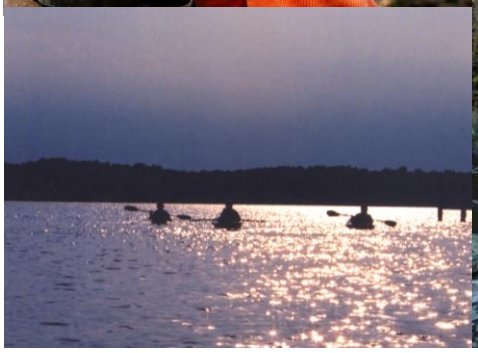
APPENDIX

water resources

FUNCTIONAL PLAN

MAY 2010



Appendix 5

WSSC Approved Water Supply Projections

MONTGOMERY COUNTY PLANNING DEPARTMENT
THE MARYLAND–NATIONAL CAPITAL PARK AND PLANNING COMMISSION

MontgomeryPlanning.org

APPROVED

2006 Water Production Projections

Washington Suburban Sanitary Commission

Planning Group

July, 2006

Executive Summary

WSSC's average water production is expected to increase by about 1% per year, reaching 224 million gallons per day (mgd) in the year 2030. These latest projections are slightly lower than the previous projections done in 2001 (Water Productions Projections, WSSC, Planning Group, April, 2001).

The actual water production of 171.9 mgd in 2005 was the second highest in WSSC history, behind 1994. After declining and flat water productions from 1994 to 2003, recent years have shown steady increases. Per (household) unit water production has remained flat over the past 5 years after significant decreases during the preceding 15 years. If per unit production continues to hold steady, total production will continue to increase as new units are added.

The ratio applied to projected average production to obtain a future year's projected maximum day production has been recalculated by including the most recent actual data. The resulting ratio of 1.48 is a very slight (<1%) decrease from the previous ratio. As has been the case since 1994, the calculation of this ratio incorporates a 20% probability that it will be exceeded by the actual ratio in any given year.

Water supply to other jurisdictions (wholesale) recently increased (due to supply interruptions from alternate sources) to 3.92 mgd (2.3% of current production) and outstanding commitments are about 12.4 mgd (7% of our current production). Such supplies and potential requests for additional supplies present possibilities for additional future increases in our production requirements.

Introduction

This report provides the latest WSSC water production projections and provides background information on how the projections were developed. In subsequent planning efforts, these water production projections will be used to analyze the adequacy of the existing water system to meet future needs and to determine the timing and sizing of needed improvements.

The development of water production projections involves these major steps:

- Development of per unit water production factors.
- The allocation of units provided by demographic growth forecasts to water system pressure zones.
- The calculation of annual average water production, by pressure zones, the grouping of pressures zones, and the calculation of group and system totals.
- The calculation of maximum day ratios for the system and pressure zone groups.
- The accounting for supplies to other jurisdictions.

Per Unit Water Production Factors

This is a critical step in the development of water production projections. Per unit production factors are multiplied by the number of forecasted units to calculate projected water production. These factors reflect whether WSSC customers are using more or less water per unit and what those use patterns are expected to be in the future.

The units for which per unit production data are developed are: single family households, multi family households and employees. These types of units are included in the Cooperative Growth Forecasts provided by the Metropolitan Washington Council of Governments and the Maryland National Capital Park and Planning Commission.

Here, it is important to distinguish between water production and water consumption. Water production is the amount of water leaving the treatment plants and entering the distribution system. Water consumption is the amount of water being measured as it leaves the distribution system. The difference between the two is the water leaving the distribution system without being measured. This water is sometimes called unaccounted-for water. The ratio of production divided by consumption is referred to here as the production factor.

Since production is the amount of water that must flow through the distribution system, water production is usually more relevant than water consumption for the purposes of water system analysis and planning. To obtain per unit production data, per-unit consumption is calculated from customer service data and then multiplied by the production factor.

One problem when comparing production data with consumption data is a lack of synchronization. Since the hundreds of thousands of customer meters in the WSSC system are read on different schedules, there is no single time interval for which total system consumption is available. To minimize the inaccuracies from asynchronous meter readings, a year's worth of consumption is averaged and compared with the corresponding production data. For this report, consumption data from January 2005 to December 2005 was used.

