

Appendix K
Final Draft Technical Memorandum: Summary of
Water Requirements

May 28, 2009

To: Nancy Quirk, Waukesha Water Utility

Copy: Richard Hope, AECOM

From: Kathy Beduhn, AECOM

Subject: **Summary of Water Requirements
Waukesha, Wisconsin**

As part of the 2006 Water System Master Plan project, historical water customer demands and pumpage records were reviewed and future water requirements were projected. This technical memorandum summarizes updated water pumpage projections considering 2006, 2007, and 2008 water pumpage and sales information and updated population projections for the City of Waukesha.

POPULATION PROJECTIONS

The Wisconsin Department of Administration estimated the 2008 population of the City of Waukesha to be 68,030.

The following table summarizes the population projections developed by the Southeastern Wisconsin Regional Planning Commission for the Waukesha water supply service area that were used to update water pumpage projections.

SUMMARY OF POPULATION PROJECTIONS

Year	Population
2028	85,800
2035	88,500
Ultimate	97,400

Source: Letter from Southeastern Wisconsin Regional Planning Commission dated March 17, 2009 (included in Attachment A).

WATER CONSUMPTION

The following sections summarize historical water consumption including water metered and sold to customers, total water pumpage, per capita water usage, and system maximum day demand.

Metered Water Sales and Water Pumpage

A summary of historical water sales and pumpage is provided in Table 1. Water sales and total pumpage have decreased slightly in the past 5 years. Over the 39-year period of data summarized in the table, water sales varied from a low of 2,366 million gallons per year (MGY) in 2008 to a high of 3,462 MGY in 1988. Total pumpage over the 39-year period has varied from a low of 2,366 MGY in 2008 to 3,607 MGY in 1988.

Per Capita Water Usage

City of Waukesha residential, commercial, and public water usage can be related to the City's population. An analysis of per capital water consumption for each of these customer classifications was performed from sales records and is summarized in Table 2. As indicated in this table, overall per capita sales to residential, commercial, and public customers have all remained fairly constant or declined slightly since the early 1990s. Figure 1 illustrates the City of Waukesha per capital consumption trends since 1970.

To project future water needs, the average daily water usage projection for customers was updated to reflect recent trends in water consumption. The per capital water consumption rate is summarized in the following table.

PER CAPITA WATER CONSUMPTION RATE			
Per Capita Sales	Residential	Commercial	Public
Average 1970 to 2008	53 gpcd	32 gpcd	8 gpcd
Maximum 1970 to 2008	72 gpcd	39 gpcd	13 gpcd
Minimum 1970 to 2008	43 gpcd	19 gpcd	4 gpcd
Average 2000 to 2008	46 gpcd	36 gpcd	5 gpcd
Average 2005 to 2008	45 gpcd	34 gpcd	4 gpcd
Used for Projection	45 gpcd	35 gpcd	5 gpcd

Note: gpcd = gallons per capita per day

System Maximum Day Pumpage

Table 3 summarizes the average and maximum day pumpage for each year from 1970 to 2008. A statistical analysis was performed of historical maximum day pumpage ratios. Two periods of analysis were examined, the entire period of 1970 to 2008, and the latest 11-year period from 1998 to 2008. Table 4 summarizes the results of this analysis.

Table 4 also includes an analysis of expected maximum day pumpage ratios for various confidence levels. To evaluate future water supply needs, a maximum day pumpage ratio of 168 percent was used which provides a confidence level of 98 percent based on maximum day pumpage ratios over the last 39 years and an approximately 96 percent confidence level over the last 11 years.

WATER CONSUMPTION AND PUMPAGE PROJECTIONS

Water sales and pumpage projections were based on assumptions of water demand, coupled with estimates of future populations. A detailed summary of the individual components of the projected water sales and pumpage requirements is provided in Table 5. The industrial sales projections are based on planning data provided during the Water System Master Plan project that included an ultimate industrial acreage slightly less than the existing acreage and some large customer surveys indicating a decline in current water usage. In addition, unaccounted-for water (difference between pumpage and sales) was estimated to be 7 percent.

Figure 2 and Figure 3 illustrate the projected average and maximum day water supply requirements, respectively. The supply projections for the ultimate population projection for the City of Waukesha are illustrated as year 2050. The lower band illustrated on Figures 2 and 3 represents the projected water supply requirements based on current knowledge of water usage and population trends; however, there are uncertainties inherent to these projections. Because of the importance of not underestimating the future water supply needs, upper bands for projected water supply requirements were established. The upper bands for water supply projections illustrated in Figure 2 (average day) and Figure 3 (maximum day) are based on the following:

1. Residential per capita demand increased from 45 gpcd to 50 gpcd.
2. Commercial per capita demand increased from 35 gpcd to 39 gpcd.
3. Public per capita demand increased from 5 gpcd to 6 gpcd.
4. Increased population projection for 2028 by 10 percent to 94,380.
5. Increased population projection for 2035 by 10 percent to 97,350.
6. Increased ultimate population projection by 10 percent to 107,140.
7. Population projection was assumed to remain as projected to 2015 and then estimated linearly to the 2028 increased population projection.

