1995 Water Demand Forecast and Resource Availability Analysis for the Washington Metropolitan Area

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INTERSTATE COMMISSION ON THE POTOMAC RIVER BASIN

This report has been prepared by the Interstate Commission on the Potomac River Basin Section for Cooperative Water Supply Operations on the Potomac. Funds for this report are provided by the United States Government, the District of Columbia, the Fairfax County Water Authority and the Washington Suburban Sanitary Commission. The opinions expressed are those of the authors and should not be construed as representing the opinions or policies of the United States or any of its agencies, the CO-OP Suppliers, or the Commissioners of the Interstate Commission on the Potomac River Basin.

PREFACE

On January 11, 1978, the governments of the United States, District of Columbia, Maryland, Virginia, and the Chairmen of the Fairfax County Water Authority and the Washington Suburban Sanitary Commission committed their constituencies to a historic agreement which allocated low flows in the Potomac River. For more than seventeen years, the Potomac River Low Flow Allocation Agreement (LFAA) has not had to be implemented; however, in preparation for that possibility, the signatory parties have met during April in each year since its ratification in order to affirm its principles and approve data upon which its implementation would be based.

Modification to No. 1 to the LFAA indicates that Article 2.C. include the following requirement: "In April 1990 and in April of each fifth year thereafter ... the Aqueduct, the Authority, the Commission and the District shall review and evaluate the adequacy of the then available water supplies to meet the water demands in the Washington metropolitan area which may then be expected to occur during the succeeding twenty year period." At their meeting of May 11, 1994, the parties to the agreement requested the Section for Cooperative Water Supply Operations on the Potomac (CO-OP) of the Interstate Commission on the Potomac River Basin to conduct the required review and evaluation of demands and supplies.

The following report discusses the methods used to determine demands and resources, and presents the results of that analysis.

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I.) STUDY BACKGROUND AND OBJECTIVE

A.) Objective of Study

The forecasting of future water demands is critical to those involved in water supply planning. These forecasts help managers assess the adequacy of the present resources and distribution systems. Since the time required to bring new resources online or complete major upgrades in the distribution systems can be 10 years or more, forecasts of future demands help managers and municipalities plan to sufficiently support regional growth.

Article 2 of the Low Flow Allocation Agreement (LFAA) was modified on July 22, 1982 requiring an evaluation of future water demands over a 20 year time period beginning in 1990, and every 5th year thereafter, and a review of the resources available to meet those demands. The objective of this study is to fulfill that mandate. This study updates the 1990 report (Holmes and Steiner, 1990) to reflect changing growth, water use and land use patterns. Although the LFAA calls for a 20 year water demand forecast, employment and household forecasts were available from 1990-2020, therefore water demands were forecasted for this thirty year period.

B.) Major Findings and Conclusions

-Washington Aqueduct Division's water demand is forecasted to grow by 24.8 mgd, from 175.8 mgd to 200.6 mgd, over the forecast period (1990-2020). During this same period Fairfax County Water Authority is expected to grow from 106.1 mgd to 189.2 mgd, a gain of 83.1 mgd. Washington Suburban Sanitary Commission is expected to increase 68.2 mgd, from 164.8 mgd in 1990 to 233.0 in 2020. The CO-OP annual average demand is predicted to grow by 176.1 mgd, from 446.7 mgd to 622.8 mgd, during the forecast period.

-The free flowing Potomac River is over-allocated with current demands and will increase with the forecasted demands, this over-allocation demonstrates the need for the system reservoirs.

-The simple assessment of the system resources with the forecasted 2020 demands showed an annual average deficit of 20.7 mgd if the river/reservoir system is operated at a constant draft, and a 54.9 mgd annual average deficit if the river/reservoir system is operated at a seasonally varying draft.

-The second assessment of the system resources with the forecasted 2020 demands for a critical period of 120-days showed an average 100.0 mgd deficit during the critical period for the constant draft method and an average 63.6 mgd deficit during the critical period for the seasonally varying method.

-The daily system simulation model developed to capture the advantages of joint

operations of the river/reservoir system showed that the system could sustain the demands forecasted for the year 2030 during a repetition of the drought of record without depleting all system resources. This supply/demand assessment indicates that some growth in demand can be accommodated by continuous adaptation of cooperative operating rules and expanded capacity of suppliers current facilities.

-Analysis shows that conservation efforts in new units decrease water demand from multi-family households while water demands from single family households continue to increase with very little effect in total water demand. A potential may exist for conservation efforts to reduce indoor water use in older service areas by retrofitting water wasting fixtures with water conserving fixtures.

-Potential future sources of water supply include: reallocated storage now used for other purposes in Jennings Randolph Reservoir, new reservoirs to be developed on sites identified in previous water resource studies, and raw water interconnections which were also identified in previous water resource studies. Other potential new sources of water include the development of groundwater and use of the Potomac River estuary. Alternatives have varying costs with incomplete and inconsistent data to make comparisons.

C.) Cooperation Among Water Suppliers

The Washington metropolitan area is served by three major water suppliers: the Washington Aqueduct Division (WAD) of the U.S. Army Corps of Engineers, the Fairfax County Water Authority (FCWA), and the Washington Suburban Sanitary Commission (WSSC). The District of Columbia's government is responsible for distributing most of the finished water treated by WAD and entering into agreements for water resources. These suppliers are referred to in this report as the CO-OP Suppliers. Each CO-OP Supplier maintains its own water intakes and filtration facilities and operates independently during times of adequate supply. However, in 1966 it became apparent that the Potomac River would no longer meet unrestricted withdrawals during times of drought. Several significant agreements were signed during the late 1970s and early 1980s which institutionalized cooperation among these water suppliers.

The first agreement institutionalizing cooperation for water supply withdrawals from the Potomac River was the Potomac River Low Flow Allocation Agreement (LFAA). It was enacted on January 11, 1978 among the Commonwealth of Virginia, the state of Maryland, the District of Columbia and the three CO-OP Suppliers in anticipation of new and expanded Potomac River withdrawals. This agreement provides an orderly allocation of flows in the Potomac River among the various water supply withdrawers when the river is inadequate to meet unrestricted demands.

Following the signing of the LFAA, joint operations were found to extend minimum supplies and reduce the probability of enacting the low flow allocation formula. The Water Supply Coordination Agreement (WSCA), signed July 22, 1982, institutionalized joint operations in times

of drought and in planning to meet future demands. The WSCA binds the CO-OP Suppliers to a cost allocation formula for purchasing, operating and maintaining future supply sources. It further directs the CO-OP Suppliers to operate all current and future supply sources jointly in times of drought. Also, on July 22, 1982 the CO-OP Suppliers contracted jointly with the Maryland Potomac Water Authority and the federal government to purchase 13,357 million gallons (mg) of water supply storage in the Bloomington (since renamed Jennings Randolph) Reservoir. This storage is intended to augment water supply in the Potomac River when natural flows can not meet water supply withdrawals. On the same date the CO-OP Suppliers contracted to jointly share the cost of building Little Seneca Reservoir (storage of 3.7 billion gallons) in Montgomery County, Maryland. Although Little Seneca Reservoir is much smaller than the Jennings Randolph Reservoir, travel time from this reservoir to the Washington metropolitan area water supply intakes is 1 day versus 4 to 7 days. This reservoir increases the flexibility of the resources by providing supplemental storage available the same day as needed to the intakes.

D.) Role of ICPRB's CO-OP Section in Water Supply Management

The WSCA gave the Interstate Commission on the Potomac River Basin Section for Cooperative Water Supply Operations (herein referred to as the CO-OP Section) a direct roll in managing water supply resources and withdrawals in the Washington metropolitan area. The agreement provides for an Operations Committee, consisting of representatives from WAD, FCWA and WSSC, which is responsible for overseeing the CO-OP Section activities. It binds all parties to joint operations during times of low flow in the Potomac River. In addition, it assigns the responsibility for scheduling water supply releases from Jennings Randolph and Little Seneca reservoirs and allocating water supply withdrawals to the ICPRB CO-OP Section. Required by the WSCA, the CO-OP Section has developed a Drought Operations Manual approved by all CO-OP Suppliers. The Drought Operations Manual documents the procedures that the CO-OP Section will follow during times of drought to schedule releases and withdrawals consistent with each individual suppliers operating practices.

On a continuing basis, the CO-OP Section is responsible for maintaining regional drought preparedness on the Potomac River. A drought exercise is conducted annually by CO-OP involving the CO-OP Suppliers and the Baltimore District of the Army Corps of Engineers which operates the Jennings Randolph Reservoir. This exercise simulates drought conditions to exercise and develop operations set out in the Operations Manual. The CO-OP Section also issues periodic Water Supply Outlooks which assess the probability of requiring reservoir releases throughout the May-October time period. The responsibilities and expertise of ICPRB CO-OP Section caused the parties to the LFAA to direct the CO-OP Section to conduct this demand and supply assessment.

E.) Contents of Report

This report presents the ICPRB CO-OP Section forecast of long term water demands in the Washington metropolitan area. The forecast and analysis utilizes information gathered from Virginia, Maryland, the District of Columbia and the U.S. Army Corps of Engineers' water

suppliers to forecast water demands for the individual suppliers and for the CO-OP Suppliers as a whole. This report contains a description of each water supplier's facilities, an analysis of recent trends in water production, a description of the model used for forecasting long term water demands, and a presentation of the model results for each Washington metropolitan area supplier and the CO-OP Suppliers as a whole.

In addition to the detailed analysis and forecast of water demands, a discussion of the available water resources is presented in this report. Assessments are made between forecasted demands and available water resources and conclusions presented. The water resources available to the Washington metropolitan area water suppliers include the Potomac River and the jointly and independently owned reservoirs in the Patuxent and Potomac, including the Occoquan, river basins. As part of the supply assessment a review of potential future sources of additional water supply is included.

II.) GENERAL DESCRIPTION OF THE WASHINGTON METROPOLITAN AREA WATER SUPPLIERS

A.) Study Area

The study area for the water demand forecast described in this report is the service areas of those suppliers in the Washington metropolitan area solely or partially dependent on the Potomac River. These include the aforementioned CO-OP Suppliers (WAD, FCWA, and WSSC) and the other suppliers that are provided with treated water by the CO-OP Suppliers. This forecast also includes the cities of Rockville, Maryland and Leesburg, Virginia which maintain their own Potomac River raw water intakes and treatment facilities.

Each CO-OP Supplier maintains its own water intakes and filtration facilities and acts independently in times of adequate natural Potomac River flows. When the drought operating rules (defined in the Water Supply Coordination Agreement) are in effect, the water supply system is operated for the benefit of all the CO-OP Suppliers irrespective of ownership. Figure II-1 shows each CO-OP Supplier's service area and water intakes and filtration facilities in the Washington metropolitan area. Following is a brief description of the Washington metropolitan area water supply system and each CO-OP Supplier's service area and facilities.

B.) Washington Metropolitan Area Water Supply System

The largest source of raw water in the Washington metropolitan area is the free flowing Potomac River. In addition, there are four major reservoir systems utilized for water supply purposes for the region. They are the Occoquan (upper and lower reservoirs), Patuxent (the combined Tridelphia and T. Howard Duckett reservoirs), Little Seneca, and Jennings Randolph reservoirs. Figure II-2 shows the location of the four major reservoir systems on a map of the Potomac River basin. The Occoquan reservoirs in Virginia, control a drainage area of 595 square miles with an estimated usable total storage of 8.2 billion gallons. The Patuxent reservoirs in Maryland, control a drainage area of 132 square miles with an estimated total usable storage of 9.8 billion gallons. The Little Seneca Reservoir in Montgomery County, Maryland is intended to provide water supply augmentation to the Potomac River a short distance upstream from the Washington metropolitan area water supply intakes. It controls a drainage area of 21 square miles and has an available storage of 3.7 billion gallons. The Jennings Randolph Reservoir, located on the North Branch Potomac River in western Maryland and West Virginia, provides water quality and water supply storage for augmenting Potomac River flows as well as local flood protection. It has a combined storage (water quality and water supply) of 30 billion gallons, of which 13.4 billion gallons is allocated to water supply storage. Its catchment has a drainage area of 263 square miles. Water supply storage in the Little Seneca and Jennings Randolph reservoirs is owned jointly by the three CO-OP Suppliers whereas the Occoquan and Patuxent reservoirs are individually owned by FCWA and WSSC, respectively. When the drought operating rules (defined in the Water Supply Coordination Agreement) are in effect, the system is operated for the benefit of all the CO-OP Suppliers without regard to the proportions by which the suppliers

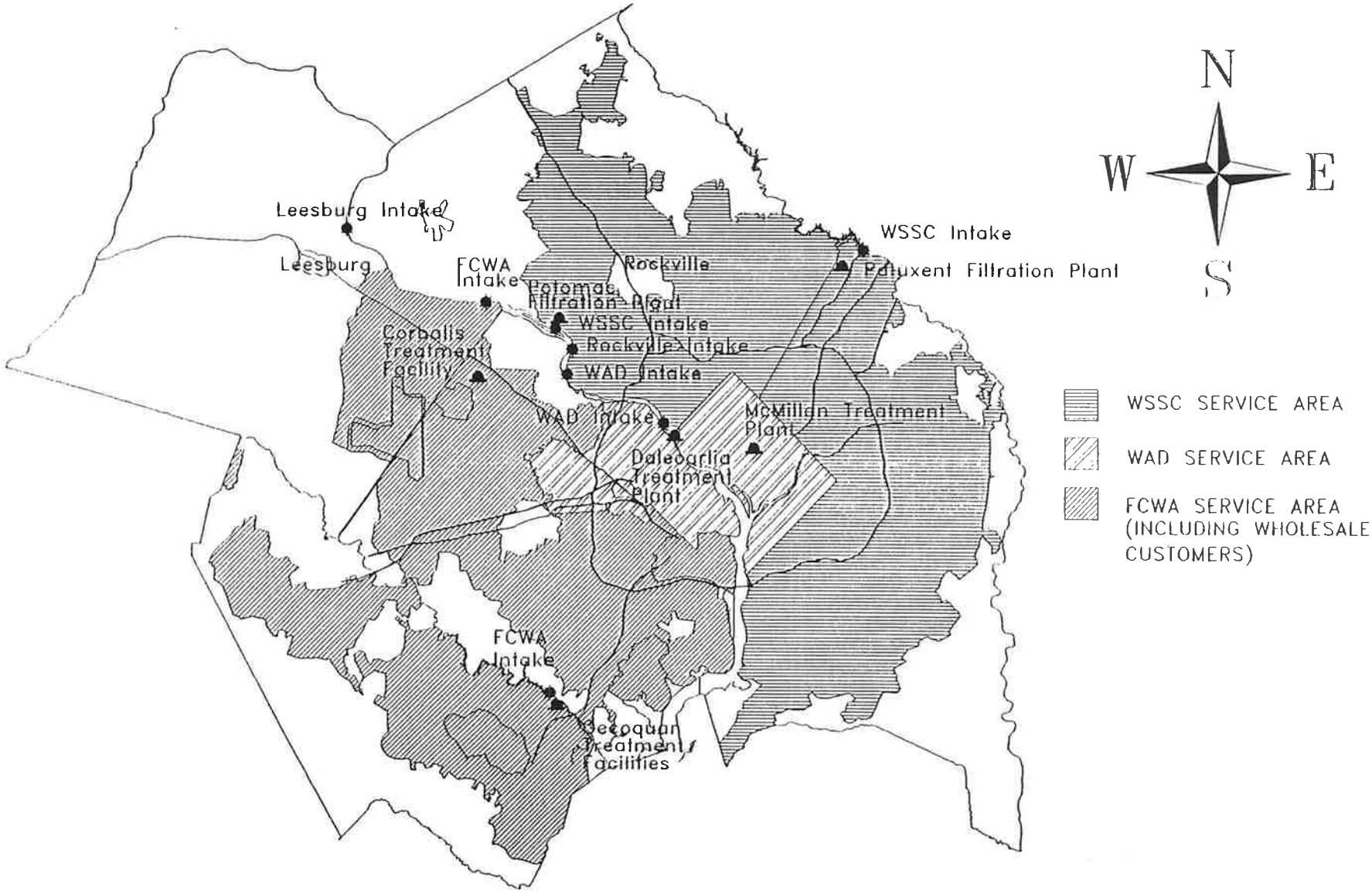


Figure II-1 Each CO-OP Supplier's service area and water intakes and filtration facilities in the Washington metropolitan area.

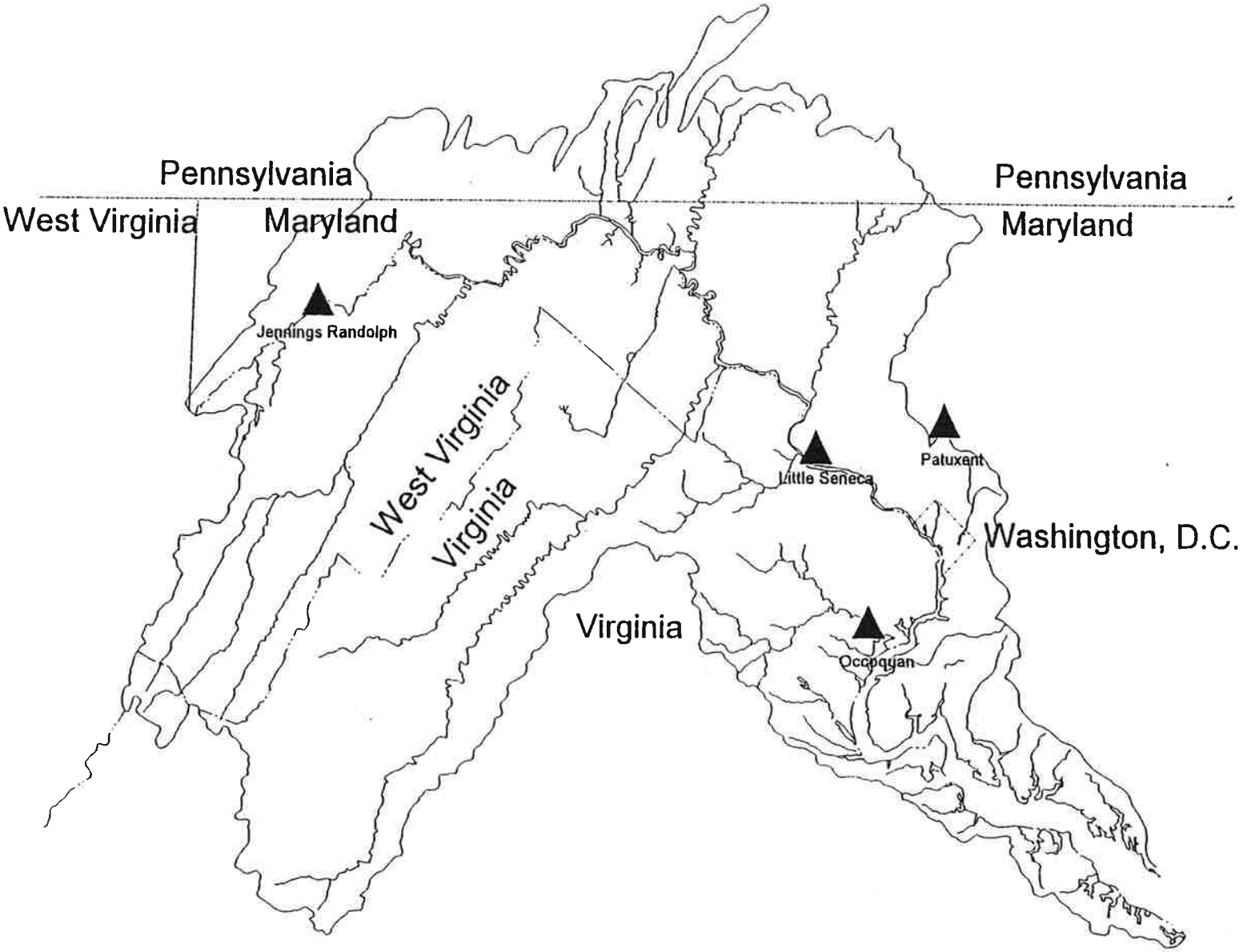


Figure II-2 The Potomac River basin with CO-OP Suppliers' current reservoir sites.

contribute to its cost.

As insight to the relative performance characteristics of these reservoirs, the inflows for each of the reservoirs are shown in Figure II-3 and Figure II-4. Figure II-3 displays cumulative inflows for the period between November 1 and May 31 during more than 50 years of historic and reconstructed records. This November 1 through May 31 period is typically the period when inflows exceed releases and the reservoirs refill. Note that the cumulative inflows are large relative to the storage capacities of 30 and 8.2 billion gallon, respectively, at the Jennings Randolph and Occoquan reservoirs, and in most years the magnitude of their inflows are similar. The similarity of their inflows is interesting because the catchment for the Occoquan Reservoir is more than twice the size of the catchment for the Jennings Randolph Reservoir. However, the catchment for the Jennings Randolph Reservoir is located in the wettest part of the Potomac River Basin and annual average rainfalls in parts of this catchment can be as much as 14 inches greater than the Occoquan Reservoir catchment. The cumulative inflow to the Patuxent Reservoir for this November 1 through May 31 period is less than the net storage capacity of 9.8 billion gallons for at least one year (water supply withdrawals and minimum flow releases during the refill period would increase the number of years when inflow would not refill the reservoir by May 31). The cumulative inflow to Little Seneca Reservoir during this period is relatively small in most years compared to its net capacity of 3.7 billion gallons. In a majority of years an empty Little Seneca Reservoir would not fill between November 1 and May 31.

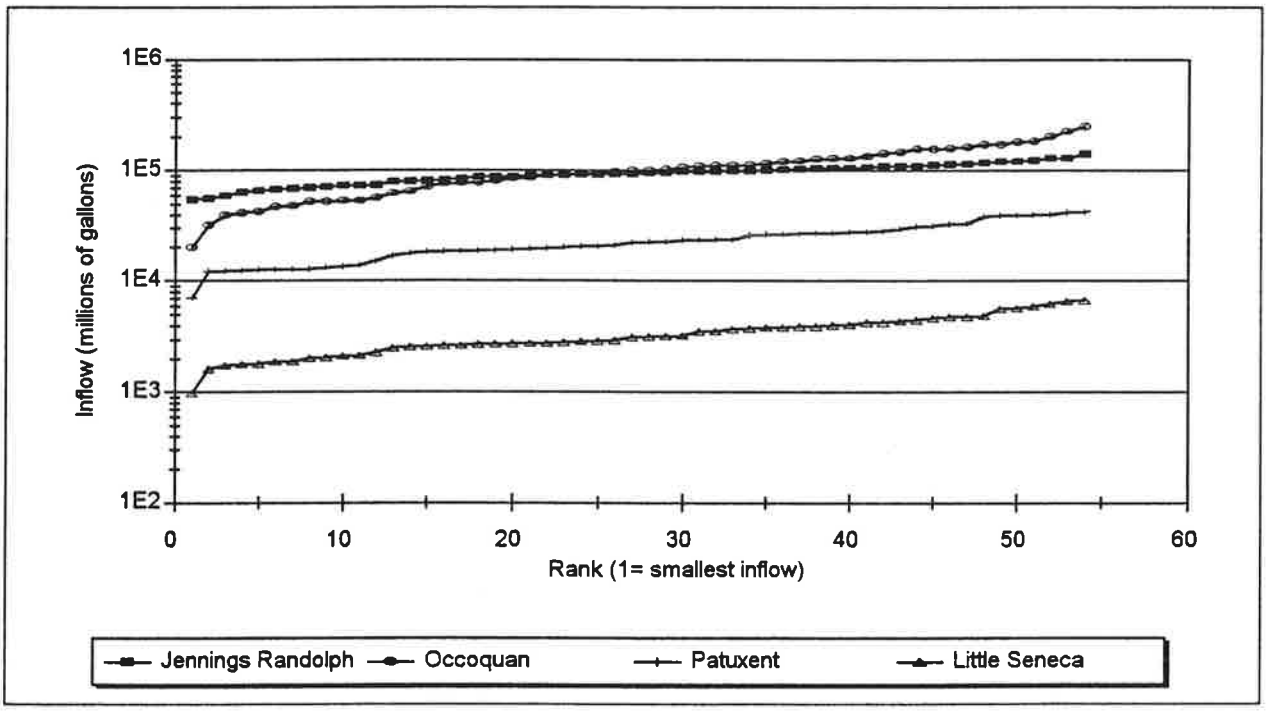


Figure II-3 Total inflows from November 1 through May 31 for water supply reservoirs.

Figure II-4 displays cumulative inflows for the period between June 1 and September 30 during more than 50 years of historic and reconstructed records. This is typically the period when releases exceed inflows and the reservoirs are drawn down. Inflows exceed storage capacity in approximately 68%, 26%, 13% and 4% of the years for the Occoquan, Patuxent, Jennings Randolph and Little Seneca reservoirs, respectively.

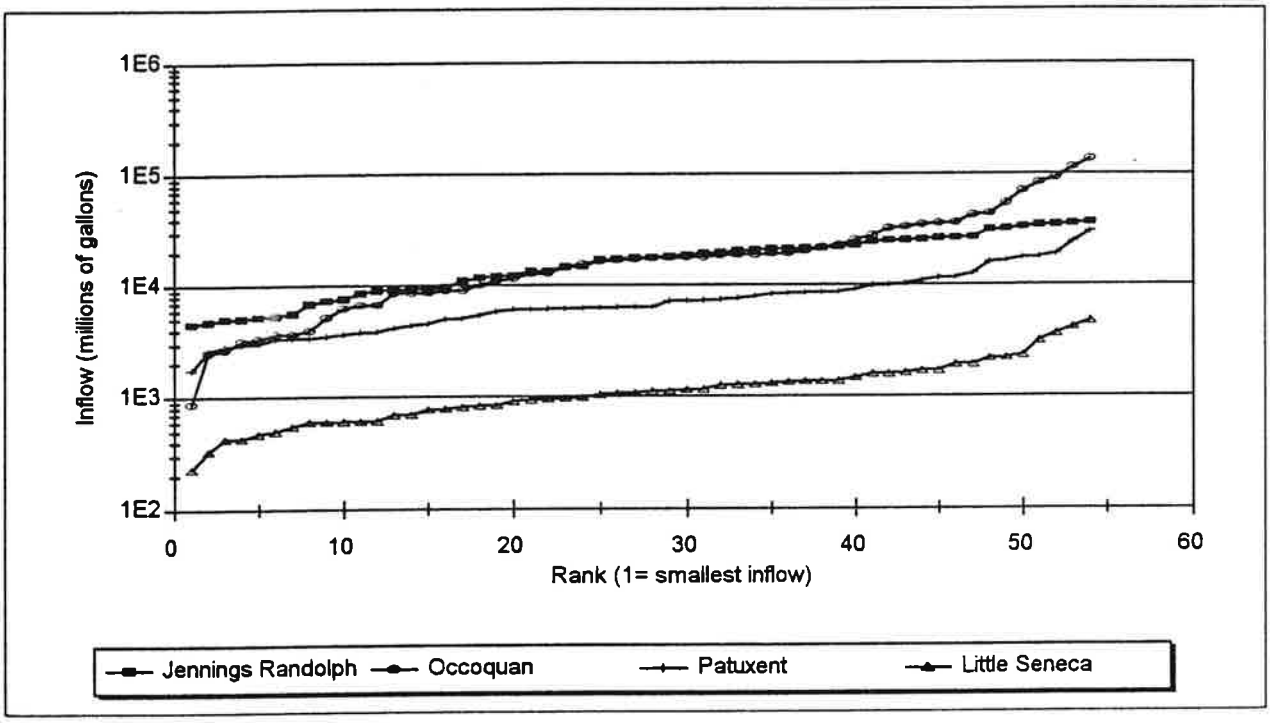


Figure II-4 Total inflows from June 1 through September 30 for water supply reservoirs.

Currently, only the Occoquan and the Patuxent reservoirs are actively operated for water supply purposes. Potomac River flows have not fallen to levels that would require augmentation since the completion of the Jennings Randolph Reservoir in 1981. Because of differing potential yields and treatment capacities for the Occoquan and Patuxent reservoirs, these reservoirs are operated in different manners. In 1994, FCWA obtained about 50.6% of their total production from the Occoquan Reservoir (an average of 58.2 mgd) whereas WSSC obtained about a third of their total production from the Patuxent Reservoir (an average of 56.6 mgd). A caveat must be included, however, that these current operating procedures probably will change in the future. Both WSSC and FCWA are currently undergoing expansion studies to increase the production and delivery capacity of their Potomac River and off-Potomac treatment plants. Once these projects are completed, WSSC's and FCWA's production strategies may be modified.

Although water supply operations have never begun at the Jennings Randolph Reservoir, water quality operations of this reservoir have been in effect since its completion. Water quality

improvement is a significant authorized purpose of both Jennings Randolph and near-by Savage reservoirs. When Savage Reservoir was completed in the early 1950s, its 6.5 billion gallons of storage was the main source of water supply for the town of Westernport, Maryland, and low flow augmentation and pollution abatement for the effluent from the Luke paper mill. It was operated as such until the early 1980s when Jennings Randolph Reservoir was completed. The 16.6 billion gallons of water quality storage in Jennings Randolph Reservoir provides a great boost to water quality as low flow augmentation in the North Branch and throughout the mainstem of the Potomac River. The general operating policy is to maintain the largest combined release from both Jennings Randolph and Savage reservoirs throughout the low flow period in the summer. This policy improves the water quality in the North Branch, and provides water quality benefits all the way down to and including the environmental flow-by requirement at Little Falls near Washington, DC. In addition to maximizing the minimum flow, water quality in the North Branch is also improved by short term high flow releases (called artificially varied flow releases). These are also produced by coordinated releases from both Jennings Randolph and Savage reservoirs.

C.) Washington Aqueduct Division

The Potomac River currently is the sole source of raw water for WAD which is withdrawn at 2 locations. In order to reduce pumping costs, most raw water is withdrawn at the Great Falls Dam and flows by gravity through 2 conduits (the Old Conduit which was completed in 1863 and the New Conduit which was completed in 1926) to the Dalecarlia Reservoir. Raw water flows into the conduits by a gravity weir. When the flow in the river is high the maximum withdrawal that can be made is approximately 210 mgd. As river levels fall, less head exists above the gravity weir so less water can be withdrawn. During low flow periods in the Potomac River the maximum withdrawal at Great Falls is 175 mgd. Additionally withdrawals from the Potomac River are made at the Little Falls Pumping Station. The capacity of this station is about 525 mgd, pumped directly into the Dalecarlia Reservoir. The Little Falls Pumping Station is used mainly to meet demands exceeding the capacity of the conduits during the summer months. All raw water must pass through Dalecarlia Reservoir. Partially treated water is also stored in Georgetown and McMillan reservoirs.

The WAD owns 1 pumping station and 3 in-ground reservoirs with a total finished water capacity of 300 million gallons. WAD pumps treated water to the District of Columbia, Arlington County, and the parts of Fairfax County served by the City of Falls Church. The District of Columbia network includes 4 major pumping stations, 1,300 miles of water mains, eight in-ground reservoirs and four elevated tanks in the system with a total finished water capacity of 110 million gallons. The Arlington County distribution network includes 435 miles of water mains, 4 pumping stations and 3 storage sites with a finished water capacity of 32.5 million gallons. The Falls Church distribution network, serving portions of Fairfax County and Falls Church, includes 455 miles of water mains, 7 pumping stations and 10.9 million gallons in finished water storage. Distribution of finished water is the responsibility of the Water and Sewer Utility Administration (WASUA) in the District of Columbia, the Arlington County Department of Public Works and the

Falls Church Department of Public Utilities. The three distribution networks combined serve over 350,000 households. WAD's peak one day production was 275.9 mg and occurred July 24, 1987.

D.) Fairfax County Water Authority

FCWA's current water supply system consists of four raw water withdrawal and treatment facilities, two solely-owned raw water reservoirs on the Occoquan River (see section II-B), 29 pumping stations, and 42.3 million gallons of finished water distribution storage in their direct service area. FCWA serves approximately 262,400 households in Fairfax County through 2,700 miles of water mains in its direct service area. Virginia-American Water Company (VAWC) distributes water provided wholesale by FCWA to over 70,000 households in the City of Alexandria and Dale City. FCWA also provides water under contract to the Prince William County Service Authority (PWCSA) and the Loudoun County Sanitation Authority (LCSA). Growth in water demands by PWCSA and LCSA will play a large role in FCWA's future overall growth. Smaller quantities of water also are provided wholesale to the town of Herndon, Fort Belvoir, Lorton Correctional Facility, Dulles International Airport, and Vulcan Materials, Inc. FCWA's peak one day production between 1974 - 1994 was 186.9 mg and occurred on June 15, 1994. Since the beginning of this study, FCWA experienced a new peak day production of 189.7 mg on September 4, 1995.

In 1994, 50.6% of FCWA's production came from the Occoquan Reservoir. The reservoir has a useable storage of approximately 8.2 billion gallons. The reservoir supports three interconnected treatment plants with a combined one day treatment capacity of 112 mg. The remainder of FCWA's supply comes from the Potomac River through their Potomac intake, located 18 miles upstream from Chain Bridge (see Figure II-1). The Potomac River raw water intake has a maximum capacity of 150 mgd to 200 mgd, and the associated Corbalis Treatment Plant currently has a treatment capacity of 150 mgd.

E.) Washington Suburban Sanitary Commission

WSSC's current water supply system consists of two raw water supply withdrawal and treatment facilities, two solely owned raw water reservoirs on the Patuxent River (see section II-B), 17 pumping stations, 57 distribution reservoirs (low-level reservoirs, standpipes and elevated tanks) with 188 million gallons of finished water distribution storage and over 4,800 miles of water mains. In 1993 WSSC served more than 530,000 households in Montgomery and Prince George's counties. WSSC also provides minor amounts of treated finished water to Howard County. WSSC's peak one-day production of 267.3 mg occurred on July 8, 1988.

In 1994 approximately 66% of WSSC's raw water came from the free flowing Potomac River. Their Potomac River treatment plant is located north of Watkins Island 14 miles upstream of Chain Bridge (see Figure II-1). The treatment plant has a maximum intake capacity of 400 mgd and a current filtration capacity of 285 mgd. The other major source of raw water is the Patuxent River reservoir system located along the northern border of Prince George's and Montgomery

counties. The two reservoirs on the river, Tridelphia and T. Howard Duckett, with a combined usable capacity of 9.8 billion gallons support the Patuxent River treatment plant which has a maximum intake and filtration capacity of 72 mgd.

F.) Cities of Rockville, Maryland and Leesburg, Virginia

The City of Rockville has an intake structure on the Potomac River approximately 12 miles upstream from Chain Bridge. The Rockville Treatment Plant has as an intake capacity of 8 mgd and a filtration capacity of 8 mgd. Both the intake and filtration capacity are undergoing expansion to 14 mgd. The Town of Leesburg, water supply system consists of three wells and a water treatment plant which is supplied by an intake on the Potomac River located 30 miles upstream from Chain Bridge. The wells supply approximately 25% of the town's annual requirements. The water treatment plant which is undergoing expansion is expected to be rated at 5 mgd in 1996.

G.) Other Water Suppliers

Other major water suppliers in the Washington metropolitan area include Fairfax City and Manassas, Virginia and Bowie, Maryland. There is some interaction between these suppliers and the suppliers described above. Fairfax City withdraws water from the Goose Creek Reservoir. It can supply water on a wholesale basis to LCSA and Herndon, Virginia. The City of Manassas withdraws water from Lake Manassas and supplies finished water to PWCSA in western Prince William County. Manassas can also supplement inflow to FCWA's Occoquan Reservoir via Broad Run. Bowie, Maryland is supplied completely by groundwater and has very little interaction with WSSC.

III.) CURRENT PATTERNS OF WATER PRODUCTION FOR THE CO-OP SUPPLIERS

A.) Introduction

This chapter describes current water production patterns of the CO-OP Suppliers. Throughout this work, the term production refers to observed water usage data and the term demand refers to future water usage. The disaggregation of future annual average water demands to monthly average or peak demands in this study requires an analysis of observed water production patterns. This chapter describes the methods used to develop mean winter water use production factors, mean monthly production factors, mean peak production factors, and probabilistic maximum production factors which are used in subsequent chapters to disaggregate future annual average demands. These factors are calculated using 5 years (1990-1994) of daily production data provided by WAD, FCWA and WSSC. A full listing of the analysis of daily production is contained in Appendix A for WAD, Appendix B for FCWA, Appendix C for WSSC and Appendix D for the CO-OP Suppliers as a whole.

B.) Mean Winter, Mean Monthly and Mean Peak Production Factors

Winter water use reflects the minimal water use within each water supply system. It is the average daily water production from December through February. Mean winter water use production factors are used to disaggregate future annual average demands to average winter water use demands. The winter water use is also necessary to operate the daily operations simulation program to determine the adequacy of supplies to meet future demands. The winter water use factor is calculated from the following equation:

$$WWUF\ (i) = \frac{WWU\ (i)}{AAP\ (i)}$$

where,

WWUF(i) = winter water use factor in year i
WWU(i) = winter water use in year i
AAP(i) = annual average production in year i

Mean winter water use factors are calculated with the following equation:

$$MWWUF = \frac{\Sigma_i WWUF\ (i)}{NYEARS}$$

where,

MWWUF = mean winter water use factor

NYEARS = number of years of production data

The mean winter water use factors for each CO-OP Supplier and for the CO-OP Suppliers as a whole are shown in Table III-1.

Table III-1 Mean winter water use factors for WSSC, FCWA, WAD and the CO-OP total, calculated from 1990-1994 production data.

WAD	FCWA	WSSC	CO-OP total
0.913	0.879	0.926	0.910

Mean monthly production factors are used to disaggregate future annual average daily demands to monthly average daily demands. These factors reflect seasonal water use patterns within each water supply system. Ratios of monthly average production to annual average production are calculated for each year of data utilizing the following equation:

$$MPF(i,j) = \frac{MAP(i,j)}{AAP(i)}$$

where,

MPF(i,j) = monthly production factor in year i and month j
MAP(i,j) = monthly average production in year i and month j

Mean monthly production factors for each month then are calculated with the following equation:

$$MMPF(j) = \frac{\Sigma_i MPF(i,j)}{NYEARS}$$

where,

MMPF(j) = mean monthly production factor for month j

The mean monthly production factors for each of the CO-OP Suppliers and the CO-OP Suppliers as a whole are shown in Table III-2. Appendices A-D contain full listings of monthly production factors calculated from the 1990-1994 time period.

Table III-2 Mean monthly production factors for WSSC, FCWA, WAD and the CO-OP total, calculated from 1990-1994 production data.				
	WAD	FCWA	WSSC	CO-OP total
January	0.93	0.89	0.94	0.93
February	0.90	0.86	0.91	0.90
March	0.91	0.88	0.91	0.90
April	0.95	0.94	0.94	0.94
May	0.99	1.04	1.01	1.01
June	1.10	1.19	1.13	1.13
July	1.17	1.21	1.16	1.17
August	1.12	1.11	1.09	1.11
September	1.08	1.07	1.05	1.07
October	1.00	0.98	0.98	0.99
November	0.95	0.92	0.95	0.94
December	0.90	0.90	0.92	0.91

Mean peak 1-day and mean peak 7-day production factors are used to disaggregate future monthly average daily demands to peak 1 and peak 7-day demands within each month. Ratios of peak 1-day to monthly average daily production are calculated for each year of data using the following equation:

$$P1PF\ (i,j) = \frac{P1P\ (i,j)}{MAP\ (i,j)}$$

where,

P1PF(i,j) = peak 1-day production factor in year i and month j
P1P(i,j) = peak 1 day production in year i and month j

Ratios of peak 7-day to monthly average daily production are calculated in the same manner. Mean peak 1-day production factors are calculated for each month using the following equation and are shown in Table III-3 for each CO-OP Supplier and the CO-OP Suppliers as a whole.

$$MP1PF\ (j) = \frac{\Sigma_i P1PF\ (i,j)}{NYEARS}$$

where,

MP1PF(j) = mean peak 1 day production factor for month j

The mean peak 7-day production factors are calculated in a similar fashion and are also shown in Table III-3. A full listing of peak 1-day and peak 7-day production factors for each year of data is shown in Appendices A-D.

Table III-3 Mean peak 1-day and 7-day factors, calculated from 1990-1994 production data.

	WAD		FCWA		WSSC		CO-OP total	
	1-day	7-day	1-day	7-day	1-day	7-day	1-day	7-day
January	1.20	1.06	1.09	1.03	1.12	1.05	1.10	1.04
February	1.10	1.03	1.08	1.02	1.09	1.02	1.06	1.02
March	1.08	1.02	1.09	1.02	1.08	1.02	1.05	1.02
April	1.13	1.05	1.15	1.07	1.11	1.05	1.09	1.05
May	1.15	1.07	1.20	1.10	1.13	1.06	1.14	1.07
June	1.14	1.06	1.26	1.12	1.20	1.09	1.17	1.09
July	1.14	1.07	1.29	1.15	1.19	1.12	1.17	1.10
August	1.11	1.04	1.20	1.08	1.13	1.06	1.11	1.05
September	1.13	1.06	1.20	1.10	1.12	1.06	1.12	1.07
October	1.08	1.03	1.11	1.05	1.11	1.03	1.07	1.03
November	1.11	1.04	1.10	1.02	1.09	1.03	1.06	1.02
December	1.15	1.06	1.08	1.03	1.08	1.02	1.07	1.03

The mean peak production factors calculated over continuous 30, 60, 90, 120 and 180-day time periods are displayed in Table III-4. These production factors will be used to estimate future peak demands over the 30-180 day time periods from forecasts of future annual average demands. The equation to calculate the 30-day peak production factor for each year of data is:

$$P30PF\ (i) = \frac{P30P\ (i)}{AAP\ (i)}$$

where,

P30PF(i) = peak 30 day production factor in year i
P30P(i) = peak 30 day production in year i

The means of these peak production factors then are calculated in a similar fashion as described above. Appendices A-D contain peak production factors calculated over continuous 30, 60, 90, 120, and 180-day time periods for each year from 1990-1994 and their period of occurrence.

Table III-4 Mean peak 30, 60, 90, 120 and 180-day production factors, calculated from 1990-1994 production data.

	WAD	FCWA	WSSC	CO-OP total
30-day	1.19	1.28	1.19	1.20
60-day	1.16	1.23	1.16	1.17
90-day	1.14	1.19	1.13	1.15
120-day	1.12	1.16	1.11	1.13
180-day	1.08	1.11	1.07	1.08

It is important to note that these peak period factors are calculated on a mean basis. Thus, they represent peak period productions that are forecast to occur in a statistically average year. High extremes in production are more significant to the operations of water suppliers. The ensuing section on probabilistic maximum production factors addresses the potential high extremes in production.

C.) Probabilistic Maximum Production Factors

This section describes the development of maximum 1-day and maximum 7-day production factors useful for estimating high extremes in future demands. These factors, termed probabilistic maximum 1-day and 7-day production factors are developed using a probabilistic framework. The probabilistic 1-day and 7-day production factors are associated with a percent probability of exceedence and will be used to forecast future maximum 1-day and 7-day demands. These factors can be used to size distribution facilities and estimate upper bounds on system demands.

Developing probabilistic maximum production factors involves assuming a probability distribution for each set of production factors (for example, the set of yearly maximum 1-day production factors for WAD) and testing whether the hypothesized distribution could be accepted. The assumed probability distribution and statistical parameters (mean and standard deviation) developed for each set of production factors then are used to develop probabilistic maximum 1-day and 7-day production factors with a small exceedence probability. Maximum 1-day and 7-day production factors for the individual CO-OP Suppliers and the CO-OP Suppliers as a whole are displayed in Table III-5. This table also shows the mean, standard deviation and maximum for each data set.

Table III-5 Maximum 1-day and 7-day production factors (peak/annual average demands) for 1990-1994. Also displayed are the mean, standard deviation and maximum for each set of data.

	WAD		FCWA		WSSC		CO-OP total	
	1-day	7-day	1-day	7-day	1-day	7-day	1-day	7-day
1990	1.33	1.22	1.53	1.35	1.41	1.25	1.36	1.24
1991	1.38	1.30	1.63	1.46	1.50	1.33	1.43	1.33
1992	1.33	1.23	1.53	1.31	1.36	1.28	1.33	1.27
1993	1.38	1.32	1.64	1.51	1.45	1.39	1.44	1.39
1994	1.30	1.23	1.63	1.47	1.33	1.23	1.37	1.28
Mean	1.344	1.261	1.593	1.420	1.409	1.296	1.387	1.301
S.D.	0.032	0.041	0.050	0.075	0.061	0.057	0.044	0.055
Max	1.38	1.32	1.64	1.51	1.50	1.39	1.44	1.39

Each set of maximum production factors is assumed to come from a normally distributed population. Based on a chi-square goodness-of-fit test run on each set of data, it was concluded that this hypothesis could not be rejected. Utilizing the standard normal curve and normal deviate, probabilistic maximum production factors associated with 1%, 2% and 5% exceedence probabilities were calculated. The probabilistic maximum 1-day and 7-day production factors for these exceedence probabilities are shown in Table III-6 and III-7 respectively. Based on the observed maximum production factors and the possibility of an upward trend in these factors discussed in the next section, the probabilistic maximum 1-day and 7-day production factors associated with a 1% probability of being exceeded will be used to forecast future maximum 1-day and 7-day demands.

Table III-6 Probabilistic maximum 1-day production factors for 5%, 2% and 1% exceedence probability, calculated from 1990-1994 production data.

	WAD	FCWA	WSSC	CO-OP total
5% exceedence	1.40	1.67	1.51	1.46
2% exceedence	1.41	1.70	1.53	1.48
1% exceedence	1.42	1.71	1.55	1.49

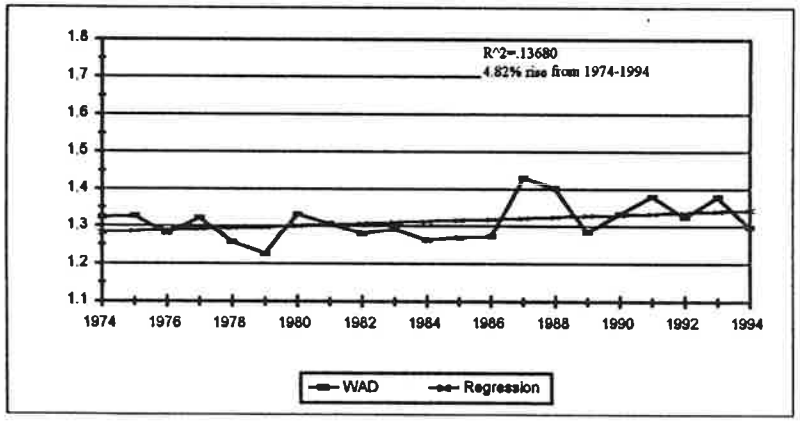
Table III-7 Probabilistic maximum 7-day production factors for 5%, 2% and 1% exceedence probability, calculated from the 1990-1994 data.

	WAD	FCWA	WSSC	CO-OP total
5% exceedence	1.33	1.54	1.39	1.39
2% exceedence	1.34	1.57	1.41	1.41
1% exceedence	1.36	1.59	1.43	1.43

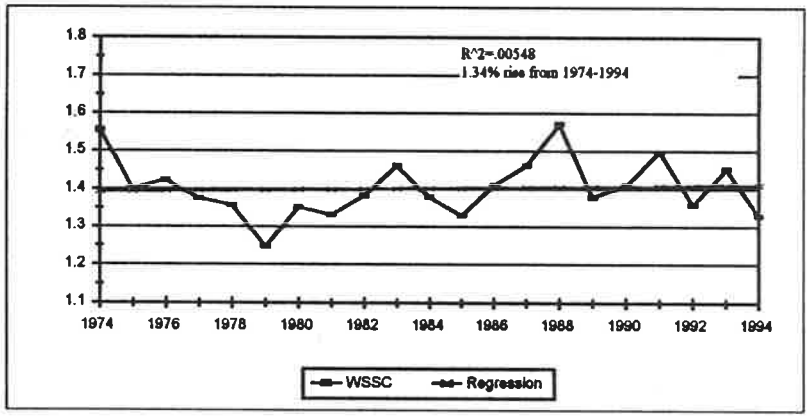
D.) Potential Trends in Production Factors

Implicit in the utilization of constant production factors calculated from current production data (to disaggregate future annual average demands) is the assumption that these factors will remain stationary throughout the forecast period. This assumption will be examined for two particular cases. Figure III-1 (a)-(d) shows plots of linear regression lines through annual maximum day production factors. These figures show a slight upward trend in these factors over time. However, R-squared values for these regression lines are low (0.005-0.184) and the overall trend is small (1%-8% rise from 1974-1994). The slope of the regression is not significantly different from zero.

