U.S. Environmental Protection Agency
Water Conservation Plan Guidelines

PART 5
ADVANCED GUIDELINES FOR PREPARING WATER CONSERVATION PLANS

These Advanced Guidelines are designed for water systems serving more than 100,000 people. Which Guidelines are appropriate may depend on various factors and conditions affecting water systems and their need for conservation planning. *Water system managers should check with their own state's rules, regulations, and recommendations about which Guidelines to follow.*

1. Specify Conservation Planning Goals

Planning Goals

Specify conservation planning goals in terms of anticipated benefits for the water system and its customers. To the extent practical, involve affected members of the community in the development of conservation planning goals and throughout the implementation process.

Planning goals can be developed from different perspectives. These planning guidelines, including the analysis of the benefits and costs of conservation activities, emphasize a water supplier perspective. The value of conservation is defined primarily in terms of avoided supply-side costs to the water system. Lowering the level of water demand can help water suppliers avoid, downsize, or postpone the construction and operation of costly supply-side facilities.

The benefits of conservation also can be understood from the perspectives of customers, as well as society at large. Conservation benefits society by preserving environmental resources. Conservation can benefit customers by lowering energy and long-term water costs. Water conservation reduces demands on wastewater systems; in fact, the need to reduce wastewater treatment costs can be a strong rationale for water conservation. The Guidelines and the worksheets can be used to simultaneously address the potential effects of conservation on water and wastewater operations. Utilities using the Advanced Guidelines also are encouraged to expand the analysis of benefits and costs to consider the customer and societal perspectives, if only in very general terms.

Conservation planning goals can take many forms. Water systems should state their goals in specific terms. Measurable goals are useful for evaluation purposes. For example, many water systems identify a specific water-use reduction goal (as a percentage of current water usage).

Water conservation planning goals may include:

- Eliminating, downsizing, or postponing the need for capital projects.
- Improving the utilization and extending the life of existing facilities.
- Lowering variable operating costs.
- Avoiding new source development costs.
- Improving drought or emergency preparedness.
- Educating customers about the value of water.
- Improving reliability and margins of safe and dependable yields.
- Protecting and preserving environmental resources.

Planners should plan on revisiting the goals section before finalizing the conservation plan and periodically thereafter, because goals and the means to achieving them will evolve. As

the water system accomplishes certain conservation goals, new objectives may come into focus.

Community Involvement

The process of developing goals can involve representatives of various groups in the community (or stakeholders) who may be concerned about a water system and its future. Modern resource planning (such as integrated resource planning) emphasizes an open process that involves all affected groups so that they can have an opportunity to express their interests and concerns.

Involving the community in goal development also serves an important public education function. Moreover, it is widely believed that involving the community in developing goals, as well as in the implementation process, can greatly enhance the success of conservation programs.

Members of the community who might be interested in water conservation include:

- Residential water consumers
- Commercial water consumers
- Industrial water consumers
- Wholesale customers
- Environmental groups
- Civil rights groups
- Indian tribes
- Labor groups
- Business and commerce groups
- Recreational water users
- Agricultural users
- Educational institutions
- Government agencies

In addition to helping the water system specify planning goals, community participants also can have an ongoing role in a system's conservation program. Ongoing involvement can help maintain and build support for achieving conservation goals and "get the word out" about the conservation effort. Participants can act as a focus group for exploring specific conservation measures (discussed in Section 4). Participants also can provide valuable linkages to key groups—consumers, businesses, and institutions—who might be involved in implementing certain conservation measures. Participants also can provide input on the level of satisfaction or dissatisfaction with the system's programs. Finally, community groups can assist the water system in monitoring results and adjusting program implementation.

For many water systems, involving the community in water-system planning will be a new experience. However, most system managers will find that involving members of the community in developing goals, implementing programs, and evaluating results is a very worthwhile investment. Fortunately, guidance on this approach is available.[1]

[1] See *Public Involvement Strategies: A Manager's Handbook* (Denver, CO: American Water Works Association Research Foundation, 1996).

2. DEVELOP A WATER SYSTEM PROFILE

System Profile

Summarize the service and operating characteristics of the water system. Provide an overview of conditions and a description of climate, water availability, or other factors that might affect water conservation planning.

Taking inventory of existing resources and conditions is an important step in the planning process. A water system profile can help systems in terms of assessing their present circumstances and designing strategies to meet emerging needs.

Most water systems should maintain the data and information necessary for building a system profile. Much information may already have been compiled for a facility plan or for other purposes. Worksheet 5-1 profiles a relatively simple summary table that systems can use to compile and present key system characteristics. The system profile can be expanded to include additional information. For example, systems may want to present data on trends for some characteristics (such as supply and demand measures). Systems should include in their profile additional characteristics or details considered relevant for understanding the nature of the system.

System Conditions

Worksheet 5-2 provides a very simple overview of planning conditions that might affect the water system and its conservation planning effort. This checklist can be used to make a general review of conditions affecting the supply or the demand for water. For planning purposes, it is important to identify and focus on the conditions that most affect a particular system.

The conditions outlined in the worksheet suggest the need for water conservation planning. While all water systems can benefit from efficiency improvements, water conservation can be especially beneficial for systems experiencing water shortages or rapid increases in demand. For example, water systems facing one or more of the following conditions are strongly urged to consider the fullest range of conservation measures available to them in accordance with these guidelines:

- Systems in state-designated critical water or stressed areas
- Systems experiencing frequent droughts, emergencies, or safe yield problems
- Systems with excessive unaccounted-for water or water losses
- Systems entering into major construction cycles
- Systems anticipating rapid growth in water demand

For some conditions, states might provide benchmark measures that water systems can use for comparison purposes. For example, a state might have specific criteria for defining critical

use or stressed areas, for classifying per-capita water use, or for identifying the age of systems. When practical, systems should try to compare significant conditions using generally accepted measures.

In addition to the summary worksheet, planners also should prepare a brief written discussion of the significant conditions affecting their systems. Particular attention can be paid to climate and water availability, but other factors affecting the system can be considered as well. This information can be used to help systems identify problems and opportunities throughout the planning process.

Current Conservation Efforts

Worksheet 5-3 is provided so that water systems can describe their current water conservation activities and programs. For each conservation measure implemented, planners can indicate the approximate annual water savings achieved, when implementation for the measure began, and whether continued implementation is planned. Any other pertinent information on current efforts and their effectiveness can be provided in the plan as well.

