Principles of Water Rates, Fees, and Charges

MANUAL OF WATER SUPPLY PRACTICES

M1

Fifth Edition

American Water Works Association

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Sections

Principles of Water Rates, Fees, and Charges

AWWA MANUAL M1

Fifth Edition

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Foreword

In 1954 the American Water Works Association (AWWA) published the report "Determination of Water Rate Schedules," which later was issued as the first AWWA manual on water rates. Since then, AWWA Manual M1, *Water Rates*, has been updated several times, most recently in 1991. Recognizing the growing number of rates-related issues, the AWWA Rates and Charges Subcommittee began to address other issues in subsequent publications.

- AWWA Manual M26, *Water Rates and Related Charges*, was first published in 1986 and updated in 1996. This manual covers connection charges, service extensions, system development and capacity charges, the costs of providing fire protection services, wholesale rates, and miscellaneous charges.
- AWWA Manual M35, *Revenue Requirements*, was published in 1990. This manual expanded on discussions in AWWA Manual M1 associated with determining revenue requirements for governmental and investor-owned utilities.
- AWWA Manual M34, *Alternative Rates*, was published in 1991 to present the proper development of the growing number of rate structures. It was subsequently expanded and reissued in 1999 as *Water Rate Structures and Pricing*.

The issues associated with water rates and charges have expanded considerably since the first rates-related documents were issued in the 1950s. The Rates and Charges Subcommittee recognized that users of the various manuals were becoming confused by the proliferation of manuals on various related subjects. As a result, the subcommittee created a new "super manual" to bring together all these issues in one document and better serve those most interested in matters associated with developing water rates and charges. The Rates and Charges Subcommittee intends to update sections of this new manual as new issues and questions arise.

As with the other manuals prepared by the Rates and Charges Subcommittee, this manual will not prescribe a solution. Rather, it is intended to provide guidance and advice. The examples presented are merely examples. The underlying data and assumptions are not endorsed or recommended either by AWWA or the Rates and Charges Subcommittee for use elsewhere. The purpose of this manual is to describe and present issues associated with developing water rates and charges, to enumerate the advantages and disadvantages of various alternatives, and to provide information to help users determine water rates and charges that are most relevant to a particular situation.

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Introduction

During the last twenty years of the twentieth century, the cost of supplying potable water increased significantly. This rapid increase can be attributed to a number of factors, including the passage and implementation of the U.S. Safe Drinking Water Act, the need to develop more remote and expensive water supplies, the need to replace aging infrastructure, and rapid economic development in some areas. The increased costs of meeting water quality requirements and utility plant needs have resulted in increased water rates and charges.

Historically, customers generally paid little attention to their water bills or the structure of the rates. However, as the rates and charges increased and water bills became a more significant percentage of customers' overall expenses, consumers have become increasingly interested in the rate setting process. Water utilities are also recognizing that the methods they employ to charge for service can influence customer use patterns.

The AWWA Rates and Charges Subcommittee believes that the costs of water rates and charges should be recovered costs from classes of customers in proportion to the cost of serving those customers. However, the subcommittee also recognizes that other considerations may be equally or more important in determining rates and charges and may better reflect emerging objectives of the utility or the community it serves.

The emergence of new rate and pricing policies has brought a continuing evolution in rate structures. In some cases, water rates and charges may have been adopted to achieve certain goals without a full understanding of the impacts or resulting implications. Some rate alternatives, if not properly designed, may even have impacts that are counter to what was intended.

This manual is intended to help policymakers and rate analysts consider all relevant factors when evaluating and selecting rates, charges, and pricing policies. It is a comprehensive collection of discussions and guidance on a variety of issues associated with designing and developing water rates and charges; it incorporates materials presented in four different AWWA guidance manuals published in earlier years.

This manual contains ten main sections:

- Section I discusses the determination of revenue requirements
- Section II presents the process in which costs are identified and allocated to classes of customers
- Section III presents various rate structures and how they are developed
- Section IV presents pricing alternatives related to specific customers or groups of customers
- Section V discusses the recognition of demands, drought conditions, and other considerations in establishing rates and charges
- Section VI discusses the derivation and implementation of capacity and development charges

- Section VII presents public and private fire protection charges
- Section VIII concentrates on developing charges for wholesale or bulk users that subsequently resell or distribute water
- Section IX presents a number of special and miscellaneous charges
- Section X presents various implementation considerations

Section I

Revenue Requirements

General Concepts

Revenues

Operation and Maintenance Expenses

Taxes

Capital-Related Costs

Examples of Revenue Requirements

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Chapter 1

General Concepts

In providing adequate water service to its customers, every water utility must receive sufficient total revenue to ensure proper operation and maintenance (O&M), development and perpetuation of the system, and preservation of the utility's financial integrity. Nearly all of total revenue requirements for most utilities are met from revenues derived from selling water to their customers. Other revenue not derived from the sale of water may come from a variety of sources such as rentals, merchandising, and providing services to other utilities or entities, and capacity or impact fees.

ADEQUACY OF REVENUES

Adequacy of water revenues can be measured by comparing revenue requirements to be met from rates with revenues under existing or authorized rates.

Length of Projections

Revenue projections can be made for any length of time depending on the purpose of the projection. For budgetary purposes, utilities may project only one year ahead. From a revenue-adequacy standpoint, projections beyond 10 years tend to be quite speculative and are of questionable value. Usually a projection period of about five years is considered adequate. This timeframe provides a reasonable forecast of anticipated future revenue needs, thereby assisting management, policymakers, and the public to foresee potential problems and to avoid surprise when future changes in rate levels are requested or announced. When a utility adequately plans ahead, five-year projections are typically sufficient to satisfy investors, bond-rating agencies, and other interested parties. These projections also indicate the security of potential investment in the utility system.