The term “DAC” refers to daily average consumption. Figure 1 shows a pie chart of 2005 DAC for the entire system, divided by unit type.

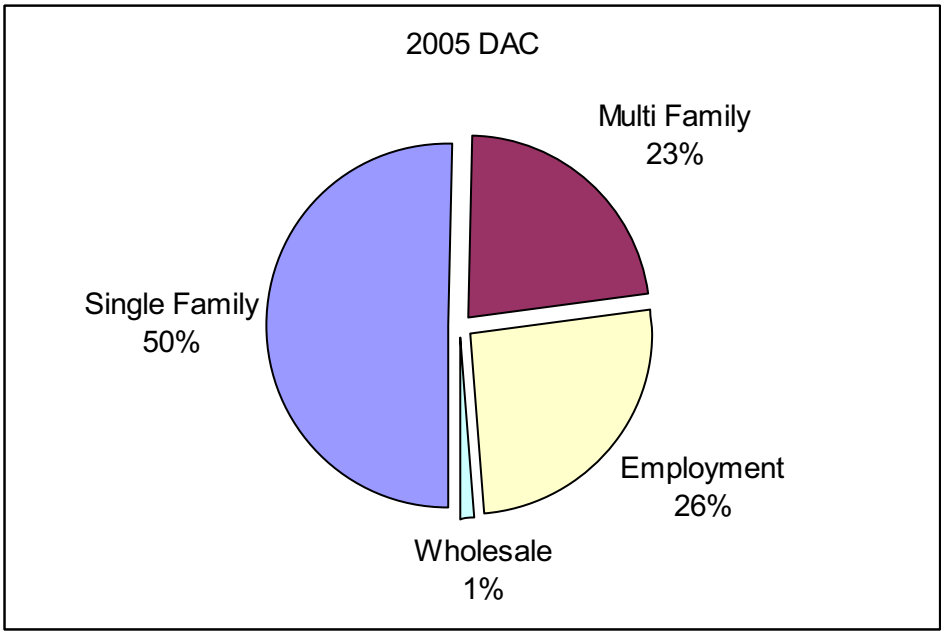


Figure 1, DAC Pie Chart

The production factor (production divided by consumption) for the year was calculated at 1.196. This is within the range of production factors calculated over the previous 10 years, as shown in Figure 2. (note: since this calculation was not done using all “known” water uses, only “metered” water uses, it should not be considered a complete water audit appropriate for all purposes).

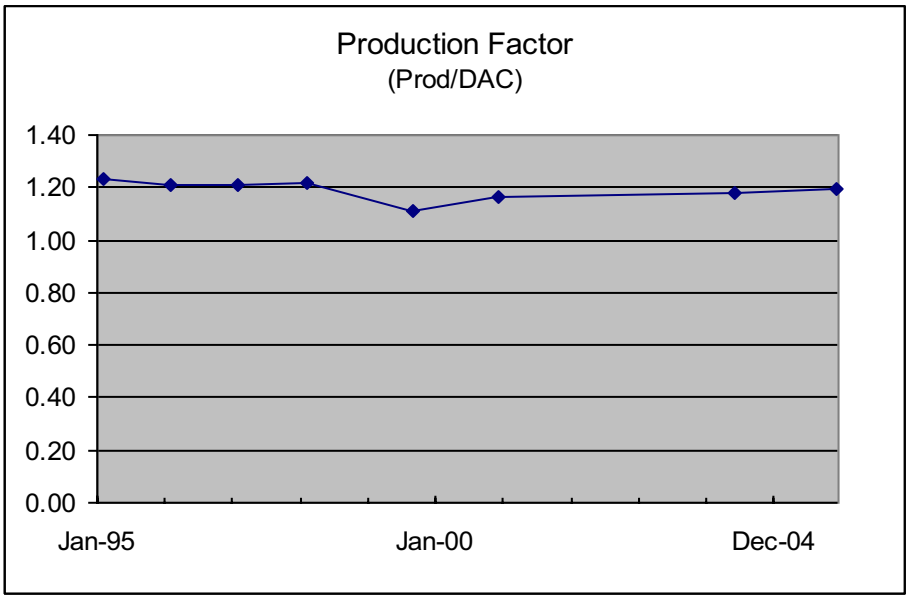


Figure 2, Production Factors

The per unit production factors for all existing units were calculated (in gallons per day) to be: Single family – 218; Multi family – 194; and Employee – 56. Graphs showing these numbers in the context of historical trends over the past 20 years are shown in figures 3, 4 and 5. The trends for Single family and Multi family show the factors have been consistent over the most recent 5 years after steady decreases over the first 15 years. The factor for employees is more variable, probably because water use is less strongly a function of the number of employees and the number of employees must be derived from demographic data rather than WSSC's customer service data.