Worksheet 5-1: Water System Profile

A	SERVICE CHARACTERISTICS	Number
1	Estimated service population	
2	Estimated service area (square miles)	
3	Miles of mains	
4	Number of treatment plants	
5	Number of separate water systems	
6	Interconnection with other systems	

B	ANNUAL WATER SUPPLY	Annual volume	Number of intakes or source points	Percent metered
7	Groundwater			%
8	Surface water			%
9	Purchases: raw			%
10	Purchases: treated			%
11	Total annual water supply			%

C	SERVICE CONNECTIONS	Connections	Water sales	Percent metered
12	Residential, single-family			%
13	Residential, multi-family			%
14	Commercial			%
15	Industrial			%
16	Public or governmental			%
17	Wholesale			%
18	Other			%
19	Total connections			%

D	WATER DEMAND	Annual volume	Percent of total	Per connection
20	Residential sales			
21	Nonresidential sales			
22	Wholesale sales			
23	Other sales			
24	Nonaccount water: authorized uses			
25	Nonaccount water: unauthorized uses			
26	Total system demand (total use)			

E	AVERAGE & PEAK DEMAND	Volume	Total supply capacity	Percent of total capacity
27	Average-day demand			%
28	Maximum-day demand			%
29	Maximum-hour demand			%

F	PRICING	Rate structure	Metering frequency	Billing frequency
30	Residential rate			
31	Nonresidential rate			
32	Other rate			

G	PLANNING	Prepared a plan ☑☐	Date	Filed with state ☑☐
33	Capital, facility, or supply plan			
34	Drought or emergency plan			
35	Water conservation plan			

Worksheet 5-2: Overview of System Conditions [a]

Line	Conditions	Increasing need for conservation→→→ Check applicable description ☑						Don't know ☑
A	**CLIMATE AND WATER AVAILABILITY**							
1	Average precipitation	High	❒	Moderate	❒	Low	❒	❒
2	Average temperatures	Low	❒	Moderate	❒	High	❒	❒
3	Critical supply areas	No	❒	At risk	❒	Yes	❒	❒
4	Competing water uses	No	❒	Possibly	❒	Yes	❒	❒
5	Environmental constraints	No	❒	Possibly	❒	Yes	❒	❒
6	Quality/quantity concerns	No	❒	Possibly	❒	Yes	❒	❒
7	Seasonal variations in climate	Low	❒	Moderate	❒	High	❒	❒
8	Instream flow problems	Low	❒	Moderate	❒	High	❒	❒
9	Shortage or emergency frequency	Low	❒	Moderate	❒	High	❒	❒
B	**INFRASTRUCTURE CONDITIONS**							
10	Age of the system	Newer	❒	Middle	❒	Older	❒	❒
11	General condition of system	Good	❒	Fair	❒	Poor	❒	❒
12	Water losses and leaks	Low	❒	Moderate	❒	High	❒	❒
13	Unaccounted-for water	Low	❒	Moderate	❒	High	❒	❒
14	Safe yield of supply exceeded	No	❒	At risk	❒	Yes	❒	❒
15	Wastewater discharges exceeded	No	❒	At risk	❒	Yes	❒	❒
16	Wastewater capacity exceeded	No	❒	At risk	❒	Yes	❒	❒
17	Potential for recycling and reuse	Low	❒	Moderate	❒	High	❒	❒
18	Improvement plans	Low	❒	Moderate	❒	High	❒	❒
19	Anticipated investment	Low	❒	Moderate	❒	High	❒	❒
C	**SYSTEM DEMOGRAPHICS**							
20	Rate of population growth per year	Low	❒	Moderate	❒	High	❒	❒
21	Rate of demand growth per year	Low	❒	Moderate	❒	High	❒	❒
22	Rate of economic growth per year	Low	❒	Moderate	❒	High	❒	❒
23	Per capita water use (by class)	Low	❒	Moderate	❒	High	❒	❒
24	Ratio of peak to average demand	Low	❒	Moderate	❒	High	❒	❒
25	Presence of large-volume users	Low	❒	Moderate	❒	High	❒	❒
D	**OTHER FACTORS**							
26								❒
27								❒
28								❒

[a] Specific (quantified) benchmarks for these indicators may be provided by the state.

Worksheet 5-3: Current Water Conservation Activities

Summarize the system's current water conservation activities/programs: _____

_____
_____
_____
_____
_____
_____
_____
_____
_____

Water conservation measures	***Approximate* annual water savings [if known]**	**Implemented since (date)**	**Is continued implementation planned?**

3. PREPARE A DEMAND FORECAST

Demand Forecasting

Prepare a forecast of anticipated water demand for selected time periods. To the extent practical, the planner should take into account variations in demand based on type of water usage, as well as perform a "what if" (sensitivity) analysis.

Forecasting water use (or water demand) is a critical part of the planning process. Forecasts can range from simple projections based on anticipated growth in the population to complex models using several variables to explain variations in water use. Forecasts can be made for a water system as a whole; however, forecasts are considered more accurate when they are prepared for separate classifications of water use or sectors.

The Guidelines suggest that planners prepare forecasts for five-year, ten-year, and twenty-year intervals. Additional time points can be used as well. The longer the planning horizon, the greater will be the uncertainty of the forecast. Forecasts should be revisited and updated on a regular basis.

The forecast should recognize the effects of conservation measures already implemented. The forecast also should recognize the demand effects of plumbing efficiency standards established under the 1992 Energy Policy Act (see Appendix B, Tables B-5 and B-6).[2] New construction and renovations will not contribute as much to total demand as in the past; systems that are not experiencing growth might detect declines in demand due to these effects. For the purposes of this conservation plan, anticipated demand effects from measures contemplated in the plan should not be included. A revision to the demand forecast based on implementing the planned conservation measures is made in Section 8 (Worksheet 5-13).

It is not necessary for systems to prepare a separate forecast for the purposes of this plan if a forecast has already been prepared for the system within a reasonable time frame. Planners should include the results of their forecasts in this plan.

Forecasting Method

Systems following the Advanced Guidelines should prepare a demand forecasting model appropriate to their capabilities and needs. Many systems in this category already employ advanced forecasting techniques. Current and reasonable forecasts already prepared by the system, including forecasts prepared under other planning or regulatory requirements, will be in accordance with the purpose of these guidelines.

[2] A method for estimating the demand effect of efficient fixtures can be found in Amy Vickers, "The Energy Policy Act: Assessing its Impact on Utilities." *Journal American Water Works Association* (August 1993): 56-62.

Advanced water demand forecasting generally involves:

- Disaggregated forecasts by customer class or other relevant groups, by average-day and maximum-day demand, and by off-peak and peak season.
- Multivariate models that seek to explain variations in water demand in terms of variations in other factors, such as climate, income, and price.
- Quantified sensitivity ("what if") analysis, which allows systems to address uncertainty by varying inputs and assumptions.

Disaggregating forecasts by customer class is important because of the different load factors that groups of customers present. Disaggregating forecasts according to type of demand is relevant for advanced demand management techniques that take into account how different types of demand affect the utility's functional costs. As discussed in Section 4, different types of supply-side facilities are designed to meet average-day or maximum-day water demands, and various conservation measures target different types of demand.

Multivariate models recognize that demand is dynamic and can change with changes in other variables. Sensitivity analysis helps planners deal explicitly with uncertainty that goes along with these dynamics. Addressing uncertainty is a very important part of advanced forecasting. With larger and more diverse service territories, uncertainties are greater; uncertainty also grows with the time horizon of the forecast. Contingency planning can help utilities cope with uncertainty.

Several computer models are available for advanced forecasting, many of which can be used in accordance with these guidelines. An example of an advanced forecasting tool is the widely-used IWR-MAIN model, which was developed by the U.S. Army Corps of Engineers.[3] Figure 5-1 is an illustration of the inputs and outputs of the model. The key features of IWR-MAIN are: spatial disaggregation, seasonal disaggregation, sector disaggregation, multiple determinants of water demand, user-added categories, and sensitivity analysis. The current version of the model also allows planners to incorporate the effects of demand-management into various planning scenarios. Use of empirical models, including but not limited to IWR-MAIN, clearly is consistent with the purpose of these guidelines.

The conservation plan should include a detailed summary of the forecast, results by customer class, and a description of the forecasting methodology used. Any adjustments to the forecasts should be explained in the plan. Worksheet 5-4 provides a template for summarizing the systemwide results of the forecast.

[3] Duane D. Baumann., John J. Boland, and W. Michael Hanemann. *Urban Water Demand Management and Planning* (New York: McGraw Hill, 1998).

