Appendix A
Water Demand Forecast

The following methodology was used to forecast water demands for PWP's service area:

1. Obtain projections of single-family, multifamily and employment for PWP's service

2. Estimate current average unit use water factors for single-family, multifamily and commercial/institutional billing categories

3. Adjust unit use water factors for average weather and passive conservation into the future

4. Multiply adjusted unit use water factors by projected demographics in order to forecast water demand by major sector: single-family, multifamily, and commercial/institutional

5. Apply historical non-revenue water percentage (difference between total water production and billed water usage) to the total of single-family, multifamily and commercial/institutional in order to forecast total water needs

A.1 Demographic Projections

The Department of Finance (DOF) prepares official annual estimates of population and housing for cities and counties in California. These estimates are based on actual census data, as well as annual vehicle registration and births/deaths data. The California Employment Development Department (EDD) prepares annual estimates of employment for major metropolitan areas and counties in the state. The Southern California Association of Governments (SCAG) produces long-range projections of population, housing and employment for cities, counties and traffic analysis zones for Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties for its Regional Transportation Plan (RTP).

The Urban Water Management Act requires that water providers use DOF and regional government planning agency demographics for water planning. Because PWP's service area also includes communities outside the city proper, an analysis of census tracts is needed to obtain historical and projected demographics. The Metropolitan Water District (MWD) uses a sophisticated geographic information system (GIS) to allocate historical and projected demographic data from DOF, EDD and SCAG into its member agency service areas, including PWP. To be consistent with MWD's regional planning efforts, as well as to meet California's requirements for urban water management, the demographic data for PWP's service area was obtained.

Table A-1 presents historical and projected demographics for PWP's service area. As shown in the table, the projected annual growth rates from 2010 to 2035 are slower than actual annual growth rates from 2000 to 2010 for population and single-family housing. This is mainly due to the fact that Pasadena is a city that is generally built out in terms of land use. Most future growth will occur in the form of redevelopment and multi-family housing rather than expansion.

Table A-1
Historical and Projected Demographics for PWP Service Area

Year	Population	Single-Family Housing Units	Multifamily Housing Units	Employment
1990	146,840	31,469	26,253	115,710
2005	168,997	34,195	27,316	119,072
2010	175,957	36,560	27,713	124,860
2015	180,691	37,578	28,907	128,985
2020	185,640	38,646	30,184	131,588
2025	190,436	39,420	31,236	134,653
2030	195,089	40,151	32,264	137,921
2035	199,562	40,717	33,157	141,047
Annual Change (1990-2010)	0.9%	0.8%	0.3%	0.4%
Annual Change (2010-2035)	0.5%	0.5%	0.8%	0.5%

Source: DOF, EDD, SCAG, as modified by MWD using a GIS planning tool to allocate demographic data to member agency service areas.

A.2 Unit Use Water Factors

As part of an evaluation of water rates, PWP recently categorized its customers into billing sectors: single-family, multifamily and commercial/institutional (see Figure A-1). This breakdown of customers was then applied to the total billed water use for calendar year 2007. The year 2007 was used to derive an estimate of current water use by billing sector because there was no mandatory or drought-related conservation, but it was current enough to account for programmatic and passive conservation that has already occurred. However, because 2007 was a relatively dry year (rainfall was 60% lower than average), a weather adjustment of -5% was applied to the total 2007 demand. MWD's statistical analysis of water usage indicates that water demands can be ± 5% due to variations in temperature and precipitation.

Because of California's plumbing codes, which requires ultra-low-flush toilets and low-flow showerheads in all new construction, new homes and businesses in Pasadena will be more water efficient than existing homes. Recent studies in Los Angeles and for Southern California suggest that passive conservation will reduce demands by approximately 5% between now and 2035 for Los Angeles County. Table A-2 presents the average unit use water factors that will be used to generate the water demand forecast for PWP's service area.

Table A-2
Average Unit Use Water Factors for PWP Service Area

Billing Sector	2007 Billed Water Use (Acre-Feet/Year)	2007 Demographic Data (homes & employees)	Average Unit Use Water Factor (gallons/day)*	Adjusted Unit Use Water Factor (gallons/day)**
Single-Family	18,759	33,501 *homes*	500	475
Multifamily	6,854	26,206 *homes*	234	222
Commercial	10,462	113,289 *employees*	82	78

* Represents billed water use divided by demographic data, then converted to gallons per day.

** Adjusted by 5% for passive water conservation due to plumbing codes.

The difference between total water production and billed water use represents non-revenue water. Non-revenue water includes water used for fire protection, hydrant flushing, reservoir maintenance, unaccounted for water, and system losses. In 2007, PWP's total water production was 39,168 acre-feet per year (AFY), while its billed water use was 36,075 AFY. Therefore, non-revenue water was 3,093 AFY or 7.9%. Generally any non-revenue water under 8% is considered fairly efficient in California. This is not to say, however, that PWP should not continue to seek more efficiency in reducing unaccounted for water, leaks and how it uses water for hydrant flushing.