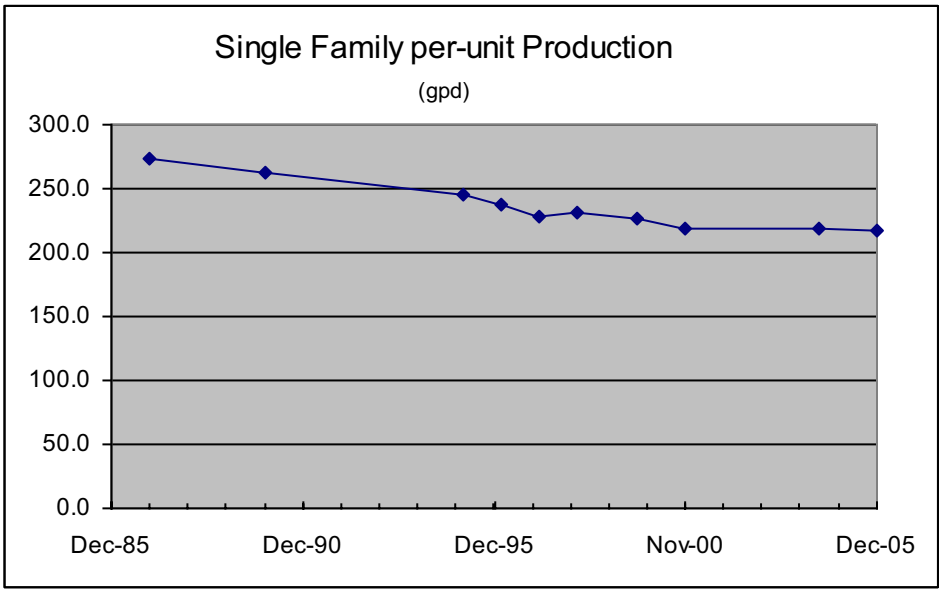


Figure 3, Single Family Unit Production

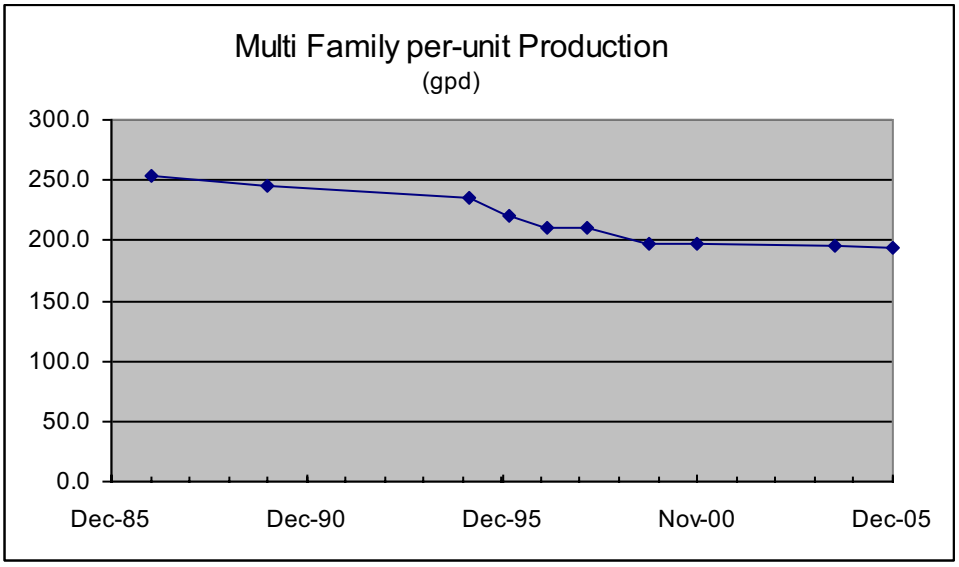


Figure 4, Multi Family Unit Production

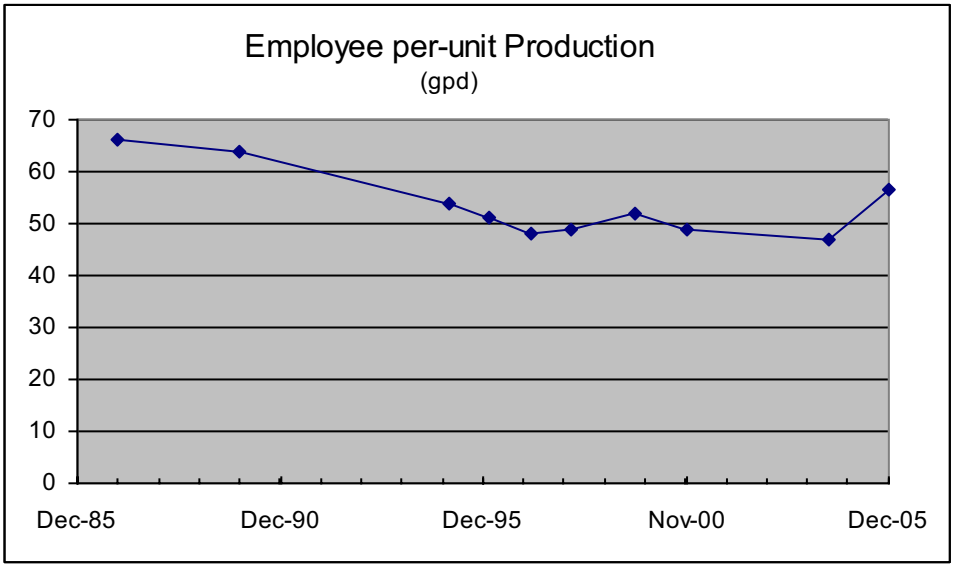


Figure 5, Employee Unit Production

From 1994 to 2003 actual water production declined or remained flat due to decreasing per unit production offsetting increases in the number of units served. Since 2003, production has increased moderately resulting in a total production of 171.9 mgd in 2005, the second highest in WSSC history. Given the recent (flat) trends in per unit production, it is expected that total production will increase as new units continue to be added. Because of factors such as weather and economics, the increase in actual production will likely be somewhat erratic.

In an effort to predict the per unit production for future units, a per unit analysis was done only for units built since 1994. The results (in gpd) were: Single family -228; Multifamily – 181; no such analysis for employees. Interestingly, for single family units, the usage for the newer units is greater than usage for all existing units, while for multifamily units, this usage for newer units is lower than the usage for all existing units.

For projecting future average production, the factors developed from the newer units will be applied to units forecasted after 2005 while the factors developed from all existing units will be applied to units included in the forecast for 2005, as shown in the following table.

	Single Family	Multi Family	Employment
For units existing as of 2005	218	194	56
For units added after 2005	228	181	56

Table 1. Recommend Per-Unit Production Factors (in gpd).

Growth and Average Production Forecasts

Round 7.0 Growth Forecasts have been provided by the M-NCPPC for both Prince George's and Montgomery counties. This data includes single family and multifamily households, employees and population in 5 year increments through 2030. (Although population data is not used in the calculation of projected water production, it is often useful data with regard to the water system).

The demographic data is provided by geographic units called COG Analysis Zones (CAZs). In general, these geographic units have no relationship to the water system boundaries, so the demographic data must be allocated to water system pressure zones. In past analysis, the allocation process involved tedious and time consuming manual calculations. Today, WSSC's Geographical Information System (GIS) automates this process and vastly increases the speed at which these allocations are made.

Table 2 shows the number of units allocated to the WSSC water pressure zones, as used for water production projections, and population. For each 5 year increment, the table shows units for each county and the total. Based on these numbers and overall population projections, as of 2005, WSSC served 90% of the Montgomery County population, 95% of the Prince George's County population and 93% of the bi-county population.

Note: When these WSSC water production projections were prepared, Round 7.0 was the latest information available. When the water production projections are revised, the most current MWCOG Round data will be used.