Regardless of the projection period used, the utility should review its projections at least annually to incorporate changed conditions. A projection should be considered a living document subject to change as conditions change. The projection period is assumed to be the utility's next five fiscal years. However, the principles discussed and shown apply to any projection period appropriate for the particular circumstances. In making projections for more than one year, measures of adequacy (i.e., indicated annual deficiencies) do not necessarily imply that an immediate rate change sufficient to cover deficiencies for the entire projection period is required or recommended. Rate changes for only a portion of the projection period may be appropriate.

Other Adequacy Studies

The adequacy of water revenues is measured and studied to aid the process of rate making for future service. Studies can be made for other purposes, including

- input for overall financial planning and budgeting
- support for (often part of) documentation for issuance of debt securities to be financed from utility revenues
- measurement or evaluation of the adequacy of revenues in the past or future as a part of contractual, litigation, rate-proceeding, or other requirements.

Rate making and planning require projections of future revenue needs. The issuance of debt securities and contractual, litigation, or rate-proceeding requirements may necessitate both evaluation of past performance and projections of future adequacy.

APPROACHES TO PROJECTING REVENUE REQUIREMENTS

The two generally accepted and practiced approaches to projecting total revenue requirements of a water utility are the "cash-needs" approach and the "utility" approach. Each has a proper place in utility practice and each, when properly used, can provide for sound utility financing. A broad overview of the elements of revenue requirements to be considered under each of these two accepted approaches is presented in the following paragraphs. Subsequent chapters discuss each of the elements.

General Techniques

Utilities should realize that it is acceptable to measure total revenue requirements using one approach, and subsequently, allocate those costs among customer classes using another approach. Historical data must be normalized or adjusted to reflect conditions that may not continue into the future. Such factors include, but are not limited to, those listed in Table 1-1. Each of these factors as well as other appropriate factors must be considered when projecting revenues and revenue requirements.

Table 1-1 Normalization factors

Factors Affecting Revenues	Factors Affecting Revenue Requirements
Number of customers served	Number of customers served
Customer water use	Customer water use
Rate changes	Non-recurring sales
Non-recurring sales	Weather
Weather	Conservation
Conservation	Use restrictions
Use restrictions	Inflation
Price elasticity	Interest rates
	Capital financing needs
	Changes to tax laws
	Other changes in operating and economic conditions

Actual performance generally will vary from projected performance. The projections are intended to forecast, as nearly as practicable, the future levels of revenue and revenue requirements so that the utility may make adequate, but not excessive, adjustments in revenues in a timely manner.

Cash-Needs Approach

The objective of the cash-needs approach for projecting revenue requirements is to ensure that utility revenues are sufficient to recover total cash needs for a given projection period. Generally, the cash-needs approach is used by government-owned utilities (except in a few jurisdictions where regulation requires the use of the utility approach).

As used in this manual, the term *cash needs*, as it applies to measuring revenue requirements of a utility, should not be confused with the accounting term *cash* as compared to *accrual* as an accounting method. Cash needs refer to the total revenues required by the utility to meet its cash expenditures, whereas the accounting term *cash* refers to revenues being recognized as earned when cash is received and expenses charged when cash is disbursed. The cash-needs approach to measuring revenue requirements of a utility may be evaluated on either the cash, accrual, or modified accrual basis of accounting.

Generally, revenue-requirement studies using the cash-needs approach are simpler than studies using the utility approach. An important factor of the cash-needs approach, particularly when used by government-owned utilities, is its reliance on debt financing. Debt indentures usually specify that sufficient cash is derived to meet cash expenditures, that deposits are made to specific reserve accounts, and that stipulated debt-service coverage requirements are met.

Revenue-requirement components. Basic revenue-requirement components of the cash-needs approach include O&M expenses, debt-service payments, contributions to specified reserves, and the cost of capital expenditures that are not debt-financed or contributed. Depreciation expense is not included.

Operation and maintenance expenses. The O&M expense component is usually projected based on actual expenditures and adjusted to reflect anticipated changes in expenditures during the projection period. Pro forma adjustments to historical O&M expenses are determined by incorporating known and measurable changes to recorded expenses, and by using well-considered estimates of future expenses.

Generally O&M expenses include salaries and wages, fringe benefits, purchased power, purchased water, other purchased services, rent, chemicals, other materials and supplies, small equipment that does not extend the useful life of major facilities, and general overhead. For a government-owned utility, other elements of O&M expense might also include the costs of support services rendered by the municipality, such as the use of computer facilities, assistance in collecting water bills, or office rental.

Debt-service payments and specified reserves. The debt-service component of the cash-needs approach usually consists of principal and interest payments on bonds or other debt instruments. It also may include debt-service reserve requirements as established by the indenture. Other reserves are often required to provide for emergency repairs and replacements, as well as for routine replacements and extensions. In addition to debt service and payments to reserve fund accounts, many utilities are required to provide net revenues sufficient to cover the bonded debt, particularly if revenue bonds are involved. Typically, coverage requirements specify that revenues be sufficient to meet O&M expenses and taxes and, at a minimum, to equal or exceed a stated percentage of the annual debt-service payments. Coverage requirements are a test of the adequacy of utility revenues and do not necessarily represent a specific cash requirement or funding obligation. The coverage requirements are intended to provide a measure of security for bondholders. As such, coverage requirements must also be considered in determining the total annual revenue needed to comply with the utility's debt covenant agreements.

