Section 8
OPTIONS FOR INCREASED CONSERVATION

Early in the Outlook process, at the time baseline demand forecasts were developed, it was recognized that conservation, water reuse, and other factors would have important impacts on regional demand during the coming years. The baseline demand forecast described in Section 4 is based on average water use factors (average water use per household or employee) during the period from 1996 through 1998, and thus incorporates the effect of conservation programs undertaken through the mid 1990s. These water use factors were reduced in future years in the baseline forecast to account for the continued effects of the 1993 plumbing code anticipated through 2020 (see discussion of code savings, below). However, the baseline projections did not include other potential reductions in water use factors resulting from additional conservation measures. The baseline forecast provided a starting point from which the effects of conservation programs could be measured.

This section presents a look at the possible impacts of conservation activities that could be achieved by utilities and their customers throughout the region from 2000 to 2020. The overall approach to this task involved development of several "conservation scenarios" that represent options for the region. Full achievement of all conservation measures for each of these scenarios was assumed to occur in 2020. The rate at which these measures are implemented, and the resulting water savings will vary from utility to utility.

Each conservation scenario includes:

- A specified quantity of water that could potentially be saved region-wide by utilities and their customers through conservation activities,
- An illustrative list of specific water-saving measures that could generate that quantity of savings (measures listed are intended to demonstrate how water savings *could* be achieved, but are not intended to be prescriptive or all-inclusive), and
- The estimated regional cost of implementing the list of measures for each scenario.

The conservation scenarios developed and the methodology used in developing them are described below. All estimates presented are approximate, based on extrapolation from more detailed documents that have been developed for specific water service areas within the region.

Appropriate Use of Conservation Scenarios

The conservation scenarios presented in this section were developed solely for the purpose of permitting broad comparisons between conservation and other options for addressing water-resource needs in the three-county region. The scenarios represent options that may substitute for or be combined with various other types of options, such as water reuse or development of new municipal water supply sources. Following are some points to note in reviewing these scenarios:

- The conservation scenarios are intended to be illustrative only, in that other combinations of conservation measures could achieve similar results. The levels of water savings and costs presented should be considered as an "order of magnitude" estimate at this time, and will likely require more detailed analysis when considered for implementation by individual utilities.
- The scenarios do not represent a regional plan for conservation, and do not impose requirements for implementation by any entity. However, it is hoped that local and regional decision makers will consider this information with regard to meeting some of the water-resource needs in the region.
- Many important issues would need to be resolved before any form of regional implementation would become feasible. Such issues might include funding mechanisms, coordination among jurisdictions and water suppliers, local control, credit for previous conservation achievements, relationship to existing water rights, and allocation of saved water to meet diverse purposes.
- These conservation scenarios address reductions in regular, long-term uses of water. They do not include emergency curtailment or other measures that may apply during drought years or other "emergency" conditions.
- Much of the conservation savings relies on a significant portion of the region's population (66 to 77 percent) implementing and maintaining all of the conservation measures. Where the conservation measure involves installing "hardware" that results in less water use (i.e., low-flow fixtures and appliances), the water savings should be reasonably predictable. When the conservation measure relies more heavily on behavioral changes (i.e., landscape audits and improved irrigation scheduling), the savings may not be realized or may not be sustained over the long-term.
- Ongoing analysis of conservation effectiveness and continuing education and consumer information programs are key to the long-term success of effective conservation programs.
- It is recognized that ultimate implementation of conservation in the region may include water savings similar to those in any one of the scenarios presented here; or somewhere between the levels contained in these scenarios.

Summary of Conservation Scenarios

Table 8-1 summarizes the four conservation scenarios developed. For each scenario the table presents estimated water savings and costs.

- **Scenario 1** represents an estimate of conservation measures already planned for implementation by utilities throughout the three-county region.
- **Scenario 2** represents the estimated conservation savings that would be needed to keep summer season demand roughly constant from 2000 to 2020, despite projected population growth of 29 percent in areas served by water utilities.
- **Scenario 3** is based on the objective of reducing total, regional summer season demand by 5 percent below 2000 levels.
- **Scenario 4** is based on the objective of reducing total, regional summer season demand by 10 percent below 2000 levels.

Table 8-1: Summary of Conservation Scenarios

Scenario (Percent Reduction in Projected 2020 Summer Season Demand)	Water Savings in 2020 (mgd) [2]			Unit Cost ($/1,000 gallons of summer season savings)		
	Year-round	Summer Season	Peak Day[1]	Average Cost[3]	Range of Costs for Individual Measures[3]	Total Annual Cost ($M/yr)
1) 9% Reduction	40	59	59–73	$1.00	$0.10 to 3.00	$ 7M
2) 13% Reduction	68	92	92–123	$1.00	$0.10 to 2.00	$10M
3) 18% Reduction	93	124	124–166	$2.00	$0.10 to 40.00	$ 32M
4) 22% Reduction	111	149	149–201	$4.00	$0.10 to 80.00	$ 69M

NOTES: Reduction percentages represent reduction in projected 2020 summer season demand. Savings shown are in addition to the substantial reductions in water consumption due to Plumbing Code Savings related to efficient plumbing fixtures and conservation achieved prior to 2000. mgd = million gallons per day

1 Expressed as a range, due to uncertainty in extrapolating summer season savings to peak day.
2 Water savings slightly exceeds targeted reductions for each scenario (% reduction) due to the "bundling" of conservation measures used in the analysis.
3 For example, Scenario 2 includes a bundle of conservation measures that range in cost from $0.10 to $2.00 per 1,000 gallons of water saved. The average cost of all the measures included in Scenario 2 is $1.00 per 1,000 gallons of water.

Together, the four conservation scenarios incorporate approximately 70 individual conservation measures, related to water consumption in the following categories:

- Residential indoor
- Residential outdoor
- Non-residential indoor
- Non-residential outdoor
- Source and distribution efficiencies

Costs presented in Table 8-1 are planning level estimates and will vary by utility. The significant increases in costs from Scenario 1 to Scenarios 2, 3, and 4 illustrate the concept of diminishing returns, i.e., as more conservation is achieved, additional increments of conservation increases rapidly. Therefore, some of these scenarios may not be cost effective when compared to other supply options

The effectiveness of conservation measures is highly dependent on participation levels, which will vary from utility to utility. The water savings presented in the scenarios are based on certain assumptions regarding participation rates by consumers. Generally, scenarios 2 and 3 assume that 66 percent of each group targeted by specific conservation actions will participate.[1] Scenario 4 assumes 77 percent participation.

These participation rates are ambitious. By way of comparison, conservation programs both locally and elsewhere in the nation have achieved 60 percent or more, at least for some program elements. These include Seattle Public Utilities' regional showerhead program, which achieved 65 percent participation in less than one year. The programs outlined in the scenarios are comprehensive, embracing a wide variety of measures involving every category of demand. They are also long-term, generally beyond the length of most water conservation