Projected Units Served

3/20/2006

Year	County	Single Family	Multi Family	Employees	Population
2005	Montgomery	215,851	102,380	428,079	850,770
	Prince George's	195,861	98,357	350,971	812,859
	Totals	**411,712**	**200,738**	**779,050**	**1,663,629**
2010	Montgomery	222,909	114,896	461,860	899,299
	Prince George's	201,549	105,736	382,000	832,710
	Totals	**424,459**	**220,631**	**843,860**	**1,732,009**
2015	Montgomery	229,849	124,968	490,478	931,463
	Prince George's	205,983	113,824	415,584	853,101
	Totals	**435,832**	**238,792**	**906,062**	**1,784,565**
2020	Montgomery	234,262	135,606	516,289	960,543
	Prince George's	210,361	121,074	451,873	873,648
	Totals	**444,624**	**256,680**	**968,162**	**1,834,190**
2025	Montgomery	236,243	149,510	541,189	995,052
	Prince George's	215,570	129,575	491,698	907,794
	Totals	**451,813**	**279,085**	**1,032,888**	**1,902,846**
2030	Montgomery	237,027	164,718	561,822	1,031,925
	Prince George's	226,348	135,661	534,741	950,098
	Totals	**463,375**	**300,379**	**1,096,563**	**1,982,024**

Table 2, Projected Units Served

By applying the per-unit production factors, the demographic data is converted to average water production data, then allocated to water system pressure zones. The resulting water production projections, by pressure zone, are shown in Table 3. In this table, Wholesale represents supplies to other jurisdictions, which are discussed in more detail later. The wholesale number included for 2005 represents the average actual usage for that year while the number included for the remaining years represents the last 3 months, when usage increased noticeably.

Projected Average Water Production

Based on Round 7.0 Growth Forecasts and Per-Unit Production:

through 2005 SF-218 MF-194 Emp-56; after 2005 SF-228 MF-181 Emp-56

Group	Zone	2005	2010	2015	2020	2025
mchigh	560A	6.29	6.41	6.61	6.8	6.88
	660A	35.9	37.69	39.77	41.79	44.05
	685A	2.12	2.2	2.24	2.27	2.32
	760A	1.13	1.34	1.54	1.7	1.82
	836A	0.71	1.48	2.18	2.55	2.79
	960A	0.79	0.81	0.86	0.9	0.9
		46.93	**49.93**	**53.19**	**56.01**	**58.76**
mcmain	350A	0.47	0.48	0.48	0.48	0.48
	495A	44.97	47.8	49.79	51.6	53.45
	552A	0.64	0.65	0.65	0.65	0.65
		46.09	**48.92**	**50.92**	**52.73**	**54.58**
pghigh	280A	1.66	1.86	2.1	2.32	2.72
	290B	3.64	3.89	4.28	4.73	5.07
	317A	7.44	8.31	8.74	9.09	9.71
	328A	0.52	0.61	0.7	0.77	0.81
	355B	1.43	1.48	1.51	1.57	1.64
	385B	7.04	7.8	8.35	8.84	9.46
	450A	16.3	16.49	16.95	17.56	18.45
		38.04	**40.44**	**42.62**	**44.88**	**47.86**
pgmain	320A	31.26	32.68	33.98	35.14	36.44
	350E	3.58	3.81	4	4.17	4.25
	415A	6.84	7.11	7.56	8.08	8.46
		41.68	**43.6**	**45.54**	**47.39**	**49.15**
Wholesale		1.92	3.62	3.62	3.62	3.62
System Totals		**174.6**	**186.5**	**195.9**	**204.6**	**214**

Table 3, Projected Average Production

Although analysis of the impact of these projections on specific projects is beyond the scope of this report (and will be conducted on a project by project basis, as needed), some comparison of this data with past projections is appropriate. In general these water production projections represent a slight decrease in system totals from the previous projections done in 2001. For the year 2005, the decrease is 4.3 mgd (2%); for 2020 the decrease is 0.8 mgd (0.4%). The breakdown of the system totals between the major zone groups (2 in each county) is very consistent with the previous projections.

The year 2005 projection of 174.6 mgd is slightly greater than the 2005 actual production of 171.9 mgd (a difference of 2.7 mgd or 1.6%) because there are more units from the demographic data allocated within the water service boundaries than are contained in our customer service data. This possibly is due to existing units currently using wells and other factors. Since units using wells may convert to public water, no adjustment for this difference has been made.