Capital expenditures. Generally, capital expenditures are classified into three broad categories: (1) normal annual (routine) replacement of existing facilities; (2) normal annual extensions and improvements; and (3) major capital replacements and improvements. A utility should periodically review and update its needs in each of these areas to recognize changing conditions. Projections for such needs are essential in developing overall revenue requirement projections. These projections of total capital needs should be accompanied by estimates of contributions received from developers or customers, government grants, and other nonutility sources.

Government-owned utilities commonly use current revenues to finance:

- normal annual replacements,
- extensions, and
- improvements (such as meters, services, vehicles, smaller mains, and similar items that occur regularly each year).

Major capital projects are typically financed with a combination of long-term debt and equity. Capital costs are distributed over the term of the bonds by repaying the debt over a number of years and using equity. The use of long-term capital results in a better matching of customers' charges with the use of the facilities so that existing customers will not be paying 100 percent of the initial cost of facilities that will be used for many years.

Other components. Other cash revenue requirements of a government-owned utility that may be financed from water system revenues include payments made to a municipality's general fund in addition to interdepartmental expenses for services rendered. Such additional requirements are unique to each local situation and should be considered where applicable.

Utility Approach

The utility approach to measuring revenue requirements is mandated for all investor-owned water utilities and mandated or permitted for government-owned utilities in jurisdictions where the utility is regulated by a utility commission or other regulatory body.

The term *utility approach* or *utility basis* tends to have two meanings in water utility rate making. One use involves measuring revenue requirements of a utility without concern for allocating those revenue requirements among classes of customers served. Utility-based revenue requirements may consist of O&M expenses, depreciation expense, return on rate base, and taxes or other payments to the municipality's general fund. The second use of the term *utility basis* in rate making is in allocating revenue requirements, or total costs of service to be derived from water rates, among the classes of customers served.

The utility basis of cost allocation is an appropriate method for calculating the costs of service applicable to all classes of customers. It is particularly applicable to those customers located outside the geographical limits of a government-owned utility. When a government-owned utility provides service to customers outside its geographical limits, the situation is similar to the relationship of an investor-owned utility to its customers because the owner (political subdivision) provides services to nonowner customers (customers outside its geographical limits). In this situation, the government-owned utility, like an investor-owned utility, is entitled to a reasonable return from nonowner customers based on the value of its plant required to serve those customers. Some jurisdictions have laws or guidelines to regulate the rates that government-owned utilities charge customers located outside their limits.

Projections for Government-Owned Utilities

For a government-owned utility, the total level of annual revenue required may be similar under either the cash-needs approach or the utility approach. The O&M expense component of total revenue requirements is usually the same under both approaches. Under the utility approach, the annual requirement for capital-related costs consists of two components—depreciation expense and return on rate base. Using the cash-needs approach, capital-related costs are recovered through total debt service (principal and interest) and coverage.

Depreciation. Depreciation is a real part of the cost of operating a utility, whether government owned or investor owned. Depreciation is the loss in value of facilities, not restored by current maintenance, that occurs in the property because of wear and tear, decay, inadequacy, and obsolescence. The annual depreciation expense component of revenue requirements allows the utility to recover its capital investment over the anticipated useful life of the depreciable assets. Therefore, it is fair that this expense be borne by the customers benefiting from the use of an asset during the useful life of the asset.

Depreciation expense should be based on the depreciable plant investment that is in service during the period for which rates are being established. Because depreciation expense is a noncash requirement, the inclusion of depreciation expense in calculating revenue requirements provides the utility with funds that are available for use as a source of capital for replacing, improving, and expanding systems or for repaying debt.

Return on rate base. The return component is intended to pay the annual interest cost of debt capital and provide a fair rate of return for the total equity capital employed to finance facilities used to provide water service. While the annual interest costs can be readily determined, the cost of equity capital is more difficult to determine. The return to the equity owner should be in keeping with the return in other enterprises having corresponding risks. Moreover, the return should be sufficient to assure confidence in the financial integrity of the enterprise so as to maintain its credit and to attract and hold capital.

The utility basis of determining revenue requirements usually necessitates establishing a rate base, defined to be the value of the assets on which the utility is entitled to earn a return, and the setting of a fair return rate on the rate base. The rate base is primarily composed of the depreciated value of the utility's property devoted to serving the public. In addition, the utility may be permitted to include an allowance in the rate base for working capital and construction work in progress (CWIP). On the other hand, grants and contributions (such as government grants, developer-donated facilities, and other nonutility-supplied funds) are generally deducted from the utility's rate base.

As previously mentioned, another element of utility basis revenue requirements for a government-owned utility may be payments to the general fund of the municipality or payments in lieu of taxes (PILOT) to other government entities.

Projections for Investor-Owned Utilities

The total annual revenue requirements of an investor-owned utility include O&M expenses, depreciation expense, income taxes, other taxes, and return on rate base. The O&M expenses, depreciation expense, and return on rate base for an investor-owned utility involve the same considerations discussed for a government-owned utility using the utility approach.

Federal, state, provincial, or local income taxes must be paid by an investor-owned utility and, therefore, are properly included in determining total revenue requirements. Other taxes, such as property taxes, gross receipts taxes, and payroll taxes, also must be recognized.

Each utility commission and regulatory body has its own rules, regulations, and policies for determining total revenue requirements. In preparing for any rate matter within a specific jurisdiction, the utility must determine the procedures and policies of the regulatory body and follow those policies in determining its revenue requirements.

TEST YEAR

Revenue requirements are frequently expressed in terms of a test year for purposes of allocating costs and designing rates. The test year may represent a specific 12-month period of time or it may be an annualization of a rate-design period of more or less than one year.