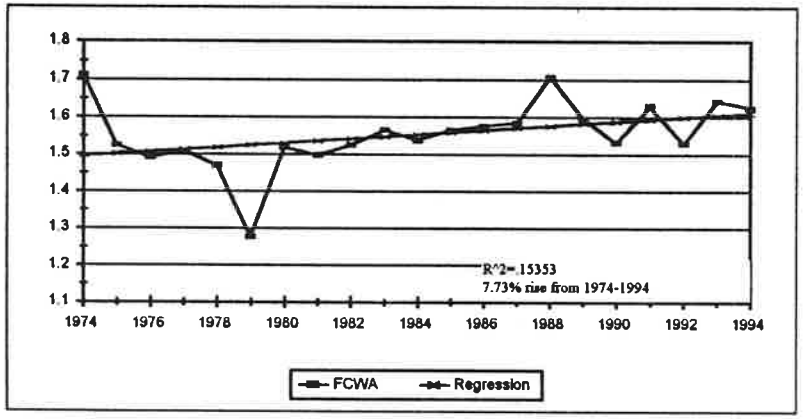
Monthly production factors may also be non-stationary. Figure III-2 (a) and (b) show monthly production factors for each of the CO-OP Suppliers calculated over the 1974-1994 and the 1990-1994 time period respectively. A comparison of these two figures shows each CO-OP Supplier currently displaying a greater range in their monthly production factors compared to the earlier data. All CO-OP Suppliers are currently experiencing higher June and July mean monthly production factors and lower winter production factors then the 1974-1994 data. Again, these changes are not large and not considered further. Thus, although the assumption of stationarity is a reasonable one, it may not be true in the strictest sense and further study is warranted.



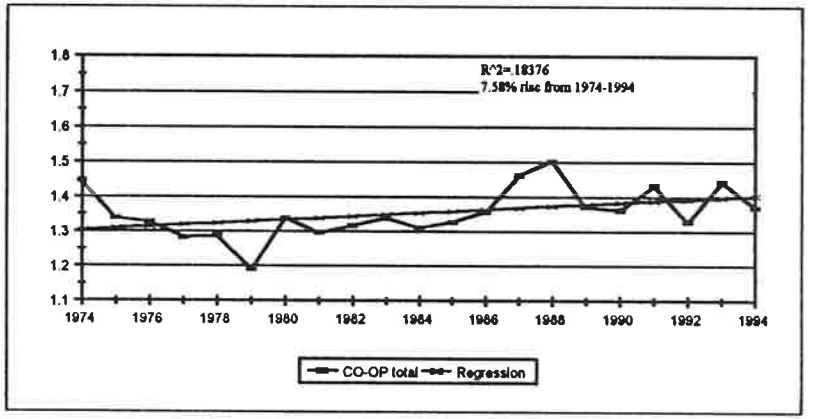
(a)



(c)

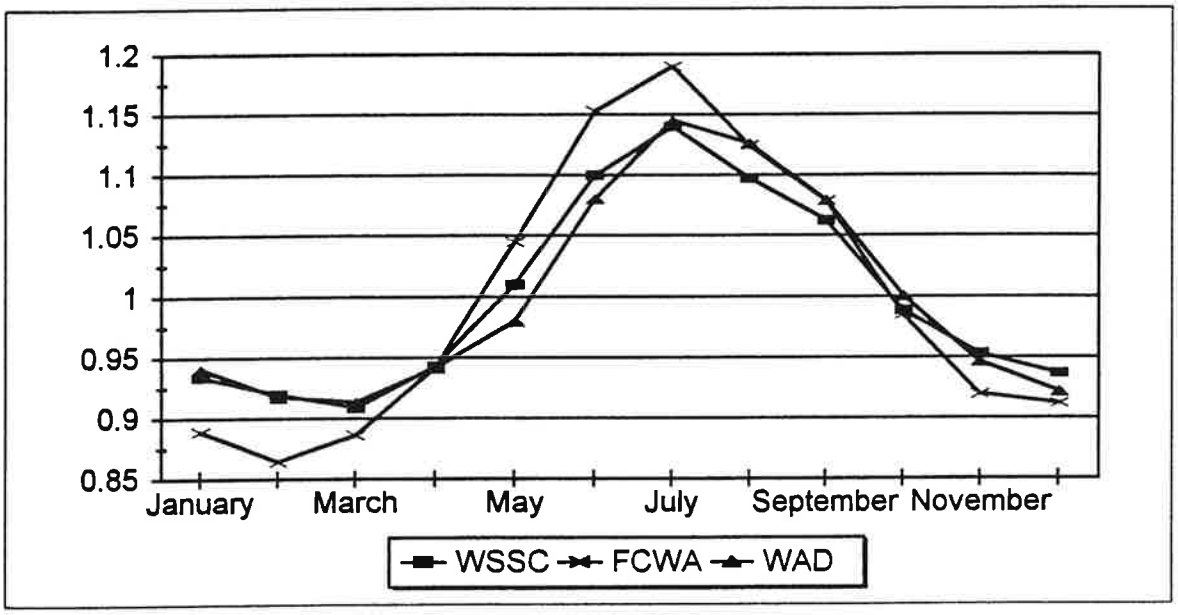


(b)

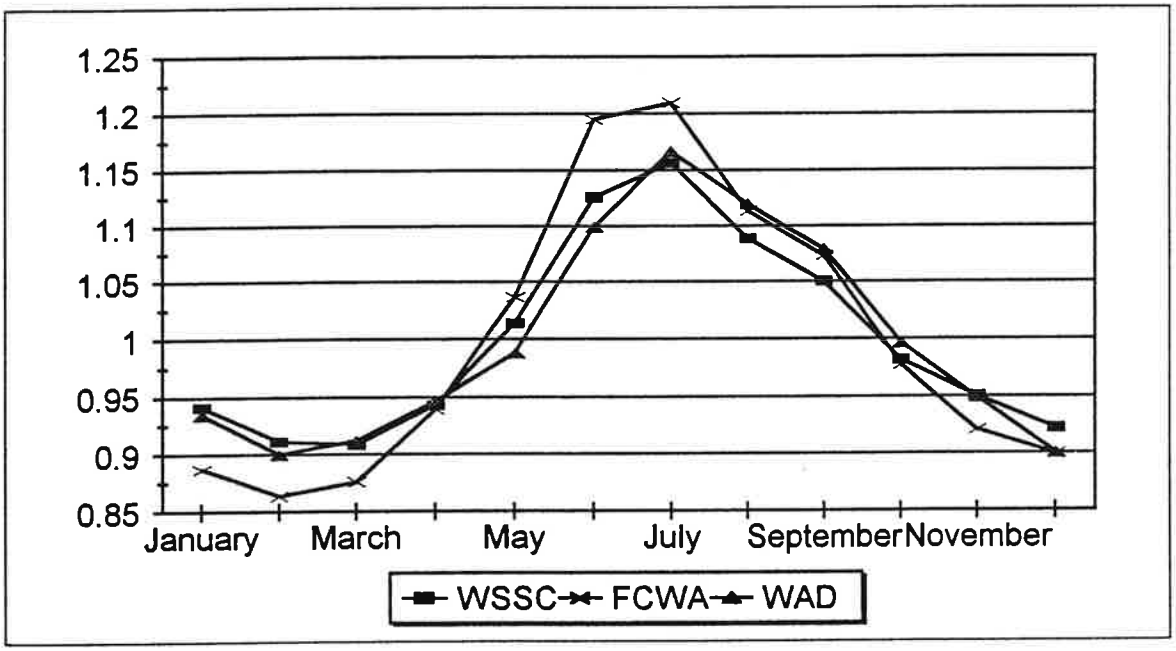


(d)

Figure III-1 Actual and regressed annual maximum day production factors for (a) WAD, (b) FCWA, (c) WSSC and (d) CO-OP total.



(a)



(b)

Figure III-2 Monthly production factors for each supplier averaged from (a) 1974-1994 and (b) 1990-1994.

E.) Changes in Water Supply Production During 1974-1994 Time Period

A review of the recent production data shows the CO-OP Suppliers' water supply needs growing during the 1974-1994 time period. Figure III-3 shows the CO-OP Suppliers' annual average production has grown by 25% over the past 21 years, from 380.3 mgd in 1974 to 474.6 mgd in 1994. During the same period, this figure shows the CO-OP Suppliers' summer (June-September) average production has also grown by 25%, from 421.3 mgd to 527.5 mgd. The largest summer production of 538.0 mgd occurred in 1990. Figure III-4 shows annual average production for each of the CO-OP Suppliers. WAD's annual average production of 186.2 mgd was 4% lower than their production of 194.6 mgd in 1974. WAD's annual average production reached a peak of 215.6 mgd in 1985, followed by cycles of decreasing and increasing production. FCWA's annual average production of 114.9 mgd in 1994 was 116% larger than their production of 53.2 in 1974. WSSC's annual average production grew from 132.5 mgd to 173.4 mgd from 1974 to 1994, an increase of 31%. Much of the growth in production for the suburban suppliers may be due to new development and/or expansion of the distribution areas.

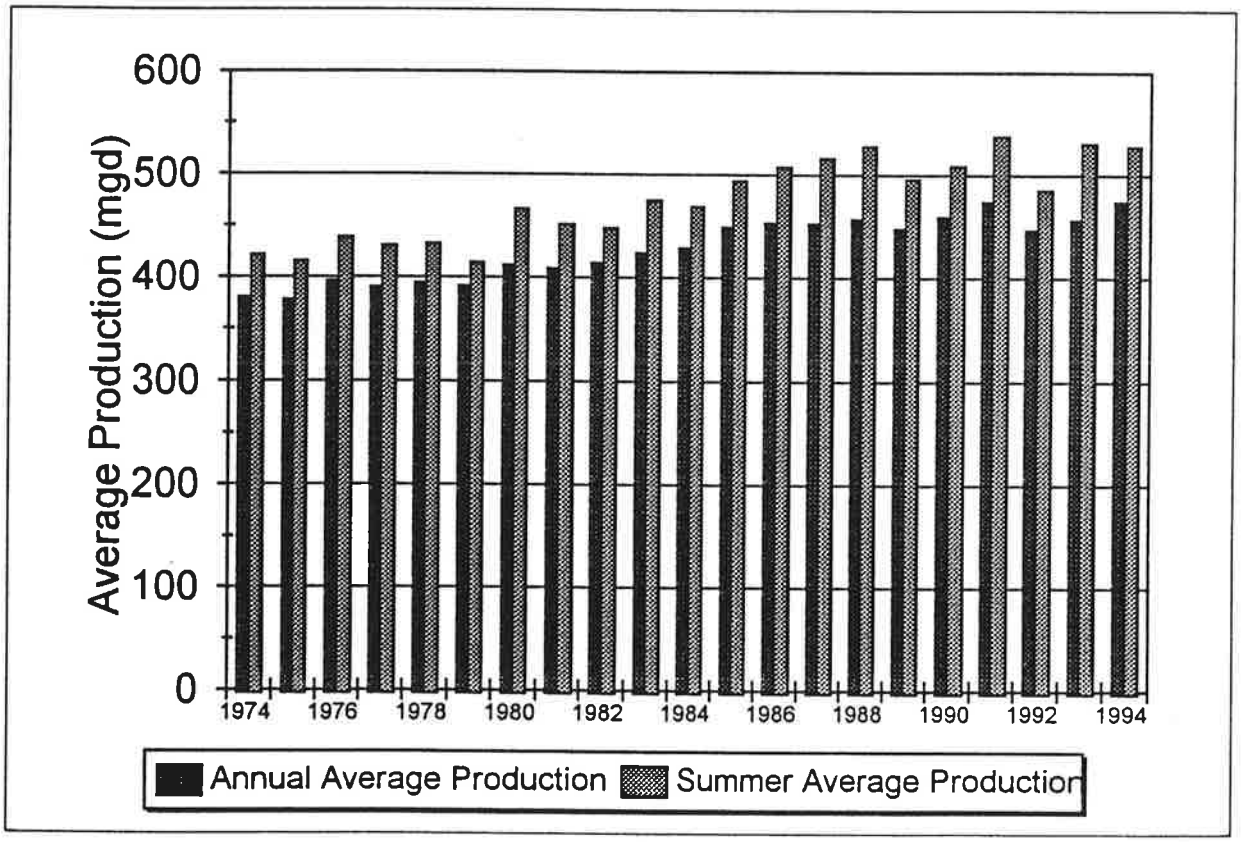


Figure III-3 CO-OP total annual average production and summer average production from 1974 to 1994.

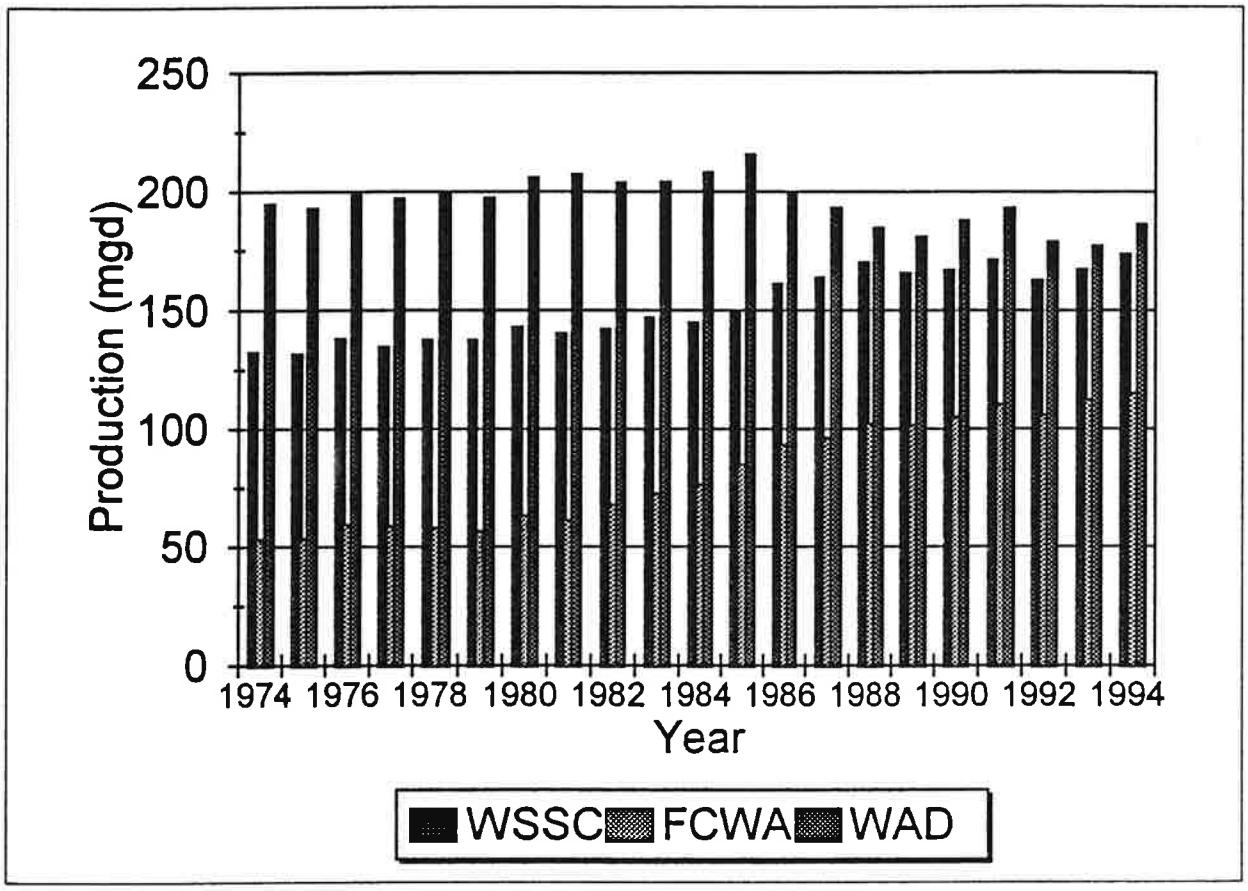


Figure III-4 Annual average production for each CO-OP Supplier from 1974 through 1994.

IV.) DEVELOPMENT OF THE LONG TERM DEMAND FORECASTING MODEL

A.) Introduction

A long term raw water demand forecasting model for the Washington metropolitan area is described in the following sections. The model uses independent forecasts of numbers of households and employees with dwelling unit information and water use data to forecast annual average water demands from 1990 to 2020 in million gallons per day (mgd). Future water demands are disaggregated among 7 water suppliers with 22 distinct service areas. Future annual average demands are further disaggregated into monthly average and peak period demands utilizing historic production factors developed in Chapter III.

Household and employment forecasts are provided by the Metropolitan Washington Council of Governments Round 5 Cooperative Forecasting Program. The Round 5 Cooperative Forecasting Program disaggregates the demographic forecasts into almost 1400 geographic zones, termed COG Analysis Zones or CAZs. The long term raw water demand forecasting model aggregates the CAZ household and employment forecasts by a delineation of each water supplier's present and future service area for each forecast year. The dwelling unit information is then applied to separate the household forecast into single family and multi-family units. Water use data was used to calculate unit use rates for the three classes of service; single-family, multi-family and employee, for each service area. Water demand forecasts for each service area were then computed by multiplying the number of units in each class of service forecast by the appropriate unit use rate. Following is a detailed description of the forecasts, delineation of service area, dwelling unit information and unit use rates used to compute the annual average water demands.

B.) Cooperative Forecasting Program

Estimates of population, households, and employment to the year 2020 utilized in the long term water demand model come from the Cooperative Forecasting: Round 5 Technical Report (Metropolitan Washington Council of Governments, 1994). The Cooperative Forecasting Program produces a consistent set of demographic forecasts for use in regional and local planning. It combines the efforts of the Metropolitan Washington Council of Governments (MWCOG), the Maryland-National Capital Park and Planning Commission (MNCPPC), and local governments. The planning area covers Loudoun, Prince William, Fairfax, Arlington and Stafford counties in Virginia; Frederick, Montgomery, Prince George's, Charles and Calvert counties in Maryland; and the District of Columbia. Since the program's inception in 1975, the Cooperative Forecasting Program has issued five sets of forecasts. The most recent set of forecasts, Round 5, was completed in October 1994 and is used in this study.

The process uses both regionally and locally derived information as inputs to predict the location and magnitude of future population, households and employment. On a regional scale, local and national demographics and economic trends are used to create a statistical benchmark for the area as a whole. Local jurisdictions also develop their own local forecasts based on such

information as building permits, site plans, or local policy using an agreed-upon set of guidelines. Regional projections are then reconciled with the jurisdiction's totals to produce local forecasts that are technically sound and politically acceptable. The local governments produce CAZ forecasts which allocate population, households and employment within the smaller districts. Thus, forecasts of water demands can be made at the CAZ level.

C.) Demographic Data

The Round 5 Cooperative Forecasting Program produced forecasts for low, intermediate, and high growth scenarios. The intermediate or "most likely" forecasts are used in the long term water demand model. Increases in future water demands forecasted by the long term water demand model reflect demographic trends reported in the Round 5 intermediate growth estimates.

Several highlights of the Round 5 intermediate forecasts are worth noting. A comparison of the 1990 and 2020 household and employment forecasts is shown in Table IV-1. Overall, population in the Washington metropolitan area is predicted to grow by 41% over the 1990-2020 forecast period, from 3.9 to 5.5-million people. Over this same period, the number of households in the Washington metropolitan area is forecasted to rise by 600,000 to 2.1-million in 2020 and employment by 1.3-million to 3.8-million in 2020. The number of households within the District of Columbia is expected to show a slight increase from 249,600 in 1990 to 251,900 in 2020. Employment in the District of Columbia is forecasted to increase 159,600 jobs in the same period. The number of households is expected to increase from 78,500 to 101,400 in Arlington County between 1990 and 2020. The number of employees in Arlington County is expected to increase from 183,100 to 281,000 jobs during the same time period. The number of households within Fairfax County is expected to increase from 292,300 in 1990 to 437,200 in 2020. Employment within Fairfax County is expected to increase from 407,700 to 678,400 in the same time period. The households in Loudoun County are forecasted to nearly triple from 30,700 in 1990 to 89,200 in 2020. The employment in Loudoun County is expected to increase from 39,300 to 115,000 jobs during this time. The households in Prince William County are expected to almost double from 69,700 in 1990 to 135,700 in 2020. Employment in Prince William County during the same time period is expected to increase from 65,800 to 160,200 jobs. The Maryland suburbs are also forecasted to show dramatic increases in households and employment between 1990 and 2020. The households within Montgomery County are forecasted to increase from 282,000 in 1990 to 400,000 in 2020. During the same time period employment in Montgomery County is expected to increase by 234,500 jobs from the 465,500 jobs in 1990. The number of households is expected to increase from 258,000 to 359,400 in Prince George's County between 1990 and 2020. Employment in Prince George's County is expected to increase from 310,400 to 493,600 during the same time period.

Table IV-1 Summary of Round 5 household and employment forecasts (thousands).						
	Households			Employment		
Jurisdiction	1990	2020	Increase (%)	1990	2020	Increase (%)
District of Columbia	249.6	251.9	0.9	747.3	906.9	21.4
Arlington County	78.5	101.4	29.2	183.1	281.0	53.5
Fairfax County	292.3	437.2	49.6	407.7	678.4	66.4
Loudoun County	30.7	89.2	190.6	39.3	115.0	192.6
Prince William County	69.7	135.7	94.7	65.8	160.2	143.5
Montgomery County	282.0	400.0	41.8	465.5	700.0	50.4
Prince George's County	258.0	359.4	39.3	310.4	493.6	59.0

The household and employment forecasts, in part, drive the water demand forecast model. It is useful to compare the data compiled by the Round 5 demographic forecast used in this report with the Round 4 forecasts used in the 1990 water demand forecast model. Round 4 and Round 5 have overlapping forecasts for the 1990 to 2010 time period which makes for an easy comparison. Overall, the household forecasts in the Washington metropolitan area reported in Round 5 are significantly lower than those reported in Round 4. The Round 5 employment forecasts for the Washington metropolitan area are larger than the Round 4 employment forecasts in 1990 and smaller than the Round 4 employment forecasts for the remainder of the forecast time period. The difference between the Round 5 and Round 4 forecasts varies significantly with each jurisdiction. Round 4 and Round 5 household forecasts during the overlapping period of 1990 to 2010 for each jurisdiction is compared in Table IV-2. A similar comparison for employment forecasts is shown in Table IV-3.

D.) Delineation of Service Area

The household and employment forecasts are provide by COG Analysis Zones, or CAZs, which are then aggregated by the service area boundaries of each water supplier. Questionnaires and interviews were conducted with officials from the water suppliers in the Washington metropolitan area. These interviews concentrated on developing an accurate delineation of each supplier's present and future service areas. They also were used to develop unit use factors and provide a description of current water supply facilities.

Table IV-2 Comparison of Round 4 and Round 5 household forecasts (thousands).

	1990		1995		2000		2005		2010	
Jurisdiction	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5
District of Columbia	259.3	249.6	261.6	252.3	265.2	254.7	267.7	254.6	264.8	252.1
Arlington County	81.4	78.5	84.8	85.7	88.6	89.7	92.3	93.6	96.0	96.3
City of Alexandria	55.6	53.3	57.6	56.6	59.2	58.8	60.7	61.4	61.9	64.4
Montgomery County	280.0	282.0	312.0	300.0	339.0	326.0	359.0	351.0	371.0	368.5
Prince George's County	262.9	258.0	278.2	277.1	295.0	294.6	313.7	310.9	337.0	326.4
Fairfax County	286.9	292.3	330.8	316.6	363.7	340.8	380.3	362.7	392.8	386.0
Loudoun County	31.0	30.7	40.8	37.4	51.9	44.8	64.1	54.1	77.4	65.3
Prince William County	77.0	69.7	96.7	78.3	108.6	89.6	117.3	103.3	126.0	114.9
Region	1,334.1	1,314.1	1,462.5	1,404.0	1,571.2	1,499.0	1,655.1	1,591.6	1,726.9	1,673.9

Table IV-3 Comparison of Round 4 and Round 5 employment forecasts (thousands).

	1990		1995		2000		2005		2010	
Jurisdiction	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5	Round 4	Round 5
District of Columbia	718.2	747.3	780.0	779.9	816.7	816.8	851.2	851.2	886.0	885.9
Arlington County	214.6	183.1	235.5	207.1	245.0	234.3	254.3	252.5	263.6	264.6
City of Alexandria	94.7	92.2	124.1	101.1	148.3	106.8	162.8	116.1	167.6	125.0
Montgomery County	455.0	465.5	515.0	464.0	575.0	519.0	625.0	575.0	670.0	625.0
Prince George's County	311.8	310.4	348.1	326.1	386.4	355.2	425.9	389.2	473.0	426.6
Fairfax County	366.0	407.7	432.7	438.5	496.1	511.5	536.1	567.0	577.1	612.9
Loudoun County	33.8	39.3	46.3	48.9	61.2	60.4	78.5	72.7	98.3	85.8
Prince William County	58.8	65.8	67.3	76.1	79.4	90.1	96.6	106.9	119.6	126.7
Region	2,252.9	2,311.3	2,549.0	2,441.7	2,808.1	2,694.1	3,030.4	2,930.6	3,255.2	3,152.5

The Washington Aqueduct Division includes approximately 450 CAZs which are aggregated into five service areas. WAD's service areas include the District of Columbia, Arlington County, the area served by Falls Church Department of Public Utilities (serving the City of Falls Church, the Town of Vienna and portions of Fairfax County), National Airport and a smaller service area made up of the Pentagon, Arlington Cemetery and Fort Myer. The service areas with their respective CAZs are listed in Appendix E. The Fairfax County Water Authority service area includes all of their direct retail service area in Fairfax County and the wholesale service areas in Loudoun and Prince William counties, and through the Virginia American Water Company (VAWC) to the City of Alexandria and Dale City. It also includes their smaller wholesale customers of Herndon, Dulles Airport, Fort Belvoir and Lorton Correctional Facility. FCWA's forecast covers more than 420 CAZs (listed in Appendix F). The Washington Suburban Sanitary Commission's service area includes Montgomery County and Prince George's County. It covers almost 550 CAZs (listed in Appendix G). In addition, the cities of Rockville, Fairfax, Manassas and Leesburg are treated separately from the above suppliers (CAZs listed in Appendix H).

E.) Dwelling Unit Ratios

Single family to multi-family dwelling unit ratios are used to estimate the number of each housing type from estimates of undifferentiated households made in the Round 5 forecast. Dwelling unit ratios for the major jurisdictions in the Washington metropolitan area are shown in Table IV-4. The ratios are compiled using information from the District of Columbia Office of Planning, Arlington County Department of Community Planning, Housing and Development, Fairfax County Government Office of Management and Budget, the City of Alexandria Department of Planning and Zoning, the Loudoun County Department of Planning, the Prince William County Office of Mapping and Information Resources, the Montgomery and Prince George's offices of the Maryland National Capital Park and Planning Commission, the City of Rockville Planning Division, the City of Fairfax, and the City of Manassas Department of Planning. For the smaller service areas, assumptions were made to ascertain a dwelling unit ratio. The service area supplied by the Falls Church Department of Utilities overlaps three jurisdictional boundaries: the City of Falls Church, the Town of Vienna and portions of Fairfax County. The dwelling unit ratio for the Falls Church service area was therefore determined from water billing information of the number of single family units served and from the COG Round 5 forecast of the total households in that service area. The number of household units in the National Airport, Pentagon, Arlington Cemetery, Fort Myer, Dulles Airport and the Lorton Correctional Facility service areas was negligible and the dwelling unit ratio was assumed to be zero. The Dale City service area was assumed to have the same dwelling unit ratio as Prince William County. Both the Town of Herndon and the Fort Belvoir service areas were assumed to have the same dwelling unit ratio as Fairfax County. The dwelling unit ratio in the Town of Leesburg service area was assumed to correspond with Loudoun County, and Andrews Air Force Base with Prince George's County.

Table IV-4 Single family to multi-family dwelling unit ratios (number of single family units/ number of multi-family units) for the major jurisdictions in the Washington metropolitan area.

Jurisdiction	1990	1995	2000	2005	2010	2015	2020
District of Columbia	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Arlington County	0.70	0.70	0.70	0.70	0.70	0.70	0.70
Fairfax County	3.19	3.2	3.18	3.15	3.08	3.02	2.95
City of Alexandria	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Loudoun County	5.23	5.27	4.44	4.15	4.01	3.94	3.90
Prince William County	4.44	4.44	4.44	4.44	4.44	4.44	4.44
Montgomery County	2.36	2.3	2.21	2.09	2.03	2.00	1.98
Prince George's County	1.62	1.78	1.90	2.00	2.10	2.18	2.25
City of Rockville	3.15	3.19	2.42	2.39	2.26	2.28	2.28
City of Fairfax	2.33	2.33	2.33	2.33	2.33	2.33	2.33
City of Manassas	3.5	3.5	3.5	3.5	3.5	3.5	3.5

These ratios are assumed to be constant throughout the water supply service areas within each political jurisdiction, even though the water supply distribution area boundaries do not correspond exactly with the political jurisdiction boundaries. For example, WSSC does not serve all of Montgomery County. However, when estimating the number of single and multi-family households in WSSC's service area in Montgomery County, the factors calculated countywide are used. The primarily rural western and northern portions of Montgomery County and the City of Rockville are not serviced by WSSC. These areas contain a higher percentage of single family households than the rest of the county. Therefore, using the jurisdictional estimation of single family to multi-family residences for WSSC's service area within Montgomery County will overestimate the number of single family residences within WSSC's service area in Montgomery County. This error is probably not large due to the small percentage of households in Montgomery County not served by WSSC. For other jurisdictions where the water supplier does not serve a large percentage of households within the jurisdiction, such as Loudoun County Sanitation Authority's (LCSA) service area within Loudoun County, this error may be large. For Prince William County this error was unacceptable since the dwelling unit ratio grossly overestimated the actual number of single family connections serviced by the Prince William County Service Authority (PWCSA). It was assumed that a major portion of the single family households in the service area are on well water and would eventually be a part of the distribution system. The number of multi-family households (determined from the dwelling unit ratio) and the

number of employees was assumed to be correct in that employees and multi-family houses are more likely to exist in the built up areas that are served by PWCSA. The single family households were estimated to grow linearly from the known number of connections in 1994 to the number computed from the dwelling unit ratio applied to the total household forecast for 2020. This is the only area for which such a correction was made.

F.) Unit Use Factors

The long term water demand forecasting model uses numbers of single family households, multi-family households and employees to forecast annual average demand. This level of disaggregation requires estimates of average daily water consumption per single family household, water consumption per multi-family household, and water consumption per employee for each service area. These unit use factors are displayed in Table IV-5.

The calculation of residential and employment unit use rates varied considerably with the information collected and provided by the supplier. For a detailed description of the calculation of each service areas unit use rates see Appendix I. Residential and employment unit use factors for WAD's service area are calculated from billing information provided by the District of Columbia Department of Public Works Water and Sewer Utility Administration (WASUA), Arlington County Department of Public Works (DPW), Falls Church Department of Public Utilities (DPU), National Airport and the Pentagon and production data provide by WAD. The production data for WAD was lower than the billing data provided by WASUA, Arlington County DPW and Falls Church DPU. The difference was attributed to different billing cycles and the cumulative effect of unpaid customer bills. To resolve this difference, the unit use values were determined from a combination of WAD's production data and, if applicable, user class demographics from the billing data. Residential and employment unit use factors for FCWA's direct service area are determined from billing information provided by FCWA's Engineering and Construction Division. Residential and employment data for FCWA's wholesale service area are determined from billing information provided by VAWC, LCSA and PWCSA. The Town of Herndon and Fort Belvoir were assumed to have the same residential unit use factors as FCWA's direct service area. The employment data for the Town of Herndon, Fort Belvoir, Dulles Airport and Lorton Correctional Facility were determined from FCWA's wholesale billing information. Residential and employment unit use factors for WSSC are obtained from their report on water production through 1994 (WSSC, 1995) and confirmed through discussions with WSSC's Water Resources Planning Section. Billing information provided by the City of Rockville, the Town of Leesburg, the City of Fairfax, and the City of Manassas, was used to compute their respective residential and employment unit use rates.

Table IV-5 Unit use factors for the Washington metropolitan area water service areas.			
Service Area	Consumption per single family residence in gallons per day (gpd)	Consumption per multi-family residence in gpd	Consumption per employee in gpd
WAD			
District of Columbia	237	237	50
Arlington Co. DPW	205	154	40
Falls Church DPU	214	122	50
National Airport	0	0	35 (1990) 30 (1995-2020)
Pentagon, Arlington Cemetery, Fort Myer	0	0	78 (1990) 38 (1995-2020)
FCWA			
Fairfax County	229	156	47
VAWC in Alexandria	200	187	50
VAWC in Dale City	217	124	48
LCSA	230	197	40
PWCSA-east	215	158	50
PWCSA-west	215	158	50
Town of Herndon	229	156	47
Dulles Airport	0	0	62 (1990) 53 (1995-2020)
Fort Belvoir	229	156	100
Lorton Correctional Facility	0	0	195
WSSC (note: unit use rates determined as per unit production)			
Montgomery County	249 (existing units) 246 (additional units)	233 (existing units) 186 (additional units)	53

Table IV-5 continued Unit use factors for the Washington metropolitan area water service areas.			
Service Area	Consumption per single family residence in gallons per day (gpd)	Consumption per multi-family residence in gpd	Consumption per employee in gpd
Prince George's County	249 (existing units) 246 (additional units)	233 (existing units) 186 (additional units)	53
Andrews Airforce Base	249	233	136 (1990) 102 (1995-2020)
Other suppliers			
City of Rockville	203	124	40
Town of Leesburg	350	280	50
City of Fairfax	205	163	50
City of Manassas	262	213	50

The unit use factors, in part, drive the water demand forecast model. These unit use factors are assumed to be stationary throughout the forecast period. As with the assumption of stationary production factors, this assumption may not be valid. For example, the unit use factors determined in this report are significantly lower than those used in the 1990 water demand forecast model for the District of Columbia and FCWA's direct service area. To determine the effects of water conserving fixtures in the new residential units, the unit use rates of newer residential units were computed for WSSC's and FCWA's direct service areas. WSSC customer database is able to sort customers by the meter installation date and track their water use. The measure chosen to estimate conservation unit use rates is the average water production for houses constructed post 1989. This year was selected to capture the effects of the change in Maryland plumbing codes. FCWA customer records track water use by sub-census tract. Discussions with representatives of FCWA located newer sub-census tracts and linear regression was performed to determine the conservation water use of these newer areas. These conservation unit use factors show a higher water usage in the new single family units than the average single family units and a lower water usage in newer multi-family units compared to all multi-family units. The conservation unit use factors only apply to newer homes and do not account for any conservation savings from retrofitting plumbing fixtures in existing homes. For both FCWA and WSSC, the sample size of newer units with conservation fixtures is small and may not be statistically significant. Therefore, these apparent inconsistencies in unit use factors, albeit small, warrant further study. The unit use factors for the CO-OP Suppliers are compared in Table IV-6.

Table IV-6 A comparison of the unit use factors for the CO-OP Suppliers. (* indicates data not verifiable by the providing agency)			
Class of Service	1990 Report	1995 Report	Conservation
WAD			
Single Family	325	237	not computed
Multi-family	315	237	not computed
Employee	50	50	not computed
FCWA			
Single Family	240	229	243
Multi-family	177	156	141
Employee	44	47	
WSSC (note: unit use rates determined as per unit production)			
Single Family	*	249/246	264
Multi-family	*	233/186	166
Employee	*	53	

G.) Long Term Water Demand Forecasting Method

Water use is disaggregated into five classes for this model: single-family residential, multi-family residential, employment, unaccounted distribution and unaccounted wholesale water use. Employment is not broken down into separate employment categories because such projections are not available for each jurisdiction. Since there are no major water consuming industries in this area, this assumption may not introduce a large error. Unaccounted water use is a constant percentage of total water use and is defined as the difference between the finished water leaving the plant, or distributed to a wholesale customer, and the total amount of billed water. The distinction between unaccounted distribution and unaccounted wholesale is merely the point of reference. For example, FCWA charges VAWC for a metered amount of water. A percentage of that water is unaccounted for between the FCWA plant and the meter for VAWC, which is termed wholesale unaccounted. In addition, there are more losses between the metered wholesale amount and the billed water in the VAWC service area, termed unaccounted distribution. Each service area then has unaccounted distribution water, and the wholesale customers have additional unaccounted wholesale water.

The basic equation used for each supplier for forecasting average annual residential and

employment water demands is:

$$WATUSE\ (k,i) = R5PRO\ (k,i) \times UUF\ (k,i)$$

where,

WATUSE(k,i) = annual average water demand in user class k=1,2,3 (single family residential, multi-family residential, and employment) in year i
R5PRO(k,i) = Round 5 intermediate projections of the number of units of user class k=1,2,3 in year i
UUF(k,i) = per unit water use factor for user class k in year i

Unaccounted distribution water use is estimated by:

$$WATUSE\ (4,i) = \frac{[WATUSE\ (1,i) + WATUSE\ (2,i) + WATUSE\ (3,i)] \times WASTED\ (i)}{1 - WASTED\ (i)}$$

where,

WATUSE(4,i) = annual average unaccounted distribution water demand in year i
WASTED(i) = percentage of water produced that is unaccounted distribution water use in year i

Unaccounted wholesale water demand is estimated by:

$$WATUSE\ (5,i) = \frac{[WATUSE\ (1,i) + WATUSE\ (2,i) + WATUSE\ (3,i) + WATUSE\ (4,i)] \times WASTEW\ (i)}{1 - WASTEW\ (i)}$$

where,

WATUSE(5,i) = annual average unaccounted wholesale water demand in year i
WASTEW(i) = percentage of water produced that is unaccounted wholesale water use in year i

Annual average water demand is then estimated by:

$$AAD\ (i) = WATUSE\ (1,i) + WATUSE\ (2,i) + WATUSE\ (3,i) + WATUSE\ (4,i) + WATUSE\ (5,i)$$

where,

AAD(i) = annual average water demand in year i

Monthly average and mean peak water demands are then estimated from the forecast of future annual average demand utilizing production factors developed in the previous chapter.

Monthly average demand for each supplier is calculated from annual average demand using:

$$MAD\ (i,j) = AAD\ (i) \times MMPF\ (j)$$

where,

MAD(i,j) = monthly average water demand in year i and month j
MMPF(j) = mean monthly production factor for month j

Mean peak 1-day demands are calculated (mean peak 7-day demands are calculated in a similar fashion) from:

$$MP1D\ (i,j) = AAD\ (i) \times MMPF\ (j) \times MP1PF\ (j)$$

where,

MP1D(i,j) = mean peak 1-day demands in year i and month j
MP1PF(j) = mean peak 1-day production factor for month j

Mean peak 30, 60, 90, 120 and 180-day demands are similarly calculated utilizing the following method. Only the equation for the mean peak 30-day demands is shown.

$$MP30D\ (i) = AAD\ (i) \times MP30PF$$

where,

MP30D(i) = mean peak 30 day demands in year i
MP30PF = mean peak 30 day production factor

Probabilistic maximum 1-day and 7-day demands are estimated from the forecast of future annual average demand utilizing the probabilistic maximum 1-day and 7-day production factors developed in the previous chapter. Probabilistic maximum 1-day demands are calculated (probabilistic maximum 7-day demands are calculated in a similar fashion) from:

$$PM1D\ (i) = AAD\ (i) \times PM1PF$$

where,

PM1D(i) = probabilistic maximum 1-day demands in year i
PM1PF = probabilistic maximum 1-day production factor

H.) Long Term Water Demand Forecasting Method with Conservation

Newer homes in the Washington metropolitan area have been built and will continue to be built with water conserving fixtures. The unit use rates of the newer homes built with water conserving fixtures were shown in Section F for the direct service areas of both WSSC and FCWA to have higher water usage in the new single family units than the average single family units and a lower water usage in newer multi-family units compared to all multi-family units. The effects of the water conserving fixtures in new units on forecasted demand can be estimated for the direct service areas of WSSC and FCWA by modifying the long term water demand forecasting method described in the previous section.

The long term forecasting method with conservation is essentially the same as that described in the previous section. There is only a slight modification of the basic equation used for each supplier for forecasting average annual residential water demand. The modified equation for forecasting annual average residential water demand with conservation is:

$$WATUSE\ (k,i) = R5PRO\ (k,1990) \times UUF\ (k,1990) + [R5PRO\ (k,i) - R5PRO\ (k,1990)] \times UUF\ (k,i)$$

where,

WATUSE(k,i) = annual average water demand in user class k=1,2,3 (single family residential, multi-family residential, and employment) in year i

R5PRO(k,i) = Round 5 intermediate projections of the number of units of user class k=1,2,3 in year i

UUF(k,1990) = per unit water use factor for user class k for all existing units (from Table IV-5)

UUF(k,i) = per unit water use factor for user class k in year i for all new units built with water conserving fixtures (from Table IV-6)

The modified equation determines a base water use from the Round 5 forecasts for 1990 and unit use rates determined from all existing units. The water demand for new units is determined by multiplying the difference of the forecast year units and the existing 1990 units by the conservation unit use rate from Table IV-6. The base water demand for existing units is added to the demands generated from the new units to determine the annual average water demand in each user class for each forecast year. Unaccounted water use and annual average demand is determined in exactly the same way as in the previous section.

V.) FORECASTS OF FUTURE WATER DEMANDS

A.) Introduction

Results of the long term water demand forecasting model are presented in this chapter. Forecasts of unrestricted water demands for each service area by supplier are presented initially. An analysis of annual average demand, demand growth by water use class for each supplier service area and demands disaggregated by the production factors determined in Chapter III are included. Also included is an analysis of the effects of water conserving fixtures in new homes on the annual average water demand. A section comparing the forecasts contained in this study to earlier forecasts follows. Lastly, this chapter contains a short description of some sources of uncertainties that may affect the likelihood of this study's forecast being realized.

B.) Forecasts of Unrestricted Water Demands

Annual water demands are forecasted to increase for all Washington metropolitan area water suppliers. These results are summarized in Table V-1. WAD is forecasted to grow by 24.8 mgd, from 175.8 mgd to 200.6 mgd, over the forecast period (1990-2020). This represents an overall increase of 14% at an annual average growth rate less than 0.5%. During this same period FCWA is expected to grow from 106.1 mgd to 189.2 mgd, a gain of 83.1 mgd. This is the largest percent gain of the CO-OP Suppliers, an overall increase of 78% and an annual growth rate of 2.6%. WSSC is expected to increase 68.2 mgd, from 164.8 mgd in 1990 to 233.0 in 2020. It is

Table V-1 Forecasted annual average water demands for the Washington metropolitan area.

	1990	1995	2000	2005	2010	2015	2020
WAD	175.8	180.7	186.9	191.9	195.9	198.1	200.6
FCWA	106.1	122.8	137.4	150.3	163.4	176.6	189.2
WSSC	164.8	173.3	186.6	199.9	211.5	222.4	233.0
CO-OP total	446.7	476.8	510.9	542.1	570.4	597.1	622.8
Other Suppliers							
Rockville	4.5	4.7	5.2	5.4	5.6	5.7	5.8
Leesburg	2.4	2.6	2.8	3.1	3.4	3.7	4.0
Fairfax	4.8	5.0	5.1	5.3	5.4	5.6	5.7
Manassas	4.1	4.7	5.1	5.4	5.6	5.8	6.0

predicted to have an annual growth rate of 1.4% and an overall growth of 41%. The CO-OP annual average demand is predicted to grow by 176.1 mgd, from 446.7 mgd to 622.8 mgd, during the forecast period. This represents an overall growth rate of 39%, an annual growth rate of 1.3%. At this annual growth rate, the CO-OP Suppliers annual average demand would double in 79 years, i.e. in the year 2069. Rockville, Leesburg, Fairfax and Manassas are expected to grow by 1.3 mgd, 1.6 mgd, 0.9 mgd and 1.9 mgd respectively.

Growth in annual average demands by supplier service area and water use class are shown separately in Table V-2. Table V-2 displays the results for the single family residential, multi-family residential and employment water use classes. Growth in the unaccounted wholesale and unaccounted distribution is directly proportional to growth in the other classes. A complete disaggregation of demands by water use class for each forecast year can be found in Appendix J for each water supplier service area.

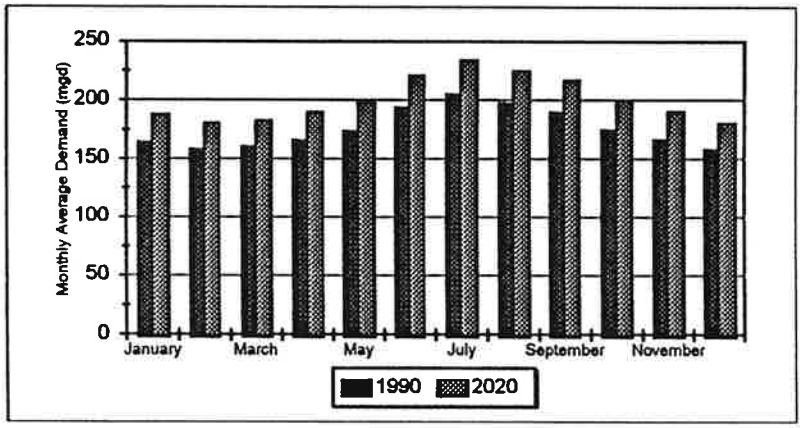
Most of WAD's growth is forecasted to be in the employment use class. WASUA, serving the District of Columbia, is forecasted to experience very little growth in residential water use. Growth in Arlington County is split between residential and employment water use with the largest residential growth in the multi-family class. Falls Church DPU is expected to show the largest increase in single family residential water use of the suppliers served by WAD. Most of FCWA's growth is forecasted to be in the single family residential water use class. This is true for both their direct service area in Fairfax County and the wholesale service areas of Loudoun and Prince William counties. The Alexandria division of VAWC is expected to see their largest growth class to be in employment water use. Absolute growth within the FCWA's service area is almost evenly split between their direct and wholesale service areas. The absolute growth of the wholesale service area is forecasted to be slightly higher than the direct service in residential water use, and slightly lower in employment water use. Additionally, upon reviewing the results, PWCSA believed their residential unit use to be larger and their employment unit use to be smaller than that found in this study. This assumption would increase PWCSA's residential demand growth forecast and decrease employment growth forecast but would not effect the total demand growth for the area. WSSC's growth is forecasted to occur predominately in the single family water use class. Prince George's County is expected to show the largest growth in single family residential water use of all the supplier service areas in this study. Both counties in the WSSC service area are expected to show significant increases in the multi-family and the employment water use classes as well. It should be noted that the water demand for Andrews Air Force Base is assumed to be supplied by WSSC for the forecast horizon. Prior to 1993, Andrews Air Force Base was supplied by WAD. The reduction in WAD's demand should correlate to an increase in WSSC's demand with no net effect on the CO-OP total demand.

Table V-2 Forecasted growth in water demands by supplier service area for residential and employment water use classes from 1990 to 2020.			
	Growth in single family residential water demands (mgd)	Growth in multi-family residential water demands (mgd)	Growth in employment water demands (mgd)
WAD			
District of Columbia	0.2	0.3	7.5
Arlington DPW	1.9	2.1	3.8
Falls Church DPU	2.2	0.9	1.4
National Airport	0.0	0.0	0.0
Pentagon, Arlington Cemetery, Fort Myer	0.0	0.0	-0.9
FCWA			
Fairfax County	19.1	5.1	9.9
VAWC - Alexandria	1.0	2.2	2.5
VAWC - Dale City	2.1	0.3	0.3
LCSA	6.7	1.6	1.9
PWCSA - east	8.0	0.9	2.6
PWCSA - west	5.7	0.7	1.8
Town of Herndon	0.8	0.2	1.0
Dulles Airport	0.0	0.0	0.5
Fort Belvoir	0.0	0.0	0.7
Lorton Correctional	0.0	0.0	0.3
WSSC			
Montgomery County	15.1	8.6	11.4
Prince George's County	21.5	2.3	9.5
Andrews Air Force Base	0.1	0.0	-0.2

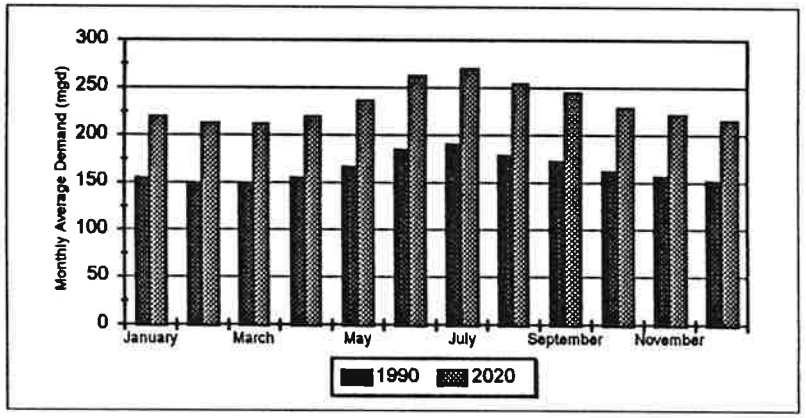
Table V-2 continued Forecasted growth in water demands by supplier service area for residential and employment water use classes from 1990 to 2020.			
	Growth in single family residential water demands (mgd)	Growth in multi-family residential water demands (mgd)	Growth in employment water demands (mgd)
Other Suppliers			
City of Rockville	0.3	0.2	0.7
Town of Leesburg	0.8	0.2	0.2
City of Fairfax	0.4	0.1	0.2
City of Manassas	1.1	0.3	0.3

Forecasted annual average demands are disaggregated into mean monthly and mean peak demands utilizing production factors discussed in Chapter III. A complete listing of the disaggregated demands is located in Appendix K for WAD, Appendix L for FCWA, Appendix M for WSSC and Appendix N for the CO-OP Suppliers as a whole. Figure V-1 (a)-(d) displays forecasted mean monthly demands for WAD, FCWA, WSSC, and the CO-OP Suppliers as a whole, respectively for 1990 and 2020. Mean July demands, which are the peak monthly demands, are forecasted to grow by 29.0 mgd for WAD, 100.4 mgd for FCWA and 78.9 mgd for WSSC. The mean July demand for the CO-OP Suppliers as a whole is forecasted to be 730.7 mgd in 2020, a growth of 206.6 mgd from 1990. The CO-OP Suppliers total demands in September and October, which correspond to the months of lowest Potomac flow, are forecasted to be 664.9 mgd and 614.4 mgd, respectively, in 2020. This is a 188.0 mgd increase for September and a 173.7 mgd increase for October.