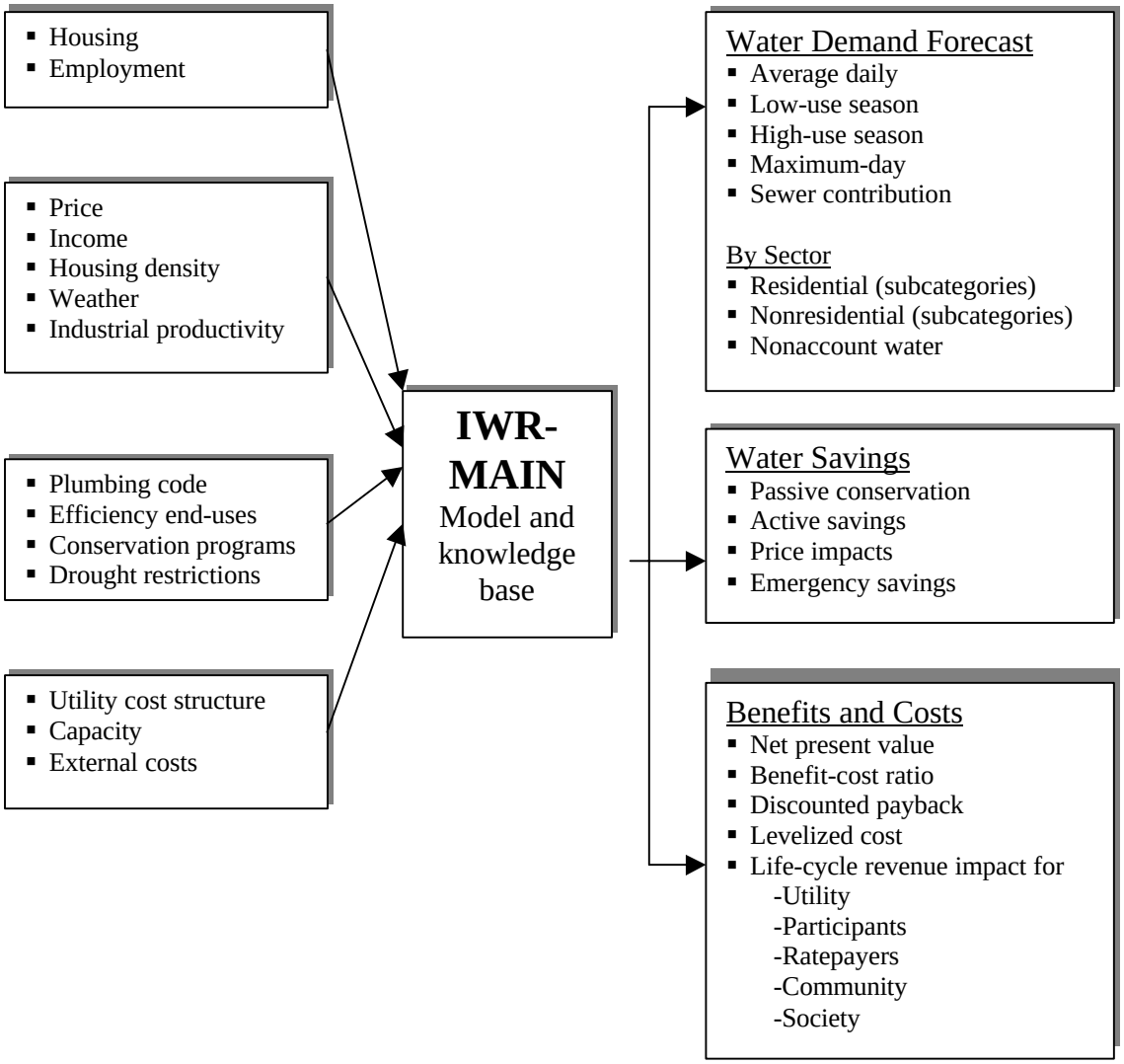


Figure 5-1. Inputs and Outputs of the IWR-MAIN Forecasting Model

Source: Duane D. Baumann, John J. Boland, and W. Michael Hanemann, *Urban Water Demand Management and Planning* (New York: McGraw-Hill, 1998): 109.

Worksheet 5-4: Summary of Preliminary Water Demand Forecast

Summary Results of Advanced Forecasting Model [a]

Line	Item	Current year	5-year forecast	10-year forecast	20-year forecast
A	**TOTAL ANNUAL WATER DEMAND**				
1	Current and projected total annual water sales to the residential sector [b]				
2	Current and projected total annual water sales to the nonresidential sector [b]				
3	Current and projected total annual water sales to the wholesale buyers [b]				
4	Current and projected total annual water sales to others [b]				
5	Current and projected total annual nonaccount water (authorized and unauthorized) [c]				
6	Current and projected total annual water demand in gallons (add lines 1 through 4) [d]				
7	Current and projected annual water supply capacity [e]				
8	Difference between total demand and total supply capacity (+ or -) (line 3 less line 2)				
B	**AVERAGE-DAY AND MAXIMUM-DAY DEMAND**				
9	Current and projected average-day demand [f]				
10	Current and projected maximum-day demand [g]				
11	Ratio of maximum-day to average-day demand (line 5 divided by line 4)				
12	Daily supply capacity (divide line 7 by 365)				
13	Ratio of maximum-day demand to daily supply capacity (divide line 10 by line 12)				

[a] This Worksheet presumes that the system has prepared a detailed demand forecast using an appropriate model. Include in the conservation plan a description of the forecasting methodology used and a detailed summary of the forecast.
[b] Current year corresponds to Worksheet 5-1, lines 20 through 23.
[c] Current year corresponds to Worksheet 5-1, lines 24 through 25.
[d] Current year corresponds to Worksheet 5-1, line 26.
[e] Supply capacity should take into account available supplies (permits), treatment capacity, and distribution system capacity and reflect the practical total supply capacity of the system, including purchased water.
[f] Current year corresponds to Worksheet 5-1, line 27.
[g] Current year corresponds to Worksheet 5-1, line 28.

4. DESCRIBE PLANNED FACILITIES

Supply Forecasting

Describe improvements planned for the water system over a reasonable planning horizon, identify the types of improvements proposed, and estimate the total, annual, and unit cost of the improvements. Prepare a preliminary forecast of installed capacity.

In this part of the conservation plan, planners are asked to prepare an estimate of supply costs based on meeting the level of water demand specified in the unadjusted demand forecast (that is, unadjusted for additional conservation). This is a critical part of the analysis because it establishes the anticipated cost of *supply-side* improvements and additions and this cost estimate will be used to represent the value of conservation or *demand-side* activities.

Because the benefits of conservation extend into the future it is important to take a forward-looking approach to supply costs. The concept of marginal or incremental cost captures the idea that the "true" value of a supply resource can be measured in terms of the cost of the next increment of supply. If only high-cost supplies are available, the marginal or incremental cost will be high. For many communities, future increments of supply will be very costly (that is, the marginal cost of developing new water sources will be high). The value of a conserved amount of water at a future point in time will be equivalent to the most costly supply option available at that future time point, because that is the supply option being displaced by conservation.

Cost Analysis

A reasonable accounting of anticipated supply-side costs is needed in order to compare the cost of supply-side measures to the cost of demand-side or conservation measures (on a cost – per-gallon basis). Planners should choose an appropriate time horizon; a twenty-year or other suitable period can be used. The choice of time frame should be consistent with the demand forecast (Section 3), as well as the other planning considerations.