Test-year periods are usually of three general types—historical, current, and future. An historical test-year period is defined as a prior 12-month period for which actual operating data are available. A current test-year period may be defined as any 12-month period that includes both historical and projected data. A current test year usually includes not more than six months of projected data, but, in some cases, up to nine months of projected data are used. A future test-year period is defined as any 12-month period beginning after the date the rate changes are to be made.

Generally, government-owned utilities are free to set their own policies regarding test-year periods. However, investor-owned utilities and those government-owned utilities that are under the jurisdiction of utility commissions are subject to particular legislative and regulatory practices that must be followed. These practices vary from jurisdiction to jurisdiction.

Government-Owned Utilities

Government-owned utilities typically select a future test year in recognition of budgetary requirements, bond indentures, and rates being designed for a future period. The test year may simply correspond to an upcoming fiscal year or represent the annualization of the period for which rates are intended to be effective. For example, if projected revenue requirements and revenues indicate that a 16 percent increase in revenues would meet the revenue requirements for a 24-month period, then the utility may wish to use a test year that averages the revenue requirements and revenues for the 24-month period.

When selecting a test year for a government-owned utility, legislative or debt-indenture requirements may need to be considered. Certain government-owned utilities are required by their ordinance or governing documents to establish rates and charges that are adequate to provide for specific revenue requirements and coverages for certain projected test periods. These revenue requirements and coverages generally require projections based on historical data to develop a future test year in evaluating the adequacy of revenues under proposed rates and charges.

Table 1-2 Summary of test-year revenue requirements (× $1,000)

Line No.		Government-Owned Utility: Cash-Needs Approach	Government-Owned Utility: Utility Approach	Investor-Owned Utility: Utility Approach
1	O&M expense	2,279	2,279	2,279
2	Debt service	860		
3	Debt service reserve	60		
4	Capital improvements	380	*	*
5	Depreciation expense		414	414
6	Other taxes			360
7	Income taxes			469
8	Return (operating income)		886†	1,451†
9	Other revenue	(79)	(79)	(31)
10	Total revenue requirements from rates	3,500	3,500	4,942

*Annual cash requirements for this item are met from depreciation expense and return.

†Includes interest on debt.

Debt-related agreements may include provisions that could influence the selection of the test year. The specified debt-service coverage tests and conditions for the issuance of additional bonds must often be considered when selecting a test year. Some debt indentures specify that rates be enacted for each upcoming fiscal year or for a specific period in the future.

Investor-Owned Utilities

An investor-owned utility must follow the established practices and policies of the applicable utility commission when selecting a test year. Many regulations require the use of an historical test year, which may be adjusted for known or reasonably anticipated changes. Some commissions allow a current test year that includes a combination of historical and projected data. Other commissions may accept a future test year.

A comparison of example test year revenue requirements for a government-owned utility on both the cash and the utility basis is shown in Table 1-2. A parallel statement of the revenue requirements for a similarly sized investor-owned utility is also shown in Table 1-2.

As shown in Table 1-2, the O&M expense component of the total test-year revenue requirement is the same for the investor-owned utility as for the government-owned utility using either the cash-needs or the utility approach. Using the utility approach, the annual depreciation expense component of total revenue requirements, shown on line 5 in Table 1-2, is $414,000. This is determined by applying a proper schedule of depreciation rates to the total depreciable plant investment in service. In the example, the depreciation value is calculated by multiplying the composite depreciation rate, about 1.89 percent, by the total depreciable plant investment ($21,904,000). Under the utility approach, the annual depreciation expense allowance is the same for either an investor-owned or a government-owned utility.

For a government-owned utility to meet the total cash-revenue requirements under the utility approach, the level of return to be derived from rates in the example is required to be $807,000 ($886,000–$79,000), as shown on lines 8 and 9 of Table 1-2. Assuming a rate base of $16,186,000, the overall rate of return for the hypothetical government-owned utility is about 4.99 percent. In any particular government-owned utility the magnitude of existing debt service and the policy regarding the amount of revenue financing of capital improvements will influence the required level of return. This may result in an indicated need for an overall rate of return markedly different from the example.

For the same example utility on an investor-owned basis, income taxes and other taxes must be considered when determining annual revenue requirements. The element of other taxes, shown on line 6 of Table 1-2, amounts to $360,000 and could include business, occupational, gross receipts, and other types of taxes.

The income-tax element of the investor-owned utility's cost of service is based on the application of a composite tax-rate allowance for both federal and state income taxes to total taxable income. In this example, taxable income equals total revenue less O&M expense, depreciation expense, other taxes, and interest expense. Income tax is shown on line 7 to be $469,000.

The rate base for the investor-owned utility is less than that for the government-owned utility by the amount of accumulated deferred income taxes.

An overall rate of return of 10.5 percent on the rate base of $13,820,000 was assumed, resulting in a requirement for return (operating income) of $1,451,000. The higher return for the investor-owned utility assumed in Table 1-2 results from the weighted cost of debt and equity capital. This return would be expected to be greater than the resulting overall 4.99 percent rate of return shown for the government-owned utility. The rate of return for the government-owned utility in this example is adequate only to provide for cash needs beyond O&M expense and capital requirements covered by depreciation expense.

Where a government-owned utility is serving customers outside its jurisdiction who are considered to be non-owners, the applicable rates of return may properly reflect a differential between owners and non-owners. For a government-owned utility providing service to non-owners, developing an appropriate rate of return may reflect imbedded interest cost and return on system equity. Once established, the rate of return assigned to system owners would be developed to recognize remaining cash needs. Consideration of differential rates of return is addressed in a subsequent chapter of this manual.