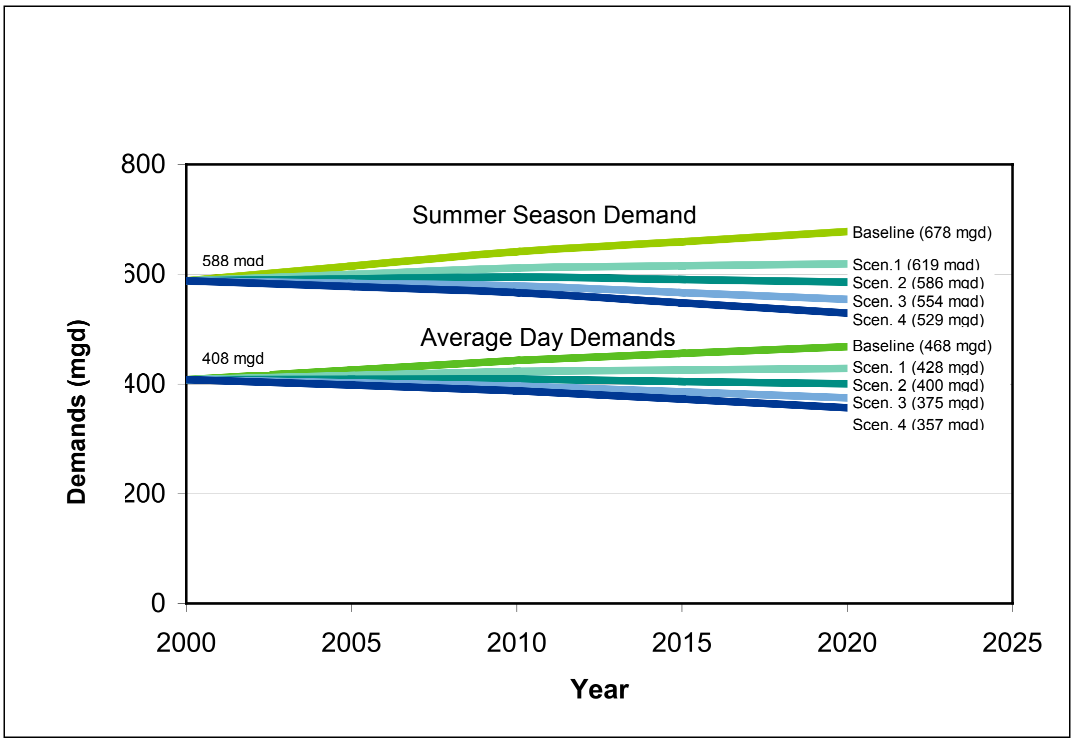
[1] For example, if a measure targets all households in the region, it is assumed 66 percent of all households will participate. In contrast, if a measure targets only single-family households with in-ground irrigation systems, it is assumed that 66 percent of these households will participate.

programs implemented to date. These factors introduce an element of uncertainty regarding the attainability of the participation rates indicated, yet also offer time to grow to these participation levels.

As part of its 1998 Conservation Potential Assessment (CPA), Seattle Public Utilities conducted focus groups and surveys of its residential and nonresidential customers to evaluate the levels of participation that could be expected in a long-term conservation effort. A review of program experience by other utilities was also conducted to confirm those survey and focus group findings (the reports and professional papers reviewed are cited in the CPA report). This work resulted in assumptions regarding participation rates ranging from 10 to 95 percent, depending on the specific conservation measure involved. For most measures in the CPA, participation rates of between 50 and 80 percent were assumed.

Figure 8-1 shows the effect of each of the scenarios as compared with the "baseline" average day demand (ADD) and the summer season demand forecast for the region. It should be noted that the baseline demand and demand indicated for each conservation scenario in Figure 8-1 include only the 158 surveyed utilities and are therefore less than the total regional baseline demand forecast. Conservation savings for smaller utilities and private wells were not estimated. For the purposes of the projections shown in Figure 8-1, it was assumed that conservation savings would be achieved at a constant rate over the 20-year period.

Figure 8-1: Average Day Demands and Summer Season Demands under Four Conservation Scenarios, with Outlook Baseline Demand for Comparison



NOTE: 2020 baseline demand and demand for each scenario include only the 158 surveyed utilities and are therefore less than the total regional baseline demand forecast. Conservation savings for smaller utilities and private wells were not estimated.

In developing these regional scenarios, information was not available regarding the volume of surface water flows necessary for healthy populations of salmon or other aquatic species, including species listed under the Endangered Species Act (ESA). Water suppliers and local governments may be responsible for responding to ESA listings on an individual basis, where applicable. The scenarios presented here should not be interpreted as guaranteeing compliance with Endangered Species Act requirements. As additional information becomes available in the future, additional scenarios may need to be developed.

A number of key issues related to regional water conservation were identified for further examination, and are described at the end of this section.

Key Elements of Conservation Scenarios

In developing the conservation scenarios, a distinction is made between the following elements of a conservation program:

- **Conservation Actions:** Actions that directly reduce water use or losses. Conservation measures may include actions such as watering turf less frequently, installation of low-flush toilets in a commercial building, or repair of leaking water mains.
- **Delivery Mechanisms:** Activities that inform or persuade consumers to implement conservation actions. Delivery mechanisms include advertising campaigns, distribution of brochures that inform consumers of the benefits of conservation, rebate programs that provide an economic incentive to install efficient plumbing fixtures, local ordinances that require certain types of landscape materials, etc. Delivery mechanisms do not save water themselves, but they increase participation by consumers in carrying out water-saving actions.
- **Metering, Pricing, and Rate Structures:** Techniques that provide a general economic incentive to reduce water use, but do not target any specific water-using activity. For example, increasing-block rate structures make it more expensive to consume large quantities of water. Like delivery mechanisms, these techniques do not save water directly, but encourage consumers to carry out water-saving actions.
- **Program Support:** Activities that improve measurement and management of water demand. For example, these activities may include conservation planning, routine analysis of water consumption data, and research to improve conservation actions or delivery mechanisms.

All of these elements are important in developing, implementing, and supporting conservation programs. However, in the conservation scenarios presented in this report, only the costs and water savings associated with conservation actions are presented. This is done to avoid potential double-counting of water savings. The savings associated with the other three categories are considered to be embedded in the scenario savings, because elements such as pricing are essential in getting consumers to carry out the specific water-saving actions.

The other three elements—delivery mechanisms; metering, pricing, and rate structures; and program support—are considered topics for further examination related to feasibility and implementation of conservation programs, and are discussed at the end of this section. This is not intended to minimize the importance of these issues. To the contrary, the delivery systems, economic incentives, and program support are essential in ensuring that the objectives of any conservation program can be met. However, these aspects of implementation necessarily involve policy issues and implementation considerations that are outside the scope of the Outlook at this time.

Conservation Scenarios

The regional conservation scenarios developed for the Outlook are presented below. For each scenario, there is an estimated level of savings and a group of illustrative measures and costs associated with that level of savings. All values should be considered to be approximations, based on extrapolation from more detailed documents.

Conservation can reduce withdrawals from surface and groundwater sources, or can allow saved water to be stored and potentially conveyed to various areas within the region, to meet specific needs related to environmental quality and/or regional development. The conservation scenarios described below offer flexibility for policy determinations, in that they do not specify the ultimate uses of the water saved.

Water conservation is an important tool to help citizens, businesses, and governments meet their needs while limiting environmental impacts. At a time when the Endangered Species Act has identified salmon populations as a key priority, and demographic forecasts project rapid population growth, this tool becomes more important than ever before. In developing these scenarios, information was not available regarding the volume of water savings necessary to minimize the effects of water withdrawals on salmon populations. The scenarios presented here should not be interpreted as guaranteeing compliance with Endangered Species Act requirements. As additional information becomes available in the future, additional scenarios may need to be developed.

In the interim, it is important to identify approaches that manage water resources both for people and fish. For the purposes of the Outlook, this suggests that water conservation during the summer months should be a higher priority than conservation at other times. Flows in the region's surface waters are at their lowest during the late summer and early fall. Withdrawals at this time generally are expected to have a greater proportional impact on flows, compared with withdrawals during the winter months. Therefore, actions that reduce demand for water during the summer offer greater potential to improve instream flows.

Reducing demand during the summer also offers benefits in managing municipal water systems. Municipal demands are highest in the summer months. Many systems face production constraints in the summer as demand approaches production capacity. Reductions in summer demand can therefore reduce or delay the need for new capacity to meet the needs of a growing population.

Water consumption can be examined in terms of (1) average daily demand throughout the year, (2) differing daily demands that occur during the summer (peak) season compared with the rest of the year, or (3) maximum day demands that occur on the single highest water-using day of the year. Each of these measures is used in water system planning for different purposes. In the Outlook, water savings were analyzed primarily in terms of average day savings and summer daily savings. However, the summer season savings are also transformed into estimated maximum day savings in order to allow comparison with the maximum day demand forecasts contained in the Outlook.

