE/1000 GALLONS
Shakopee	Scott	Declining Block	.83(0-6) .60(6-20) .55(20-40) .43(>40)
Bayport	Washington	Single Block	2.0
Cottage Grove	Washington	Declining Block	1.19(1-15) .85(>15)
Forest Lake	Washington	Declining Block	2.0(0-5) 1.2 (5-10) 1.0(10-20) .90 (>20)
Hugo	Washington	Declining Block	.77(1-15) .60(>15)
Lake Elmo	Washington	Single Block	1.0
Landfall	Washington	Flat Charge	0.0
Mahtomedi	Washington	Single Block	1.30
Newport	Washington	Increasing Block	1.06(0-10) 1.31(10-15) 1.98 (15-25) 3.2(25-42)
Oakdale	Washington	Single Block	.75 ($2 service charge)
Oak Park Heights	Washington	Declining Block	.93 (0-15) .90(>15)
St. Paul Park	Washington	Declining Block	1.1(1-10) 1.0(>10)
Stillwater	Washington	Single Block	1.00 ($10.00 min)
Woodbury	Washington	Declining Blocks	1.0(1-8) .55(>8)

APPENDIX C

COMMERCIAL AND INDUSTRIAL WATER USE PERCENTAGES

COMMERCIAL AND INDUSTRIAL WATER USE PERCENTAGES BY CITY

City	County	% Comm.	% Indust.	% Comm./ Indust.	% Resid.
Andover	Anoka	7	0		93
Anoka	Anoka			25	75
Blaine	Anoka			33	67
Centerville	Anoka	0	0		100
Circle Pines	Anoka	5	0		95
Columbia Heights	Anoka	11	5		84
Coon Rapids	Anoka	13	2		85
Fridley	Anoka			10	90
Hilltop	Anoka			25	75
Lexington	Anoka			3	97
Lino Lakes	Anoka	1	0		99
Ramsey	Anoka	3.5	0		96.5
St. Francis	Anoka			15	85
Spring Lake Park	Anoka	10.7	1.4		87.9
Carver	Carver	10	0		90
Chanhassen	Carver	6	13		81
Chaska	Carver	11.2	15.1		74
Cologne	Carver	5	5		90
Hamburg	Carver	5	0		95
Mayer	Carver	25	0		75
New Germany	Carver	10	29		69
Norwood	Carver			25	75

City	County	%Comm.	%Indust.	%Comm./ Indust.	%Resid.
Victoria	Carver	1	0		99
Waconia	Carver	14	19		67
Watertown	Carver			0	100
Young America	Carver	7	5		88
Apple Valley	Dakota	8	0		92
Burnsville	Dakota			20	73
Eagan	Dakota	1.8	1.1		97
Empire	Dakota	0	0		100
Farmington	Dakota	1	11		88
Hampton	Dakota	40	0		60
Hastings	Dakota			10	90
Inver Grove Heights	Dakota	9.9	1.3		89
Lakeville	Dakota	7	9		84
Mendota Heights	Dakota			30	70
New Trier	Dakota			10	90
Randolph	Dakota			0	100
Rosemount	Dakota	9	2		89
South St. Paul	Dakota			25	75
Vermillion	Dakota			2	98
West St. Paul	Dakota			11	89
Bloomington	Hennepin			33	67
Brooklyn Center	Hennepin			30	70
Brooklyn Park	Hennepin			10	90
Champlin	Hennepin	5	0		95
Crystal	Hennepin			15	85

City	County	%Comm.	%Indust.	%Comm./ Indust.	%Resid.
Eden Prairie	Hennepin			35	65
Edina	Hennepin			25	75
Excelsior	Hennepin			39	61
Golden Valley	Hennepin			23	77
Hopkins	Hennepin			35	65
Long Lake	Hennepin	15	35		50
Loretto	Hennepin	12	3		85
Maple Grove	Hennepin	4	6		90
Maple Plain	Hennepin			35	65
Medina	Hennepin	7	10		83
Minneapolis	Hennepin			45	55
Minnetonka	Hennepin			40	60
Minnetonka Beach	Hennepin	25			75
Minnetrista	Hennepin			10	90
Mound	Hennepin			10	90
New Hope	Hennepin			25	75
Orono	Hennepin			5	
Osseo	Hennepin			25	
Plymouth	Hennepin			32	68
Richfield	Hennepin	5	1		94
Robbinsdale	Hennepin			5	95
Rockford	Hennepin			20	80
Rogers	Hennepin	50	15		35
St. Anthony	Hennepin			25	75
St. Bonifacius	Hennepin			9	91
St. Louis Park	Hennepin			51	49
Shorewood	Hennepin			9	91

City	County	%Comm.	%Indust.	%Comm./ Indust.	%Resid.
Spring Park	Hennepin	32	0		68
Tonka Bay	Hennepin	6	0		94
Wayzata	Hennepin			9	91
Bayport	Washington	10	25		65
Cottage Grove	Washington			9	91
Forest Lake	Washington			12.3	88
Hugo	Washington			15	85
Lake Elmo	Washington	10	0		90
Landfall	Washington			10	90
Mahtomedi	Washington	10	1		89
Newport	Washington	30	5		65
Oakdale	Washington			7.3	93
Oak Park Heights	Washington	19.4	0		81
St. Paul Park	Washington	15	10		75
Stillwater	Washington	8	4		88
Woodbury	Washington	11	6		83
Belle Plain	Scott			30	70
Elko	Scott			2	98
Jordan	Scott			10	90
New Market	Scott	5	0		95
Prior Lake	Scott	7	0		93
Savage	Scott	7	13		80
Shakopee	Scott	14	40		46
Arden Hills	Ramsey			20	80
Falcon Heights	Ramsey			5	95
Lauderdale	Ramsey			20	80
Little Canada	Ramsey	20	5		75

City	County	%Comm.	%Indust.	%Comm./ Indust.	%Resid.
Maplewood	Ramsey			50	50
Mounds View	Ramsey	8	1		91
New Brighton	Ramsey			3	97
North St. Paul	Ramsey			25	75
Roseville	Ramsey			35	65
St. Paul	Ramsey			50	50
Shoreview	Ramsey	2.8	6.8		90
Vadnais Heights	Ramsey			27	73
White Bear Lake	Ramsey			20	80
White Bear Twp.	Ramsey	2.5	5		92.5

APPENDIX D

RESIDENTIAL WATER USE DATA FILE

RESIDENTIAL WATER USE DATA FILE

(Variable Descriptions)

Variable	Description
cityname	* all 111 cities supplied by municipal water or sewer
ctyname	county name corresponding to cityname
single	total number of 1988 single-family units
multi	total number of 1988 multi-family units
units	total number of 1988 multi-family and single-family units
pop	the estimated 1988 population
hdensity	1984 housing density
pdensity	1988 population density
MHH	the 1988 median household income
price	annual average water rate ($/1000 gallons)
P5000	water rate ($/1000 gallons) for 0-5000 gallons
P10000	water rate ($/1000 gallons) for 5001-10000 gallons
P15000	water rate ($/1000 gallons) for 10001-15000 gallons
P20000	water rate ($/1000 gallons) for 15001-20000 gallons
pmode	type of water rate structure (i.e. flat rate, increasing block, declining block, single block)
percent	the percent of municipal water used for residential purposes
connect	the number of water connections
extra1	total water use MGY (million gallons per year)
rwater	water use for residential water use only MGY
amhv	number of people served by municipal system

* Birchwood and Willernie are served by White Bear Lake.

OBS	CITYNAME	CTYNAME	SINGLE	MULTI	UNITS	POP	AMHV	HDENSITY	PDENSITY	MHH
1	ANDOVER	ANOKA	4116	121	4237	13086	3809	0.96	3.51	43193
2	ANOKA	ANOKA	3855	2700	6555	16408	16408	3.57	2.62	31180
3	BLAINE	ANOKA	10552	1853	12405	36259	35400	2.75	3.04	39095
4	CENTERVILLE	ANOKA	389	42	431	1229	450	1.51	3.35	41552
5	CIRCLE PINES	ANOKA	1311	244	1555	4846	4846	2.71	3.13	41585
6	COLUMBIA HEIGHTS	ANOKA	5635	2452	8087	19169	19170	5.18	2.52	34115
7	COON RAPIDS	ANOKA	12632	4589	17221	45774	44700	2.71	2.88	40791
8	FRIDLEY	ANOKA	7480	3910	11390	29337	29336	3.81	2.66	37234
9	HILLTOP	ANOKA	308	125	433	781	781	11.70	1.69	21387
10	LEXINGTON	ANOKA	566	264	830	2215	2215	2.69	2.74	30072
11	LINO LAKES	ANOKA	2473	47	2520	7600	425	0.96	3.25	38481
12	RAMSEY	ANOKA	3638	87	3725	12181	500	1.08	3.49	41774
13	ST. FRANCIS	ANOKA	605	158	763	1938	650	1.20	3.07	30030
14	SPRING LAKE PARK	ANOKA	1897	508	2405	6722	6881	3.63	3.01	37912
15	CARVER	CARVER	248	32	280	728	495	2.06	2.70	31493
16	CHANHASSEN	CARVER	3121	849	3970	9226	8800	1.65	2.74	43058
17	CHASKA	CARVER	2972	1427	4399	10478	10000	3.42	2.73	33212
18	COLOGNE	CARVER	188	54	242	613	626	3.14	2.48	28821
19	HAMBURG	CARVER	148	42	190	489	490	3.65	2.68	22405
20	MAYER	CARVER	139	22	161	396	390	2.60	2.51	32420
21	NEW GERMANY	CARVER	120	32	152	377	375	2.50	2.44	19399
22	NORWOOD	CARVER	374	145	519	1359	1360	3.65	2.54	27268
23	VICTORIA	CARVER	670	90	760	2191	660	1.51	2.96	40560
24	WACONIA	CARVER	887	575	1462	3354	3345	4.05	2.28	28197
25	WATERTOWN	CARVER	675	216	891	2188	2190	3.24	2.41	26419
26	YOUNG AMERICA	CARVER	398	72	470	1358	1360	2.55	2.73	28516

OBS	PRICE	P5000	P10000	P15000	P20000	MODE	AVEWTEMP	AVESTEMP	PERCENT	CONNECT	EXTRA1	EXTRA2
1	0.94	0.94	0.94	0.94	0.94	S	14.9	75.4	93.0	500	178.85	.
2	0.53	0.53	0.53	0.53	0.53	S	14.9	75.4	75.0	5000	949.00	.
3	0.35	0.35	0.35	0.35	0.35	I	14.9	75.4	67.0	8700	1825.00	.
4	1.50	1.50	1.50	1.50	1.50	S	14.9	75.4	100	175	12.41	.
5	0.75	0.75	0.75	0.75	0.75	S	14.9	75.4	95.0	1400	182.50	.
6	1.78	1.78	1.78	1.78	0.85	D	14.9	75.4	84.0	7000	675.25	.
7	0.98	0.98	0.98	0.98	0.98	S	14.9	75.4	85.0	14000	1430.80	.
8	0.53	0.69	0.69	0.53	0.53	D	14.9	75.4	50.0	7884	2372.00	.
9	1.14	1.14	1.14	1.14	1.14	S	14.9	75.4	75.0	.	36.50	.
10	1.25	1.25	1.25	0.75	0.75	D	14.9	75.4	97.0	592	63.88	.
11	1.20	1.20	1.20	1.20	1.20	S	14.9	75.4	99.0	200	12.41	.
12	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	96.5	150	18.25	.
13	1.30	1.30	1.30	1.30	1.30	S	14.9	75.4	84.6	283	54.75	.
14	0.91	0.91	0.91	0.91	0.69	D	14.9	75.4	87.9	1872	365.00	.
15	2.70	2.70	2.70	2.70	1.70	D	14.9	75.4	90.0	177	12.78	.
16	0.85	0.80	0.80	0.85	0.85	I	14.9	75.4	81.0	3000	438.00	.
17	0.65	0.80	0.80	0.65	0.65	D	14.9	75.4	74.0	2202	1160.70	.
18	1.75	1.75	1.75	1.75	1.75	S	14.9	75.4	90.0	215	27.38	.
19	1.50	2.25	1.50	1.50	1.50	D	14.9	75.4	95.0	163	14.60	.
20	0.70	1.44	0.70	0.70	0.70	D	14.9	75.4	75.0	155	12.04	.
21	1.00	1.25	1.00	1.00	0.75	D	14.9	75.4	61.0	140	10.95	.
22	1.25	2.00	1.25	1.25	1.25	D	14.9	75.4	75.0	450	76.65	.
23	1.33	1.33	1.33	1.33	0.96	D	14.9	75.4	99.0	63	18.25	.
24	1.10	2.75	1.10	1.10	1.10	D	14.9	75.4	67.0	1200	255.50	.
25	1.25	1.25	1.25	1.25	1.25	S	14.9	75.4	100	576	91.25	.
26	1.40	3.00	1.40	1.40	1.40	D	14.9	75.4	88.0	425	39.78	.

OBS	CITYNAME	CTYNAME	SINGLE	MULTI	UNITS	POP	AMHV	HDENSITY	PDENSITY	MHH
27	APPLE VALLEY	DAKOTA	8222	3060	11282	31674	31600	2.79	3.16	45016
28	BURNSVILLE	DAKOTA	11010	8516	19526	46687	45700	3.33	2.73	43515
29	EAGAN	DAKOTA	9321	8169	17490	42555	41850	3.19	2.68	39281
30	EMPIRE	DAKOTA	394	35	429	1375	620	0.90	3.02	39137
31	FARMINGTON	DAKOTA	1528	541	2069	5350	5650	2.56	2.79	30755
32	HAMPTON	DAKOTA	100	17	117	322	335	2.05	2.77	28516
33	HASTINGS	DAKOTA	3799	1673	5472	14481	14493	3.54	2.71	34404
34	INVER GROVE HEIGHTS	DAKOTA	5615	2413	8028	21477	18450	2.52	2.78	35908
35	LAKEVILLE	DAKOTA	6702	1142	7844	20501	19600	2.07	3.02	39489
36	MENDOTA HEIGHTS	DAKOTA	2692	574	3266	8679	8680	1.70	2.83	55167
37	NEW TRIER	DAKOTA	32	2	34	115	115	1.62	3.41	27159
38	RANDOLPH	DAKOTA	108	11	119	425	250	1.78	2.77	28686
39	ROSEMOUNT	DAKOTA	2228	533	2761	7420	5900	2.13	3.00	35859
40	SOUTH ST. PAUL	DAKOTA	5955	2313	8268	20362	20361	4.88	2.48	32570
41	VERMILLION	DAKOTA	163	14	177	559	540	2.33	3.23	34045
42	WEST ST. PAUL	DAKOTA	4806	3766	8572	18591	18591	4.74	2.15	30967
43	BLOOMINGTON	HENNEPIN	23187	12788	35975	85299	85100	3.27	2.45	42502
44	BROOKLYN CENTER	HENNEPIN	7817	3962	11779	29422	29420	3.94	2.51	36309
45	BROOKLYN PARK	HENNEPIN	11850	9232	21082	53840	53400	3.64	2.70	36110
46	CHAMPLIN	HENNEPIN	4625	659	5284	14501	14500	1.99	3.14	39292
47	CRYSTAL	HENNEPIN	7500	2140	9640	24901	24900	3.86	2.40	36484
48	EDEN PRAIRIE	HENNEPIN	9141	5704	14845	34906	34600	2.65	2.70	48816
49	EDINA	HENNEPIN	12816	8288	21104	46095	46095	3.36	2.18	49212
50	EXCELSIOR	HENNEPIN	498	821	1319	2574	2574	5.73	1.90	25860
51	GOLDEN VALLEY	HENNEPIN	6627	1772	8399	21318	21318	2.60	2.55	49188
52	HOPKINS	HENNEPIN	3266	4955	8221	14851	14850	6.65	2.02	28220

OBS	PRICE	P5000	P10000	P15000	P20000	MODE	AVEWTEMP	AVESTEMP	PERCENT	CONNECT	EXTRA1	EXTRA2
27	0.66	0.66	0.66	0.66	0.66	D	14.9	75.4	92.0	10248	1825.00	.
28	0.94	0.94	0.94	0.94	0.94	I	14.9	75.4	73.0	12058	2007.50	.
29	1.45	1.45	1.45	0.80	0.80	D	14.9	75.4	97.0	10000	2226.50	.
30	42.00	42.00	42.00	42.00	42.00	F	14.9	75.4	100	168	20.07	.
31	22.00	22.00	22.00	22.00	22.00	F	14.9	75.4	88.0	1650	292.00	.
32	0.40	0.40	0.40	0.40	0.40	S	14.9	75.4	60.0	100	21.90	.
33	0.73	0.73	0.73	0.73	0.73	S	14.9	75.4	90.0	4130	824.90	.
34	1.20	1.20	1.20	1.20	1.20	S	14.9	75.4	89.0	4300	547.50	.
35	0.77	0.77	0.77	0.77	0.77	S	14.9	75.4	84.0	4800	730.00	.
36	1.60	1.60	1.60	1.60	1.60	D	14.9	75.4	70.0	.	540.20	.
37	45.00	45.00	45.00	1.00	1.00	D	14.9	75.4	90.0	35	8.39	.
38	1.00	1.00	1.00	0.70	0.70	D	14.9	75.4	100	92	9.13	.
39	1.10	1.10	1.10	1.10	1.10	S	14.9	75.4	89.0	1479	206.95	.
40	0.62	0.62	0.62	0.62	0.62	D	14.9	75.4	75.0	6625	1022.00	.
41	0.25	0.25	0.25	0.25	0.25	S	14.9	75.4	98.0	165	13.87	.
42	1.45	1.45	1.45	1.45	1.45	D	14.9	75.4	89.0	.	795.70	.
43	1.30	1.30	1.30	1.30	1.30	S	14.9	75.4	67.0	23857	4580.75	.
44	0.47	0.47	0.47	0.47	0.47	S	14.9	75.4	70.0	8800	1642.50	.
45	0.75	1.29	0.75	0.75	0.75	D	14.9	75.4	90.0	13500	2190.00	.
46	0.71	2.67	0.71	0.71	0.71	D	14.9	75.4	95.0	4300	547.50	.
47	1.04	1.04	1.04	1.04	1.04	S	14.9	75.4	85.0	7482	1825.00	.
48	0.95	0.95	0.95	0.95	0.95	S	14.9	75.4	65.0	11000	1241.00	.
49	0.56	0.56	0.56	0.56	0.56	S	14.9	75.4	75.0	13360	2701.00	.
50	1.70	1.70	1.70	1.70	1.13	D	14.9	75.4	61.0	1300	158.41	.
51	0.98	0.98	0.98	0.98	0.98	S	14.9	75.4	77.0	6915	1350.50	.
52	0.85	0.85	0.85	0.85	0.85	S	14.	75.4	65.0	3000	766.50	.