It is recommended for long-term planning purpose that the upper band for average and maximum day water supply be used. It is also recommended that water supply be continually updated to ensure a proactive response to changes in population growth, development, and water demand patterns are addressed

SUMMARY

The following table summarizes the upper band of water supply needs for the City of Waukesha which is recommended to be used for planning purposes.

SUMMARY OF WATER SUPPLY NEEDS		
Year	Average Day Demand	Maximum Day Demand
2015	8.8 MGD	14.8 MGD
2028	10.7 MGD	18.0 MGD
2035	11.0 MGD	18.5 MGD
Ultimate (2050)	12.0 MGD	20.2 MGD
Note: MGD= million gallons per day		

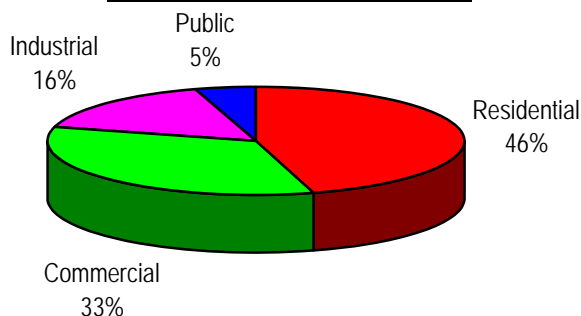
TABLES

TABLE 1
WATER SALES AND PUMPAGE HISTORY
WAUKESHA, WISCONSIN

Year	Annual Water Sales (MGY)					Total Sales (MGY)	Total Pumpage (MGY)	Percent Pumpage Metered
	Residential	Commercial	Industrial	Public	Other			
1970	822.892	276.190	1,535.995	169.083	11.906	2,816.1	3,006.8	93.7%
1971	890.447	280.171	1,447.088	167.631	19.188	2,804.5	3,012.4	93.1%
1972	881.497	287.192	1,565.355	172.490	31.935	2,938.5	3,072.7	95.6%
1973	975.877	323.378	1,465.842	192.700	15.252	2,973.0	3,128.1	95.0%
1974	1,025.621	328.510	1,537.468	206.624	13.291	3,111.5	3,242.7	96.0%
1975	1,052.895	330.920	1,594.955	187.992	21.310	3,188.1	3,336.3	95.6%
1976	1,216.208	312.331	1,539.435	192.299	43.691	3,304.0	3,337.7	99.0%
1977	1,221.868	318.338	1,528.131	186.411	25.995	3,280.7	3,297.2	99.5%
1978	1,210.372	331.961	1,575.439	192.370	25.298	3,335.4	3,376.2	98.8%
1979	1,010.523	611.688	1,610.236	182.680	35.070	3,450.2	3,526.8	97.8%
1980	1,006.519	610.472	1,514.522	178.821	21.278	3,331.6	3,372.4	98.8%
1981	988.866	605.862	1,381.485	181.293	28.538	3,186.0	3,137.9	101.5%
1982	955.905	582.575	1,167.949	173.322	31.914	2,911.7	2,983.5	97.6%
1983	1,013.178	624.780	1,125.678	190.081	21.608	2,975.3	3,025.1	98.4%
1984	992.981	624.760	1,265.934	167.928	9.780	3,061.4	3,222.1	95.0%
1985	1,046.448	636.325	1,329.419	182.512	17.915	3,212.6	3,317.3	96.8%
1986	979.119	646.851	1,266.090	171.550	16.013	3,079.6	3,172.0	97.1%
1987	1,016.124	665.474	1,283.305	186.079	17.982	3,169.0	3,348.3	94.6%
1988	1,184.474	724.986	1,346.657	189.440	16.381	3,461.9	3,606.7	96.0%
1989	1,085.159	745.900	1,166.538	169.859	16.908	3,184.4	3,239.0	98.3%
1990	1,034.574	724.123	1,030.874	160.143	1.042	2,950.8	3,076.6	95.9%
1991	1,104.334	756.742	965.288	178.332	35.004	3,039.7	3,054.8	99.5%
1992	1,060.875	794.856	745.217	101.682	0.000	2,702.6	2,873.2	94.1%
1993	1,016.286	815.077	810.622	94.230	0.000	2,736.2	2,882.5	94.9%
1994	1,076.528	846.078	769.630	104.456	0.000	2,796.7	2,974.1	94.0%
1995	1,077.515	856.522	765.975	119.209	0.000	2,819.2	3,011.5	93.6%
1996	1,087.119	860.396	763.133	120.014	0.000	2,830.7	2,892.3	97.9%
1997	1,089.493	821.105	783.390	117.377	0.000	2,811.4	2,945.3	95.5%
1998	1,109.478	837.823	796.217	116.833	0.000	2,860.4	2,974.5	96.2%
1999	1,112.499	847.914	722.097	177.408	0.000	2,859.9	3,028.4	94.4%
2000	1,067.184	848.664	660.364	108.873	0.000	2,685.1	2,816.7	95.3%
2001	1,128.475	874.030	586.552	114.492	0.000	2,703.5	2,822.0	95.8%
2002	1,185.745	914.138	612.856	119.173	0.000	2,831.9	2,953.2	95.9%
2003	1,176.115	895.850	461.885	120.071	0.000	2,653.9	2,795.9	94.9%
2004	1,117.325	854.624	435.004	121.601	0.000	2,528.6	2,699.0	93.7%
2005	1,193.851	874.418	428.518	120.126	0.000	2,616.9	2,831.5	92.4%
2006	1,077.127	858.062	424.603	109.846	0.000	2,469.6	2,620.5	94.2%
2007	1,086.542	846.566	404.079	110.532	0.000	2,447.7	2,618.7	93.5%
2008	1,056.650	827.543	382.413	99.646	0.000	2,366.3	2,531.0	93.5%