Probabilistic maximum 1-day and 7-day demands are estimated from annual average demands utilizing the probabilistic maximum 1-day production factors described in Section C of Chapter III. The results for 1% exceedence probability are displayed in Table V-3. Forecasted probabilistic 1-day and 7-day demands for WAD are expected to rise by 35.3 mgd and 33.8 mgd, respectively, between 1990 and 2020. FCWA's probabilistic maximum 1-day and 7-day demands are predicted to rise by 142.0 mgd and 132.0 mgd, respectively, over the forecasted period. This represents the largest growth in probabilistic maximum demands of the CO-OP Suppliers. Probabilistic maximum 1-day and 7-day demands for WSSC are forecasted to grow by 105.8 mgd and 97.6 mgd, respectively. Forecasted probabilistic maximum 1-day and 7-day demands for the CO-OP Suppliers as a whole are 927.9 mgd and 890.6 mgd, respectively in the year 2020. This represents a growth in probabilistic maximum 1-day and 7-day demands of 262.4 mgd and 251.8 mgd, respectively. As shown in Table V-3, the CO-OP Suppliers as a whole probabilistic demands are not simply the sum of individual demands but somewhat smaller. This is because maximum demands for the individual CO-OP Suppliers are not concurrent. The CO-OP Suppliers as a



(a)



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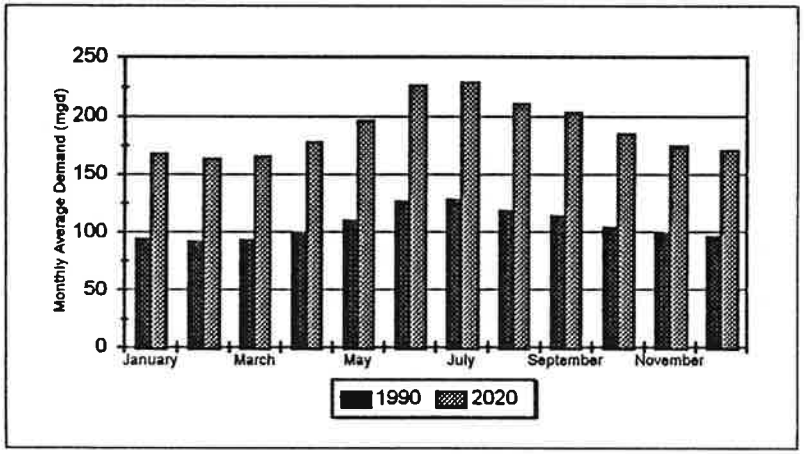

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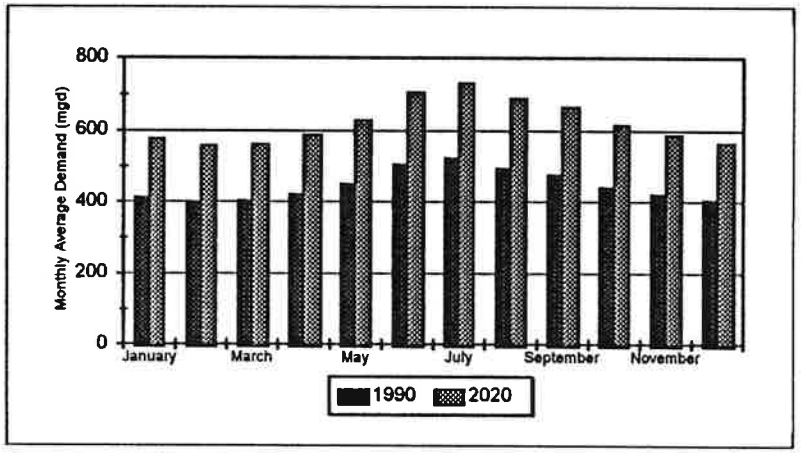

(d)

Figure V-1 Monthly average demand for 1990 and 2020 for (a) WAD, (b) FCWA, (c) WSSC and (d) CO-OP total.

whole probabilistic maximum production factors developed in Chapter III reproduce this asynchrony in maximum demands among the different CO-OP Suppliers.

Table V-3 Forecasted probabilistic maximum 1-day and 7-day water demands with 1% exceedence probability in million gallons per day.

Year	1990	1995	2000	2005	2010	2015	2020
WAD							
1-day	249.6	256.5	265.4	272.6	277.7	281.3	284.8
7-day	239.1	245.7	254.2	261.0	266.0	269.4	272.8
FCWA							
1-day	181.5	210.0	235.0	257.0	279.4	301.9	323.5
7-day	168.7	195.2	218.5	239.0	259.8	280.7	300.8
WSSC							
1-day	255.4	268.7	289.2	309.9	327.8	344.8	361.2
7-day	235.6	247.9	266.8	285.9	302.4	318.1	333.2
CO-OP total							
1-day	665.5	710.4	761.2	807.8	850.0	889.6	927.9
7-day	638.7	681.8	730.6	775.2	815.7	853.8	890.6

C.) Forecasts of Water Demands with Conservation

Annual average demands with the effects of new homes built with water conservation fixtures were forecasted for the direct service areas of WSSC and FCWA. A comparison of the annual average demand by service class with and without water conserving fixtures is shown in Table V-4 for the direct service area of WSSC and Table V-5 for the direct service area of FCWA. Throughout the forecast period in both the WSSC and FCWA direct service areas there is a larger single family demand with the conservation method than without. Anecdotal information suggests that although new units are built with water conserving fixtures they are also built with more bathrooms and more water using fixtures (i.e., Jacuzzi tubs, etc.). The annual average demand from multi-family units with the conservation method is slightly less than without conservation. The total annual average demand for both the direct service areas of WSSC and FCWA is slightly higher when the analysis with conservation is used. This difference is considered small and not studied further. It should be noted that the conservation analysis only included conservation fixtures in new homes and did not consider any water saving benefits from

retrofitting pre-conservation units with water conserving fixtures, which warrants further study.

Table V-4 WSSC's direct service area annual average demand by service class with and without conservation (all values in mgd).

Forecast year	1990	1995	2000	2005	2010	2015	2020
SF with conservation	84.2	91.5	99.1	105.9	111.7	117.7	123.5
SF without conservation	84.2	91.0	98.0	104.4	110.0	115.4	120.9
SF difference	0.0	0.5	1.0	1.5	1.9	2.3	2.7
MF with conservation	40.4	41.6	43.5	45.7	47.2	48.6	50.0
MF without conservation	40.4	41.8	43.9	46.3	48.0	49.6	51.2
MF difference	0.0	-0.2	-0.4	-0.6	-0.8	-1.0	-1.2
Tot with conservation	162.6	171.9	185.4	198.8	210.6	221.7	232.5
Tot without conservation	162.6	171.6	184.7	198.0	209.5	220.5	231.0
Total difference	0.0	0.3	0.6	0.8	1.1	1.3	1.5

Table V-5 FCWA's direct service area annual average demand by service class with and without conservation (all values in mgd).

Forecast year	1990	1995	2000	2005	2010	2015	2020
SF with conservation	40.2	44.4	47.9	50.7	53.7	57.0	60.4
SF without conservation	40.2	44.1	47.4	50.1	52.9	56.0	59.3
SF difference	0.0	0.2	0.4	0.6	0.8	1.0	1.2
MF with conservation	8.6	9.3	10.0	10.6	11.4	12.2	13.2
MF without conservation	8.6	9.4	10.2	10.8	11.7	12.6	13.7
MF difference	0.0	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5
Tot with conservation	69.4	76.1	83.8	90.1	96.2	102.4	108.4
Tot without conservation	69.4	76.0	83.5	89.6	95.6	101.7	107.7
Total difference	0.0	0.2	0.3	0.4	0.5	0.7	0.8

D.) Comparison of Water Demand Forecasts with Earlier Studies

A comparison of the forecasted Washington metropolitan area annual average demands with two earlier studies of Washington metropolitan area demands; the 20 Year Water Demand Forecast and Resource Availability Analysis for the Washington Metropolitan Area completed by ICPRB in 1990 (Holmes and Steiner, 1990) and the Metropolitan Washington Area Water Supply Study completed in 1983 by the Army Corps of Engineers (U.S. Army Corps of Engineers, 1983) is displayed in Figure V-2. Both earlier studies use the same basic method as this study but earlier demographic data. It is immediately apparent that the CO-OP forecast for annual average demand of 622.8 mgd for 2020 is about 20 mgd below the level forecasted by the Army Corps of Engineers for the same year and close to the level forecasted by the 1990 ICPRB study for 2000-2005. The lower forecasts in this study is due to updated demographic forecasts, as described in Chapter IV Section C, and the updated unit use consumption shown in Chapter IV Section F. A log-linear regression was performed on both household and employment growth rates for each supplier service area to extrapolate the Round 5 growth from 2020 to 2050. Dwelling unit ratios and unit use consumption were assumed to be constant and water demand forecasts were computed for this forecast period. The extrapolated results are displayed in Figure V-2 for the CO-OP Suppliers as a whole. With the current demographic information and growth rates, demands are forecasted to be less than the level determined by the Army Corps of Engineers study for 2030. Demands are forecasted to grow to 765.9 mgd by the year 2050. Another forecast of Washington metropolitan area water demands is contained in Proposed Potomac River Water Supply Structures (U.S. Army Corps of Engineers, 1978). This study was completed in 1978 and used a per capita method to forecast future demands, forecasting annual average demands to grow from 510.9 mgd in 1990 to 712.6 mgd in 2020.

E.) Uncertainties in Water Demand Forecasting

There are several major unknown factors in forecasts of future water demands that will affect their likelihood of realization. These are stated below.

-There are certain inherent uncertainties in the demographic predictions on which the water demand forecast is based. These uncertainties range from local to national economic and demographic factors from which estimates of households and employment levels are derived.

-Unforeseen local political pressures may force water demand growth away from some transportation corridors and towards others.

- Long term variation in climate may affect demands and supplies in unknown ways, possibly contributing to the overall severity of a water supply shortage or varying consumption patterns significantly.

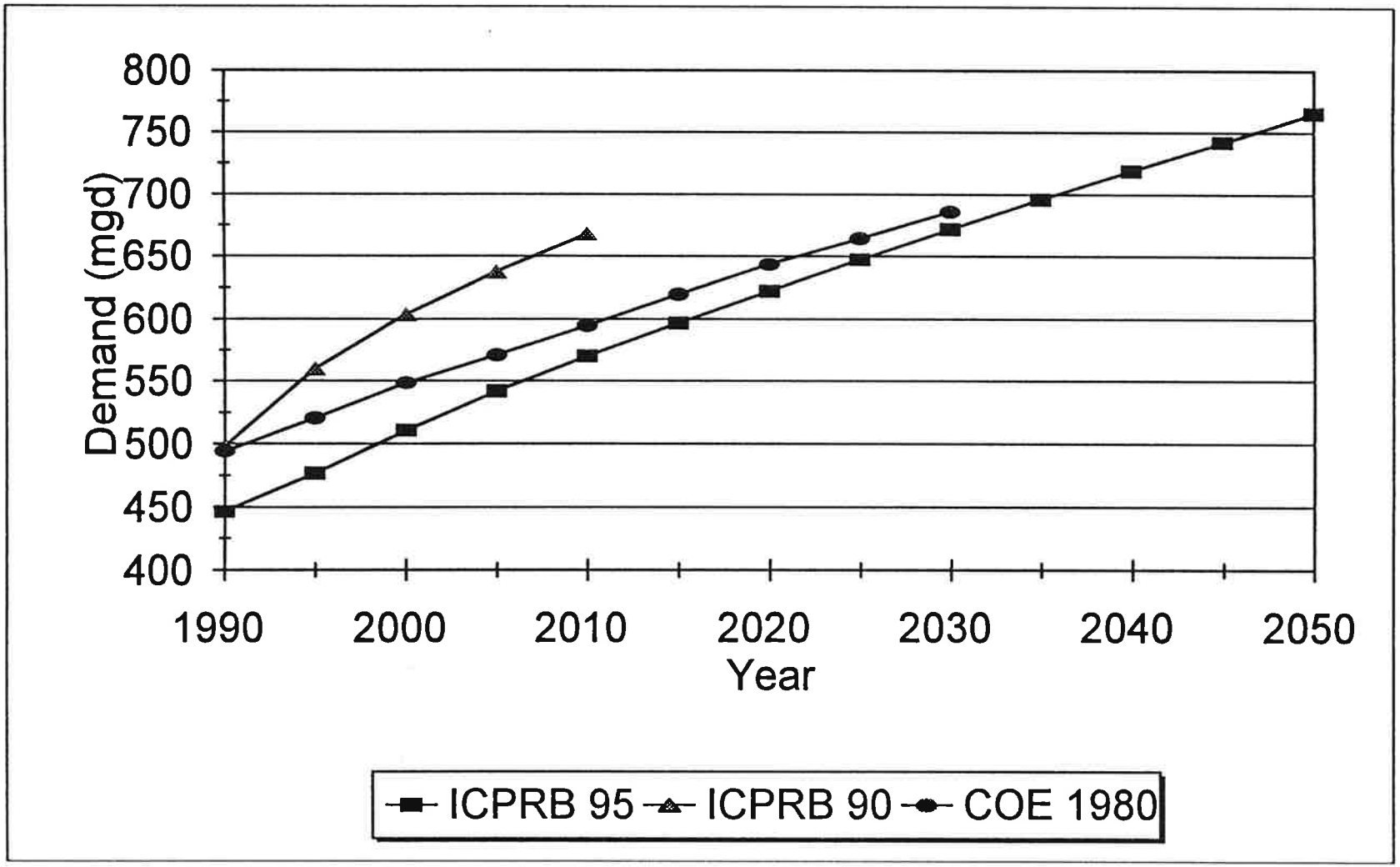

Figure V-2 Comparison of 1995 projections with earlier studies.

VI.) COMPARISON OF DEMAND FORECAST WITH AVAILABLE RESOURCES

A.) Introduction

The objective of this chapter is to present an assessment of the adequacy of the water resources to meet projected demands. The largest source of raw water supply in the Washington metropolitan area is the natural flow of the Potomac River. The average annual flow in the Potomac River near Washington D.C. from 1959 to 1994 is 7,730 mgd (USGS, 1994), more than 16 times the average CO-OP Suppliers total water supply production in 1994 of 475 mgd. However, the minimum one day flow for the period of record dropped as low as 388 mgd on September 10, 1966 and minimum monthly flow as low as 380 mgd (not adjusted for diversions) in October 1930. In contrast, the maximum historical 1-day September CO-OP Suppliers total production was 613.6 mgd in 1988 and the largest historical average CO-OP Suppliers total October production of 468.5 mgd occurred in 1990. Thus, the free flowing Potomac River is over-allocated with current demands, and this over-allocation will increase with the demands forecasted in the previous chapter. These figures demonstrate the need for the system reservoirs.

A simple assessment of the adequacy of the resources to meet projected demands is to compare the sum of the annual average historic yields of the resources to the projected demands. The historic yield of a reservoir is an annual average demand that could be reliably supplied by the reservoir with the historical hydrologic record. The demand satisfied by the resources is usually computed as a constant draft. However, demands are not constant and reservoirs are not operated at a constant draft, therefore analysis of historic yields determined from a seasonally varying draft is also performed to capture reservoir operations with seasonal demands. A second simple assessment is made comparing the historic yields to demands for a critical period. A critical period is chosen to represent drought conditions when demands are at a peak. Finally, a system simulation model that captures fluctuating demands, historical flows and daily reservoir operations is used to compare forecasted demands with the drought of record. Descriptions and results of the three assessments follow.

B.) Comparison of Historic Yields of System Resources to Forecasted Demands

The simplest assessment of adequacy may be obtained by comparing the sum of the historic yields of the sources to the maximum projected demands. The historic yield analysis is performed with both a constant draft and a seasonally varying draft. For each of the reservoirs the historic yield is the annual average maximum continuous demand which could be satisfied throughout the historic record. The equivalent constant draft historic yield for the free flowing Potomac River is the minimum daily flow in the period of record. The seasonally varying draft is represented by average annual demands with seasonal patterns. The seasonal demand patterns are characterized in historical production data of the CO-OP Suppliers by day of week and week of year factors. The ICPRB Calendar Model scales a winter water use with the day of week and week of year factors to determine an annual average demand that captures the seasonal and daily fluctuations in water demand for each supplier. The seasonally varying draft thus captures the

larger releases from reservoirs during higher demand periods. The equivalent seasonally varying historic yield for the free flowing Potomac River is the annual average of a demand sequence that just utilizes the minimum daily flow in the period of record.

The historic yield based on constant draft and seasonally varying draft for each reservoir's current available storage and for the Potomac River at Little Falls is summarized Table VI-1. The constant draft method provides a total yield of 702.1 mgd. The seasonally varying yield reflects the effects of higher demands during lower summertime flows. The net result of a seasonally varying draft is a lower total yield of 667.9 mgd. The true yield of the Occoquan Reservoir may be higher, especially if the expected increase in effluent from the Upper Occoquan Sewage Authority (UOSA) wastewater treatment plant is included. Other sources not included here, but potentially available to the demand region during the forecast horizon include: treated effluent from the proposed Broad Run advanced wastewater treatment plant in Loudoun County, Beaver Dam Creek Reservoir, Goose Creek Reservoir, and releases from Lake Manassas.

Table VI-1 Annual average supply assessment determined from a constant draft and seasonally varying draft historic yield for each resource in the CO-OP system.

Resource	Available Storage (billion gallons)	Constant Draft (mgd)	Seasonally Varying Draft (mgd)
Jennings Randolph	30.0	158.3	155.3
Occoquan	8.2	52.4	50.2
Patuxent	9.8	44.4	43.9
Savage	6.5	32.9	32.3
Little Seneca	3.7	9.1	9.1
Little Falls	0.0	405.0	377.1
Total Historic Yield		702.1	667.9

The maximum forecasted annual average demand of 622.8 mgd occurs in 2020, and is therefore used for comparison with resources. In addition to the demands a 100 mgd environmental flow-by (minimum in-stream flow) is required at Little Falls. For the purposes of this comparison the environmental flow-by is treated as an additional demand in the supply/demand assessment. The demands in the CO-OP system are displayed in Table VI-2.

Table VI-2 Annual average demand assessment for the CO-OP system (all values in mgd).	
Maximum forecasted annual average demand (2020)	622.8
Little Falls flow-by	100.0
Total annual average demand	722.8

The 2020 annual average demand is compared with historic yields calculated by both the constant draft and the seasonally varying draft method in Table VI-3. The total annual average demand is 20.7 mgd larger than the constant draft historic yield of the available resources. A comparison of the total demand with the seasonally varying historic yield reveals a larger resource deficit of 54.9 mgd.

Table VI-3 Comparison of annual average historic yields to demands (all values in mgd).		
	Constant Draft Yield	Seasonally Varying Yield
Total Historic Yield	702.1	667.9
Total Demand	722.8	722.8
Resource excess(+) or deficit(-)	-20.7	-54.9

C.) Comparison of Historic Yields of System Resources to Forecasted Demands for a Critical Period

Annual average demands used in the previous section underestimate the peak demands associated with drought conditions. Some multi-day period of operation should be chosen for comparison of demands to have meaning in terms of resource availability. The mean peak 120-day demand expected in the year 2020 is selected as the criterion for comparison with resources because it approximates the number of days of required releases from the Jennings Randolph Reservoir in a repetition of the worst drought of record with the forecasted demands. The 120-day critical period of demands is estimated from production data to occur from May 28 through September 24.

The average historic yield for the 120-day critical period based on constant draft and seasonally varying draft for each reservoir's current available storage and for the Potomac River at Little Falls is summarized in Table VI-4. The constant draft method provides a total yield of 702.1 mgd. The seasonally varying yield reflects the effects of operating the reservoir at a higher yield during times of higher demands. The seasonally varying yield also reflects the asynchronous behavior between peak demands and minimum flows. The net result of a seasonally varying draft

is a higher total yield of 738.5 mgd.

Table VI-4 Critical period supply assessment determined from a constant draft and seasonally varying draft historic yield for each resource in the CO-OP system.

Resource	Available Storage (billion gallons)	Constant Draft (mgd)	Seasonally Varying Draft (mgd)
Jennings Randolph	30.0	158.3	171.4
Occoquan	8.2	52.4	57.1
Patuxent	9.8	44.4	48.2
Savage	6.5	32.9	35.6
Little Seneca	3.7	9.1	10.0
Little Falls	0.0	405.0	416.2
Critical Period Historic Yield		702.1	738.5

The mean peak 120-day demand for the CO-OP Suppliers is the product of the year 2020 average annual system demand (622.8 mgd) and the mean peak 120-day production factor for the CO-OP Suppliers (1.13) developed in Chapter III. This results in a mean peak 120-day demand in 2020 of 702.1 mgd. In addition to the water supply demands, a 100 mgd environmental flow-by is required at Little Falls. For the purposes of this comparison the environmental flow-by is treated as an additional demand in the supply/demand assessment. The total demand of 802.1 mgd would include the mean peak 120-day water supply demand plus the 100 mgd environmental flow-by at Little Falls. The critical period demands in the CO-OP system are displayed in Table VI-5.

Table VI-5 Critical period demand assessment for the CO-OP system (all values in mgd).

Maximum forecasted critical period demand (2020)	702.1
Little Falls flow-by	100.0
Total critical period demand	802.1

The mean peak 120-day system demand is compared with both the constant draft and seasonally varying draft historic yields of the system resources in Table VI-6. The total critical period demand for the CO-OP Suppliers is 100.0 mgd larger than the critical period constant draft historic yield of the available resources. A comparison of the system demand with the seasonally

varying historic yield reveals a smaller resource deficit of 63.6 mgd.

Table VI-6 Comparison of critical period historic yield of system resources with year 2020 critical period demands (all values in mgd).

	Constant Demand Yield	Seasonally Varying Yield
Critical Period Historic Yield	702.1	738.5
Total critical period demand	802.1	802.1
Resource excess(+) or deficit(-)	-100.0	-63.6

Comparing yields of system resources with mean peak demands is conservative since the resources are not operated at their historic yields. Each reservoir may be operated above the historic yield to jointly maximize the reliability of the reservoir system. Additionally, water supply withdrawals from the Potomac River maximize the use of the natural flow in the river when conditions allow and often exceed the historic yield. A comparison of the historic yield with mean peak demand assumes 100% efficient use of all resources which is not realistic. A daily system simulation model was developed to capture the advantages of joint operations and maximize use of the natural flow in the Potomac River. The system simulation model also captures a reasonable amount of waste in the operation of the river/reservoir system. This model was used to more accurately describe the yield of the system. A comparison of this system simulation model to forecasted demands is presented in the next section.

D.) Comparison of the Daily System Simulation Model with Forecasted Demands

Reservoirs are not operated at their historic yields. Rather, combined system operation has been shown to produce significant gains in yield over and above the sum of the historic yields. In general, the system operating policy is to minimize the probability of any reservoir not refilling by June of the following year. This policy has the effect of using the natural flow in the Potomac River to its fullest extent when conditions allow, thus conserving storage in the reservoirs. When releases from the Potomac reservoirs are needed to increase water supply, Jennings Randolph Reservoir is used to meet the expected difference between demand and the sum of available flow in the river and remaining reliable yield of the Occoquan and Patuxent reservoirs. Due to the time of travel required for upstream releases to reach the Washington metropolitan area water intakes and uncertainties in river flow and demand projections, releases from Jennings Randolph may be insufficient to meet demand. In those cases, the Occoquan and Patuxent reservoirs may be operated above their reliable yield and/or releases from Little Seneca Reservoir would be made at short notice to make up the difference. In some cases, releases from Jennings Randolph combined with changing natural flow may exceed demands. These flows and releases can not be used with 100% efficiency and would decrease the effective yield of the system. A daily system simulation

model was developed to capture the advantages of joint operations as well as the inefficiencies of the river/reservoir system to more accurately describe the yield of the system. A comparison of this system simulation model to forecasted demands is presented in this section.

The system simulation model uses inputs of daily streamflow hydrology and a daily demand sequence for each CO-OP Supplier with the system operation described previously to compute daily withdrawals at each water supply intake and daily reservoir volumes. Reconstructed inflow records were developed for the Jennings Randolph, Savage, Seneca, Occoquan and Patuxent reservoirs and for the natural flow at Little Falls for the period of record. The reconstructed streamflow hydrology used to describe the yield of the system is the drought of record hydrology from 1930-1931. The annual average demands forecasted in Chapter V for 1990-2020 can be used with the winter water use factor from Chapter III to compute a forecasted winter water demand from 1990-2020. Forecasted daily demand sequences can be developed by multiplying a year of daily production data by the ratio of the forecasted winter water demand to the actual winter water produced that year. For this simulation the production data from 1983 was used because of the large daily variability. The 1983 daily demand sequence was scaled in this way to produce a daily demand trace for each of the forecasted years from 1990-2020 and the extrapolated forecasts from 2025-2050. The drought hydrology and the forecasted demand traces were used in the system simulation model to compute daily withdrawals at each water supply intake and daily reservoir volumes.

The forecasted annual average demand including the 100 mgd flow-by and the system simulated remaining system storage during the drought of record is displayed in Table VI-7. Yield is defined as the annual average demand that could be reliably supplied by the historical hydrologic record. Thus, the yield of the river/reservoir system is the average annual demand the system could supply during the drought of record without depleting all system resources. Table VI-7 shows that the maximum demands the system can sustain for the drought of record are the demands forecasted for the year 2030.

E.) Summary and Conclusions of Demand/Supply Assessment

The free flowing Potomac River is over-allocated with current demands and will increase with the forecasted demands, this over-allocation demonstrates the need for the system reservoirs. The simple assessment of the system resources with the forecasted 2020 demands showed an annual average deficit of 20.7 mgd if the river/reservoir system is operated at a constant draft, and a 54.9 mgd annual average deficit if the river/reservoir system is operated at a seasonally varying draft. The difference between the two methods is largely due to the calculation of the yield of the free flowing Potomac River. The seasonally varying draft by definition uses the Potomac River with less efficiency on an annual average basis. The second assessment of the system resources with the forecasted 2020 demands for a critical period of 120-days showed an average 100.0 mgd deficit during the critical period for the constant draft method and an average 63.6 mgd deficit during the critical period for the seasonally varying method. As expected, during the critical

To be read in conjunction with p. 51

In 1995, ICPRB conducted a study and prepared a report entitled "1995 Water Demand Forecast and Resource Availability Analysis for the Washington Metropolitan Area." Beginning in 1990, this analysis is conducted every five years with the best available data at the time as part of the Potomac River Low Flow Allocation Agreement. The Washington Metropolitan Area has relatively little experience with water use restrictions due to resource deficits. However, it is assumed that water use restrictions would likely be implemented when system storage was reduced to approximately 40 percent of water supply capacity. This assumption is based partly on the fact that during the drought of 1977, the Fairfax County Water Authority was considering serious water restrictions when the Occoquan Reservoir was depleted to approximately 40 percent of its storage. Therefore, this criterion is used as the threshold of need for new storage.

The total available storage assumed in the 1995 demand forecast study included Jennings Randolph Lake water quality storage and most of Savage River Reservoir, both of which may be fully exhausted and not under the direct control of the WMA water utilities. Therefore, the assumed system water supply storage (35.1 bg) directly accessible to the WMA utilities is the total Jennings Randolph (water supply only), Occoquan, Patuxent, and Little Seneca reservoirs. Forty percent of this storage corresponds to a volume of approximately 14 bg and would be the amount remaining after meeting unrestricted demands, forecasted to occur in approximately the year 2015, during a record drought of hydrology (1930-1931).

Table VI-7 System simulation forecasted demands and minimum combined system storage.		
Forecast Year	Annual Average Demand including flow-by (mgd)	Remaining System Storage (billion gallons)
1990	552.9	23.9
1995	583.5	23.4
2000	618.2	22.3
2005	650.1	20.3
2010	678.9	17.7
2015	706.0	14.1
2020	732.1	10.4
2025	757.6	6.9
2030	782.3	3.4
2035	806.6	-0.2
2040	830.3	-3.2
2045	853.8	-6.7
2050	877.8	-10.7

period the deficits are larger than the annual average deficit. However, the critical period assessment shows the advantages of the river/reservoir system being operated at a seasonally varying draft. Fortunately, the resources are not operated at the historic yields. Each reservoir may be operated above the historic yield to jointly maximize the reliability of the reservoir system. Additionally, water supply withdrawals from the Potomac River maximize the use of the natural flow in the river when conditions allow and often exceed the historic yield. The daily system simulation model developed to capture the advantages of joint operations of the river/reservoir system showed that the system could sustain the demands forecasted for the year 2030 during a repetition of the drought of record without depleting all system resources.

VII.) POTENTIAL FUTURE SOURCES OF ADDITIONAL WATER SUPPLY

A.) Introduction

If demands continue to grow, as forecasted in Chapter V, it is shown in Chapter VI that existing sources of water will be inadequate to meet those demands. A review of potential future sources of additional water supply was conducted as a related task in this study of future demands and the adequacy of available existing sources.

Potential future sources of water supply include: reallocated storage now used for other purposes in Jennings Randolph Reservoir, new reservoirs to be developed on sites identified in previous water resource studies, and raw water interconnections which were also identified in previous water resource studies. Other potential new sources of water include the development of groundwater and use of the Potomac River estuary. In addition to potential storage capacity, and inflow yield estimates in some cases, an attempt has been made to update the construction costs presented in previous studies. Updated construction costs do not include environmental impact, real estate costs, public involvement and other considerations.

B.) Reallocation of Jennings Randolph Reservoir

Jennings Randolph Reservoir is a multipurpose project owned and operated by the U.S. Army Corps of Engineers. In 1988 the Maryland Department of Natural Resources requested that the Corps of Engineers conduct a study of the use of storage in the project in order to determine the extent to which existing non-water supply storage could be reallocated to water supply purposes. The feasibility phase of the study is nearing completion, but a final determination of reallocatable storage is not expected to be known for several months. It is anticipated that some storage will be available for reallocation in order to partially meet future water supply needs of the Washington metropolitan area. Estimated costs of reallocated storage are not yet available from the feasibility phase of the study; however, results from the prior reconnaissance phase (U.S. Army Corps of Engineers, 1989) indicate that they would be between $9,570,000 and $9,800,000 per billion gallons at May 1989 values.

C.) Potential Future Reservoirs

A number of studies have examined, and re-examined, possible sites for reservoirs to increase water supplies for the Washington metropolitan area. The earliest of the studies conducted in the last 35 years to identify and consolidate potential future reservoir sites was documented in the Corps of Engineers' Potomac River Basin Report (1963). This study was significant in that it identified 16 major multipurpose reservoir sites and hundreds of smaller potential flood control structures. Although the recommendations of the study met with considerable public opposition, the report provides much valuable information relative to the identified sites. Some of those sites have been reviewed in subsequent studies.

A water supply study completed in 1974 by Black & Veatch Consulting Engineers (B&V) identified 21 potential reservoir sites in or near the areas supplied by the Fairfax County Water Authority and the Washington Suburban Sanitary Commission. The B&V study also reviewed the three proposals then thought to be likely to proceed from the Corps of Engineers' 1963 report. Those sites most likely to be developed were considered to be Jennings Randolph, then under construction on the North Branch Potomac River, Sixes Bridge on the Monocacy River, and Verona on the Middle River tributary to the Shenandoah. The 21 potential sites in or near the areas supplied by the FCWA and WSSC are listed in Table VII-1. Included in the listing is an estimate of the developable volume of water supply storage, the natural inflow to the sites, and construction costs (updated to 1984 values). The inflow of all but the L-25 site was anticipated to be augmented by pumping from the Potomac River. The locations of the 21 potential reservoir sites presented in Table VII-1 are shown on Figure VII-1.

The estimated capacities, yields and costs of the potential future water supply reservoir sites reconsidered from the Corps of Engineers' 1983-F study are presented in Table VII-2. The locations of the 17 potential reservoir sites presented in Table VII-2 are shown in the Potomac River basin on Figure VII-2 together with the 3 largest sites from Table VII-1 and the existing reservoirs which serve the Washington metropolitan area. Site number 1 (Jennings Randolph) was built.

D.) Potential Future Raw Water Interconnections

As with reservoir sites, a number of studies have examined, and re-examined, possible routes for raw water interconnections to increase water supplies for the Washington metropolitan area. Both the Black & Veatch (1974) and the Corps of Engineers' (1983-E) studies consider potential raw water interconnections in some detail.

The most favored resources to be connected are: (1) the Potomac River and the Occoquan reservoirs, and (2) the Potomac River and the Patuxent reservoirs. These are the only interconnections which would result in a significant increase in system yield. It was assumed in both studies that the two interconnections would be used to pump Potomac River water to the off-Potomac reservoirs in times of high flows, and in the opposite direction for Potomac low flow augmentation in times of drought. This method of operation assumed that the treatment plants associated with the Occoquan and Patuxent reservoirs were sized only for the safe yield of those reservoirs. Studies are currently underway at both the FCWA and WSSC to determine the optimum capacities to which those treatment facilities should be constructed during future modifications. A significant consideration in the current studies for both plants is the amount of redundant capacity to include as a hedge against the possibility that the Potomac River may be subject to serious pollution incidents. Such pollution could cause the water suppliers to rely solely on their Occoquan and Patuxent reservoirs and associated treatment plants.

Table VII-1 Potential future water supply reservoir sites in or near the FCWA and WSSC service areas, from the Black & Veatch 1974 report.				
Site	Location	Net Storage (bg)	Inflow (1) (mgd)	Cost (1994 $/bg)
L-1	Catoctin Creek	12.40	11.47	7,333,000
L-4	Trib. S. Fork Catoctin Cr.	1.21	0.23	30,907,000
L-5	Limestone Branch	1.71	0.15	20,686,000
L-6	S. Fork Limestone Branch	3.10	0.28	12,679,000
L-7	Tuscarora Creek	1.65	0.56	40,011,000
L-8	N. Fork Goose Creek	9.63	2.96	14,437,000
L-9	Beaverdam Creek	7.79	2.81	15,474,000
L-11	Beaverdam Creek	7.14	4.81	15,728,000
L-15	Cromwell Run	5.03	2.49	19,629,000
L-18	Beaverdam Creek	1.89	0.73	30,834,000
L-20	N. Fork Goose Creek	39.10	11.91	7,095,000
L-21	Goose Creek	62.10	33.60	7,041,000
L-24	Upper Bull Run	5.39	3.01	20,163,000
L-25	Goose Creek	5.72	44.01	29,632,000
L-26	Piney Run	2.81	1.62	13,687,000
L-27	Dutchman Creek	3.61	1.64	14,162,000
M-3	Little Monocacy River	1.96	1.55	17,301,000
M-4	Trib. Little Monocacy River	10.65	0.47	8,925,000
M-5	Tenmile Creek	9.81	0.88	9,834,000
M-6	Hookers Branch, Seneca Cr.	4.46	4.04	22,827,000
M-7	Muddy Branch	1.66	0.39	38,195,000

Notes: (1) Annual Inflow is estimated by the Basin Climate Index (BCI) technique (Smith, 1973), then reduced to 22% of the BCI value in order to account for drought conditions.

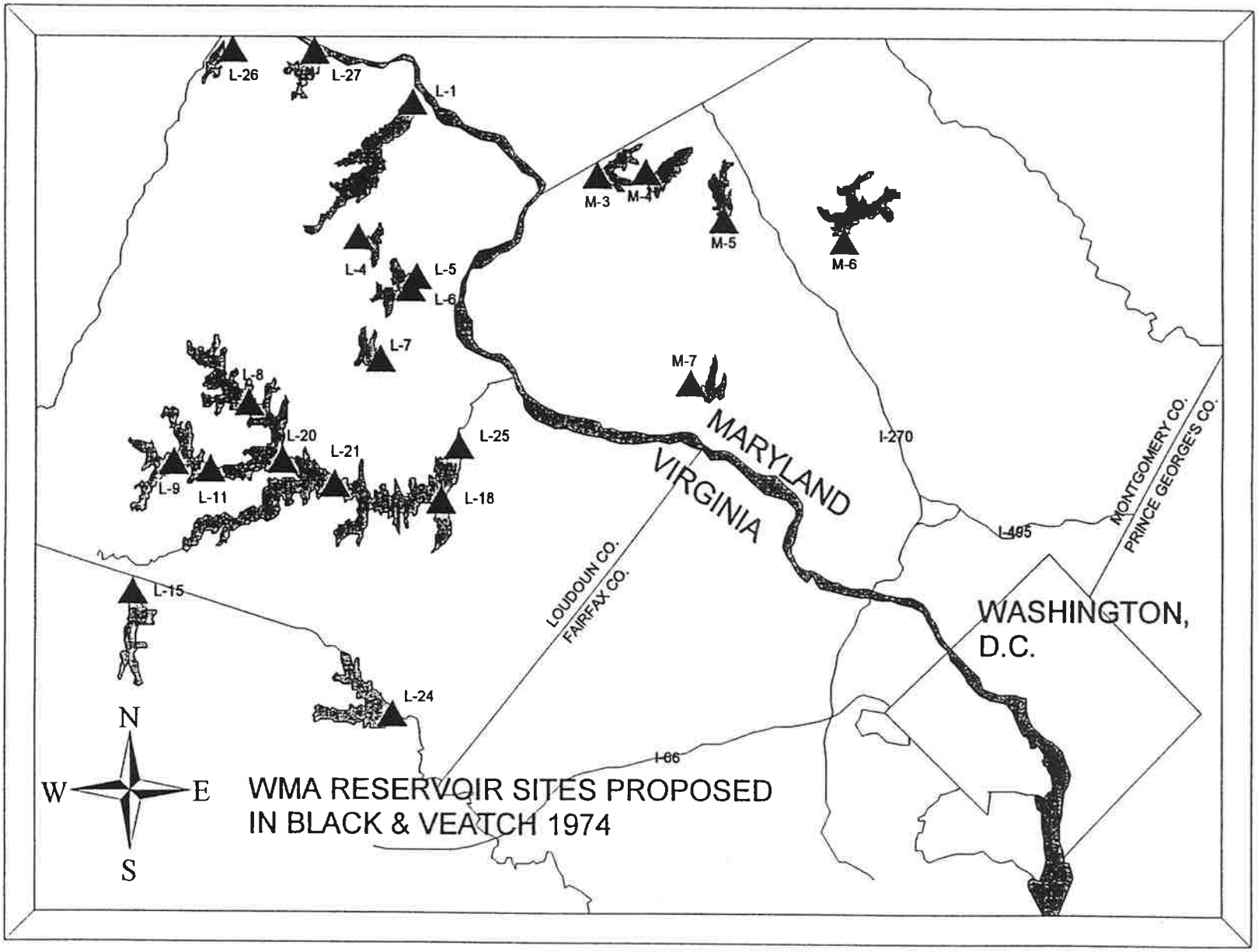

Figure VII-1 Washington metropolitan area reservoir sites proposed in Black and Veatch 1974.

Table VII-2 Potential future water supply reservoir sites, from the Corps of Engineers' 1983-F study.				
Site	Location	Net Storage (bg)	Est. Yield (mgd)	Cost (1994 $/bg)
2	Royal Glen, S. Branch Potomac River	74.30	312	2,609,000
3	Chambersburg, Conococheague Creek	9.10	40	8,635,000
4	Verona, Middle R., Shenandoah River	33.90	110	6,652,000
5	Sixes Bridge, Monocacy River	20.50	85	4,745,000
6	West Branch, W. Br. Conococheague Cr.	14.70	42	5,015,000
7	Brocks Gap, N. Fk. Shenandoah River	39.40	95	2,642,000
8	Winchester, Opequon Creek	9.20	30	7,558,000
9	Seneca, Potomac River	150.00	900	4,298,000
10	Licking Creek, Licking Creek	26.80	89	2,671,000
11	Mount Storm, Stony River	8.80	32	7,026,000
12	Town Creek, Town Creek	18.70	63	3,306,000
13	North Mountain, Back Creek, WV	31.10	89	3,327,000
14	Savage II, Savage River	12.70	37	6,551,000
15	Back Creek, Back Creek, PA	6.40	18	7,303,000
16	Tonoloway Creek, Tonoloway Creek	16.30	64	5,370,000
17	Sideling Hill, Sideling Hill Creek	17.80	61	3,966,000
18	Little Cacapon, Little Cacapon River	17.30	59	4,386,000

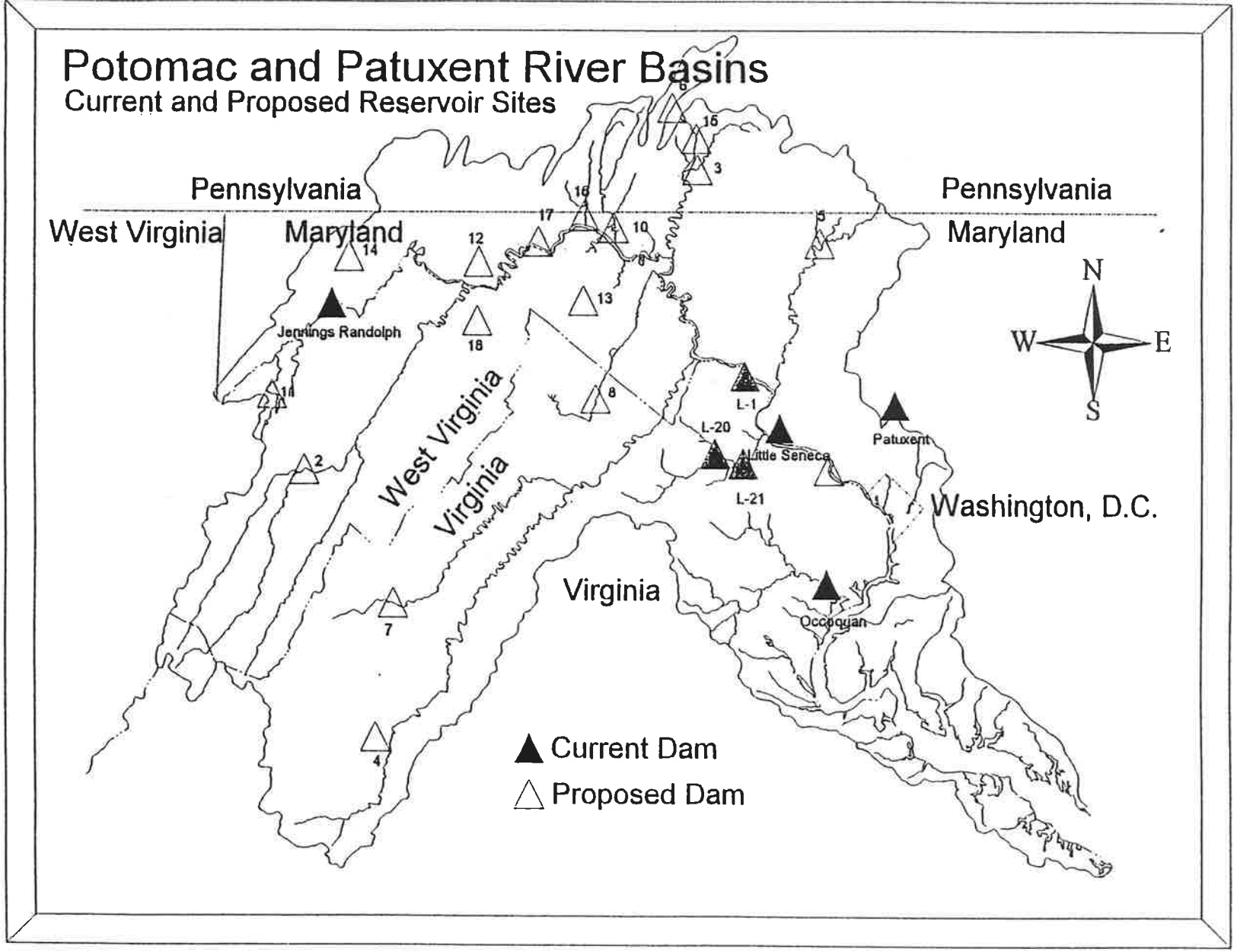

Figure VII-2 Current and proposed reservoir sites.

The sizing and yield of the potential raw water interconnections would depend on how they would be operated. The possible uses could be: (1) high Potomac flow skimming for future Potomac flow augmentation, and/or (2) possibly, high Potomac flow skimming for storage in the Occoquan and/or Patuxent reservoirs and subsequent treatment at the associated reservoir treatment plants.

Alternatives with potential capacities of 180 mgd each have been studied. Construction costs of up to $187,647,000 for the Potomac to Patuxent interconnection and $224,302,000 for the Potomac to Occoquan interconnection were determined (costs updated to 1994 values). Annual operating costs were estimated to be incurred at approximately 5% of the original construction costs.

The route of the Potomac River to Occoquan Reservoir raw water interconnection is shown in Figure VII-3, and the route of the Potomac River to Patuxent Reservoir raw water interconnection is shown in Figure VII-4.

E.) Other Potential Sources

Well fields could be developed in Prince George's and/or Anne Arundel counties in Maryland. The estimate capital costs of a 100 mgd groundwater development were estimated to be $49,190,000 (Black & Veatch, 1974). The facilities required would include: wells, collection pipelines, pumping stations, power facilities, and treatment facilities. In a more recent study by the Corps of Engineers (1983-F), well fields could be developed in Prince George's, Anne Arundel, Calvert and/or Charles counties in Maryland. At October 1981 price levels, the capital costs of developing 25 mgd, 50 mgd, and 100 mgd would be at least $33,830,000, $61,370,000, and $122,460,000 respectively. Annual operation and maintenance costs were expected to be approximately 2.5% of original capital costs.

The upper reaches of the Potomac River estuary are essentially fresh water. This area has been the subject of studies (Black & Veatch, 1974) as a potential source of water supply. However, the area receives a significant amount of treated waste water, and as such has been considered to be a low priority source compared to others which are not subject to that concern. A Corps of Engineers' study in the early 1980s to determine treatability of Potomac estuary water involved the construction of a pilot scale plant and experimentation with various unit processes. For a plant with a capacity of 200 mgd, the construction cost was estimated to be approximately $225,000,000 (1994 dollars), with annual operating and maintenance costs incurred at a rate of approximately 10% of the original construction cost.