OBS	CITYNAME	CTYNAME	SINGLE	MULTI	UNITS	POP	AMHV	HDENSITY	PDENSITY	MHH
53	LONG LAKE	HENNEPIN	533	274	807	2770	1988	2.68	2.41	36095
54	LORETTO	HENNEPIN	83	69	152	345	345	3.45	2.40	33947
55	MAPLE GROVE	HENNEPIN	9257	3296	12553	35883	34000	2.50	3.14	45227
56	MAPLE PLAIN	HENNEPIN	473	263	736	1803	1803	2.26	2.49	37790
57	MEDINA	HENNEPIN	954	105	1059	3035	1000	0.86	3.19	47065
58	MINNEAPOLIS	HENNEPIN	77649	95653	173302	355800	355800	8.79	2.07	23385
59	MINNETONKA	HENNEPIN	12630	6565	19195	43741	43742	1.75	2.59	49234
60	MINNETONKA BEACH	HENNEPIN	221	8	229	596	596	1.20	2.89	68648
61	MINNETRISTA	HENNEPIN	1273	42	1315	3663	320	0.80	3.05	45861
62	MOUND	HENNEPIN	3169	813	3982	9951	9951	2.99	2.51	35112
63	NEW HOPE	HENNEPIN	5040	3635	8675	22944	22944	4.34	2.56	39046
64	ORONO	HENNEPIN	2698	121	2819	7284	2150	0.96	2.76	50084
65	OSSEO	HENNEPIN	672	367	1039	2707	2707	4.86	2.47	28404
66	PLYMOUTH	HENNEPIN	13033	6749	19782	47800	46150	2.41	2.69	45365
67	RICHFIELD	HENNEPIN	11271	4788	16059	36762	36760	4.87	2.21	33281
68	ROBBINSDALE	HENNEPIN	4739	1657	6396	14589	14588	5.07	2.20	32862
69	ROCKFORD	HENNEPIN	116	66	182	2600	2615	4.19	2.43	27837
70	ROGERS	HENNEPIN	175	88	263	716	730	2.20	2.87	31392
71	ST. ANTHONY	HENNEPIN	2228	1358	3586	8245	8245	5.33	2.30	46545
72	ST. BONIFACIUS	HENNEPIN	309	105	414	1086	1086	2.34	2.86	34861
73	ST. LOUIS PARK	HENNEPIN	12880	7835	20715	43702	43700	5.32	2.08	34809
74	SHOREWOOD	HENNEPIN	1911	175	2086	5094	1356	1.13	2.94	44303
75	SPRING PARK	HENNEPIN	309	618	927	1584	1584	5.59	1.68	27250
76	TONKA BAY	HENNEPIN	599	29	628	1479	1479	1.92	2.46	43407
77	WAYZATA	HENNEPIN	974	855	1829	3711	3711	1.81	2.02	36449
78	ARDEN HILLS	RAMSEY	2397	583	2980	9737	9737	2.28	2.75	45341

OBS	PRICE	P5000	P10000	P15000	P20000	MODE	AVEWTEMP	AVESTEMP	PERCENT	CONNECT	EXTRA1	EXTRA2
53	2.25	2.25	2.25	2.25	2.25	S	14.9	75.4	50.0	600	104.02	.
54	1.07	1.00	1.07	1.07	1.07	I	14.9	75.4	85.0	117	16.42	.
55	0.90	0.90	0.90	0.90	0.90	S	14.9	75.4	90.0	10000	1533.00	.
56	1.55	1.75	1.75	1.55	1.35	D	14.9	75.4	65.0	540	94.90	.
57	1.95	1.95	1.95	1.95	1.95	S	14.9	75.4	83.0	380	91.25	.
58	1.14	1.14	1.14	1.14	1.14	S	14.9	75.4	55.0	103831	19819.50	.
59	0.80	0.80	0.80	0.80	0.80	S	14.9	75.4	60.0	14100	2277.60	.
60	1.27	1.27	1.27	1.27	1.27	S	14.9	75.4	75.0	222	21.90	.
61	1.50	1.70	1.70	1.50	1.50	D	14.9	75.4	90.0	118	16.42	.
62	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	90.0	3150	237.25	.
63	0.95	3.60	0.95	0.95	0.95	D	14.9	75.4	75.0	5285	2664.50	.
64	1.17	1.17	1.17	1.17	1.17	S	14.9	75.4	95.0	710	90.52	.
65	0.75	0.85	0.85	0.75	0.75	D	14.9	75.4	75.0	792	154.39	.
66	0.75	0.75	0.75	0.75	0.75	S	14.9	75.4	68.0	11000	2737.50	.
67	1.15	1.15	1.15	1.15	1.15	S	14.9	75.4	94.0	11600	1679.00	.
68	1.20	1.27	1.27	1.20	1.20	D	14.9	75.4	95.0	4960	551.15	.
69	1.15	1.15	1.15	1.15	1.15	S	14.9	75.4	80.0	401	94.90	.
70	1.00	1.00	1.00	0.95	0.95	D	14.9	75.4	35.0	187	36.50	.
71	0.80	0.80	0.80	0.80	0.80	S	14.9	75.4	75.0	2200	355.51	.
72	1.00	1.55	1.00	1.00	1.00	D	14.9	75.4	91.0	355	43.80	.
73	0.50	0.54	0.50	0.50	0.50	D	14.9	75.4	49.0	13420	2555.00	.
74	1.40	2.20	2.20	1.40	1.40	D	14.9	75.4	91.0	452	20.44	.
75	1.00	1.50	1.00	1.00	1.00	D	14.9	75.4	68.0	300	81.76	.
76	1.80	1.80	1.80	1.80	1.80	S	14.9	75.4	94.0	595	73.00	.
77	0.70	0.70	0.70	0.70	0.70	I	14.9	75.4	91.0	1090	311.71	.
78	1.27	1.27	1.27	1.20	1.20	D	14.9	75.4	80.0	2304	313.90	.

OBS	CITYNAME	CTYNAME	SINGLE	MULTI	UNITS	POP	AMHV	HDENSITY	PDENSITY	MHH
79	FALCON HEIGHTS	RAMSEY	1455	629	2084	5386	5386	4.97	2.31	29934
80	LAUDERDALE	RAMSEY	470	757	1227	2307	2307	6.86	2.07	28200
81	LITTLE CANADA	RAMSEY	2157	1899	4056	8623	8500	3.61	2.29	31703
82	MAPLEWOOD	RAMSEY	8114	3593	11707	29303	24615	2.76	2.60	38076
83	MOUNDS VIEW	RAMSEY	3517	1336	4853	13025	13025	3.04	2.68	35591
84	NEW BRIGHTON	RAMSEY	5637	2977	8614	23342	23343	3.93	2.64	40138
85	NORTH ST. PAUL	RAMSEY	3347	1147	4494	12349	12350	3.85	2.76	33931
86	ROSEVILLE	RAMSEY	9511	4307	13818	34784	34785	2.93	2.48	40799
87	ST. PAUL	RAMSEY	56597	62365	118962	265092	265100	6.81	2.30	26119
88	SHOREVIEW	RAMSEY	6362	2828	9190	23898	23600	2.75	2.68	43144
89	VADNAIS HEIGHTS	RAMSEY	2501	1381	3882	9720	6785	2.38	2.60	35930
90	WHITE BEAR LAKE	RAMSEY	6474	2283	8757	23505	23450	2.61	2.72	40868
91	WHITE BEAR TOWNSHIP	RAMSEY	2658	640	3298	8600	7800	2.53	2.75	41878
92	BELLE PLAINE	SCOTT	912	223	1135	3159	3091	2.32	2.55	27675
93	ELKO	SCOTT	87	5	92	296	125	1.70	3.13	31493
94	JORDAN	SCOTT	847	151	998	2830	2800	2.50	2.92	29655
95	NEW MARKET	SCOTT	106	8	114	308	310	2.71	2.65	33331
96	PRIOR LAKE	SCOTT	3296	759	4055	10640	10350	1.98	2.85	43519
97	SAVAGE	SCOTT	2659	621	3280	8251	7800	2.09	2.95	42774
98	SHAKOPEE	SCOTT	2922	1398	4320	11733	11000	2.93	2.79	34782
99	BAYPORT	WASHINGTON	604	164	768	3106	3106	2.47	2.34	36072
100	COTTAGE GROVE	WASHINGTON	5973	796	6769	21799	20300	2.10	3.38	43366
101	FOREST LAKE	WASHINGTON	1304	1030	2334	6160	5430	1.17	2.43	24394
102	HUGO	WASHINGTON	1354	63	1417	4250	1000	0.89	3.16	37418
103	LAKE ELMO	WASHINGTON	2030	96	2126	6189	800	1.23	2.68	39123
104	LANDFALL	WASHINGTON	315	0	315	635	635	8.31	1.86	24622

OBS	PRICE	P5000	P10000	P15000	P20000	MODE	AVEWTEMP	AVESTEMP	PERCENT	CONNECT	EXTRA1	EXTRA2
79	1.51	1.51	1.51	1.51	1.51	D	14.9	75.4	95.0	.	255.50	.
80	1.45	1.45	1.45	1.45	1.45	D	14.9	75.4	80.0	.	80.30	.
81	1.50	1.50	1.50	1.50	1.50	S	14.9	75.4	75.0	1350	292.00	.
82	1.74	1.74	1.74	1.74	1.74	D	14.9	75.4	50.0	.	1478.25	.
83	0.90	0.90	0.90	0.90	0.90	S	14.9	75.4	91.0	2850	511.00	.
84	0.55	0.55	0.55	0.55	0.55	S	14.9	75.4	97.0	5225	912.50	.
85	0.70	0.70	0.70	0.70	0.70	S	14.9	75.4	75.0	4000	547.50	.
86	1.09	1.09	1.09	1.09	1.09	S	14.9	75.4	65.0	9071	1825.00	.
87	1.27	1.27	1.27	1.27	1.27	D	14.9	75.4	50.0	100000	13067.00	.
88	0.90	0.90	0.90	0.90	0.90	S	14.9	75.4	90.0	6500	620.50	.
89	0.90	0.90	0.90	0.90	0.90	S	14.9	75.4	73.0	2700	438.00	.
90	1.12	1.12	1.12	1.12	1.12	S	14.9	75.4	80.0	8125	876.00	.
91	45.00	45.00	45.00	45.00	45.00	F	14.9	75.4	92.5	2529	251.48	.
92	8.00	8.00	8.00	8.00	8.00	F	14.9	75.4	70.0	825	146.00	.
93	2.00	2.00	2.00	2.00	2.00	S	14.9	75.4	98.0	35	3.28	.
94	1.54	1.00	1.54	1.54	1.54	I	14.9	75.4	89.8	625	116.80	.
95	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	95.0	93	5.84	.
96	1.40	1.40	1.40	1.40	1.40	S	14.9	75.4	93.0	3136	292.00	.
97	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	80.0	2400	182.50	.
98	0.60	0.83	0.60	0.60	0.60	D	14.9	75.4	46.0	3081	803.00	.
99	2.00	2.00	2.00	2.00	2.00	S	14.9	75.4	65.0	600	109.50	.
100	1.19	1.19	1.19	1.19	0.85	D	14.9	75.4	91.0	5700	839.50	.
101	1.20	2.00	1.20	1.00	1.00	D	14.9	75.4	88.0	1416	251.85	.
102	0.77	0.77	0.77	0.77	0.60	D	14.9	75.4	85.0	300	27.38	.
103	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	90.0	245	17.88	.
[illegible]	0.00	0.00	0.00	0.00	0.00	F	14.9	75.4	89.3	373	28.47	.

OBS	CITY NAME	CTY NAME	SING LE	MULTI	UNITS	POP	AMHV	HDEN SITY	PDEN SITY	MHH	PRIC E	P50 00	P100 00	P150 00	P200 00	MOD E	AVEW TEMP	AVES TEMP	PERC ENT	CONN ECT	EXTR A1	EXTR A2
105	MAHTOMEDI	WASHINGTON	1605	280	1885	4650	4300	2.07	2.79	37979	1.30	1.30	1.30	1.30	1.30	S	14.9	75.4	89.0	1350	140.16	.
106	NEWPORT	WASHINGTON	990	433	1423	3567	3400	1.96	2.62	32751	1.06	1.06	1.06	1.31	1.98	I	14.9	75.4	65.0	950	124.10	.
107	OAKDALE	WASHINGTON	4195	2281	6476	16026	16026	2.97	2.70	36822	0.75	0.75	0.75	0.75	0.75	S	14.9	75.4	93.0	4685	730.00	.
108	OAK PARK HEIGHTS	WASHINGTON	669	756	1425	3751	3751	3.83	2.63	32538	0.93	0.93	0.93	0.93	0.90	D	14.9	75.4	81.0	800	130.30	.
109	ST. PAUL PARK	WASHINGTON	1524	221	1745	4915	4800	2.61	2.91	34710	1.00	1.10	1.10	1.00	1.00	D	14.9	75.4	75.0	1296	182.50	.
110	STILLWATER	WASHINGTON	3542	1374	4916	13485	13485	3.07	2.68	37363	1.00	1.00	1.00	1.00	1.00	S	14.9	75.4	88.0	4000	657.00	.
111	WOODBURY	WASHINGTON	4310	2868	7178	18500	17300	2.24	2.97	45318	0.55	1.00	1.00	0.55	0.55	D	14.9	75.4	83.0	5260	912.50	.