Maximum Value =

2005 Metered Water Consumption
Waukesha Water Utility



2008 Metered Water Consumption
Waukesha Water Utility

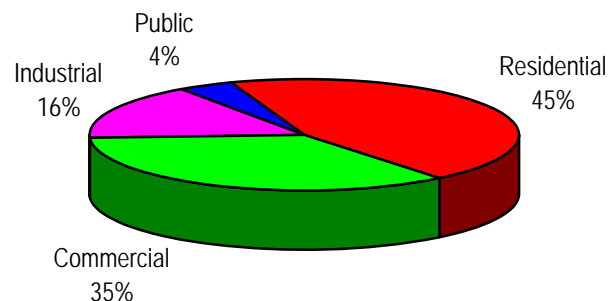
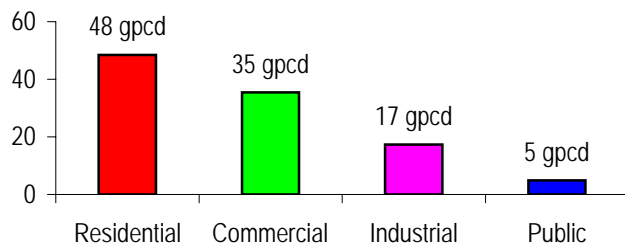


TABLE 2
HISTORICAL PER CAPITA CONSUMPTION
 WAUKESHA WATER UTILITY
 WAUKESHA, WISCONSIN

Year	Estimated Population	Gallons per capita per day				
		Residential	Commercial	Industrial	Public	Total
1970	39,695	56.8	19.1	106.0	11.7	194
1971	40,762	59.8	18.8	97.3	11.3	188
1972	41,829	57.7	18.8	102.5	11.3	192
1973	42,896	62.3	20.7	93.6	12.3	190
1974	43,963	63.9	20.5	95.8	12.9	194
1975	45,030	64.1	20.1	97.0	11.4	194
1976	46,097	72.3	18.6	91.5	11.4	196
1977	47,164	71.0	18.5	88.8	10.8	191
1978	48,231	68.8	18.9	89.5	10.9	189
1979	49,298	56.2	34.0	89.5	10.2	192
1980	50,365	54.8	33.2	82.4	9.7	181
1981	51,024	53.1	32.5	74.2	9.7	171
1982	51,684	50.7	30.9	61.9	9.2	154
1983	52,343	53.0	32.7	58.9	9.9	156
1984	53,002	51.3	32.3	65.4	8.7	158
1985	53,662	53.4	32.5	67.9	9.3	164
1986	54,321	49.4	32.6	63.9	8.7	155
1987	54,980	50.6	33.2	63.9	9.3	158
1988	55,639	58.3	35.7	66.3	9.3	170
1989	56,299	52.8	36.3	56.8	8.3	155
1990	56,958	49.8	34.8	49.6	7.7	142
1991	57,613	52.5	36.0	45.9	8.5	145
1992	58,268	49.9	37.4	35.0	4.8	127
1993	58,923	47.3	37.9	37.7	4.4	127
1994	59,578	49.5	38.9	35.4	4.8	129
1995	60,232	49.0	39.0	34.8	5.4	128
1996	60,887	48.9	38.7	34.3	5.4	127
1997	61,542	48.5	36.6	34.9	5.2	125
1998	62,197	48.9	36.9	35.1	5.1	126
1999	63,027	48.4	36.9	31.4	7.7	124
2000	64,825	45.1	35.9	27.9	4.6	113
2001	65,324	47.3	36.7	24.6	4.8	113
2002	66,237	49.0	37.8	25.3	4.9	117
2003	66,807	48.2	36.7	18.9	4.9	109
2004	66,816	45.8	35.0	17.8	5.0	104
2005	67,580	48.4	35.4	17.4	4.9	106
2006	67,750	43.6	34.7	17.2	4.4	100
2007	67,880	43.9	34.2	16.3	4.5	99
2008	68,030	42.6	33.4	15.4	4.0	96