Use of summer season savings is more relevant to the concept of "water for people and water for fish." Summer season savings more accurately reflects the potential for reduction in water use when instream water needs are the highest. It is important to note that many of the conservation measures available will cause reductions in water use year-round, not just during the summer period.

Conversion between savings expressed for the summer season, and savings on the peak day was based on production ratios for municipal water supply. Production on the maximum day is typically about 1.35 times higher than production on the average summer day.[2] This factor of 1.35 was used to convert maximum day levels to estimated summer season daily demand, and vice versa. This approach has significant limitations. The conservation savings result from the implementation of many individual measures. Some of these measures may have an increased impact on the highest water-using day of the year, compared with the average day in the summer season. However, this increased impact may or may not be in proportion to the increased usage on the maximum day. In addition, other measures (e.g., many indoor domestic measures) do not have an increased impact on the highest-water using day of the summer. Despite its limitations, this technique was deemed acceptable for developing order of magnitude estimates of savings on the maximum day. Due to the uncertainty in maximum day savings, these savings are expressed as a range, from a low value that is the same as the average summer season savings, to a high value that is 1.35 times higher than the average summer season savings. This range of savings is reflected in Table 8-1. Further information is presented in Appendix B.

Demand can also be analyzed in terms of per capita consumption of water, such as gallons per capita per day (gpcd). In the Outlook, per capita savings are presented solely as a means of relating the total savings to quantities that are easier to visualize. The per capita figure reflects an average of water uses in diverse sectors, such as household use, commercial use, industrial use, schools, parks, and systems operations. Per capita use varies widely from one locale to another, due to the different makeup of water-using activities in urban, suburban, and semi-rural communities around the region (see Figure 8-5). Based on a projected 2020 population of 3.6 million served by utilities in the region, the regional baseline projection of average day demand in 2020 (468 mgd) is equivalent to a per capita demand of 130 gpcd.

As noted previously, the water savings presented are based on certain assumptions regarding rates of participation by consumers. Generally, scenarios 2 and 3 assume that 66 percent of each group targeted by specific conservation actions will participate. Scenario 4 assumes 77 percent participation. These rates are generally higher than those experienced in other regions, and will likely require a combination of incentives to achieve. The costs presented for the various scenarios may not fully reflect the costs of achieving these participation rates.

Water Savings Levels Defined for Each Scenario

Scenario 1: 9% Reduction in Summer Season Demand in 2020

Scenario 1 would achieve a 9 percent reduction in summer season demand, compared with the baseline projections in the Outlook.[3] This scenario was developed in order to account for the estimated water savings projected in existing conservation programs in the region. For example, the regional conservation programs under way for Seattle, Everett, Tacoma, and their wholesale customers were included in this estimate, as well as an estimate of conservation programs planned by other utilities in the region that are not served by one of these regional suppliers. These conservation programs are planned for implementation in coming years; however, the conservation savings have not yet been achieved, and will require continued funding and sustained efforts on the part of the respective water suppliers and their customers.

[2] Based on data from Everett, Tacoma, and Seattle water systems, this factor is approximately 1.36, 1.28, and 1.40, respectively.

[3] As noted above, summer season daily demands were estimated by dividing the Outlook projection of Maximum Day Demand by a factor of 1.35.

Table 8-1, above, presents the results for Scenario 1, together with the other three scenarios. The data used to develop Scenario 1 are summarized in Table 8-2, below.

Under Scenario 1, average day savings year-round are estimated to be 40 mgd. The total average day demand projected for utilities in the region in 2020 would be reduced to 428 mgd (see Figure 8-1). This is equivalent to a per capita demand of 118 gallons per capita per day on a year-round basis.

There are additional actions involving water reuse that will add to the savings totals listed in Table 8-2. These include industrial water reuse projects planned at the Kimberly-Clark mill in Everett and the Kraft mill in Tacoma, as well as a number of other projects in Pierce, King, and Snohomish Counties. These projects are projected to add up to approximately 30 mgd in average day water savings. These savings will be presented in Section 10, Water Reuse Options.

Table 8-2: Projection of Existing Conservation Programs (Basis for Scenario 1)

	ADD Savings (mgd)				Summer Season Savings (mgd)				MDD Savings [1] (mgd)			
	2005	2010	2015	2020	2005	2010	2015	2020	2005	2010	2015	2020
Seattle System (including wholesale customers) [2]	6.2	12.3	17.0	21.6	9.8	19.5	26.8	34.0	12.2	24.3	33.1	41.9
Everett System (including wholesale customers) [3]	1.6	3.2	3.8	3.6	2.2	4.0	4.4	4.3	3.0	5.4	5.9	5.8
Tacoma System (including wholesale customers) [4]	2.9	5.9	8.1	11.1	3.7	7.7	10.7	14.6	4.3	9.0	13.1	18.4
Estimate of Other Systems in Region [5]	1.2	2.4	3.2	4.0	1.7	3.5	4.7	5.9	2.2	4.3	5.8	7.3
Total Savings	12	24	32	40	17	35	47	59	22	43.	58	73

mgd = million gallons per day ADD = Average Day Demand MDD = Maximum Day Demand

1 MDD savings cannot be determined directly from the measures analysis. It is assumed that MDD savings are proportional to seasonal savings, in the same ratio as Maximum Day Demand to seasonal day demand. Based on production data from Seattle, Everett, and Tacoma, this ratio is 1.35.

2 Includes savings from 1% Conservation Program, extended to 2020, plus reduction in non-revenue water associated with reservoir-covering program and reduced reservoir cleaning/overflowing due to completion of Tolt Filtration Plant (SPU Draft Water System Plan, July 2000, Chapter 2.3.3)

3 Does not include Kimberly-Clark conservation program involving reclaimed water (additional 4 mgd). These savings are shown separately, related to reuse projects in region.

4 Does not include Simpson Tacoma Kraft conservation program efforts (additional 2–3 mgd). These savings are shown separately, related to reuse projects in region.

5 Other systems in region serve a population that is 34% of the sum of the 3 large regional systems. For purposes of this estimate, it is assumed that other systems' adopted conservation plans, on average, achieve proportional savings that are 1/3 the intensity of the large regional systems' plans. Based on this assumption, the savings associated with other systems are estimated to be approximately 11% of the savings associated with the 3 large regional systems.

Scenario 2: 13% Reduction in Summer Season Demand in 2020

Scenario 2 is designed to reduce 2020 summer season demand in the three-county region by approximately 13 percent. This is roughly equivalent to the increase in summer season demand between 2000 and 2020. This would require summer season daily savings of approximately 90 mgd[4] (roughly equivalent to 121 mgd in maximum day savings).

The maximum day demand numbers given in the Outlook already reflect plumbing code savings. Regional water savings needed to meet the goal were expressed as a total volume, a percent reduction, and a regional per capita value. Only demand associated with utilities surveyed in the Outlook was considered.

Under Scenario 2, average day savings year-round are estimated to be 68 mgd. The total ADD projected for the region in 2020 would be reduced to 400 mgd (see Figure 8-1). This is equivalent to a per capita demand of 111 gallons per capita per day on a year-round basis.

The amount of conservation savings associated with Scenario 2 is comparable to that anticipated in Seattle's "1% Conservation Program" (10% reduction over 10 years, affecting roughly 42 percent of the regional population). It is equivalent to a 2020 regional per capita MDD of 220 gallons per capita per day.[5]

Table 8-1, above, summarizes findings for Scenario 2 in comparison with the other three scenarios. Illustrative measures to achieve all scenarios are described in Appendix B.

Scenario 3: 18% Reduction in Summer Season Demand in 2020

Scenario 3 is designed to reduce 2020 summer season demand in the three-county region by approximately 18 percent. This scenario requires a total reduction of approximately 119 mgd in summer season daily demand (roughly equivalent to 161 mgd in MDD) by 2020, compared with baseline conditions. It is equivalent to a 2020 regional per capita MDD of 209 gallons per capita per day.