APPENDIX E

SUMMARY OF 1990, 2000 AND 2010 RESIDENTIAL WATER USE

SUMMARY OF 1990 2000 and 2010 RESIDENTIAL WATER USE

Cityname	1990 Projections Residential Use (mgy)	1990 Projections Residential Use (mgd)	2000 Projections Residential Use (mgy)	2000 Projections Residential Use (mgd)	2010 Projections Residential Use (mgy)	2010 Projections Residential Use (mgd)
Andover	173.17	0.47	174.43	0.48	175.69	0.48
Anoka	702.46	1.92	702.46	1.92	702.46	1.92
Blaine	1247.66	3.42	1638.04	4.49	1831.37	5.02
Centerville	14.89	0.04	26.59	0.07	42.89	0.12
Circle Pines	179.05	0.49	203.81	0.56	216.04	0.59
Columbia Heights	580.32	1.59	588.49	1.61	592.52	1.62
Coon Rapids	1261.04	3.45	1621.41	4.44	1799.81	4.93
Fridley	1251.18	3.43	1226.04	3.36	1213.66	3.33
Hilltop	28.42	0.08	28.17	0.08	28.06	0.08
Lexington	61.53	0.17	59.6	0.16	58.65	0.16
Lino Lakes	13.96	0.04	14.88	0.04	15.78	0.04
Ramsey	24.91	0.07	28.58	0.08	35.96	0.10
St. Francis	49.99	0.14	64.76	0.18	79.63	0.22
Spring Lake Park	331.36	0.91	349.11	0.96	357.83	0.98
Carver	11.62	0.03	12.82	0.04	14.02	0.04
Chanhassen	446.45	1.22	688.97	1.89	809.4	2.22
Chaska	1018.57	2.79	1146.91	3.14	1210.22	3.32
Cologne	25.61	0.07	27.24	0.07	31.72	0.09
Hamburg	14.16	0.04	15.33	0.04	17.09	0.05
Mayer	8.32	0.02	9.27	0.03	10.47	0.03
New Germany	6.77	0.02	7.51	0.02	8.98	0.02
Norwood	55.96	0.15	58.14	0.16	59.23	0.16
Victoria	19.14	0.05	22.91	0.06	26.69	0.07
Waconia	154.61	0.42	206.6	0.57	232.35	0.64
Watertown	95.97	0.26	104.58	0.29	126.19	0.35
Young America	34.08	0.09	35.41	0.10	36.07	0.10
Apple Valley	1777.59	4.87	2338.91	6.41	2616.93	7.17
Burnsville	1538.19	4.21	1695.76	4.65	1773.53	4.86
Eagan	2433.93	6.67	3481.47	9.54	4001	10.96
Empire	19.41	0.05	23.89	0.07	26.1	0.07
Farmington	265.3	0.73	283.42	0.78	301.57	0.83
Hampton	13.34	0.04	13.75	0.04	14.15	0.04
Hastings	748.06	2.05	904.08	2.48	981.22	2.69
Inver Grove Heights	487.27	1.33	718.83	1.97	839.86	2.30
Lakeville	687.44	1.88	1038.45	2.85	1212.71	3.32
Mendota Heights	432.99	1.19	496.51	1.36	527.88	1.45
New Trier	7.62	0.02	9.46	0.03	11.3	0.03
Randolph	11.77	0.03	12.9	0.04	14.05	0.04
Rosemount	224.5	0.62	444.71	1.22	554.48	1.52
South St. Paul	752.51	2.06	752.51	2.06	752.51	2.06
Vermillion	14.11	0.04	15.67	0.04	16.45	0.05

West St. Paul	704.6	1.93	736.16	2.02	751.72	2.06
Bloomington	3150.86	8.63	3327.36	9.12	3414.37	9.35
Brooklyn Center	1173.1	3.21	1173.1	3.21	1173.1	3.21
Brooklyn Park	2047.08	5.61	2625.55	7.19	2911.9	7.98
Champlin	614.54	1.68	669.37	1.83	724.37	1.98
Crystal	1461.49	4.00	1461.49	4.00	1461.49	4.00
Eden Prairie	912.5	2.50	1336.42	3.66	1546.77	4.24
Edina	2007.87	5.50	2016.97	5.53	2021.45	5.54
Excelsior	96.48	0.26	105.03	0.29	109.26	0.30
Golden Valley	1094.29	3.00	1154.21	3.16	1183.76	3.24
Hopkins	517.24	1.42	507.97	1.39	503.41	1.38
Long Lake	52.34	0.14	68.66	0.19	76.74	0.21
Loretto	14.17	0.04	14.17	0.04	16.25	0.04
Maple Grove	1589.1	4.35	2052.1	5.62	2281.3	6.25
Maple Plain	73.9	0.20	75.2	0.21	75.7	0.21
Medina	85.1	0.23	171.6	0.47	214.7	0.59
Minneapolis	10875.5	29.80	10402.5	28.50	10402.5	28.50
Minnetonka	1478	4.05	1727	4.73	1850.1	5.07
Minnetonka Beach	16.8	0.05	16.6	0.05	16.5	0.05
Minnetrista	14.9	0.04	15	0.04	15.3	0.04
Mound	217.7	0.60	227.5	0.62	232.3	0.64
New Hope	2039.3	5.59	2015.2	5.52	2003.4	5.49
Orono	87.8	0.24	92.5	0.25	97.1	0.27
Osseo	119.9	0.33	125.8	0.34	128.7	0.35
Plymouth	2063.3	5.65	2860.2	7.84	3255.2	8.92
Richfield	1633.1	4.47	1603.5	4.39	1588.9	4.35
Robbinsdale	527.7	1.45	509.3	1.40	509.3	1.40
Rockford	78.5	0.22	90.5	0.25	105.5	0.29
Rogers	13.1	0.04	14.6	0.04	17.7	0.05
St. Anthony	241.9	0.66	257.4	0.71	265.1	0.73
St. Bonifacius	40.4	0.11	45.5	0.12	48	0.13
St. Louis Park	1210.7	3.32	1305.1	3.58	1351.6	3.70
Shorewood	19.7	0.05	19.7	0.05	19.7	0.05
Spring Park	56.2	0.15	56.2	0.15	56.2	0.15
Tonka Bay	76.8	0.21	78.4	0.21	79.2	0.22
Wayzata	267.1	0.73	298.7	0.82	314.3	0.86
Arden Hills	242.2	0.66	279.6	0.77	298.1	0.82
Falcon Heights	243.4	0.67	246.5	0.68	248	0.68
Lauderdale	68.3	0.19	65.5	0.18	64	0.18
Little Canada	240.3	0.66	234.9	0.64	232.3	0.64
Maplewood	770.7	2.11	803	2.20	835.3	2.29
Mounds View	453.1	1.24	502.4	1.38	526.7	1.44
New Brighton	910.8	2.50	923.9	2.53	930.3	2.55
North St. Paul	405.5	1.11	430.7	1.18	443.2	1.21
Roseville	1193.8	3.27	1205.6	3.30	1211.4	3.32
St. Paul	6226.6	17.06	6226.6	17.06	6226.6	17.06
Shoreview	587.7	1.61	710.7	1.95	771.5	2.11
Vadnais Heights	338.2	0.93	418.8	1.15	499.9	1.37
White Bear Lake	668.5	1.83	718	1.97	742.4	2.03

White Bear Twp.	254.2	0.70	324.6	0.89	359.4	0.98
Belle Plaine	102.5	0.28	116.2	0.32	133.3	0.37
Elko	3.2	0.01	3.2	0.01	3.2	0.01
Jordan	118.4	0.32	128.1	0.35	139.8	0.38
New Market	6.3	0.02	7.2	0.02	7.3	0.02
Prior Lake	297.3	0.81	395.7	1.08	444.5	1.22
Savage	163.4	0.45	285	0.78	345.5	0.95
Shakopee	359	0.98	440.3	1.21	480.5	1.32
Bayport	64	0.18	64	0.18	64	0.18
Cottage Grove	888.3	2.43	964	2.64	1001.4	2.74
Forest Lake	220.4	0.60	271.2	0.74	296.4	0.81
Hugo	23.5	0.06	24	0.07	24.5	0.07
Lake Elmo	16.1	0.04	16.1	0.04	16.1	0.04
Landfall	27.3	0.07	27.8	0.08	28.1	0.08
Mahtomedi	124.7	0.34	162.9	0.45	181.8	0.50
Newport	91.7	0.25	99.1	0.27	102.7	0.28
Oak Park Heights	115.7	0.32	141.1	0.39	153.6	0.42
Oakdale	752.1	2.06	819.6	2.25	852.9	2.34
St. Paul Park	139.8	0.38	142.8	0.39	144.2	0.40
Stillwater	547.9	1.50	654.57	1.79	707.3	1.94
Woodbury	861.3	2.36	1083.43	2.97	1193.4	3.27
Total	71424.49	195.68	79486.04	217.77	83909.01	229.89

APPENDIX F

COMMERCIAL/INDUSTRIAL WATER USE DATA FILE

COMMERCIAL/INDUSTRIAL VARIABLE DESCRIPTIONS

Variables	Descriptions
cityname	all 111 cities supplied by municipal water or sewer
ctyname	county name corresponding to city
comm	percent of water used for commercial/industrial purposes
hwater	total water use MGY
cwater	total commercial/industrial water use MGY
acres	acres of irrigable land
temp	total number of employees in 1988
manu	total number of manufacturing employees in 1988
govt	total number of government employees in 1988
nonman	total number of non-manufacturing employees in 1988
agfor	total number of agriculture, forestry, and fisheries employees in 1988
mining	total number of mining employees in 1988
contract	total number of contract employees in 1988
trans	total number of transportation, communication, and public utilities employees in 1988
wtrade	total number of wholesale trade employees in 1988
rtrade	total number of retail employees in 1988
services	total number of service employees in 1988
fire	total number of finance, insurance and real estate employees in 1988
extra5	total number of car washes in 1988
bod	the amount of water used for commercial air conditioning purposes in 1988
iconnect	the amount of water used for commercial/industrial purposes for permitted wells

OBS	CITYNAME	CTYNAME	COMM	TEMP	MANU	GOVNT	NONMAN	AGFOR	MINING	CONTRACT	TRANS
1	ANDOVER	ANOKA	7.0	615	14	29	572	.	.	80	.
2	ANOKA	ANOKA	25.0	13008	.	3794	.	120	.	671	374
3	APPLE VALLEY	DAKOTA	8.0	5062	210	991	3861	.	.	263	64
4	ARDEN HILLS	RAMSEY	20.0	11659	7107	326	4226	.	.	47	.
5	BAYPORT	WASHINGTON	35.0	2662	.	492	.	.	.	.	.
6	BELLE PLAINE	SCOTT	30.0	835	.	120	.	.	.	37	.
7	BLAINE	ANOKA	33.0	10637	2739	857	7041	47	.	746	672
8	BLOOMINGTON	HENNEPIN	33.0	71722	16984	3155	51583	159	.	1936	2090
9	BROOKLYN CENTER	HENNEPIN	30.0	13872	2538	999	10335	57	.	344	396
10	BROOKLYN PARK	HENNEPIN	10.0	14549	1951	1811	10787	114	.	1545	241
11	BURNSVILLE	DAKOTA	20.0	21559	1763	1498	18298	106	.	909	1508
12	CARVER	CARVER	10.0	779	.	23	.	.	.	32	.
13	CENTERVILLE	ANOKA	0.0	413	58	118	238	4	.	94	.
14	CHAMPLIN	HENNEPIN	5.0	1085	16	333	736	.	.	109	.
15	CHANHASSEN	CARVER	19.0	1868	935	61	872	.	.	53	.
16	CHASKA	CARVER	26.3	4820	2310	968	1542	55	.	174	256
17	CIRCLE PINES	ANOKA	5.0	985	.	256	.	.	.	49	.
18	COLOGNE	CARVER	10.0	150	.	2	.	.	.	6	.
19	COLUMBIA HEIGHTS	ANOKA	16.0	5083	523	603	3956	.	.	358	.
20	COON RAPIDS	ANOKA	15.0	11379	1285	1953	8141	38	.	409	.
21	COTTAGE GROVE	WASHINGTON	9.0	4047	.	1010	.	.	.	41	136
22	CRYSTAL	HENNEPIN	15.0	6192	742	430	5020	.	.	224	200
23	EAGAN	DAKOTA	3.4	17107	4118	1208	11781	.	.	662	2238
24	EDEN PRAIRIE	HENNEPIN	35.0	30571	10861	1162	18548	128	.	1146	1105
25	EDINA	HENNEPIN	25.0	47337	4175	1901	41261	39	.	1640	1312
26	ELKO	SCOTT	2.0	57	2	.	54	.	.	11	10

OBS	WTRADE	RTRADE	FIRE	SERVICES	HWATER	REST	EFFLUENT	MARGINAL	BOD	CPRICE	ACRES	ICONNECT	EXTRA5
1	.	257	.	128	179	0	.	.	0.00	.	249	0.00	1.00
2	420	1924	521	1490	949	127	.	.	0.00	.	508	126.90	1.00
3	104	1813	212	1368	1825	153	.	.	0.00	.	520	153.40	5.00
4	266	651	1109	1979	314	66	.	.	24.40	.	1325	66.40	.
5	.	98	.	87	110	483	.	.	0.00	.	127	482.50	0.00
6	.	258	.	.	146	1	.	.	0.00	.	138	1.00	2.00
7	251	3823	280	1222	1825	5	.	.	0.00	.	2575	4.80	4.00
8	8790	12004	5747	20857	4581	137	.	.	213.50	.	2539	136.70	5.00
9	577	5373	482	3106	1643	1	.	.	5.70	.	643	1.00	.
10	744	4493	560	3090	2190	5	.	.	0.00	.	753	4.90	.
11	2260	8121	696	4698	2008	54786	.	.	0.00	.	1419	1325.23	.
12	9	48	11	132	13	0	.	.	0.00	.	6	0.00	0.00
13	14	42	.	44	12	0	.	.	0.00	.	24	0.00	1.00
14	25	281	10	214	548	0	.	.	0.00	.	80	0.00	3.00
15	.	491	.	140	438	0	.	.	0.00	.	202	0.00	1.00
16	52	469	165	371	1161	84	.	.	0.00	.	266	84.00	.
17	31	209	34	135	183	0	.	.	0.00	0.75	22	0.00	0.00
18	.	15	.	.	27	0	.	.	0.00	.	25	0.00	1.00
19	204	1682	249	1445	675	14	.	.	0.00	.	290	14.10	2.00
20	220	3218	393	3702	1431	0	.	.	0.00	.	603	0.00	.
21	21	1257	59	427	840	2638	.	.	0.00	.	530	2638.20	.
22	155	2389	272	1780	1825	0	.	.	0.00	.	610	0.00	3.00
23	2264	2266	.	1949	2227	323	.	.	0.90	.	1054	323.20	10.00
24	4763	4390	1950	5066	1241	100	.	.	3.10	.	1865	100.20	.
25	4633	10227	6868	16542	2701	0	.	.	626.70	.	1093	0.00	4.00
26	6	9	4	10	3	0	.	.	0.00	.	41	0.00	0.00

OBS	CITYNAME	CTYNAME	COMM	TEMP	MANU	GOVNT	NONMAN	AGFOR	MINING	CONTRACT	TRANS	WTRADE
27	EMPIRE	DAKOTA	0.0	115	.	3	.	.	.	.	.	.
28	EXCELSIOR	HENNEPIN	39.0	2389	34	756	1599	29	.	102	26	97
29	FALCON HEIGHTS	RAMSEY	5.0	3788	.	2093	.	.	.	30	.	.
30	FARMINGTON	DAKOTA	12.0	2633	246	833	1554	.	.	158	395	106
31	FOREST LAKE	WASHINGTON	12.3	4759	448	948	3363	41	.	115	157	93
32	FRIDLEY	ANOKA	50.0	20304	8870	654	10780	.	.	601	380	707
33	GOLDEN VALLEY	HENNEPIN	23.0	27174	10254	1094	15826	75	.	1521	711	2931
34	HAMBURG	CARVER	5.0	42	.	4	.	.	.	11	.	6
35	HAMPTON	DAKOTA	40.0	154	.	.	.	.	.	.	.	.
36	HASTINGS	DAKOTA	10.0	6656	1704	1460	3492	29	.	245	129	158
37	HILLTOP	ANOKA	25.0	268	28	32	208	.	.	19	.	11
38	HOPKINS	HENNEPIN	35.0	13977	4097	1603	8277	30	.	359	272	1638
39	HUGO	WASHINGTON	15.0	1038	293	52	693	19	.	264	.	43
40	INVER GROVE HEIGHTS	DAKOTA	11.2	3850	159	824	2867	43	.	289	343	94
41	JORDAN	SCOTT	10.2	860	173	161	526	.	.	41	.	29
42	LAKE ELMO	WASHINGTON	10.0	833	74	64	695	24	.	109	.	.
43	LAKEVILLE	DAKOTA	16.0	5114	1790	627	2697	57	.	338	219	345
44	LANDFALL	WASHINGTON	10.7	44	3	10	31	.	.	4	1	1
45	LAUDERDALE	RAMSEY	20.0	421	.	233	.	.	.	3	.	.
46	LEXINGTON	ANOKA	3.0	985	.	256	.	.	.	48	.	31
47	LINO LAKES	ANOKA	1.0	900	57	118	238	5	.	94	.	14
48	LITTLE CANADA	RAMSEY	25.0	3462	518	307	2637	.	.	333	191	170
49	LONG LAKE	HENNEPIN	50.0	1651	505	321	825	35	.	116	.	143
50	LORETTO	HENNEPIN	15.0	328	.	3	.	.	.	81	.	.
51	MAHTOMEDI	WASHINGTON	11.0	614	6	219	389	.	.	45	.	13
52	MAPLE GROVE	HENNEPIN	10.0	5450	1298	907	3245	60	.	457	203	233