Planners should begin by preparing an estimate of major improvements and additions that will be required over the planning horizon in order to meet anticipated demand (including a safe reserve margin). Detailed cost estimates may be available from facility plans or other planning documents. Worksheet 5-5 can be used to summarize improvements and additions, which are disaggregated into three categories: source of supply, transmission and treatment, and distribution. (Additional categories can be used as needed).

Planners should consider all capital facility improvements and additions. Improvements include renovations and expansions needed to maintain or enhance safety or reliability within existing facilities. Additions consist of new facilities. Routine maintenance improvements should not be included. Anticipated water purchases and costs also should be recorded on

Worksheet 5-5. For this part of the analysis, the effects of conservation measures currently being implemented should be considered, but the effects of new conservation measures on the need for supply capacity or water purchases should be excluded. (These effects are addressed in Section 8.)

If no capital improvements and additions are planned, "0" values can be entered and the estimate of supply costs can be based on operating costs (including the cost of energy, chemicals, and purchased water).

Estimating Incremental Supply Costs

The Advanced Guidelines recommend a method for determining the present value of supply-side costs. This analysis should be calculated separately for (1) improvements and additions needed to meet *average* demand, and (2) improvements and additions needed to meet *peak* demand so that the results can be compared to corresponding conservation measures. As illustrated in Worksheet 5-6, this spreadsheet method provides the planner with a year-by-year accounting of costs.

The resulting estimates of total annual incremental costs by type of facility (peak and average) can be used by planners to estimate the incremental cost of supply associated with meeting average or peak demand on a system-specific basis.

Supply-side facilities are designed to meet different types of water demand (as summarized in Table 5-1); similarly, different conservation measures affect different types of water demand. Planners should identify, as reasonably possible, the extent to which improvements and additions are needed to meet average and/or peak demand.

Two adjustments can be made to costs: one for the annual escalation rate and one for the discount rate. The escalation rate is used to ensure that the benefits of conservation are not undervalued. By using an escalation rate, the analyst assumes that incremental costs of supply measured at a future point in time will be greater than present incremental costs. Many planners, for example, believe that future water supplies will be much more costly to secure and develop, even in real-dollar (inflation adjusted) terms. In addition to supply costs, other infrastructure costs are expected to escalate with time. In general, the escalation rate will be higher for areas experiencing supply or other constraints that will put pressure on total system costs. Choosing the appropriate escalation rate requires analyst judgment; however, planners may want to investigate past escalation trends relevant to their system.

The second adjustment involves applying a discount rate, which is used to estimate the present value of costs that extend into the future. The discount rate reflects the time value of money (or opportunity costs) and can be based on the system's overall cost of capital.

Table 5-1: Relationship of Water Demand to Supply Facilities

Type of Water Demand	Type of Water Supply Facility
Average-day	Source of supply facilities, including raw water storage facilities (such as reservoirs)
Maximum-day (peak)	Water treatment plants Major transmission lines
Maximum-hour [a]	Treated water storage facilities Distribution mains [b] Pumping stations [b]

Source: Adapted from Charles W. Howe and F. Pierce Linaweaver, "The Impact of Price on Residential Water Demand and its Relationship to System Design and Price Structure, *Water Resources Research* 3 (First Quarter 1967): 13-32.

[a] Maximum-day demand plus fire-flow requirements.
[b] These facilities should be considered in the analysis if they could be affected by such conservation measures as leak detection and repair, pressure management, or integrated resource management.

Planners should note that discounting is not the same as adjusting for inflation. In order to simplify the presentation, Worksheet 5-6 does not include an adjustment for inflation. It is not necessary to convert nominal to real (inflation-adjusted) dollars for the purpose of assessing benefits and costs. However, if planners choose to represent costs in real dollars, the escalation rate and the discount rate also should be expressed in real dollar terms.

Given the uncertainty associated with the recommended adjustment factors, planners using the Advanced Guidelines also are encouraged to conduct a sensitivity analysis to establish a range of values based on different assumptions for the three adjustments.

Preliminary Supply-Capacity Forecast

Based on the anticipated improvements and additions, planners also can present a preliminary forecast of total supply capacity over the planning period. Worksheet 5-7 is provided for this purpose. The forecast, which can be presented in a table or graph, can be used to indicate when changes to capacity are expected to occur. The total supply forecast should reflect both additions to capacity and retirements. Improvements that allow the system to maintain capacity can be indicated with entries under both additions (to reflect the improvement) and retirements (to reflect the facilities taken out of service). A similar analysis can be used for wastewater facilities.

The supply forecast is *preliminary* because it can and will be revised later in the plan to reflect the effect of conservation on water supply needs.

Worksheet 5-5: Anticipated Improvements and Additions

Describe planned improvements and additions: _____
_____
_____
_____
_____

Describe time frame for planned improvements and additions (years): _____
_____
_____
_____
_____

Type of Project [a]	Improve-ment	Addition	State date	End date
Source of supply	❒	❒	_____	_____
Water treatment facilities	❒	❒	_____	_____
Treated water storage	❒	❒	_____	_____
Major transmission lines	❒	❒	_____	_____
Other _____	❒	❒	_____	_____

Need for Project(s) (Check all that apply)		**Notes**
Enhance compliance with regulations	❒	_____
Replace older equipment or facilities	❒	_____
Meet average-day demand	❒	_____
Meet maximum-day demand	❒	_____
Meet future growth needs	❒	_____
Other _____	❒	_____

Funding		**Interest rate**
Cost of financing	❒	_____
Overall cost of capital [if known]	❒	_____

Water purchases	
Anticipated future water purchases	_____ (gallons per year)
Cost of water purchases	_____ (dollars per gallon)

[a] Comprehensive plans can include wastewater facilities.

Worksheet 5-6: Present Value of Planned Supply-Side Facilities [a]

Year [b]	Annual incremental capacity from improve-ments/ additions [c]	Annualized incremental capital cost [d]	Annual operating cost [e]	Un-discounted total annualized incremental cost [f]	Escalated value of supply cost in nominal dollars [g]	Present value of supply cost in nominal dollars [h]	Present value of supply cost Per gallon in nominal dollars [i]
	gallons	$	$	$	$	$	$/gallon
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10**…**							
20							
Total							

Source: Adapted from Pekelney, Chesnutt, and Hanemann (1996). See Glossary (Appendix C) for definitions.

[a] = This analysis should be calculated separately for (1) improvements and additions needed to meet **average** demand, and (2) improvements and additions needed to meet **peak** demand so that the results can be compared to corresponding conservation measures. The analysis also can be expanded to include the incremental cost of wastewater collection and treatment.

[b] = The number of years should correspond to the anticipated useful life of the project(s).

[c] = Total gallons of capacity made available through the project(s).

[d] = Annualized incremental capital cost (K):

$$K = \frac{C \times i \times (1 + i)^n}{(1 + i)^n - 1}$$

where: K = annualized capital costs
C = total expenditures required
n = the useful service life of the capital expenditure (see [b])
i = the appropriate interest or financing rate

[e] = Annual variable operating cost (including energy, chemicals, and water purchases).

[f] = [d] + [e]

[g] = [f] x $(1 + s)^t$ where s is the selected annual escalation rate and t is the year. The escalation rate can be tailored to the nature of capital expenditures.

[h] = [g]/$(1 + r)^t$ where r is the selected annual discount rate and t is the year. The escalation rate can be tailored to the nature of capital expenditures.

