Appendix L.
Conservation BMPs to Cut Demand of Potable Water

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For communities along the Delaware Estuary, drinking water comes from either groundwater wells accessing underground aquifers or surface water intakes that draw water directly from the Delaware and its tributaries. Yet as the combined effects of continued development and global climate change threaten these sources, new sources of drinking water may eventually be required. In places already dealing with drinking water shortages, numerous alternative techniques are already employed, such as seafront desalinization, wastewater recycling, atmospheric condensers, and massive aqueducts that carry water hundreds of miles to meet demand.

California is one such region. The state's Central Valley Project is a series of dams, canals, levees and reservoirs that divert 2.2 trillion gallons from a water-rich northern California to a water-poor southern California. However, continued population growth has increased southern California's water needs, and new sources have begun to be explored in order to meet the demand.

In a 2008, the Los Angeles Economic Development Corporation released the report *Where Will We Get the Water? Assessing Southern California's Future Water Strategies*. The report examined the costs of implementing different mechanisms in order to meet the water demands of the region. Although the report's findings are specific to projects located in southern California, it does provide some insight into the orders of magnitude of cost difference between these different water procurement strategies.

Table 1: Alternative Water Procurement Strategies

Procurement Strategy	Years to Implement	Capital Costs	Operating Costs	Costs per 1000 Gallons
Water Conservation	0-2	$0	$0.5 M	$0.64
Stormwater Capture	3-5	$40-63 M	$1-3.5 M	$1.07+
Wastewater Recycling	6-10	$480 M	$30 M	$3.07
Ocean Desalination	6-10	$300 M	$37 M	$3.07+
Groundwater Desalination	6-10	$24 M	$0.7 M	$2.30-3.68

Source: Los Angeles Economic Development Corporation, *Where Will We Get the Water?*

According to the 2000 US Census, the 15 counties located along the Delaware Estuary have a combined population of approximately 6.5 million people, with a total drinking water demand of 164 billion gallons per year. Using the strategies listed above, offsetting existing water demand by one percent would cost the region one to six million dollars per year, with water conservation being the least expensive new "source" of drinking water.

Water conservation focuses extensively on the use of best-management practices (BMPs) to reduce water consumption. BMPs are typically highly replicable modifications in

habits and hardware that can easily be implemented by households, businesses and local governments. Individual practices may provide additional benefits beyond water savings as well. Front loading washers can save owners between $44-106 annually in reduced electricity costs, dramatically offsetting the purchase price over the machine's lifetime. As most BMPs reduce water consumption, they also reduce the amount of sewerage to be disposed of as well, improving water quality. However, because BMPs vary dramatically in price, water savings and applicability, it can be difficult to effectively compare BMPs in order to prioritize one over another.

In 2005, the California Urban Water Conservation Council (CUWCC) published a study evaluating the costs and benefits of various water conservation BMPs: automatic irrigation controls, gray water landscaping, front loading washers, hot water recirculation, water metering/submetering, ultra low flush toilets, and residential water audits and fixture retrofits. The following table summarizes their findings, and incorporates an estimated lifespan for each BMP in order to project costs per savings. It assumes that a more expensive installation will yield both higher efficiency and a longer lifespan, leading to an overall higher water savings

Table 1: Water Conservation BMPs – Household Costs & Savings

Best Management Practice	Total Cost Per Installation	Annual Savings Per Household	Estimated Lifespan	Costs Per 1000 Gallons Saved
Automatic Irrigation Controls	$555-820	21%	10-15 years	$4.05 - 4.11
Gray Water Landscaping	$750-5400	11-45%	10-15 years	$10.27 - 12.33
Front Loading Washers	$400-1600	8-16%	5-10 years	$15.22 - 15.27
Hot Water Recirculation	$400-1880	3-16%	5-10 years	$36.53 - 17.76
Metering/ Submetering	$250-750	29-45%	15-20 years	$0.90 - 1.28
Ultra Low Flush Toilets	$189-300	12-15%	15-20 years	$1.51 - 1.63
Residential Water Audit & Retrofit	$52-217	12-18%	5-10 years	$1.36 - 1.85

Source: California Urban Water Conservation Council, *BMP Costs & Savings Study*

The 6.5 million individuals who live in the estuary region live in a variety of different housing situations, ranging from rural farmhouses to suburban cul-de-sacs to townhouses and multifamily apartments in the city. As a result, BMPs have differing levels of applicability. Metering/submetering may offer the highest ratio of savings to cost, yet over three-quarters of the population live in single family homes and most likely already using meters. As a result, metering/submetering is only applicable for households living in multifamily units, reducing the BMP's potential savings. Because of these variations, what may seem to be the most effective BMP from a per-installation cost/savings perspective may be less effective when applied to the region as a whole.

Table 2: Water Conservation BMPs – Regional Savings

Best Management Practice	Targeted Households	Percent of Total Households	Regional Savings	Per Capita Cost of 1% Annual Savings
Automatic Irrigation Controls	Single Family, Detached	45%	10%	$1.02 - 1.04
Gray Water Landscaping	Single Family, Detached	45%	5-21%	$2.60 - 3.12
Front Loading Washers	Single Family	75%	6-13%	$3.85 - 3.86
Hot Water Recirculation	All Households	100%	4-17%	$4.49 - 9.42
Metering/ Submetering	Multifamily Households	25%	8-12%	$0.23 - 0.32
Ultra Low Flush Toilets	All Households	100%	13-16%	$0.38 - 0.41
Residential Water Audit & Retrofit	All Households	100%	13-19%	$0.34 - 0.47

Source: California Urban Water Conservation Council, *BMP Costs & Savings Study*, 2000 US Census

The previous table attempts to estimate the potential savings to the region that each BMP may provide. It assumes that for a given BMP, all targeted households participate. However, with the exception of metering/submetering, these BMPs all require some form of consumer buy-in, making high rates of adoption unrealistic. Beyond their initial purchase price, many of these BMPs also require the inconvenience of an extensive renovation, further disincentivizing widespread adoption. From this perspective, residential water audits and retrofits is perhaps the least invasive BMP. Further, the relatively low costs are often subsidized by water purveyors, at least initially.

Overall, the key challenge of pursuing water conservation is that it relies on making changes to consumer behavior. What the BMPs examined in the CUWCC study are capable of doing, however, is reducing the impact of such change on a consumers lifestyle by increasing the efficiency of residential water use.