Maximum Value =

2005 Per Capita Consumption
 Waukehsa Water Utility



2008 Per Capita Consumption
 Waukehsa Water Utility

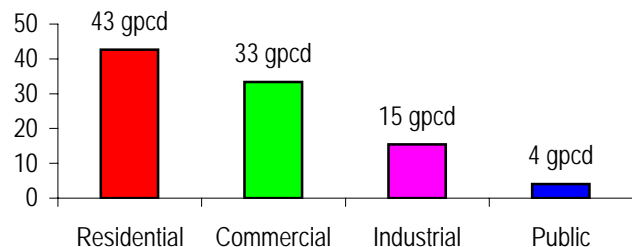


TABLE 3
DAILY PUMPAGE VARIATIONS
 WAUKESHA WATER UTILITY
 WAUKESHA, WISCONSIN

Year	Avg. Day Pumpage (MGD)	Max. Day Pumpage (MGD)	Date of Maximum Day	Ratio of Max. to Avg. Day	Year	Avg. Day Pumpage (MGD)	Max. Day Pumpage (MGD)	Date of Maximum Day	Ratio of Max. to Avg. Day
1970	8.24	12.30	07/07	1.49	1990	8.43	11.67	07/17	1.38
1971	8.25	12.84	07/07	1.56	1991	8.37	12.31	08/28	1.47
1972	8.40	11.91	05/25	1.42	1992	7.85	13.86	06/11	1.77
1973	8.57	12.42	07/18	1.45	1993	7.90	10.09	08/27	1.28
1974	8.88	12.87	07/19	1.45	1994	8.15	12.40	06/19	1.52
1975	9.14	13.30	07/31	1.45	1995	8.25	12.81	06/22	1.55
1976	9.12	14.04	07/17	1.54	1996	7.90	10.66	08/14	1.35
1977	9.03	13.24	05/13	1.47	1997	8.07	11.84	06/10	1.47
1978	9.25	12.86	08/14	1.39	1998	8.15	12.79	07/14	1.57
1979	9.66	13.35	07/19	1.38	1999	8.30	11.59	07/07	1.40
1980	9.21	14.04	06/25	1.52	2000	7.72	10.15	06/27	1.31
1981	8.60	12.91	07/08	1.50	2001	7.73	12.53	07/09	1.62
1982	8.17	11.08	06/07	1.36	2002	8.09	12.78	07/17	1.58
1983	8.29	12.07	06/22	1.46	2003	7.66	11.67	08/22	1.52
1984	8.80	12.13	08/06	1.38	2004	7.39	10.48	09/13	1.42
1985	9.09	13.45	07/17	1.48	2005	7.76	12.87	06/23	1.66
1986	8.69	11.71	07/18	1.35	2006	7.18	10.23	07/18	1.42
1987	9.17	15.19	06/18	1.66	2007	7.17	9.59	06/14	1.34
1988	9.85	15.20	06/29	1.54	2008	6.93	9.93	08/19	1.43
1989	8.87	12.31	06/23	1.39					