OBS	RTRADE	FIRE	SERVICES	HWATER	REST	EFFLUENT	MARGINAL	BOD	CPRICE	ACRES	ICONNECT	EXTRA5
27	.	.	.	20	0	.	.	0.00	.	123	0.00	0.00
28	655	128	562	158	0	.	.	0.00	.	57	0.40	1.00
29	397	53	523	256	77	.	.	0.00	.	43	76.60	1.00
30	333	107	455	292	145	.	.	0.00	.	163	145.20	2.00
31	1458	235	1264	252	0	.	.	0.00	.	188	0.00	2.00
32	5410	471	3211	2372	5	.	.	0.00	.	1264	4.50	5.00
33	3151	842	6595	1351	889	.	.	10.00	.	925	888.90	.
34	11	.	7	15	0	.	.	0.00	.	10	0.00	1.00
35	109	.	.	22	0	.	.	0.00	.	16	0.00	0.00
36	1419	294	1218	825	28	.	.	0.00	.	331	28.30	.
37	89	13	76	37	0	.	.	0.00	.	19	0.00	.
38	3033	407	2538	767	0	.	.	130.40	.	590	0.00	6.00
39	144	.	91	28	0	.	.	0.00	.	158	0.00	0.00
40	1261	103	734	548	6	.	.	14.00	.	894	5.90	4.00
41	221	.	113	117	0	.	.	0.00	.	57	0.00	2.00
42	249	55	148	18	8	.	.	4.30	.	162	7.50	0.00
43	777	85	876	730	16	.	.	0.00	.	526	16.20	.
44	16	1	8	28	0	.	.	0.00	.	6	0.00	.
45	44	6	58	80	0	.	.	0.00	.	51	0.00	.
46	209	34	135	64	0	.	.	0.00	.	37	0.00	1.00
47	42	.	44	12	32	.	.	0.00	1.20	153	32.10	0.00
48	955	99	874	292	0	.	.	0.00	.	234	0.00	3.00
49	184	67	280	104	0	.	.	0.00	.	79	0.00	2.00
50	50	.	165	16	0	.	.	0.00	.	13	0.00	0.00
51	210	.	121	140	0	.	.	0.00	.	43	0.00	.
52	1315	198	779	1533	89	.	.	0.00	.	2157	89.10	1.00

OBS	CITYNAME	CTYNAME	COMM	TEMP	MANU	GOVNT	NONMAN	AGFOR	MINING	CONTRACT	TRANS	WTRADE
53	MAPLE PLAIN	HENNEPIN	35.0	1507	205	364	938	19	.	109	.	119
54	MAPLEWOOD	RAMSEY	50.0	24539	665	1399	10375	64	.	249	282	587
55	MAYER	CARVER	25.0	42	.	4	.	.	.	11	.	6
56	MEDINA	HENNEPIN	17.0	1522	330	22	1170	64	.	272	100	62
57	MENDOTA HEIGHTS	DAKOTA	30.0	4311	1605	143	2563	30	.	85	29	680
58	MINNEAPOLIS	HENNEPIN	45.0	281036	39724	45421	195891	273	.	5794	14733	17075
59	MINNETONKA	HENNEPIN	40.0	31271	5884	1210	24177	149	.	1496	669	3879
60	MINNETONKA BEACH	HENNEPIN	25.0	174	6	2	166	.	.	23	.	5
61	MINNETRISTA	HENNEPIN	10.0	.	.	.	.	.	.	.	.	.
62	MOUND	HENNEPIN	10.0	1915	.	502	.	.	.	98	18	72
63	MOUNDS VIEW	RAMSEY	9.0	1449	.	239	.	.	.	57	35	161
64	NEW BRIGHTON	RAMSEY	3.0	7971	2334	555	5082	51	.	586	839	803
65	NEW GERMANY	CARVER	39.0	42	.	4	.	.	.	11	.	6
66	NEW HOPE	HENNEPIN	25.0	12887	4291	1102	7494	.	.	1051	53	1486
67	NEW MARKET	SCOTT	5.0	57	2	.	54	.	.	11	10	6
68	NEW TRIER	DAKOTA	10.0	57	.	6	.	.	.	10	8	8
69	NEWPORT	WASHINGTON	35.0	1744	.	58	.	.	.	40	610	231
70	NORTH ST. PAUL	RAMSEY	25.0	2814	492	383	1939	.	.	248	18	104
71	NORWOOD	CARVER	25.0	578	67	83	429	2	.	15	29	.
72	OAK PARK HEIGHTS	WASHINGTON	19.4	2662	.	492	.	.	.	.	.	.
73	OAKDALE	WASHINGTON	7.0	2163	149	504	1510	.	.	177	38	64
74	ORONO	HENNEPIN	5.0	569	.	68	.	.	.	27	.	.
75	OSSEO	HENNEPIN	25.0	3134	681	447	2006	.	.	351	.	283
76	PLYMOUTH	HENNEPIN	32.0	32509	8542	1806	22161	282	.	1368	1326	5566
77	PRIOR LAKE	SCOTT	7.0	2216	37	408	1771	.	.	222	111	62
78	RAMSEY	ANOKA	3.5	615	14	29	572	.	.	80	.	.

OBS	RTRADE	FIRE	SERVICES	HWATER	REST	EFFLUENT	MARGINAL	BOD	CPRICE	ACRES	ICONNECT	EXTRA5
53	167	.	454	95	0	.	.	0.00	.	67	0.00	1.00
54	5305	382	3506	1478	21	.	.	0.00	.	931	20.70	.
55	11	.	7	12	1	.	.	0.00	.	7	1.20	1.00
56	144	.	528	91	1	.	.	0.00	.	145	0.50	0.00
57	460	99	1180	540	0	.	.	8.10	.	234	0.00	0.00
58	41296	32021	84699	19819	559208	.	.	2833.90	.	7420	2682.97	.
59	9680	1303	7001	2278	0	.	.	0.00	.	1183	0.00	2.00
60	77	.	.	22	0	.	.	0.00	.	4	0.00	0.00
61	.	.	.	16	0	.	.	0.00	.	33	0.00	0.00
62	339	45	295	237	0	.	.	0.00	.	65	0.00	0.00
63	619	56	.	511	0	.	.	0.00	.	100	0.00	4.00
64	1238	263	1302	913	45	.	.	0.00	.	536	45.30	1.00
65	11	.	7	11	0	.	.	0.00	.	17	0.00	0.00
66	1541	347	3016	2665	14	.	.	0.00	.	504	14.30	7.00
67	9	4	10	6	0	.	.	0.00	.	14	0.00	0.00
68	22	.	3	8	0	.	.	0.00	.	3	0.00	.
69	329	169	161	124	0	.	.	0.00	.	223	0.00	2.00
70	932	102	518	548	0	.	.	17.20	.	164	0.00	2.00
71	82	32	.	77	29	.	.	0.00	.	32	29.30	2.00
72	98	.	87	130	95697	.	.	0.00	.	240	0.00	1.00
73	803	46	382	730	0	.	.	0.00	.	134	0.00	0.00
74	152	.	269	91	2	.	.	0.00	.	94	2.00	.
75	519	29	563	154	0	.	.	0.00	.	127	0.00	1.00
76	5727	.	5126	2738	174	.	.	16.50	.	1290	173.50	.
77	587	78	691	292	0	.	.	0.00	.	105	0.00	3.00
78	256	.	128	18	11	.	.	0.00	.	388	10.80	1.00

OBS	CITYNAME	CTYNAME	COMM	TEMP	MANU	GOVNT	NONMAN	AGFOR	MINING	CONTRACT	TRANS
79	RANDOLPH	DAKOTA	0.0	57	.	6	.	.	.	10	8
80	RICHFIELD	HENNEPIN	6.0	11023	604	1152	9267	93	.	624	415
81	ROBBINSDALE	HENNEPIN	5.0	6320	105	292	5923	.	.	193	.
82	ROCKFORD	HENNEPIN	20.0	438	.	.	.	.	.	.	.
83	ROGERS	HENNEPIN	65.0	1607	374	80	1153	19	.	298	.
84	ROSEMOUNT	DAKOTA	11.0	4073	.	1675	.	12	.	333	108
85	ROSEVILLE	RAMSEY	35.0	33990	12525	1506	19959	105	.	1162	1832
86	SAVAGE	SCOTT	20.0	2322	965	187	1170	.	.	341	.
87	SHAKOPEE	SCOTT	54.0	6972	1280	1016	4676	80	.	406	83
88	SHOREVIEW	RAMSEY	9.6	5962	3158	421	2383	.	.	197	.
89	SHOREWOOD	HENNEPIN	9.0	417	.	42	.	.	.	14	.
90	SOUTH ST. PAUL	DAKOTA	25.0	6909	823	1146	4940	21	.	154	407
91	SOUTH ST. PAUL	DAKOTA	25.0	6909	823	1146	4940	21	.	154	407
92	SPRING LAKE PARK	ANOKA	12.1	1995	218	384	1393	.	.	75	.
93	SPRING PARK	HENNEPIN	32.0	694	22	7	665	.	.	92	.
94	ST. ANTHONY	HENNEPIN	25.0	2914	469	321	2124	.	.	7	.
95	ST. BONIFACIUS	HENNEPIN	9.0	424	220	4	200	.	.	.	.
96	ST. FRANCIS	ANOKA	15.4	1128	56	590	482	.	.	63	7
97	ST. LOUIS PARK	HENNEPIN	51.0	38321	8571	1406	28344	42	.	990	373
98	ST. PAUL	RAMSEY	50.0	188460	47575	33526	107359	232	.	5449	5890
99	ST. PAUL PARK	WASHINGTON	25.0	1115	492	179	444	.	.	24	41
100	STILLWATER	WASHINGTON	12.0	7738	1026	1516	5196	80	.	322	157
101	TONKA BAY	HENNEPIN	6.0	46	.	5	.	.	.	2	.
102	VADNAIS HEIGHTS	RAMSEY	27.0	1922	684	197	1041	.	.	126	.
103	VERMILLION	DAKOTA	2.0	57	.	.	.	.	.	10	8
104	VICTORIA	CARVER	1.0	316	.	11	.	.	.	24	.

OBS	WTRADE	RTRADE	FIRE	SERVICES	HWATER	REST	EFFLUENT	MARGINAL	BOD	CPRICE	ACRES	ICONNECT	EXTRA5
79	8	22	.	3	9	0	.	.	0.00	.	29	0.00	0.00
80	290	4356	781	2708	1679	13	.	.	0.50	.	332	12.60	8.00
81	164	1062	232	4244	551	0	.	.	0.00	.	96	0.00	1.00
82	.	137	.	4	95	0	.	.	0.00	.	18	0.00	.
83	90	536	33	177	37	0	.	.	0.00	.	131	0.00	2.00
84	143	402	.	358	207	1694	.	.	0.00	1.85	735	1694.20	5.00
85	1506	9037	1968	4349	1825	.	.	.	23.70	.	1539	38.40	.
86	148	180	33	320	183	17	.	.	0.00	.	448	16.90	3.00
87	352	1921	235	1599	803	590	.	.	0.00	.	1124	590.20	6.00
88	300	728	168	809	621	0	.	.	0.00	.	224	0.00	2.00
89	5	139	.	78	20	5	.	.	0.00	.	59	4.70	.
90	1590	860	582	1326	1022	8	.	.	0.00	.	717	8.10	.
91	1590	860	582	1326	1022	8	.	.	0.00	.	717	8.10	.
92	58	574	.	611	365	0	.	.	0.00	.	119	0.00	1.00
93	21	310	.	.	82	1	.	.	0.00	.	57	0.70	2.00
94	368	779	158	776	356	0	.	.	0.00	.	203	0.00	2.00
95	.	126	.	56	44	0	.	.	0.00	.	25	0.00	1.00
96	11	262	.	98	55	0	.	.	0.00	.	185	0.00	.
97	3167	7147	4889	11736	2555	321	.	.	337.20	.	1175	321.40	4.00
98	7154	24407	13819	50408	13067	.	.	.	3132.30	.	6328	8172.71	20.00
99	.	91	9	186	183	894	.	.	0.00	.	249	894.40	.
100	171	2220	456	1790	657	77	.	.	0.00	.	186	77.00	2.00
101	1	15	.	9	73	0	.	.	0.00	.	16	0.00	0.00
102	19	555	.	310	438	0	.	.	120.70	.	153	0.00	3.00
103	8	22	.	3	14	0	.	.	0.00	.	8	0.00	0.00
104	.	51	16	.	18	0	.	.	0.00	1.33	13	0.00	1.00

OBS	CITYNAME	CTYNAME	COMM	TEMP	MANU	GOVNT	NONMAN	AGFOR	MINING	CONTRACT	TRANS	WTRADE	RTRADE	FIRE	SERVICES	HWATER	REFLUENT	EFMARGINAL	BOD	CPRICODE	ACRES	ICONECT	EXTRA5
105	WACONIA	CARVER	33.0	2303	508	668	1127	.	.	28	72	.	443	90	427	256	0	. .	0.00	.	79	0.00	3.00
106	WATERTOWN	CARVER	0.0	591	41	133	417	.	.	48	.	19	217	.	101	91	3	. .	0.00	.	42	3.00	1.00
107	WAYZATA	HENNEPIN	9.0	5151	145	394	4612	7	.	234	82	218	1812	592	1667	312	0	. .	0.00	.	120	0.00	3.00
108	WEST ST. PAUL	DAKOTA	11.0	8593	1012	706	6875	59	.	232	218	323	3593	433	2017	796	0	. .	296.40	.	348	0.00	4.00
109	WHITE BEAR LAKE	RAMSEY	20.0	7936	824	1877	5234	53	.	316	69	88	2960	311	1438	876	4	. .	0.00	.	285	4.00	2.00
110	WHITE BEAR TOWNSHIP	RAMSEY	7.5	934	97	221	616	6	.	37	8	10	348	37	169	251	0	. .	0.00	.	135	0.00	0.00
111	WOODBURY	WASHINGTON	17.0	4815	.	404	.	48	.	121	.	.	597	1341	991	913	1	. .	0.00	.	242	1.00	2.00
112	YOUNG AMERICA	CARVER	12.0	578	67	83	429	2	.	15	28	.	82	32	.	40	0	. .	0.00	.	14	0.00	0.00

APPENDIX G

SUMMARY OF COMMERCIAL/INDUSTRIAL WATER USE FOR 1990, 2000 AND 2010

Summary of Commercial/Industrial Water Use for 1990, 2000 and 2010

Cityname	1990 Projections Commercial Use (mgy)	1990 Projections Commercial Use (mgd)	2000 Projections Commercial Use (mgy)	2000 Projections Commercial Use (mgd)	2010 Projections Commercial Use (mgy)	2010 Projections Commercial Use (mgd)
Andover	7.8	0.021	9.97	0.027	12.18	0.033
Anoka	363.9	0.997	363.9	0.997	379.33	1.039
Blaine	756.94	2.074	951.16	2.606	1215.78	3.331
Centerville	0	0.000	0	0.000	0	0.000
Circle Pines	9.28	0.025	9.28	0.025	11.34	0.031
Columbia Heights	146.59	0.402	173.67	0.476	187.37	0.513
Coon Rapids	269.59	0.739	333.77	0.914	421.11	1.154
Fridley	1628.88	4.463	1896.21	5.195	2031.21	5.565
Hilltop	10.33	0.028	14.18	0.039	16.14	0.044
Lexington	1.95	0.005	1.95	0.005	2.16	0.006
Lino Lakes	40.18	0.110	56.52	0.155	77.56	0.212
Ramsey	7.13	0.020	11.13	0.030	13.19	0.036
St. Francis	11.54	0.032	15.83	0.043	20.23	0.055
Spring Lake Park	69.18	0.190	81.96	0.225	102.79	0.282
Carver	0.61	0.002	0.61	0.002	0.78	0.002
Chanhassen	114.67	0.314	150.45	0.412	218.9	0.600
Chaska	450.08	1.233	540.88	1.482	679.66	1.862
Cologne	1.75	0.005	1.75	0.005	1.75	0.005
Hamburg	0.88	0.002	0.88	0.002	0.88	0.002
Mayer	10.94	0.030	10.94	0.030	10.94	0.030
New Germany	5.17	0.014	5.17	0.014	5.17	0.014
Norwood	50.5	0.138	50.5	0.138	59.83	0.164
Victoria	0.37	0.001	0.37	0.001	0.44	0.001
Waconia	80.18	0.220	92.28	0.253	108.65	0.298
Watertown	3.05	0.008	3.61	0.010	4.76	0.013
Young America	3.2	0.009	3.64	0.010	4.09	0.011
Apple Valley	295.4	0.809	427.7	1.172	598.4	1.639
Burnsville	1765.6	4.837	2302	6.307	2942.4	8.061
Eagan	474.6	1.300	659.4	1.807	904.3	2.478
Empire	0	0.000	0	0.000	0	0.000
Farmington	246.5	0.675	285.5	0.782	348.9	0.956
Hampton	11.7	0.032	11.7	0.032	14.9	0.041
Hastings	126.3	0.346	135.6	0.372	154.4	0.423
Inver Grove Heights	123.5	0.338	136.7	0.375	175.3	0.480
Lakeville	158.6	0.435	187.9	0.515	253.7	0.695
Mendota Heights	198.9	0.545	237.2	0.650	276.2	0.757
New Trier	0.7	0.002	0.7	0.002	0.7	0.002
Randolph	0	0.000	0	0.000	0	0.000
Rosemount	1916	5.249	2629.2	7.203	3066.1	8.400
South St. Paul	309.7	0.848	309.7	0.848	318.3	0.872
Vermillion	0.5	0.001	0.5	0.001	0.5	0.001
West St. Paul	388.5	1.064	251.6	0.689	114.8	0.315
Bloomington	1944.9	5.328	2222.6	6.089	2115.9	5.797
Brooklyn Center	563.6	1.544	660.4	1.809	738.4	2.023
Brooklyn Park	231.5	0.634	335.3	0.919	406.1	1.113
Champlin	25	0.068	39.1	0.107	53.6	0.147
Crystal	288.8	0.791	288.8	0.791	288.8	0.791
Eden Prairie	507.5	1.390	680.6	1.865	817.9	2.241
Edina	1375.5	3.768	1093.9	2.997	796.4	2.182
Excelsior	79.9	0.219	79.9	0.219	79.9	0.219
Golden Valley	1396.5	3.826	1490.3	4.083	1485.3	4.069
Hopkins	528.3	1.447	485	1.329	419.8	1.150
Long Lake	64.2	0.176	64.2	0.176	64.2	0.176
Loretto	1.8	0.005	1.8	0.005	2.2	0.006
Maple Grove	220.5	0.604	369.7	1.013	630.7	1.728
Maple Plain	45.3	0.124	45.3	0.124	47.8	0.131
Medina	12.3	0.034	12.3	0.034	13.5	0.037
Minneapolis	15071.1	41.291	13791.1	37.784	12465.5	34.152
Minnetonka	934.4	2.560	966.6	2.648	998.9	2.737