Scenario 3 is based on the objective of reducing summer season demand by five percent below 2000 levels. This is equivalent to an 18 percent reduction in 2020 projected summer demand. This scenario requires a total reduction of approximately 119 mgd[6] in summer season daily demand by 2020, compared with baseline conditions.

Under Scenario 3, average day savings year-round are estimated to be 93 mgd. The total ADD projected for the region in 2020 would be reduced to 375 mgd (see Figure 8-1). This is equivalent to a per capita demand of 104 gallons per capita per day on a year-round basis.

Table 8-1 summarizes findings for Scenario 3, in comparison with the other three scenarios. Illustrative measures to achieve all scenarios are included in Appendix B.

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[4] The value reported in Table 8-1 is slightly higher, because the combination of measures grouped together for Scenario 2 adds up to 92 mgd in savings, slightly exceeding the goal of 90 mgd.

[5] It should be noted that per capita savings are presented solely as a means of relating the total savings to quantities that are easier to visualize. The per capita figure averages uses in diverse sectors, such as household use, commercial use, industrial use, schools, parks, and system operations. Per capita use varies widely from one locale to another, due to the different makeup of water-using activities in urban, suburban, and semi-rural communities around the region.

[6] The value reported in Table 1 is slightly higher, because the combination of measures grouped together for Scenario 3 adds up to 124 mgd in savings, slightly exceeding the goal of 119 mgd.

Scenario 4: 23% Reduction in Summer Season Demand in 2020

Scenario 4 is based on the objective of reducing summer demand by ten percent below 2000 levels. This is equivalent to a 22% reduction in 2020 projected summer demand. This scenario requires a total reduction of approximately 148 mgd in summer season daily demand by the 2020, compared with baseline conditions.

Under Scenario 4, average day savings year-round are estimated to be 111 mgd. The total ADD projected for the region in 2020 would be reduced to 357 mgd (Figure 8-1). This is equivalent to a per capita demand of 99 gallons per capita per day on a year-round basis.

Scenario 4 is designed to reduce 2020 summer season demand in the three-county region by approximately 23 percent. This scenario requires a total reduction of approximately 148 mgd (roughly equivalent to 200 mgd in MDD) by 2020, compared with baseline conditions. It is equivalent to a 2020 regional per capita MDD of 198 gallons per capita per day.

Table 8-1 summarizes findings for Scenario 4, in comparison with the other three scenarios. Illustrative measures to achieve all scenarios are included in Appendix B. Scenario 4 includes an adjustment in the assumed participation rate, from 66 percent (level in Scenarios 2 and 3) to 77 percent.

Sources of Information on Water Savings and Costs

In developing the conservation scenarios, the Outlook relies on existing sources of information on to conservation opportunities in the region. In particular, the Conservation Potential Assessment (CPA) produced by Seattle Public Utilities in 1998 served as a source of information regarding conservation measures, target populations, quantities of water that can be achieved by each measure, and costs of each measure. Generally, all of the measures included in the CPA's "technical potential savings package" are also included in the conservation scenarios presented here (however, some of the CPA measures have been combined together).

The CPA covers Seattle and its wholesale customers, and is therefore representative of conservation opportunities affecting approximately 42 percent of the three-county regional population in 2000. For purposes of developing regional conservation scenarios, the opportunities estimated in the CPA were extrapolated to cover the entire population served by water utilities covered by the Outlook. This extrapolation therefore covers approximately 91 percent of the regional population.

The extrapolation for Scenarios 2, 3, and 4 was carried out as follows:

- For each residential measure listed in the CPA, the target number of households affected in the Seattle/purveyor service area was identified.
- For each non-residential measure, the target number of accounts affected in the Seattle/purveyor service area was identified. This number of accounts was transformed into an estimated number of employees, using the assumption of 35 employees per non-residential account (this was necessary because the Outlook has information on regional employment, but not regional number of accounts).
- Based on the number of households and employees in the three-county region estimated in the Outlook using Puget Sound Regional Council (PSRC) data, the estimates of households and employees affected by each conservation measure were extrapolated to a regional total.

- For each measure, a specific targeted group was identified. A 66 percent participation rate was applied to the targeted group for each measure. Water savings and costs were calculated based on this participation rate.
- For each measure, the water savings per household and water savings per employee were estimated using values reported in the CPA.
- It was assumed that for measures involving landscape irrigation, water savings per household and per employee would generally be higher in the region as a whole, than in the Seattle and purveyor service area used in the CPA. This is due to larger lot sizes and more extensive landscaped areas in the region as a whole. Therefore, a 20 percent additional savings was applied to the unit savings estimated for each of these irrigation-related measures.
- A similar adjustment was made for measures affecting industrial customers. In this case the adjustment was downward. The unit savings for industrial measures was reduced by 20 percent to account for presumed differences between the service area covered in the CPA and service areas in the region as a whole.
- For each measure, the cost per household and cost per employee were estimated using values reported in the CPA.
- Total water savings and costs in the three-county region were then estimated by multiplying the extrapolated numbers of households and employees affected by each measure, by the water savings and costs identified.

Some additional measures included in the scenarios were not contained in the CPA. Similar approaches were used for these measures, but using data contained in other sources, such as the conservation plan developed for Everett and its wholesale customers, and estimates based on the experience of Conservation Workgroup members.

The result of this process was an estimated water savings and cost for each of approximately 90 individual measures evaluated, covering five demand categories:

- Residential indoor use
- Residential outdoor use
- Non-residential indoor use
- Non-residential outdoor use
- Source/distribution efficiencies

The costs estimated for Scenario 1 were developed using a different approach. This scenario represents the projected water savings and costs associated with conservation programs that have already been defined by water utilities in the three-county region (see Table 8-2). Water savings and costs were obtained directly from the largest three regional water purveyors, Everett, Seattle, and Tacoma, based on their conservation plans for their retail and wholesale service areas. Estimated water savings are shown in Table 8-2. Costs reported were $5.5 million for Seattle, and $450,000 each for Everett and Tacoma.

Existing conservation programs were estimated for the remaining utilities in the region (i.e., those not served by one of the three sources listed above). This estimate of water savings and costs was based on the proportion of regional population served by other utilities, and the assumption that these utilities have planned conservation programs that will achieve, on average, one-third the intensity of programs planned by the three large regional systems.

Descriptions of all individual measures used are presented in Appendix B. Detailed information used in calculations for all of these measures is also presented in Appendix B.

Measures Used to Develop Conservation Scenarios

Once the water savings and costs of individual measures had been estimated for the three-county region, these savings and costs were grouped together to meet the quantitative water savings established for each scenario (see above). The measures were arrayed in order based on cost per thousand gallons of water saved during the summer season. The lowest-cost grouping of measures was identified for Scenarios 2, 3 and 4, respectively (see Appendix B). Care was taken to avoid any duplicative measures. The total water savings and cost of each of these groupings was then determined for each scenario, as summarized in Table 8-1.

As mentioned above, Scenario 1 was developed using a different approach. This scenario represents the projected water savings and costs associated with conservation programs that have already been defined by water utilities in the three-county region (see Table 8-2). Water savings and costs were obtained directly from the largest three regional water purveyors, Everett, Seattle, and Tacoma, based on their conservation plans for their retail and wholesale service areas. Water savings and cost for existing conservation programs for the remaining utilities in the region were estimated. This estimate was based on the proportion of regional population served by other utilities, and the assumption that these utilities have planned conservation programs that on average achieve one-third the intensity of programs planned by the three large regional systems.

Background on Regional Conditions

Geographic Variation in Water Consumption

In terms of demographics and economic activity, the Central Puget Sound region is highly diverse. Communities within the region range from densely populated urban centers to unincorporated rural areas. Income levels vary widely, as do patterns of housing and employment.