[i] = [h]/[c]

Worksheet 5-7: Preliminary Supply-Capacity Forecast

Year	Additions (+)	Retirements (-)	Total supply capacity for the system (annual or daily)
0			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

5. IDENTIFY CONSERVATION MEASURES

Levels and Measures

Review the list of conservation measures recommended for consideration and identify measures that have been implemented, are planned, or are not planned. Provide an explanation for why any measure is not planned for the water system.

Water systems have a vast array of specific conservation measures at their disposal. These measures include both supply-side and demand-side management techniques for saving water and range from relatively simple educational tools to the promotion of advanced water-efficient technologies. Use of any particular measure depends on whether it meets cost-effectiveness and other planning criteria and whether its use complies with applicable laws and regulations, including state and local plumbing codes.

The conservation measures are organized into three levels: Level 1, Level 2, and Level 3. Each level includes four categories of measures. Specific water conservation measures are identified within each category. Appendix A provides additional information and several worksheets on the conservation measures. Planners are encouraged to explore the full range of potential conservation measures for consideration in their conservation programs.

Identifying Conservation Measures

Worksheet 5-8 summarizes the minimum set of measures recommended for consideration in the Advanced Guidelines. Systems should use the checklist to review and summarize the measures that are currently implemented, planned, or not planned at this time. Planners also can identify additional measures and practices as they develop their conservation plans.

Water systems following the Advanced Guidelines are expected to implement the very fundamental and widely accepted practices under Level 1. If Level 1 measures are not in place and not planned for implementation, planners should submit a strong justification, including a cost-effectiveness analysis if it is the basis for not implementing the measure.

Planners can screen the measures in terms of general feasibility. In some cases, it may not be possible for a system to implement a measure because of legal restrictions or for other compelling reasons. The conservation plan should provide an explanation if a measure cannot be implemented for the period of time covered by the plan. It is not necessary to prepare a cost effectiveness analysis for measures that cannot be implemented.

Worksheet 5-8: Checklist of Conservation Measures

Measure [a]	Already implemented ☑	Plan to implement ☑	Comments [b]
LEVEL 1 MEASURES			
Universal metering [B]			
Source-water metering	❒	❒	
Service-connection metering	❒	❒	
Meter public-use water	❒	❒	
Fixed-interval meter reading	❒	❒	
Meter-accuracy analysis	❒	❒	
Test, calibrate, repair, and replace meters	❒	❒	
Water accounting and loss control [A]			
Account for water	❒	❒	
Repair known leaks	❒	❒	
Analysis of nonaccount water	❒	❒	
Water system audit	❒	❒	
Leak detection and repair strategy	❒	❒	
Automated sensors/telemetry	❒	❒	
Loss-prevention program	❒	❒	
Costing and pricing [B]			
Cost-of-service accounting	❒	❒	
User charges	❒	❒	
Metered rates	❒	❒	
Cost analysis	❒	❒	
Nonpromotional rates	❒	❒	
Advanced pricing methods	❒	❒	
Information and education [B]			
Understandable water bill	❒	❒	
Information available	❒	❒	
Informative water bill	❒	❒	
Water-bill inserts	❒	❒	
School program	❒	❒	
Public-education program	❒	❒	
Workshops	❒	❒	
Advisory committee	❒	❒	

[Worksheet continues. See footnotes at end of worksheet.]

Worksheet 5-8 (continued)

Measure [a]	Already implemented ☑	Plan to implement ☑	Comments [b]
LEVEL 2 MEASURES			
Water-use audits [B]			
Audits of large-volume users	❒	❒	
Large-landscape audits	❒	❒	
Selective end-use audits	❒	❒	
Retrofits [B]			
Retrofit kits available	❒	❒	
Distribution of retrofit kits	❒	❒	
Targeted programs	❒	❒	
Pressure management [A]			
Systemwide pressure regulation	❒	❒	
Selective use of pressure-reducing valves	❒	❒	
Landscape efficiency [P]			
Promotion of landscape efficiency	❒	❒	
Landscape planning and renovation	❒	❒	
Selective irrigation submetering	❒	❒	
Irrigation management	❒	❒	
LEVEL 3 MEASURES			
Replacements and promotions [B]			
Rebates and incentives (nonresidential)	❒	❒	
Rebates and incentives (residential)	❒	❒	
Promotion of new technologies	❒	❒	
Reuse and recycling [B]			
Industrial applications	❒	❒	
Large-volume irrigation applications	❒	❒	
Selective residential applications	❒	❒	
Water-use regulation [B]			
Water-use standards and regulations	❒	❒	
Requirements for new developments	❒	❒	
Integrated resource management [B]			
Supply-side technologies	❒	❒	
Demand-side technologies	❒	❒	

[a] For more information about measures see Appendix A.
[b] Note special issues related to the measure, including legal or other obstacles precluding implementation.
Note: Measures can affect average-day demand [A], maximum-day (peak) demand [P], or both [B], as indicated.

6. ANALYZE BENEFITS AND COSTS

Purpose

For each identified water conservation and other measures of interest, estimate total implementation costs (dollars) and anticipated water savings (volume), assess the cost-effectiveness of the measure, and compare the cost of conservation to benefits (measured in terms of the incremental cost of supply).

In this section, an analysis of benefits and costs is used to aid the comparison and selection of measures. Planners will consider criteria other than efficiency in Section 7 and estimate actual effects of conservation on planned capital facilities in Section 8.

Analyzing benefits and costs is an invaluable part of the planning process. Use a *cost-effectiveness* analysis to compare alternative conservation measures in terms of dollars per gallon of water saved. For example, one measure might produce savings at a cost of $.25/1,000 gallons while another produces savings at a cost of $.50/1,000 gallons. Cost-effectiveness analysis also can be used to compare conservation measures to supply options. Use a *net benefit* analysis to determine whether the benefits of implementing a measure outweigh the costs.

It is not necessary for planners to prepare a cost-effectiveness or net benefit analysis of Level 1 measures if those measures are already implemented or planned for implementation. An analysis should be presented if cost-effectiveness is the basis for rejecting a Level 1 measure. If the analysis of Level 1 measures leads the planner to conclude that a proposed measure is not cost-effective or that it fails to meet other criteria for implementation, the plan should include an explanation of these findings and conclusions in Worksheet 5-12 (Section 7).

Water Savings

Worksheet 5-9 should be completed for *each* conservation measure identified in Section 5. In some cases planners may want to combine measures based on the conservation program they envision. *All interrelated measures that are expected to result in an identifiable amount of water savings should be combined and treated as one measure in order to avoid counting the planned water savings more than once in the analysis.*

The worksheet begins with an open-ended description of the measure and an estimate of water savings. The anticipated life span for the measure should be indicated. Planners also should indicate whether the measure is targeted toward reduction in average-day demand, maximum-day demand, or both. Estimates of potential water savings should be as realistic as possible, based on system and regional considerations. For some measures, particularly those dependent on customer responses (such as information and education programs), the estimation will reflect a high degree of uncertainty. Planners can choose to use a range of estimates under these circumstances.

The plan should indicate typical water savings from the measure, the number of planned installations, and the anticipated life span for the measure, as well as whether the measure is expected to reduce average-day or maximum-day demand (or both).

Implementation Costs

Worksheet 5-9 includes a method for summing the total cost of implementing the measure. All costs associated with implementation should be included. Planners should ascertain reasonable cost estimates by potential vendors whenever possible. The types of costs that should be analyzed include:

- Materials
- Labor
- Rebates or other payments
- Marketing and advertising
- Administration
- Consulting or contracting
- Other

A realistic implementation schedule should be considered. Any special circumstances affecting the schedule or cost of implementing the proposed measures should be discussed in the plan.