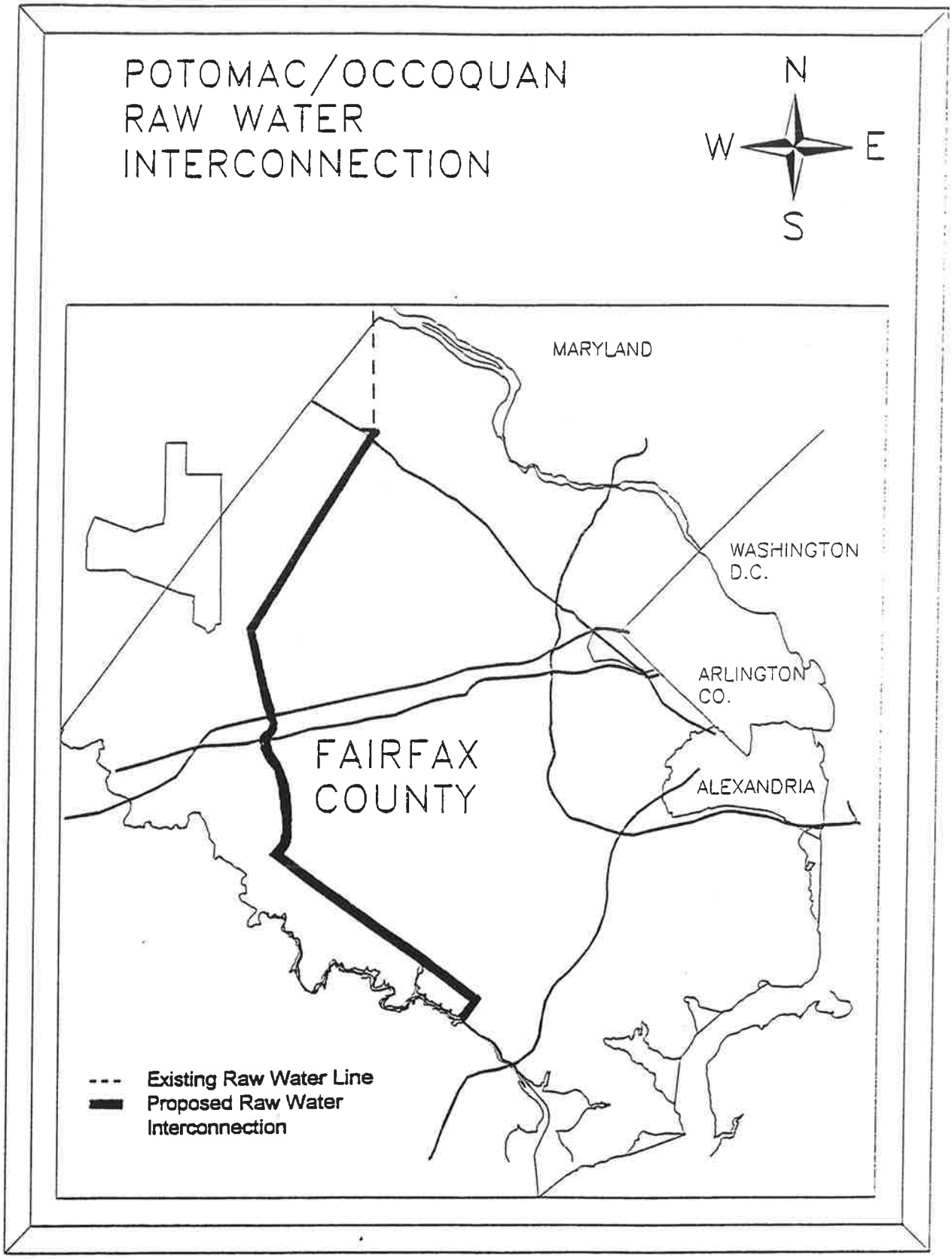

Figure VII-3 Potomac / Occoquan raw water interconnection.

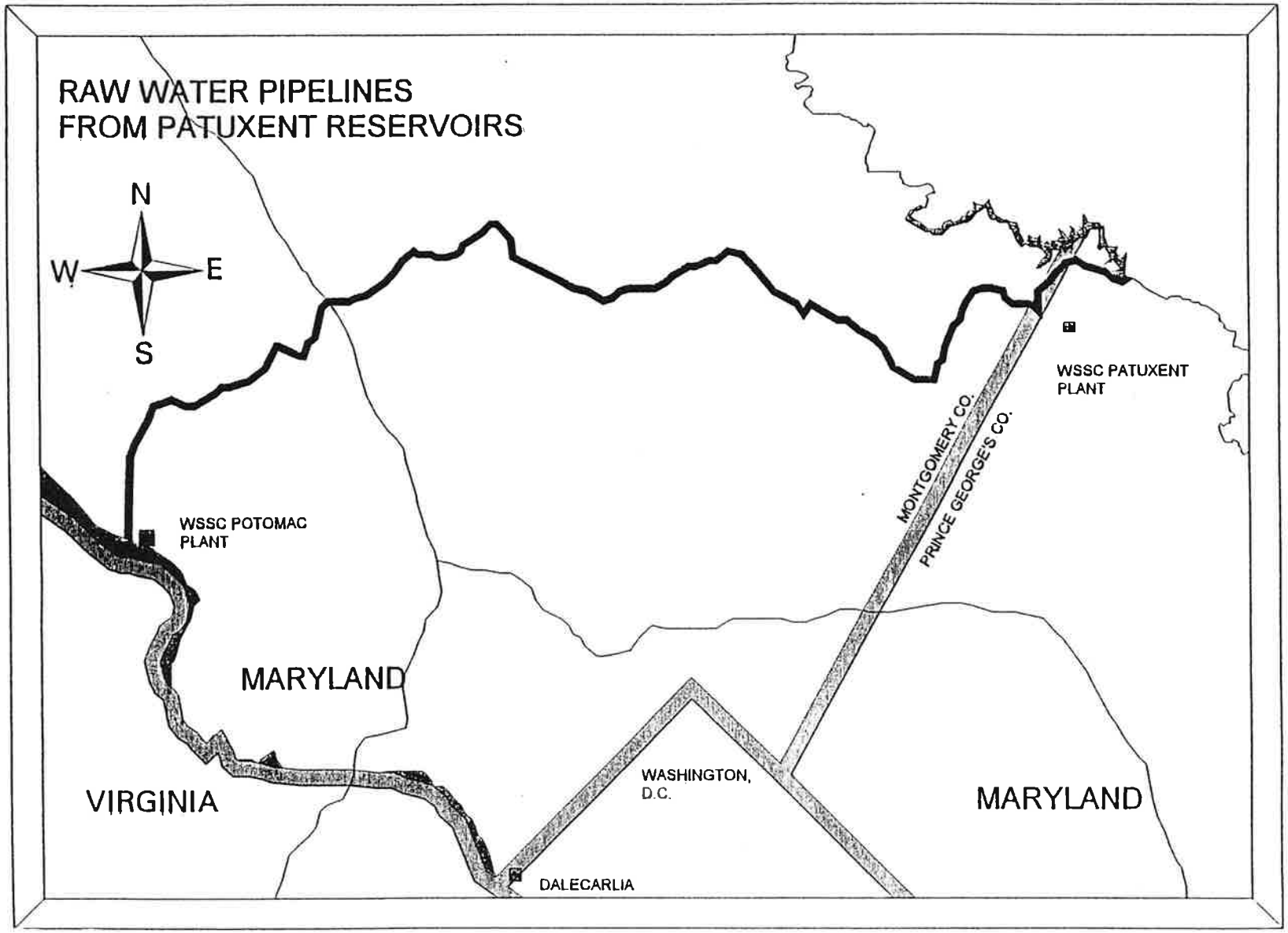

Figure VII-4 Raw water pipeline from Patuxent Reservoir.

VIII.) STUDY CONCLUSIONS

The preceding chapters have discussed the CO-OP Section's development and application of a long term water demand forecasting model for the Washington metropolitan area. The model is designed to forecast annual average and peak demands at 5 year intervals for the 1990-2020 time period. This report also described comparisons of these forecasted demands with available resources. This study was undertaken to fulfill Article 2 of the Low Flow Allocation Agreement mandating an evaluation of future water demands and the resources available to meet those demands every 5 years beginning in 1990. The following conclusions may be drawn from this study.

-Washington Aqueduct Division's water demand is forecasted to grow by 24.8 mgd, from 175.8 mgd to 200.6 mgd, over the forecast period (1990-2020). During this same period Fairfax County Water Authority is expected to grow from 106.1 mgd to 189.2 mgd, a gain of 83.1 mgd. Washington Suburban Sanitary Commission is expected to increase 68.2 mgd, from 164.8 mgd in 1990 to 233.0 in 2020. The CO-OP annual average demand is predicted to grow by 176.1 mgd, from 446.7 mgd to 622.8 mgd, during the forecast period.

-The free flowing Potomac River is over-allocated with current demands and will increase with the forecasted demands, this over-allocation demonstrates the need for the system reservoirs.

-The simple assessment of the system resources with the forecasted 2020 demands showed an annual average deficit of 20.7 mgd if the river/reservoir system is operated at a constant draft, and a 54.9 mgd annual average deficit if the river/reservoir system is operated at a seasonally varying draft.

-The second assessment of the system resources with the forecasted 2020 demands for a critical period of 120-days showed an average 100.0 mgd deficit during the critical period for the constant draft method and an average 63.6 mgd deficit during the critical period for the seasonally varying method.

-The daily system simulation model developed to capture the advantages of joint operations of the river/reservoir system showed that the system could sustain the demands forecasted for the year 2030 during a repetition of the drought of record without depleting all system resources. This supply/demand assessment indicates that some growth in demand can be accommodated by continuous adaptation of cooperative operating rules and expanded capacity of suppliers current facilities.

-Analysis shows that conservation efforts in new units decrease water demand from multi-

family households while water demands from single family households continue to increase with very little effect in total water demand. A potential may exist for conservation efforts to reduce indoor water use in older service areas by retrofitting water wasting fixtures with water conserving fixtures.

-Potential future sources of water supply include: reallocated storage now used for other purposes in Jennings Randolph Reservoir, new reservoirs to be developed on sites identified in previous water resource studies, and raw water interconnections which were also identified in previous water resource studies. Other potential new sources of water include the development of groundwater and use of the Potomac River estuary. Alternatives have varying costs with incomplete and inconsistent data to make comparisons.

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Appendix A - Production Data for Washington Aqueduct Division

	1990	1991	1992	1993	1994	MEAN
Annual Average Production	187.63	193.03	178.46	177.03	186.18	
Winter Water Use	164.50	168.34	175.88	157.96	175.06	
WWU Production Factor	0.88	0.87	0.99	0.89	0.94	0.913
Monthly Average Production						
January	163.06	171.16	179.14	157.79	190.43	
February	163.71	162.18	171.63	154.47	177.48	
March	172.07	169.53	169.53	159.19	170.36	
April	177.45	178.16	173.26	169.20	174.53	
May	187.29	198.07	172.83	174.90	178.53	
June	204.90	220.05	184.06	193.61	212.57	
July	219.08	224.95	203.18	218.47	209.81	
August	211.38	222.69	193.58	206.47	198.80	
September	203.84	211.19	187.62	196.64	196.73	
October	193.93	193.52	174.94	174.06	182.76	
November	182.00	186.57	170.01	160.22	177.15	
December	171.08	176.12	161.30	157.51	164.73	
Monthly Average Production Factors						
January	0.87	0.89	1.00	0.89	1.02	0.93
February	0.87	0.84	0.96	0.87	0.95	0.90
March	0.92	0.88	0.95	0.90	0.92	0.91
April	0.95	0.92	0.97	0.96	0.94	0.95
May	1.00	1.03	0.97	0.99	0.96	0.99
June	1.09	1.14	1.03	1.09	1.14	1.10
July	1.17	1.17	1.14	1.23	1.13	1.17
August	1.13	1.15	1.08	1.17	1.07	1.12
September	1.09	1.09	1.05	1.11	1.06	1.08
October	1.03	1.00	0.98	0.98	0.98	1.00
November	0.97	0.97	0.95	0.91	0.95	0.95
December	0.91	0.91	0.90	0.89	0.88	0.90
Peak 1-Day Production						
January	176.80	216.20	236.60	175.90	228.70	
February	184.50	183.50	184.60	167.60	192.90	
March	191.50	187.20	179.20	171.60	179.30	
April	201.60	196.10	196.20	191.70	201.50	
May	218.80	252.80	183.40	194.00	199.70	
June	242.40	239.10	212.10	222.10	241.80	
July	250.40	266.60	230.60	244.20	235.00	
August	236.50	242.90	209.40	230.60	222.70	
September	236.20	239.90	203.70	234.80	215.60	
October	207.10	212.90	185.80	188.10	197.70	
November	207.50	198.70	184.60	185.60	192.60	
December	187.40	192.40	178.60	187.70	209.50	

Appendix A - Production Data for Washington Aqueduct Division (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 1-Day Production Factors						
January	1.08	1.26	1.32	1.11	1.20	1.20
February	1.13	1.13	1.08	1.09	1.09	1.10
March	1.11	1.10	1.06	1.08	1.05	1.08
April	1.14	1.10	1.13	1.13	1.15	1.13
May	1.17	1.28	1.06	1.11	1.12	1.15
June	1.18	1.09	1.15	1.15	1.14	1.14
July	1.14	1.19	1.13	1.12	1.12	1.14
August	1.12	1.09	1.08	1.12	1.12	1.11
September	1.16	1.14	1.09	1.19	1.10	1.13
October	1.07	1.10	1.06	1.08	1.08	1.08
November	1.14	1.06	1.09	1.16	1.09	1.11
December	1.10	1.09	1.11	1.19	1.27	1.15
Peak 7-Day Production						
January	170.80	176.07	187.13	164.01	216.66	
February	168.56	165.51	176.40	157.00	184.51	
March	178.70	176.74	171.39	161.84	172.69	
April	192.50	181.61	180.29	178.30	184.87	
May	204.39	224.97	177.00	182.37	187.36	
June	221.71	229.94	192.44	206.94	229.47	
July	229.36	251.10	219.33	233.49	219.83	
August	219.03	229.87	197.97	214.50	208.11	
September	219.19	224.91	193.51	214.03	206.51	
October	200.04	202.11	178.69	178.17	186.80	
November	190.23	191.46	173.79	172.21	181.23	
December	179.17	182.17	170.60	172.40	171.59	
Peak 7-Day Production Factor						
January	1.05	1.03	1.04	1.04	1.14	1.06
February	1.03	1.02	1.03	1.02	1.04	1.03
March	1.04	1.04	1.01	1.02	1.01	1.02
April	1.08	1.02	1.04	1.05	1.06	1.05
May	1.09	1.14	1.02	1.04	1.05	1.07
June	1.08	1.04	1.05	1.07	1.08	1.06
July	1.05	1.12	1.08	1.07	1.05	1.07
August	1.04	1.03	1.02	1.04	1.05	1.04
September	1.08	1.07	1.03	1.09	1.05	1.06
October	1.03	1.04	1.02	1.02	1.02	1.03
November	1.05	1.03	1.02	1.07	1.02	1.04
December	1.05	1.03	1.06	1.09	1.04	1.06

Appendix A - Production Data for Washington Aqueduct Division (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 30-Day Production	220.98	229.13	205.08	223.50	216.06	
Peak 30-Day Production Factor	1.18	1.19	1.15	1.26	1.16	1.19
Peak 60-Day Production	216.89	225.30	199.38	214.80	212.51	
Peak 60-Day Production Factor	1.16	1.17	1.12	1.21	1.14	1.16
Peak 90-Day Production	215.02	223.15	195.96	210.82	207.33	
Peak 90-Day Production Factor	1.15	1.16	1.10	1.19	1.11	1.14
Peak 120-Day Production	210.69	221.80	192.59	204.63	204.90	
Peak 120-Day Production Factor	1.12	1.15	1.08	1.16	1.10	1.12
Peak 180-Day Production	204.01	212.68	186.57	194.60	197.35	
Peak 180-Day Production Factor	1.09	1.10	1.05	1.10	1.06	1.08

Appendix B - Production Data for Fairfax County Water Authority

	1990	1991	1992	1993	1994	MEAN
Annual Average Production	104.97	110.39	106.04	112.43	114.94	
Winter Water Use	94.09	96.26	95.35	97.81	98.82	
WWU Production Factor	0.90	0.87	0.90	0.87	0.86	0.879
Monthly Average Production						
January	95.51	95.95	94.58	98.31	102.41	
February	90.95	94.59	94.64	96.84	96.73	
March	94.67	96.58	97.05	97.58	94.17	
April	101.69	102.04	106.24	99.20	105.64	
May	103.34	120.85	112.57	115.05	117.07	
June	121.39	135.22	117.51	131.02	151.48	
July	120.89	125.98	123.30	154.15	140.26	
August	112.18	128.00	113.17	135.36	122.82	
September	112.84	121.27	109.71	118.87	126.65	
October	105.62	107.20	104.91	104.77	113.66	
November	101.67	99.23	100.19	99.30	104.32	
December	98.06	96.81	98.19	97.11	103.25	
Monthly Average Production Factors						
January	0.91	0.87	0.89	0.87	0.89	0.89
February	0.87	0.86	0.89	0.86	0.84	0.86
March	0.90	0.87	0.92	0.87	0.82	0.88
April	0.97	0.92	1.00	0.88	0.92	0.94
May	0.98	1.09	1.06	1.02	1.02	1.04
June	1.16	1.22	1.11	1.17	1.32	1.19
July	1.15	1.14	1.16	1.37	1.22	1.21
August	1.07	1.16	1.07	1.20	1.07	1.11
September	1.08	1.10	1.03	1.06	1.10	1.07
October	1.01	0.97	0.99	0.93	0.99	0.98
November	0.97	0.90	0.94	0.88	0.91	0.92
December	0.93	0.88	0.93	0.86	0.90	0.90
Peak 1-Day Production						
January	105.20	103.60	100.90	106.80	113.70	
February	97.70	101.30	103.70	103.50	106.30	
March	104.50	104.60	105.20	105.20	103.60	
April	127.40	113.80	113.80	113.30	124.50	
May	114.60	154.50	134.10	136.80	146.60	
June	160.90	176.30	136.00	166.00	186.90	
July	160.80	180.00	162.30	184.70	166.30	
August	149.80	152.20	129.30	164.80	138.20	
September	130.90	154.90	124.00	146.00	150.20	
October	128.00	121.00	112.50	114.40	120.90	
November	112.90	112.30	107.80	106.70	113.60	
December	105.70	104.10	105.20	105.40	110.10	

Appendix B - Production Data for Fairfax County Water Authority (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 1-Day Production Factors						
January	1.10	1.08	1.07	1.09	1.11	1.09
February	1.07	1.07	1.10	1.07	1.10	1.08
March	1.10	1.08	1.08	1.08	1.10	1.09
April	1.25	1.12	1.07	1.14	1.18	1.15
May	1.11	1.28	1.19	1.19	1.25	1.20
June	1.33	1.30	1.16	1.27	1.23	1.26
July	1.33	1.43	1.32	1.20	1.19	1.29
August	1.34	1.19	1.14	1.22	1.13	1.20
September	1.16	1.28	1.13	1.23	1.19	1.20
October	1.21	1.13	1.07	1.09	1.06	1.11
November	1.11	1.13	1.08	1.07	1.09	1.10
December	1.08	1.08	1.07	1.09	1.07	1.08
Peak 7-Day Production						
January	98.29	97.80	95.99	100.43	110.39	
February	92.12	96.83	95.37	98.50	100.53	
March	98.51	97.24	100.76	98.60	96.37	
April	113.26	105.40	109.11	105.06	119.00	
May	107.79	143.96	121.51	126.46	129.63	
June	134.93	152.94	127.29	154.93	168.89	
July	133.87	161.54	139.27	169.37	156.10	
August	126.07	137.44	117.91	145.17	130.97	
September	124.01	134.10	114.39	137.51	140.59	
October	115.11	112.24	107.76	109.90	115.93	
November	105.86	99.99	101.70	101.47	106.83	
December	100.86	99.60	101.37	100.06	105.26	
Peak 7-Day Production Factor						
January	1.03	1.02	1.01	1.02	1.08	1.03
February	1.01	1.02	1.01	1.02	1.04	1.02
March	1.04	1.01	1.04	1.01	1.02	1.02
April	1.11	1.03	1.03	1.06	1.13	1.07
May	1.04	1.19	1.08	1.10	1.11	1.10
June	1.11	1.13	1.08	1.18	1.11	1.12
July	1.11	1.28	1.13	1.10	1.11	1.15
August	1.12	1.07	1.04	1.07	1.07	1.08
September	1.10	1.11	1.04	1.16	1.11	1.10
October	1.09	1.05	1.03	1.05	1.02	1.05
November	1.04	1.01	1.02	1.02	1.02	1.02
December	1.03	1.03	1.03	1.03	1.02	1.03

Appendix B - Production Data for Fairfax County Water Authority (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 30-Day Production	128.62	136.86	126.48	159.28	152.73	
Peak 30-Day Production Factor	1.23	1.24	1.19	1.42	1.33	1.28
Peak 60-Day Production	123.42	135.61	121.49	147.84	147.06	
Peak 60-Day Production Factor	1.18	1.23	1.15	1.31	1.28	1.23
Peak 90-Day Production	119.49	130.93	118.63	142.96	139.77	
Peak 90-Day Production Factor	1.14	1.19	1.12	1.27	1.22	1.19
Peak 120-Day Production	117.02	130.34	116.83	136.71	136.85	
Peak 120-Day Production Factor	1.11	1.18	1.10	1.22	1.19	1.16
Peak 180-Day Production	113.36	123.54	114.15	127.27	129.21	
Peak 180-Day Production Factor	1.08	1.12	1.08	1.13	1.12	1.11

Appendix C - Production Data for Washington Suburban Sanitary Commision

	1990	1991	1992	1993	1994	MEAN
Annual Average Production	166.94	170.93	162.46	166.98	173.44	
Winter Water Use	156.22	155.54	154.18	147.27	165.64	
WWU Production Factor	0.94	0.91	0.95	0.88	0.96	0.926
Monthly Average Production						
January	155.71	156.18	155.46	147.03	177.37	
February	150.92	153.92	152.33	146.33	162.54	
March	153.70	154.46	150.58	146.52	158.77	
April	161.47	159.49	157.16	150.82	163.66	
May	165.91	186.03	163.39	165.24	171.95	
June	182.80	201.11	178.00	186.24	199.05	
July	189.30	195.16	185.84	210.83	190.65	
August	178.51	188.34	175.19	191.59	181.66	
September	177.57	177.69	170.57	177.25	179.92	
October	168.99	165.01	158.77	162.34	170.31	
November	160.97	158.15	153.54	161.07	165.38	
December	156.37	154.36	148.35	156.71	159.45	
Monthly Average Production Factors						
January	0.93	0.91	0.96	0.88	1.02	0.94
February	0.90	0.90	0.94	0.88	0.94	0.91
March	0.92	0.90	0.93	0.88	0.92	0.91
April	0.97	0.93	0.97	0.90	0.94	0.94
May	0.99	1.09	1.01	0.99	0.99	1.01
June	1.09	1.18	1.10	1.12	1.15	1.13
July	1.13	1.14	1.14	1.26	1.10	1.16
August	1.07	1.10	1.08	1.15	1.05	1.09
September	1.06	1.04	1.05	1.06	1.04	1.05
October	1.01	0.97	0.98	0.97	0.98	0.98
November	0.96	0.93	0.95	0.96	0.95	0.95
December	0.94	0.90	0.91	0.94	0.92	0.92
Peak 1-Day Production						
January	168.90	168.00	166.80	160.60	223.50	
February	164.10	163.90	163.00	162.40	178.80	
March	167.00	161.10	164.90	158.70	173.70	
April	185.10	183.80	167.20	160.50	184.40	
May	178.40	225.80	181.20	184.90	198.50	
June	235.20	248.80	205.70	217.20	230.60	
July	224.20	255.90	220.40	242.60	216.70	
August	214.00	212.10	191.80	221.60	193.90	
September	197.00	200.70	185.10	214.50	194.70	
October	187.60	188.50	168.00	181.50	187.40	
November	178.60	170.90	170.20	174.10	180.70	
December	168.80	165.30	162.00	168.80	170.00	

Appendix C - Production Data for Washington Suburban Sanitary Commission (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 1-Day Production Factors						
January	1.08	1.08	1.07	1.09	1.26	1.12
February	1.09	1.06	1.07	1.11	1.10	1.09
March	1.09	1.04	1.10	1.08	1.09	1.08
April	1.15	1.15	1.06	1.06	1.13	1.11
May	1.08	1.21	1.11	1.12	1.15	1.13
June	1.29	1.24	1.16	1.17	1.16	1.20
July	1.18	1.31	1.19	1.15	1.14	1.19
August	1.20	1.13	1.09	1.16	1.07	1.13
September	1.11	1.13	1.09	1.21	1.08	1.12
October	1.11	1.14	1.06	1.12	1.10	1.11
November	1.11	1.08	1.11	1.08	1.09	1.09
December	1.08	1.07	1.09	1.08	1.07	1.08
Peak 7-Day Production						
January	160.06	158.53	159.56	149.06	203.33	
February	152.56	156.99	157.79	148.90	165.11	
March	157.90	156.46	151.94	148.57	162.60	
April	175.44	169.81	160.40	155.83	174.13	
May	170.36	213.21	170.44	174.43	180.16	
June	196.46	226.14	187.09	210.41	213.76	
July	208.99	226.51	207.40	232.47	210.33	
August	190.37	199.70	184.64	206.77	186.41	
September	186.21	188.79	174.56	200.21	188.84	
October	174.46	173.19	163.54	169.34	171.77	
November	165.73	161.36	157.00	165.40	171.70	
December	159.07	156.97	150.70	161.60	161.27	
Peak 7-Day Production Factor						
January	1.03	1.02	1.03	1.01	1.15	1.05
February	1.01	1.02	1.04	1.02	1.02	1.02
March	1.03	1.01	1.01	1.01	1.02	1.02
April	1.09	1.06	1.02	1.03	1.06	1.05
May	1.03	1.15	1.04	1.06	1.05	1.06
June	1.07	1.12	1.05	1.13	1.07	1.09
July	1.10	1.16	1.12	1.10	1.10	1.12
August	1.07	1.06	1.05	1.08	1.03	1.06
September	1.05	1.06	1.02	1.13	1.05	1.06
October	1.03	1.05	1.03	1.04	1.01	1.03
November	1.03	1.02	1.02	1.03	1.04	1.03
December	1.02	1.02	1.02	1.03	1.01	1.02

Appendix C - Production Data for Washington Suburban Sanitary Commission (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 30-Day Production	192.35	206.33	189.36	215.19	200.15	
Peak 30-Day Production Factor	1.15	1.21	1.17	1.29	1.15	1.19
Peak 60-Day Production	188.45	202.15	183.00	203.53	195.65	
Peak 60-Day Production Factor	1.13	1.18	1.13	1.22	1.13	1.16
Peak 90-Day Production	184.76	197.29	180.60	200.52	190.77	
Peak 90-Day Production Factor	1.11	1.15	1.11	1.20	1.10	1.13
Peak 120-Day Production	182.46	194.42	177.72	193.50	188.77	
Peak 120-Day Production Factor	1.09	1.14	1.09	1.16	1.09	1.11
Peak 180-Day Production	177.91	186.20	172.46	182.82	182.74	
Peak 180-Day Production Factor	1.07	1.09	1.06	1.09	1.05	1.07

Appendix D - Production Data for the CO-OP Suppliers Total

	1990	1991	1992	1993	1994	MEAN
Annual Average Production	459.54	474.35	446.96	456.43	474.57	
Winter Water Use	414.81	420.14	425.41	403.04	439.52	
WWU Production Factor	0.90	0.89	0.95	0.88	0.93	0.910
Monthly Average Production						
January	414.28	423.29	429.18	403.13	470.20	
February	405.58	410.69	418.61	397.63	436.75	
March	420.44	420.56	417.17	403.29	423.30	
April	440.60	439.69	436.66	419.23	443.83	
May	456.55	504.95	448.79	455.19	467.55	
June	509.09	556.38	479.56	510.87	563.09	
July	529.27	546.09	512.32	583.45	540.73	
August	502.07	539.03	481.94	533.41	503.28	
September	494.25	510.15	467.89	492.76	503.30	
October	468.54	465.72	438.63	441.16	466.74	
November	444.64	443.95	423.73	420.59	446.85	
December	425.52	427.29	407.84	411.34	427.43	
Monthly Average Production Factors						
January	0.90	0.89	0.96	0.88	0.99	0.93
February	0.88	0.87	0.94	0.87	0.92	0.90
March	0.91	0.89	0.93	0.88	0.89	0.90
April	0.96	0.93	0.98	0.92	0.94	0.94
May	0.99	1.06	1.00	1.00	0.99	1.01
June	1.11	1.17	1.07	1.12	1.19	1.13
July	1.15	1.15	1.15	1.28	1.14	1.17
August	1.09	1.14	1.08	1.17	1.06	1.11
September	1.08	1.08	1.05	1.08	1.06	1.07
October	1.02	0.98	0.98	0.97	0.98	0.99
November	0.97	0.94	0.95	0.92	0.94	0.94
December	0.93	0.90	0.91	0.90	0.90	0.91
Peak 1-Day Production						
January	445.50	448.20	489.10	422.90	552.00	
February	434.80	431.90	441.40	420.90	463.70	
March	445.30	439.30	435.30	421.10	450.30	
April	501.90	470.00	469.90	440.40	499.10	
May	506.70	622.50	491.70	503.70	542.20	
June	625.50	651.80	538.90	599.70	650.00	
July	617.40	679.50	593.30	658.90	610.20	
August	580.70	584.90	529.20	614.70	538.50	
September	548.10	586.60	504.50	588.20	548.40	
October	503.10	520.90	455.80	475.20	482.00	
November	473.70	467.20	443.30	459.20	472.70	
December	446.30	453.30	429.40	444.30	473.90	

Appendix D - Production Data for the CO-OP Suppliers Total (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 1-Day Production Factors						
January	1.08	1.06	1.14	1.05	1.17	1.10
February	1.07	1.05	1.05	1.06	1.06	1.06
March	1.06	1.04	1.04	1.04	1.06	1.05
April	1.14	1.07	1.08	1.05	1.12	1.09
May	1.11	1.23	1.10	1.11	1.16	1.14
June	1.23	1.17	1.12	1.17	1.15	1.17
July	1.17	1.24	1.16	1.13	1.13	1.17
August	1.16	1.09	1.10	1.15	1.07	1.11
September	1.11	1.15	1.08	1.19	1.09	1.12
October	1.07	1.12	1.04	1.08	1.03	1.07
November	1.07	1.05	1.05	1.09	1.06	1.06
December	1.05	1.06	1.05	1.08	1.11	1.07
Peak 7-Day Production						
January	429.14	428.57	438.41	409.17	526.57	
February	410.67	415.79	429.00	401.80	450.16	
March	433.91	427.36	422.37	406.34	428.96	
April	479.79	455.51	448.04	431.61	476.81	
May	476.29	582.14	468.96	481.87	494.06	
June	553.10	608.93	505.76	570.73	607.49	
July	568.16	631.60	565.53	635.33	586.26	
August	535.47	560.99	499.96	564.14	522.00	
September	529.41	546.81	480.91	551.37	533.83	
October	487.40	487.54	449.89	457.41	472.50	
November	459.44	450.21	428.14	434.54	459.24	
December	436.13	435.59	419.67	425.06	436.73	
Peak 7-Day Production Factor						
January	1.04	1.01	1.02	1.01	1.12	1.04
February	1.01	1.01	1.02	1.01	1.03	1.02
March	1.03	1.02	1.01	1.01	1.01	1.02
April	1.09	1.04	1.03	1.03	1.07	1.05
May	1.04	1.15	1.04	1.06	1.06	1.07
June	1.09	1.09	1.05	1.12	1.08	1.09
July	1.07	1.16	1.10	1.09	1.08	1.10
August	1.07	1.04	1.04	1.06	1.04	1.05
September	1.07	1.07	1.03	1.12	1.06	1.07
October	1.04	1.05	1.03	1.04	1.01	1.03
November	1.03	1.01	1.01	1.03	1.03	1.02
December	1.02	1.02	1.03	1.03	1.02	1.03

Appendix D - Production Data for the CO-OP Suppliers Total (continued)

	1990	1991	1992	1993	1994	MEAN
Peak 30-Day Production	537.96	563.98	517.63	597.22	564.02	
Peak 30-Day Production Factor	1.17	1.19	1.16	1.31	1.19	1.20
Peak 60-Day Production	527.37	561.20	501.27	564.04	553.66	
Peak 60-Day Production Factor	1.15	1.18	1.12	1.24	1.17	1.17
Peak 90-Day Production	518.83	550.28	494.15	554.08	536.96	
Peak 90-Day Production Factor	1.13	1.16	1.11	1.21	1.13	1.15
Peak 120-Day Production	510.04	546.47	486.28	534.34	529.84	
Peak 120-Day Production Factor	1.11	1.15	1.09	1.17	1.12	1.13
Peak 180-Day Production	495.13	521.77	472.98	504.57	508.82	
Peak 180-Day Production Factor	1.08	1.10	1.06	1.11	1.07	1.08

Appendix E - CAZs in WAD's service area

WAD - WASUA - District of Columbia

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
001A	100%	421	3,044	426	3,044	430	3,045	429	3,544	425	3,544	425	3,544	425	3,544
001B	100%	621	8,705	628	8,705	634	8,705	633	8,705	627	8,705	627	8,705	627	8,705
001C	100%	0	16,111	0	17,111	0	18,111	0	18,612	0	18,612	0	18,612	0	18,612
001D	100%	0	8,972	0	8,972	0	8,972	0	8,972	0	8,972	0	8,972	0	8,972
001E	100%	0	3,674	0	3,674	0	3,674	0	3,674	0	3,674	0	3,674	0	3,674
001F	100%	0	12,216	0	12,216	0	12,216	0	12,216	0	12,216	0	12,216	0	12,216
002A	100%	427	8,845	432	9,844	436	10,844	436	11,344	431	11,344	431	11,344	431	11,344
002B	100%	0	20,960	0	20,960	0	20,960	0	20,960	0	20,960	0	20,960	0	20,960
002C	100%	2	27,152	2	27,152	2	27,152	2	27,152	2	27,152	2	27,152	2	27,152
002D	100%	541	11,887	547	11,887	552	11,887	552	11,887	546	11,887	546	11,887	546	11,887
002E	100%	1,283	4,719	1,297	4,720	1,309	4,720	1,309	4,720	1,296	4,720	1,295	4,720	1,295	4,720
002F	100%	1,011	12,766	1,022	12,766	1,032	12,766	1,031	12,766	1,021	12,766	1,021	12,766	1,020	12,766
003A	100%	0	19,313	0	19,313	0	19,313	0	19,313	0	19,313	0	19,313	0	19,313
003B	100%	0	4,071	0	7,070	0	9,072	0	10,571	0	11,570	0	11,570	0	12,071
003C	100%	507	6,243	512	9,244	517	11,244	517	12,745	512	13,744	512	13,744	512	14,244
003D	100%	500	23,378	505	23,378	510	23,378	510	23,378	505	23,378	505	23,378	505	23,378
003E	100%	24	17,824	24	17,824	24	17,824	24	17,824	24	17,824	24	17,824	24	17,824
003F	100%	109	8,062	110	8,062	111	8,062	111	8,062	110	8,062	110	8,062	110	8,062
004A	100%	1	9,452	1	11,452	1	13,451	1	14,452	1	15,452	1	15,452	1	15,452
004B	100%	7	1,554	7	3,552	7	3,553	7	3,553	7	3,553	7	3,553	7	3,553
004C	100%	107	6,619	108	8,619	109	9,619	109	10,620	108	11,619	108	11,619	108	11,619
004D	100%	486	510	491	510	496	3,510	496	5,510	491	6,511	491	6,511	490	6,511
004E	100%	19	4,696	19	5,695	19	6,195	19	6,696	19	7,196	19	7,196	19	7,196
005A	100%	0	13,811	0	14,811	0	15,813	0	16,813	0	17,313	0	17,313	0	17,313
005B	100%	0	6,113	0	6,112	0	7,112	0	8,112	0	8,612	0	8,612	0	8,612
005C	100%	23	5,319	23	7,319	23	8,320	23	9,319	23	9,319	23	9,319	23	9,319
005D	100%	0	10,380	0	10,380	0	10,380	0	10,380	0	10,881	0	10,881	0	10,881
005E	100%	0	660	0	660	0	660	0	660	0	660	0	660	0	660
005F	100%	0	6,446	0	6,446	0	6,446	0	6,446	0	6,446	0	6,446	0	6,446
006A	100%	1	2,841	1	2,841	1	2,841	1	2,841	1	2,841	1	2,841	1	2,841
006B	100%	0	10,296	0	10,297	0	11,797	0	12,798	0	13,298	0	13,298	0	13,298
006C	100%	0	8,180	0	11,179	0	13,180	0	14,180	0	15,179	0	15,179	0	15,179
006D	100%	0	7,796	0	7,796	0	11,296	0	13,795	0	14,796	0	14,796	0	14,796
006E	100%	0	4,108	0	4,108	0	4,108	0	4,108	0	4,108	0	4,108	0	4,108
006F	100%	1	0	1	0	1	0	1	0	1	0	1	0	1	0
011A	100%	721	2,146	729	2,146	736	2,146	735	2,146	728	2,146	728	2,146	728	2,146
011B	100%	1,715	829	1,734	829	1,750	829	1,749	1,329	1,732	1,830	1,731	1,830	1,731	1,830
011C	100%	875	4,148	884	4,148	893	4,148	893	4,148	884	4,148	883	4,148	883	4,148
011D	100%	162	5,962	164	5,962	165	5,963	165	6,462	164	6,962	164	6,962	163	6,962
011E	100%	539	3,052	545	3,052	550	3,052	550	3,052	544	3,052	544	3,052	544	3,052
011F	100%	0	9	0	9	0	9	0	9	0	9	0	9	0	9
011G	100%	277	3,670	280	3,670	283	3,670	283	3,670	280	4,171	280	4,171	280	4,171
011H	100%	206	1,434	208	1,434	210	1,434	210	1,434	208	1,434	208	1,434	208	1,434
011J	100%	196	1,554	198	1,554	200	1,554	200	1,554	198	1,554	198	1,554	198	1,554
011K	100%	196	5,468	198	5,468	200	5,468	200	5,468	198	5,468	198	5,468	198	5,468
012A	100%	153	2,081	155	2,082	156	2,082	156	2,082	155	2,082	154	2,082	154	2,082
012B	100%	1,503	3,233	1,519	3,233	1,534	3,234	1,533	3,234	1,518	3,233	1,517	3,233	1,517	3,233

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
012C	100%	3,869	5,295	3,911	5,295	3,948	5,295	3,946	5,295	3,908	5,295	3,906	5,295	3,905	5,295
012D	100%	1,672	1,146	1,690	1,146	1,706	1,147	1,705	1,148	1,689	1,147	1,688	1,147	1,687	1,147
013A	100%	3,011	2,637	3,044	2,636	3,073	2,636	3,071	2,636	3,041	3,636	3,040	3,636	3,039	3,636
013B	100%	1,637	2,058	1,655	2,057	1,670	2,057	1,670	2,057	1,653	2,057	1,653	2,057	1,652	2,057
013C	100%	2,367	2,073	2,393	2,073	2,415	2,073	2,414	2,073	2,391	2,073	2,390	2,073	2,389	2,073
013D	100%	1,450	1,994	1,466	1,994	1,480	1,994	1,479	1,994	1,465	1,994	1,464	1,994	1,463	1,994
013E	100%	1,453	3,564	1,469	3,564	1,483	3,563	1,482	5,065	1,468	6,064	1,467	6,064	1,466	6,064
014A	100%	1,318	1,026	1,332	1,026	1,345	1,026	1,344	1,025	1,331	2,026	1,331	2,526	1,330	3,025
014B	100%	823	1,243	832	1,243	840	1,243	839	1,243	831	1,243	831	1,243	831	1,243
014C	100%	865	378	874	378	883	378	882	378	874	378	873	378	873	378
014D	100%	414	564	418	564	422	564	422	564	418	564	418	564	418	564
015A	100%	309	2,527	312	2,527	315	2,527	315	2,526	312	4,026	312	4,526	312	5,026
015B	100%	985	656	996	656	1,005	656	1,005	656	995	656	994	656	994	656
015C	100%	336	5,998	340	8,999	343	10,997	343	11,998	339	12,497	339	12,497	339	12,497
015D	100%	280	10,484	283	13,485	286	14,486	286	15,486	283	15,986	283	15,986	283	15,986
015E	100%	337	8,340	341	8,340	344	8,340	344	9,340	340	10,340	340	10,340	340	10,340
015F	100%	0	6,856	0	7,858	0	7,857	0	7,858	0	7,858	0	7,858	0	7,858
015G	100%	0	1,889	0	1,888	0	2,889	0	3,891	0	4,391	0	4,889	0	5,390
015H	100%	156	525	158	525	159	525	159	523	158	525	157	525	157	525
015J	100%	714	1,643	722	1,643	729	1,643	728	1,643	721	1,643	721	1,643	721	1,643
016A	100%	0	1,656	0	1,656	0	1,656	0	1,656	0	1,656	0	1,656	0	1,656
016B	100%	474	2,094	479	2,094	484	2,094	483	2,094	479	2,094	479	2,094	478	2,094
016C	100%	505	7,399	510	7,399	515	7,399	515	7,399	510	7,399	510	7,399	510	7,399
016D	100%	122	10,193	123	10,193	124	10,193	124	10,193	123	11,193	123	11,693	123	12,192
017A	100%	0	1,296	0	1,296	0	1,296	0	1,296	0	1,296	0	1,296	0	1,296
017B	100%	0	3,939	0	3,939	0	3,939	0	3,939	0	3,939	0	3,939	0	3,939
017C	100%	0	1,382	0	1,382	0	1,382	0	1,382	0	1,382	0	1,382	0	1,382
017D	100%	0	8,397	0	9,397	0	10,396	0	11,396	0	11,897	0	11,897	0	11,897
017E	100%	1	12,181	1	12,181	1	12,181	1	12,181	1	12,181	1	12,181	1	12,181
017F	100%	0	10,682	0	10,682	0	10,682	0	10,682	0	10,682	0	10,682	0	10,682
017G	100%	0	6,220	0	6,220	0	6,220	0	6,220	0	6,220	0	6,220	0	6,220
017H	100%	0	2,390	0	2,390	0	2,390	0	2,390	0	2,390	0	2,390	0	2,390
017J	100%	0	7,150	0	7,150	0	7,150	0	7,150	0	7,150	0	7,150	0	7,150
017K	100%	7	15,042	7	15,042	7	15,042	7	15,042	7	15,042	7	15,042	7	15,042
018A	100%	0	2,778	0	2,778	0	2,778	0	2,778	0	2,778	0	2,778	0	2,778
018B	100%	1	147	1	147	1	147	1	147	1	147	1	147	1	147
018C	100%	0	26	0	26	0	26	0	26	0	26	0	26	0	26
018D	100%	0	148	0	148	0	148	0	148	0	148	0	148	0	148
018E	100%	0	5	0	5	0	5	0	5	0	5	0	5	0	5
018F	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
018G	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
020A	100%	652	1,010	659	1,010	665	1,010	665	1,010	659	1,010	658	1,010	658	1,010
020B	100%	148	8,166	150	8,166	151	8,166	151	8,166	149	8,166	149	8,166	149	8,166
020C	100%	298	569	301	569	304	569	304	569	301	569	301	569	301	569
020D	100%	537	952	543	952	548	952	548	952	542	952	542	952	542	952
020E	100%	903	222	913	222	921	222	921	222	912	222	912	222	911	222
020F	100%	87	782	88	782	89	782	89	782	88	782	88	782	88	782

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
020G	100%	320	140	323	140	327	140	326	140	323	140	323	140	323	140
020H	100%	132	165	133	165	135	165	135	165	133	165	133	165	133	165
020J	100%	3,374	479	3,410	479	3,443	479	3,442	479	3,408	479	3,406	479	3,405	479
020K	100%	781	1,840	789	1,840	797	1,840	797	1,840	789	1,840	789	1,840	788	1,840
020L	100%	2,905	699	2,936	699	2,964	699	2,963	699	2,934	699	2,933	699	2,932	699
020M	100%	2,348	1,497	2,373	1,497	2,396	1,497	2,395	1,497	2,372	1,497	2,371	1,497	2,370	1,497
020N	100%	3,214	6,897	3,249	6,897	3,280	6,897	3,278	6,897	3,246	6,897	3,245	6,897	3,244	6,897
021A	100%	1,504	676	1,520	676	1,535	676	1,534	676	1,519	676	1,518	676	1,518	676
021B	100%	743	1,026	751	1,026	758	1,026	758	1,026	750	1,026	750	1,026	750	1,026
021C	100%	85	521	86	521	87	521	87	521	86	521	86	521	86	521
021D	100%	608	1,373	615	1,373	620	1,373	620	1,373	614	1,373	614	1,373	614	1,373
021E	100%	902	869	912	869	920	869	920	869	911	869	911	869	910	869
021F	100%	218	3,182	220	3,182	222	3,182	222	3,182	220	3,182	220	3,182	220	3,182
021G	100%	246	987	249	987	251	987	251	987	248	987	248	987	248	987
021H	100%	1,792	2,122	1,811	2,122	1,829	2,122	1,828	2,122	1,810	2,122	1,809	2,122	1,809	2,122
021J	100%	562	1,580	568	1,580	573	1,580	573	1,580	568	1,580	567	1,580	567	1,580
021K	100%	1,478	893	1,494	893	1,508	893	1,508	893	1,493	893	1,492	893	1,492	893
021L	100%	963	1,715	973	1,715	983	1,715	982	1,715	973	1,715	972	1,715	972	1,715
021M	100%	905	4,234	915	4,234	923	4,235	923	4,235	914	4,235	914	4,235	913	4,235
022A	100%	1,807	3,759	1,827	3,759	1,844	3,759	1,843	3,759	1,825	3,759	1,824	3,759	1,824	3,759
022B	100%	1,977	559	1,998	559	2,017	559	2,017	559	1,997	559	1,996	559	1,995	559
022C	100%	2,255	2,830	2,279	2,830	2,301	2,830	2,300	2,830	2,278	2,830	2,277	2,830	2,276	2,830
022D	100%	1,790	1,588	1,809	1,588	1,827	1,588	1,826	1,588	1,808	1,588	1,807	1,588	1,806	1,588
022E	100%	3,310	715	3,346	715	3,378	715	3,376	715	3,343	715	3,342	715	3,340	715
022F	100%	3,974	1,066	4,017	1,066	4,055	1,066	4,054	1,066	4,014	1,066	4,012	1,066	4,011	1,066
022G	100%	1,827	270	1,847	270	1,864	270	1,864	270	1,845	270	1,845	270	1,844	270
022H	100%	460	88	465	88	469	88	469	88	465	88	464	88	464	88
022J	100%	2,004	1,990	2,026	1,990	2,045	1,990	2,044	1,990	2,024	1,990	2,023	1,990	2,022	1,990
023A	100%	634	1,288	641	1,289	647	1,788	647	2,289	640	2,788	640	2,788	640	2,788
023B	100%	1,421	429	1,436	429	1,450	429	1,449	429	1,435	429	1,435	429	1,434	429
023C	100%	2,214	307	2,238	307	2,259	307	2,258	307	2,236	307	2,235	307	2,234	307
023D	100%	1,175	193	1,188	193	1,199	193	1,199	193	1,187	193	1,186	193	1,186	193
023E	100%	1,021	663	1,032	663	1,042	663	1,041	664	1,031	662	1,031	662	1,030	662
023F	100%	1,096	1,049	1,108	1,049	1,118	1,049	1,118	1,048	1,107	1,048	1,107	1,048	1,106	1,048
023G	100%	2,810	652	2,840	653	2,867	1,053	2,866	1,453	2,838	1,654	2,837	1,654	2,836	1,654
023H	100%	1,034	130	1,045	130	1,055	130	1,055	130	1,044	130	1,044	130	1,044	130
023J	100%	1,586	932	1,603	932	1,618	932	1,618	932	1,602	932	1,601	932	1,601	932
023K	100%	412	350	416	350	420	350	420	350	416	350	416	350	416	350
024A	100%	2,357	889	2,382	889	2,405	889	2,404	889	2,381	889	2,380	889	2,379	889
024B	100%	1,611	929	1,628	929	1,644	929	1,643	929	1,627	929	1,626	929	1,626	929
024C	100%	529	7,869	535	7,869	540	7,869	540	7,869	534	7,869	534	7,869	534	7,869
024D	100%	1,620	285	1,638	285	1,653	285	1,652	287	1,636	286	1,636	286	1,635	286
024E	100%	475	11,364	480	11,364	485	11,363	485	11,362	480	11,862	480	12,364	479	12,864
024F	100%	0	345	0	345	0	345	0	345	0	345	0	345	0	345
024G	100%	577	571	583	571	589	571	589	571	583	571	583	571	582	571
024H	100%	8	2,015	8	2,015	8	2,015	8	2,015	8	2,015	8	2,015	8	2,015
024J	100%	25	1,388	25	1,388	26	1,388	26	1,388	25	1,388	25	1,388	25	1,388