Minnetonka Beach	10	0.027	10	0.027	10	0.027
Minnetrista	0	0.000	0	0.000	0	0.000
Mound	27.6	0.076	34.6	0.095	37.5	0.103
New Hope	687	1.882	716.1	1.962	745.3	2.042
Orono	6.9	0.019	6.9	0.019	8.2	0.022
Osseo	43.6	0.119	43.6	0.119	43.6	0.119
Plymouth	942.1	2.581	1182.4	3.239	1464.1	4.011
Richfield	142.2	0.390	147.7	0.405	153.2	0.420
Robbinsdale	26	0.071	26	0.071	30.8	0.084
Rockford	10.2	0.028	10.2	0.028	12.5	0.034
Rogers	14.1	0.039	17.2	0.047	20.4	0.056
St. Anthony	143.5	0.393	143.5	0.393	150.6	0.413
St. Bonifacius	4.7	0.013	4.7	0.013	5.8	0.016
St. Louis Park	2040.1	5.589	1918.4	5.256	1796.8	4.923
Shorewood	8.9	0.024	8.9	0.024	8.9	0.024
Spring Park	62.9	0.172	62.9	0.172	67.5	0.185
Tonka Bay	4.8	0.013	4.8	0.013	4.8	0.013
Wayzata	30.2	0.083	30.2	0.083	30.2	0.083
Arden Hills	133.5	0.366	121.3	0.332	133.3	0.365
Falcon Heights	87.1	0.239	87.1	0.239	94.9	0.260
Lauderdale	21.5	0.059	21.5	0.059	23.7	0.065
Little Canada	73.9	0.202	85.6	0.235	109.4	0.300
Maplewood	741.5	2.032	809.7	2.218	878.5	2.407
Mounds View	65.6	0.180	65.6	0.180	83.8	0.230
New Brighton	93.3	0.256	93.3	0.256	98.4	0.270
North St. Paul	164.1	0.450	155.5	0.426	174	0.477
Roseville	856	2.345	888.9	2.435	922	2.526
St. Paul	17970.8	49.235	16662.5	45.651	15268.5	41.832
Shoreview	71.1	0.195	82.3	0.225	105.2	0.288
Vadnais Heights	210.7	0.577	183.9	0.504	164.9	0.452
White Bear Lake	151.2	0.414	153.6	0.421	158.5	0.434
White Bear Township	15.9	0.044	20.3	0.056	24.8	0.068
Belle Plaine	66.8	0.183	72.9	0.200	79.1	0.217
Elko	0.1	0.000	0.1	0.000	0.1	0.000
Jordan	14.1	0.039	17.2	0.047	20.4	0.056
New Market	0.3	0.001	0.3	0.001	0.3	0.001
Prior Lake	18.3	0.050	20.3	0.056	23.3	0.064
Savage	70.8	0.194	124.2	0.340	157.3	0.431
Shakopee	1191	3.263	1522.4	4.171	1945.9	5.331
Bayport	401.2	1.099	401.2	1.099	422.3	1.157
Cottage Grove	3049.7	8.355	3424.5	9.382	3803	10.419
Forest Lake	25.6	0.070	25.6	0.070	27.7	0.076
Hugo	3.1	0.008	4	0.011	4.9	0.013
Lake Elmo	20.7	0.057	19.9	0.055	21.7	0.059
Landfall	3.5	0.010	3.5	0.010	3.5	0.010
Mahtomedi	35.19	0.096	35.19	0.096	38.17	0.105
Newport	44.94	0.123	50.46	0.138	56.03	0.154
Oak Park Heights	23.59	0.065	28.83	0.079	32.02	0.088
Oakdale	86.76	0.238	128.45	0.352	185.98	0.510
St. Paul Park	833.94	2.285	833.94	2.285	926.12	2.537
Stillwater	150.58	0.413	161.65	0.443	184.01	0.504
Woodbury	217.18	0.595	329.7	0.903	465.54	1.275
Total	64470.67	176.632	65986.43	180.785	67407.51	184.678

APPENDIX H

COMMERCIAL/INDUSTRIAL AND RESIDENTIAL PROJECTIONS

COMMERCIAL/INDUSTRIAL AND RESIDENTIAL PROJECTIONS

Cityname	1990 Projections				2000 Projections				2010 Projections			
	Residential Use (mgy)	Commercial Use (mgy)	Total Use (mgy)	Total Use (mgd)	Residential Use (mgy)	Commercial Use (mgy)	Total Use (mgy)	Total Use (mgd)	Residential Use (mgy)	Commercial Use (mgy)	Total Use (mgy)	Total Use (mgd)
Andover	173.17	7.8	180.97	0.50	174.43	9.97	184.4	0.51	175.69	12.18	187.87	0.51
Anoka	702.46	363.9	1066.36	2.92	702.46	363.9	1066.36	2.92	702.46	379.33	1081.79	2.96
Blaine	1247.66	756.94	2004.6	5.49	1638.04	951.16	2589.2	7.09	1831.37	1215.78	3047.15	8.35
Centerville	14.89	0	14.89	0.04	26.59	0	26.59	0.07	42.89	0	42.89	0.12
Circle Pines	179.05	9.28	188.33	0.52	203.81	9.28	213.09	0.58	216.04	11.34	227.38	0.62
Columbia Heights	580.32	146.59	726.91	1.99	588.49	173.67	762.16	2.09	592.52	187.37	779.89	2.14
Coon Rapids	1261.04	269.59	1530.63	4.19	1621.41	333.77	1955.18	5.36	1799.81	421.11	2220.92	6.08
Fridley	1251.18	1628.88	2880.06	7.89	1226.04	1896.21	3122.25	8.55	1213.66	2031.21	3244.87	8.89
Hilltop	28.42	10.33	38.75	0.11	28.17	14.18	42.35	0.12	28.06	16.14	44.2	0.12
Lexington	61.53	1.95	63.48	0.17	59.6	1.95	61.55	0.17	58.65	2.16	60.81	0.17
Lino Lakes	13.96	40.18	54.14	0.15	14.88	56.52	71.4	0.20	15.78	77.56	93.34	0.26
Ramsey	24.91	7.13	32.04	0.09	28.58	11.13	39.71	0.11	35.96	13.19	49.15	0.13
St. Francis	49.99	11.54	61.53	0.17	64.76	15.83	80.59	0.22	79.63	20.23	99.86	0.27
Spring Lake Park	331.36	69.18	400.54	1.10	349.11	81.96	431.07	1.18	357.83	102.79	460.62	1.26
Carver	11.62	0.61	12.23	0.03	12.82	0.61	13.43	0.04	14.02	0.78	14.8	0.04
Chanhassen	446.45	114.67	561.12	1.54	688.97	150.45	839.42	2.30	809.4	218.9	1028.3	2.82
Chaska	1018.57	450.08	1468.65	4.02	1146.91	540.88	1687.79	4.62	1210.22	679.66	1889.88	5.18
Cologne	25.61	1.75	27.36	0.07	27.24	1.75	28.99	0.08	31.72	1.75	33.47	0.09
Hamburg	14.16	0.88	15.04	0.04	15.33	0.88	16.21	0.04	17.09	0.88	17.97	0.05
Mayer	8.32	10.94	19.26	0.05	9.27	10.94	20.21	0.06	10.47	10.94	21.41	0.06
New Germany	6.77	5.17	11.94	0.03	7.51	5.17	12.68	0.03	8.98	5.17	14.15	0.04
Norwood	55.96	50.5	106.46	0.29	58.14	50.5	108.64	0.30	59.23	59.83	119.06	0.33
Victoria	19.14	0.37	19.51	0.05	22.91	0.37	23.28	0.06	26.69	0.44	27.13	0.07
Waconia	154.61	80.18	234.79	0.64	206.6	92.28	298.88	0.82	232.35	108.65	341	0.93
Watertown	95.97	3.05	99.02	0.27	104.58	3.61	108.19	0.30	126.19	4.76	130.95	0.36
Young America	34.08	3.2	37.28	0.10	35.41	3.64	39.05	0.11	36.07	4.09	40.16	0.11
Apple Valley	1777.59	295.4	2072.99	5.68	2338.91	427.7	2766.61	7.58	2616.93	598.4	3215.33	8.81
Burnsville	1538.19	1765.6	3303.79	9.05	1695.76	2302	3997.76	10.95	1773.53	2942.4	4715.93	12.92
Eagan	2433.93	474.6	2908.53	7.97	3481.47	659.4	4140.87	11.34	4001	904.3	4905.3	13.44
Empire	19.41	0	19.41	0.05	23.89	0	23.89	0.07	26.1	0	26.1	0.07
Farmington	265.3	246.5	511.8	1.40	283.42	285.5	568.92	1.56	301.57	348.9	650.47	1.78
Hampton	13.34	11.7	25.04	0.07	13.75	11.7	25.45	0.07	14.15	14.9	29.05	0.08
Hastings	748.06	126.3	874.36	2.40	904.08	135.6	1039.68	2.85	981.22	154.4	1135.62	3.11
Inver Grove Heights	487.27	123.5	610.77	1.67	718.83	136.7	855.53	2.34	839.86	175.3	1015.16	2.78
Lakeville	687.44	158.6	846.04	2.32	1038.45	187.9	1226.35	3.36	1212.71	253.7	1466.41	4.02
Mendota Heights	432.99	198.9	631.89	1.73	496.51	237.2	733.71	2.01	527.88	276.2	804.08	2.20
New Trier	7.62	0.7	8.32	0.02	9.46	0.7	10.16	0.03	11.3	0.7	12	0.03
Randolph	11.77	0	11.77	0.03	12.9	0	12.9	0.04	14.05	0	14.05	0.04
Rosemount	224.5	1916	2140.5	5.86	444.71	2629.2	3073.91	8.42	554.48	3066.1	3620.58	9.92
South St. Paul	752.51	309.7	1062.21	2.91	752.51	309.7	1062.21	2.91	752.51	318.3	1070.81	2.93
Vermillion	14.11	0.5	14.61	0.04	15.67	0.5	16.17	0.04	16.45	0.5	16.95	0.05

West St. Paul	704.6	388.5	1093.1	2.99	736.16	251.6	987.76	2.71	751.72	114.8	866.52	2.37
Bloomington	3150.86	1944.9	5095.76	13.96	3327.36	2222.6	5549.96	15.21	3414.37	2115.9	5530.27	15.15
Brooklyn Center	1173.1	563.6	1736.7	4.76	1173.1	660.4	1833.5	5.02	1173.1	738.4	1911.5	5.24
Brooklyn Park	2047.08	231.5	2278.58	6.24	2625.55	335.3	2960.85	8.11	2911.9	406.1	3318	9.09
Champlin	614.54	25	639.54	1.75	669.37	39.1	708.47	1.94	724.37	53.6	777.97	2.13
Crystal	1461.49	288.8	1750.29	4.80	1461.49	288.8	1750.29	4.80	1461.49	288.8	1750.29	4.80
Eden Prairie	912.5	507.5	1420	3.89	1336.42	680.6	2017.02	5.53	1546.77	817.9	2364.67	6.48
Edina	2007.87	1375.5	3383.37	9.27	2016.97	1093.9	3110.87	8.52	2021.45	796.4	2817.85	7.72
Excelsior	96.48	79.9	176.38	0.48	105.03	79.9	184.93	0.51	109.26	79.9	189.16	0.52
Golden Valley	1094.29	1396.5	2490.79	6.82	1154.21	1490.3	2644.51	7.25	1183.76	1485.3	2669.06	7.31
Hopkins	517.24	528.3	1045.54	2.86	507.97	485	992.97	2.72	503.41	419.8	923.21	2.53
Long Lake	52.34	64.2	116.54	0.32	68.66	64.2	132.86	0.36	76.74	64.2	140.94	0.39
Loretto	14.17	1.8	15.97	0.04	14.17	1.8	15.97	0.04	16.25	2.2	18.45	0.05
Maple Grove	1589.1	220.5	1809.6	4.96	2052.1	369.7	2421.8	6.64	2281.3	630.7	2912	7.98
Maple Plain	73.9	45.3	119.2	0.33	75.2	45.3	120.5	0.33	75.7	47.8	123.5	0.34
Medina	85.1	12.3	97.4	0.27	171.6	12.3	183.9	0.50	214.7	13.5	228.2	0.63
Minneapolis	10875.5	15071.1	25946.6	71.09	10402.5	13791.1	24193.6	66.28	10402.5	12465.5	22868	62.65
Minnetonka	1478	934.4	2412.4	6.61	1727	966.6	2693.6	7.38	1850.1	998.9	2849	7.81
Minnetonka Beach	16.8	10	26.8	0.07	16.6	10	26.6	0.07	16.5	10	26.5	0.07
Minnetrista	14.9	0	14.9	0.04	15	0	15	0.04	15.3	0	15.3	0.04
Mound	217.7	27.6	245.3	0.67	227.5	34.6	262.1	0.72	232.3	37.5	269.8	0.74
New Hope	2039.3	687	2726.3	7.47	2015.2	716.1	2731.3	7.48	2003.4	745.3	2748.7	7.53
Orono	87.8	6.9	94.7	0.26	92.5	6.9	99.4	0.27	97.1	8.2	105.3	0.29
Osseo	119.9	43.6	163.5	0.45	125.8	43.6	169.4	0.46	128.7	43.6	172.3	0.47
Plymouth	2063.3	942.1	3005.4	8.23	2860.2	1182.4	4042.6	11.08	3255.2	1464.1	4719.3	12.93
Richfield	1633.1	142.2	1775.3	4.86	1603.5	147.7	1751.2	4.80	1588.9	153.2	1742.1	4.77
Robbinsdale	527.7	26	553.7	1.52	509.3	26	535.3	1.47	509.3	30.8	540.1	1.48
Rockford	78.5	10.2	88.7	0.24	90.5	10.2	100.7	0.28	105.5	12.5	118	0.32
Rogers	13.1	14.1	27.2	0.07	14.6	17.2	31.8	0.09	17.7	20.4	38.1	0.10
St. Anthony	241.9	143.5	385.4	1.06	257.4	143.5	400.9	1.10	265.1	150.6	415.7	1.14
St. Bonifacius	40.4	4.7	45.1	0.12	45.5	4.7	50.2	0.14	48	5.8	53.8	0.15
St. Louis Park	1210.7	2040.1	3250.8	8.91	1305.1	1918.4	3223.5	8.83	1351.6	1796.8	3148.4	8.63
Shorewood	19.7	8.9	28.6	0.08	19.7	8.9	28.6	0.08	19.7	8.9	28.6	0.08
Spring Park	56.2	62.9	119.1	0.33	56.2	62.9	119.1	0.33	56.2	67.5	123.7	0.34
Tonka Bay	76.8	4.8	81.6	0.22	78.4	4.8	83.2	0.23	79.2	4.8	84	0.23
Wayzata	267.1	30.2	297.3	0.81	298.7	30.2	328.9	0.90	314.3	30.2	344.5	0.94
Arden Hills	242.2	133.5	375.7	1.03	279.6	121.3	400.9	1.10	298.1	133.3	431.4	1.18
Falcon Heights	243.4	87.1	330.5	0.91	246.5	87.1	333.6	0.91	248	94.9	342.9	0.94
Lauderdale	68.3	21.5	89.8	0.25	65.5	21.5	87	0.24	64	23.7	87.7	0.24
Little Canada	240.3	73.9	314.2	0.86	234.9	85.6	320.5	0.88	232.3	109.4	341.7	0.94
Maplewood	770.7	741.5	1512.2	4.14	803	809.7	1612.7	4.42	835.3	878.5	1713.8	4.70
Mounds View	453.1	65.6	518.7	1.42	502.4	65.6	568	1.56	526.7	83.8	610.5	1.67
New Brighton	910.8	93.3	1004.1	2.75	923.9	93.3	1017.2	2.79	930.3	98.4	1028.7	2.82
North St. Paul	405.5	164.1	569.6	1.56	430.7	155.5	586.2	1.61	443.2	174	617.2	1.69
Roseville	1193.8	856	2049.8	5.62	1205.6	888.9	2094.5	5.74	1211.4	922	2133.4	5.84
St. Paul	6226.6	17970.8	24197.4	66.29	6226.6	16662.5	22889.1	62.71	6226.6	15268.5	21495.1	58.89
Shoreview	587.7	71.1	658.8	1.80	710.7	82.3	793	2.17	771.5	105.2	876.7	2.40
Vadnais Heights	338.2	210.7	548.9	1.50	418.8	183.9	602.7	1.65	499.9	164.9	664.8	1.82
White Bear Lake	668.5	151.2	819.7	2.25	,718	153.6	871.6	2.39	742.4	158.5	900.9	2.47