Each worksheet also includes a place to estimate annual unit water savings (that is, savings per measure or "unit"), total annual water savings, and total life span water savings for the measure. For each measure, the method used to estimate water savings should be provided. This might include, for example, a formula for converting daily per capita savings to annual savings. In some cases (such as a leakage control program), it might not be feasible to estimate savings for each unit, in which case total annual savings for the entire measure are sufficient.

Analyzing Benefits and Costs

Worksheet 5-10 also provides a detailed and relatively precise method for calculating the cost effectiveness and net benefit of each conservation measure. The spreadsheet format allows planners to incorporate year-to-year changes in benefits and costs. The number of years represented in the spreadsheet will vary with the anticipated life span of the measure.

For some water conservation measures, savings will be constant from year-to-year. The same value will appear for each year. However, the spreadsheet also allows the analyst to recognize changes in the effectiveness of the conservation measures over time.

The benefits of conservation are displayed in terms of the incremental cost of supply (from Worksheet 5-6). The estimate of benefits should reflect differences in savings from reduction in average-day demand versus reductions in maximum-day demand. This can be accomplished by using the disaggregated estimates of capital in the calculation of benefits.

For example, benefits from measures that reduce only average-day demand can be adjusted to include only the incremental capital cost of source facilities, plus annual operating costs; both are measured on a per gallon basis. The method also allows the planner to incorporate incremental additions and improvements at different years.

The costs are represented in terms of total program costs for the measure. Most conservation program costs take the form of one-year (year 0) expenditures; costs in the subsequent years drop to zero. However, some measures may require recurring expenditures. When this is the case, the same discount rate used in the estimation of supply costs (in Worksheet 5-6) should be applied to the conservation expenditures.

The net present value of conservation is simply the difference between net present benefits and net present costs. The spreadsheet uses nominal dollars to represent net present value. The worksheet reports only nominal dollars. However, planners can adjust their estimates of benefits and costs for anticipated inflation and convert nominal to real (inflation-adjusted) dollars. If real dollars are reported, the escalation rate and discount rate should be expressed in real dollar terms as well.

Comparison of Measures

Worksheet 5-11 can be used to compare the individual analyses of conservation measures in Worksheet(s) 5-10. Worksheet 5-11 can be used to screen measures for implementation on the basis of the relative cost-effectiveness and net benefits associated with each measure.

Worksheet 5-9: Program Costs for Each Conservation Measure or Group of Measures

Describe conservation measure: _____
_____
_____

Typical water savings from the measure: _____ per _____
Number of planned installations: _____
Anticipated life span for the measure: _____ years

The measure is designed to reduce:
- ❒ Average-day demand
- ❒ Maximum-day demand
- ❒ Both average-day and maximum-day demand

Line	Item	Amount	Amount
A	**COST OF THE CONSERVATION MEASURE [a]**	**Per unit [b]**	**Total cost of the measure**
1	Materials		
2	Labor		
3	Rebates or other payments		
4	Marketing and advertising		
5	Administration		
6	Consulting or contracting		
7	Other		
8	Total program costs for the life of the measure (add lines 1 through 7) [c]		
B	**ESTIMATED SAVINGS**		
9	Number of units to be installed [d]		
10	Estimated annual water savings per unit in gallons [e]		
11	Total estimated annual savings for the measure in gallons (multiply line 9 by line 10)		
12	Expected life span for the measure in years		
13	Total life span estimated savings for the measure in gallons (multiply line 11 by line 12)		

[a] A separate analysis should be performed for each conservation measure, but measures can be combined if they jointly produce water savings.
[b] Examples of a unit are a toilet, a retrofit kit, and an audit. A unit estimate may not be appropriate for each measure, in which case total program water savings and costs for the measure can be used.
[c] Include all recurring operation and maintenance costs over the life of the measure.
[d] Units can be individual product units (such as toilets) or groups of products (such as household retrofits), as long as the analysis is consistent. Leave blank if unit values do not apply.
[e] For example, water savings per retrofit. See Appendix B for benchmarks and sample calculations. Leave blank if unit values do not apply.

Notes on analysis: _____
_____
_____
_____

Worksheet 5-10: Analysis of Each Conservation Measure or Group of Measures

Year [a]	Annual water savings from the conservation measure [b]	Present value of supply cost per gallon in nominal dollars [c]	Undiscounted cost of the conservation measure [d]	Present value cost of conservation in nominal dollars [e]	Net savings from conservation in nominal dollars [f]	Net benefit from implementing the measure [g]
	gallons	$/gallon	$/gallon	$/gallon	$/gallon	$
0	0	$	$	$	$	$
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Totals						
Average annual savings [h]						

Source: Adapted in part from Pekelney, Chesnutt, and Hanemann (1996).

[a] = The number of years analyzed should cover the expected useful life of the measure.
[b] = Anticipated annual conservation savings. Include attrition or rebound effects if applicable.
[c] = From corresponding column in Worksheet 5-6 (last column).
[d] = Recurring expenditures should be included in the table at the appropriate year.
[e] = $[d]/(1 + r)^t$ where r is the selected discount rate and t is the year. The discount rate should be the same used in Section 4. This column assesses the per-gallon cost of each measure.
[f] = [c] – [e].
[g] = [f] x [b]. This column assesses the total net benefit of the measure.
[h] = Based on the total number of years in the planning horizon.

Worksheet 5-11: Comparison of Benefits and Costs of the Conservation Measures

Line	Conservation measure [a]	Total program cost for the measure [b]	Anticipated annual water savings in gallons [c]	Cost of water saved by the measure ($/gallon) [d]	Net benefit of implementing the measure(s) [e]
1		$		$	$
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20…					

[a] = Combined measures that produce joint conservation savings should be treated as one measure to avoid duplicate counting.
[b] = Based on Worksheet 5-9, line 8.
[c] = Based on Worksheet 5-10, average annual water savings from the conservation measure.
[d] = Based on Worksheet 5-10, present value of supply cost in nominal dollars.
[e] = Based on Worksheet 5-10, net benefit from implementing the measure. This estimate of net benefit does not consider societal benefits and costs.

7. SELECT CONSERVATION MEASURES

Selection Criteria

Describe the process by which conservation measures were selected for implementation, including identification of selection criteria. Summarize the selected measures and total anticipated program costs for implementation.

The first step in the selection process is to identify criteria for evaluating the conservation measures. The cost-effectiveness of the measures (from Section 6) is one criterion, but other factors should be considered as well. Planners are free to consider as many selection criteria as they believe are appropriate, but the relevance of the criteria should be explained in the conservation plan.

Criteria that can be used in selecting conservation measures for implementation include:

- ❒ Program costs
- ❒ Cost-effectiveness
- ❒ Ease of implementation
- ❒ Budgetary considerations
- ❒ Staff resources and capability
- ❒ Environmental impacts
- ❒ Ratepayer impacts
- ❒ Environmental and social justice
- ❒ Water rights and permits
- ❒ Legal issues or constraints
- ❒ Regulatory approvals
- ❒ Public acceptance
- ❒ Timeliness of savings
- ❒ Consistency with other programs

For each selection criterion used, planners should identify whether, how, and why the factor affects the feasibility of implementing one or more conservation measures. Different factors might be assigned different weights. Planners also may want to bear in mind that techniques can be used to mitigate adverse effects and improve acceptance of measures. A cost-effective conservation measure should not be dismissed without careful consideration of how barriers to implementation might be overcome.