Water use throughout the region mirrors this diversity. A variety of factors combine to produce differing levels of water use. Some of these factors include:

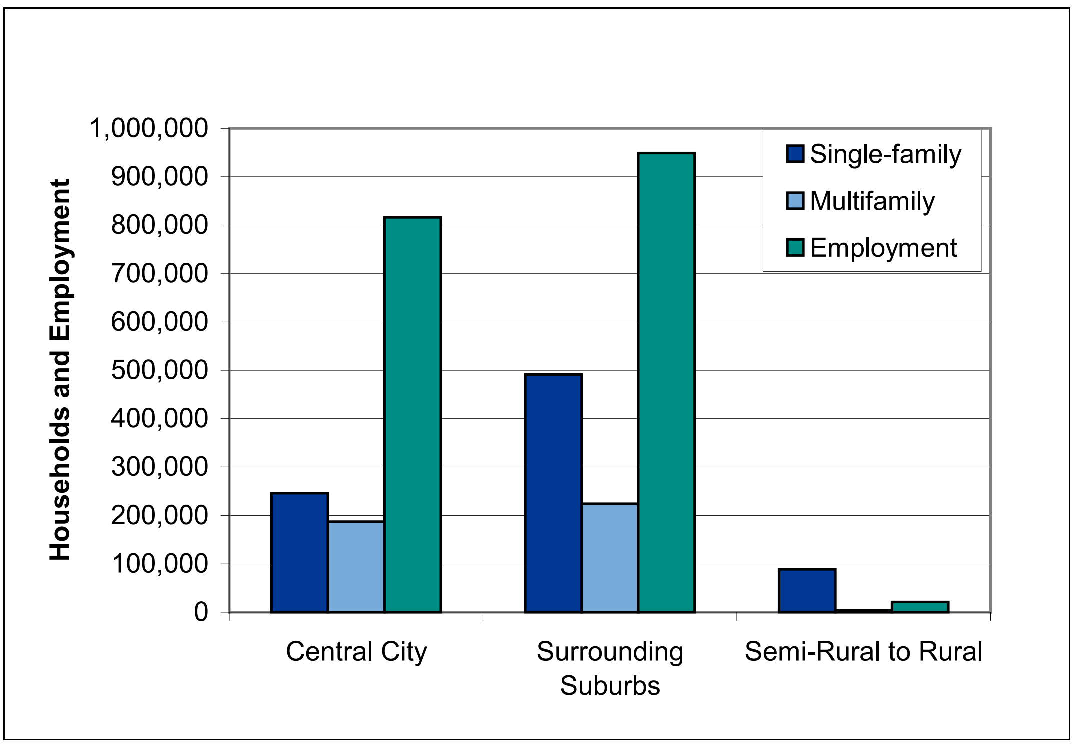
- **Lot size:** Occupants of larger lots generally use more water than occupants of smaller lots, assuming similar landscape design and materials;
- **Industrial activity:** Some major industrial facilities require substantial quantities of water, due to the nature of the manufacturing process.
- **Mix of employment and residential population:** Some areas are primarily residential in nature; while others include a mix of residential and economic uses of water.
- **Mix of single-family and multifamily residences:** Single-family household units generally use more water than multifamily household units (i.e., apartment units, condominiums, etc.).
- **Income level:** Higher income levels generally result in higher water consumption.

Figures 8-2 through 8-5 display how water consumption varies among central city, suburban areas, and rural to semi-rural areas in the three-county region.[7] These patterns affect the opportunities for water conservation in the region, both in terms of groups that could be targeted for water savings, and the specific measures, levels of water savings, and costs of implementing conservation.

Together, these figures illustrate several important points:

- Most people live and work in the suburban areas surrounding the region's central cities. However, more people are employed within the central cities than live there. The central cities also have a higher proportion of residents living in multifamily units than the other areas.
- Water demands reflect the varying demographic and economic characteristics of the regional areas. For example, water use per employee is higher in the central cities, due to the higher concentration of commercial and industrial customers. Water use per household reflects differences between development patterns in the central cities, suburbs, and semi-rural areas.
- Overall per capita use is greatest in the urban areas because of the relatively greater nonresidential use for the given resident population.
- The ratio of peak water use to average annual use is higher in the suburban areas because of greater relative use of water for irrigation.

Figure 8-2: Regional Number of Households and Employees by Type of Demographic Area



[7] Source of data: Regional Water Supply Outlook projections.

Figure 8-3: Regional Daily Demand per Household and per Employee by Demographic Area