White Bear Township	254.2	15.9	270.1	0.74	324.6	20.3	344.9	0.94	359.4	24.8	384.2	1.05
Belle Plaine	102.5	66.8	169.3	0.46	116.2	72.9	189.1	0.52	133.3	79.1	212.4	0.58
Elko	3.2	0.1	3.3	0.01	3.2	0.1	3.3	0.01	3.2	0.1	3.3	0.01
Jordan	118.4	14.1	132.5	0.36	128.1	17.2	145.3	0.40	139.8	20.4	160.2	0.44
New Market	6.3	0.3	6.6	0.02	7.2	0.3	7.5	0.02	7.3	0.3	7.6	0.02
Prior Lake	297.3	18.3	315.6	0.86	395.7	20.3	416	1.14	444.5	23.3	467.8	1.28
Savage	163.4	70.8	234.2	0.64	285	124.2	409.2	1.12	345.5	157.3	502.8	1.38
Shakopee	359	1191	1550	4.25	440.3	1522.4	1962.7	5.38	480.5	1945.9	2426.4	6.65
Bayport	64	401.2	465.2	1.27	64	401.2	465.2	1.27	64	422.3	486.3	1.33
Cottage Grove	888.3	3049.7	3938	10.79	964	3424.5	4388.5	12.02	1001.4	3803	4804.4	13.16
Forest Lake	220.4	25.6	246	0.67	271.2	25.6	296.8	0.81	296.4	27.7	324.1	0.89
Hugo	23.5	3.1	26.6	0.07	24	4	28	0.08	24.5	4.9	29.4	0.08
Lake Elmo	16.1	20.7	36.8	0.10	16.1	19.9	36	0.10	16.1	21.7	37.8	0.10
Landfall	27.3	3.5	30.8	0.08	27.8	3.5	31.3	0.09	28.1	3.5	31.6	0.09
Mahtomedi	124.7	35.19	159.89	0.44	162.9	35.19	198.09	0.54	181.8	38.17	219.97	0.60
Newport	91.7	44.94	136.64	0.37	99.1	50.46	149.56	0.41	102.7	56.03	158.73	0.43
Oak Park Heights	115.7	23.59	139.29	0.38	141.1	28.83	169.93	0.47	153.6	32.02	185.62	0.51
Oakdale	752.1	86.76	838.86	2.30	819.6	128.45	948.05	2.60	852.9	185.98	1038.88	2.85
St. Paul Park	139.8	833.94	973.74	2.67	142.8	833.94	976.74	2.68	144.2	926.12	1070.32	2.93
Stillwater	547.9	150.58	698.48	1.91	654.57	161.65	816.22	2.24	707.3	184.01	891.31	2.44
Woodbury	861.3	217.18	1078.48	2.95	1083.43	329.7	1413.13	3.87	1193.4	465.54	1658.94	4.55
Total	71424.49	64470.67	135895.16	372	79486.04	65986.43	145472.47	399	83909.01	67407.51	151316.52	415

APPENDIX I

SELF-SUPPLIED WATER USES

ALL SELF SUPPLIED WATER USES EXCEPT FOR COMMERCIAL/INDUSTRIAL USES

City	Private Works (mgy)	Irrigation (mgy)	Power Generation (mgy)	Sewage Treatment	Water Level Main. (mgy)	Misc. Uses (mgy)	Total (mgy)	Total (mgd)
Andover		17.1			4.0		21.1	0.058
Anoka	2.0	37.0					39	0.107
Blaine	61.1	24.2		1.0	1.0		87.3	0.239
Centerville		0.0					0	0.000
Circle Pines		0.4					0.4	0.001
Columbia Heights		0.1		71.1	1.0		72.2	0.198
Coon Rapids		54.7		2.0	1.0		57.7	0.158
Fridley	26.8	10.4					37.2	0.102
Hilltop							0	0.000
Lexington							0	0.000
Lino Lakes	7.7	33.2			1.0	1.0	42.9	0.118
Ramsey	9.6	70.7					80.3	0.220
St. Francis		21.0					21	0.058
Spring Lake Park							0	0.000
Carver		0.0					0	0.000
Chanhassen		2.3					2.3	0.006
Chaska	9.1	24.8					33.9	0.093
Cologne							0	0.000
Hamburg							0	0.000
Mayer							0	0.000
New Germany							0	0.000
Norwood							0	0.000
Victoria		0.3					0.3	0.001
Waconia		2.1					2.1	0.006
Watertown		9.2					9.2	0.025
Young America							0	0.000
Apple Valley		43.6		15.6			59.2	0.162
Burnsville	1.9	3.7	54551.5				54557	149.472
Eagan		16.2			16.0		32.2	0.088
Empire		114.8		3.3			118.1	0.324
Farmington		76.6					76.6	0.210
Hampton		52.7					52.7	0.144
Hastings	33.9	86.6					120.5	0.330
Inver Grove Hts	34.9			0.2	1.0		36.1	0.099
Lakeville		25.7		2.0			27.7	0.076
Mendota Heights		30.9					30.9	0.085
New Trier		21.7					21.7	0.059
Randolph		43.7					43.7	0.120
Rosemount		177.8		66.1			243.9	0.668
South St. Paul							0	0.000
Vermillion		8.4					8.4	0.023
West St. Paul		27.3					27.3	0.075
Bloomington	2.3	53.8		1.0	350.6	17.9	425.6	1.166
Brooklyn Center				9.0	1.5		10.5	0.029
Brooklyn Park		85.8		1.0			86.8	0.238
Champlin		10.0			2.0		12	0.033
Crystal				1.0	0.9		1.9	0.005
Eden Prairie		70.3					70.3	0.193
Edina		74.8			17.5		92.3	0.253
Excelsior		8.8					8.8	0.024
Golden Valley	2.0	39.0			1.0		42	0.115
Hopkins		31.7		3.0			34.7	0.095
Long Lake							0	0.000
Loretto							0	0.000
Maple Grove		2.9			58.0		60.9	0.167
Maple Plain							0	0.000
Medina		39.4					39.4	0.108
Minneapolis	6.1	59.3	57678.7	281.2	292.0		58317	159.773
Minnetonka					1.8		1.8	0.005
Minnetonka Beach		7.7					7.7	0.021
Minnetrista		4.7			69.1		73.8	0.202

Mound				2.3			2.3	0.006
New Hope		12.2					12.2	0.033
Orono	4.2	32.5		1.0	9.0		46.7	0.128
Osseo							0	0.000
Plymouth	2.0	9.3			2.0		13.3	0.036
Richfield	3.9				40.0		43.9	0.120
Robbinsdale					9.4		9.4	0.026
Rockford							0	0.000
Rogers							0	0.000
St. Anthony	0.8						0.8	0.002
St. Bonifacius							0	0.000
St. Louis Park		43.5		5.0	1.0		49.5	0.136
Shorewood							0	0.000
Spring Park							0	0.000
Tonka Bay							0	0.000
Wayzata							0	0.000
Arden Hills	41.8	0.5		25.8			68.1	0.187
Falcon Heights		26.5					26.5	0.073
Lauderdale							0	0.000
Little Canada	9.6						9.6	0.026
Maplewood	1.0	176.2			56.4		233.6	0.640
Mounds View				18.3	32.1		50.4	0.138
New Brighton		1.2		7.0	5.0		13.2	0.036
North St. Paul				1.2			1.2	0.003
Roseville	4.2	8.1		1.0	7.6		20.9	0.057
St. Paul		67.9	50095.4	626.5	52.5	328.4	51171	140.194
Shoreview	8.4	0.0			618.2		626.6	1.717
Vadnais Heights	2.0						2	0.005
White Bear Lake		16.2			55.8		72	0.197
White Bear Twp.							0	0.000
Belle Plaine		19.9					19.9	0.055
Elko							0	0.000
Jordan		0.0			1.0		1	0.003
New Market							0	0.000
Prior Lake							0	0.000
Savage							0	0.000
Shakopee	0.8	22.1			2001.6		2024.5	5.547
Bayport				4.9			4.9	0.013
Cottage Grove		126.5		134.9	4609.4		4870.8	13.345
Forest Lake	3.1	28.3					31.4	0.086
Hugo		3.3				1.0	4.3	0.012
Lake Elmo	74.4	34.9		86.0	3.0		198.3	0.543
Landfall	27.0						27	0.074
Mahtomedi							0	0.000
Newport	0.0	7.9		0	0.0	0.0	7.9	0.022
Oakdale	7.4			14.4	1.0		22.8	0.062
Oak Park Heights			95696.7				95697	262.183
St. Paul Park				2.0			2	0.005
Stillwater		12.7		1.0			13.7	0.038
Woodbury	1.0	26.3		1408.8	1.0		1437.1	3.937
Water Used MGY	389.0	2201.4	258022.3	2797.6	8325.4	348.3	272084	
Water Used MGD	1.1	6.0	707.0	7.7	22.8	1.0	745	

APPENDIX J

TOTAL WATER USE BY CITY FOR 1988

Total Water Use for 1988 By City

Cityname	Residential Use (mgy)	Commercial Use (mgy)	Private Works (mgy)	Irrigation (mgy)	Power Generation (mgy)	Sewage Treatment (mgy)	Water Level Main. (mgy)	Misc. Uses (mgy)	Total (mgy)	Total (mgd)
Andover	166.33	12.52		17.1			4.0		199.95	0.548
Anoka	711.75	364.15	2.0	37.0					1114.9	3.055
Blaine	1222.75	607.05	61.1	24.2		1.0	1.0		1917.1	5.252
Centerville	12.41	0		0.0					12.41	0.034
Circle Pines	173.37	9.12		0.4					182.89	0.501
Columbia Heights	567.21	122.14		0.1		71.1	1.0		761.55	2.086
Coon Rapids	1216.18	214.62		54.7		2.0	1.0		1488.5	4.078
Fridley	1186.00	1190.5	26.8	10.4					2413.7	6.613
Hilltop	27.38	9.13							36.51	0.100
Lexington	61.96	1.92							63.88	0.175
Lino Lakes	12.29	32.22	7.7	33.2			1.0	1.0	87.41	0.239
Ramsey	17.61	11.44	9.6	70.7					109.35	0.300
St. Francis	46.32	8.43		21.0					75.75	0.208
Spring Lake Park	320.83	44.16							364.99	1.000
Carver	11.50	1.28		0.0					12.78	0.035
Chanhassen	354.78	83.22		2.3					440.3	1.206
Chaska	858.92	389.26	9.1	24.8					1282.08	3.513
Cologne	24.64	2.74							27.38	0.075
Hamburg	13.87	0.73							14.6	0.040
Mayer	9.03	4.21							13.24	0.036
New Germany	6.68	4.27							10.95	0.030
Norwood	57.49	48.46							105.95	0.290
Victoria	18.07	0.18		0.3					18.55	0.051
Waconia	171.18	84.31		2.1					257.59	0.706
Watertown	91.25	3		9.2					103.45	0.283
Young America	35.01	4.8							39.81	0.109
Apple Valley	1679.00	299.4		43.6		15.6			2037.6	5.582
Burnsville	1465.47	1726.73	1.9	3.7	54551.5				57749.3	158.217
Eagan	2159.70	399.8		16.2			16.0		2591.7	7.101
Empire	20.07	0		114.8		3.3			138.17	0.379
Farmington	256.96	180.24		76.6					513.8	1.408
Hampton	13.14	8.76		52.7					74.6	0.204
Hastings	742.41	110.76	33.9	86.6					973.67	2.668
Inver Grove Heights	487.27	81.22	34.9			0.2	1.0		604.59	1.656
Lakeville	613.20	133		25.7		2.0			773.9	2.120
Mendota Heights	378.14	170.16		30.9					579.2	1.587
New Trier	7.56	0.84		21.7					30.1	0.082
Randolph	9.13	0		43.7					52.83	0.145
Rosemount	184.19	1716.97		177.8		66.1			2145.06	5.877
South St. Paul	766.50	263.6							1030.1	2.822
Vermillion	13.59	0.28		8.4					22.27	0.061

West St. Paul	708.17	383.93		27.3					1119.4	3.067
Bloomington	3069.10	1861.83	2.3	53.8		1.0	350.6	17.9	5356.53	14.675
Brooklyn Center	1149.75	499.45				9.0	1.5		1659.7	4.547
Brooklyn Park	1971.00	223.9		85.8		1.0			2281.7	6.251
Champlin	520.12	27.37		10.0			2.0		559.49	1.533
Crystal	1551.25	273.75				1.0	0.9		1826.9	5.005
Eden Prairie	806.65	537.65		70.3					1414.6	3.876
Edina	2025.75	1301.95		74.8			17.5		3420	9.370
Excelsior	96.63	62.18		8.8					167.61	0.459
Golden Valley	1039.88	1209.51	2.0	39.0			1.0		2291.39	6.278
Hopkins	498.22	398.67		31.7		3.0			931.59	2.552
Long Lake	52.01	52.01							104.02	0.285
Loretto	13.96	2.4							16.36	0.045
Maple Grove	1379.70	242.4		2.9			58.0		1683	4.611
Maple Plain	61.70	33.2							94.9	0.260
Medina	75.70	16		39.4					131.1	0.359
Minneapolis	10900.70	14435.4	6.1	59.3	57678.7	281.2	292.0		83653.4	229.187
Minnetonka	1366.60	911					1.8		2279.4	6.245
Minnetonka Beach	16.40	5.5		7.7					29.6	0.081
Minnetrista	14.80	0		4.7			69.1		88.6	0.243
Mound	213.50	23.7				2.3			239.5	0.656
New Hope	1998.40	680.4		12.2					2691	7.373
Orono	86.00	6.5	4.2	32.5		1.0	9.0		139.2	0.381
Osseo	115.80	38.6							154.4	0.423
Plymouth	1861.50	1066	2.0	9.3			2.0		2940.8	8.057
Richfield	1578.30	113.8	3.9				40.0		1736	4.756
Robbinsdale	523.60	27.6					9.4		560.6	1.536
Rockford	75.90	19							94.9	0.260
Rogers	12.80	23.7							36.5	0.100
St. Anthony	266.60	89	0.8						356.4	0.976
St. Bonifacius	39.90	3.9							43.8	0.120
St. Louis Park	1251.90	1961.6		43.5		5.0	1.0		3263	8.940
Shorewood	18.60	6.5							25.1	0.069
Spring Park	55.60	26.9							82.5	0.226
Tonka Bay	68.60	4.4							73	0.200
Wayzata	283.70	28.1							311.8	0.854
Arden Hills	251.10	153.6	41.8	0.5		25.8			472.8	1.295
Falcon Heights	242.70	89.4		26.5					358.6	0.982
Lauderdale	64.20	16.1							80.3	0.220
Little Canada	219.00	73	9.6						301.6	0.826
Maplewood	739.10	759.8	1.0	176.2			56.4		1732.5	4.747
Mounds View	465.00	46				18.3	32.1		561.4	1.538
New Brighton	885.10	72.7		1.2		7.0	5.0		971	2.660
North St. Paul	410.60	154.1				1.2			565.9	1.550
Roseville	1186.20	700.8	4.2	8.1		1.0	7.6		1907.9	5.227
St. Paul	6533.50	17838.5		67.9	50095.4	626.5	52.5	328.4	75542.7	206.966
Shoreview	558.40	59.6	8.4	0.0			618.2		1244.6	3.410
Vadnais Heights	319.70	239	2.0						560.7	1.536
White Bear Lake	700.80	179.2		16.2			55.8		952	2.608

White Bear Township	232.60	18.9							251.5	0.689
Belle Plaine	102.20	44.8		19.9					166.9	0.457
Elko	3.20	0.1							3.3	0.009
Jordan	104.90	11.9		0.0			1.0		117.8	0.323
New Market	5.50	0.3							5.8	0.016
Prior Lake	271.60	20.4							292	0.800
Savage	146.00	53.4							199.4	0.546
Shakopee	369.40	1023.8	0.8	22.1			2001.6		3417.7	9.364
Bayport	71.20	520.8				4.9			596.9	1.635
Cottage Grove	763.90	2713.8		126.5		134.9	4609.4		8348.5	22.873
Forest Lake	221.60	31	3.1	28.3					284	0.778
Hugo	23.30	4.1		3.3				1.0	31.7	0.087
Lake Elmo	16.10	13.6	74.4	34.9		86.0	3.0		228	0.625
Landfall	25.40	3	27.0						55.4	0.152
Mahtomedi	124.70	15.4							140.1	0.384
Newport	80.70	43.4	0.0	7.9		0	0.0	0.0	132	0.362
Oak Park Heights	105.50	25.3	7.4		95696.7	14.4	1.0		95850.3	262.604
Oakdale	678.90	51.1							730	2.000
St. Paul Park	136.90	940				2.0			1078.9	2.956
Stillwater	578.20	155.8		12.7		1.0			747.7	2.048
Woodbury	757.38	156.1	1.0	26.3		1408.8	1.0		2350.58	6.440
Water Used	69354.51	61172.22	389.0	2201.4	258022.3	2797.6	8325.4	348.3	402611	1103.0