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
024K	100%	771	101	779	101	787	101	786	101	779	101	778	101	778	101
025A	100%	781	112	789	112	797	112	797	112	789	112	789	112	788	112
025B	100%	753	1,177	761	1,176	768	1,176	768	1,176	761	1,676	760	2,177	760	2,675
025C	100%	970	645	980	645	990	645	989	645	980	645	979	645	979	645
025D	100%	61	117	62	117	62	117	62	117	62	117	62	117	62	117
025E	100%	0	457	0	457	0	457	0	457	0	457	0	960	0	1,458
025F	100%	1,374	6,114	1,389	6,114	1,402	6,114	1,402	6,114	1,388	6,115	1,387	6,115	1,387	6,115
026A	100%	912	1,649	922	1,649	931	1,649	930	1,648	921	1,648	921	1,648	920	1,648
026B	100%	858	772	867	771	876	770	875	770	867	770	866	770	866	770
026C	100%	1,386	937	1,401	937	1,414	1,437	1,414	1,937	1,400	2,437	1,399	2,937	1,399	3,437
026D	100%	745	134	753	134	760	134	760	135	752	135	752	135	752	135
026E	100%	191	3,566	193	3,564	195	3,565	195	4,064	193	5,565	193	6,566	193	7,566
026F	100%	414	1,690	418	1,690	422	2,190	422	2,689	418	4,190	418	5,190	418	6,190
026G	100%	0	1,071	0	1,071	0	1,071	0	1,071	0	1,071	0	1,071	0	1,071
026H	100%	3,227	739	3,262	739	3,293	739	3,292	738	3,259	738	3,258	738	3,257	738
026J	100%	659	418	666	419	672	419	672	919	666	918	665	918	665	918
026K	100%	2,170	1,077	2,193	1,077	2,214	1,077	2,213	1,077	2,192	1,077	2,191	1,077	2,190	1,077
026L	100%	438	160	443	160	447	160	447	161	442	161	442	161	442	161
026M	100%	1,461	248	1,477	248	1,491	248	1,490	248	1,476	248	1,475	248	1,474	248
026N	100%	3,189	1,422	3,223	1,422	3,254	1,923	3,253	2,423	3,221	2,923	3,220	3,423	3,218	3,923
027A	100%	1,788	492	1,807	492	1,825	492	1,824	492	1,806	492	1,805	492	1,804	492
027B	100%	819	956	828	955	836	955	835	955	827	955	827	955	827	955
027C	100%	1,017	691	1,028	691	1,038	691	1,037	691	1,027	691	1,027	691	1,026	691
027D	100%	979	284	990	284	999	283	999	283	989	283	988	283	988	283
027E	100%	1,927	345	1,948	345	1,966	345	1,966	345	1,946	345	1,946	345	1,945	345
027F	100%	353	193	357	193	360	193	360	193	357	193	356	193	356	193
027G	100%	462	1	467	1	471	1	471	1	467	1	466	1	466	1
027H	100%	8	2,823	8	3,822	8	3,822	8	3,822	8	3,821	8	3,821	8	3,821
027J	100%	126	294	127	294	129	294	129	294	127	294	127	294	127	294
027K	100%	0	14	0	14	0	14	0	14	0	14	0	14	0	14
028A	100%	532	819	538	819	543	819	543	819	537	819	537	819	537	819
028B	100%	33	503	33	503	34	503	34	504	33	503	33	503	33	503
028C	100%	34	735	34	735	35	1,235	35	1,735	34	3,236	34	4,236	34	5,236
028D	100%	0	8,947	0	11,548	0	12,448	0	12,997	0	13,497	0	13,997	0	14,496
028E	100%	687	796	694	796	701	796	701	795	694	796	694	796	693	796
028F	100%	720	1,797	728	1,797	735	1,797	734	1,797	727	1,798	727	1,798	727	1,798
028G	100%	391	1,131	395	1,131	399	1,131	399	1,131	395	1,131	395	1,131	395	1,131
028H	100%	467	296	472	296	477	296	476	296	472	296	471	296	471	296
028J	100%	633	484	640	484	646	484	646	483	639	483	639	483	639	483
028K	100%	0	80	0	80	0	80	0	80	0	80	0	80	0	80
028L	100%	1	212	1	212	1	3,211	1	6,212	1	9,211	1	10,213	1	10,213
029A	100%	0	623	0	623	0	623	0	623	0	623	0	623	0	623
029B	100%	24	731	24	731	24	731	24	731	24	731	24	731	24	731
029C	100%	0	1,020	0	1,020	0	1,020	0	1,020	0	1,020	0	1,020	0	1,020
029D	100%	1,366	6,198	1,381	6,199	1,394	6,199	1,393	6,199	1,380	6,199	1,379	6,199	1,379	6,199
029E	100%	1,366	682	1,381	682	1,394	682	1,393	681	1,380	1,182	1,379	1,683	1,379	2,182
029F	100%	163	506	165	506	166	506	166	507	165	506	165	506	165	506

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
029G	100%	2,154	369	2,177	369	2,198	369	2,197	870	2,176	1,371	2,175	1,869	2,174	2,370
029H	100%	1,197	630	1,210	631	1,221	631	1,221	631	1,209	631	1,209	631	1,208	631
029J	100%	66	372	67	372	67	372	67	372	67	372	67	372	67	372
029K	100%	12	5,674	12	5,673	12	7,672	12	8,672	12	9,673	12	10,173	12	10,673
029L	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
030A	100%	507	65	512	65	517	65	517	65	512	65	512	65	512	65
030B	100%	803	797	812	797	819	797	819	797	811	797	811	797	810	797
030C	100%	0	1,962	0	1,962	0	1,962	0	1,962	0	1,962	0	1,962	0	1,962
030D	100%	787	4,094	796	4,094	803	4,094	803	4,094	795	4,094	795	4,094	794	4,094
030E	100%	552	282	558	282	563	282	563	282	558	282	557	282	557	282
030F	100%	799	633	808	633	815	633	815	633	807	633	807	633	806	633
030G	100%	720	545	728	545	735	544	734	544	727	544	727	544	727	544
030H	100%	268	3,234	271	3,234	273	3,235	273	3,235	271	3,235	271	3,235	270	3,235
030J	100%	159	1,996	161	1,996	162	1,996	162	1,996	161	1,996	161	1,996	160	1,996
031A	100%	1,654	512	1,672	512	1,688	512	1,687	512	1,671	512	1,670	512	1,669	512
031B	100%	525	2,096	531	2,097	536	2,597	536	2,597	530	2,597	530	2,597	530	2,597
031C	100%	418	125	423	125	427	125	426	125	422	125	422	125	422	125
031D	100%	743	1,111	751	1,111	758	1,111	758	1,111	750	1,111	750	1,111	750	1,111
031E	100%	108	1,653	109	1,653	110	1,653	110	1,653	109	1,653	109	1,653	109	1,653
032A	100%	426	78	431	78	435	78	435	78	430	78	430	78	430	78
032B	100%	161	104	163	104	164	104	164	104	163	104	163	104	162	104
032C	100%	0	19	0	19	0	19	0	19	0	19	0	19	0	19
032D	100%	105	29	106	29	107	29	107	29	106	29	106	29	106	29
032E	100%	1,671	455	1,689	455	1,705	455	1,704	455	1,688	455	1,687	455	1,686	455
032F	100%	839	463	848	463	856	463	856	463	847	463	847	463	847	463
032G	100%	255	338	258	338	260	338	260	338	258	338	257	338	257	338
032H	100%	1,230	479	1,243	479	1,255	479	1,255	479	1,242	479	1,242	479	1,241	479
032J	100%	834	207	843	207	851	207	851	207	842	207	842	207	842	207
032K	100%	561	164	567	164	572	164	572	164	567	164	566	164	566	164
032L	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
032M	100%	110	26	111	26	112	26	112	26	111	26	111	26	111	26
032N	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
032P	100%	1,176	378	1,189	378	1,200	378	1,200	378	1,188	378	1,187	378	1,187	378
032Q	100%	193	44	195	44	197	44	197	44	195	44	195	44	195	44
032R	100%	120	19	121	19	122	19	122	19	121	19	121	19	121	19
032S	100%	391	53	395	53	399	53	399	53	395	53	395	53	395	53
033A	100%	1,081	175	1,093	175	1,103	175	1,103	175	1,092	175	1,091	175	1,091	175
033B	100%	501	140	506	140	511	140	511	140	506	140	506	140	506	140
033C	100%	1,138	371	1,150	371	1,161	371	1,161	371	1,149	371	1,149	371	1,148	371
033D	100%	479	750	484	750	489	750	489	750	484	750	484	750	483	750
033E	100%	556	596	562	596	567	596	567	596	562	596	561	596	561	596
033F	100%	668	304	675	304	682	304	681	304	675	304	674	304	674	304
033G	100%	1,376	888	1,391	886	1,404	886	1,404	886	1,390	886	1,389	886	1,389	886
033H	100%	2,043	536	2,065	536	2,085	536	2,084	536	2,063	536	2,063	536	2,062	536
033J	100%	1,167	223	1,180	223	1,191	223	1,190	223	1,179	223	1,178	223	1,178	223
033K	100%	639	775	646	775	652	775	652	775	645	775	645	775	645	775
033L	100%	1,233	1,579	1,246	1,579	1,258	1,579	1,258	1,579	1,245	1,579	1,245	1,579	1,244	1,579

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
033M	100%	1,735	722	1,754	723	1,770	723	1,770	723	1,752	723	1,752	723	1,751	723
033N	100%	3,390	485	3,427	486	3,459	486	3,458	486	3,424	486	3,423	486	3,421	486
033P	100%	305	8,493	308	8,492	311	8,493	311	8,993	308	9,493	308	9,493	308	9,493
033Q	100%	428	103	433	103	437	103	437	103	432	103	432	103	432	103
033R	100%	314	348	317	348	320	348	320	348	317	348	317	348	317	348
033S	100%	1,237	659	1,250	659	1,262	659	1,262	659	1,249	659	1,249	659	1,248	659
033T	100%	702	2,060	710	2,061	716	2,061	716	2,059	709	2,059	709	2,059	708	2,059
033U	100%	241	237	244	237	246	237	246	237	243	237	243	237	243	237
033V	100%	673	743	680	743	687	743	686	743	680	743	679	743	679	743
033W	100%	126	5	127	5	129	5	129	5	127	5	127	5	127	5
034A	100%	1,230	115	1,243	115	1,255	115	1,255	115	1,242	115	1,242	115	1,241	115
034B	100%	2,036	597	2,058	597	2,078	597	2,077	596	2,056	596	2,056	596	2,055	596
034C	100%	1,662	187	1,680	187	1,696	187	1,695	187	1,679	187	1,678	187	1,677	187
034D	100%	491	1	496	1	501	1	501	1	496	1	496	1	496	1
034E	100%	821	343	830	343	838	343	837	343	829	343	829	343	829	343
034F	100%	500	2,388	505	2,388	510	2,388	510	2,388	505	2,388	505	2,388	505	2,388
034G	100%	574	481	580	481	586	481	585	481	580	481	580	481	579	481
034H	100%	336	468	340	468	343	468	343	468	339	468	339	468	339	468
034J	100%	479	693	484	693	489	691	489	692	484	691	484	691	483	691
034K	100%	778	563	786	563	794	563	794	563	786	563	785	563	785	563
034L	100%	548	600	554	600	559	600	559	600	553	600	553	600	553	600
034M	100%	477	73	482	73	487	73	487	73	482	73	482	73	481	73
034N	100%	261	110	264	110	266	110	266	110	264	110	264	110	263	110
034P	100%	698	106	706	106	712	106	712	106	705	106	705	106	704	106
034Q	100%	299	311	302	311	305	311	305	311	302	311	302	311	302	311
034R	100%	876	135	885	135	894	135	894	135	885	135	884	135	884	135
034S	100%	291	542	294	542	297	544	297	543	294	543	294	543	294	543
035A	100%	343	244	347	244	350	244	350	244	346	244	346	244	346	244
035B	100%	430	260	435	260	439	260	439	260	434	260	434	260	434	260
035C	100%	363	3,557	367	3,557	370	3,557	370	4,058	367	5,056	366	5,056	366	5,056
035D	100%	164	2,589	166	2,589	167	2,589	167	3,090	166	4,089	166	4,089	166	4,089
035E	100%	1,366	146	1,381	146	1,394	146	1,393	146	1,380	146	1,379	146	1,379	146
035F	100%	508	823	513	823	518	823	518	823	513	823	513	823	513	823
035G	100%	271	1,638	274	1,638	277	1,638	276	1,638	274	1,638	274	1,638	273	1,638
036A	100%	578	308	584	308	590	308	590	308	584	308	584	308	583	308
036B	100%	1,008	296	1,019	296	1,029	396	1,028	346	1,018	346	1,018	346	1,017	346
036C	100%	812	963	821	963	829	963	828	963	820	963	820	963	819	963
036D	100%	1,526	394	1,543	394	1,557	394	1,557	395	1,541	394	1,541	394	1,540	394
036E	100%	821	1,256	830	1,256	838	1,256	837	1,256	829	1,256	829	1,256	829	1,256
036F	100%	370	255	374	255	378	255	377	255	374	255	374	255	373	255
036G	100%	526	85	532	85	537	85	537	85	531	85	531	85	531	85
036H	100%	1,245	233	1,258	233	1,270	233	1,270	233	1,257	233	1,257	233	1,256	233
036J	100%	2,898	715	2,929	715	2,957	715	2,956	715	2,927	715	2,926	715	2,925	715
036K	100%	992	234	1,003	234	1,012	234	1,012	234	1,002	234	1,002	234	1,001	234
036L	100%	820	159	829	159	837	159	836	159	828	159	828	159	828	159
036M	100%	947	1,702	957	1,702	966	1,702	966	1,702	956	1,703	956	1,703	956	1,703
037A	100%	1,194	65	1,207	65	1,218	65	1,218	65	1,206	65	1,205	65	1,205	65

Appendix E - CAZs in WAD's service area (continued)

WAD - WASUA - District of Columbia (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
037B	100%	754	1,269	762	1,269	769	1,269	769	1,269	762	1,269	761	1,269	761	1,269
037C	100%	665	204	672	204	679	204	678	204	672	204	671	204	671	204
037D	100%	713	341	721	341	728	341	727	341	720	341	720	341	720	341
037E	100%	999	51	1,010	51	1,019	51	1,019	51	1,009	51	1,009	51	1,008	51
037F	100%	1,518	365	1,534	365	1,549	365	1,548	365	1,533	365	1,533	365	1,532	365
037G	100%	2,185	244	2,209	244	2,230	244	2,229	245	2,207	244	2,206	244	2,205	244
037H	100%	2,017	463	2,039	463	2,058	463	2,057	463	2,037	464	2,036	464	2,036	464
037J	100%	1,600	118	1,617	118	1,633	118	1,632	118	1,616	118	1,615	118	1,615	118
037K	100%	939	72	949	72	958	72	958	72	948	72	948	72	948	72
038A	100%	1,796	468	1,815	468	1,833	468	1,832	468	1,814	468	1,813	468	1,813	468
038B	100%	4,446	677	4,494	677	4,537	677	4,535	677	4,491	677	4,489	677	4,487	677
038C	100%	1,103	432	1,115	432	1,126	432	1,125	432	1,114	432	1,114	432	1,113	432
038D	100%	426	125	431	125	435	125	435	125	430	125	430	125	430	125
038E	100%	1,018	174	1,029	174	1,039	174	1,038	174	1,028	174	1,028	174	1,027	174
038F	100%	0	4,387	0	4,387	0	4,387	0	4,387	0	4,387	0	4,387	0	4,387
038G	100%	1,506	378	1,522	378	1,537	377	1,536	378	1,521	377	1,520	377	1,520	377
038H	100%	853	2,496	862	2,496	870	2,496	870	2,496	862	2,496	861	2,496	861	2,496
038J	100%	1,911	113	1,932	113	1,950	113	1,949	113	1,930	113	1,929	113	1,929	113
038K	100%	2,286	587	2,311	587	2,333	587	2,332	587	2,309	587	2,308	587	2,307	587
038L	100%	1,158	73	1,171	73	1,182	73	1,181	73	1,170	73	1,169	73	1,169	73
038M	100%	110	98	111	98	112	98	112	98	111	98	111	98	111	98
038N	100%	1,488	598	1,504	598	1,518	598	1,518	598	1,503	598	1,502	598	1,502	598
038P	100%	2,546	348	2,574	348	2,598	348	2,597	348	2,571	348	2,570	348	2,569	348
038Q	100%	1,413	1,064	1,428	1,064	1,442	1,064	1,441	1,064	1,427	1,064	1,427	1,064	1,426	1,064
038R	100%	79	1,249	80	1,249	81	1,249	81	1,249	80	1,250	80	1,250	80	1,250
038S	100%	756	208	764	208	771	208	771	208	764	208	763	208	763	208
038T	100%	1,475	204	1,491	204	1,505	204	1,505	204	1,490	204	1,489	204	1,489	204
038U	100%	2,289	957	2,314	957	2,336	957	2,335	957	2,312	957	2,311	957	2,310	957
038V	100%	1,224	640	1,237	640	1,249	640	1,249	640	1,236	640	1,236	640	1,235	640
038W	100%	1,254	158	1,268	158	1,280	158	1,279	158	1,267	158	1,266	158	1,266	158
039A	100%	0	234	0	234	0	234	0	234	0	234	0	234	0	234
039B	100%	151	957	153	957	154	957	154	957	153	957	152	957	152	957
039C	100%	465	3,839	470	3,839	474	3,839	474	3,839	470	3,839	469	3,839	469	3,839
039D	100%	1,980	153	2,001	153	2,020	153	2,020	153	2,000	153	1,999	153	1,998	153
039E	100%	305	223	308	223	311	223	311	223	308	223	308	223	308	223
039F	100%	1,380	3,524	1,395	3,524	1,408	3,524	1,408	3,524	1,394	3,524	1,393	3,524	1,393	3,524
039G	100%	1	1,294	1	1,294	1	1,294	1	1,294	1	1,294	1	1,294	1	1,294

Appendix E - CAZs in WAD's service area (continued)

WAD - Arlington DPW

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
311B	100%	1,357	204	1,717	221	1,763	221	1,807	221	1,854	221	1,901	221	1,946	221
311C	100%	1	377	1	405	1	405	1	405	1	405	1	405	1	405
311D	100%	128	3,036	125	3,036	125	3,036	125	3,036	125	3,036	125	3,036	125	3,036
311E	100%	116	6,447	123	6,447	123	6,447	123	6,447	123	6,447	123	6,447	123	6,447
312A	100%	165	10,427	185	11,194	185	11,192	185	11,566	185	11,939	185	11,903	185	11,903
312B	100%	2,657	11,311	2,929	12,864	3,016	13,252	3,100	13,794	3,186	13,793	3,275	13,794	3,359	13,794
312C	100%	1,256	3,884	1,550	4,169	1,579	4,381	1,607	4,587	1,636	4,612	1,666	4,637	1,694	4,661
321A	100%	13	1,919	0	3,402	179	4,499	358	5,589	537	7,250	716	8,343	895	9,428
321B	100%	807	6,007	927	6,446	1,110	7,572	1,293	8,688	1,477	9,810	1,660	10,933	1,843	12,045
321C	100%	1,217	32,185	1,306	34,558	1,306	34,884	1,305	34,882	1,305	34,882	1,306	34,882	1,305	34,882
322A	100%	2,505	675	2,776	1,281	3,088	1,305	3,518	1,321	3,951	1,337	4,385	1,353	4,816	1,371
322B	100%	514	3,080	991	3,690	1,461	4,497	2,227	5,395	2,857	6,299	3,329	7,203	3,797	8,098
322C	100%	2,508	3,692	2,561	4,262	2,561	4,674	2,559	4,670	2,560	4,670	2,561	4,670	2,560	4,670
322D	100%	709	156	719	167	719	167	718	167	718	167	718	167	718	167
322E	100%	1,993	1,231	2,192	1,334	2,192	1,334	2,190	1,334	2,190	1,334	2,192	1,334	2,190	1,334
322F	100%	450	697	457	747	457	1,518	457	2,281	457	3,050	457	3,045	457	3,045
322G	100%	524	1,466	532	1,820	532	1,824	532	2,023	532	2,090	532	2,157	532	2,224
323A	100%	4,245	1,220	4,253	1,310	4,253	1,647	4,250	1,983	4,250	2,319	4,252	2,656	4,250	2,654
324A	100%	2,053	2,320	2,319	2,489	2,319	2,489	2,317	2,489	2,317	2,489	2,319	2,489	2,317	2,489
324B	100%	1,001	1,681	1,004	1,805	1,004	1,804	1,003	1,804	1,003	1,804	1,004	1,804	1,003	1,804
325A	100%	1,949	7,770	3,521	10,667	4,209	10,982	4,663	12,788	4,701	13,260	4,738	13,736	4,772	13,735
325B	100%	1,245	2,328	1,248	2,499	1,431	3,612	1,430	3,605	1,430	3,605	1,431	3,605	1,430	3,605
325C	100%	561	105	551	113	551	113	552	113	552	113	553	113	554	113
325D	100%	132	1,353	134	1,450	207	2,086	277	2,716	349	3,348	421	3,981	491	4,609
325E	100%	84	1,730	81	1,856	119	2,817	158	3,772	196	4,733	234	5,693	272	6,643
325F	100%	1,260	732	1,275	786	1,275	786	1,273	786	1,274	786	1,275	786	1,274	786
325G	100%	902	178	899	192	899	192	899	192	899	192	899	192	899	192
325H	100%	659	960	650	990	709	1,576	769	2,158	827	2,743	886	3,328	946	3,906
325J	100%	362	1,214	477	1,303	993	2,515	1,607	3,095	1,848	3,342	2,112	3,340	2,376	3,340
325K	100%	57	1,971	59	3,682	59	6,349	305	7,305	305	7,464	305	7,463	305	7,463
325L	100%	391	235	389	252	389	392	389	531	389	530	389	530	390	530
325M	100%	1,390	2,196	1,730	3,277	1,902	4,691	1,922	4,798	1,945	4,798	1,969	4,798	1,990	4,798
325N	100%	426	3,154	1,764	5,326	2,032	8,934	2,388	10,240	2,644	10,965	2,900	10,961	3,154	10,961
325P	100%	1,108	4,158	1,259	4,464	1,340	5,699	1,418	6,924	1,499	7,257	1,582	7,256	1,661	7,256
326A	100%	282	520	279	558	282	686	285	813	288	812	292	812	295	812
326B	100%	1,581	770	1,603	827	1,606	955	1,608	1,081	1,612	1,081	1,616	1,081	1,618	1,081
327A	100%	614	64	601	68	601	68	601	68	601	68	601	68	601	68
327B	100%	541	474	543	508	543	636	542	763	542	762	543	762	542	762
327C	100%	164	67	163	72	163	72	163	72	163	72	163	72	163	72
327D	100%	1,608	335	1,598	359	1,598	359	1,597	359	1,597	359	1,598	359	1,597	359
327E	100%	522	1,586	601	1,702	618	1,738	633	1,774	650	1,810	667	1,846	683	1,882
330A	100%	3,387	733	3,446	786	3,446	1,627	3,444	2,460	3,444	3,298	3,446	4,138	3,444	4,967
330B	100%	3,419	842	3,535	903	3,535	1,073	3,532	1,239	3,532	1,408	3,534	1,578	3,532	1,743
330C	100%	3,484	2,692	3,878	2,891	3,892	3,333	3,903	3,770	3,917	4,211	3,933	4,561	3,945	4,557
330D	100%	1,236	1,667	1,284	1,790	1,305	2,431	1,325	3,070	1,347	3,711	1,368	4,352	1,389	4,986
330E	100%	1,720	340	1,701	365	1,701	365	1,700	365	1,700	365	1,701	365	1,700	365
331A	100%	714	1,298	705	1,393	705	1,516	704	1,514	705	1,514	705	1,514	705	1,514

Appendix E - CAZs in WAD's service area (continued)

WAD - Arlington DPW (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
331B	100%	2,549	500	2,641	537	2,641	537	2,639	537	2,640	537	2,641	537	2,640	537
331C	100%	1,414	318	1,387	342	1,387	342	1,386	342	1,386	342	1,387	342	1,386	342
331D	100%	28	67	29	1,648	29	3,233	29	3,224	29	3,224	29	3,224	29	3,224
331E	100%	666	622	669	667	669	667	669	667	669	667	669	667	669	667
332A	100%	2,160	1,596	2,250	1,713	2,611	3,343	2,651	3,775	2,692	3,774	2,734	3,774	2,774	3,774
332B	100%	236	2,772	529	4,077	590	4,702	651	4,977	711	4,976	773	4,976	833	4,976
332C	100%	319	163	317	175	317	175	317	175	317	175	317	175	317	175
332D	100%	724	318	715	341	715	341	714	341	714	341	715	341	714	341
332E	100%	1,468	329	1,451	354	1,451	354	1,450	354	1,451	354	1,451	354	1,450	354
332F	100%	647	379	853	406	853	406	852	406	852	406	853	406	852	406
332G	100%	596	360	584	387	584	387	584	387	584	387	584	387	584	387
332H	100%	672	279	657	300	698	511	739	721	779	931	820	1,142	861	1,352
332J	100%	129	240	130	259	190	642	250	1,023	310	1,407	370	1,790	429	2,169
333A	100%	493	281	487	301	487	301	487	301	487	301	487	301	487	301
333B	100%	846	712	842	764	842	764	842	764	842	764	842	764	842	764
333C	100%	653	803	647	861	647	861	647	861	647	861	647	861	647	861
333D	100%	468	319	468	342	468	342	467	342	467	342	468	342	467	342
333E	100%	620	139	626	149	626	149	626	149	626	149	626	149	626	149
333F	100%	1,020	3,087	1,034	3,315	1,033	3,314	1,033	3,314	1,033	3,314	1,033	3,314	1,033	3,314
333G	100%	308	278	309	298	309	298	309	298	309	298	309	298	309	298
333H	100%	934	129	948	139	948	139	947	139	947	139	948	139	947	139
333J	100%	253	143	249	154	249	153	249	153	249	153	249	153	249	153
333K	100%	374	136	365	146	365	146	365	146	365	146	365	146	365	146
333L	100%	1,044	460	1,036	494	1,036	493	1,036	493	1,036	493	1,036	493	1,036	493
333M	100%	1,011	211	991	226	991	226	990	226	990	226	991	226	990	226
333N	100%	941	486	927	523	933	523	939	523	945	523	952	523	958	523
334A	100%	1,485	209	1,489	223	1,492	411	1,494	599	1,497	598	1,501	598	1,503	598
334B	100%	737	1,037	726	1,114	726	1,114	726	1,114	726	1,114	726	1,114	726	1,114
334C	100%	376	83	376	89	376	89	375	89	375	89	375	89	375	89
334D	100%	530	79	529	86	529	86	529	86	529	86	529	86	529	86
334E	100%	313	51	309	55	309	55	309	55	309	55	309	55	309	55
334F	100%	489	123	486	132	486	132	486	132	486	132	486	132	486	132

Appendix E - CAZs in WAD's service area (continued)

WAD - Falls Church DPU - Falls Church and Vienna
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
544A	100%	603	498	586	498	595	498	666	498	731	498	778	498	828	498
544B	100%	1,515	734	1,564	745	1,659	748	1,724	748	1,808	749	1,924	749	2,048	749
544C	100%	905	124	865	124	866	124	874	124	899	124	957	124	1,018	124
544D	50%	2,640	3,959	2,902	4,509	2,935	5,059	3,204	5,159	3,464	5,159	3,686	5,159	3,922	5,159
544G	20%	1,333	783	1,319	783	1,320	783	1,337	783	1,379	783	1,468	783	1,562	783
544H	50%	712	2,619	691	2,653	693	2,678	715	2,677	746	2,678	794	2,678	844	2,678
544J	100%	679	1,980	695	2,056	701	2,156	746	2,156	793	2,156	844	2,156	898	2,156
544K	100%	336	1,303	350	1,308	357	1,323	365	1,323	366	1,327	368	1,328	372	1,334
544L	100%	1,035	1,211	1,083	1,235	1,106	1,256	1,130	1,260	1,135	1,262	1,140	1,266	1,153	1,285
544M	100%	651	3,576	684	3,606	700	3,626	716	3,631	720	3,635	723	3,639	732	3,655
544N	100%	271	537	285	547	291	556	298	559	300	566	301	569	305	579
544P	100%	280	312	290	312	399	312	511	312	601	612	639	612	681	612
544Q	100%	146	792	154	801	158	812	162	812	163	826	164	829	166	850
544R	100%	1,756	1,771	1,844	1,800	1,887	1,826	1,929	1,838	1,940	1,858	1,948	1,869	1,972	1,899
544S	100%	1,505	1,353	1,498	1,395	1,511	1,431	1,558	1,431	1,625	1,431	1,729	1,431	1,842	1,431
545A	100%	2,551	7,540	2,739	8,051	2,749	9,551	2,812	10,351	2,918	10,900	3,106	11,452	3,305	11,575
545B	100%	3,017	2,639	3,182	2,889	3,220	3,039	3,343	3,039	3,504	3,039	3,729	3,039	3,968	3,039
545C	100%	2,186	2,200	2,225	2,306	2,236	2,376	2,291	2,376	2,377	2,376	2,529	2,376	2,693	2,376
545D	100%	1,253	721	1,208	726	1,213	726	1,243	726	1,291	726	1,375	726	1,462	726
545E	100%	228	21	212	21	215	21	237	21	257	21	274	21	292	21
545F	100%	655	255	656	255	666	254	758	256	838	256	891	256	949	256
546A	100%	762	351	777	351	793	351	843	351	897	351	955	351	1,016	351
546B	100%	711	348	707	348	711	348	748	348	788	348	838	348	892	348
546C	100%	352	3,066	343	3,067	353	3,387	440	3,388	511	3,387	543	3,387	579	3,387
546D	100%	1,290	3,800	1,371	4,000	1,413	4,400	1,537	4,450	1,659	4,500	1,765	4,500	1,879	4,500
546E	100%	738	1,932	776	1,982	786	2,182	837	2,228	890	2,228	947	2,228	1,009	2,228
546F	100%	1,766	2,232	1,738	2,312	1,762	2,412	1,830	2,412	1,917	2,412	2,040	2,412	2,170	2,412
546G	100%	1,532	597	1,684	597	1,705	597	1,759	597	1,835	597	1,952	597	2,079	597
546H	100%	1,023	408	1,083	426	1,101	426	1,202	425	1,299	426	1,384	426	1,473	426
546J	100%	735	376	729	377	738	376	813	377	884	376	941	376	1,002	376
546K	100%	850	1,500	912	1,510	939	1,530	1,080	1,530	1,202	1,531	1,280	1,531	1,362	1,531
546L	100%	172	1,787	164	1,789	190	1,789	296	1,789	376	1,789	400	1,789	426	1,789
556B	100%	350	196	348	196	355	196	408	196	454	196	483	196	514	196
556C	50%	1,847	2,651	1,951	2,700	2,212	2,760	2,472	2,825	2,709	2,825	2,883	2,825	3,069	2,825
556H	80%	269	9,796	289	10,146	310	10,896	487	11,620	621	12,021	661	12,421	703	12,621
556J	100%	970	6,146	1,120	6,396	1,290	7,047	1,825	7,696	2,237	8,546	2,382	9,396	2,535	10,196
556K	100%	1,064	360	1,072	365	1,097	365	1,236	365	1,362	365	1,449	365	1,542	365
556L	100%	1,014	309	995	314	998	314	1,021	314	1,060	314	1,128	314	1,201	314
557A	100%	836	1,855	829	1,897	832	1,897	854	1,897	888	1,897	945	1,897	1,006	1,897
557B	100%	1,057	4,753	1,078	4,813	1,105	4,913	1,123	5,013	1,161	5,013	1,235	5,013	1,315	5,013
557C	100%	429	151	439	151	449	150	501	151	547	151	583	151	621	151
557D	100%	811	2,100	1,093	2,125	1,288	2,175	1,378	2,240	1,471	2,240	1,566	2,240	1,666	2,240
557E	100%	561	631	575	696	627	735	788	801	916	801	975	801	1,037	801
558C	100%	223	18,685	247	19,289	287	21,790	354	23,689	409	24,924	435	26,159	464	27,894
558D	70%	448	8,500	508	8,700	519	9,400	579	10,255	634	10,856	675	11,456	718	12,956
567A	50%	663	193	624	193	627	194	649	193	678	194	722	194	768	194
567C	50%	2,304	1,633	2,345	1,633	2,490	1,633	2,556	1,633	2,659	1,633	2,830	1,633	3,012	1,633

Appendix E - CAZs in WAD's service area (continued)

WAD - Falls Church DPU - Falls Church and Vienna (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
567D	50%	1,093	647	1,316	649	1,598	1,103	1,702	1,557	1,811	1,557	1,928	1,557	2,052	1,557
567E	100%	1,624	1,775	1,594	1,800	1,598	1,800	1,636	1,800	1,698	1,800	1,807	1,800	1,923	1,800
567F	100%	779	2,423	798	2,466	801	2,466	824	2,466	859	2,466	914	2,466	972	2,466
568C	100%	1,023	205	1,024	205	1,081	205	1,213	205	1,332	205	1,418	205	1,509	205
568D	100%	650	144	707	145	729	145	828	144	914	145	972	145	1,035	145

WAD - WASUA - National Airport
Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
320A	100%	0	11,038	0	11,850	0	11,979	0	11,979	0	11,979	0	11,979	0	11,979

WAD - WASUA - Pentagon, Arlington Cemetery, Fort Myers
Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
310A	100%	0	23,755	0	23,754	28	24,180	55	24,602	83	24,602	111	24,602	139	24,602
311A	100%	0	138	0	148	0	148	0	148	0	148	0	148	0	148

Appendix F - CAZs in FCWA's service area

FCWA - Direct Service Area - Fairfax County

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
540A	100%	660	9,814	656	10,163	664	10,514	690	10,863	723	11,189	770	11,514	818	11,514
540B	100%	1,064	1,051	1,123	1,070	1,135	1,090	1,190	1,090	1,254	1,091	1,334	1,091	1,420	1,091
540C	100%	725	765	775	783	785	800	830	800	880	800	937	800	997	800
540D	100%	1,985	5,141	1,672	5,441	1,962	6,065	2,106	6,291	2,254	6,492	2,400	6,592	2,555	6,592
540E	100%	176	1,048	176	1,048	184	1,198	222	1,198	253	1,599	269	1,599	286	1,599
541A	100%	1,429	475	1,407	475	1,416	475	1,440	476	1,490	476	1,585	476	1,687	476
541B	100%	1,040	3,521	1,095	3,551	1,102	3,584	1,149	3,583	1,207	3,583	1,285	3,583	1,367	3,582
541C	100%	1,442	3,305	1,501	3,405	1,516	3,455	1,576	3,505	1,652	3,505	1,758	3,505	1,870	3,505
541D	100%	1,671	1,115	1,676	1,120	1,685	1,125	1,750	1,126	1,834	1,126	1,952	1,126	2,078	1,126
541E	100%	478	865	479	866	482	866	501	866	525	867	558	867	594	867
541F	100%	1,010	861	1,035	861	1,046	861	1,125	861	1,205	861	1,283	861	1,365	861
542A	100%	2,343	2,088	2,337	2,218	2,345	2,418	2,402	2,618	2,494	2,669	2,655	2,669	2,825	2,669
542B	100%	5,184	2,598	5,145	2,743	5,224	2,829	5,241	2,878	5,368	2,878	5,711	2,878	6,078	2,878
542C	100%	2,318	1,057	2,274	1,072	2,279	1,082	2,322	1,082	2,402	1,082	2,555	1,082	2,721	1,082
542D	100%	1,050	810	1,018	810	1,022	810	1,048	810	1,090	811	1,159	811	1,233	811
542E	100%	1,986	1,660	1,995	1,677	2,005	1,688	2,060	1,689	2,144	1,689	2,282	1,689	2,429	1,689
543A	100%	3,385	3,659	3,508	3,689	3,521	3,720	3,592	3,719	3,721	3,720	3,960	3,720	4,216	3,720
543B	100%	5,155	7,095	5,278	7,245	5,438	7,644	5,580	7,845	5,802	8,044	6,175	8,045	6,573	8,045
543C	100%	521	4,207	952	4,408	955	4,607	975	4,607	1,010	4,606	1,075	4,607	1,144	4,607
543D	100%	1,958	1,369	1,980	1,449	1,996	1,848	2,118	1,849	2,250	1,848	2,395	1,849	2,548	1,849
543E	100%	842	1,058	952	1,068	955	1,068	955	1,068	976	1,068	1,039	1,068	1,106	1,068
543F	100%	1,059	1,836	1,222	1,836	1,223	1,836	1,224	1,836	1,251	1,835	1,331	1,835	1,416	1,835
544D	50%	2,640	3,959	2,902	4,509	2,935	5,059	3,204	5,159	3,464	5,159	3,686	5,159	3,922	5,159
544E	100%	2,670	3,128	2,607	3,529	2,614	4,129	2,686	4,629	2,793	5,129	2,973	5,629	3,165	6,029
544F	100%	790	468	789	468	792	468	820	468	857	468	911	468	970	468
544G	80%	1,333	783	1,319	783	1,320	783	1,337	783	1,379	783	1,468	783	1,562	783
544H	50%	712	2,619	691	2,653	693	2,678	715	2,677	746	2,678	794	2,678	844	2,678
550A	100%	4,031	2,082	4,730	2,203	4,737	2,602	4,775	3,102	4,907	3,502	5,223	3,902	5,559	4,102
550B	100%	1,231	1,349	1,273	1,354	1,289	1,363	1,400	1,363	1,508	1,364	1,604	1,364	1,707	1,364
550C	100%	4,092	3,596	4,291	3,745	4,596	3,945	4,816	4,045	5,076	4,095	5,401	4,145	5,748	4,145
550D	100%	4,341	1,630	4,625	1,691	4,862	1,840	4,994	1,916	5,197	1,916	5,531	1,916	5,885	1,916
550E	100%	1,737	733	2,094	733	2,098	733	2,128	733	2,195	733	2,336	733	2,487	733
550F	100%	654	778	332	789	337	816	361	816	384	817	409	817	435	817
551A	100%	1,149	298	1,168	298	1,291	298	1,375	298	1,465	298	1,559	298	1,658	298
551B	100%	1,298	437	1,262	437	1,343	437	1,390	437	1,452	437	1,546	437	1,645	437
551C	100%	2,659	1,486	2,704	1,490	2,804	1,490	2,928	1,490	3,079	1,491	3,278	1,491	3,488	1,491
551D	100%	2,505	539	2,529	541	2,544	541	2,566	540	2,637	541	2,806	541	2,986	541
552A	100%	385	212	397	236	660	242	660	241	674	241	718	241	764	241
552B	100%	545	497	618	502	670	636	758	636	837	636	891	636	948	636
552C	100%	251	919	236	1,023	340	1,069	457	1,068	549	1,068	584	1,068	621	1,068
552D	100%	593	388	1,492	389	2,030	424	2,217	424	2,396	424	2,550	424	2,714	424
552E	100%	1,900	387	3,178	434	3,251	587	3,766	692	4,211	692	4,481	692	4,769	697
552F	100%	1,874	1,024	2,402	1,493	2,604	2,632	2,624	3,783	2,695	4,783	2,869	5,483	3,053	5,682
552G	100%	623	111	643	129	1,069	529	1,069	930	1,093	1,029	1,163	1,029	1,237	1,029
552H	100%	1,254	313	1,253	313	1,304	1,113	1,561	1,613	1,776	2,113	1,891	2,113	2,012	2,113
553A	100%	2,676	4,772	2,656	4,871	2,660	5,671	2,691	6,071	2,770	6,272	2,947	6,272	3,137	6,272
553B	100%	1,435	2,099	1,607	2,179	1,699	2,480	2,056	2,779	2,352	2,879	2,503	2,879	2,664	2,879

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Direct Service Area - Fairfax County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
553C	100%	262	5,371	273	6,272	277	7,272	302	8,172	327	9,073	348	9,447	370	9,647
553D	100%	896	1,098	901	1,098	916	1,098	968	1,149	1,025	1,198	1,090	1,222	1,160	1,248
554A	100%	1,101	389	1,116	399	1,136	400	1,203	400	1,277	400	1,359	400	1,447	400
554B	100%	1,747	1,660	1,764	1,660	1,785	1,661	1,858	1,660	1,950	1,660	2,076	1,660	2,209	1,660
554C	100%	1,302	227	1,255	231	1,262	232	1,278	232	1,317	231	1,402	231	1,492	231
554D	100%	1,839	322	1,930	322	1,938	322	2,001	322	2,089	322	2,224	322	2,367	322
554E	100%	3,275	1,672	3,223	1,723	3,223	1,877	3,224	1,877	3,296	1,877	3,507	1,877	3,733	1,877
555A	100%	798	264	924	264	949	264	957	264	983	264	1,047	264	1,114	264
555B	100%	3,165	551	3,118	551	3,125	551	3,172	551	3,276	551	3,487	551	3,711	551
555C	100%	653	1,396	662	1,461	688	1,461	757	1,461	822	1,461	875	1,461	931	1,461
555D	100%	1,442	1,020	1,422	1,035	1,423	1,050	1,423	1,051	1,455	1,051	1,548	1,051	1,648	1,051
555E	100%	1,414	4,976	1,379	4,976	1,381	4,976	1,385	4,976	1,418	4,976	1,509	4,976	1,606	4,976
556A	100%	626	1,396	660	1,414	670	2,214	733	3,014	793	3,014	844	3,014	898	3,014
556C	50%	1,847	2,651	1,951	2,700	2,212	2,760	2,472	2,825	2,709	2,825	2,883	2,825	3,069	2,825
556D	100%	609	105	681	105	687	105	721	105	761	105	809	105	861	105
556E	50%	1,978	858	1,947	857	1,967	858	2,060	858	2,171	858	2,310	858	2,459	858
556F	100%	1,046	708	1,020	708	1,033	708	1,137	708	1,236	709	1,315	709	1,400	709
556G	100%	1,989	9,376	2,018	9,675	2,310	10,426	2,310	11,375	2,361	11,475	2,512	11,575	2,674	11,575
556H	20%	269	9,796	289	10,146	310	10,896	487	11,620	621	12,021	661	12,421	703	12,621
558A	100%	630	11,244	783	11,746	885	12,545	888	13,399	909	14,000	968	14,600	1,030	14,800
558B	100%	1,055	15,494	1,373	16,278	1,558	22,278	1,559	26,378	1,593	29,478	1,696	32,078	1,806	34,578
558D	30%	448	8,500	508	8,700	519	9,400	579	10,255	634	10,856	675	11,456	718	12,956
559A	80%	916	721	1,005	721	1,143	721	1,411	721	1,631	721	1,736	721	1,847	721
559B	100%	64	0	72	0	84	0	107	0	125	0	133	0	141	0
559C	100%	154	156	154	156	155	156	167	156	180	156	191	156	204	156
559D	100%	1,003	288	1,053	288	1,110	288	1,487	288	1,784	288	1,900	288	2,022	288
559E	100%	212	184	208	184	216	184	270	184	313	184	333	184	354	184
560A	100%	6,372	1,669	6,507	1,679	6,721	1,699	6,840	1,700	7,074	1,699	7,530	2,008	8,013	2,008
560B	100%	1,478	886	1,535	886	1,589	886	1,754	885	1,908	886	2,031	886	2,162	886
560C	100%	1,451	1,437	1,481	1,437	1,516	1,438	1,752	1,437	1,956	1,436	2,081	1,436	2,215	1,436
560D	100%	1,003	371	1,031	370	1,046	371	1,131	371	1,216	371	1,294	371	1,378	371
560E	100%	2,446	533	2,440	533	2,457	533	2,574	533	2,713	533	2,886	533	3,072	533
560F	100%	1,596	2,403	1,655	2,423	1,680	2,448	1,870	2,448	2,044	2,448	2,176	2,448	2,314	2,448
560G	100%	1,020	516	1,015	526	1,019	526	1,049	526	1,093	525	1,163	525	1,239	525
560H	100%	476	128	514	128	563	128	712	128	832	128	886	128	944	128
562A	100%	2,430	677	2,463	676	2,564	677	2,618	676	2,712	677	2,887	677	3,072	677
562B	100%	771	7,773	727	8,177	730	12,329	757	16,099	792	19,800	843	23,099	897	24,806
562C	100%	438	4,686	500	4,986	548	5,486	548	5,786	560	6,086	595	6,386	633	6,833
562D	100%	1,793	1,439	1,862	1,464	2,905	1,564	3,147	1,665	3,387	1,764	3,604	1,864	3,836	1,964
562E	100%	285	1,080	278	1,169	278	1,444	279	1,845	286	2,245	305	2,645	324	2,845
563A	100%	2,720	551	2,718	700	2,896	701	2,907	700	2,978	700	3,169	700	3,373	700
563B	100%	1,057	20	1,762	55	1,835	430	1,918	430	2,018	430	2,147	430	2,286	430
563C	100%	463	561	1,055	561	1,171	561	1,262	561	1,352	561	1,439	561	1,532	561
563D	100%	2,430	209	2,528	209	2,551	209	2,660	209	2,794	209	2,974	209	3,165	209
563E	100%	1,379	99	1,457	99	1,473	99	1,579	99	1,687	100	1,796	100	1,911	100
563F	100%	1,312	419	1,356	419	1,366	419	1,382	419	1,424	419	1,515	419	1,613	419
564A	100%	2,510	1,343	2,474	1,378	2,476	1,384	2,496	1,384	2,564	1,383	2,728	1,383	2,904	1,383

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Direct Service Area - Fairfax County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
564B	100%	200	14	263	14	332	14	376	14	416	14	443	14	471	14
564C	100%	541	35	723	35	724	35	731	35	753	35	801	35	852	35
564D	100%	2,042	611	1,970	611	2,009	611	2,107	611	2,223	611	2,366	611	2,518	611
564E	100%	1,588	889	1,590	904	1,593	909	1,610	910	1,656	909	1,762	909	1,875	909
564F	100%	3,407	679	3,566	683	3,569	688	3,594	689	3,690	689	3,926	689	4,179	689
565A	100%	623	2,741	518	2,840	530	3,141	561	3,266	596	3,266	634	3,266	675	3,266
565B	100%	4,229	3,013	4,169	3,063	4,201	3,103	4,306	3,131	4,473	3,135	4,761	3,135	5,066	3,135
565C	100%	1,998	256	1,962	255	1,985	256	2,057	256	2,153	255	2,291	255	2,439	255
565D	100%	1,080	91	1,016	91	1,020	91	1,022	91	1,045	91	1,112	91	1,183	91
565E	100%	2,383	2,359	2,354	2,423	2,366	2,463	2,417	2,463	2,505	2,463	2,666	2,463	2,838	2,463
565F	100%	1,640	902	1,523	902	1,534	902	1,626	902	1,727	902	1,838	902	1,956	902
566A	100%	796	2,400	903	2,550	973	2,916	1,220	2,916	1,420	2,915	1,509	2,915	1,607	2,915
566B	100%	25	3,775	13	4,624	340	7,104	422	8,699	488	9,848	520	10,999	553	12,048
567A	50%	663	193	624	193	627	194	649	193	678	194	722	194	768	194
567B	100%	629	341	719	341	802	341	883	341	960	341	1,021	341	1,087	341
567C	50%	2,304	1,633	2,345	1,633	2,490	1,633	2,556	1,633	2,659	1,633	2,830	1,633	3,012	1,633
567D	50%	1,093	647	1,316	649	1,598	1,103	1,702	1,557	1,811	1,557	1,928	1,557	2,052	1,557
568A	100%	900	219	976	219	983	247	1,029	247	1,083	248	1,153	248	1,227	248
568B	100%	525	131	530	131	578	131	616	131	656	131	698	131	742	131
568E	100%	253	622	252	622	269	622	357	622	426	622	453	622	482	622
569B	100%	675	879	784	899	803	898	887	898	965	899	1,026	899	1,092	899
569C	100%	1,071	478	1,068	478	1,119	478	1,129	478	1,162	478	1,237	478	1,316	478
569D	30%	780	462	858	462	904	462	1,009	462	1,105	462	1,176	462	1,252	462
570B	100%	88	399	302	549	844	799	844	999	863	1,149	918	1,299	977	1,399
570C	100%	1,293	80	1,778	80	1,788	330	1,869	581	1,966	980	2,092	1,380	2,226	1,580
570D	100%	977	1,907	1,354	2,057	1,551	2,258	2,075	2,407	2,488	2,557	2,649	2,707	2,819	2,807
570E	60%	697	820	855	826	991	831	1,985	831	2,725	831	2,900	831	3,087	831
571D	60%	509	176	571	175	577	176	595	176	622	175	661	175	705	175
571F	20%	391	51	439	51	452	50	532	51	599	51	638	51	679	51
571G	20%	138	138	232	138	263	138	306	138	343	138	365	138	389	138
572B	20%	108	93	298	93	349	93	408	93	459	93	488	93	520	93
572C	60%	609	237	666	237	679	237	728	237	778	237	828	237	882	237
572D	80%	1,208	718	1,338	718	1,368	718	1,514	718	1,651	718	1,757	718	1,869	718
572E	100%	1,168	420	1,563	420	1,666	420	2,119	420	2,484	421	2,643	421	2,813	421
573A	60%	1,310	183	1,868	183	1,920	183	2,210	183	2,463	183	2,621	183	2,789	183
573B	60%	384	331	498	331	611	331	710	331	796	331	847	331	902	331
573C	30%	40	4	39	4	42	4	66	4	83	4	89	4	94	4
573D	100%	1,458	655	2,858	1,548	3,913	2,149	4,770	2,699	5,476	3,199	5,828	3,699	6,202	4,149
573E	100%	4,417	1,439	6,692	1,734	7,096	1,934	7,575	2,135	8,077	2,283	8,597	2,334	9,148	2,383
573F	100%	165	704	592	774	809	973	1,081	1,174	1,295	1,324	1,379	1,324	1,467	1,324
573G	100%	0	356	0	356	780	1,491	1,152	2,491	1,438	3,991	1,530	4,241	1,629	4,491
573H	100%	3,839	788	4,815	1,088	5,514	1,128	5,615	1,128	5,810	1,128	6,183	1,128	6,580	1,128
573J	100%	1,023	235	1,353	240	1,462	240	1,849	240	2,161	240	2,300	240	2,448	240
574A	100%	2,834	1,531	3,197	2,681	3,410	2,880	3,818	2,980	4,189	3,080	4,458	3,180	4,744	3,280
574B	100%	4,023	5,678	5,243	7,322	6,224	10,272	6,536	12,472	6,898	14,372	7,341	15,822	7,813	16,422
574C	100%	377	1,796	1,206	5,496	1,539	7,771	2,247	10,161	2,793	11,961	2,973	13,561	3,164	14,662
574D	100%	454	5,732	720	5,982	1,046	8,132	1,046	10,838	1,068	13,037	1,137	13,987	1,210	13,987