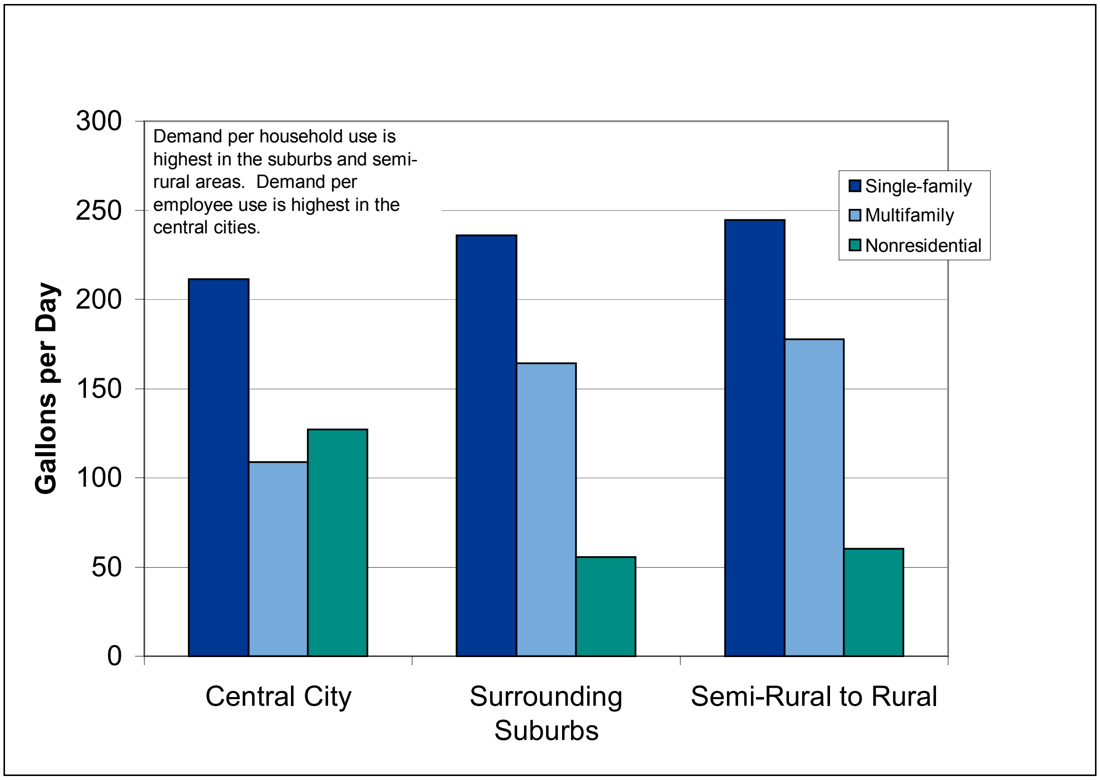


Figure 8-4: Regional Average Daily Water Demand by Demographic Area

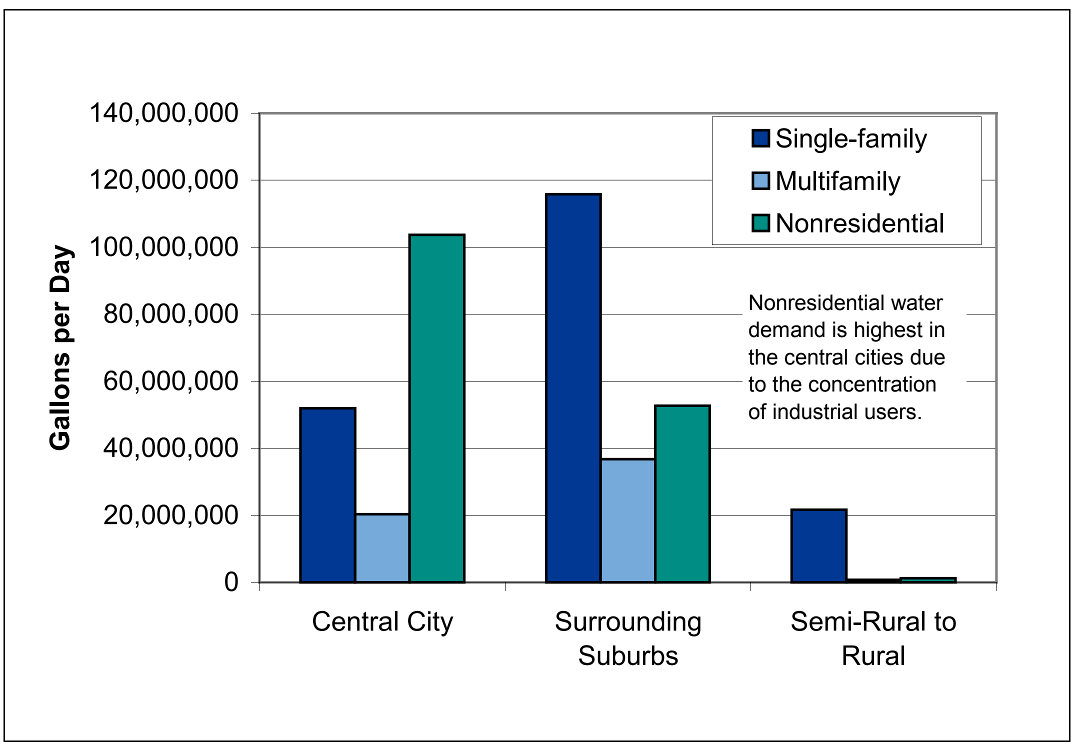
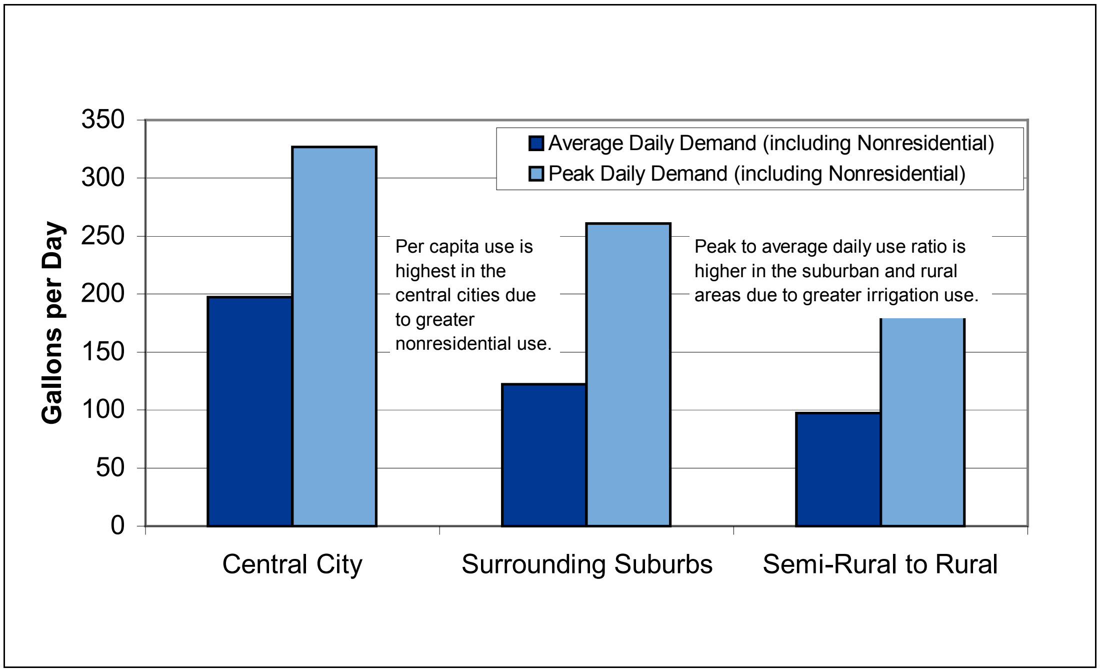


Figure 8-5: Regional Daily per Capita Demand (Average and Peak) by Demographic Area



Seasonal Variation in Water Consumption

Western Washington exhibits strong seasonal patterns of temperature and precipitation, and these patterns have a pronounced effect on demand for water (Figure 8-6). During the wet winter months water use supports domestic needs and economic activity. During the dry summer months additional water-using activities occur, such as watering of turf and landscape materials, cooling of offices and other structures, increased washing of vehicles, use of outdoor swimming pools, etc. This results in increased demands during the summer season.

The seasonality of water consumption is important in conservation planning. Conservation measures targeting "base use" (i.e., uses that occur in both winter and summer) have the effect of reducing both winter and summer consumption. Measures that target "seasonal use" are effective in reducing the summer peak, but do not save water during the winter months. Both base use and seasonal use are appropriate targets for conservation, but they must be analyzed separately to understand the full effects.

Figure 8-7 shows the breakdown of seasonal water uses (data is for Seattle and Seattle Purveyors only).

Figure 8-6: Seasonal Pattern of Demand (Seattle and Seattle Purveyors Only)