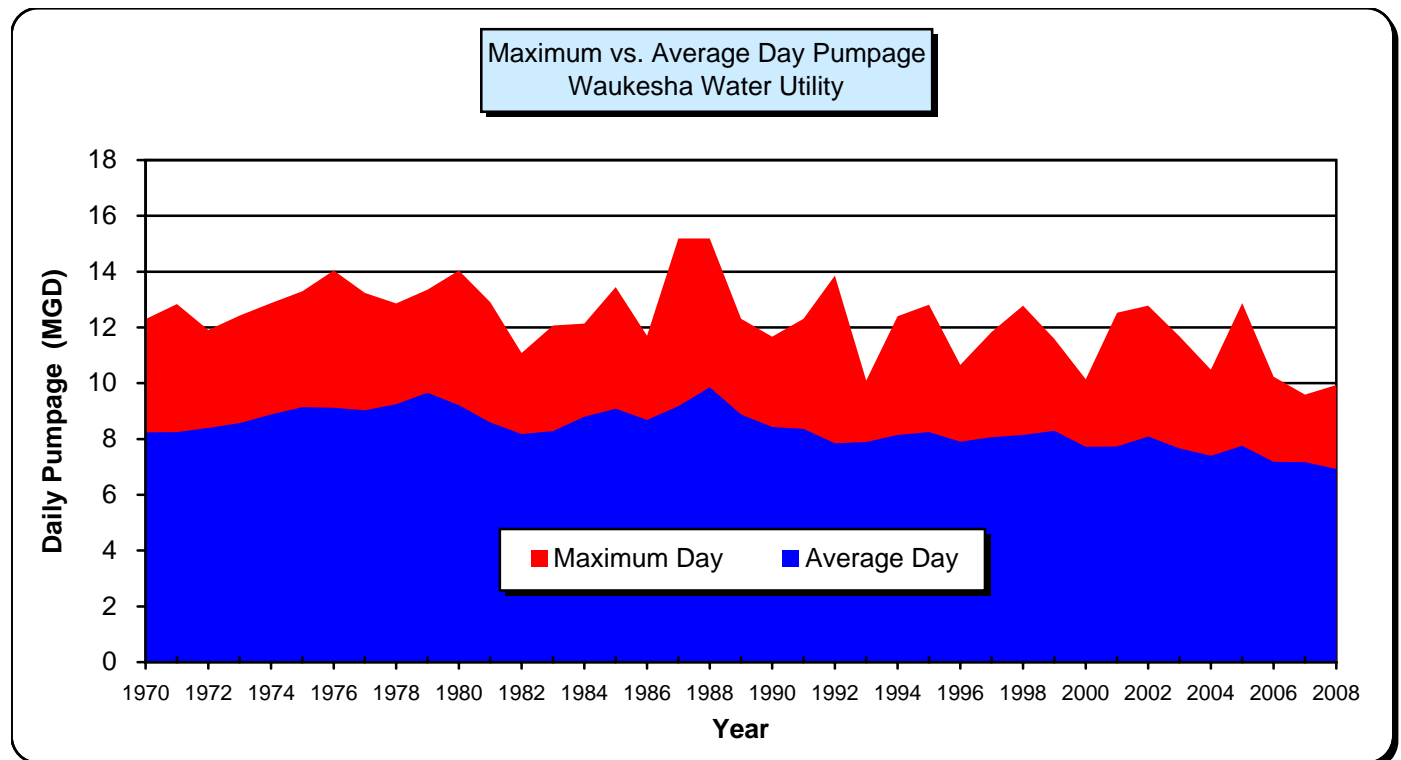


TABLE 4

**STATISTICAL ANALYSIS:
RATIO OF MAXIMUM TO AVERAGE DAY DEMAND
WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN**

	1998 to 2008	1970 to 2008
Number of years of Data	11	39
Maximum Ratio - Max. to Avg. Day Pumpage	165.9%	176.6%
Minimum Ratio - Max. to Avg. Day Pumpage	131.5%	127.8%
Average Ratio Max. to Avg. Day Pumpage	148.0%	146.9%
Standard Deviation	11.1%	10.3%

Confidence Level (%)	Ratio of Max. to Avg. Day Pumpage	Ratio of Max. to Avg. Day Pumpage
80%	157%	156%
85%	159%	158%
90%	162%	160%
95%	166%	164%
98%	171%	168%
99%	174%	171%

Note

The "Confidence Level" represents the probability (%) that in any given year, the actual ratio of maximum to average day pumpage will be less than or equal to the ratio indicated in the table. The ratios in the table were determined based on a statistical analysis of historical ratios over each period of analysis, assuming a normal distribution.