Maximum Day Projections

For many water system analyses and planning tasks, it is necessary to use the highest anticipated daily flow into the distribution system. This value is calculated by multiplying the projected average production by the ratio of the highest daily to average flow, as derived from historical data. This ratio is called the maximum day ratio.

Table 4 shows historical water production data including the actual system wide maximum day ratios experienced for the period 1985 through 2005. A statistical analysis of historical maximum day ratios can provide the probability of any selected ratio being exceeded during a single year. A statistical analysis can also yield a design maximum day ratio resulting from a selected exceedance probability. This is the method used to determine the maximum day ratios for maximum day production projections.

Year	Average Production	Maximum Day Production	Ratio	Date of Maximum Day
1985	148.6	197.4	1.33	8-Sep
1986	160.8	226.7	1.41	11-Jun
1987	163.3	238.8	1.46	23-Jul
1988	169.9	267.3	1.57	8-Jul
1989	165.3	227.6	1.38	11-Sep
1990	166.9	235.2	1.41	30-Jun
1991	171.0	255.9	1.50	20-Jul
1992	162.5	220.4	1.36	20-Jul
1993	167.0	242.7	1.45	11-Jul
1994	173.5	230.6	1.33	14-Jun
1995	167.1	233.9	1.40	4-Aug
1996	161.3	198.9	1.23	12-Mar
1997	164.7	245.8	1.49	15-Jul
1998	166.6	219.8	1.32	30-Aug
1999	168.2	263.4	1.57	8-Jun
2000	162.0	200.8	1.24	11-Jun
2001	167.4	253.2	1.51	11-Sep
2002	164.8	221.8	1.35	13-Aug
2003	164.3	206.5	1.26	21-Jan
2004	168.1	210.4	1.25	29-Aug
2005	171.9	226.2	1.32	26-Jun

Table 4, Historical Maximum Day Ratios

The implications of using different exceedance probabilities were addressed in a 1992 study, The Peak Water Consumption Management Study, by O'Brien and Gere. In summary, it concluded that increasing the exceedance probability resulted in a tradeoff between reduced water system cost and the increased possibility of limitations on outdoor water use during dry summers. WSSC management directed that a 20% exceedance probability be used to calculate the projected maximum day ratio. In others words, it was decided to plan the water system based on production projections that, on average, will be exceeded once in 5 years, with the expectation that outdoor water use or other limitations will then be implemented.

The maximum day ratios for the 4 pressure zone groups would normally be calculated as part of this effort. Unfortunately, a significant gap in the data needed to calculate these ratios was created when Project 80 flow into Prince George's county was initiated, but not recorded, in November, 2000. This data gap was closed in November, 2004 but it may be several more years before a statistically significant data sample will be available again. In the absence of available new data, it is recommended that the results from the previous 2001 report continue to be used. (The ratios for the different zones and the system ratio need not occur on the same day, so it is mathematically permissible for all zone ratios to be greater than the system ratio.)

Zones	Maximum Day Ratio
System	1.48
MC High*	1.51
MC Main*	1.73
PG High*	1.56
PG Main*	1.53

Table 5, Calculated Maximum Day Ratios for Projections
*from 2001 report, see preceding paragraph

This new system maximum day ratio represents a very slight decrease from the previous ratio of 1.49, calculated in 2001.

Figure 6 provides a graph of the projected average and maximum day production through 2030 and historical average and maximum day production since 1980.