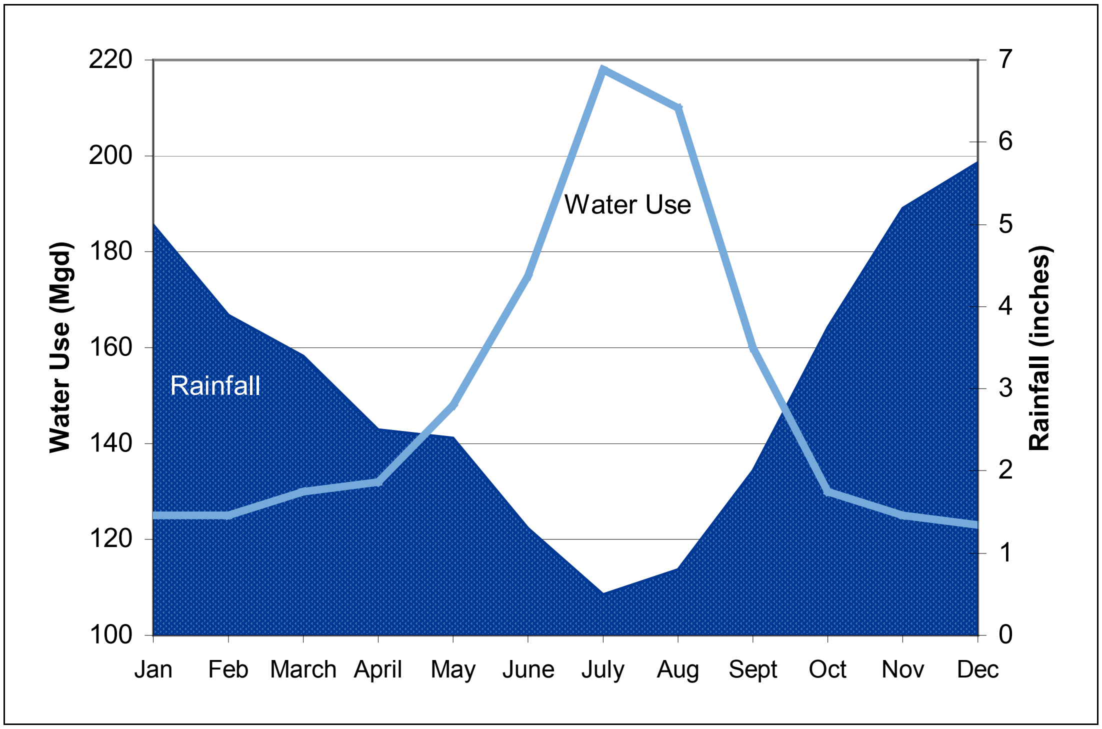
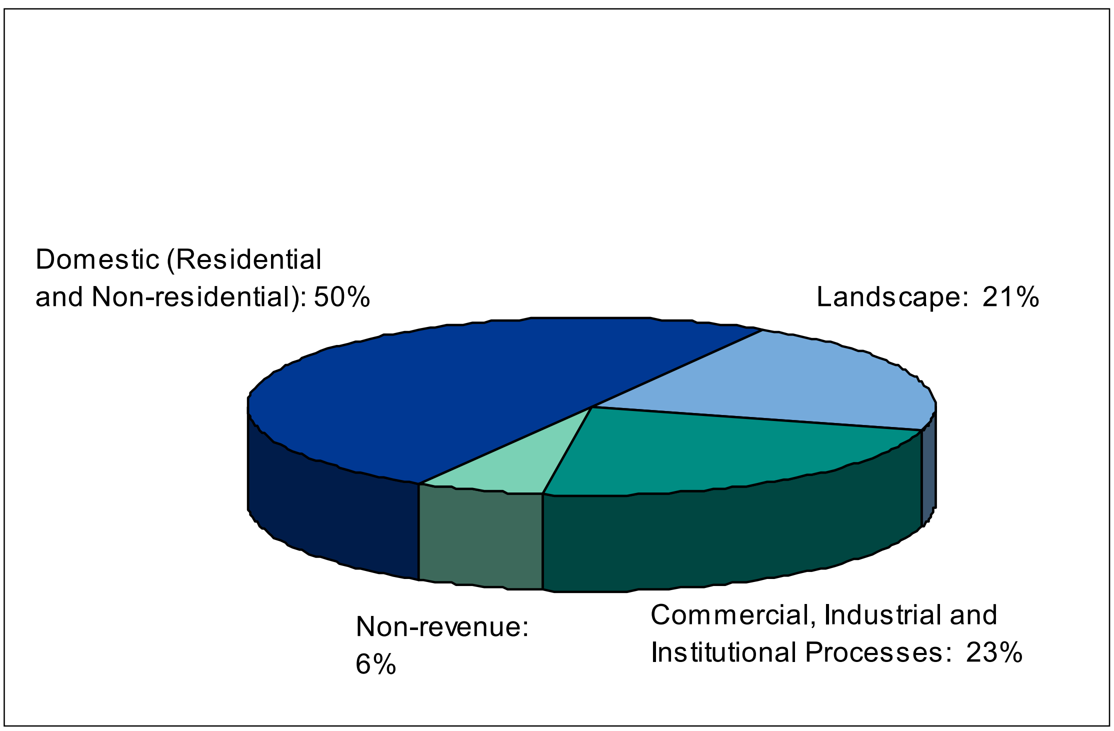


Figure 8-7: End Uses of Peak Season Water Use



Current Status of Conservation Programs

The nature and extent of conservation programs implemented in King, Pierce, and Snohomish Counties also vary widely. State guidelines require that public water systems evaluate a range of conservation measures to determine whether they are cost-effective for implementation. In some parts of the region, conservation programs have been designed for groups of water systems that rely on a common source, such as the City of Everett and its wholesale customers. In other areas, each water system has developed its own approach to conservation. Generally the smaller utilities in the region have fewer staff and less funding available for conservation programs, compared with large systems. Regardless of the approach, water systems must count on the cooperation and interest of consumers, and political acceptance of elected officials and others, in order for conservation programs to be effective.

Appendix B provides an estimate of the extent of current (as of year 2000) conservation activities being implemented by water utilities in King, Pierce, and Snohomish Counties. Measures are assessed for both small utilities and medium to large utilities. The information contained in Appendix B was based on review of existing regional conservation plans associated with Seattle, Everett, and Tacoma and their respective wholesale customers; preliminary information from a survey of water utilities in the Northwest undertaken by the American Water Works Association, Pacific Northwest Section; and general experience of Conservation Workgroup members.

In addition to the measures already implemented to varying degrees within the region, many water systems have identified further conservation activities for the coming years. For example, Seattle and its wholesale purveyors have committed to a "1% Conservation Program," which is projected to reduce per capita demand by 1 percent per year over a 10-year period. Similarly, Everett, Tacoma, their wholesale customers, and many other utilities throughout the region have new or ongoing programs that will continue to reduce demand within the region.

Key Issues for Conservation Options

Preparation of the Outlook included developing the conservation options described in this section. However, a number of key issues remain to be addressed to enhance conservation achievements in the region. Many of these issues concern fundamental aspects of implementing conservation on a local and regional basis. As a stimulus to further discussion of regional aspects of water conservation in King, Pierce, and Snohomish Counties, this section provides a brief summary of those key issues.

Political Acceptance of Conservation Objectives and Approaches

Many of the conservation scenarios described in this document would require substantial increases in funding, staffing, and consumer participation throughout the region, compared with current levels. However, current conservation levels vary throughout the region. Some of the measures envisioned would also require changes in land-use practices, building codes, and local ordinances. If these types of changes are to occur, broad political acceptance is necessary. The importance of political acceptance often begins with the public, and carries through to the local and state elected officials who have the authority to commit public resources to conservation activities. Even in areas where water is delivered by special-purpose districts, the elected officials of local cities and counties need to be involved in changes that would result in increased conservation.

Elected officials receive many signals from the electorate, and these signals are sometimes conflicting. For example, the public may express objectives of: (1) improving the environment, (2) reducing the role of government in private decisions, and (3) keeping rates and taxes low. To achieve broad political acceptance, any effort to expand conservation activities must somehow balance these multiple mandates.

Political acceptance requires recognition of the roles water conservation can play in achieving important objectives such as restoring and maintaining fish runs in the region, and meeting the municipal water supply needs of a growing population. It also requires an understanding of the limitations of conservation for achieving these goals. In addition, both the public and elected officials need clear and accurate information regarding the costs of conservation activities, effects on utility rates, and possible effects on lifestyles. Political acceptance also hinges on questions such as the balance between government requirements and individual choice, and the degree of control by local governments as opposed to state agencies or regional organizations. All of these issues are closely related to other topics discussed in this section, such as education and outreach, pricing and rate structures, and regional coordination/local control issues (see below).

Education and Outreach

Education and outreach play a vital role in any successful conservation program. Education is needed not only to inform the public, but also to ensure that elected officials, utility managers, and state regulators are well informed regarding both the opportunities and the challenges involving water conservation.

With regard to regional conservation activities pursuant to the scenarios discussed within this document, several aspects of education will be important. These include:

- Ensuring that elected officials (city council members, utility board members, etc.) across the region are well-informed regarding the linkages between conservation activities and broader public objectives such as fish restoration and provision of municipal water supply.
- Providing information to the public regarding how their uses of water affect environmental quality, and overcoming the perception some consumers may have that conservation is unnecessary because the Puget Sound region has a rainy climate.
- Improving consumer understanding of the economics of conservation in the short- and long-term, for both residential and non-residential consumers. This includes elements such as the relationship between water use and utility bills (water, sewer, and power), and understanding the full life-cycle cost savings associated with water-efficient appliances.
- Providing accurate and understandable information to residential and non-residential consumers regarding available conservation techniques.
- Improving information and training available to water utility management and staff regarding conservation techniques and “revenue-neutral” conservation rate structures, particularly at smaller utilities within the region that have not yet had extensive experience with conservation.

- Informing members of key industries such as development, construction, landscaping, irrigation, retail nurseries, home-improvement outlets, and others of the ways conservation can be effectively incorporated into their routine practices without compromising profitability.
- Increased attention to water resource issues in youth education programs.