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Direct Service Area - Fairfax County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
574E	100%	1,915	740	2,302	796	2,426	796	2,616	796	2,806	796	2,986	796	3,177	796
574F	100%	893	253	1,055	253	1,178	253	1,285	253	1,388	253	1,478	253	1,573	253
574G	100%	952	133	984	133	989	133	1,018	133	1,060	133	1,129	133	1,201	133
575A	20%	0	1,877	4	2,202	4	2,632	4	3,862	4	5,461	4	6,677	4	7,840
575B	100%	2,559	7,280	3,071	7,945	3,346	11,224	3,437	14,310	3,578	17,310	3,807	19,810	4,052	21,810
575C	100%	2,311	6,979	2,412	8,374	2,560	11,830	2,626	13,730	2,729	15,630	2,903	17,330	3,090	18,980
575D	100%	124	3,914	142	4,459	683	6,059	683	7,259	697	9,960	742	12,160	790	13,960
575E	100%	3,184	626	3,520	630	3,690	630	3,905	630	4,141	630	4,407	630	4,689	630
576A	100%	3,551	6,551	3,799	6,800	4,094	7,826	4,136	8,325	4,255	8,625	4,529	8,925	4,820	9,425
576B	100%	4,970	5,688	4,851	5,999	5,108	6,398	5,108	6,874	5,221	6,873	5,556	6,873	5,913	6,873
576C	100%	1,906	307	2,059	313	2,061	315	2,070	315	2,123	315	2,259	315	2,404	315
576D	100%	743	157	743	157	751	157	766	157	793	157	844	157	898	157
576E	100%	1,582	2,979	1,613	3,328	1,647	4,129	1,726	4,329	1,818	4,328	1,935	4,328	2,058	4,328
576F	100%	1,200	3,000	1,219	3,351	1,360	3,951	1,378	4,405	1,420	4,604	1,511	4,604	1,608	4,604
577C	100%	1,189	741	1,216	1,092	2,338	2,291	2,338	3,291	2,390	4,292	2,544	5,292	2,707	5,292
577D	100%	68	2,682	78	2,992	372	5,992	372	8,992	380	11,492	404	13,992	430	16,492
577E	100%	93	436	625	1,038	1,369	2,562	1,370	4,477	1,401	5,483	1,490	6,383	1,586	7,003
577F	100%	2,132	666	2,225	665	2,317	666	2,508	665	2,696	665	2,870	665	3,054	665
577G	100%	2,077	6,977	2,209	7,851	2,227	8,881	2,305	9,931	2,410	10,231	2,565	10,731	2,730	11,232
578A	60%	489	434	606	434	642	494	697	494	751	495	799	495	850	495
578B	100%	1,587	132	1,635	132	1,765	132	1,840	132	1,934	132	2,058	132	2,190	132
578C	100%	3,394	1,615	3,721	1,814	4,136	1,814	4,271	1,815	4,460	1,814	4,746	1,814	5,050	1,814
578D	100%	731	383	1,432	383	2,002	448	2,076	448	2,174	448	2,313	448	2,462	448
578E	100%	303	218	334	224	398	224	488	222	562	223	599	223	637	223

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - VAWC - Alexandria

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
430A	100%	1,059	5,615	1,083	6,428	1,084	6,471	1,085	6,409	1,180	7,070	1,181	7,000	1,182	7,477
430B	100%	971	3,871	985	3,871	986	3,982	987	3,982	987	3,982	988	3,882	989	3,776
430C	100%	785	3,753	874	3,876	875	3,876	876	3,876	876	3,876	877	3,776	878	4,098
430D	100%	948	1,140	1,169	1,140	1,170	1,140	1,171	1,140	1,172	1,140	1,173	1,140	1,174	1,140
430E	100%	1,078	59	1,093	59	1,093	59	1,093	59	1,093	59	1,093	59	1,093	59
431A	100%	733	1,477	737	1,477	734	1,477	735	1,544	736	1,544	737	1,544	738	1,656
431B	100%	170	1,664	444	1,557	444	1,697	444	2,361	444	2,231	444	3,062	661	3,470
431C	100%	362	420	369	478	370	768	371	1,075	372	1,075	373	1,075	374	1,075
431D	100%	428	1,999	461	1,999	462	1,999	463	1,999	464	1,999	464	1,951	465	1,951
431E	100%	750	2,161	794	2,419	795	2,932	796	3,627	796	3,527	797	3,527	798	3,636
431F	100%	281	2,954	288	4,768	289	4,987	290	4,987	291	4,987	292	4,987	293	5,216
431G	100%	3	869	3	1,227	200	2,142	350	2,563	500	2,563	500	2,563	500	2,563
431H	100%	607	1,996	616	1,796	617	1,555	618	1,555	619	1,555	620	1,555	621	1,555
431J	100%	289	195	294	195	294	195	294	195	294	195	294	195	294	195
431K	100%	484	368	493	368	493	368	493	368	493	368	493	368	493	368
432A	100%	2,223	261	2,239	261	2,239	261	2,239	261	2,239	229	2,239	229	2,239	229
432B	100%	1,523	994	1,683	994	1,685	994	1,687	994	1,689	994	1,691	994	1,693	994
432C	100%	378	549	527	549	529	1,162	717	1,760	905	2,358	1,074	2,971	1,076	2,971
432D	100%	875	116	886	116	888	116	889	116	891	116	893	116	895	116
432E	100%	1,311	230	1,341	230	1,342	230	1,343	230	1,344	230	1,345	230	1,346	230
432F	100%	1,139	476	1,215	476	1,216	476	1,217	476	1,218	476	1,219	476	1,220	476
432G	100%	1,059	1,606	1,095	1,633	1,096	1,633	1,097	1,633	1,098	1,633	1,099	1,633	1,100	1,633
432H	100%	1,051	695	1,044	799	1,045	799	1,046	799	1,047	799	1,048	799	1,049	799
432J	100%	420	304	432	304	434	304	436	304	437	304	439	304	441	304
432K	100%	754	601	841	601	842	601	843	803	844	803	845	803	846	803
432L	100%	445	90	445	90	447	90	449	90	451	90	453	90	455	90
432M	100%	379	409	378	409	380	409	382	409	384	409	386	409	388	409
432N	100%	738	94	751	94	752	94	753	94	754	94	755	94	756	94
432P	100%	337	505	341	505	342	505	343	505	344	505	345	505	346	505
432Q	100%	503	361	503	644	943	2,144	1,383	4,169	2,439	6,328	3,495	8,487	4,463	10,821
432R	100%	999	97	1,009	97	1,010	97	1,011	97	1,012	97	1,013	97	1,014	97
440A	100%	1,091	867	1,096	867	1,099	867	1,102	867	1,105	867	1,108	867	1,111	867
440B	100%	553	277	557	277	559	277	562	277	565	277	568	277	571	277
440C	100%	416	750	421	750	425	750	429	750	433	750	437	750	441	750
440D	100%	1,601	1,122	1,867	1,421	1,871	1,421	1,875	1,421	1,879	1,421	1,882	1,439	1,886	1,439
440E	100%	0	2,105	0	3,249	225	4,115	675	5,865	1,350	8,073	1,800	10,493	2,250	12,682
440F	100%	0	6,883	0	7,047	0	9,828	0	9,828	0	11,094	0	11,094	0	11,094
440G	100%	0	1,027	0	1,326	0	1,465	0	2,358	0	3,205	500	3,730	500	4,693
440H	100%	2	1,107	2	1,213	2	1,513	2	1,813	2	2,007	2	2,007	2	2,007
440J	100%	50	1,515	47	2,045	47	2,623	47	3,201	497	3,181	947	3,241	1,316	3,241
440K	100%	1,272	1,745	1,278	2,030	1,281	2,030	1,284	2,030	1,287	2,030	1,290	2,030	1,293	2,030
440L	100%	757	191	832	191	835	191	838	191	840	191	843	191	846	191
441A	100%	2,141	2,187	2,151	2,187	2,151	2,187	2,151	2,187	2,151	2,187	2,151	2,187	2,151	2,187
441B	100%	2,976	2,793	3,006	2,793	3,009	2,793	3,012	2,793	3,014	2,793	3,017	2,793	3,020	2,793
441C	100%	51	1,706	68	2,323	68	2,323	68	2,323	68	2,323	68	2,323	68	2,323
441D	100%	2,592	594	2,774	594	2,774	685	2,774	685	2,774	685	2,774	685	2,774	685
441E	100%	3,962	2,068	4,156	2,299	4,156	2,299	4,156	2,299	4,156	2,299	4,156	2,248	4,156	2,198

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - VAWC - Alexandria (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
441F	100%	1,703	2,322	2,536	2,538	2,536	2,538	2,536	2,538	2,536	2,538	2,536	2,510	2,536	2,510
441G	100%	594	1,971	602	1,971	602	2,223	602	2,223	602	2,223	602	2,692	602	2,592
441H	100%	0	828	0	828	0	828	0	828	0	828	0	1,100	0	1,029
441J	100%	0	4,045	0	4,045	300	182	655	552	1,010	867	1,310	1,237	1,610	1,552
441K	100%	2	5,274	2	5,274	2	5,274	2	5,274	2	5,624	2	6,224	2	7,583
441L	100%	0	233	0	233	0	233	0	233	0	233	0	233	0	233
442A	100%	622	2,069	632	2,069	634	2,069	637	2,069	640	2,069	643	2,069	646	2,069
442B	100%	1,727	3,692	1,733	3,692	1,736	3,692	1,739	3,692	1,741	4,392	1,744	4,392	1,747	4,392
442C	100%	2,081	6,665	2,395	6,265	2,889	6,493	3,272	6,493	3,272	6,393	3,272	6,323	3,272	6,323
442D	100%	2,685	307	2,693	307	2,693	307	3,234	307	3,234	307	3,234	307	3,234	307
442E	100%	943	1,638	955	3,236	955	3,136	955	3,603	955	3,603	955	4,303	955	5,003
442F	100%	2,038	296	2,057	296	2,507	903	2,510	903	2,513	903	2,516	903	2,518	903
442G	100%	339	3	342	3	345	3	348	3	351	3	354	3	357	3

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - VAWC - Dale City

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
772B	100%	4,145	812	5,323	1,161	6,190	1,221	7,194	1,282	7,567	1,347	7,960	1,416	8,372	1,488
772C	100%	4,133	931	4,845	977	5,110	1,027	5,388	1,078	5,679	1,135	5,986	1,192	6,308	1,253
772D	100%	2,500	2,299	2,627	3,150	3,047	4,021	3,533	4,660	4,097	4,898	4,306	5,147	4,526	5,411
772E	100%	3,490	2,128	3,668	2,237	3,853	2,351	4,464	2,724	5,172	3,159	5,993	3,662	6,945	4,244

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - LCSA

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
671A	100%	3	956	0	1,011	0	1,100	0	1,871	0	2,396	0	2,921	0	3,446
671B	100%	15	2,582	0	3,175	0	3,764	0	3,920	0	4,445	0	4,970	0	5,495
671C	100%	23	3,146	30	3,239	60	3,358	120	3,478	240	3,611	457	3,743	552	3,876
671D	100%	53	1,602	178	1,981	300	2,448	320	2,939	400	3,465	467	3,988	562	4,513
671E	100%	4,439	1,908	4,550	2,004	4,620	2,118	4,780	2,242	4,775	2,373	4,870	2,504	4,965	2,635
671F	100%	2,864	2,240	3,152	3,012	3,320	3,933	3,408	4,917	3,404	5,969	3,500	7,019	3,596	8,070
672A	100%	6,901	2,350	8,736	3,457	10,243	5,235	10,638	5,695	11,476	7,008	12,664	8,320	13,652	9,634
680A	100%	196	53	239	72	268	95	330	218	350	349	368	480	407	611
680B	100%	79	0	86	19	95	42	104	66	113	92	122	118	131	144
680C	100%	179	970	202	1,155	776	1,387	1,765	1,764	3,200	2,156	3,800	2,548	4,100	2,942
681B	100%	242	5	255	199	272	427	611	674	1,223	936	1,835	1,198	2,447	1,460
681C	100%	63	18	86	37	117	60	350	183	939	314	1,852	445	3,024	576
681D	100%	11	11	20	397	0	847	0	1,472	0	2,128	0	3,666	0	6,338
681E	100%	60	0	80	193	121	923	1,234	915	2,502	1,440	3,373	1,965	4,032	2,490
681F	100%	686	345	1,667	625	2,834	1,011	4,101	1,347	5,153	1,741	6,205	2,134	7,257	2,529
681G	100%	594	538	1,580	1,018	2,742	1,593	4,008	2,211	5,061	2,868	6,113	3,523	7,165	4,179
682D	100%	45	11	50	783	80	1,648	200	2,687	400	3,736	1,000	4,786	1,800	5,837

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - PWCSA - east

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
770A	100%	2,164	3,410	2,276	3,584	2,394	3,767	2,518	4,367	2,649	5,063	2,785	5,868	2,928	6,804
770B	100%	1,772	3,819	1,890	4,428	2,386	5,132	2,509	6,550	2,638	8,360	2,773	10,670	2,916	12,369
770C	100%	2,431	2,706	2,560	2,845	2,705	2,990	3,188	3,143	3,477	3,303	3,634	3,471	3,799	3,648
770D	100%	2,556	2,970	2,698	3,123	2,987	3,282	3,566	3,806	3,566	4,411	3,566	5,113	3,566	5,929
771A	100%	3,531	1,224	3,821	1,715	4,303	1,988	4,786	2,306	4,834	2,672	4,882	3,098	4,930	3,590
771B	100%	3,706	1,785	3,996	2,069	4,140	2,176	4,237	2,286	4,333	2,403	4,430	2,525	4,526	2,655
771C	100%	15	4,208	16	7,254	17	9,258	20	10,733	24	12,441	28	14,425	32	15,160
771D	100%	1,677	1,564	2,185	1,643	2,560	1,905	2,994	2,431	3,497	3,103	4,080	3,960	4,756	5,054
771E	100%	4,679	1,300	4,919	1,364	5,169	1,435	5,434	1,508	5,712	1,585	6,004	1,666	6,311	1,751
772A	100%	574	379	671	399	767	419	815	439	864	462	892	485	921	510
773C	100%	741	231	780	243	819	256	951	269	1,105	283	1,162	296	1,222	312
773D	100%	677	130	784	136	825	144	955	151	1,107	159	1,283	167	1,487	176
780A	100%	560	303	850	317	1,573	334	2,297	386	2,587	448	2,876	517	3,166	601
780B	100%	864	1,361	874	1,430	883	1,503	893	1,580	903	1,661	912	1,747	922	1,835
780C	100%	2,028	9,655	2,028	10,147	2,028	10,666	2,028	11,210	2,028	11,783	2,028	12,383	2,028	13,015
780D	100%	2,173	1,079	2,290	1,133	2,412	1,192	2,541	1,253	2,676	1,318	2,818	1,384	2,967	1,455
780E	100%	112	169	595	178	1,318	687	2,476	2,046	3,441	3,871	4,406	5,738	5,371	6,653
780F	100%	1,130	126	1,612	132	2,336	639	3,494	1,991	4,459	3,808	5,424	5,665	6,389	6,567
781A	100%	18	564	18	593	18	623	18	655	18	688	18	723	18	760
781B	100%	328	117	388	123	410	130	433	136	457	143	482	150	509	159
781C	100%	3,586	648	3,876	681	4,165	716	4,455	830	5,178	962	5,902	1,115	6,626	1,292
782B	100%	554	186	582	195	612	205	710	215	824	226	955	238	1,108	250
782C	100%	1,034	261	1,082	366	1,131	424	1,179	446	1,227	468	1,275	493	1,324	518

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - PWCSA - west

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
773A	100%	238	40	276	42	320	44	371	46	430	48	499	51	579	53
773B	100%	502	89	599	94	695	99	792	104	888	109	985	115	1,081	121
773E	100%	516	446	709	469	806	493	902	518	999	544	1,095	572	1,192	601
774A	100%	2,094	1,197	2,287	1,679	2,311	1,765	2,335	1,855	2,335	1,950	2,335	2,049	2,335	2,154
774B	100%	462	264	752	277	1,089	292	1,379	306	1,406	322	1,435	339	1,465	355
774D	100%	641	1,506	985	1,712	1,169	1,954	1,305	2,212	1,442	2,455	1,600	2,577	1,729	2,634
775A	100%	32	5	34	5	35	5	35	5	37	5	39	5	41	5
775B	100%	32	675	34	750	35	800	37	850	39	1,175	41	1,300	43	1,300
775C	100%	3,114	6,343	3,667	7,469	3,872	8,280	4,088	9,599	4,226	11,128	4,634	12,900	4,803	13,558
775D	100%	3,393	2,085	3,466	2,416	3,538	2,801	3,538	3,247	3,538	3,763	3,538	4,363	3,538	5,059
775E	100%	2,042	1,402	2,114	1,789	2,187	2,075	2,187	2,179	2,187	2,291	2,187	2,408	2,187	2,531
782A	100%	209	280	220	294	230	309	243	326	254	342	268	359	281	376
782D	100%	1,139	386	1,326	406	1,542	471	1,793	546	2,084	633	2,421	734	2,812	852
782E	100%	301	691	311	726	320	763	340	802	359	843	378	886	398	931
783A	100%	247	113	392	131	633	138	1,116	160	1,405	226	1,424	240	1,444	274
783B	100%	699	377	735	396	772	416	813	437	854	459	898	482	944	506
783C	100%	346	195	713	205	1,215	215	1,842	226	2,566	238	3,289	250	4,013	263
783D	100%	116	1,710	164	1,982	647	1,964	1,129	2,035	1,612	2,820	2,094	4,042	2,104	4,914
783E	100%	41	2,089	89	2,195	157	2,547	340	2,953	350	3,121	446	3,591	543	4,290
784A	100%	940	317	950	301	959	286	1,008	271	1,056	259	1,104	246	1,159	233
784B	100%	77	42	87	44	1,110	3,841	1,527	6,726	1,834	8,929	1,834	9,099	1,834	9,269
784C	100%	247	146	250	156	273	740	458	839	969	2,148	1,089	2,199	1,210	2,248
784D	100%	388	706	408	742	891	860	1,373	997	1,856	1,156	2,338	1,340	3,035	1,553
784E	100%	482	280	508	294	605	341	907	496	1,439	594	1,789	645	2,112	675
784F	100%	6	0	6	0	7	250	7	684	8	873	8	1,114	8	1,291
784G	100%	206	279	217	293	506	308	892	500	1,230	600	1,568	680	1,702	880
784H	100%	481	163	505	171	531	169	558	167	586	165	616	163	647	161
784J	100%	180	39	190	41	199	43	209	45	220	47	231	49	243	51

Appendix F - CAZs in FCWA's service area (continued)

FCWA - Wholesale - Herndon

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
577A	100%	1,022	612	1,142	642	1,415	673	1,415	672	1,446	673	1,539	673	1,638	673
577B	100%	1,326	2,189	1,463	2,340	1,726	2,515	1,732	2,515	1,773	2,515	1,887	2,515	2,008	2,515
577H	100%	1,580	5,179	1,743	5,478	2,057	5,978	2,064	6,348	2,113	6,648	2,249	6,848	2,394	6,848
577J	100%	3	1,401	121	3,610	1,652	7,111	1,652	10,110	1,688	12,611	1,797	15,111	1,912	17,611
577K	100%	1,299	3,040	1,453	3,391	1,800	4,091	1,800	4,691	1,840	5,291	1,958	5,791	2,083	6,091

FCWA - Wholesale - Dulles

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
575A	80%	0	1,877	4	2,202	4	2,632	4	3,862	4	5,461	4	6,677	4	7,840
670A	100%	18	6,210	0	7,646	0	9,320	0	10,132	0	10,921	0	11,706	0	12,495

FCWA - Wholesale - Fort Belvoir

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
561A	100%	1,291	8,377	418	8,638	445	12,237	685	12,582	868	12,927	924	13,281	983	13,381
561B	100%	0	2,166	0	2,266	0	2,516	0	2,616	0	2,716	0	2,816	0	2,846
561C	100%	1,053	4,047	0	4,246	0	4,648	0	4,797	0	4,946	0	5,097	0	5,146

FCWA - Wholesale - Lorton

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
570A	100%	7	1,033	1	1,033	2	1,038	11	1,038	17	1,038	18	1,038	19	1,038

Appendix G - CAZs in WSSC's service area

WSSC - Montgomery County

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
140A	100%	1,014	723	1,037	708	1,047	720	1,057	733	1,067	732	1,087	733	1,107	734
140B	100%	779	148	778	147	778	149	778	149	778	149	778	149	778	149
140C	100%	515	110	516	109	516	111	516	110	516	110	516	110	516	110
140D	100%	873	4,277	872	4,151	882	4,207	882	4,296	882	4,380	902	4,457	902	4,529
140E	100%	1,463	5,098	1,463	4,813	1,473	4,991	1,483	5,325	1,493	5,644	1,513	5,921	1,523	6,177
140F	100%	1,019	166	1,022	166	1,022	168	1,022	170	1,022	172	1,022	174	1,022	175
140G	100%	779	348	788	390	813	395	823	394	823	393	853	396	863	396
140H	100%	522	137	523	136	523	138	523	139	523	138	523	138	523	139
140J	100%	906	279	970	286	970	291	970	292	970	296	980	301	1,010	310
141A	100%	868	192	1,022	217	1,272	262	1,272	260	1,272	260	1,272	260	1,272	260
141B	100%	3,385	9,598	3,361	9,152	3,361	9,975	3,361	10,648	3,371	11,186	3,471	11,648	3,571	12,069
141C	100%	1,163	389	1,170	383	1,170	390	1,170	387	1,170	387	1,170	386	1,170	385
141D	100%	446	303	448	298	448	306	448	314	448	313	448	312	458	315
141E	100%	967	1,179	970	1,054	980	1,099	990	1,151	990	1,199	1,000	1,243	1,000	1,281
141F	100%	1,568	306	1,577	302	1,582	310	1,582	317	1,592	317	1,592	316	1,602	317
142A	100%	442	86	449	85	454	86	454	89	454	89	474	89	494	90
142B	100%	1,180	656	1,242	659	1,272	679	1,347	690	1,377	695	1,407	700	1,437	706
142C	100%	1,505	395	1,524	391	1,534	398	1,534	405	1,544	405	1,564	406	1,614	412
142D	100%	650	1,721	650	1,673	650	1,749	800	1,899	810	2,026	810	2,136	820	2,239
142E	100%	945	55	947	66	952	66	952	66	952	66	961	66	961	66
142F	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
142G	100%	1,806	1,971	1,803	1,921	1,808	1,970	1,818	1,962	1,818	1,956	1,838	1,955	1,838	1,951
142H	100%	1,990	509	2,011	499	2,021	511	2,021	531	2,021	551	2,041	569	2,111	590
143A	100%	1,837	8,577	1,944	8,083	2,264	8,521	2,484	9,339	2,684	10,161	2,874	10,872	3,024	11,517
143B	100%	1,256	24,155	1,497	22,654	2,017	24,662	2,097	26,575	2,097	28,310	2,257	29,810	2,407	31,174
143C	100%	1,619	10,071	1,609	10,203	1,610	10,807	1,610	11,618	1,610	12,368	1,691	13,020	1,891	13,620
144A	100%	206	14,302	210	13,856	210	14,224	210	14,766	210	15,232	210	15,191	210	15,154
144B	100%	77	5,957	81	5,772	81	5,886	81	6,099	81	6,285	81	6,268	81	6,253
144C	100%	2,359	2,437	2,637	2,407	2,737	2,470	2,737	2,530	2,737	2,523	2,737	2,516	2,737	2,512
144D	100%	340	28	343	28	343	29	343	29	443	37	443	37	443	37
144E	100%	682	452	697	446	772	476	847	530	857	579	877	624	897	666
144F	100%	1,442	438	1,447	433	1,447	492	1,447	509	1,447	519	1,467	528	1,477	535
145A	100%	713	274	733	266	753	274	753	272	753	272	753	271	763	270
145B	100%	3,083	790	3,065	829	3,069	875	3,181	933	3,193	979	3,209	1,019	3,217	1,055
145C	100%	770	198	766	207	767	219	795	233	798	244	802	255	804	264
145D	100%	104	2,551	103	2,584	103	2,685	103	2,886	103	3,096	103	3,282	103	3,454
145E	100%	967	1,440	970	1,430	995	1,513	1,000	1,658	1,000	1,803	1,005	1,928	1,005	2,043
145F	100%	1,360	1,597	1,355	1,553	1,360	1,598	1,360	1,684	1,370	1,761	1,375	1,829	1,375	1,892
145G	100%	228	139	246	99	256	108	406	121	406	126	416	133	416	138
145H	100%	762	630	772	621	782	741	782	781	782	805	782	825	782	843
146A	100%	2,155	7,501	2,550	9,043	3,130	9,652	3,730	10,270	5,380	10,801	5,380	11,241	5,380	11,645
146B	100%	444	18,517	791	16,682	1,031	17,999	1,761	19,452	2,261	20,789	2,291	21,939	2,291	22,986
146C	100%	1,687	7,259	1,675	6,566	1,675	7,727	2,170	8,551	2,170	9,245	2,170	9,839	3,025	10,381
147A	100%	1,958	604	1,954	594	1,959	616	1,979	671	1,994	731	2,014	784	2,034	832
147B	100%	1,275	927	1,276	849	1,276	986	1,336	1,090	1,346	1,182	1,356	1,262	1,461	1,334
147C	100%	2,224	583	2,218	572	2,228	589	2,243	613	2,253	635	2,273	634	2,283	633
147D	100%	1,302	856	1,303	833	1,303	878	1,303	936	1,313	988	1,328	1,034	1,328	1,075

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Montgomery County (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
147E	100%	1,424	541	1,429	526	1,439	544	1,449	593	1,459	644	1,469	689	1,469	729
147F	100%	2,390	2,535	2,378	2,466	2,388	2,530	2,403	2,650	2,413	2,643	2,433	2,637	2,443	2,632
147G	100%	343	57	341	56	341	57	341	56	341	56	341	56	341	56
147H	100%	653	68	653	68	653	69	653	68	653	68	653	68	653	68
147J	100%	2,241	246	2,235	243	2,245	250	2,245	254	2,245	253	2,255	254	2,265	255
147K	100%	1,290	647	1,286	630	1,286	651	1,286	691	1,296	732	1,316	767	1,326	799
147L	100%	1,638	333	1,716	325	1,726	334	1,736	352	1,756	367	1,786	382	1,826	395
147M	100%	2,232	473	2,226	462	2,246	474	2,256	493	2,266	493	2,301	493	2,331	493
150A	100%	404	533	431	521	531	549	541	576	541	597	541	618	541	617
150B	100%	603	340	769	356	1,049	405	1,109	425	1,149	443	1,209	450	1,229	453
150C	100%	537	115	568	147	588	151	608	151	638	155	688	162	738	169
150D	100%	821	147	845	150	915	162	955	166	985	170	1,005	172	1,015	174
150E	100%	401	2,009	418	1,950	428	2,003	438	2,115	438	2,215	448	2,303	448	2,382
151A	100%	1,474	353	1,514	363	1,524	371	1,534	370	1,544	372	1,564	376	1,584	381
151B	100%	681	327	726	328	796	351	846	461	876	599	956	727	1,086	852
151C	100%	1,010	327	1,153	342	1,423	387	1,443	387	1,443	387	1,443	386	1,443	386
151D	100%	1,840	4,413	1,837	4,659	1,837	4,852	1,877	5,153	1,917	5,433	1,927	5,677	1,927	5,901
151E	100%	726	174	731	178	731	179	741	178	741	178	741	177	741	177
151F	100%	638	38	643	39	653	40	663	40	663	40	663	40	693	42
151G	100%	1,300	278	1,311	278	1,321	285	1,401	294	1,501	309	1,671	334	1,881	364
151H	100%	644	465	664	457	674	480	674	501	674	519	674	535	674	540
151J	100%	1,325	1,043	1,330	1,014	1,348	1,043	1,420	1,043	1,510	1,048	1,645	1,056	1,825	1,069
151K	100%	632	429	638	420	638	436	648	475	668	516	698	553	728	586
152A	100%	1	19,350	1	21,441	501	23,369	1,201	25,524	1,201	27,207	1,201	28,648	1,201	29,947
152B	100%	1,235	424	1,231	415	1,231	424	1,231	441	1,231	456	1,251	457	1,271	457
152C	100%	877	838	946	820	976	851	976	913	1,006	972	1,016	1,022	1,036	1,069
152D	100%	1,081	1,530	1,123	1,492	1,123	1,534	1,123	1,612	1,123	1,680	1,133	1,743	1,143	1,799
152E	100%	848	426	847	416	857	427	857	425	867	425	887	426	897	428
152F	100%	1,063	5,342	1,155	4,076	1,227	4,400	1,492	5,076	1,492	5,590	1,492	5,805	1,502	6,005
152G	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
152H	100%	1,016	4,934	1,014	4,822	1,014	4,984	1,014	5,338	1,024	5,663	1,044	5,944	1,044	6,202
152J	100%	866	150	960	153	1,022	168	1,187	188	1,187	198	1,187	207	1,187	216
152K	100%	2,457	280	2,440	274	2,440	280	2,440	279	2,440	278	2,640	287	2,840	296
152L	100%	1,016	284	1,009	302	1,009	309	1,809	345	2,409	375	2,409	373	2,409	373
152M	100%	357	12,157	564	11,730	1,114	12,603	1,484	13,037	1,764	13,480	2,764	13,902	3,664	14,296
152N	100%	43	5,991	243	5,899	443	6,500	443	7,434	513	8,092	1,513	8,880	2,713	9,594
152P	100%	1,679	4,343	1,667	4,196	1,667	4,336	1,667	4,666	1,667	4,990	1,677	5,275	1,687	5,534
153E	20%	2,273	9,193	2,280	8,344	2,602	10,411	2,902	11,819	3,202	11,904	3,202	12,005	3,202	12,119
153F	100%	738	3,001	733	2,769	908	3,207	908	3,235	908	3,268	1,108	3,302	1,108	3,331
153G	100%	1,857	13,249	1,844	12,877	1,844	13,189	2,344	13,878	2,944	14,548	3,054	15,116	3,374	15,656
153J	50%	1,928	1,474	1,914	1,542	1,914	1,564	1,914	1,578	1,914	1,597	1,914	1,618	1,914	1,642
154A	100%	1,611	1,498	1,610	1,440	1,610	1,517	1,620	1,686	1,630	1,853	1,640	1,996	1,650	2,126
154B	100%	582	69	583	69	583	70	583	70	593	70	593	70	603	71
154C	100%	1,086	1,167	1,088	1,143	1,258	1,283	1,258	1,539	1,268	1,852	1,278	2,128	1,298	2,386
154D	100%	686	1,151	701	1,093	721	1,142	726	1,219	726	1,290	726	1,351	726	1,408
154E	100%	781	639	811	581	838	616	843	666	843	720	852	768	861	810
154F	100%	829	8,506	1,050	7,948	1,764	8,746	2,345	9,549	2,345	10,062	2,346	10,418	2,347	10,664

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Montgomery County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
154G	100%	1,307	429	1,310	418	1,318	429	1,334	448	1,350	448	1,382	448	1,414	449
154H	100%	1,056	165	1,062	163	1,064	165	1,078	170	1,082	170	1,110	171	1,128	172
154J	100%	1,178	2,605	1,170	2,526	1,170	2,598	1,190	2,737	1,190	2,753	1,210	2,772	1,230	2,788
154K	100%	1,368	571	1,393	556	1,393	573	1,413	606	1,413	639	1,433	668	1,453	694
154L	100%	762	507	789	525	973	547	973	577	973	605	973	629	973	651
155A	100%	1,322	364	1,313	354	1,313	362	1,313	381	1,313	397	1,313	411	1,313	424
155B	100%	1,169	913	1,166	887	1,166	917	1,166	986	1,166	1,052	1,176	1,111	1,186	1,166
155C	100%	1,657	965	1,665	978	1,675	1,011	1,675	1,063	1,695	1,110	1,715	1,151	1,735	1,190
155D	100%	2,582	228	2,581	226	2,589	238	2,589	250	2,598	260	2,615	271	2,640	280
155E	100%	1,475	770	1,470	766	1,470	788	1,480	830	1,480	868	1,480	901	1,480	931
155F	100%	1,434	236	1,424	232	1,424	237	1,424	243	1,424	243	1,424	242	1,424	242
155G	100%	614	102	610	100	610	102	610	105	610	105	610	105	610	104
155H	100%	455	40	455	40	457	42	457	45	458	45	461	47	466	50
155J	100%	1,028	280	1,029	273	1,104	284	1,179	300	1,186	312	1,201	323	1,224	334
155K	100%	406	634	451	599	460	626	594	675	598	728	602	773	610	815
155L	100%	374	204	398	201	404	212	410	238	416	268	422	293	434	318
155M	100%	342	93	343	91	368	95	393	101	395	104	400	108	408	111
155N	100%	1,847	915	1,876	898	1,885	922	1,970	975	2,012	1,023	2,063	1,064	2,131	1,101
155P	100%	1,066	225	1,070	220	1,174	230	1,318	241	1,358	247	1,382	247	1,438	249
155Q	100%	267	57	268	55	294	57	330	60	340	61	346	62	360	61
155R	100%	326	162	331	159	333	163	348	172	355	181	364	188	376	194
156A	100%	2,764	849	2,774	828	2,794	851	2,819	891	2,839	929	2,879	961	2,919	992
156B	100%	683	184	683	183	683	187	683	185	683	185	683	185	683	184
156C	100%	1,118	421	1,120	410	1,120	424	1,120	451	1,120	480	1,120	505	1,120	527
156D	100%	1,552	293	1,551	287	1,561	296	1,576	320	1,576	343	1,576	363	1,576	382
156E	100%	1,132	360	1,129	355	1,129	383	1,379	489	1,379	596	1,379	690	1,379	777
157A	100%	980	461	1,113	507	1,153	540	1,203	556	1,213	565	1,223	574	1,233	582
157B	100%	716	482	716	469	716	481	716	505	726	529	726	547	726	566
157C	100%	1,042	1,354	1,045	1,317	1,045	1,354	1,045	1,419	1,045	1,477	1,055	1,475	1,055	1,471
157D	100%	1,486	1,139	1,585	1,072	1,625	1,126	1,665	1,224	1,665	1,324	1,665	1,410	1,665	1,490
157E	100%	970	422	973	406	973	418	973	436	973	454	993	454	993	453
157F	100%	466	1,456	468	1,357	468	1,420	468	1,548	468	1,680	468	1,798	468	1,904
157G	100%	11	2,762	11	2,677	11	2,747	11	2,939	11	3,122	11	3,282	11	3,428
157H	100%	2,848	1,924	3,158	1,935	3,158	2,051	3,258	2,317	3,268	2,612	3,308	2,868	3,338	3,104
157J	100%	475	256	482	249	492	257	542	260	592	263	592	263	592	262
157K	100%	1,605	688	1,624	635	1,634	653	1,644	676	1,654	698	1,654	717	1,654	737
157L	100%	1,273	252	1,314	245	1,314	253	1,314	263	1,324	274	1,344	283	1,354	283
157M	100%	1,187	3,740	1,219	3,666	1,269	3,814	1,299	4,123	1,299	4,433	1,299	4,704	1,299	4,950
157N	100%	643	1,533	638	1,491	828	1,584	828	1,666	828	1,733	828	1,728	868	1,727
157P	100%	931	6,553	924	6,529	924	7,792	924	8,970	924	10,158	924	11,195	924	12,149
157Q	100%	1,875	1,634	1,932	1,654	2,032	1,759	2,182	2,001	2,362	2,271	2,782	2,520	3,052	2,741
160A	50%	6	13,578	6	13,459	6	14,774	6	14,971	506	15,540	806	16,028	956	16,467
160D	50%	1,591	157	1,599	160	1,627	167	1,627	169	1,627	172	1,627	174	1,627	179
160E	10%	1,153	2,466	1,187	2,240	1,589	2,297	1,597	2,611	1,607	3,563	1,622	4,513	1,642	4,512
161A	100%	6	2,417	6	2,076	108	2,332	516	2,323	924	2,315	1,077	2,309	1,230	2,303
161B	100%	3	3,625	3	3,115	3	3,497	3	3,483	3	3,472	3	3,463	3	3,454
161C	40%	1,561	4,107	1,559	3,767	1,559	3,796	1,607	3,812	1,607	3,831	1,607	3,855	1,607	3,883

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Montgomery County (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
161G	40%	75	4,062	76	4,253	76	4,980	81	5,612	81	6,225	81	6,761	81	7,255
161H	100%	202	2,118	203	2,040	305	2,078	608	2,151	808	2,157	908	2,160	1,008	2,163
161J	100%	4	2,716	4	2,726	252	3,329	1,094	4,798	1,986	6,649	2,233	7,999	2,380	9,075
161K	100%	107	752	106	729	106	748	106	745	106	743	106	741	106	739
161L	100%	504	6,265	508	6,514	516	6,825	516	7,553	516	8,202	516	8,760	516	9,264
161M	90%	97	4,511	99	4,777	99	5,666	104	6,303	104	6,901	104	7,426	104	7,910
161N	100%	447	523	464	509	484	523	494	522	494	520	494	519	494	518
161P	100%	624	326	635	321	655	337	695	371	725	404	755	435	785	463
161Q	100%	808	45	812	46	812	46	812	46	812	46	812	46	812	46
161R	100%	359	71	381	71	391	73	391	73	391	73	391	73	391	72
162A	100%	1,265	184	1,261	182	1,271	186	1,271	184	1,271	184	1,271	184	1,301	187
162B	100%	1,541	544	1,530	531	1,535	545	1,535	570	1,535	595	1,535	616	1,535	636
162C	100%	1,420	432	1,410	421	1,415	432	1,415	429	1,415	428	1,415	427	1,415	426
162D	100%	2,189	184	2,173	180	2,173	184	2,173	183	2,173	182	2,173	182	2,173	182
162E	100%	959	824	957	802	957	826	957	875	957	920	957	959	957	995
162F	100%	890	2,638	884	2,547	884	2,638	884	2,826	884	3,007	884	3,164	884	3,309
162G	100%	594	65	600	66	610	68	610	68	610	69	610	70	620	72
163A	100%	5,496	1,718	6,652	1,735	7,452	1,805	8,052	1,913	8,532	2,006	8,802	2,084	8,862	2,151
163B	100%	5,759	774	5,738	764	5,898	793	5,978	841	6,048	888	6,068	930	6,068	967
163C	100%	1,491	371	1,745	368	1,805	383	1,825	402	1,825	417	1,835	418	1,835	419
164A	100%	373	495	430	568	470	607	620	661	690	707	770	749	840	788
164B	100%	133	160	152	157	162	163	362	191	512	213	552	224	582	233
164C	100%	1,474	158	1,594	162	1,664	173	1,704	179	1,714	183	1,734	187	1,734	189
164D	100%	1,587	184	1,606	185	1,616	188	1,626	192	1,636	195	1,646	194	1,656	195
164E	100%	1,309	338	1,310	332	1,330	346	1,430	378	1,490	408	1,540	434	1,580	459
164F	100%	705	213	725	216	755	229	785	252	805	278	825	300	845	321
164G	100%	209	401	218	395	238	426	258	498	268	579	278	652	288	719
164H	100%	1,141	785	1,183	767	1,353	851	1,383	1,053	1,473	1,279	1,593	1,470	1,703	1,638
164J	100%	6,863	2,054	7,254	2,033	7,444	2,348	7,834	2,761	8,114	3,074	8,374	3,352	8,604	3,614
164K	100%	76	929	85	860	105	936	135	1,044	145	1,156	155	1,253	165	1,342
170A	70%	478	105	485	114	560	202	580	353	590	539	600	697	610	842
170B	10%	222	52	260	82	330	92	370	101	420	112	490	124	580	137
170C	80%	101	94	110	109	140	113	170	116	200	119	250	125	310	132
170D	100%	404	189	431	190	541	215	611	229	651	239	691	246	721	251
170E	100%	183	49	197	50	207	52	227	62	237	70	237	75	257	84
170F	100%	514	169	550	170	765	199	925	224	1,035	243	1,205	269	1,395	297
170G	100%	1,877	297	2,364	345	2,524	461	2,524	676	2,524	946	2,524	1,181	2,524	1,395
170H	100%	1,406	165	1,406	164	1,406	167	1,406	166	1,406	165	1,406	165	1,406	165
170J	100%	1,964	205	2,165	272	2,275	286	2,495	304	2,745	321	3,015	340	3,315	362
170K	100%	122	103	171	111	441	164	671	272	811	378	1,001	475	1,251	575
170L	100%	267	41	295	46	415	65	465	72	485	75	505	77	515	79
170M	100%	287	47	305	50	345	57	375	61	415	66	495	78	565	89
170N	100%	381	119	423	121	433	125	443	125	473	128	513	131	543	135
170P	100%	168	414	252	539	1,182	841	1,652	1,509	1,822	2,242	2,032	2,726	2,222	3,146
171A	100%	1,045	2,168	1,158	2,544	1,178	2,999	1,198	3,476	1,198	3,958	1,218	4,375	1,248	4,754
171B	100%	2,722	5,796	2,804	5,448	2,914	6,207	3,054	6,571	3,118	6,840	3,332	7,075	3,484	7,285
171C	100%	781	187	819	316	859	323	899	337	915	352	971	366	1,019	379

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Montgomery County (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
171D	100%	1,524	1,883	3,098	1,751	4,188	3,587	4,468	6,951	4,538	9,730	4,668	11,330	4,808	12,816
171E	100%	1,490	9,283	2,194	9,830	2,674	12,173	2,994	14,745	3,594	17,351	4,474	19,335	5,224	20,950
171F	100%	2,448	3,867	2,496	4,562	2,516	7,195	2,586	8,842	2,646	10,322	2,726	11,223	2,806	12,010
171G	100%	2	4,431	2	4,295	2	4,436	2	4,717	2	4,971	2	5,193	2	5,397
172A	100%	1,400	331	1,560	344	1,680	362	1,680	360	1,680	362	1,680	360	1,680	361
172B	100%	2,058	1,407	2,056	1,301	2,236	1,456	2,254	1,630	2,254	1,805	2,254	1,955	2,254	2,093
172C	100%	1,800	9,969	1,898	10,069	1,938	10,875	2,140	11,842	2,180	12,905	2,510	13,857	2,530	14,730
172D	100%	1,451	8,075	1,644	8,165	1,714	9,117	1,760	9,741	1,770	10,377	1,803	10,940	1,830	11,461
172E	100%	1,288	218	1,306	224	1,407	231	1,440	232	1,460	233	1,507	235	1,541	237
172F	100%	1,289	540	1,300	525	1,300	540	1,340	538	1,360	537	1,390	537	1,410	536
172G	100%	3,786	647	4,234	657	4,348	667	4,348	669	4,348	671	4,348	674	4,348	674
172H	100%	2,675	1,448	3,071	1,886	3,227	2,122	3,477	2,269	3,527	2,396	3,577	2,504	3,647	2,606
172J	100%	881	2,784	890	2,787	910	2,869	920	3,114	920	3,338	930	3,537	940	3,717
172K	100%	3,016	2,013	3,010	1,894	3,030	1,977	3,110	2,144	3,180	2,311	3,430	2,460	3,560	2,596
172L	100%	418	4,954	435	5,522	535	5,785	535	6,191	535	6,604	755	6,970	755	7,307
172M	100%	1,351	474	1,371	468	1,401	525	1,421	1,001	1,441	1,444	1,481	1,829	1,561	2,177
172N	100%	1,259	151	1,380	157	1,400	164	1,450	171	1,480	176	1,540	180	1,630	185
173A	50%	60	4	60	4	610	33	1,710	88	2,360	122	2,560	133	2,660	139
173B	100%	1,702	82	1,960	97	2,810	146	2,910	187	3,610	270	4,340	345	4,890	411
173C	100%	1,717	1,147	1,818	1,306	2,368	2,227	2,693	2,803	2,708	3,118	2,784	3,373	2,794	3,556
173D	100%	4,701	2,697	4,900	3,120	4,950	3,411	5,065	3,875	5,170	4,275	5,194	4,584	5,204	4,849
173E	100%	1,386	3,142	1,386	3,078	1,386	3,293	1,386	3,736	1,386	4,180	1,606	4,560	1,806	4,892
173F	100%	2,702	612	3,093	671	3,943	826	4,273	878	4,373	899	4,423	914	4,423	929
173G	100%	271	105	684	481	2,184	5,426	3,064	8,918	3,314	10,948	3,414	13,036	3,514	14,858
173H	100%	4,447	4,702	5,320	5,665	6,120	7,569	6,920	10,629	7,480	13,295	7,630	15,150	7,780	16,709
173J	100%	486	43	1,253	114	1,953	238	2,533	557	2,533	817	2,533	983	2,533	1,131
174A	100%	2,515	7,196	3,587	7,608	3,907	9,060	3,907	10,882	3,907	12,749	3,907	14,357	3,907	15,817
174B	100%	198	544	227	1,116	257	1,302	307	1,529	347	1,751	407	1,942	447	2,115
174C	100%	239	148	247	149	257	164	297	176	327	185	357	193	407	202
174D	100%	631	301	787	316	1,087	372	1,337	498	1,487	651	1,667	791	1,797	920
175C	100%	1,999	388	2,015	455	2,025	554	2,025	615	2,025	662	2,035	701	2,045	735
175D	100%	1,464	596	1,514	615	1,974	675	2,294	746	2,394	797	2,474	840	2,534	880
175E	100%	1,671	225	1,719	225	1,859	242	1,899	260	1,939	281	1,959	298	1,979	313
175F	100%	715	424	810	433	940	467	1,130	527	1,180	561	1,190	584	1,200	605
175G	100%	363	173	370	168	390	175	440	187	500	198	550	208	600	217
175H	100%	993	617	1,016	610	1,036	727	1,066	833	1,106	938	1,126	1,027	1,146	1,108
175J	50%	659	2,590	1,339	2,628	2,079	2,865	2,779	3,137	2,939	3,311	3,059	3,460	3,139	3,591
175K	30%	355	217	367	215	397	233	417	297	437	354	457	402	477	445
181E	50%	115	21	119	21	124	22	129	22	129	22	134	22	139	22
181F	30%	90	102	94	102	104	112	114	145	114	186	119	223	124	259
181G	50%	229	28	242	29	442	41	942	270	1,442	555	1,942	808	2,142	1,023
181H	30%	152	22	151	48	161	52	181	68	201	88	206	105	211	121
182A	50%	654	428	669	417	689	434	709	527	729	635	734	729	739	814
182B	100%	334	1,533	367	1,804	1,667	3,056	4,267	4,759	6,567	6,404	9,067	7,840	11,067	9,128
182C	50%	848	152	952	157	1,112	172	1,222	183	1,322	193	1,422	202	1,522	213
182D	40%	713	278	818	285	938	303	1,148	330	1,348	358	1,548	385	1,798	418
182E	50%	1,263	271	1,294	269	1,354	278	1,374	284	1,404	290	1,444	298	1,484	304

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Montgomery County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
182F	50%	385	108	392	107	402	110	412	115	422	120	427	125	432	129
182G	100%	2,131	1,266	2,201	1,666	2,496	1,746	2,766	1,885	3,046	2,020	3,346	2,141	3,546	2,254
182H	100%	368	455	370	541	380	564	400	609	410	657	440	701	470	743
182J	50%	469	192	476	189	491	196	511	210	531	227	536	241	541	253