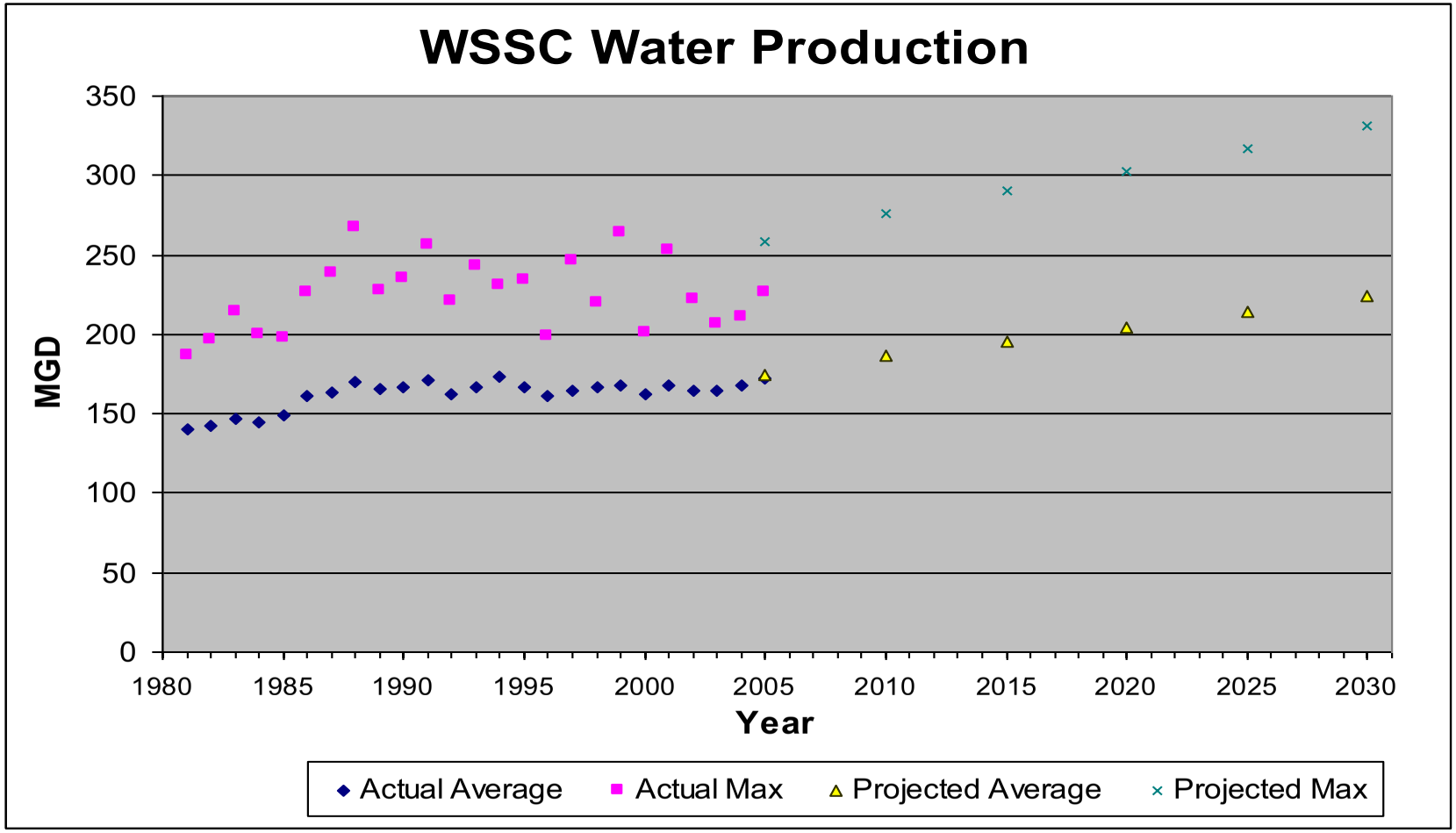


Figure 6, Historical and Projected Water Production

Supplies to Other Jurisdictions

The WSSC has water system interconnections with several other jurisdictions. Some of these interconnections are subject to formal agreements while others operate based on informal understandings. Some of these supply arrangements are used as an everyday supply, some are for emergencies only and some are used to meet the other jurisdiction's peak demands. In cases where the interconnections are used to meet the other jurisdiction's peak demands, the cost to the WSSC may exceed the revenue recovered from the per-gallon cost of the water used and other compensation should be arranged.

Jurisdiction	Allowable Withdrawal (mgd)	Average Withdrawal* (mgd)	WSSC Pressure Zone
City of Bowie	Not specified – emergency only	Not currently metered	Hg350E
Charles County	1.4	0.001	Hg328A
Howard County	5.0	3.07	Hg415A
City of Rockville	6.0	Negligible	Hg660A
DC-WASA	Not specified	0.01	Hg495A

*based on meter readings from March 2005 to February 2006

Table 6, Supplies to Other Jurisdictions