Effects of Pricing and Rate Structures on Consumer Choices

Water rates play an important role in influencing consumer behavior with respect to conservation. Numerous studies have demonstrated that both the overall price of water and the rate structure affect consumer choices with respect to day-to-day water uses in residential and non-residential settings, as well as choices of water-using appliances, landscaping, etc. Combining a well-designed rate structure with effective conservation programs and outreach information can yield synergies that increase the effectiveness of each element.

Generally, consumers are expected to use less water if the price is higher, particular with regard to "discretionary" uses such as outdoor watering (although this may not apply to some more affluent customers). Rate structures can be designed to emphasize price signals at higher rates of consumption. For example, inclined block rates charge more per gallon at higher levels of consumption. Seasonal rates typically charge more per gallon during the summer months than during the winter months, above a certain base quantity designed to provide for minimum domestic needs.

Billing practices are also important in this regard. It is common in the region for water utilities to issue bills every other month, and water bills may be combined with bills for sewer and other services. Because of these practices, customers may find it difficult to recognize the impact of water consumption on their monthly bill, and therefore may not act to reduce water consumption during the peak season when reductions are most valuable. A change in billing practices would require a corresponding change in meter-reading practices. Estimates of costs for such changes in meter-reading and billing practices have not been developed for the Outlook.

Rate levels and rate structures vary widely, depending on the circumstances of particular utilities in the region. Many utilities have already adopted rate structures designed to send appropriate price signals to customers and thereby encourage conservation. For other utilities, changes in rate structures, metering, and billing practices would be needed to achieve the participation rates envisioned in the conservation scenarios presented in the Outlook.

The conservation scenarios described incorporate participation rates that are high relative to participation achieved in many other areas that have promoted conservation. These participation rates are unlikely to be achievable unless rate structures are implemented throughout the regions that provide strong financial incentives to conserve. Such rate structures will be effective over time only if accompanied by a sustained information program that ensures consumers remain aware of the linkages between water consumption and their utility bills.

Further information on this topic can be found in the Washington State Department of Health document entitled "Conservation Oriented Rates for Public Water Systems in Washington, Report to the Legislature" (1995).

Methods for Evaluating Economic Aspects of Conservation

It is important that decision makers have sound information regarding the costs and benefits of conservation. It is equally important that consumers receive accurate price signals regarding the value of water. Both of these depend on effective use of methods for economic evaluation. As would be expected in a region with diverse sources and delivery systems for municipal water supply, the techniques and assumptions used in economic evaluation vary somewhat among the many diverse utilities in the region.

Important aspects of economic evaluation include:

- Whether cost-benefit analysis by a given water system should consider only the costs and benefits experienced by customers of that system, or whether broader costs and benefits ("externalities") should be considered, and given the same weight. If broader issues are considered, a related issue concerns whether the customers of that system should bear all of the financial costs, or whether broader sources of funding should be provided.
- Whether and how water rates should incorporate externalities, such as effects on instream flows or regional aquifer levels, to ensure consumers receive appropriate price signals on the value of water.
- How non-financial costs and benefits should be addressed in cost-benefit analysis (e.g., impacts on environmental quality, impacts on water system reliability, etc.).
- Consideration of collateral benefits such as reduced capital and operating costs associated with wastewater treatment.
- Use of marginal cost pricing compared with average cost pricing, in ratemaking.[8]
- Equity issues, due to differential effects of pricing on low-income customers, compared with high-income customers.
- Potential variation in decision making from community to community, due to differing community values.
- Appropriate expectations for the level of detail in economic analysis by small utilities with modest staffing and financial resources, compared with larger utilities that have more extensive resources and experience.

Some utilities in the region already incorporate some or all of these concepts in their decision-making and rate practices. Others do not. Together, these issues have important effects on the use of conservation compared with other approaches to municipal water supply, and on the degree of consistency in conservation programs throughout the region.

Balancing Regional Coordination with Local Control

One of the challenges involved in implementing any of the conservation scenarios discussed in the Outlook is the issue of balancing regional coordination with local control. Regional coordination offers potential advantages of consistency, predictability, and cost savings.

[8] Marginal cost pricing reflects the cost of each additional increment of water sold. The cost of producing and delivering water to meet peak demands (e.g., in the summer months) is usually higher than the cost during non-peak periods. Therefore, marginal cost pricing generally results in higher rates for water consumed during peak periods, compared with water consumed during non-peak periods.

Local control can offer the advantage of tailoring programs to meet specific needs and community values.

At this time, this balance is based on use of statewide guidelines for conservation planning, coupled with local decision making on the degree and type of conservation activities to be implemented to achieve local objectives. The statewide guidelines call for measurement of water uses, specific techniques for demand forecasting, documentation of objectives, and evaluation of specific categories of conservation activities using a cost-effectiveness test. The guidelines have increasing levels of expectations for small, medium, and large utilities, respectively. Each utility has the responsibility to apply the guidelines to its specific circumstances, and determine the appropriate conservation program, subject to state review. More specific review and implementation is required of utilities applying for increased water rights.

If a higher degree of coordination were desired for the region, there are several ways this could be achieved. Available techniques could include:

- Formation of a new institution such as a water conservation commission to plan, fund and/or implement conservation activities within the region (or delegation of this role to one or more existing entities),
- Increased regulatory requirements from the state Department of Health and/or Ecology,
- New funding for conservation from a regional or statewide source, tied to specific, regionally-consistent performance requirements,
- Improved advisory and informational linkages among utilities, stakeholders, and state agencies, building on existing organizations such as the Water Conservation Coalition of Puget Sound, the Central Puget Sound Water Suppliers' Forum and its Conservation Workgroup, or
- Binding agreements among utilities region-wide, or within various subregions,
- Some combination of the approaches above.

State Water Law

Many observers have noted that uncertainty clouds various aspects of State water law in Washington. This uncertainty can affect efforts to conserve water, and can make it difficult to find common ground among differing perspectives. In particular, the "use it or lose it" principle regarding water rights appears to many to present a disincentive to conserving water.

Issues related to water law have many dimensions and involve interests across the state. While opinions on how to resolve this uncertainty are diverse, there is little doubt that it affects the decisions of water suppliers in important ways related to conservation. Additional discussion of these issues is included in Section 12.

State Role in Promoting Conservation

State agencies have a different role in the water field, in comparison with local governments, water utilities, and private citizens. The Washington State Department of Health regulates water systems. One of the tools used by the Department of Health is the review and approval of water system plans, including conservation plans. The Department of Ecology administers water rights, and has the responsibility to balance uses of water with environmental protection. Once the Department of Health's new data system is in place, and data is being collected, the database will help provide a basis for evaluating different utilities' conservation programs. It should be noted that existing rules require utilities to implement "cost-effective" conservation measures, but that the term "cost-effective" is not defined, and thus difficult for utilities to implement.

Involvement of the departments of Health and/or Ecology could potentially contribute to achievement of the conservation scenarios described in this document. Both agencies can contribute to education and outreach efforts involving citizens, utilities, and elected officials, if they have the resources to do so. Both agencies have a place in discussions on regional coordination and objectives. The Department of Ecology would be directly involved in any clarification of state water law, as discussed above.

Coordination Between Land-Use Management and Water-Resource Management

The state Growth Management Act (GMA) establishes policy and procedural linkages between land development and provision of utility services. However, experience with GMA suggests that these linkages have not yet successfully integrated land-use management and water-resource management. This linkage is relevant to water conservation, because it can be far more cost-effective to incorporate water-saving design in new construction than to retrofit existing structures and developed sites. These considerations apply to building codes, landscaping ordinances, water metering (e.g., irrigation water meters and sub-metering of multifamily housing), decisions on source of supply from existing utilities as opposed to new water systems, definition of critical areas under GMA, and many other issues. Under the right circumstances, alterations in land-use practices that reduce water consumption may also reduce overall public costs, if they reduce the need for extending roads and other utility services.

These issues are complex and involve the adopted plans and procedures of many jurisdictions. Clearly, however, improved coordination between local land-use authorities, permitting departments and water utilities could substantially improve prospects for achieving conservation savings across the region.