Selecting the Measures

Worksheet 5-12 provides a simple format for summarizing the selection of measures. For each measure, planners should indicate whether the measure was selected for implementation. Planners also should identify the primary reason or reasons for selecting or rejecting the measure. Special conditions or actions that are required before a selected measure can be implemented (such as an approval from regulators) should be noted.

In some cases, planners may conclude that a measure (or measures) cannot be implemented because of a constraint that exists in the short term. Conservation measures that might be planned for future implementation, once constraints are resolved, should be discussed in the plan. Planners should briefly discuss their implementation strategies with respect to such measures.

For the conservation measures selected for implementation, planners should estimate the expected reductions in average-day and maximum-day demand. These estimates will be used in the next section of the plan to integrate conservation savings with the system's plans for supply-side facilities.

Worksheet 5-12: Selection of Conservation Measures and Estimate of Water Savings

Line	Measure	Selected ☑	Primary criteria for selecting or rejecting the conservation measure for implementation	Estimated reduction in demand for selected measures (gallons per day) [a]	
				Average-day demand	Maximum-day demand
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20…					
Total					

[a] Based on Worksheet 5-9, line 11. Planners will need to convert estimates of annual water savings to estimates of reductions in average-day and maximum-day demand for each measure or group of measures.

8. INTEGRATE RESOURCES AND MODIFY FORECASTS

Integrating Options

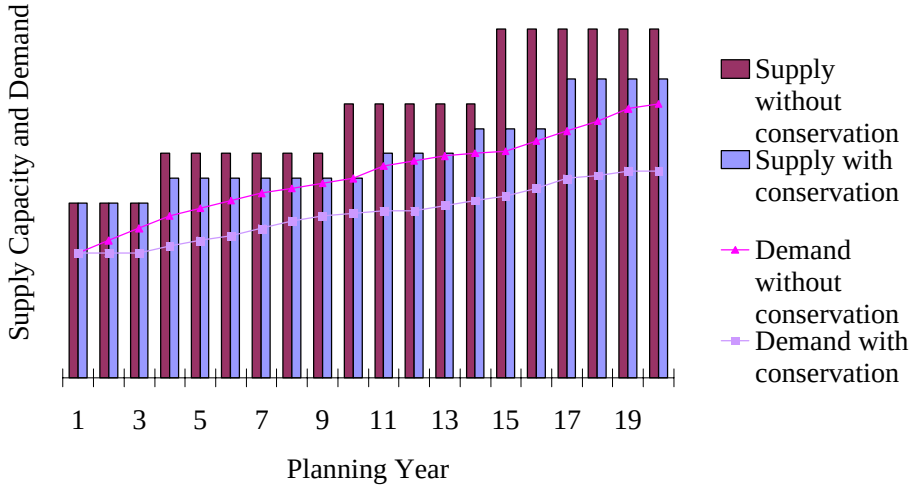
Modify water demand and supply-capacity forecasts to reflect the anticipated effects of conservation. Indicate whether and how water savings from conservation will allow systems to eliminate, downsize, or postpone supply-side projects or water purchases.

In this section, planners can revise the demand and supply-capacity forecasts made in earlier sections of the plan based on anticipated conservation savings. Pay particular attention to the effects of conservation on specific supply-facility projects.

Planners should be cautious to avoid counting demand-side or supply-side resources more than once in the analysis. Anticipated savings from conservation should be based on realistic estimates of savings associated with the planned measures. Similarly, supply projects that involve multiple facilities should be considered in terms of the total water supply capacity that is made available through those combined facilities. Timing is another issue. The plan should address how different supply-side and demand-side projects involve different life spans and implementation schedules. One twenty-year supply-side project, for example, might be offset by a series of conservation measures that begin and end at different times.

Some conservation plans use a graph to display anticipated annual supply capacity and demand without and with the implementation of conservation measures. Figure 5-2 is an example of this type of graph for a twenty-year planning horizon.

Figure 5-2
Sample Graph of Modified Supply and Demand Forecasts
Based on Implementing Conservation Measures



Modifying Demand Forecasts

Planners should use Worksheet 5-13 to collate information from previous worksheets and analyses in order to revise the demand forecasts made in Worksheet 5-4. Revisions should reflect changes based on the introduction of *new* conservation measures. The effects of measures already being implemented should be included in the original demand forecast.

Modifying the demand forecast requires a considerable degree of judgment, particularly in estimating the effects of conservation on average-day and maximum-day demand. The plan should include an explanation of the approach used in revising the demand forecasts.

Project-Specific Savings

Planners should identify the anticipated effects of conservation on planned supply-side improvements and additions (as specified in Section 4). Worksheet 5-14 is provided for this purpose. A worksheet should be completed for separable supply projects as appropriate. Ideally, water conservation strategies that reduce demand will translate into supply-side savings through one or more of the following actions:

- Eliminating a project for the foreseeable future
- Downsizing a project based on reduced capacity needs
- Postponing a project into the future
- Eliminating, reducing, or postponing water purchases

Adjustments to supply-capacity planning must be realistic, especially in terms of complex and sometimes competing goals. Supply projects cannot be eliminated, downsized, or postponed if doing so would compromise public health or safety, reduce operational efficiency, or inflate costs beyond a reasonable amount. Some systems (including systems that currently operate with inadequate or unreliable supply reserves) may not be able to translate all demand reductions into supply-capacity reductions. Planners should identify and describe such circumstances. On the other hand, supply projects that are not needed or oversized place an unnecessary burden on systems and their customers.

Modifying Supply Forecasts

The supply-capacity forecast is revised in Worksheet 5-15. The revision to the supply-capacity forecast should be based on Worksheet(s) 5-14 and consistent with accepted supply-capacity planning practices. The modification of forecasts should reflect reasonable assumptions about anticipated implementation schedules, which are summarized in Section 9. Planners also can indicate the anticipated capacity reserve (the difference between forecast supply capacity and demand).

Worksheet 5-15 also provides a method of summarizing savings in capital and operating costs, based on reductions in supply capacity. Planners also should estimate reductions in

operating costs at *existing* facilities that will occur with demand reductions (apart from operating costs associated with planned facilities). The total program cost of conservation can be compared with the savings in total capital and annual operating costs.

As recognized throughout these Guidelines, water conservation also has nonmonetary benefits. Planners should discuss, as appropriate, how implementation of the conservation program will help their system cope with any of the conditions identified in Section 2 (Worksheet 5-2). For example, the planned measures might help a system address problems related to safe yields or drought management.

Revenue Effects

The conservation plan should briefly describe how planned conservation measures will affect water utility revenues (based on reduction in sales) and discuss strategies for addressing these revenue effects. Reductions in water usage will affect the revenues of the water utility. Reductions in water usage will affect the revenues of the water utility. Conservation will help the water utility reduce variable costs (such as energy, chemical, and purchased water costs). In the long term, conservation also will help the utility reduce fixed costs (associated with new capital facilities). In the short term, reductions and sales can lead to a shortfall in revenues needed to cover fixed costs and sustain the financial viability of the water system.

The planner can estimate the effect of conservation on revenues by multiplying current water rates by the adjusted level of sales (for the variable portion of the water bill). The adjusted level of sales should include the anticipated effects of conservation. Conservation-oriented rate structures have direct revenue effects that should be considered. Worksheet A-4 in Appendix A can be used to evaluate the revenue effects of rate changes.