To estimate how these unit use water factors are affected by weather and economic recessions, a statistical regression model was used. This model correlated historical monthly water production for PWP against population, temperature, rainfall, and economic recession (unemployment). The regression equation had an R^2 value of 0.84 (a value of 1.0 indicates perfect correlation), which indicates a good statistical fit. When controlling for other factors, the presence of an economic recession reduces water demand by approximately 5 percent.

The Bureau of Labor Statistics tracks employment for metropolitan areas in the U.S., Figure A-1 show unemployment in the Pasadena metropolitan area. As seen in this figure, there were two significant economic recessions in Pasadena since 1990, one starting in 1992 the other starting in late 2008. The one starting in 2008 is still occurring and will likely last until 2011 or maybe longer.

To account for this current economic recession and its impact on water demands, the water use factors in Table A-2 were adjusted downward by 5% in 2010. In 2015, the water use factors were adjusted downward by 3% in 2015, and 1% in 2020. After 2020 the effects of the current economic recession are not expected to have any impacts on water demand.

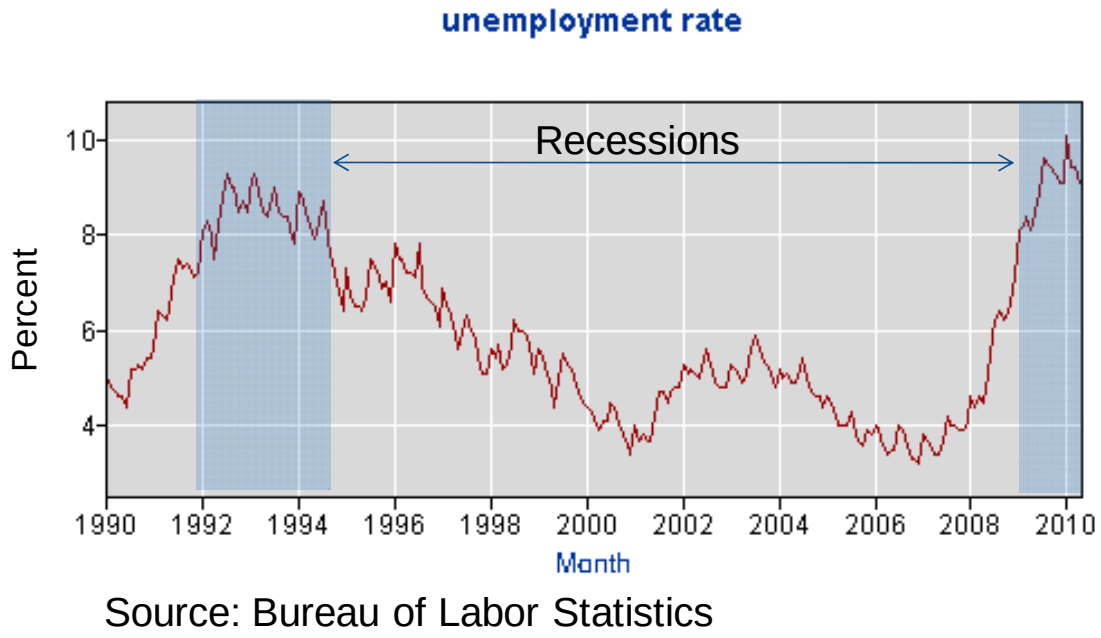

Figure A-1
Economic Recessions in Pasadena Metropolitan Area

A.3 Water Demand Forecast

To generate the water demand forecast for PWP's service area, the adjusted average unit water factors for each billing sector (Table A-2) were multiplied by the corresponding projected demographic (Table A-1). Then the billing sectors were summed and the non-revenue factor of 7.9% was applied in order to estimate future non-revenue water. The formula for calculating non-revenue water is:

Non-Revenue Water = Sum of Billed Water Use x [0.079 ÷ (1 - 0.079)]

Table A-3 presents the water demand forecast for PWP's service area. It should be noted that this demand forecast assumes average historical weather and no future active water conservation. Active water conservation is that in which PWP will accomplish by a combination of future ordinances, rebates, education, and/or water pricing. For the WIRP, future active water conservation is treated as a potential new option that PWP could implement just like a new water supply option (see Appendix B for evaluation of future active water conservation).

Table A-3
Water Demand Forecast for PWP (Acre-Feet per Year)

Sector	2015	2020	2025	2030	2035
Single-Family	19,200	19,900	20,300	20,500	20,600
Multifamily	6,800	7,200	7,400	7,600	7,700
Commercial/Institutional	10,800	11,100	11,300	11,500	11,600
Non Revenue	3,200	3,300	3,400	3,400	3,400
Total	40,000	41,500	42,500	43,000	43,300

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