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
240A	100%	435	12	435	12	533	13	636	16	667	18	667	18	667	18
240B	100%	3,399	801	3,404	809	3,453	847	3,453	892	3,469	951	3,504	1,015	3,544	1,071
240C	100%	4,920	1,700	4,927	1,738	4,927	1,791	4,927	1,860	4,928	1,949	4,928	2,068	4,928	2,236
240D	100%	567	58	592	379	600	590	600	700	604	707	604	714	604	720
240E	100%	425	181	521	179	556	182	556	191	587	202	587	211	587	223
240F	100%	485	380	485	390	485	413	485	444	485	476	485	502	492	524
240G	100%	1,087	537	1,088	546	1,090	564	1,090	587	1,184	618	1,185	658	1,185	679
240H	100%	68	15,285	68	15,295	68	15,317	68	15,974	68	16,619	68	17,381	84	18,367
241A	100%	935	893	945	919	963	977	1,057	1,053	1,158	1,147	1,172	1,240	1,207	1,330
241B	100%	2,627	677	2,628	673	2,628	700	2,628	729	2,628	768	2,628	815	2,628	857
241C	100%	2,190	1,199	2,192	1,212	2,192	1,277	2,192	1,357	2,192	1,456	2,193	1,560	2,200	1,658
241D	100%	1,817	805	1,817	822	1,817	874	1,817	933	1,817	1,001	1,817	1,072	1,817	1,128
241E	100%	679	888	679	891	679	896	679	924	679	952	679	985	679	1,023
241F	100%	1,599	290	1,599	284	1,599	284	1,599	292	1,599	299	1,599	310	1,599	323
241G	100%	998	423	1,048	436	1,112	466	1,112	499	1,143	538	1,179	579	1,179	609
242A	100%	1,194	40	1,195	41	1,195	43	1,200	46	1,201	49	1,253	50	1,317	54
242B	100%	1,081	1,860	1,089	1,920	1,091	2,076	1,091	2,278	1,092	2,529	1,094	2,753	1,094	2,969
242C	100%	483	79	485	73	487	75	487	80	488	83	488	87	488	91
242D	100%	940	221	940	390	940	457	940	542	940	652	940	796	940	979
242E	100%	277	5,153	277	5,303	277	5,612	277	5,964	277	6,263	277	6,725	277	7,256
242F	100%	244	911	244	948	244	1,071	244	1,204	244	1,359	244	1,502	244	1,653
242G	100%	860	181	863	197	876	217	876	243	876	275	876	297	876	319
242H	100%	829	1,420	830	1,024	831	1,050	831	1,082	831	1,125	831	1,183	831	1,250
242J	100%	1,154	1,794	1,159	1,840	1,160	1,922	1,161	2,063	1,162	2,218	1,163	2,351	1,163	2,478
242K	100%	962	689	968	712	969	782	970	862	972	961	975	1,048	1,021	1,130
242L	100%	918	457	919	463	919	491	919	534	919	586	919	633	919	672
242M	100%	2,350	371	2,448	371	2,456	382	2,456	398	2,459	415	2,459	438	2,459	453
242N	100%	0	282	58	351	185	393	185	434	185	483	185	506	185	523
242P	100%	716	822	717	838	717	885	717	943	717	1,018	717	1,096	717	1,169
242Q	100%	1,815	863	1,815	890	1,815	958	1,815	1,045	1,815	1,150	1,815	1,248	1,815	1,331
242R	100%	402	616	402	650	404	713	404	789	405	877	405	937	405	964
243A	100%	1,307	1,297	1,374	1,260	1,423	1,321	1,423	1,414	1,423	1,498	1,423	1,588	1,423	1,686
243B	100%	342	280	346	292	346	319	346	353	347	394	347	430	347	464
243C	100%	0	1,319	0	1,553	0	2,329	0	2,999	0	3,676	0	4,626	65	6,051
243D	100%	449	238	451	248	452	299	471	332	491	363	513	394	560	418
243E	100%	424	830	425	862	425	924	425	1,003	425	1,093	425	1,182	425	1,264
243F	100%	28	770	29	787	29	830	29	894	29	971	170	1,061	189	1,119
243G	100%	1,283	1,341	1,294	1,273	1,296	1,340	1,299	1,427	1,302	1,539	1,308	1,657	1,701	1,778
243H	100%	782	78	782	82	814	88	906	96	1,008	106	1,168	115	1,215	121
243J	100%	0	1,176	0	1,226	0	1,328	0	1,455	0	1,607	0	1,733	0	1,860
243K	100%	2,643	3,419	2,643	3,599	2,643	3,651	2,643	3,723	2,735	3,820	2,873	3,974	3,035	4,221
243L	100%	0	517	0	538	0	589	0	674	0	758	0	827	0	895
243M	100%	1,317	789	1,339	820	1,359	871	1,362	946	1,371	1,025	1,390	1,088	1,454	1,156
243N	100%	732	1,007	734	1,048	739	1,139	739	1,255	741	1,397	744	1,522	755	1,633
243P	100%	892	1,437	903	1,468	917	1,553	921	1,665	928	1,802	944	1,940	964	2,050
244A	100%	853	2,345	856	2,450	856	2,676	856	2,962	856	3,305	857	3,591	857	3,829
244B	100%	396	491	403	549	403	578	403	613	404	655	406	702	414	731

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
244C	100%	1,460	4,160	1,463	4,190	1,463	4,432	1,463	4,762	1,463	5,173	1,464	5,535	1,477	5,925
244D	100%	1,686	3,890	1,692	4,009	1,692	4,054	1,692	4,133	1,693	4,215	1,695	4,302	1,715	4,388
244E	100%	3,755	1,311	3,771	1,344	3,776	1,417	3,922	1,504	4,079	1,621	4,225	1,735	4,225	1,835
244F	100%	1,694	2,489	1,759	2,567	1,759	2,758	1,763	3,009	1,768	3,318	1,773	3,602	1,776	3,862
245A	100%	0	3,305	0	3,462	0	3,774	0	4,185	0	4,669	0	5,164	0	5,530
245B	100%	1,322	1,240	1,324	1,288	1,324	3,485	1,324	5,035	1,382	6,277	1,382	6,992	1,408	7,218
245C	100%	1,576	980	1,577	1,011	1,577	1,063	1,577	1,118	1,577	1,186	1,577	1,249	1,577	1,303
245D	100%	705	53	705	55	705	59	705	65	705	73	705	77	705	82
245E	100%	1,343	389	1,352	388	1,356	400	1,358	410	1,362	425	1,369	442	1,382	452
245F	100%	1,736	513	1,783	520	1,831	539	1,837	557	1,855	586	1,895	622	1,936	665
245G	100%	2,505	2,279	2,510	2,338	2,525	2,375	2,538	2,423	2,549	2,501	2,572	2,636	2,623	2,861
245H	100%	2,166	1,311	2,174	1,065	2,174	1,169	2,174	1,293	2,174	1,442	2,174	1,565	2,174	1,643
245J	100%	506	636	529	735	569	751	569	769	618	797	619	836	619	865
245K	100%	1,358	310	1,487	329	1,660	347	1,728	365	1,728	387	1,728	410	1,728	426
245L	100%	602	317	614	319	614	375	614	405	615	441	616	474	616	502
245M	100%	64	4,880	65	4,909	65	5,293	65	5,791	65	6,420	65	6,991	71	7,507
245N	100%	149	445	151	472	151	486	151	515	152	546	152	579	152	611
246A	100%	41	418	45	436	45	479	45	494	45	509	45	524	45	537
246B	100%	646	321	668	345	668	372	682	379	683	386	685	393	685	400
246C	100%	389	1,485	392	1,534	392	1,564	392	1,601	392	1,639	393	1,677	400	1,717
246D	100%	0	2	0	2	0	4	0	153	0	255	0	306	17	459
246E	100%	565	1,710	579	1,777	579	1,913	579	1,972	580	2,039	580	2,117	588	2,206
246F	100%	202	6,542	253	6,665	271	6,827	273	7,049	295	7,260	295	7,483	295	7,841
246G	100%	752	448	805	473	834	489	941	509	997	530	1,164	552	1,164	571
246H	100%	761	443	780	444	780	444	780	449	781	455	781	477	781	498
246J	100%	961	167	1,060	231	1,124	234	1,124	235	1,124	238	1,124	242	1,124	252
246K	100%	681	444	698	479	698	482	698	486	699	492	703	506	726	512
246L	100%	818	118	829	120	829	129	831	130	832	131	832	135	832	136
246M	100%	952	120	1,012	119	1,327	90	1,327	101	1,327	112	1,327	126	1,327	135
246N	100%	823	1,000	1,396	1,209	2,257	1,252	3,018	1,972	3,547	2,427	3,662	3,216	3,911	4,069
246P	100%	1,180	667	1,430	663	1,914	678	2,201	915	2,594	1,187	3,082	1,359	3,512	1,650
246Q	100%	2,272	804	2,396	1,066	2,396	1,084	2,396	1,110	2,396	1,135	2,396	1,268	2,395	1,635
246R	100%	1,883	360	1,762	368	1,974	375	1,974	379	1,974	384	1,974	399	1,974	402
246S	100%	491	2,223	505	2,253	505	2,327	505	2,377	505	2,441	505	2,539	505	2,666
246T	100%	1,030	1,389	1,059	1,423	1,059	1,513	1,059	1,636	1,059	1,784	1,059	1,921	1,059	2,061
246U	100%	604	1,648	608	1,677	608	1,691	608	1,708	608	1,820	608	1,943	608	2,068
246V	100%	1,545	3,432	1,692	3,431	1,720	3,452	1,920	3,486	1,930	3,552	1,939	3,815	1,939	4,278
247A	100%	2,330	615	2,407	651	2,407	675	2,407	707	2,416	748	2,436	799	2,467	845
247B	100%	1,180	289	1,219	298	1,266	320	1,266	353	1,268	392	1,268	424	1,268	454
247C	100%	1,291	333	1,395	317	1,395	319	1,492	332	1,520	345	1,521	415	1,533	432
247D	100%	103	34	103	35	103	36	103	38	103	40	103	42	124	45
247E	100%	86	96	88	91	88	93	88	97	88	101	89	106	115	113
247F	100%	442	135	741	142	843	155	937	169	1,063	183	1,101	207	1,159	217
247G	100%	1,249	161	1,614	348	1,807	353	2,001	363	2,223	374	2,484	395	2,774	407
247H	100%	204	112	204	104	204	106	204	109	204	114	204	119	204	128
247J	100%	1,598	1,048	1,657	1,711	1,657	1,742	1,657	1,776	1,783	1,831	1,806	1,925	1,915	2,086
247K	100%	915	2,607	1,112	2,674	1,112	2,700	1,209	2,733	1,325	2,796	1,325	3,123	1,325	3,706

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
247L	100%	1,636	628	1,645	644	1,645	698	1,645	764	1,645	845	1,645	918	1,645	981
247M	100%	446	2,569	463	2,621	468	2,836	483	3,041	490	3,294	505	3,545	527	3,814
247N	100%	1,119	836	1,159	860	1,304	907	1,350	982	1,414	1,069	1,559	1,149	1,686	1,233
247P	100%	521	10,813	521	11,082	521	11,924	521	12,941	521	13,941	521	14,825	565	15,713
247Q	100%	3,640	444	3,711	443	3,808	460	3,905	499	4,021	537	4,021	571	4,021	607
248A	100%	1,102	106	1,129	110	1,167	118	1,195	124	1,219	133	1,219	142	1,219	148
248B	100%	1,734	153	1,774	150	1,844	153	1,911	157	2,008	161	2,008	169	2,008	174
248C	100%	0	5,465	0	6,885	0	8,434	0	9,471	0	10,508	0	11,542	0	12,576
248D	100%	1,570	1,144	1,599	1,133	1,602	1,074	1,604	1,034	1,606	1,106	1,611	1,178	1,627	1,242
248E	100%	896	503	1,484	433	1,862	557	2,085	500	2,055	437	2,055	471	2,055	496
248F	100%	1,270	419	1,297	429	1,307	451	1,315	480	1,323	515	1,323	552	1,323	574
248G	100%	1,008	459	1,008	462	1,008	490	1,008	523	1,008	564	1,008	606	1,008	637
248H	100%	4	436	4	477	4	585	4	644	4	705	4	767	4	824
248J	100%	1,345	1,082	1,464	1,178	1,464	1,180	1,558	1,185	1,668	1,199	1,809	1,205	1,973	1,220
248K	100%	117	178	117	178	117	182	117	185	117	188	117	201	117	202
248L	100%	59	2,760	59	2,842	69	3,163	69	3,436	73	3,768	73	4,191	73	4,714
248M	100%	468	177	471	177	471	177	471	177	471	177	471	185	479	185
248N	100%	423	191	574	187	574	201	574	219	574	240	574	258	574	276
248P	100%	1,009	152	1,176	142	1,273	153	1,321	167	1,385	184	1,385	196	1,385	210
248Q	100%	2,606	224	2,816	218	2,819	223	3,042	239	3,042	250	3,042	260	3,042	274
248R	100%	1,074	1,894	1,153	1,951	1,220	2,107	1,404	2,315	1,624	2,570	1,854	2,784	2,084	2,995
248S	100%	934	284	934	278	935	287	935	304	935	322	935	340	935	360
249A	100%	355	3,867	396	3,983	427	4,283	458	4,646	483	5,083	483	5,497	483	5,925
249B	100%	2,542	3,598	2,544	3,624	2,559	3,692	2,559	3,737	2,563	3,779	2,563	3,939	2,563	4,238
249C	100%	1,273	1,463	1,273	1,467	1,318	1,472	1,318	1,481	1,318	1,499	1,318	1,558	1,318	1,690
249D	100%	1,572	87	1,656	94	1,660	102	1,660	110	1,660	122	1,660	136	1,660	143
249E	100%	1,952	359	1,990	346	2,001	355	2,001	367	2,016	378	2,190	396	2,406	417
249F	100%	417	41	425	42	425	47	430	50	434	56	441	61	454	65
249G	100%	123	125	259	151	307	176	307	185	307	195	307	207	307	214
249H	100%	1,087	98	1,227	94	1,227	100	1,336	106	1,336	112	1,336	116	1,336	123
249J	100%	506	76	508	70	521	70	522	72	527	74	538	76	551	80
249K	100%	4,159	457	4,160	458	4,164	466	4,164	484	4,165	509	4,168	540	4,208	564
249L	100%	531	219	540	205	615	210	615	219	641	229	641	241	641	255
249M	100%	1,656	189	1,734	191	1,747	197	1,747	200	1,747	204	1,887	213	2,051	215
249N	100%	686	37	713	38	740	40	740	46	740	52	740	56	740	59
249P	100%	545	690	545	694	545	710	545	727	545	754	545	805	553	902
249Q	100%	0	0	0	0	0	0	0	0	0	0	0	0	0	0
250A	100%	1,507	1,708	1,511	1,729	1,563	1,759	1,566	1,846	1,583	1,936	1,583	1,971	1,601	1,999
250B	100%	2,075	2,176	2,146	2,240	2,146	2,453	2,146	2,706	2,146	2,993	2,146	3,235	2,146	3,475
250C	100%	1,037	496	1,080	508	1,168	517	1,168	529	1,168	539	1,168	554	1,167	568
250D	100%	813	2,406	827	2,432	827	2,772	827	3,235	827	3,437	827	3,617	827	3,797
251A	100%	1,980	1,080	2,021	1,087	2,052	1,115	2,079	1,164	2,103	1,219	2,155	1,263	2,264	1,337
251B	100%	1,513	408	1,517	441	1,517	488	1,517	548	1,518	616	1,519	670	1,519	716
251C	100%	0	2,669	0	2,844	0	3,141	0	3,532	0	3,977	0	4,342	0	4,658
251D	100%	182	6,590	182	6,769	182	6,818	182	6,869	182	7,090	182	7,310	182	7,451
251E	70%	33	59	34	59	36	60	36	61	37	62	37	62	37	63
252A	60%	5	0	5	0	5	0	5	0	5	0	5	0	5	0

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County (continued)

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
252B	90%	2	100	2	106	2	110	2	122	2	132	2	146	2	149
252C	70%	1,297	6,543	1,297	6,734	1,297	7,100	1,297	7,385	1,297	7,491	1,297	7,788	1,314	7,947
252D	100%	3,265	6,008	3,426	6,175	3,613	6,323	4,109	6,494	4,543	6,691	5,026	6,873	5,419	7,054
252E	100%	1,053	774	1,060	817	1,080	883	1,103	968	1,118	1,064	1,151	1,143	1,185	1,211
252F	100%	3,077	2,101	3,184	2,179	3,360	2,347	3,402	2,546	3,519	2,752	3,666	2,974	3,666	3,184
252G	100%	635	5,337	898	5,705	937	6,311	954	7,250	954	8,177	954	8,943	954	9,642
253A	100%	1,730	4,809	1,816	5,301	2,002	5,803	2,095	6,488	2,241	7,237	2,241	7,852	2,241	8,425
253B	100%	835	1,144	1,060	1,227	1,060	1,601	1,158	1,798	1,206	1,990	1,353	2,150	1,479	2,308
253C	100%	302	63	314	77	369	126	467	248	514	371	660	381	847	391
253D	100%	756	1,387	969	1,490	1,263	1,645	1,263	1,828	1,263	2,046	1,263	2,222	1,263	2,373
253E	100%	626	392	717	413	893	456	991	507	1,103	571	1,348	626	1,477	671
254A	100%	753	410	1,083	434	1,204	481	1,245	538	1,360	604	1,360	661	1,360	706
254B	100%	575	297	745	314	798	371	798	407	798	450	798	485	798	516
254C	100%	765	89	1,034	96	1,034	193	1,380	534	1,638	965	2,014	1,100	2,303	1,163
254D	100%	0	1,596	143	2,311	486	2,736	486	3,118	490	3,604	497	4,209	519	5,005
254E	100%	1,569	2,446	2,326	3,027	2,329	3,352	2,831	3,738	3,325	4,188	3,325	4,548	3,325	4,843
255A	100%	353	110	353	119	421	125	573	134	573	145	573	160	573	173
255B	100%	2,093	603	2,299	654	2,451	847	2,605	1,214	2,605	1,242	2,605	1,265	2,605	1,306
255C	100%	2,239	2,121	2,296	2,141	2,614	2,199	2,716	2,331	2,865	2,478	3,202	2,624	3,818	2,800
255D	100%	1,148	580	1,148	604	1,339	674	1,741	757	1,857	847	2,097	925	2,250	995
255E	100%	849	516	849	542	875	577	875	624	884	680	1,029	727	1,157	775
255F	100%	134	437	154	447	154	480	154	528	204	585	260	634	260	687
255G	100%	89	102	93	108	238	114	286	124	335	133	335	139	335	148
255H	100%	441	93	531	96	565	102	673	110	794	119	988	128	1,116	133
255J	100%	49	519	51	819	51	1,130	293	1,271	295	1,814	537	2,063	994	2,491
256A	100%	26	1,831	27	1,870	27	1,902	27	1,936	27	1,971	27	2,005	27	2,041
256B	70%	2,248	10,806	2,248	10,907	2,248	11,245	2,248	11,612	2,248	12,007	2,248	12,262	2,248	12,391
256C	100%	782	1,077	788	1,112	830	1,186	831	1,272	846	1,382	876	1,466	911	1,541
256D	100%	942	3,261	1,166	3,391	1,476	3,633	1,584	3,943	1,609	4,547	1,609	4,913	1,609	5,332
256E	100%	320	789	361	929	361	1,018	402	1,052	420	1,092	420	1,126	420	1,163
257A	100%	38	72	38	76	38	84	45	130	94	177	147	262	212	316
257B	100%	499	364	545	357	545	365	594	386	643	409	696	431	761	458
257C	100%	406	257	503	269	503	296	508	328	534	365	632	396	679	424
257D	100%	1,027	106	1,058	110	1,205	122	1,303	135	1,374	150	1,521	163	1,638	175
257E	100%	443	187	476	188	506	191	703	203	770	214	987	227	987	241
257F	100%	1,186	413	1,219	414	1,317	428	1,320	450	1,358	478	1,400	501	1,400	528
257G	100%	1,822	3,067	2,098	3,199	2,393	3,737	2,590	4,525	2,807	5,290	3,265	5,569	3,634	5,844
257H	100%	1,041	2,066	1,099	2,117	1,305	2,238	1,328	2,381	1,408	2,569	1,425	2,717	1,464	2,882
257J	100%	472	270	472	428	521	446	521	464	536	483	536	502	536	526
257K	100%	1,854	637	1,876	666	1,906	709	1,914	791	1,932	861	1,970	919	1,970	972
258A	100%	1,434	3,331	1,611	3,533	1,611	3,711	1,624	3,941	1,646	4,224	1,688	4,448	1,688	4,661
258B	100%	1,724	412	1,877	423	1,877	435	1,975	469	2,017	500	2,070	529	2,135	562
258C	100%	2,199	623	2,523	630	2,739	656	2,837	693	2,837	736	2,837	776	2,837	821
258D	100%	1,025	111	1,025	111	1,025	114	1,025	113	1,025	113	1,025	113	1,025	117
258E	100%	712	120	712	124	770	131	770	136	774	143	780	150	796	155
258F	100%	1,486	485	1,486	507	1,689	663	1,781	734	1,873	813	2,011	879	2,172	935
258G	100%	1,172	292	1,180	294	1,219	314	1,226	339	1,241	366	1,275	389	1,314	411

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
259A	100%	190	53	191	55	197	61	394	444	901	862	1,493	1,130	2,262	2,112
259B	100%	1,341	104	1,343	954	1,343	1,188	1,343	1,272	1,344	1,380	1,344	1,517	1,344	1,693
259C	100%	2,109	623	2,314	638	2,421	675	2,519	755	2,632	822	2,669	884	2,669	943
259D	100%	1,031	1,890	1,132	2,017	1,285	2,143	1,317	2,296	1,385	2,481	1,581	2,629	1,737	2,779
259E	100%	2,198	395	2,257	400	2,301	426	2,360	461	2,398	500	2,545	535	2,640	566
260A	100%	991	531	995	541	997	868	1,023	881	1,137	895	1,285	966	1,415	1,236
260B	100%	881	1,846	915	1,920	915	2,278	1,014	2,643	1,046	3,174	1,083	3,899	1,083	5,041
260C	100%	112	6,446	119	6,827	119	8,090	119	9,367	138	10,754	523	12,059	1,033	13,080
260D	100%	1,933	2,981	1,978	3,113	2,074	3,489	2,074	3,789	2,104	4,151	2,210	4,538	2,426	5,029
260E	100%	11	7,179	11	7,514	11	8,578	11	11,026	11	12,167	155	13,112	282	14,020
261A	100%	1,301	241	1,313	245	1,333	245	1,370	246	1,390	251	1,390	257	1,390	265
261B	100%	3,486	726	3,494	744	3,511	827	3,511	899	3,511	984	3,512	1,055	3,528	1,123
261C	100%	2,632	6,254	2,635	6,513	2,635	7,087	2,635	7,730	2,635	8,445	2,635	9,012	2,635	9,512
262A	70%	530	5,313	750	5,547	848	6,050	877	6,713	934	7,515	1,103	7,768	1,211	8,034
262B	60%	22	41	22	42	22	43	22	524	22	1,544	22	1,733	22	1,835
262C	100%	4,243	984	4,592	1,008	4,998	1,089	4,998	1,293	4,998	1,417	4,998	1,527	4,997	1,624
262D	90%	4,520	4,274	4,749	4,353	4,749	4,414	4,749	4,502	4,752	4,627	4,760	4,723	4,825	4,831
262E	100%	91	1,752	91	2,050	91	2,216	91	2,392	91	2,573	91	2,715	91	2,866
263A	40%	488	430	488	448	488	464	488	492	488	518	488	539	488	557
263B	30%	1,108	106	1,108	110	1,108	117	1,204	128	1,233	138	1,329	148	1,456	156
263C	90%	367	34	503	37	503	38	541	39	567	44	665	48	754	52
263D	60%	36	1	42	1	42	1	42	1	92	2	238	2	367	2
264A	100%	78	296	80	299	178	556	178	560	208	573	355	582	575	615
264B	100%	189	69	501	75	755	85	756	92	930	102	939	108	939	115
264C	50%	3,719	1,050	3,723	1,053	3,728	1,081	3,728	1,125	3,729	1,179	3,733	1,223	3,802	1,291
264D	80%	104	331	107	450	108	668	109	764	110	904	111	1,051	111	1,426
264E	60%	152	94	227	97	355	106	385	84	434	95	434	107	434	115
264F	60%	3,670	1,660	3,685	1,676	3,685	1,725	3,685	1,806	3,685	1,914	3,685	1,996	3,685	2,082
264G	100%	959	528	1,436	530	1,852	547	2,023	673	2,387	698	3,023	720	3,023	759
264H	100%	253	70	691	81	691	91	1,186	103	1,571	108	1,611	116	1,698	125
264J	100%	255	203	289	208	289	218	295	231	302	243	302	257	302	270
264K	100%	137	2	215	3	244	3	292	5	332	6	332	7	332	8
264L	90%	60	416	107	416	195	419	683	447	953	470	953	488	953	516
265A	100%	89	106	243	104	339	112	415	121	492	135	607	145	708	154
265B	100%	393	7	451	8	451	70	652	75	806	78	806	78	806	78
265C	100%	59	136	74	130	170	142	265	156	280	171	424	185	550	200
265D	100%	234	79	489	87	875	273	1,339	303	1,680	328	1,928	344	1,927	360
265E	100%	35	38	117	40	401	50	500	57	658	66	658	71	658	77
265F	100%	2,478	445	2,883	988	3,427	1,911	3,733	2,420	4,159	3,520	4,465	3,664	4,929	4,189
265G	100%	328	57	330	302	330	1,003	330	1,706	330	1,709	330	1,711	330	1,814
265H	90%	70	104	70	352	70	396	118	431	167	448	219	450	283	454
265J	100%	2,117	800	2,324	803	2,329	855	2,428	1,260	2,557	1,321	2,706	1,370	2,836	1,428
265K	90%	90	48	94	50	103	54	126	60	137	66	150	71	150	76
266A	100%	851	318	938	475	966	482	1,003	496	1,156	519	1,348	535	1,563	564
266B	100%	287	7	401	8	672	40	774	44	886	47	1,129	54	1,518	59
266C	100%	652	16	716	15	716	16	716	17	718	19	720	19	772	19
266D	100%	17	495	79	497	79	499	79	518	98	536	139	559	139	588

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Prince George's County (continued)
Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
266E	100%	811	33	1,819	53	2,377	250	2,749	260	3,320	273	4,003	287	5,119	306
266F	100%	58	994	415	1,001	706	1,084	854	1,134	1,144	1,184	1,144	1,236	1,144	1,309
266G	100%	35	62	36	67	138	76	284	83	439	97	441	105	441	113
266H	100%	323	2,945	325	2,985	327	3,043	328	3,210	330	3,387	332	3,565	378	3,778
266J	100%	70	854	71	889	71	973	71	1,074	71	1,198	71	1,303	71	1,405
266K	100%	13	323	13	331	13	352	13	383	13	420	13	451	13	488
266L	100%	23	38	23	38	24	40	255	54	627	511	1,116	574	1,776	701
266M	100%	27	1,015	27	1,073	27	1,311	27	1,449	27	1,607	27	1,736	27	1,867
266N	100%	19	0	265	2	548	8	739	27	950	34	950	37	950	38
267A	60%	200	60	232	58	281	57	329	55	378	53	430	51	494	50
267B	90%	917	71	991	69	1,059	70	1,118	72	1,176	154	1,273	158	1,350	166
267C	100%	134	159	137	161	147	168	160	170	168	171	168	172	168	174
268A	100%	1,230	2,144	1,471	2,281	1,766	2,515	2,258	2,801	2,800	3,090	3,046	3,359	3,046	3,570
268B	100%	1,333	82	1,664	88	1,884	92	1,982	95	2,167	100	2,573	107	2,573	108
268C	100%	351	169	460	163	660	168	953	182	1,139	193	1,139	200	1,139	210
268D	100%	306	439	360	449	413	468	455	491	488	520	527	542	527	559
269A	100%	1,893	843	2,044	858	2,334	911	2,452	984	2,597	1,404	3,030	1,786	3,325	1,867
269B	100%	1,021	1,605	1,103	1,688	1,522	1,848	1,852	2,038	2,132	2,536	2,378	2,756	2,649	2,878
270A	100%	1,956	223	2,519	227	2,924	249	3,325	266	3,879	443	4,557	462	5,483	485
270B	100%	81	474	96	473	132	494	138	527	155	562	155	594	155	626
270C	50%	57	338	61	485	61	531	79	565	85	611	86	648	86	687
271A	100%	611	680	624	668	828	685	1,041	712	1,051	744	1,072	772	1,097	817
271B	100%	128	507	141	506	239	936	337	1,400	338	2,332	340	2,853	340	3,465
271C	60%	62	87	67	86	72	92	77	92	82	96	87	101	94	101
272A	100%	213	59	220	61	220	63	317	67	430	74	577	399	587	419
272B	100%	230	35	233	36	233	39	233	43	234	48	236	53	261	57
272C	100%	28	2	28	2	48	2	537	11	694	16	890	24	1,110	29
272D	100%	35	131	35	134	35	147	378	161	500	178	647	804	941	900
273A	100%	578	50	601	51	601	57	601	62	714	69	862	74	992	80
273B	100%	710	206	748	209	756	216	756	226	786	237	825	247	871	261
273C	100%	471	139	735	149	980	178	1,137	194	1,137	554	1,137	576	1,137	622
273D	100%	92	59	96	61	96	66	96	72	97	80	98	86	368	97
273E	100%	121	109	124	103	126	104	182	109	200	114	200	117	200	126
273F	100%	518	203	525	217	771	242	1,077	278	1,264	316	1,510	351	1,510	380
274A	100%	113	456	116	458	136	464	147	472	156	482	167	491	167	496
274B	100%	279	171	286	176	312	186	408	201	443	219	483	234	483	251
274C	100%	332	176	343	181	458	190	483	210	528	234	672	254	672	270
274D	100%	211	43	611	46	946	53	1,017	62	1,248	72	1,276	83	1,393	96
280A	60%	121	34	129	36	221	39	261	43	303	49	303	53	303	56
280B	70%	162	99	190	95	294	101	345	109	397	117	397	126	397	134
280C	20%	98	8	108	9	141	10	152	11	167	12	167	13	167	13
280D	20%	138	27	151	27	204	28	211	29	231	30	274	32	326	34
280G	40%	131	95	133	101	133	110	133	120	133	134	134	147	134	166

Appendix G - CAZs in WSSC's service area (continued)

WSSC - Andrews Air force Base

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
256B	100%	2,248	10,806	2,248	10,907	2,248	11,245	2,248	11,612	2,248	12,007	2,248	12,262	2,248	12,391
256D	20%	942	3,261	1,166	3,391	1,476	3,633	1,584	3,943	1,609	4,547	1,609	4,913	1,609	5,332

Appendix H - CAZs in Rockville, Fairfax, Manassas, and Leesburg

City of Rockville

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
153A	100%	316	1,551	528	1,506	528	1,513	528	1,514	528	1,517	528	1,521	528	1,527
153B	100%	448	692	485	780	594	1,157	594	1,159	594	1,162	594	1,166	594	1,172
153C	100%	896	1,384	970	1,560	1,188	2,314	1,188	2,317	1,188	2,324	1,188	2,332	1,188	2,344
153D	100%	305	1,159	308	994	308	2,593	308	2,992	308	3,073	308	3,064	308	3,057
153E	80%	2,273	9,193	2,280	8,344	2,602	10,411	2,902	11,819	3,202	11,904	3,202	12,005	3,202	12,119
153H	100%	992	531	1,007	534	1,189	578	1,189	595	1,189	616	1,189	640	1,189	665
153J	50%	1,928	1,474	1,914	1,542	1,914	1,564	1,914	1,578	1,914	1,597	1,914	1,618	1,914	1,642
153K	100%	812	434	824	437	973	473	973	487	973	504	973	523	973	544
153L	100%	376	635	416	703	503	1,005	503	1,007	503	1,009	503	1,013	503	1,017
160A	50%	6	13,578	6	13,459	6	14,774	6	14,971	506	15,540	806	16,028	956	16,467
160B	100%	823	1,050	977	1,064	977	1,088	977	1,108	977	1,131	977	1,157	977	1,187
160C	100%	440	57	443	60	455	65	455	69	455	73	455	77	455	83
160D	50%	1,591	157	1,599	160	1,627	167	1,627	169	1,627	172	1,627	174	1,627	179
160E	90%	1,153	2,466	1,187	2,240	1,589	2,297	1,597	2,611	1,607	3,563	1,622	4,513	1,642	4,512
161C	60%	1,561	4,107	1,559	3,767	1,559	3,796	1,607	3,812	1,607	3,831	1,607	3,855	1,607	3,883
161D	100%	968	570	966	607	966	613	966	615	966	617	966	621	966	625
161E	100%	623	10,980	834	11,345	999	13,656	1,149	14,315	1,149	14,983	1,149	15,031	1,149	15,091
161F	100%	1,294	1,478	1,295	1,575	1,295	1,609	1,295	1,637	1,295	1,668	1,295	1,706	1,295	1,746
161G	60%	75	4,062	76	4,253	76	4,980	81	5,612	81	6,225	81	6,761	81	7,255
161M	10%	97	4,511	99	4,777	99	5,666	104	6,303	104	6,901	104	7,426	104	7,910

City of Fairfax - Goose Creek Supply

Round 5.1 Cooperative Forecasts for 1990 - 2020

		1990	1990	1995	1995	2000	2000	2005	2005	2010	2010	2015	2015	2020	2020
	% of		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL		TOTAL
CAZ	CAZ	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO	House	EMPLO
556E	50%	1,978	858	1,947	857	1,967	858	2,060	858	2,171	858	2,310	858	2,459	858
566C	100%	950	717	964	717	978	727	1,073	732	1,162	732	1,237	732	1,317	732
566D	100%	1,163	6,458	1,174	6,713	1,205	6,766	1,224	6,821	1,249	6,821	1,249	6,849	1,249	6,867
566E	100%	523	1,359	532	1,626	551	1,683	563	1,739	579	1,739	579	1,768	579	1,787
566F	100%	1,264	3,630	1,288	4,135	1,336	4,243	1,365	4,350	1,404	4,349	1,404	4,404	1,404	4,440
566G	100%	2,222	2,672	2,307	2,787	2,409	2,872	2,581	2,872	2,757	2,872	2,935	2,872	3,123	2,872
566H	100%	1,865	625	1,838	625	1,845	625	1,901	625	1,982	625	2,110	625	2,245	625
566J	100%	823	2,783	831	3,242	850	3,338	862	3,435	878	3,435	878	3,484	878	3,518
566K	100%	856	4,732	871	5,186	900	5,283	917	5,380	940	5,379	940	5,429	940	5,462
566L	100%	1,863	3,695	1,896	4,313	1,961	4,445	2,000	4,576	2,052	4,577	2,052	4,643	2,052	4,688
566M	100%	875	4,228	890	4,488	919	4,543	936	4,598	959	4,599	959	4,626	959	4,645
572D	20%	1,208	718	1,338	718	1,368	718	1,514	718	1,651	718	1,757	718	1,869	718

Appendix H - CAZs in Rockville, Fairfax, Manassas, and Leesburg (continued)

City of Manassas - Lake Manassas Supply

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
774C	100%	1,575	796	1,575	796	1,575	796	1,575	796	1,575	796	1,575	796	1,575	796
774E	100%	3,156	2,614	3,268	2,712	3,268	2,829	3,268	2,953	3,268	3,071	3,268	3,127	3,268	3,155
774F	100%	1,120	3,592	1,570	3,813	1,970	4,079	2,270	4,356	2,470	4,621	2,701	4,753	2,890	4,814
774G	100%	1,585	761	2,147	1,001	2,547	1,286	2,747	1,588	2,897	1,873	3,070	2,015	3,211	2,082
774H	100%	1,691	562	2,366	799	2,766	1,077	2,966	1,373	3,116	1,649	3,289	1,789	3,430	1,854
774J	100%	30	4,110	30	4,406	30	4,759	30	5,135	30	5,487	30	5,665	30	5,747
774K	100%	1,486	3,973	1,486	4,091	1,486	4,230	1,486	4,376	1,486	4,517	1,486	4,587	1,486	4,619
774L	100%	379	1,851	379	1,870	379	1,891	379	1,914	379	1,935	379	1,946	379	1,952

Leesburg

Round 5.1 Cooperative Forecasts for 1990 - 2020

CAZ	% of CAZ	1990 House	1990 TOTAL EMPLO	1995 House	1995 TOTAL EMPLO	2000 House	2000 TOTAL EMPLO	2005 House	2005 TOTAL EMPLO	2010 House	2010 TOTAL EMPLO	2015 House	2015 TOTAL EMPLO	2020 House	2020 TOTAL EMPLO
682G	100%	2,172	5,495	2,398	5,863	2,578	6,228	2,902	6,709	3,189	7,102	3,476	7,497	3,763	7,891
682H	100%	2,129	3,158	2,344	3,537	2,591	3,601	2,862	4,375	3,149	4,767	3,436	5,161	3,723	5,553

WAD - WASUA - District of Columbia: The Office of Engineering Services provided unit use factors for the District of Columbia of 240 gpd per residential unit and 50 gpd per employee. Although the WASUA billing information has a consumption of 103 mgd and a total of 143.48 mgd in 1993 the amount of water bought from WAD in 1993 was 138.33 mgd. It was suggested that the water bought from WAD is a more reliable number since unpaid bills and different billing cycles would effect the WASUA total. It was determined that unaccounted water and National Airport, the Pentagon, Arlington Cemetery, Fort Myer and the George Washington Memorial Parkway in Virginia were included in WAD's 1993 billing. To rectify this a residential unit use production was calculated for DC after subtracting out the unaccounted water use, the employment water use and the Virginia demand. The employee unit use was assumed to follow the AWWA standard of 50 gpd per employee. From the COG Round V employee projections the number of employees for DC in 1993 was estimated as 766,900. The employee water use for 1993 was approximated by multiplying the number of employees by the assumed unit use rate resulting in 38.35 mgd. The unaccounted water was estimated as 28.22% of the total water demand of 138.33 mgd resulting in an unaccounted water use of 40.48 mgd. Subtracting from the total water bought from WAD the unaccounted water use of 40.48 mgd and the approximate employee water usage of 38.35 mgd and the Virginia usage (.375 mgd for National Airport and .898 mgd for all other Virginia users) results in the household usage of 59.672 mgd. Dividing the household usage by the number of households approximated from the COG Round V household projections for 1993, (251,251 households) resulted in a household unit use rate of 237 gpd per household.

WAD - Arlington DPW: The Arlington County Department of Public Works provided estimates of unit use. With regards to usage in a study done by Camp Dresser and McGee in 1991, they estimated that single family households use 225 gallons per day per dwelling unit, multi-family households use 202 gallons per day per dwelling unit, and apartments 260 gallons per day per dwelling unit. 1994 billing information suggested different numbers. Approximately 31,100 single family accounts consumed 3.16 bg in 1994. Apartment use accounted for 4.11 bg in 1994. The commercial consumption for 1994 was 3.35 bg.

Although the 1994 billing information has a consumption of 29.1 mgd in 1994 the amount of water bought from WAD in 1994 was 25.2 mgd. It was suggested that the water bought from WAD is a more reliable number since unpaid bills and different billing cycles would effect the consumption total. It was further suggested that the percentage of water to single family, multi-family and employees in the consumption data could be used with the wholesale amounts to determine accurate unit use rate. From the above consumption data, it was determined that the single families account for 29.8% of the total consumption, employees account for 31.5% and multi-families account for the remaining 38.7% of the total consumption. The actual water bought in 1994 from WAD was 25.2 mgd of which 15% was unaccounted (approximately 3.8 mgd) resulting in 21.4 mgd total consumption. The consumption by type was estimated by multiplying the total consumption by the appropriate percentage for each type. The single family consumption was computed to be 6.4 mgd. This was divided by the 31,100 single family units to obtain the unit use rate of 205 gpd. The number of apartments in 1994 was estimated by an interpolated value of the COG Round V household forecast minus the number of single families resulting in 53,900 multi-family units. It was estimated that the multi-families consumed approximately 8.29 mgd. This was divided by the number of multi-family units resulting in a unit use rate of 154 gpd. The remaining consumption of 21.42 mgd was attributed to employees and divided by the estimated number of employees (170,000) to compute the employee unit use rate of 40 gpd.

WAD - Falls Church DPW: The City of Falls Church Department of Public Utilities provided the estimate of unit use rates to be the following; 300 gpd per single family house, 225 gpd per multi-family house and 50 gpd per employee. These numbers are based on the AWWA recommended unit use rates for design. The average household consumption and the number of accounts were disaggregated by housing type, single family residential or townhouse, and by location, the City of Falls Church or Fairfax County, for the winter billing quarter of 1995. This estimate of the unit use rate was performed by scaling the winter water single family unit use rate to an average annual unit use rate and then "backing out" the multi-family unit use rate. Using a weighted average of the number of single family accounts and the average household consumption by area, a single family unit use rate for the winter quarter was determined to be 207.56 gpd per unit. The ratio of an annual average unit use factor to the winter quarter unit use factor for a single family was determined from FCWA's data to be 1.199. Falls Church single family unit use factor was scaled by this ratio to 248.87 gpd. The winter quarter unit use rate for townhouses was determined to be 196.6 gpd. FCWA's data provided a ratio of an annual average unit use factor to a winter quarter unit use factor for townhouses of 1.179. This ratio was used to scale

the winter quarter unit use rate for townhouses to the annual average unit use rate of 196.6 gpd. A weighted average of the number of single family and townhouses and the annual average unit use rate produced an aggregated single family unit use rate of 237 gpd. The total number of single family units was 27,826, the resulting single family consumption was approximately 6.59 mgd. The employee unit use was assumed to follow the AWWA standard of 50 gpd per employee. From the COG Round V employee projections the number of employees for the Falls Church DPW service area in 1994 was estimated as 106,000. The employee water use for 1994 was approximated by multiplying the number of employees by the assumed unit use rate resulting in 5.3 mgd. The total amount of water produced by the Falls Church DPW was 17 mgd. Subtracting from the total, the amount used by single families, the approximate employee water usage, and an unaccounted water of 1.87 mgd (11% of 17 mgd) results in the multi-family usage of 3.24 mgd. The number of multi-family households was approximated from the COG Round V total number of households for 1994 of 47,700 minus the number of single family accounts. The number of multi-family households was estimated to be 19,874. The multi-family unit use rate was computed by dividing the multi-family usage by the number of multi-family units resulting in approximately 163 gpd per unit.

Although the 1994 billing information has a consumption of 17 mgd in 1994 the amount of water bought from WAD in 1994 was 15.36 mgd. It was suggested that the water bought from WAD is a more reliable number since unpaid bills and different billing cycles would effect the consumption total. It was assumed from the above calculations that the single family residential water use accounted for 38.8% of the total water use, thus 38.8% of the WAD total estimates the single family use to equal 5.95 mgd. The single family residential use (5.95 mgd) was divided by the number of single family homes (27,826) to determine a single family unit use of 214 gpd. The employee unit use was assumed to follow the AWWA standard of 50 gpd per employee. From the COG Round V employee projections the number of employees for the Falls Church DPW service area in 1994 was estimated as 106,000. The employee water use for 1994 was approximated by multiplying the number of employees by the assumed unit use rate resulting in 5.3 mgd. The total amount of water produced by the Falls Church DPW was 15.36 mgd. Subtracting from the total, the amount used by single families, the approximate employee water usage, and an unaccounted water of 1.69 mgd (11% of 15.36 mgd) results in the multi-family usage of 2.42 mgd. The number of multi-family households was approximated from the COG Round V total number of households for 1994 of 47,700 minus the number of single family accounts. The number of multi-family households was estimated to be 19,874. The multi-family unit use rate was computed by dividing the multi-family usage by the number of multi-family units resulting in approximately 122 gpd per unit.

WAD - WASUA - National Airport: National Airport was able to provide the actual water bought from WASUA for the period from 1990-1994. The water delivered to National Airport was .43 mgd in 1990 and .374 in 1994. Water is accounted by employee use and an unaccounted water use in this area. The employee unit use rate was estimated as 35 gpd in 1990 and 30 gpd for the remainder of the forecast period. In addition to the unaccounted water at National Airport there is a 28.22% unaccounted water delivered from WASUA.

WAD - WASUA - Pentagon, Arlington Cemetery, Fort Myer: The Bureau of Water Measurement and Billing provided metered water sold to the Virginia accounts of Pentagon, Arlington Cemetery, Fort Myer and George Washington Memorial Parkway. The metered water was 1.869 mgd in 1990 and 0.879 mgd in 1994. It was assumed that water is accounted solely by employee consumption in this area. The employee unit use was estimated to be 78 gpd in 1990 and 38 gpd for the remainder of the forecast period. There is an additional 28.22% unaccounted water delivered from WASUA.

FCWA - Fairfax County: FCWA provided a "domestic demand", the number of single family units, the number of townhouses, and the number of apartment units, by sub-census tract for each quarter in 1993. The complete data set was used to perform a linear regression of the dependent variable "domestic demand" on the independent variables; single family units, townhouse units and apartment units to determine the unit use rates. The unit use rates determined by the regression were as follows; 253 gpd per single family unit, 171 gpd per townhouse, and 156 gpd per apartment unit. A second regression was performed combining the single family units with the townhouse units as one independent variable. The unit use rates determined by the second regression were 223 gpd per single family unit and 150 gpd per apartment unit. Using a weighted average of single family unit use rate with the townhouse unit use rate seem to perform better than the aggregated regression. The weighted average unit use rate then for single family unit is 229 gpd the multifamily unit use rate remains at 156 gpd per apartment.

FCWA - VAWC - Alexandria: Virginia America Water Company provided a table of total water sales and the number of customer accounts by residential, commercial, industrial and municipal uses from 1983 through 1994. A single family unit use was determined by dividing the residential water sale by the number of residential customers for each year of record. The single family unit use rate averaged over all the years of record was 200 gpd per unit. The number of employees in Alexandria is known from the COG Round V forecast for 1990 and 1995 and can be interpolated for the interim years. The employee water use was estimated for each year by multiplying the number of employees by the assumed employee unit use rate of 50 mgd. The multi-family water use was estimated by subtracting the residential use and the employee use from the total use for each year. The number of households in Alexandria is known from the COG Round V forecast for 1990 and 1995 and can be interpolated for the interim years. By subtracting the number of residential accounts from the COG Round V household forecast an estimate of the number of multi-family units was determined. A multi-family unit use was determined by dividing the estimate of multi-family water use by the estimate of multi-family units for 1990 through 1994. The average multi-family unit use rate was determined to be 187 gpd per unit. The percentage of unaccounted water was determined by dividing the difference between the total water purchased from FCWA to the total water billed by the total water purchased for each year. The average unaccounted water use was 1%.

FCWA - VAWC - Dale City: Virginia America Water Company provided a table of total water sales and the number of customer accounts by residential, commercial, industrial and municipal uses from 1983 through 1994. A single family unit use was determined by dividing the residential water sale by the number of residential customers for each year of record. The single family unit use rate averaged over all the years of record was 217 gpd per unit. The number of employees in Dale City is known from the COG Round V forecast for 1990 and 1995 and can be interpolated for the interim years. The employee water use was estimated for each year by multiplying the number of employees by the assumed employee unit use rate of 48 mgd. The multi-family water use was estimated by subtracting the residential use and the employee use from the total use for each year. The number of households in Dale City is known from the COG Round V forecast for 1990 and 1995 and can be interpolated for the interim years. By subtracting the number of residential accounts from the COG Round V household forecast an estimate of the number of multi-family units was determined. A multi-family unit use was determined by dividing the estimate of multi-family water use by the estimate of multi-family units for 1990 through 1994. The average multi-family unit use rate was determined to be 124 gpd per unit. The percentage of unaccounted water was determined by dividing the difference between the total water purchased from FCWA to the total water billed by the total water purchased for each year. The average unaccounted water use was 6%.

FCWA - LCSA: LCSA Customer Service Department was able to provide detailed information. The number of residential connections increased from 14,337 in 1990 to 20,338 in 1994. The corresponding water use increased from 4.24 mgd to 6.46 mgd. An in-house study of LCSA customer water use determined the average consumption to be 75 gallons per person per day. It estimated that there were 2.9 people per household. The same study estimated that a single family household consumes 21,000 gallons per quarter or approximately 230 gpd. An apartment unit consumes 18,000 gallons per quarter or approximately 197 gpd. LCSA began purchasing water from FCWA in June 1993 and currently purchases 64% of the total demand from FCWA and the remainder from the City of Fairfax Goose Creek supply. Approximately 20% of the water produced is unaccounted for.

FCWA - PWCSA: Limited information was available from the PWCSA to determine the unit use rates. It was assumed that the 3/4" meters represented all of the single family residential accounts in the service area. There were approximately 35,674 residential accounts that consumed approximately 7.67 mgd in 1994. The single family unit use rate of 215 gpd per unit was determined by dividing the amount consumed by the number of accounts. The employee unit use was assumed 40 gpd per employee. From the COG Round V employee projections the number of employees for Prince William County was estimated as 67,000. The employee water use was approximated by multiplying the number of employees by the assumed unit use rate resulting in 2.68 mgd. The total amount of water billed by PWCSA was 13.5 mgd. Subtracting from the total the amount used by single families and the approximate employee water usage results in the multi-family usage of 3.15 mgd. The number of multi-family households was approximated from the COG Round V total number of households, 62,785 minus the number of single family accounts. The number of multi-family households was estimated to be 27,111. The multi-family unit use rate was computed by dividing the multi-family usage by the number of multi-family units resulting in approximately 116 gpd per unit. The percent of unaccounted water is 5% of the total water produced. As a check, the ratio of single family to multi-family households was computed from the above

assumptions and compared to the actual housing stock. Here the billing indicates 35,674 single family households and approximates 27,111 multi-family households resulting in a ratio of 1.32 which varies greatly from the current ratio of 4.44 provided by the Prince William County Office of Mapping and Information Resources.