Conservation planners should work closely with financial planners in order to integrate their analyses, identify potential revenue shortfalls, and devise strategies to ensure that the utility will meet its revenue requirements.

Adjustments to water rates may be needed. For some utilities, a change in rates requires approval from an oversight board or state public utility commission. When rate increases are offset by usage reductions, customer bills and utility revenues can be maintained. Customers and utilities eventually will realize savings from conservation through long-term reductions in costs.

Worksheet 5-13: Modified Demand Forecast

Line	Item	Current year	Year 5	Year 10	Year 20
1	Average-day demand before conservation [a]				
2	Reduction in average-day demand (line 1 less line 2) [b]				
3	Average-day demand after conservation				
4	Maximum-day demand before conservation [a]				
5	Reduction in maximum-day demand (line 4 less line 5) [b]				
6	Maximum-day demand after conservation				
7	Ratio maximum-day to average-day demand before conservation (line 4 divided by line 1)				
8	Ratio maximum-day to average-day demand after conservation (line 6 divided by line 3)				

[a] From Worksheet 5-4, line 6.
[b] Based on Worksheet 5-12.

Worksheet 5-14: Project-Specific Savings

DESCRIPTION OF PROJECT [a]

Describe the supply-side project(s): _____
_____

Project was scheduled to begin: _____

Purpose of the project: ❒ Improvement ❒ Addition

The project is designed to meet: ❒ Average-day demand ❒ Maximum-day demand

Type of project:
❒ Source of supply
❒ Water treatment facilities
❒ Treated water storage
❒ Major transmission lines
❒ Purchased water
❒ Other _____

CHANGES TO PROJECT [b]

Line	Item	Project supply capacity (daily)	Project Costs	
			Total capital costs ($)	Annual operating costs ($)
A	**CAPITAL PROJECT IS ELIMINATED**			
1	Original project			
2	Savings from elimination (equals line 1)			
B	**CAPITAL PROJECT IS DOWNSIZED**			
3	Original project			
4	Downsized project			
5	Savings from downsizing (line 3 less line 4)			
C	**CAPITAL PROJECT IS POSTPONED**			
6	Present value of original project			
7	Present value of postponed project			
8	Savings from postponement (line 6 less line 7)			
D	**NEED FOR PURCHASED WATER IS REDUCED [c]**			
9	Original estimate of purchases			
10	Revised estimate of purchases (can be "0")			
11	Savings from reduced purchases (line 9 less line 10)			

[a] Comprehensive plans can include wastewater facilities.
[b] Based on Worksheet 5-13 estimates of reductions in demand.
[c] For purchased water, report only annual operating costs and include costs associated with take-or-pay contract provisions. Transmission facilities needed to transport purchased water should include capital and operating costs associated with such facilities and reported as a capital project.

Worksheet 5-15: Modified Supply Forecast and Estimated Total Savings

MODIFIED SUPPLY FORECAST

Line	Item	Current Year	Year 5	Year 10	Year 20
A	**Forecast Supply Capacity (Daily)**				
1	Supply capacity before conservation program [a]				
2	Planned reduction in supply capacity [b]				
3	Supply capacity after conservation (line 1 less line 2)				
B	**Capacity Reserve**				
4	Supply capacity less demand (line 3 less line 2 on Worksheet 5-13)				

ESTIMATED TOTAL SAVINGS

Line	Item	Supply capacity (daily)	Project Costs	
			Total capital costs ($)	Annual operating costs ($)
C	**Total Estimated Savings from Changes to Supply Projects [c]**			
1	Cost of supply projects before conservation			
2	Cost of supply projects after conservation			
3	Savings (line 1 less line 2)			
D	**Total Estimated Savings from Reduced Operating Costs at Existing Facilities [d]**			
4	Operating costs before conservation			
5	Operating costs after conservation			
6	Savings (line 4 less line 5)			
E	**Conservation Program Costs**			Total program costs ($)
7	Total cost of implementing selected conservation measures [e]			

[a] From Worksheet 5-7.
[b] Based on Worksheet(s) 5-14.
[c] Based on Worksheet(s) 5-14.
[d] Based on annual variable operating cost (including energy, chemicals, and water purchases).
[e] Based on Worksheet 5-11.

9. PRESENT IMPLEMENTATION AND EVALUATION STRATEGY

Implementation

Present a strategy and timetable for implementing conservation measures and other elements of the conservation plan. Describe proposed approaches for implementing and evaluating planned conservation measures.

In this final step in the conservation planning process, the water system specifies its strategy and timetable for implementation. It can be emphasized, however, that conservation planning will require an *ongoing* effort on the part of water utility managers. Ongoing planning and implementation will go hand in hand. The implementation strategy should include a preliminary schedule for monitoring and evaluating program results and revisiting the plan for updates and modifications.

Implementation of Measures

Worksheet 5-16 is a simple template for summarizing the water system's implementation and evaluation schedule for the conservation measures. For each measure, the schedule can identify significant implementation actions, a beginning date, and a completion date. Implementation actions include:

- Securing budgetary resources
- Hiring of staff
- Procurement of materials
- Agreements with suppliers or consultants
- Acquisition of permits or other approvals from regulatory agencies
- Legislative actions (for changes in water-use regulations)
- Activity milestones (for example, system audits or distribution of retrofit kits)

Planners should make note of any specific factors or contingencies that might affect or prevent the implementation of specific measures. For example, if a measure cannot be implemented prior to obtaining a special permit or other authority, this fact should be noted along with an explanation of the strategy for obtaining the necessary authority.

Some measures might require implementation actions that take place over several years (in order to sustain conservation savings). The plan should provide sufficient detail to understand the utility's strategy with regard to implementing such measures.

Implementation and Evaluation

Worksheet 5-17 provides a very simple summary of the water system's general implementation and evaluation strategy for the conservation plan. Three areas are highlighted:

- Public involvement
- Monitoring and evaluation
- Updates and revisions

A plan for public involvement should discuss whether and when the water system intends to involve members of the community in the implementation of the conservation plan. Some systems may want to schedule regular meetings with community groups to keep them informed of the system's progress in meeting goals.

A plan for monitoring and evaluation should address data collection, modeling, and other issues that will be important in tracking the effects of water conservation on demand over time. The system may want to plan to collect new kinds of data for monitoring purposes as well as for future forecasting needs. Many systems might find, for example, that more detailed data on demand by customer class are needed, including more detail on contributions to average-day and maximum-day demands. More detailed data might also be needed to assess trends in nonaccount water.

A plan for updates and revisions will help keep the system's conservation plan current over time and account for the system's actual experience with conservation. Updating forecasts of water demand and supply capacity as new data become available is especially important. In some cases, the system might want to revise or expand its planning goals. Many systems update plans every five years. However, changing conditions or other concerns might justify more frequent updates. The schedule of updates and revisions might be affected by state or local requirements for conservation planning by the water system.

The conservation planning document also should include a record of the plan's adoption by the water system's governing body (such as a Board of Directors or City Council), as appropriate.

Worksheet 5-16: Implementation Schedule for Measures

Line	Measure	Required action	Beginning date	Completion date	Notes
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

Worksheet 5-17: Implementation Strategy

A. PUBLIC INVOLVEMENT

Describe plan for public involvement:

B. MONITORING AND EVALUATION

Describe plan for monitoring and evaluation:

Describe plan to collect water demand data:

C. PLAN UPDATES

Describe plan for updates and revisions:

D. ADOPTION OF THE PLAN

Date plan completed: _____
Date plan approved: _____
Approved by [governing body]: _____
Signature: _____

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