From the example shown in Table 1-2, it is apparent that the overall revenue requirement to be obtained from water rates varies with the type of ownership and other system requirements. In the example, the overall level of revenue requirements varies from $3,500,000 for the government-owned utility paying no income taxes, financed with tax-free bonds, and in which the customers have made the equity investment for which no return is required, to $4,942,000 for an investor-owned utility paying all taxes, with no tax-free financing available, and having to pay a fair and reasonable return to equity investors who provided a portion of the investment requirements.

Chapter 2

Revenues

Revenues are the lifeblood of a water utility. Without adequate revenues, the quality of service will deteriorate from the lack of proper maintenance and system improvements.

SOURCES OF REVENUE

There are two basic sources of revenues available to a water utility: operating revenues and non-operating revenues. Operating revenues include sales of water to general customers and other services that are usually provided under standard rate schedules or by contractual arrangements. Non-operating revenues include merchandising and contract of services (jobbing), tax revenues, gains or losses from the sale of property, rental of non-operating property, interest income, and other items not usually directly related to the provision of water service.

Additionally, in some government-owned utilities, transfers from the government-entity general fund are used as a revenue source to fund such items as debt service, various capital outlays, and, in some cases, O&M expenses. With the exception of dedicated funds, utilities that use such transfers are not considered to be adequately financed, self-sustaining enterprises.

Revenue Classifications

Table 2-1 shows a list of typical revenue classifications. As noted in the table, sales to general retail customers may be subdivided into unmetered (if applicable) and metered sales, and each category usually is further subdivided into customer classes such as residential, commercial, and industrial. Additional subdivisions or alternative classifications may include such categories as governmental, apartments, single-family, and multi-family dwellings.

Where applicable to government-owned utilities, each of these general water-service classes is considered separately in determining whether it is inside or outside of the jurisdictional limits of the owning agency.

Sales for resale generally consist of deliveries to customer groups, such as suburban cities or water districts, on a wholesale basis through master meters. Other

Table 2-1 Typical revenue classifications

Operating Revenues	Non-operating Revenues	Contributions to Capital
General Water Service	Merchandising and contract services (jobbing)	Developer and customer contributions
Unmetered sales	Rents from non-operating property	Grants
Metered sales	Interest and dividend income	
Sales for resale (wholesale)	Gains or losses from disposition of property	
Other special sales	Tax revenues	
Private fire protection	Transfers from other governmental funds	
Public fire protection	Allowance for funds used during construction	
Other Operating Revenues	Other non-operating revenues	
Miscellaneous service revenue		
Forfeited discounts		
Rents from water property		
Other water revenues		

special sales may include irrigation, air conditioning, standby, off-peak, interruptible, and individual contract service where special rates may apply.

Private fire protection service revenues include charges for sprinkler-service connections, standpipes, fire hydrants, and other fire protection facilities located on the customers' premises. Public fire protection service revenues generally include the charges for service provided through public fire hydrants.

Miscellaneous service revenues include any revenues resulting from other services regularly provided by the utility. This includes, among other elements, revenues from charges for connecting or disconnecting service, special meter readings, temporary hydrant use, new account charges, and collection-related charges.

Forfeited discounts include revenues from discounts foregone as a result of untimely payment of water bills. They also can include penalties assessed for late payment of water bills.

Rents from water property include rental income from the lease or rental of operating property and equipment. Other water revenues may include billings for outside agencies, gain on sale of materials, wheeling charges, or any other sources not covered by published rates. Utilities required or wishing to include service-connection fees or system-development charges (impact fees) as operating revenues could include them in other water revenues. However, if these items of revenue are significant, they should be accounted for separately. Service-connection fees and system-development charges are more properly included under non-operating revenue (if they are considered revenue). In the case of investor-owned utilities, such fees and charges usually have been treated as contributions in aid of construction on the utility's books and not as a revenue item.

Merchandising and contract services (jobbing) revenues are net revenues from sales of equipment and services rendered to customers. Water utilities rarely sell equipment and this account normally includes only net contract services revenues. Contract services include such items as installing customers' services on their premises, repairing customers' services or plumbing, and any other type of construction or repair for which the utility charges the customer on a one-time basis. The utility credits this account with the amounts billed to customers for work and concurrently charges the account with the cost, including labor, materials, equipment use, labor overheads, taxes, and any other costs that can be attributed to the work performed. In this manner, the net revenue from such operation is reflected in the account. The result can be either a gain or a loss to the utility depending on the utility's diligence in properly establishing charges related to these activities.

Rents from non-operating property include rental income from utility property not used for operating purposes (such as the rental of buildings on land purchased to acquire water rights). If the utility has investments that earn interest or dividends, such income should be reported in the interest and dividend income account.

If a utility sells or otherwise disposes of an item of utility property, the net proceeds are reported as gains or losses from sale or disposition of utility property. The net gain or loss is measured by the net selling price less the net book cost (book cost less accumulated depreciation) of the property sold.

Tax revenues usually consist of ad valorem or other taxes assessed for the benefit of the water utility. Transfers from other government funds often are considered to be similar to grants and usually are treated the same.

Allowance for funds used during construction (AFUDC) is an accounting entry designed to permit the utility to recover the costs associated with financing on-going, long-term construction activities. Typically, AFUDC can not be included in the current-period revenue requirement, but instead is added to the cost of the construction and capitalized.

Other non-operating revenues is an all-encompassing term for items of non-operating revenues that do not warrant a separate, individual accounting. Non-operating revenues are considered to be "below-the-line" items; that is, they are not necessarily treated as available to meet the revenue requirements of the utility.