The delineation of the Prince William County service area was suspected to be incorrect since it grossly overestimated the actual connections of single families. It was assumed that a major portion of the single family households may still be on well water but would eventually be a part of the distribution system. It was further assumed that the original delineation of multi-family households and employees was correct in that employees and multi-family houses are more likely to be in the built up areas that are served by PWCSA. The single family households was computed to grow linearly from the known connections of 35,674 in 1994 to the full delineation in 2020 with approximately 65% of the single family houses in the eastern part of the county and the remainder in the western. Using the new interpolated values with the 1994 water production, different values of unit use were determined. The total amount of water wholesaled to PWCSA in 1994 was 13.5 mgd, of which 7.67 was sold to residential customers and approximately 0.675 mgd (5%) was unaccounted for. The unit use rate for single families was determined by dividing the single family use by the known number of single family accounts resulting in a unit use of 215 gpd. The employee water usage was determined by multiplying the interpolated number of employees in 1994 by an assumed employee unit use rate of 50 gpd. The approximate number of employees in 1994 was 67,353 resulting in a water use of 3.37 mgd. The multi-family water use was determined by subtracting the single family use, employee use and unaccounted water from the total resulting in a water use of 1.785 mgd. The interpolated number of multi-family units in 1994 was 11294. The multi-family unit use rate of 158 gpd was determined by dividing the multi-family water use by the number of multi-family units.

FCWA - Town of Herndon: The unit use rates for the Town of Herndon are assumed to be the same as those calculated for Fairfax County.

FCWA - Dulles: Dulles Airport was able to provide the actual water bought from FCWA for the period from 1990-1994. The water delivered to Dulles Airport was .47 mgd in 1990 and .49 in 1994. Water is accounted solely by employee use in this area. The employee unit use rate was estimated as 62 gpd in 1990 and 53 gpd for the remainder of the forecast period. In addition there is approximately 11% unaccounted water from FCWA to Dulles Airport.

FCWA - Fort Belvoir: Fort Belvoir Operations and Maintenance was contacted. They estimated an approximate 213 gpd per residential unit (single and multi-family units). They noted a problem with the COG Round V household forecast and could not reason a decrease in housing. There actual housing is as follows; 159 single family units, 828 duplexes, 481 townhouses, and 602 apartments. For the interim the 1990 housing was assumed constant for the remaining of the forecast period. The unit use rates for the single family and multi-family units were kept the same as FCWA and the employee unit use rate was adjusted to meet the known 1990 value of 1.94 mgd and the 1994 water usage of 2.02 mgd. The corresponding employee use rate was 100 gpd for 1990 and for the remainder of the forecast period. In addition there is approximately 11% unaccounted water from FCWA to Fort Belvoir.

FCWA - Lorton: A per capita use was used for the Lorton Department of Corrections. The Round V forecast of population was added to the forecast of employees. A per capita use of 195 gpd was used to match the wholesale actual amounts of 1990 and 1993 provided by FCWA.

WSSC - Prince George's County: Per unit production factors were provided by the WSSC Water Resources Planning Section. The per unit production for all existing units was estimated as 249 gpd per single family, 233 gpd per multi-family and 53 gpd per employee. Per unit production for new units was estimated as 246 gpd per single family , 186 gpd per multi-family and 53 gpd per employee. To obtain a per unit average consumption the per unit average production must be divided by a factor of 1.22. The average difference between the water entering the distribution system and the water measured leaving the system was 18% of the water entering the system.

WSSC - Montgomery County: WSSC calculated the unit use factors based on the entire service area and does not distinguish between the counties, therefore the unit use factors for Montgomery County are the same as Prince George's County.

WSSC - Andrews Air Force Base: The unit use rates for Andrews Air Force Base were assumed to be the same as the unit use rates used for existing single family and multi-family units in Prince George's County. The employee unit use rate was assumed to be 136 gpd in 1990 and 102 gpd for the remainder of the forecast period to accurately capture the known wholesale amount of 2.15 mgd in 1990 and 1.74 mgd in 1994. It is believed that the average annual water use decreased as a result of metering errors by WASUA that were corrected when the base became part of WSSC's distribution in 1993. The high employee unit use may be attributed to the existence of dorms which are not captured in the household forecasts. A study performed for Andrews Air Force Base estimated that residential use accounted for 47% of the annual average demand. There are approximately 2082 residential units (must have a kitchen and a bathroom) and 1037 dorm rooms.

City of Rockville: The unit use factors for Rockville were estimated from billing information from 1994. The total amount of water produced in 1994 was 4.54 mgd, approximately 5% (0.22 mgd) was unaccounted for in billing customers. The residential usage was metered to be 2.07 mgd by 10,204 individual meters. A single family unit use rate was determined by dividing the residential usage by the number of accounts resulting in 203 gpd per unit. The employee usage was assumed to be 40 mgd. The COG estimate of the number of employees in 1994 was 42,800 who used approximately 1.71 mgd. The multifamily usage was determined by subtracting the single family usage, the employee usage and the unaccounted usage from the total for 1994 resulting in .54 mgd. The COG estimate of households for 1994 was approximately 14,500 units. The number of multi-family units was determined by subtracting the number of single family units from the total number of units, resulting in approximately 4,300 multi-family units. The multi-family unit use rate was computed by dividing the multi-family usage by the number of units, resulting in 124 gpd per multi-family unit.

Town of Leesburg: Randy Shoemaker of the Town of Leesburg Department of Water provide unit use rates of 350 gpd for a single family unit, 280 gpd for a multi-family unit and 50 gpd for an employee. It was estimated that 20% of the total water use is unaccounted for.

City of Fairfax: The unit use factors for the City of Fairfax were calculated from 1990 billing information. The residential, commercial and total consumption for 1990 were provided along with the number of residential accounts. An assumption was made that the residential accounts are all single family accounts. A 205 gpd per single family unit use rate was computed by dividing the single family consumption, 1.8 mgd, by the number of accounts, 8796 units. The employee unit use was assumed to follow the AWWA standard of 50 gpd per employee. From the COG Round V employee projections the number of employees for the City of Fairfax in 1990 was estimated as 31,471. The employee water use for 1990 was approximated by multiplying the number of employees by the assumed unit use rate resulting in 1.57 mgd. The total amount of water billed by the City of Fairfax was 4.17 mgd. Subtracting from the total the amount used by single families and the approximate employee water usage results in the multi-family usage of 0.79 mgd. The number of multi-family households was approximated from the COG Round V total number of households for 1990 of 13,634 minus the number of single family accounts. The number of multi-family households was estimated to be 4,838. The multi-family unit use rate was computed by dividing the multi-family usage by the number of multi-family units resulting in approximately 163 gpd per unit. As a check, the ratio of single family to multi-family households was computed from the above assumptions and compared to the actual housing stock. Here the billing indicates 8,796 single family households and approximates 4,838 multi-family households resulting in a ratio of 1.82 compared to the current ratio of 2.33 provided by the City of Fairfax.

City of Manassas: The City of Manassas had billing information available from February 1995. The billing information included the number of single family accounts, single family consumption and the total consumption. The single family unit use rate of 220 gpd per unit was determined by dividing the single family consumption, 1.87 mgd, by the number of accounts, 8485 units. The employee unit use was assumed to follow the AWWA standard of 50 gpd per employee. From the COG Round V employee projections the number of employees for the City of Manassas in 1995 was estimated as 19,400. The employee water use for 1995 was approximated by multiplying the number of employees by the assumed unit use rate resulting in 0.97 mgd. The total amount of water billed by the City of Manassas was 3.72 mgd. Subtracting

from the total the amount used by single families and the approximate employee water usage results in the multi-family usage of 0.88 mgd. The number of multi-family households was approximated from the COG Round V total number of households for 1995 of 12,800 minus the number of single family accounts. The number of multi-family households was estimated to be 4,315. The multi-family unit use rate was computed by dividing the multi-family usage by the number of multi-family units resulting in approximately 205 gpd per unit. As a check, the ratio of single family to multi-family households was computed from the above assumptions and compared to the actual housing stock. Here the billing indicates 8,485 single family households and approximates 4,315 multi-family households resulting in a ratio of 1.97 compared to the current ratio of 3.5 provided by the City of Manassas Department of Planning. Since the unit use ratios were determined from February billing data annual average to winter unit use ratios were used to scale the values to annual average unit use rates. The winter scaling factor was determined from FCWA data which was provided in quarters. The scaling factor of 1.19 was used for single family unit use rate increasing the unit use rate to 262 gpd. The scaling factor of 1.04 was determined for multi-family and scaled the multi-family unit use rate to 213 gpd.

Appendix J: Demands by Water Use Class for each Water Supplier Service Area

WAD - WASUA - District of Columbia

	1990	1995	2000	2005	2010	2015	2020
Households	249634	252329	254726	254628	252135	252032	251934
Dwelling Unit Ratio	0.66	0.66	0.66	0.66	0.66	0.66	0.66
Single Family	99252	100324	101277	101238	100246	100205	100167
Multi-family	150382	152005	153449	153390	151889	151827	151767
EMPLOYMENT	747316	779914	816818	851224	885922	896428	906923
% unaccounted	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Unit Use (gpd)							
Single Family	237	237	237	237	237	237	237
Multi-family	237	237	237	237	237	237	237
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	23.52	23.78	24.00	23.99	23.76	23.75	23.74
Multi-family	35.64	36.03	36.37	36.35	36.00	35.98	35.97
Employee	37.37	39.00	40.84	42.56	44.30	44.82	45.35
Unaccounted	37.95	38.84	39.79	40.46	40.91	41.10	41.30
Total Water Use	134.48	137.64	141.00	143.37	144.96	145.66	146.36

WAD - Arlington DPW

	1990	1995	2000	2005	2010	2015	2020
Households	78520	85697	89670	93549	96219	98790	101266
Dwelling Unit Ratio	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Single Family	32332	35287	36923	38520	39620	40678	41698
Multi-family	46188	50410	52747	55029	56599	58112	59568
EMPLOYMENT	148196	171343	197987	215766	227865	236667	244270
% unaccounted	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Unit Use (gpd)							
Single Family	205	205	205	205	205	205	205
Multi-family	154	154	154	154	154	154	154
Employee	40	40	40	40	40	40	40
Water Use (mgd)							
Single Family	6.63	7.23	7.57	7.90	8.12	8.34	8.55
Multi-family	7.11	7.76	8.12	8.47	8.72	8.95	9.17
Employee	5.93	6.85	7.92	8.63	9.11	9.47	9.77
Unaccounted	3.47	3.86	4.17	4.41	4.58	4.72	4.85
Total Water Use	23.14	25.71	27.78	29.41	30.53	31.48	32.34

Appendix J: Demands by Water Use Class for each Water Supplier Service Area (continued)

WAD - Falls Church DPW - Falls Church and Vienna

	1990	1995	2000	2005	2010	2015	2020
Households	46319	48088	49710	53448	57082	60472	64122
Dwelling Unit Ratio	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Single Family	27019	28051	28997	31178	33298	35276	37404
Multi-family	19300	20037	20712	22270	23784	25197	26717
EMPLOYMENT	103491	106824	114798	119986	123766	127169	131139
% unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	214	214	214	214	214	214	214
Multi-family	122	122	122	122	122	122	122
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	5.78	6.00	6.21	6.67	7.13	7.55	8.00
Multi-family	2.35	2.44	2.53	2.72	2.90	3.07	3.26
Employee	5.17	5.34	5.74	6.00	6.19	6.36	6.56
Unaccounted	1.65	1.70	1.79	1.90	2.00	2.10	2.20
Total Water Use	14.96	15.49	16.26	17.29	18.22	19.08	20.02

WAD - WASUA - National Airport

	1990	1995	2000	2005	2010	2015	2020
Households	0	0	0	0	0	0	0
Dwelling Unit Ratio	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	0	0	0	0	0
EMPLOYMENT	11038	11850	11979	11979	11979	11979	11979
% unaccounted	0.10	0.10	0.10	0.10	0.10	0.10	0.10
% WASUA unaccounted	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Unit Use (gpd)							
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	0	0	0	0	0
Employee	35	30	30	30	30	30	30
Water Use (mgd)							
Single Family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multi-family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Employee	0.39	0.36	0.36	0.36	0.36	0.36	0.36
Unaccounted	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Wholesale Total Use	0.43	0.40	0.40	0.40	0.40	0.40	0.40
WASUA unaccounted	0.17	0.16	0.16	0.16	0.16	0.16	0.16
Total Water Use	0.60	0.55	0.56	0.56	0.56	0.56	0.56

Appendix J: Demands by Water Use Class for each Water Supplier Service Area (continued)

WAD - WASUA - Pentagon, Arlington Cemetery, Fort Myers

	1990	1995	2000	2005	2010	2015	2020
Households	0	0	28	55	83	111	139
Dwelling Unit Ratio	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	28	55	83	111	139
EMPLOYMENT	23893	23902	24328	24750	24750	24750	24750
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% WASUA unaccounted	0.28	0.28	0.28	0.28	0.28	0.28	0.28
Unit Use (gpd)							
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	0	0	0	0	0
Employee	78	38	38	38	38	38	38
Water Use (mgd)							
Single Family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multi-family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Employee	1.86	0.91	0.92	0.94	0.94	0.94	0.94
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale water use	1.86	0.91	0.92	0.94	0.94	0.94	0.94
WASUA unaccounted	0.73	0.36	0.36	0.37	0.37	0.37	0.37
Total Water Use	2.60	1.27	1.29	1.31	1.31	1.31	1.31

FCWA - Direct Service Area - Fairfax County

	1990	1995	2000	2005	2010	2015	2020
Households	230416	252836	272211	288291	305888	325536	346449
Dwelling Unit Ratio	3.19	3.2	3.18	3.15	3.08	3.02	2.95
Single Family	175424	192637	207089	218823	230915	244557	258740
Multi-family	54992	60199	65122	69468	74972	80979	87709
EMPLOYMENT	276400	299969	355459	400220	437138	466177	486653
% unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	229	229	229	229	229	229	229
Multi-family	156	156	156	156	156	156	156
Employee	47	47	47	47	47	47	47
Water Use (mgd)							
Single Family	40.17	44.11	47.42	50.11	52.88	56.00	59.25
Multi-family	8.58	9.39	10.16	10.84	11.70	12.63	13.68
Employee	12.99	14.10	16.71	18.81	20.55	21.91	22.87
Unaccounted	7.63	8.36	9.18	9.86	10.52	11.19	11.84
Total Water Use	69.37	75.96	83.47	89.62	95.64	101.74	107.65

FCWA - Wholesale - VAWC - Alexandria

	1990	1995	2000	2005	2010	2015	2020
Households	53280	56635	58797	61366	64390	67376	69744
Dwelling Unit Ratio	0.43	0.43	0.43	0.43	0.43	0.43	0.43
Single Family	16021	17030	17680	18453	19362	20260	20972
Multi-family	37259	39605	41117	42913	45028	47116	48772
EMPLOYMENT	92209	100829	106811	116086	125002	133572	142762
% unaccounted	0.01	0.01	0.01	0.01	0.01	0.01	0.01
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	200	200	200	200	200	200	200
Multi-family	187	187	187	187	187	187	187
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	3.20	3.41	3.54	3.69	3.87	4.05	4.19
Multi-family	6.97	7.41	7.69	8.02	8.42	8.81	9.12
Employee	4.61	5.04	5.34	5.80	6.25	6.68	7.14
Unaccounted	0.15	0.16	0.17	0.18	0.19	0.20	0.21
Wholesale Total Use	14.93	16.01	16.73	17.70	18.73	19.74	20.66
FCWA Unaccounted	1.85	1.98	2.07	2.19	2.31	2.44	2.55
Total Water Use	16.78	17.99	18.80	19.88	21.04	22.18	23.21

FCWA - Wholesale - VAWC - Dale City

	1990	1995	2000	2005	2010	2015	2020
Households	14268	16463	18200	20579	22515	24245	26151
Dwelling Unit Ratio	4.44	4.44	4.44	4.44	4.44	4.44	4.44
Single Family	11645	13437	14854	16796	18376	19788	21344
Multi-family	2623	3026	3346	3783	4139	4457	4807
EMPLOYMENT	6170	7525	8620	9744	10539	11417	12396
% unaccounted	0.06	0.06	0.06	0.06	0.06	0.06	0.06
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	217	217	217	217	217	217	217
Multi-family	124	124	124	124	124	124	124
Employee	48	48	48	48	48	48	48
Water Use (mgd)							
Single Family	2.53	2.92	3.22	3.64	3.99	4.29	4.63
Multi-family	0.33	0.38	0.41	0.47	0.51	0.55	0.60
Employee	0.30	0.36	0.41	0.47	0.51	0.55	0.60
Unaccounted	0.19	0.22	0.25	0.28	0.31	0.33	0.36
Wholesale Total Use	3.34	3.88	4.30	4.86	5.31	5.73	6.18
FCWA Unaccounted	0.41	0.48	0.53	0.60	0.66	0.71	0.76
Total Water Use	3.76	4.36	4.83	5.46	5.97	6.43	6.95

FCWA - Wholesale - LCSA

	1990	1995	2000	2005	2010	2015	2020
Households	16453	20911	25848	31969	39236	46626	53690
Dwelling Unit Ratio	5.23	5.27	4.44	4.15	4.01	3.94	3.9
Single Family	13812	17576	21097	25761	31404	37188	42733
Multi-family	2641	3335	4751	6208	7832	9438	10957
EMPLOYMENT	16735	22377	29989	36599	45027	54328	64775
% unaccounted	0.20	0.20	0.20	0.20	0.20	0.20	0.20
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	230	230	230	230	230	230	230
Multi-family	197	197	197	197	197	197	197
Employee	40	40	40	40	40	40	40
Water Use (mgd)							
Single Family	3.18	4.04	4.85	5.93	7.22	8.55	9.83
Multi-family	0.52	0.66	0.94	1.22	1.54	1.86	2.16
Employee	0.67	0.90	1.20	1.46	1.80	2.17	2.59
Unaccounted	1.09	1.40	1.75	2.15	2.64	3.15	3.64
Wholesale Total Use	5.46	6.99	8.73	10.76	13.21	15.73	18.22
FCWA Unaccounted	0.67	0.86	1.08	1.33	1.63	1.94	2.25
Total Water Use	6.13	7.86	9.81	12.10	14.84	17.68	20.47

FCWA - Wholesale - PWCSA - east

	1990	1995	2000	2005	2010	2015	2020
Households	25066	31958	39087	46468	53586	60686	67822
Dwelling Unit Ratio	4.44	4.44	4.44	4.44	4.44	4.44	4.44
Single Family	18281	24460	30639	36818	42997	49176	55355
Multi-family	6785	7498	8448	9650	10589	11510	12467
EMPLOYMENT	38195	44098	49871	58737	69621	81897	91063
% unaccounted	0.05	0.05	0.05	0.05	0.05	0.05	0.05
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	215	215	215	215	215	215	215
Multi-family	158	158	158	158	158	158	158
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	3.93	5.26	6.59	7.92	9.24	10.57	11.90
Multi-family	1.07	1.18	1.33	1.52	1.67	1.82	1.97
Employee	1.91	2.20	2.49	2.94	3.48	4.09	4.55
Unaccounted	0.36	0.46	0.55	0.65	0.76	0.87	0.97
Wholesale Total Use	7.28	9.10	10.96	13.03	15.16	17.35	19.39
FCWA Unaccounted	0.90	1.13	1.36	1.61	1.87	2.14	2.40
Total Water Use	8.18	10.23	12.32	14.64	17.03	19.50	21.79

FCWA - Wholesale - PWCSA - west

	1990	1995	2000	2005	2010	2015	2020
Households	12430	17379	22667	27992	33284	38445	43482
Dwelling Unit Ratio	4.44	4.44	4.44	4.44	4.44	4.44	4.44
Single Family	8906	13336	17767	22197	26628	31058	35489
Multi-family	3524	4043	4900	5795	6656	7387	7993
EMPLOYMENT	21865	25079	32269	39131	47243	52798	57138
% unaccounted	0.05	0.05	0.05	0.05	0.05	0.05	0.05
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	215	215	215	215	215	215	215
Multi-family	158	158	158	158	158	158	158
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	1.91	2.87	3.82	4.77	5.73	6.68	7.63
Multi-family	0.56	0.64	0.77	0.92	1.05	1.17	1.26
Employee	1.09	1.25	1.61	1.96	2.36	2.64	2.86
Unaccounted	0.19	0.25	0.33	0.40	0.48	0.55	0.62
Wholesale Total Use	3.75	5.01	6.53	8.05	9.62	11.04	12.37
FCWA Unaccounted	0.46	0.62	0.81	0.99	1.19	1.36	1.53
Total Water Use	4.22	5.63	7.34	9.04	10.81	12.40	13.90

FCWA - Wholesale - Herndon

	1990	1995	2000	2005	2010	2015	2020
Households	5230	5922	8650	8663	8860	9430	10035
Dwelling Unit Ratio	3.19	3.2	3.18	3.15	3.08	3.02	2.95
Single Family	3982	4512	6581	6576	6688	7084	7494
Multi-family	1248	1410	2069	2087	2172	2346	2541
EMPLOYMENT	12421	15461	20368	24336	27738	30938	33738
% unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	229	229	229	229	229	229	229
Multi-family	156	156	156	156	156	156	156
Employee	47	47	47	47	47	47	47
Water Use (mgd)							
Single Family	0.91	1.03	1.51	1.51	1.53	1.62	1.72
Multi-family	0.19	0.22	0.32	0.33	0.34	0.37	0.40
Employee	0.58	0.73	0.96	1.14	1.30	1.45	1.59
Unaccounted	0.21	0.24	0.34	0.37	0.39	0.43	0.46
Wholesale Total Use	1.90	2.22	3.13	3.34	3.57	3.87	4.16
FCWA Unaccounted	0.23	0.27	0.39	0.41	0.44	0.48	0.51
Total Water Use	2.13	2.50	3.52	3.76	4.01	4.35	4.67

FCWA - Wholesale - Dulles

	1990	1995	2000	2005	2010	2015	2020
Households	18	3	3	3	3	3	3
Dwelling Unit Ratio	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0
Multi-family	18	3	3	3	3	3	3
EMPLOYMENT	7712	9408	11426	13222	15290	17048	18767
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	0	0	0	0	0
Employee	62	53	53	53	53	53	53
Water Use (mgd)							
Single Family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multi-family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Employee	0.48	0.50	0.61	0.70	0.81	0.90	0.99
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale Total Use	0.48	0.50	0.61	0.70	0.81	0.90	0.99
FCWA Unaccounted	0.06	0.06	0.07	0.09	0.10	0.11	0.12
Total Water Use	0.54	0.56	0.68	0.79	0.91	1.02	1.12

FCWA - Wholesale - Fort Belvoir

	1990	1995	2000	2005	2010	2015	2020
Households	2344	2344	2344	2344	2344	2344	2344
Dwelling Unit Ratio	3.19	3.2	3.18	3.15	3.08	3.02	2.95
Single Family	1785	1786	1783	1779	1769	1761	1751
Multi-family	559	558	561	565	575	583	593
EMPLOYMENT	14590	15150	19401	19995	20589	21194	21373
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	229	229	229	229	229	229	229
Multi-family	156	156	156	156	156	156	156
Employee	100	100	100	100	100	100	100
Water Use (mgd)							
Single Family	0.41	0.41	0.41	0.41	0.41	0.40	0.40
Multi-family	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Employee	1.46	1.52	1.94	2.00	2.06	2.12	2.14
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale Total Use	1.95	2.01	2.44	2.50	2.55	2.61	2.63
FCWA Unaccounted	0.24	0.25	0.30	0.31	0.32	0.32	0.33
Total Water Use	2.20	2.26	2.74	2.80	2.87	2.94	2.96

FCWA - Wholesale - Lorton

	1990	1995	2000	2005	2010	2015	2020
Households	7	1	2	11	17	18	19
Dwelling Unit Ratio	0	0	0	0	0	0	0
Single Family	0	0	0	0	0	0	0
Multi-family	7	1	2	11	17	18	19
EMPLOYMENT	1033	1033	1038	1038	1038	1038	1038
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
% FCWA unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	0	0	0	0	0	0	0
Multi-family	0	0	0	0	0	0	0
Employee	195	195	195	195	195	195	195
Water Use (mgd)							
Single Family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Multi-family	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Employee	1.28	1.57	1.57	1.58	1.58	1.58	1.58
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wholesale Total Use	1.28	1.57	1.57	1.58	1.58	1.58	1.58
FCWA Unaccounted	0.16	0.19	0.19	0.20	0.20	0.20	0.20
Total Water Use	1.44	1.77	1.77	1.77	1.78	1.78	1.78

WSSC - Montgomery County

	1990	1995	2000	2005	2010	2015	2020
Households	261528	277851	300906	323621	339473	354923	369105
Dwelling Unit Ratio	2.36	2.3	2.21	2.09	2.03	2	1.98
Single Family	183692	193654	207166	218889	227436	236615	245244
Multi-family	77836	84197	93740	104732	112037	118308	123861
EMPLOYMENT	417788	416438	462672	514901	561725	599437	633055
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unit Use (gpd)							
Single Family	249	246	246	246	246	246	246
Multi-family	233	186	186	186	186	186	186
Employee	53	53	53	53	53	53	53
Water Use (mgd)							
Single Family	45.74	48.19	51.51	54.40	56.50	58.76	60.88
Multi-family	18.14	19.32	21.09	23.14	24.50	25.66	26.70
Employee	22.14	22.07	24.52	27.29	29.77	31.77	33.55
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Water Use	86.02	89.58	97.13	104.83	110.77	116.19	121.13

WSSC - Prince George's County

	1990	1995	2000	2005	2010	2015	2020
Households	249850	268616	285818	301909	317112	333253	349436
Dwelling Unit Ratio	1.62	1.78	1.9	2	2.1	2.18	2.25
Single Family	154487	171992	187260	201273	214818	228456	241917
Multi-family	95362	96625	98558	100636	102294	104796	107519
EMPLOYMENT	300377	315817	344308	377519	413828	445803	479782
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unit Use (gpd)							
Single Family	249	246	246	246	246	246	246
Multi-family	233	186	186	186	186	186	186
Employee	53	53	53	53	53	53	53
Water Use (mgd)							
Single Family	38.47	42.77	46.53	49.98	53.31	56.66	59.98
Multi-family	22.22	22.45	22.81	23.20	23.51	23.97	24.48
Employee	15.92	16.74	18.25	20.01	21.93	23.63	25.43
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Water Use	76.61	81.97	87.59	93.19	98.75	104.27	109.88

WSSC - Andrews Air force Base

	1990	1995	2000	2005	2010	2015	2020
Households	2436	2481	2543	2565	2570	2570	2570
Dwelling Unit Ratio	1.62	1.78	1.9	2	2.1	2.18	2.25
Single Family	1506	1589	1666	1710	1741	1762	1779
Multi-family	930	893	877	855	829	808	791
EMPLOYMENT	11458	11585	11972	12401	12916	13245	13457
% unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Unit Use (gpd)							
Single Family	249	249	249	249	249	249	249
Multi-family	233	233	233	233	233	233	233
Employee	136	102	102	102	102	102	102
Water Use (mgd)							
Single Family	0.38	0.40	0.41	0.43	0.43	0.44	0.44
Multi-family	0.22	0.21	0.20	0.20	0.19	0.19	0.18
Employee	1.56	1.18	1.22	1.26	1.32	1.35	1.37
Unaccounted	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Water Use	2.15	1.79	1.84	1.89	1.94	1.98	2.00

City of Rockville

	1990	1995	2000	2005	2010	2015	2020
Households	13903	14696	16251	16681	17180	17343	17436
Dwelling Unit Ratio	3.15	3.19	2.42	2.39	2.26	2.28	2.28
Single Family	10553	11188	11499	11760	11910	12056	12120
Multi-family	3350	3507	4752	4921	5270	5288	5316
EMPLOYMENT	43052	42726	51145	54264	56785	58539	59432
% unaccounted	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Unit Use (gpd)							
Single Family	203	203	203	203	203	203	203
Multi-family	124	124	124	124	124	124	124
Employee	40	40	40	40	40	40	40
Water Use (mgd)							
Single Family	2.14	2.27	2.33	2.39	2.42	2.45	2.46
Multi-family	0.42	0.43	0.59	0.61	0.65	0.66	0.66
Employee	1.72	1.71	2.05	2.17	2.27	2.34	2.38
Unaccounted	0.23	0.23	0.26	0.27	0.28	0.29	0.29
Total Water Use	4.50	4.65	5.23	5.44	5.62	5.73	5.79

Leesburg

	1990	1995	2000	2005	2010	2015	2020
Households	4301	4742	5169	5764	6338	6912	7486
Dwelling Unit Ratio	5.23	5.27	4.44	4.15	4.01	3.94	3.9
Single Family	3611	3986	4219	4645	5073	5513	5958
Multi-family	690	756	950	1119	1265	1399	1528
EMPLOYMENT	8653	9400	9829	11084	11869	12658	13444
% unaccounted	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Unit Use (gpd)							
Single Family	350	350	350	350	350	350	350
Multi-family	280	280	280	280	280	280	280
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	1.26	1.39	1.48	1.63	1.78	1.93	2.09
Multi-family	0.19	0.21	0.27	0.31	0.35	0.39	0.43
Employee	0.43	0.47	0.49	0.55	0.59	0.63	0.67
Unaccounted	0.47	0.52	0.56	0.62	0.68	0.74	0.80
Total Water Use	2.36	2.60	2.79	3.12	3.40	3.69	3.98

City of Fairfax - Goose Creek Supply

	1990	1995	2000	2005	2010	2015	2020
Households	13635	13832	14211	14755	15378	15849	16349
Dwelling Unit Ratio	2.33	2.33	2.33	2.33	2.33	2.33	2.33
Single Family	9540	9678	9944	10324	10760	11090	11440
Multi-family	4094	4154	4268	4431	4618	4760	4910
EMPLOYMENT	31472	34404	35098	35701	35701	36005	36209
% unaccounted	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Unit Use (gpd)							
Single Family	205	205	205	205	205	205	205
Multi-family	163	163	163	163	163	163	163
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	1.96	1.98	2.04	2.12	2.21	2.27	2.35
Multi-family	0.67	0.68	0.70	0.72	0.75	0.78	0.80
Employee	1.57	1.72	1.75	1.79	1.79	1.80	1.81
Unaccounted	0.61	0.63	0.65	0.67	0.68	0.70	0.71
Total Water Use	4.80	5.01	5.14	5.29	5.43	5.55	5.67

City of Manassas - Lake Manassas Supply

	1990	1995	2000	2005	2010	2015	2020
Households	11022	12821	14021	14721	15221	15798	16269
Dwelling Unit Ratio	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Single Family	8573	9972	10905	11450	11839	12287	12654
Multi-family	2449	2849	3116	3271	3382	3511	3615
EMPLOYMENT	18259	19488	20947	22491	23949	24678	25019
% unaccounted	0.11	0.11	0.11	0.11	0.11	0.11	0.11
Unit Use (gpd)							
Single Family	262	262	262	262	262	262	262
Multi-family	213	213	213	213	213	213	213
Employee	50	50	50	50	50	50	50
Water Use (mgd)							
Single Family	2.25	2.61	2.86	3.00	3.10	3.22	3.32
Multi-family	0.52	0.61	0.66	0.70	0.72	0.75	0.77
Employee	0.91	0.97	1.05	1.12	1.20	1.23	1.25
Unaccounted	0.45	0.52	0.56	0.60	0.62	0.64	0.66
Total Water Use	4.14	4.71	5.13	5.42	5.64	5.84	6.00

Appendix K: WAD Disaggregated Demands

Annual Average Demand

1990	1995	2000	2005	2010	2015	2020
175.8	180.7	186.9	191.9	195.6	198.1	200.6

Mean Monthly Demand

	1990	1995	2000	2005	2010	2015	2020
January	164.3	168.9	174.7	179.4	182.8	185.2	187.5
February	158.2	162.6	168.2	172.8	176.0	178.3	180.5
March	160.3	164.7	170.4	175.0	178.4	180.6	182.9
April	166.4	171.0	176.9	181.7	185.1	187.5	189.9
May	173.6	178.5	184.6	189.6	193.2	195.7	198.2
June	193.3	198.7	205.5	211.1	215.1	217.8	220.6
July	205.0	210.7	218.0	223.9	228.1	231.1	234.0
August	196.8	202.3	209.3	214.9	219.0	221.8	224.6
September	189.8	195.1	201.8	207.3	211.2	213.9	216.6
October	175.1	180.0	186.2	191.2	194.8	197.3	199.8
November	166.8	171.5	177.4	182.2	185.6	188.0	190.4
December	158.3	162.7	168.3	172.8	176.1	178.4	180.6

Winter Water Use

1990	1995	2000	2005	2010	2015	2020
160.5	164.9	170.6	175.2	178.6	180.8	183.1

Mean peak 30, 60, 90, 120, and 180-day demand

	1990	1995	2000	2005	2010	2015	2020
30-day	208.7	214.5	221.9	227.9	232.2	235.2	238.2
60-day	203.7	209.4	216.6	222.5	226.7	229.6	232.5
90-day	200.5	206.1	213.2	219.0	223.1	226.0	228.9
120-day	197.1	202.6	209.6	215.3	219.3	222.2	225.0
180-day	189.6	194.9	201.6	207.1	211.0	213.7	216.4

Mean Peak 1-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	196.6	202.1	209.1	214.7	218.8	221.6	224.4
February	174.2	179.1	185.2	190.2	193.8	196.3	198.8
March	173.3	178.1	184.2	189.2	192.8	195.2	197.7
April	188.2	193.5	200.1	205.5	209.4	212.1	214.8
May	199.1	204.7	211.7	217.4	221.6	224.4	227.2
June	220.6	226.8	234.6	240.9	245.5	248.6	251.8
July	233.8	240.3	248.6	255.3	260.1	263.5	266.8
August	217.6	223.7	231.4	237.6	242.2	245.3	248.4
September	215.3	221.2	228.9	235.1	239.5	242.6	245.6
October	188.9	194.1	200.8	206.2	210.1	212.8	215.5
November	184.7	189.9	196.4	201.7	205.6	208.2	210.8
December	182.3	187.4	193.8	199.1	202.8	205.4	208.0

Mean Peak 7-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	174.1	178.9	185.1	190.1	193.7	196.2	198.7
February	162.4	167.0	172.7	177.4	180.7	183.1	185.4
March	164.2	168.8	174.6	179.3	182.7	185.1	187.4
April	175.0	179.8	186.0	191.0	194.7	197.2	199.7
May	185.6	190.7	197.3	202.6	206.5	209.1	211.8
June	205.7	211.4	218.7	224.6	228.9	231.8	234.8
July	219.8	225.9	233.7	240.0	244.5	247.7	250.8
August	203.8	209.5	216.7	222.5	226.8	229.7	232.6
September	201.6	207.2	214.3	220.1	224.3	227.2	230.0
October	180.1	185.1	191.5	196.7	200.4	203.0	205.6
November	173.2	178.0	184.2	189.2	192.7	195.2	197.7
December	167.0	171.6	177.6	182.4	185.8	188.2	190.6

Maximum 1-Day Demand

1990	1995	2000	2005	2010	2015	2020
236.2	242.8	251.2	257.9	262.8	266.2	269.6

Maximum 7-Day Demand

1990	1995	2000	2005	2010	2015	2020
221.6	227.8	235.6	242.0	246.6	249.7	252.9

Statistical Maximum 1-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	246.1	252.9	261.6	268.7	273.8	277.3	280.8
2% exceedence	247.8	254.7	263.5	270.6	275.8	279.3	282.8
1% exceedence	249.6	256.5	265.4	272.5	277.7	281.3	284.8

Statistical Maximum 7-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	233.8	240.3	248.6	255.3	260.1	263.4	266.8
2% exceedence	235.5	242.1	250.4	257.2	262.1	265.4	268.8
1% exceedence	239.0	245.7	254.2	261.0	266.0	269.4	272.8

Appendix L: FCWA Disaggregated Demands

Annual Average Demand

1990	1995	2000	2005	2010	2015	2020
106.1	122.8	137.4	150.3	163.4	176.6	189.2

Mean Monthly Demand

	1990	1995	2000	2005	2010	2015	2020
January	94.2	109.0	121.9	133.3	145.0	156.6	167.8
February	91.7	106.1	118.7	129.8	141.1	152.5	163.4
March	93.0	107.6	120.4	131.6	143.1	154.6	165.7
April	99.7	115.3	129.1	141.2	153.5	165.8	177.7
May	110.0	127.3	142.4	155.8	169.4	183.0	196.1
June	126.8	146.7	164.2	179.5	195.2	210.9	226.0
July	128.4	148.5	166.2	181.8	197.6	213.5	228.8
August	118.2	136.7	153.0	167.4	182.0	196.6	210.6
September	113.9	131.8	147.5	161.3	175.4	189.5	203.1
October	103.7	120.0	134.3	146.9	159.7	172.6	184.9
November	97.7	113.0	126.5	138.4	150.4	162.5	174.1
December	95.5	110.5	123.7	135.2	147.0	158.9	170.2

Winter Water Use

1990	1995	2000	2005	2010	2015	2020
93.3	107.9	120.8	132.1	143.6	155.2	166.3

Mean peak 30, 60, 90, 120, and 180-day demand

	1990	1995	2000	2005	2010	2015	2020
30-day	135.9	157.3	176.0	192.5	209.3	226.1	242.3
60-day	130.4	150.9	168.9	184.7	200.8	217.0	232.5
90-day	125.9	145.7	163.0	178.3	193.8	209.4	224.4
120-day	123.2	142.5	159.5	174.4	189.7	204.9	219.6
180-day	117.4	135.9	152.0	166.3	180.8	195.3	209.3

Mean Peak 1-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	102.5	118.6	132.8	145.2	157.9	170.6	182.8
February	99.2	114.7	128.4	140.4	152.7	165.0	176.7
March	101.3	117.2	131.2	143.4	156.0	168.5	180.6
April	114.8	132.9	148.7	162.6	176.8	191.0	204.7
May	132.4	153.2	171.5	187.6	203.9	220.3	236.1
June	159.4	184.5	206.4	225.8	245.4	265.2	284.1
July	165.8	191.8	214.7	234.8	255.3	275.8	295.5
August	142.0	164.4	183.9	201.2	218.7	236.3	253.2
September	136.3	157.7	176.5	193.0	209.8	226.7	242.9
October	115.5	133.7	149.6	163.6	177.9	192.2	205.9
November	107.1	123.9	138.7	151.7	164.9	178.2	190.9
December	102.7	118.8	133.0	145.4	158.1	170.8	183.0

Appendix L: FCWA Disaggregated Demands

Mean Peak 7-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	97.2	112.5	125.9	137.7	149.7	161.7	173.3
February	93.5	108.2	121.1	132.4	144.0	155.6	166.7
March	95.2	110.1	123.2	134.8	146.5	158.3	169.6
April	106.8	123.6	138.4	151.3	164.5	177.7	190.4
May	121.4	140.5	157.3	172.0	187.0	202.0	216.5
June	142.6	165.0	184.6	201.9	219.5	237.2	254.1
July	147.1	170.2	190.5	208.3	226.5	244.7	262.2
August	127.1	147.1	164.6	180.0	195.7	211.5	226.6
September	125.6	145.4	162.7	177.9	193.4	209.0	223.9
October	108.6	125.6	140.6	153.7	167.2	180.6	193.5
November	99.8	115.5	129.3	141.4	153.7	166.1	178.0
December	98.2	113.6	127.1	139.0	151.1	163.3	175.0

Maximum 1-Day Demand

1990	1995	2000	2005	2010	2015	2020
169.0	195.6	218.9	239.3	260.2	281.2	301.3

Maximum 7-Day Demand

1990	1995	2000	2005	2010	2015	2020
150.7	174.4	195.1	213.4	232.0	250.7	268.6

Statistical Maximum 1-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	177.2	205.1	229.5	251.0	272.9	294.8	315.9
2% exceedence	180.4	208.8	233.6	255.5	277.8	300.1	321.6
1% exceedence	181.5	210.0	235.0	257.0	279.4	301.9	323.5

Statistical Maximum 7-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	163.4	189.1	211.6	231.4	251.6	271.9	291.3
2% exceedence	166.6	192.8	215.8	235.9	256.5	277.2	297.0
1% exceedence	168.7	195.2	218.5	239.0	259.8	280.7	300.8

Appendix M: WSSC Disaggregated Demands

Annual Average Demand

1990	1995	2000	2005	2010	2015	2020
164.8	173.3	186.6	199.9	211.5	222.4	233.0

Mean Monthly Demand

	1990	1995	2000	2005	2010	2015	2020
January	155.1	163.2	175.6	188.2	199.1	209.4	219.3
February	150.1	157.9	170.0	182.1	192.7	202.7	212.3
March	149.7	157.5	169.5	181.7	192.2	202.2	211.8
April	155.4	163.4	175.9	188.5	199.4	209.7	219.7
May	167.0	175.7	189.1	202.7	214.4	225.5	236.2
June	185.5	195.2	210.1	225.1	238.1	250.5	262.4
July	190.5	200.4	215.7	231.1	244.5	257.2	269.4
August	179.4	188.7	203.1	217.7	230.3	242.2	253.7
September	173.1	182.1	196.0	210.0	222.1	233.6	244.8
October	161.8	170.2	183.2	196.3	207.6	218.4	228.8
November	156.6	164.8	177.3	190.0	201.0	211.4	221.5
December	151.9	159.8	172.0	184.3	195.0	205.1	214.9

Winter Water Use

1990	1995	2000	2005	2010	2015	2020
152.6	160.5	172.8	185.1	195.8	206.0	215.8

Mean peak 30, 60, 90, 120, and 180-day demand

	1990	1995	2000	2005	2010	2015	2020
30-day	196.7	206.9	222.7	238.6	252.4	265.5	278.1
60-day	190.6	200.5	215.8	231.3	244.7	257.4	269.6
90-day	187.0	196.7	211.7	226.8	239.9	252.4	264.4
120-day	183.6	193.1	207.9	222.7	235.6	247.9	259.6
180-day	176.8	186.0	200.2	214.5	226.9	238.7	250.0

Mean Peak 1-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	173.3	182.3	196.2	210.2	222.4	233.9	245.0
February	163.1	171.6	184.7	197.9	209.3	220.2	230.7
March	161.8	170.2	183.2	196.3	207.6	218.4	228.8
April	172.6	181.5	195.4	209.4	221.5	233.0	244.0
May	189.5	199.3	214.5	229.9	243.2	255.8	267.9
June	222.8	234.4	252.3	270.3	285.9	300.8	315.1
July	227.4	239.3	257.5	275.9	291.9	307.0	321.6
August	202.5	213.0	229.3	245.7	259.9	273.4	286.4
September	194.4	204.5	220.1	235.9	249.5	262.5	274.9
October	178.9	188.2	202.5	217.0	229.6	241.5	253.0
November	171.4	180.3	194.1	208.0	220.0	231.4	242.4
December	163.7	172.2	185.3	198.6	210.0	220.9	231.4

Mean Peak 7-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	162.2	170.6	183.7	196.8	208.2	219.0	229.4
February	153.1	161.1	173.4	185.8	196.5	206.7	216.6
March	152.4	160.3	172.5	184.9	195.5	205.7	215.5
April	163.7	172.2	185.4	198.6	210.1	221.0	231.5
May	177.7	186.9	201.2	215.6	228.1	239.9	251.3
June	202.4	212.9	229.1	245.5	259.7	273.2	286.2
July	212.9	223.9	241.0	258.3	273.2	287.4	301.0
August	189.7	199.5	214.8	230.1	243.4	256.1	268.2
September	183.9	193.5	208.3	223.1	236.1	248.3	260.1
October	167.1	175.8	189.2	202.7	214.4	225.5	236.3
November	160.9	169.3	182.2	195.2	206.5	217.2	227.6
December	154.8	162.8	175.2	187.8	198.6	208.9	218.9

Maximum 1-Day Demand

1990	1995	2000	2005	2010	2015	2020
232.2	244.2	262.9	281.7	298.0	313.4	328.3

Maximum 7-Day Demand

1990	1995	2000	2005	2010	2015	2020
213.5	224.6	241.7	259.0	274.0	288.2	301.9

Statistical Maximum 1-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	248.8	261.7	281.7	301.9	319.3	335.9	351.8
2% exceedence	252.1	265.2	285.4	305.8	323.5	340.3	356.5
1% exceedence	255.4	268.7	289.2	309.8	327.8	344.8	361.2

Statistical Maximum 7-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	229.0	240.9	259.3	277.9	293.9	309.2	323.9
2% exceedence	232.3	244.4	263.1	281.9	298.2	313.6	328.5
1% exceedence	235.6	247.9	266.8	285.9	302.4	318.1	333.2

Appendix N: CO-OP Total disaggregated demands

Annual Average Demand

1990	1995	2000	2005	2010	2015	2020
446.7	476.8	510.9	542.1	570.4	597.1	622.8

Mean Monthly Demand

	1990	1995	2000	2005	2010	2015	2020
January	413.5	441.3	472.9	501.8	528.0	552.7	576.4
February	399.9	426.9	457.4	485.4	510.7	534.5	557.6
March	402.9	430.1	460.8	489.0	514.6	538.6	561.8
April	421.3	449.7	481.9	511.4	538.1	563.2	587.4
May	450.7	481.0	515.4	547.0	575.5	602.4	628.3
June	505.6	539.7	578.3	613.6	645.7	675.8	704.9
July	524.1	559.4	599.5	636.1	669.3	700.6	730.7
August	494.6	527.9	565.7	600.3	631.6	661.1	689.6
September	476.9	509.0	545.4	578.8	609.0	637.4	664.9
October	440.7	470.4	504.0	534.8	562.8	589.0	614.4
November	421.2	449.6	481.7	511.2	537.9	563.0	587.2
December	405.7	433.0	464.0	492.4	518.1	542.3	565.6

Winter Water Use

1990	1995	2000	2005	2010	2015	2020
406.5	433.9	464.9	493.3	519.1	543.3	566.7

Mean peak 30, 60, 90, 120, and 180-day demand

	1990	1995	2000	2005	2010	2015	2020
30-day	537.3	573.5	614.5	652.1	686.2	718.2	749.1
60-day	523.0	558.3	598.2	634.8	667.9	699.1	729.2
90-day	512.8	547.4	586.5	622.4	654.9	685.4	714.9
120-day	503.6	537.5	576.0	611.2	643.1	673.1	702.1
180-day	483.6	516.2	553.1	586.9	617.6	646.4	674.2

Mean Peak 1-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	494.8	528.2	565.9	600.6	631.9	661.4	689.9
February	440.4	470.0	503.7	534.5	562.4	588.6	614.0
March	435.5	464.9	498.1	528.6	556.2	582.2	607.2
April	476.7	508.8	545.2	578.5	608.8	637.2	664.6
May	516.8	551.6	591.0	627.2	660.0	690.8	720.5
June	577.0	615.9	660.0	700.3	736.9	771.3	804.5
July	597.6	637.9	683.5	725.3	763.2	798.8	833.2
August	546.9	583.7	625.5	663.7	698.4	731.0	762.4
September	540.8	577.3	618.5	656.4	690.7	722.9	754.0
October	475.3	507.3	543.6	576.8	607.0	635.3	662.6
November	466.4	497.8	533.4	566.0	595.6	623.4	650.2
December	467.2	498.7	534.4	567.1	596.7	624.5	651.4

Appendix N: CO-OP Total disaggregated demands

Mean Peak 7-Day Demand

	1990	1995	2000	2005	2010	2015	2020
January	430.4	459.4	492.2	522.4	549.6	575.3	600.1
February	407.2	434.6	465.7	494.2	520.0	544.3	567.7
March	409.5	437.1	468.4	497.0	523.0	547.4	571.0
April	442.8	472.7	506.5	537.4	565.5	591.9	617.4
May	482.8	515.3	552.2	585.9	616.5	645.3	673.1
June	549.2	586.2	628.2	666.6	701.4	734.1	765.7
July	577.3	616.2	660.2	700.6	737.2	771.6	804.8
August	518.3	553.2	592.8	629.0	661.9	692.8	722.6
September	510.3	544.7	583.6	619.3	651.7	682.1	711.5
October	454.9	485.6	520.3	552.2	581.0	608.1	634.3
November	431.2	460.2	493.1	523.3	550.7	576.4	601.2
December	416.1	444.1	475.9	505.0	531.4	556.2	580.1

Maximum 1-Day Demand

1990	1995	2000	2005	2010	2015	2020
619.5	661.2	708.5	751.9	791.1	828.0	863.7

Maximum 7-Day Demand

1990	1995	2000	2005	2010	2015	2020
581.1	620.3	664.7	705.3	742.2	776.8	810.2

Statistical Maximum 1-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	652.1	696.1	745.9	791.5	832.8	871.7	909.2
2% exceedence	661.1	705.6	756.1	802.3	844.3	883.7	921.7
1% exceedence	665.5	710.4	761.2	807.8	850.0	889.6	927.9

Statistical Maximum 7-Day Demand with 5%, 2%, and 1% exceedence probability

	1990	1995	2000	2005	2010	2015	2020
5% exceedence	620.9	662.7	710.1	753.6	792.9	829.9	865.6
2% exceedence	629.8	672.3	720.3	764.4	804.3	841.9	878.1
1% exceedence	638.7	681.8	730.5	775.2	815.7	853.8	890.6