APPENDIX K

TOTAL WATER USE BY CITY FOR 1990

TOTAL WATER USE FOR 1990 BY CITY

Cityname	Residential Use (mgy)	Commercial Use (mgy)	Private Works (mgy)	Irrigation (mgy)	Power Generation (mgy)	Sewage Treatment (mgy)	Water Level Main. (mgy)	Misc. Uses (mgy)	Total (mgy)	Total (mgd)
Andover	173.17	7.8		17.1			4.0		202.07	0.554
Anoka	702.46	363.9	2.0	37.0					1105.36	3.028
Blaine	1247.66	756.94	61.1	24.2		1.0	1.0		2091.9	5.731
Centerville	14.89	0		0.0					14.89	0.041
Circle Pines	179.05	9.28		0.4					188.73	0.517
Columbia Heights	580.32	146.59		0.1		71.1	1.0		799.11	2.189
Coon Rapids	1261.04	269.59		54.7		2.0	1.0		1588.33	4.352
Fridley	1251.18	1628.88	26.8	10.4					2917.26	7.992
Hilltop	28.42	10.33							38.75	0.106
Lexington	61.53	1.95							63.48	0.174
Lino Lakes	13.96	40.18	7.7	33.2			1.0	1.0	97.04	0.266
Ramsey	24.91	7.13	9.6	70.7					112.34	0.308
St. Francis	49.99	11.54		21.0					82.53	0.226
Spring Lake Park	331.36	69.18							400.54	1.097
Carver	11.62	0.61		0.0					12.23	0.034
Chanhassen	446.45	114.67		2.3					563.42	1.544
Chaska	1018.57	450.08	9.1	24.8					1502.55	4.117
Cologne	25.61	1.75							27.36	0.075
Hamburg	14.16	0.88							15.04	0.041
Mayer	8.32	10.94							19.26	0.053
New Germany	6.77	5.17							11.94	0.033
Norwood	55.96	50.5							106.46	0.292
Victoria	19.14	0.37		0.3					19.81	0.054
Waconia	154.61	80.18		2.1					236.89	0.649
Watertown	95.97	3.05		9.2					108.22	0.296
Young America	34.08	3.2							37.28	0.102
Apple Valley	1777.59	295.4		43.6		15.6			2132.19	5.842
Burnsville	1538.19	1765.6	1.9	3.7	54551.5				57860.9	158.523
Eagan	2433.93	474.6		16.2			16.0		2940.73	8.057
Empire	19.41	0		114.8		3.3			137.51	0.377
Farmington	265.3	246.5		76.6					588.4	1.612
Hampton	13.34	11.7		52.7					77.74	0.213
Hastings	748.06	126.3	33.9	86.6					994.86	2.726
Inver Grove Heights	487.27	123.5	34.9			0.2	1.0		646.87	1.772
Lakeville	687.44	158.6		25.7		2.0			873.74	2.394
Mendota Heights	432.99	198.9		30.9					662.79	1.816
New Trier	7.62	0.7		21.7					30.02	0.082
Randolph	11.77	0		43.7					55.47	0.152
Rosemount	224.5	1916		177.8		66.1			2384.4	6.533
South St. Paul	752.51	309.7							1062.21	2.910
Vermillion	14.11	0.5		8.4					23.01	0.063
West St. Paul	704.6	388.5		27.3					1120.4	3.070

Bloomington	3150.86	1944.9	2.3	53.8		1.0	350.6	17.9	5521.36	15.127
Brooklyn Center	1173.1	563.6				9.0	1.5		1747.2	4.787
Brooklyn Park	2047.08	231.5		85.8		1.0			2365.38	6.480
Champlin	614.54	25		10.0			2.0		651.54	1.785
Crystal	1461.49	288.8				1.0	0.9		1752.19	4.801
Eden Prairie	912.5	507.5		70.3					1490.3	4.083
Edina	2007.87	1375.5		74.8			17.5		3475.67	9.522
Excelsior	96.48	79.9		8.8					185.18	0.507
Golden Valley	1094.29	1396.5	2.0	39.0			1.0		2532.79	6.939
Hopkins	517.24	528.3		31.7		3.0			1080.24	2.960
Long Lake	52.34	64.2							116.54	0.319
Loretto	14.17	1.8							15.97	0.044
Maple Grove	1589.1	220.5		2.9			58.0		1870.5	5.125
Maple Plain	73.9	45.3							119.2	0.327
Medina	85.1	12.3		39.4					136.8	0.375
Minneapolis	10875.5	15071.1	6.1	59.3	57678.7	281.2	292.0		84263.9	230.860
Minnetonka	1478	934.4					1.8		2414.2	6.614
Minnetonka Beach	16.8	10		7.7					34.5	0.095
Minnetrista	14.9	0		4.7			69.1		88.7	0.243
Mound	217.7	27.6				2.3			247.6	0.678
New Hope	2039.3	687		12.2					2738.5	7.503
Orono	87.8	6.9	4.2	32.5		1.0	9.0		141.4	0.387
Osseo	119.9	43.6							163.5	0.448
Plymouth	2063.3	942.1	2.0	9.3			2.0		3018.7	8.270
Richfield	1633.1	142.2	3.9				40.0		1819.2	4.984
Robbinsdale	527.7	26					9.4		563.1	1.543
Rockford	78.5	10.2							88.7	0.243
Rogers	13.1	14.1							27.2	0.075
St. Anthony	241.9	143.5	0.8						386.2	1.058
St. Bonifacius	40.4	4.7							45.1	0.124
St. Louis Park	1210.7	2040.1		43.5		5.0	1.0		3300.3	9.042
Shorewood	19.7	8.9							28.6	0.078
Spring Park	56.2	62.9							119.1	0.326
Tonka Bay	76.8	4.8							81.6	0.224
Wayzata	267.1	30.2							297.3	0.815
Arden Hills	242.2	133.5	41.8	0.5		25.8			443.8	1.216
Falcon Heights	243.4	87.1		26.5					357	0.978
Lauderdale	68.3	21.5							89.8	0.246
Little Canada	240.3	73.9	9.6						323.8	0.887
Maplewood	770.7	741.5	1.0	176.2			56.4		1745.8	4.783
Mounds View	453.1	65.6				18.3	32.1		569.1	1.559
New Brighton	910.8	93.3		1.2		7.0	5.0		1017.3	2.787
North St. Paul	405.5	164.1				1.2			570.8	1.564
Roseville	1193.8	856	4.2	8.1		1.0	7.6		2070.7	5.673
St. Paul	6226.6	17970.8		67.9	50095.4	626.5	52.5	328.4	75368.1	206.488
Shoreview	587.7	71.1	8.4	0.0			618.2		1285.4	3.522
Vadnais Heights	338.2	210.7	2.0						550.9	1.509
White Bear Lake	668.5	151.2		16.2			55.8		891.7	2.443
White Bear Township	254.2	15.9							270.1	0.740

Belle Plaine	102.5	66.8		19.9					189.2	0.518
Elko	3.2	0.1							3.3	0.009
Jordan	118.4	14.1		0.0			1.0		133.5	0.366
New Market	6.3	0.3							6.6	0.018
Prior Lake	297.3	18.3							315.6	0.865
Savage	163.4	70.8							234.2	0.642
Shakopee	359	1191	0.8	22.1			2001.6		3574.5	9.793
Bayport	64	401.2				4.9			470.1	1.288
Cottage Grove	888.3	3049.7		126.5		134.9	4609.4		8808.8	24.134
Forest Lake	220.4	25.6	3.1	28.3					277.4	0.760
Hugo	23.5	3.1		3.3				1.0	30.9	0.085
Lake Elmo	16.1	20.7	74.4	34.9		86.0	3.0		235.1	0.644
Landfall	27.3	3.5	27.0						57.8	0.158
Mahtomedi	124.7	35.19							159.89	0.438
Newport	91.7	44.94	0.0	7.9		0	0.0	0.0	144.54	0.396
Oak Park Heights	115.7	23.59	7.4		95696.7	14.4	1.0		95858.8	262.627
Oakdale	752.1	86.76							838.86	2.298
St. Paul Park	139.8	833.94				2.0			975.74	2.673
Stillwater	547.9	150.58		12.7		1.0			712.18	1.951
Woodbury	861.3	217.18	1.0	26.3		1408.8	1.0		2515.58	6.892
Water Used	71424.49	64470.67	389.0	2201.4	258022.3	2797.6	8325.4	348.3	407979	1117.8

APPENDIX L

TOTAL WATER USE BY CITY FOR 2000

TOTAL WATER USE FOR 2000 BY CITY

Cityname	Residential Use (mgy)	Commercial Use (mgy)	Private Works (mgy)	Irrigation (mgy)	Power Generation (mgy)	Sewage Treatment (mgy)	2000 Water Level Main. (mgy)	Misc. Uses (mgy)	Total (mgy)	Total (mgd)
Andover	174.43	9.97		17.1			2		203.5	0.558
Anoka	702.46	363.9	2.0	37.0			0		1105.36	3.028
Blaine	1638.04	951.16	61.1	24.2		1.0	0.5		2676	7.332
Centerville	26.59	0		0.0			0		26.59	0.073
Circle Pines	203.81	9.28		0.4			0		213.49	0.585
Columbia Heights	588.49	173.67		0.1		71.1	0.5		833.86	2.285
Coon Rapids	1621.41	333.77		54.7		2.0	0.5		2012.38	5.513
Fridley	1226.04	1896.21	26.8	10.4			0		3159.45	8.656
Hilltop	28.17	14.18					0		42.35	0.116
Lexington	59.6	1.95					0		61.55	0.169
Lino Lakes	14.88	56.52	7.7	33.2			0.5	1.0	113.8	0.312
Ramsey	28.58	11.13	9.6	70.7			0		120.01	0.329
St. Francis	64.76	15.83		21.0			0		101.59	0.278
Spring Lake Park	349.11	81.96					0		431.07	1.181
Carver	12.82	0.61		0.0			0		13.43	0.037
Chanhassen	688.97	150.45		2.3			0		841.72	2.306
Chaska	1146.91	540.88	9.1	24.8			0		1721.69	4.717
Cologne	27.24	1.75					0		28.99	0.079
Hamburg	15.33	0.88					0		16.21	0.044
Mayer	9.27	10.94					0		20.21	0.055
New Germany	7.51	5.17					0		12.68	0.035
Norwood	58.14	50.5					0		108.64	0.298
Victoria	22.91	0.37		0.3			0		23.58	0.065
Waconia	206.6	92.28		2.1			0		300.98	0.825
Watertown	104.58	3.61		9.2			0		117.39	0.322
Young America	35.41	3.64					0		39.05	0.107
Apple Valley	2338.91	427.7		43.6		15.6	0		2825.81	7.742
Burnsville	1695.76	2302	1.9	3.7	54551.5		0		58554.86	160.424
Eagan	3481.47	659.4		16.2			8		4165.07	11.411
Empire	23.89	0		114.8		3.3	0		141.99	0.389
Farmington	283.42	285.5		76.6			0		645.52	1.769
Hampton	13.75	11.7		52.7			0		78.15	0.214
Hastings	904.08	135.6	33.9	86.6			0		1160.18	3.179
Inver Grove Heights	718.83	136.7	34.9			0.2	0.5		891.13	2.441
Lakeville	1038.45	187.9		25.7		2.0	0		1254.05	3.436
Mendota Heights	496.51	237.2		30.9			0		764.61	2.095
New Trier	9.46	0.7		21.7			0		31.86	0.087
Randolph	12.9	0		43.7			0		56.6	0.155
Rosemount	444.71	2629.2		177.8		66.1	0		3317.81	9.090
South St. Paul	752.51	309.7					0		1062.21	2.910
Vermillion	15.67	0.5		8.4			0		24.57	0.067

West St. Paul	736.16	251.6		27.3			0		1015.06	2.781
Bloomington	3327.36	2222.6	2.3	53.8		1.0	175.3	17.9	5800.26	15.891
Brooklyn Center	1173.1	660.4				9.0	0.75		1843.25	5.050
Brooklyn Park	2625.55	335.3		85.8		1.0	0		3047.65	8.350
Champlin	669.37	39.1		10.0			2.5		720.97	1.975
Crystal	1461.49	288.8				1.0	0.45		1751.74	4.799
Eden Prairie	1336.42	680.6		70.3			0		2087.32	5.719
Edina	2016.97	1093.9		74.8			8.75		3194.42	8.752
Excelsior	105.03	79.9		8.8			0		193.73	0.531
Golden Valley	1154.21	1490.3	2.0	39.0			0.5		2686.01	7.359
Hopkins	507.97	485		31.7		3.0	0		1027.67	2.816
Long Lake	68.66	64.2					0		132.86	0.364
Loretto	14.17	1.8					0		15.97	0.044
Maple Grove	2052.1	369.7		2.9			29		2453.7	6.722
Maple Plain	75.2	45.3					0		120.5	0.330
Medina	171.6	12.3		39.4			0		223.3	0.612
Minneapolis	10402.5	13791.1	6.1	59.3	57678.7	281.2	146		82364.9	225.657
Minnetonka	1727	966.6					0.9		2694.5	7.382
Minnetonka Beach	16.6	10		7.7			0		34.3	0.094
Minnetrista	15	0		4.7			34.55		54.25	0.149
Mound	227.5	34.6				2.3	0		264.4	0.724
New Hope	2015.2	716.1		12.2			0		2743.5	7.516
Orono	92.5	6.9	4.2	32.5		1.0	4.5		141.6	0.388
Osseo	125.8	43.6					0		169.4	0.464
Plymouth	2860.2	1182.4	2.0	9.3			1		4054.9	11.109
Richfield	1603.5	147.7	3.9				20		1775.1	4.863
Robbinsdale	509.3	26					4.7		540	1.479
Rockford	90.5	10.2					0		100.7	0.276
Rogers	14.6	17.2					0		31.8	0.087
St. Anthony	257.4	143.5	0.8				0		401.7	1.101
St. Bonifacius	45.5	4.7					0		50.2	0.138
St. Louis Park	1305.1	1918.4		43.5		5.0	0.5		3272.5	8.966
Shorewood	19.7	8.9					0		28.6	0.078
Spring Park	56.2	62.9					0		119.1	0.326
Tonka Bay	78.4	4.8					0		83.2	0.228
Wayzata	298.7	30.2					0		328.9	0.901
Arden Hills	279.6	121.3	41.8	0.5		25.8	0		469	1.285
Falcon Heights	246.5	87.1		26.5			0		360.1	0.987
Lauderdale	65.5	21.5					0		87	0.238
Little Canada	234.9	85.6	9.6				0		330.1	0.904
Maplewood	803	809.7	1.0	176.2			28.2		1818.1	4.981
Mounds View	502.4	65.6				18.3	16.05		602.35	1.650
New Brighton	923.9	93.3		1.2		7.0	2.5		1027.9	2.816
North St. Paul	430.7	155.5				1.2	0		587.4	1.609
Roseville	1205.6	888.9	4.2	8.1		1.0	3.8		2111.6	5.785
St. Paul	6226.6	16662.5		67.9	50095.4	626.5	26.25	328.4	74033.55	202.832
Shoreview	710.7	82.3	8.4	0.0			309.1		1110.5	3.042
Vadnais Heights	418.8	183.9	2.0				0		604.7	1.657
White Bear Lake	718	153.6		16.2			27.9		915.7	2.509

White Bear Township	324.6	20.3					0		344.9	0.945
Belle Plaine	116.2	72.9		19.9			0		209	0.573
Elko	3.2	0.1					0		3.3	0.009
Jordan	128.1	17.2		0.0			0.5		145.8	0.399
New Market	7.2	0.3					0		7.5	0.021
Prior Lake	395.7	20.3					0		416	1.140
Savage	285	124.2					0		409.2	1.121
Shakopee	440.3	1522.4	0.8	22.1			1000.8		2986.4	8.182
Bayport	64	401.2				4.9	0		470.1	1.288
Cottage Grove	964	3424.5		126.5		134.9	2304.7		6954.6	19.054
Forest Lake	271.2	25.6	3.1	28.3			0		328.2	0.899
Hugo	24	4		3.3			0	1.0	32.3	0.088
Lake Elmo	16.1	19.9	74.4	34.9		86.0	1.5		232.8	0.638
Landfall	27.8	3.5	27.0				0		58.3	0.160
Mahtomedi	162.9	35.19					0		198.09	0.543
Newport	99.1	50.46	0.0	7.9		0	0	0.0	157.46	0.431
Oak Park Heights	141.1	28.83	7.4		95696.7	14.4	0.5		95888.93	262.709
Oakdale	819.6	128.45			0		0		948.05	2.597
St. Paul Park	142.8	833.94				2.0	0		978.74	2.681
Stillwater	654.57	161.65		12.7		1.0	0		829.92	2.274
Woodbury	1083.43	329.7	1.0	26.3		1408.8	0.5		2849.73	7.807
Water Used	79486.04	65986.43	389.0	2201.4	258022.3	2797.6	4164.2	348.3	413395.3	1132.6