Historically, for investor-owned utilities, these revenues were not considered to be part of the water system operations. Generally, water customers were not entitled to benefit from the gains, nor made to suffer the losses, that resulted from the utility's non-operating endeavors or investments. Recent rulings in some jurisdictions have provided for gains from land sales to be shared between customers and stockholders. However, many government-owned utilities use non-operating revenues to reduce the net operating revenue requirement. In a government-owned water utility, the customers within the owner jurisdiction are, in effect, the stockholders. As such, customers may be entitled to have their rates reflect gains from such non-operating endeavors. However, these revenues normally are quite unstable and, therefore, cannot be relied on. Caution and diligence are necessary in forecasting non-operating revenues if they are to be used to reduce the operating revenue requirement.

Developer and customer contributions consist of cash or property donated for plant construction, which may include one-time connection fees and system-development charges (impact fees) assessed to new customers. These fees and charges provide funds that are intended for purchase or construction of the utility plant. Connection fees normally are intended to cover the cost of the customer's service and tapping into the water main. Sometimes the cost of the customer's meter and meter installation is included. System-development charges generally are designed to help offset the capital cost of existing or future water supplies and other essential plant resources required to provide service to a new customer. In both government-owned and investor-owned utilities, these items generally are accounted for as customer contributions in aid of construction (CIAC).

Grants usually are considered to be contributions made by the granting agency, such as the federal government.

UNBILLED REVENUES

All water meters are not read and billed at the same time, since most water utilities cycle their billing. Under any cycle-billing system, there are unbilled revenues at the end of each accounting period, representing the water sales from the last billing of each customer to the end of the accounting period. Thus, earned revenues do not equal the billed revenues for any accounting period. The difference between the unbilled revenues at the end and at the beginning of an accounting period is the accrued amount to be applied to the billed revenues to determine the earned revenues for the accounting period.

If there is no growth in the number of customers, no rate change during the accounting period, and customer usage is stable, there will be little difference between earned revenues and billed revenues. However, if customer growth is significant or if a rate change takes effect during the period, the unbilled revenues at the end of the accounting period will differ from those at the beginning of the period. Therefore, this accrued amount may be large, and earned revenues may be significantly different from billed revenues.

Some utilities bill service charges or minimum charges in advance. In such cases, some billed but unearned revenues could exist at the end of each accounting period. Therefore, if the unearned revenues at the end of the accounting period exceed the unearned revenues at the beginning of the accounting period, a negative revenue accrual would result.

For ratemaking purposes, the accrued amount must be excluded from base revenues because rate changes and customer growth are annualized and added to the billed revenues. Thus, if the accrual adjustment is not excluded, base revenues would be adjusted twice for rate changes and growth.

CASH VERSUS ACCRUAL REVENUES

Cash receipts sometimes are used as a basis for setting and adjusting water rates. However, most investor-owned water utilities and many government-owned utilities maintain their accounting records on an accrual basis. The accrual method provides a better matching of revenues and expenses and a more accurate assessment of the profitability of the utility than does cash-basis accounting.

Many government-owned water utilities operate on a cash basis of accounting because of bond indenture or other requirements. Recognizing that cash revenues often lag accrued revenues, government-owned utilities must account for this lag in cash receipts and provide for it, particularly if they operate strictly on a cash basis of accounting.

PROJECTING REVENUE

In projecting revenue that may be available to the utility from the sources listed in Table 2-1, the utility must first develop adequate historical data as a basis for projecting future revenues.

Historical Data

The amount of revenue that may be derived from water rates under any particular rate schedule can be projected appropriately based on historical data regarding customer billing.

The amount and detail of needed data vary, depending on the local situation. The most accurate projections result from separately summarizing and analyzing billing data for each customer classification. For metered accounts, the utility may need to compile the number of bills rendered by customer class and meter size, and the water sales by rate block. This compilation usually includes adjustments for credits, additional billings, partial bills, final bills, and changes in the number of customers served. The compilation should include a verification procedure, such as a comparison with billed revenues. The verification procedure also should include a check on the days billed. A change in the billing cycle or in the makeup of the billing routes could result in test-year billings for more or less than 365 days. To properly analyze a bill, the utility must have billings for 365 days.

Flat-rate revenues and fire-service revenues can be annualized by establishing the average number of billing units for each rate level during the historical base year. Growth projections can be added if applicable.

In many situations, particularly for smaller utilities, detailed billing data are not available. In such cases, the utility must estimate a satisfactory basis for projection of anticipated revenues.

Projection Considerations

Reasonable projections of each revenue category listed in Table 2-1 must be considered and made as appropriate. As previously noted, it is often necessary to normalize or adjust historical data to reflect abnormal conditions that may have caused unusual variations. Some of the most common areas for adjustment are discussed below. For a more detailed discussion of revenue forecasting methodologies and issues, the reader should consult the publication *Forecasting Urban Water Demand* (AWWA 1996) or other texts on this subject.

Growth in number of customers. Growth in the number of customers served can be projected by recognizing historical growth patterns, growth restrictions, and changes in economic conditions, and by being aware of proposed developments in the service area. Historical customer class average water use and/or revenues per customer normally are adequate to project revenues in growth situations. However, if the current rates have not been in effect for a sufficient period to establish a valid average revenue per customer, historical average revenues need to be adjusted to reflect rate changes. Also, it often is necessary to perform special analyses of projected future revenues from existing or new industrial or other large-use customers.

The number of customers served at any particular point in time, such as historical year end, needs to be annualized so that projections ultimately can reflect a full year's service. Often the trend in average of beginning and end of year number of customers of record provides a satisfactory method of projection. A factor that would require adjustments includes the effects of past annexation of new customers, an occurrence not likely to be repeated with regularity. Another factor that would necessitate an adjustment would be the effects of a major area-wide economic downturn or upturn that is not typical of a long-term trend.