Historical Maximum Day Ratios
Waukesha Water Utility

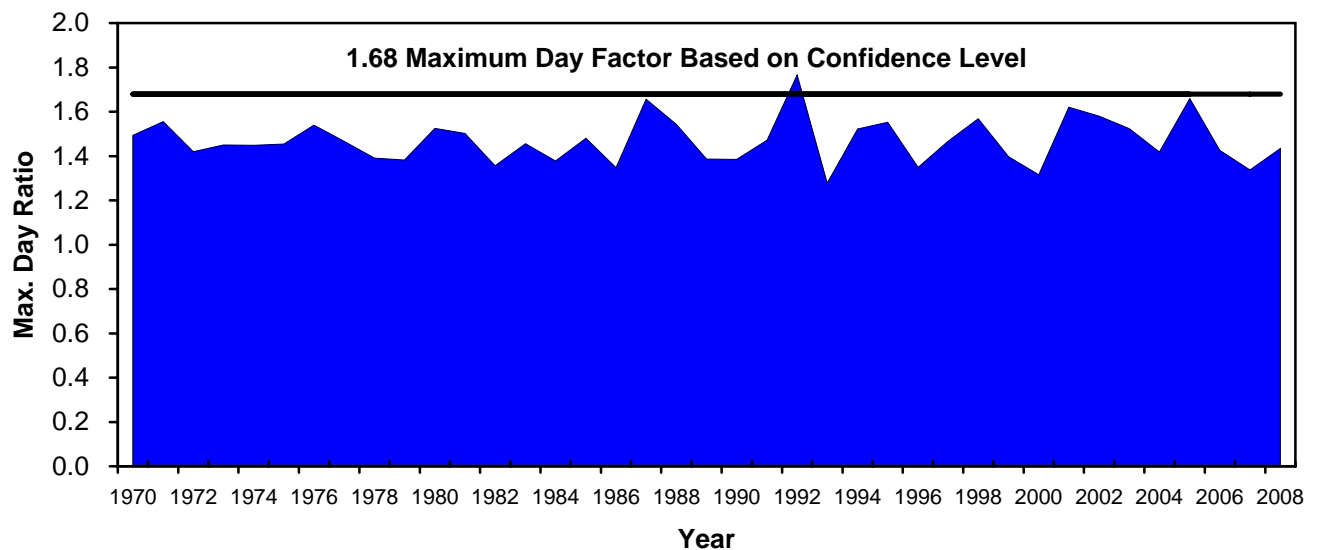


TABLE 5

WATER SALES AND PUMPAGE PROJECTIONS

WAUKESHA WATER UTILITY
WAUKESHA, WISCONSIN

<u>Customer Classification</u>	<u>Actual 2008</u>	<u>Projected 2028</u>	<u>Projected 2035</u>	<u>Projected Ultimate</u>
<i>Population Served</i>	68,030	85,800	88,500	97,400
<i>Residential Sales</i>				
Per Capita Sales (gpcd)	43	45	45	45
Annual Sales (MGY)	1,057	1,410	1,450	1,600
<i>Public Sales</i>				
Per Capita Sales (gpcd)	4	5	5	5
Annual Sales (MGY)	100	160	160	180
<i>Commercial Sales</i>				
Per Capita Sales (gpcd)	33	35	35	35
Annual Sales (MGY)	828	1,100	1,130	1,240
<i>Industrial Sales</i>				
Annual Sales:				
Existing Sales (MGY)	382	415	400	400
TOTAL METERED SALES (MGY)	2,370	3,090	3,140	3,420
Unaccounted-For Water (MGY)	161	230	240	260
TOTAL PUMPAGE (MGY)	2,531	3,320	3,380	3,680
AVERAGE DAY DEMAND (MGD)	6.93	9.10	9.26	10.08
MAXIMUM DAY DEMAND (MGD)	9.93	15.28	15.56	16.94

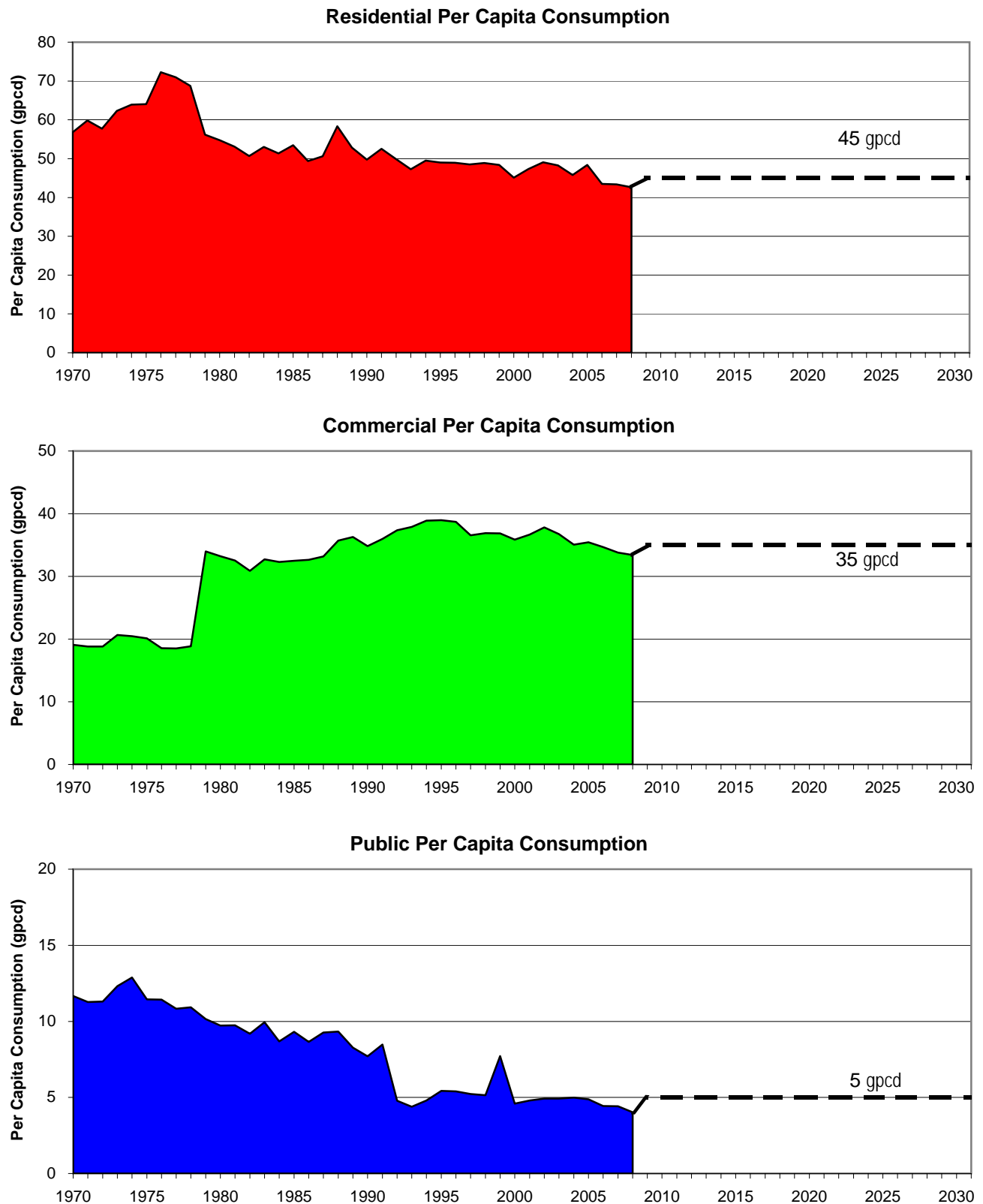
Notes:

Projected populations from Southeastern Wisconsin Regional Planning Commission letter dated March 17, 2009.
Industrial sales projections based on planning data provided during Water System Master Plan project of ultimate industrial acreage slightly decreasing from existing acreage and some large customer surveys indicating decline in water usage.