APPENDIX M

TOTAL WATER USE BY CITY FOR 2010

TOTAL WATER USE FOR 2010 BY CITY

Cityname	Residential Use (mgy)	Commercial Use (mgy)	Private Works (mgy)	Irrigation (mgy)	Power Generation (mgy)	Sewage Treatment (mgy)	Water Level Main. (mgy)	Misc. Uses (mgy)	Total (mgy)	Total (mgd)
Andover	175.69	12.18		17.1			0.0		204.97	0.562
Anoka	702.46	379.33	2.0	37.0			0.0		1120.79	3.071
Blaine	1831.37	1215.78	61.1	24.2		1.0	0.0		3133.45	8.585
Centerville	42.89	0		0.0			0.0		42.89	0.118
Circle Pines	216.04	11.34		0.4			0.0		227.78	0.624
Columbia Heights	592.52	187.37		0.1		71.1	0.0		851.09	2.332
Coon Rapids	1799.81	421.11		54.7		2.0	0.0		2277.62	6.240
Fridley	1213.66	2031.21	26.8	10.4			0.0		3282.07	8.992
Hilltop	28.06	16.14					0.0		44.2	0.121
Lexington	58.65	2.16					0.0		60.81	0.167
Lino Lakes	15.78	77.56	7.7	33.2			0.0	1.0	135.24	0.371
Ramsey	35.96	13.19	9.6	70.7			0.0		129.45	0.355
St. Francis	79.63	20.23		21.0			0.0		120.86	0.331
Spring Lake Park	357.83	102.79					0.0		460.62	1.262
Carver	14.02	0.78		0.0			0.0		14.8	0.041
Chanhassen	809.4	218.9		2.3			0.0		1030.6	2.824
Chaska	1210.22	679.66	9.1	24.8			0.0		1923.78	5.271
Cologne	31.72	1.75					0.0		33.47	0.092
Hamburg	17.09	0.88					0.0		17.97	0.049
Mayer	10.47	10.94					0.0		21.41	0.059
New Germany	8.98	5.17					0.0		14.15	0.039
Norwood	59.23	59.83					0.0		119.06	0.326
Victoria	26.69	0.44		0.3			0.0		27.43	0.075
Waconia	232.35	108.65		2.1			0.0		343.1	0.940
Watertown	126.19	4.76		9.2			0.0		140.15	0.384
Young America	36.07	4.09					0.0		40.16	0.110
Apple Valley	2616.93	598.4		43.6		15.6	0.0		3274.53	8.971
Burnsville	1773.53	2942.4	1.9	3.7	54551.5		0.0		59273.03	162.392
Eagan	4001	904.3		16.2			0.0		4921.5	13.484
Empire	26.1	0		114.8		3.3	0.0		144.2	0.395
Farmington	301.57	348.9		76.6			0.0		727.07	1.992
Hampton	14.15	14.9		52.7			0.0		81.75	0.224
Hastings	981.22	154.4	33.9	86.6			0.0		1256.12	3.441
Inver Grove Heights	839.86	175.3	34.9			0.2	0.0		1050.26	2.877
Lakeville	1212.71	253.7		25.7		2.0	0.0		1494.11	4.093
Mendota Heights	527.88	276.2		30.9			0.0		834.98	2.288
New Trier	11.3	0.7		21.7			0.0		33.7	0.092
Randolph	14.05	0		43.7			0.0		57.75	0.158
Rosemount	554.48	3066.1		177.8		66.1	0.0		3864.48	10.588
South St. Paul	752.51	318.3					0.0		1070.81	2.934
Vermillion	16.45	0.5		8.4			0.0		25.35	0.069

West St. Paul	751.72	114.8		27.3			0.0		893.82	2.449
Bloomington	3414.37	2115.9	2.3	53.8		1.0	0.0	17.9	5605.27	15.357
Brooklyn Center	1173.1	738.4				9.0	0.0		1920.5	5.262
Brooklyn Park	2911.9	406.1		85.8		1.0	0.0		3404.8	9.328
Champlin	724.37	53.6		10.0			0.0		787.97	2.159
Crystal	1461.49	288.8				1.0	0.0		1751.29	4.798
Eden Prairie	1546.77	817.9		70.3			0.0		2434.97	6.671
Edina	2021.45	796.4		74.8			0.0		2892.65	7.925
Excelsior	109.26	79.9		8.8			0.0		197.96	0.542
Golden Valley	1183.76	1485.3	2.0	39.0			0.0		2710.06	7.425
Hopkins	503.41	419.8		31.7		3.0	0.0		957.91	2.624
Long Lake	76.74	64.2					0.0		140.94	0.386
Loretto	16.25	2.2					0.0		18.45	0.051
Maple Grove	2281.3	630.7		2.9			0.0		2914.9	7.986
Maple Plain	75.7	47.8					0.0		123.5	0.338
Medina	214.7	13.5		39.4			0.0		267.6	0.733
Minneapolis	10402.5	12465.5	6.1	59.3	57678.7	281.2	0.0		80893.3	221.625
Minnetonka	1850.1	998.9					0.0		2849	7.805
Minnetonka Beach	16.5	10		7.7			0.0		34.2	0.094
Minnetrista	15.3	0		4.7			0.0		20	0.055
Mound	232.3	37.5				2.3	0.0		272.1	0.745
New Hope	2003.4	745.3		12.2			0.0		2760.9	7.564
Orono	97.1	8.2	4.2	32.5		1.0	0.0		143	0.392
Osseo	128.7	43.6					0.0		172.3	0.472
Plymouth	3255.2	1464.1	2.0	9.3			0.0		4730.6	12.961
Richfield	1588.9	153.2	3.9				0.0		1746	4.784
Robbinsdale	509.3	30.8					0.0		540.1	1.480
Rockford	105.5	12.5					0.0		118	0.323
Rogers	17.7	20.4					0.0		38.1	0.104
St. Anthony	265.1	150.6	0.8				0.0		416.5	1.141
St. Bonifacius	48	5.8					0.0		53.8	0.147
St. Louis Park	1351.6	1796.8		43.5		5.0	0.0		3196.9	8.759
Shorewood	19.7	8.9					0.0		28.6	0.078
Spring Park	56.2	67.5					0.0		123.7	0.339
Tonka Bay	79.2	4.8					0.0		84	0.230
Wayzata	314.3	30.2					0.0		344.5	0.944
Arden Hills	298.1	133.3	41.8	0.5		25.8	0.0		499.5	1.368
Falcon Heights	248	94.9		26.5			0.0		369.4	1.012
Lauderdale	64	23.7					0.0		87.7	0.240
Little Canada	232.3	109.4	9.6				0.0		351.3	0.962
Maplewood	835.3	878.5	1.0	176.2			0.0		1891	5.181
Mounds View	526.7	83.8				18.3	0.0		628.8	1.723
New Brighton	930.3	98.4		1.2		7.0	0.0		1036.9	2.841
North St. Paul	443.2	174				1.2	0.0		618.4	1.694
Roseville	1211.4	922	4.2	8.1		1.0	0.0		2146.7	5.881
St. Paul	6226.6	15268.5		67.9	50095.4	626.5	0.0	328.4	72613.3	198.941
Shoreview	771.5	105.2	8.4	0.0			0.0		885.1	2.425
Vadnais Heights	499.9	164.9	2.0				0.0		666.8	1.827
White Bear Lake	742.4	158.5		16.2			0.0		917.1	2.513

White Bear Township	359.4	24.8					0.0		384.2	1.053
Belle Plaine	133.3	79.1		19.9			0.0		232.3	0.636
Elko	3.2	0.1					0.0		3.3	0.009
Jordan	139.8	20.4		0.0			0.0		160.2	0.439
New Market	7.3	0.3					0.0		7.6	0.021
Prior Lake	444.5	23.3					0.0		467.8	1.282
Savage	345.5	157.3					0.0		502.8	1.378
Shakopee	480.5	1945.9	0.8	22.1			0.0		2449.3	6.710
Bayport	64	422.3				4.9	0.0		491.2	1.346
Cottage Grove	1001.4	3803		126.5		134.9	0.0		5065.8	13.879
Forest Lake	296.4	27.7	3.1	28.3			0.0		355.5	0.974
Hugo	24.5	4.9		3.3			0.0	1.0	33.7	0.092
Lake Elmo	16.1	21.7	74.4	34.9		86.0	0.0		233.1	0.639
Landfall	28.1	3.5	27.0				0.0		58.6	0.161
Mahtomedi	181.8	38.17					0.0		219.97	0.603
Newport	102.7	56.03	0.0	7.9		0	0.0	0.0	166.63	0.457
Oak Park Heights	153.6	32.02	7.4		95696.7	14.4	0.0		95904.12	262.751
Oakdale	852.9	185.98					0.0		1038.88	2.846
St. Paul Park	144.2	926.12				2.0	0.0		1072.32	2.938
Stillwater	707.3	184.01		12.7		1.0	0.0		905.01	2.479
Woodbury	1193.4	465.54	1.0	26.3		1408.8	0.0		3095.04	8.480
Water Used	83909.01	67407.51	389.0	2201.4	??	2797.6	0.0	348.3	ERR	1137.2

APPENDIX N

NON-MUNICIPAL WATER USE BY CITY

Non-Municipal Water Use by City

	1988 Pop.	Water Use	1990 Pop.	Water Use	2000 Pop.	Water Use	2010 Pop.	Water Use
Bethel	292	0.030076	313	0.032239	282	0.0289945	250	0.02575
Burns Twp.	2302	0.237106	2452	0.252556	2676	0.275628	2900	0.2987
Columbus Twp.	3686	0.379658	3781	0.389443	4191	0.4316215	4600	0.4738
East Bethel	8159	0.840377	8126	0.836978	8563	0.881989	9000	0.927
Ham Lake	9439	0.972217	9149	0.942347	9575	0.9861735	10000	1.03
Linwood Twp.	3377	0.347831	3463	0.356689	3632	0.3740445	3800	0.3914
Oak Grove Twp.	4971	0.512013	5083	0.523549	5242	0.5398745	5400	0.5562
Benton Twp.	957	0.098571	959	0.098777	980	0.1008885	1000	0.103
Camden Twp.	945	0.097335	908	0.093524	929	0.095687	950	0.09785
Chaska Twp.	211	0.021733	206	0.021218	278	0.028634	350	0.03605
Dahlgren Twp.	1330	0.13699	1326	0.136578	1313	0.135239	1300	0.1339
Hancock Twp.	426	0.043878	432	0.044496	466	0.047998	500	0.0515
Hollywood Twp.	1166	0.120098	1113	0.114639	1182	0.1216945	1250	0.12875
Laketown Twp.	2432	0.250496	2326	0.239578	2663	0.274289	3000	0.309
San Francisco Twp.	737	0.075911	722	0.074366	811	0.083533	900	0.0927
Waconia Twp.	1487	0.153161	1346	0.138638	1523	0.156869	1700	0.1751
Watertown Twp.	1501	0.154603	1428	0.147084	1564	0.161092	1700	0.1751
Young Amercia Twp.	1027	0.105781	934	0.096202	967	0.099601	1000	0.103
Castle Rock Twp.	1503	0.154809	1449	0.149247	1575	0.1621735	1700	0.1751
Coates	192	0.019776	204	0.021012	252	0.025956	300	0.0309
Douglas Twp.	623	0.064169	615	0.063345	658	0.0677225	700	0.0721
Eureka Twp.	1375	0.141625	1327	0.136681	1564	0.1610405	1800	0.1854
Greenvale Twp.	675	0.069525	642	0.066126	721	0.074263	800	0.0824
Hampton Twp.	964	0.099292	908	0.093524	1154	0.118862	1400	0.1442
Lilydale	575	0.059225	668	0.068804	584	0.060152	500	0.0515
Marshan Twp.	1595	0.164285	1115	0.114845	1758	0.1810225	2400	0.2472
Mendota	219	0.022557	194	0.019982	222	0.022866	250	0.02575
Miesville	179	0.018437	178	0.018334	179	0.018437	180	0.01854
Nininger Twp.	851	0.087653	802	0.082606	951	0.097953	1100	0.1133
Randolph Twp.	425	0.043775	418	0.043054	509	0.052427	600	0.0618
Ravenna Twp.	1936	0.199408	1932	0.198996	2066	0.212798	2200	0.2266
Sciota Twp.	276	0.028428	244	0.025132	287	0.029561	330	0.03399
Sunfish Lake	379	0.039037	398	0.040994	414	0.042642	430	0.04429
Vermillion Twp.	1229	0.126587	1184	0.121952	1342	0.138226	1500	0.1545
Waterford Twp.	502	0.051706	478	0.049234	489	0.050367	500	0.0515
Corcoran	4953	0.510159	5212	0.536836	5856	0.603168	6500	0.6695
Dayton	4294	0.442282	4139	0.426317	4870	0.5015585	5600	0.5768
Deephaven	3741	0.385323	3779	0.389237	3640	0.3748685	3500	0.3605
Fort Snelling	216	0.022248	215	0.022145	208	0.0213725	200	0.0206
Greenfield	1545	0.159135	1525	0.157075	1638	0.1686625	1750	0.18025
Greenwood	656	0.067568	664	0.068392	682	0.070246	700	0.0721
Hanover	266	0.027398	314	0.032342	357	0.036771	400	0.0412
Hassan Twp.	1981	0.204043	2085	0.214755	2293	0.2361275	2500	0.2575

Independence	2771	0.285413	2758	0.284074	2829	0.291387	2900	0.2987
Medicine Lake	398	0.040994	383	0.039449	392	0.0403245	400	0.0412
Woodland	496	0.051088	477	0.049131	499	0.0513455	520	0.05356
Gem Lake	410	0.04223	397	0.040891	449	0.0461955	500	0.0515
North Oaks	3205	0.330115	3336	0.343608	3518	0.362354	3700	0.3811
Belle Plaine Twp.	790	0.08137	726	0.074778	863	0.088889	1000	0.103
Blakely Twp.	508	0.052324	486	0.050058	543	0.055929	600	0.0618
Cedar Lake Twp.	1709	0.176027	1799	0.185297	1900	0.1956485	2000	0.206
Credit River Twp.	2897	0.298391	2936	0.302408	3318	0.341754	3700	0.3811
Helena Twp.	1263	0.130089	1256	0.129368	1353	0.139359	1450	0.14935
Jackson Twp.	1490	0.15347	1338	0.137814	1594	0.164182	1850	0.19055
Louisville Twp.	890	0.09167	882	0.090846	966	0.099498	1050	0.10815
New Market Twp.	1993	0.205279	2160	0.22248	2130	0.21939	2100	0.2163
Sand Creek Twp.	1585	0.163255	1580	0.16274	1740	0.17922	1900	0.1957
Spring Lake Twp.	2905	0.299215	2979	0.306837	3090	0.3182185	3200	0.3296
St. Lawrence Twp.	416	0.042848	390	0.04017	495	0.050985	600	0.0618
Afton	2675	0.275525	2623	0.270169	2712	0.2792845	2800	0.2884
Baytown Twp.	913	0.094039	911	0.093833	1106	0.1138665	1300	0.1339
Dellwood	815	0.083945	896	0.092288	923	0.095069	950	0.09785
Denmark Twp.	1288	0.132664	1221	0.125763	1461	0.1504315	1700	0.1751
Forest Lake Twp.	6160	0.63448	6559	0.675577	6680	0.6879885	6800	0.7004
Grant Twp.	3680	0.37904	4014	0.413442	4007	0.412721	4000	0.412
Grey Cloud Twp.	339	0.034917	335	0.034505	368	0.0378525	400	0.0412
Lake St. Croix Beach	1179	0.121437	1153	0.118759	1227	0.1263295	1300	0.1339
Lakeland	2109	0.217227	2011	0.207133	2256	0.2323165	2500	0.2575
Lakeland Shores	188	0.019364	218	0.022454	234	0.024102	250	0.02575
Marine on St. Croix	552	0.056856	539	0.055517	545	0.0560835	550	0.05665
May Twp.	2430	0.25029	2470	0.25441	2635	0.271405	2800	0.2884
New Scandia Twp.	3186	0.328158	3188	0.328364	3444	0.354732	3700	0.3811
Pine Springs	470	0.04841	456	0.046968	528	0.054384	600	0.0618
St. Mary's Point	351	0.036153	359	0.036977	430	0.0442385	500	0.0515
Stillwater Twp.	2015	0.207545	2182	0.224746	2391	0.246273	2600	0.2678
West Lakeland Twp.	1593	0.164079	1779	0.183237	1640	0.1688685	1500	0.1545
Total Use (mgy)		4860		4871		5239		5608
Total Use (mgd)		13.3		13.3		14.3		15.4

*Willernie and Birchwood
are sericed by White Bear Lake