Non-recurring sales. Sales not expected to continue in the future should be eliminated from projections. This would include a large water user going off the system, abnormally high sales caused by an incorrect meter reading if not credited during the base year, leakage of customers' plumbing, and temporary purchases. Sufficient data must be accumulated to calculate the volume of non-recurring sales and appropriate adjustment made to revenue projections.

Weather normalization. In many areas, weather conditions can greatly affect water sales. Thus, the utility should consider adjusting past sales when weather conditions have been abnormal. It is useful to follow a procedure that correlates average water use per customer over a period of years with temperature, rainfall, and other climatic conditions. These data are used together with normal climatic data to project water sales under normal weather conditions. Normal climatic conditions may be established using long-term averages as reported by the National Weather Service for the service area.

Care should be exercised when attempting to normalize water sales for weather. Other variables that affected the historical data may have more effect on the results than the weather normalization itself and, therefore, should be reflected in the revenue study.

Conservation. Revenue projections may need to be adjusted to reflect conservation measures installed in the past or to reflect conservation measures to be used in the future. These projections can be difficult to adjust. Past conservation measures may permanently reduce water sales, so comparing water sales before the conservation measures were installed could overstate future projections. The effects of future conservation measures can be difficult to quantify and support. However, a diligent attempt should be made to estimate the effect of conservation efforts on revenues; otherwise, actual revenues may differ significantly from projections.

Price elasticity. Most water use is considered to be relatively insensitive to the price of water (price inelastic). However, some uses, such as lawn watering and industrial sales, may be somewhat more sensitive to the price of water. Major rate increases have, at times, significantly reduced industrial water sales. The addition of billings for other utility services based on water usage, such as wastewater services, also can affect water use.

Many water utilities are investigating and implementing pricing techniques to modify water demand. Some regulatory agencies also are considering this method to promote water conservation. Extreme care should be used in projecting revenues that reflect these pricing techniques because generalized water price-elasticity information may not apply to specific circumstances.

EXAMPLE

Tables 2-2 and 2-3 illustrate how to project revenues. These tables are intended to assist the reader in recognizing customer base, water use, revenues, O&M expenses, capital structure, and associated capital costs as part of the projection process. These tables apply equally to government-owned and investor-owned water utilities. The adequacy of projected five-year revenues under existing rates is presented in a flow-of-funds analysis for the government-owned utility and an operating income statement for the investor-owned utility.

Revenue sources typically available to utilities have been discussed in this chapter. Included in the tables are water sales revenue from residential, commercial, industrial, and wholesale customer classes; revenue from charges for private and public fire protection; other miscellaneous operating revenues; and non-operating income. Table 2-2 summarizes a projection of the average number of customers served and the associated water use by customer class for each of the years in the example study period. As noted, the projections for the number of customers and water use are equally applicable to both government-owned and investor-owned utilities.

The number of customers and water use by customer class for the most recent historical year are set forth in Table 2-2 to serve as a reference point for the reader. As previously discussed, a review of historic changes in customer growth, use per

Table 2-2 Number of customers and water use

Customer Class	Historical Year	Projected Years 1	2	3	4	5
	Number of Customers (avg.)					
Residential	15,180	15,330	15,480	15,630	15,780	15,930
Commercial	1,200	1,210	1,220	1,230	1,240	1,250
Industrial	35	35	35	35	35	35
Wholesale	4	4	4	4	4	4
Private fire	150	150	150	150	150	150
Public fire	1	1	1	1	1	1
Total	16,570	16,730	16,890	17,050	17,210	17,370

Customer Class	Historical Year	Projected Years 1	2	3	4	5
	Water Use—thous gal					
Residential	950,000	958,000	968,000	977,000	986,000	996,000
Commercial	465,000	469,000	473,000	477,000	481,000	484,000
Industrial	1,095,000	1,095,000	1,095,000	1,095,000	1,095,000	1,095,000
Wholesale	230,000	230,000	230,000	230,000	230,000	230,000
Private fire	na	na	na	na	na	na
Public fire	na	na	na	na	na	na
Total	2,740,000	2,752,000	2,766,000	2,779,000	2,792,000	2,805,000

customer, and variance in usage patterns caused by weather and other factors is necessary for sound projections. In Table 2-2, these underlying factors are assumed to have been recognized in preparing the forecast. It may be noted that not all classes are expected to experience growth.

Table 2-3 shows projected revenues under existing rates for both government-owned and investor-owned utilities. In projecting revenues under existing rates, average unit revenues applicable to the number of customers (service charges,

Table 2-3 Water sales and miscellaneous revenues

Customer Class	Historical Year, $	Projected Years, $ 1	2	3	4	5
Residential	1,660,000	1,677,000	1,694,000	1,710,000	1,726,000	1,743,000
Commercial	500,000	507,000	511,000	515,000	519,000	523,000
Industrial	620,000	620,000	620,000	620,000	620,000	620,000
Wholesale	120,000	120,000	120,000	120,000	120,000	120,000
Private fire	40,000	40,000	40,000	40,000	40,000	40,000
Public fire	270,000	270,000	270,000	270,000	270,000	270,000
Subtotal	3,210,000	3,234,000	3,255,000	3,275,000	3,295,000	3,316,000
Other operating revenues	20,000	25,000	26,000	27,000	28,000	29,000
Non-operating income	55,000	50,000	53,000	56,000	59,000	62,000
Total	3,285,000	3,309,000	3,334,000	3,358,000	3,382,000	3,407,000

minimum bills, and fire protection) and average unit revenues applicable to water usage (volume charges) are applied to the projected number of customers and water use, respectively (as previously developed in Table 2-2).