Unaccounted-for water was projected at 7% of total pumpage for future years.

Maximum day demand 1.68 times average day demand.

FIGURES

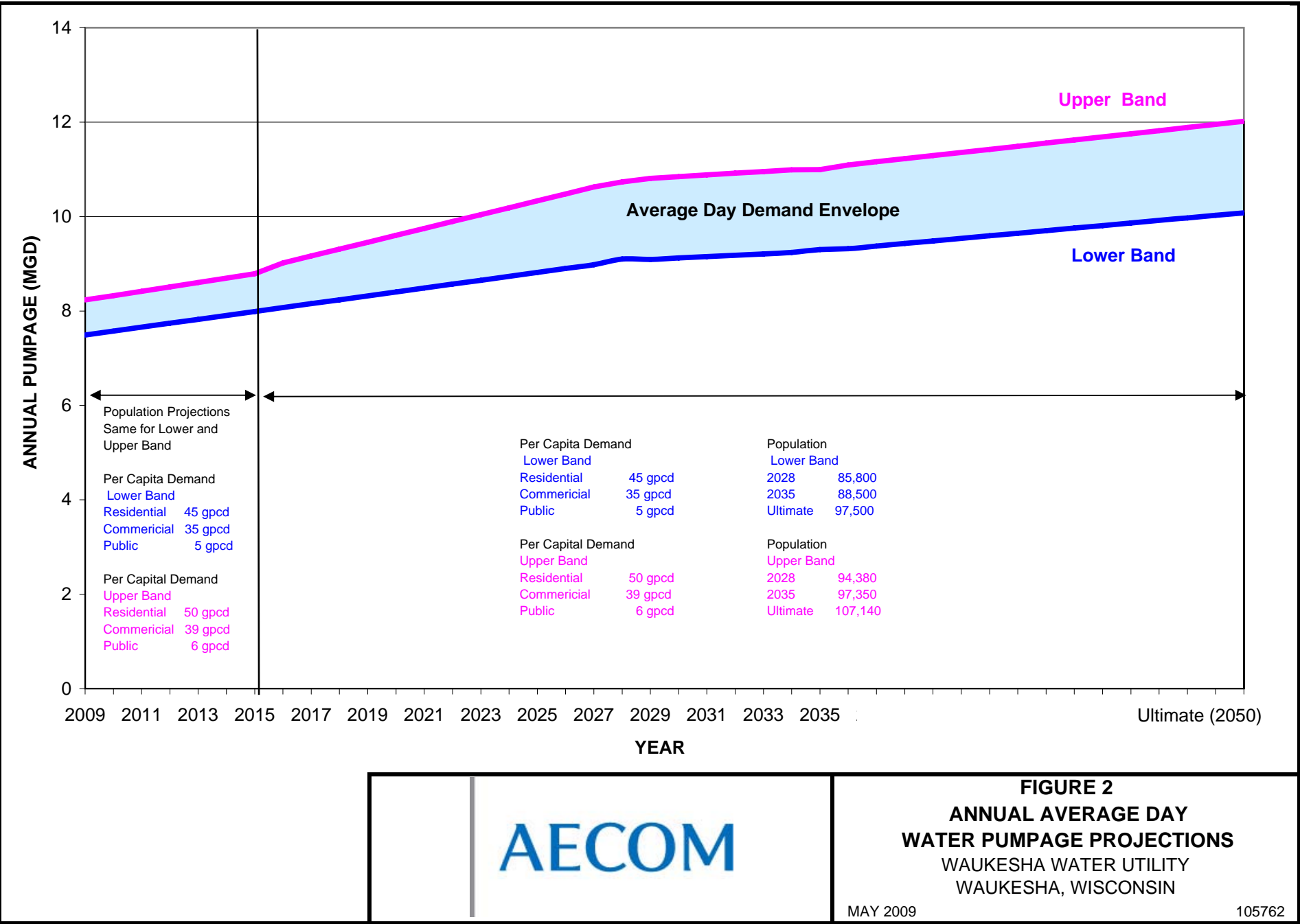


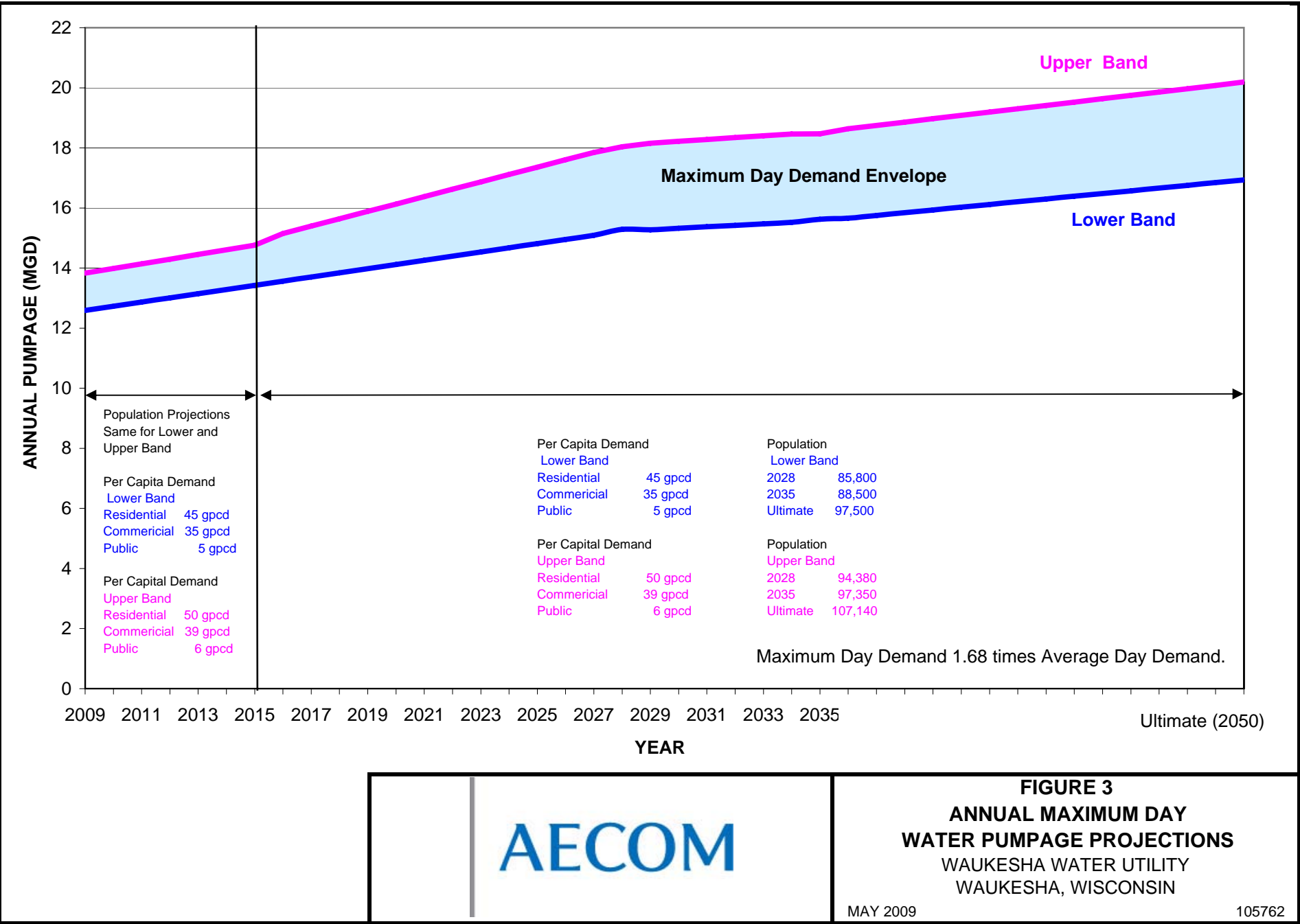
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FIGURE 1
HISTORICAL PER CAPITA
CONSUMPTION
 WAUKESHA WATER UTILITY
 WAUKESHA, WISCONSIN

MAY 2009

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ATTACHMENT A
POPULATION PROJECTIONS

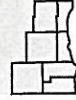
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

W239 N1812 ROCKWOOD DRIVE • PO BOX 1607 • WAUKESHA, WI 53187-1607 •

TELEPHONE (262) 547-6721
FAX (262) 547-1103

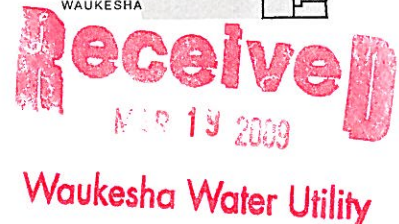
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March 17, 2009

Mr. Steven Crandell
Community Development Director,
City of Waukesha
201 Delafield Street
Waukesha, WI 53188-3633



Dear Mr. Crandell:

In response to your request, the Regional Planning staff has prepared an estimate of the ultimate population for the Waukesha water supply service area. The ultimate population for the water supply service is estimated at 97,400 persons. This compares to the year 2000 population of 75,500 persons and a planned year 2028 population of 85,800 persons, as set forth in the SEWRPC staff memorandum entitled "Response to Request by the City of Waukesha Water Utility to Delineate the 20-Year Planned Water Supply Service Area for the Utility." The ultimate population is an estimate of the population that could be accommodated within the water supply service area, assuming full development conditions as envisioned under the land use element of the Waukesha County comprehensive plan, with input on population densities for various residential land use categories and other aspects of the plan from your staff.

The 2028 population represents a step on the way to the 2035 population of 88,500 persons set forth in the ongoing regional water supply plan. The ultimate population within the water supply service area represents a condition beyond the 2035 planning horizon adopted for the regional water supply plan.

We trust that this responds to your request. Should you have any questions, feel free to call.

Sincerely,

Kenneth R. Yunker, P.E.
Executive Director

KRY/WJS/lgh

#143499 v1 - response to s crandell

cc: Michael G. Hahn, SEWRPC
Robert P. Biebel, SEWRPC