Projected revenues from miscellaneous operating and non-operating sources are based on historical average revenue levels from these sources. In some instances, such as revenue from forfeited discounts or late payment penalties, projected revenues from these sources may be directly related to projected water sales revenues. Other miscellaneous revenue sources, such as charges for connecting and disconnecting service, may vary directly with the projected number of customers or the growth in the number of customers. Such relationships should be determined based on an analysis of the applicable revenue accounts.

Chapter 3

Operation and Maintenance Expenses

For any utility to be self-sufficient, the utility must recover its full revenue requirements on an ongoing basis. Chapter 1 provided an overview of revenue requirements and how they are determined under both a cash-needs approach and a utility approach. As noted in chapter 1, O&M expenses comprise a major part of revenue requirements. In this chapter, O&M expenses for both government-owned and investor-owned utilities are discussed. Specific items include

- classifying O&M expenses
- identifying non-recurring O&M expenses
- identifying capitalized O&M expenses
- identifying special considerations for government-owned utilities, including interdepartmental O&M expenses and payments to the general fund
- estimating O&M expenses

O&M expenses are the prudent and necessary costs to operate and maintain treatment plants, wells, lines, pumping, transmission and distribution facilities, and the cost of customer service and administrative and general expenses. O&M expenses are typically measured and reported on for a period of one year corresponding to the fiscal time period of the entity being reported upon.

As used in this chapter, O&M expenses exclude depreciation expense and expenditures that would significantly extend the lives of the facilities beyond those first contemplated, as well as taxes. These items are covered in chapters 4 and 5.

CLASSIFYING O&M EXPENSES

To properly account for O&M expenses, it is necessary to develop a common accounting method for classifying expenses consistently from year to year. Specifically, O&M expenses should be classified in a manner to achieve the following goals:

- Permit proper monitoring and reporting of each O&M expense item.
- Separate capital expenditures from O&M expenses.
- Provide appropriate information to utility managers for operating the utility in a cost-effective manner.
- Provide historical data in a format that facilitates projections.
- Support cost-of-service and rate-making calculations.
- Enhance comparability of expenses among water utilities.

Chart of Accounts

The most effective way to classify and track O&M expenses on a consistent basis is through a detailed chart or system of accounts. For an O&M expense to be appropriately classified, the chart of accounts is used to properly code the expense item; that is, as a water utility completes each financial transaction, a record of that transaction is tracked into the appropriate account within the chart of accounts. Typically, the larger and more complex the utility, the greater the need for a more detailed chart of accounts.

The National Association of Regulatory Utility Commissioners (NARUC) has recommended a "Uniform System of Accounts," which is widely used by regulated utilities and can be modified for government-owned utilities as shown in the AWWA publication, *Water Utility Accounting*. Other charts of accounts that meet the goals previously set forth are also used.

The NARUC coding (numbering) scheme consists of a three-digit number for O&M expenses (600–699 for water expenses). O&M expenses are further subdivided into five functional operational areas (source of supply, treatment, transmission and distribution, customer accounts, and administrative and general expenses) and further segregated between operating expenses and maintenance expenses by the addition of a one-digit suffix.

For example, salaries and wages for employees is account 601. If those salaries are performed in connection with operating source and supply, the account is 601.1. If, on the other hand, the salaries are required for maintenance in source and supply, the account number is 601.2.

IDENTIFYING NONRECURRING O&M EXPENSES

Some O&M expenses do not have the characteristics of ongoing annual expenses. These expenses are not incurred repeatedly from year to year, but occur infrequently. A good example of a non-recurring O&M expense is the cost of painting a water storage tank. Tank painting does not create a new asset, but provides maintenance to an existing asset. This expense is an O&M expense, even though it might be incurred only once every 10 years.

Amortization

Many utilities amortize infrequently occurring O&M expense over the expected period between expenditures to minimize major fluctuations in annual expenses.

Non-recurring expenses that might be amortized include certain maintenance activities (such as tank painting), regulatory expenses, and planning studies. For example, a utility that has one tank might paint that tank every 10 years. In this case, the cost of painting the tank would be amortized over 10 years and the annual expense would be one-tenth of the total cost.

Scheduling

If possible, groups of non-recurring O&M expenses should be scheduled in such a way that approximately the same expense is incurred annually. For example, a utility may have 10 storage tanks, and one tank is painted each year. By the time the tenth tank is painted in the tenth year, it is time to repaint the first tank and so on. In this case, the cost of tank painting would be expensed annually rather than amortized over a 10-year period.

IDENTIFYING CAPITALIZED O&M EXPENSES

From the revenue-requirement standpoint, it is important to recognize that some expenditures that might normally be considered O&M expenses must be capitalized. An example of such an expenditure would be salaries and wages of employees who devote time to a project that is a capital investment. Such salaries, wages, and accompanying overhead (such as related payroll taxes, worker's compensation, materials and supplies, and transportation expenses), are capitalized as a part of the cost of the project. When capitalized, such expenditures are not included as O&M expenses, but are accounted for and depreciated in the same manner as other capitalized costs associated with the project.

IDENTIFYING SPECIAL CONSIDERATIONS FOR GOVERNMENT-OWNED UTILITIES

The accounting system and related chart of accounts should be structured to provide each utility manager with information to track expenses by organizational unit. Government-owned utilities may also adopt the chart of accounts used by the local government accounting system. In some cases, an appropriate chart of accounts may be mandated by state law. In these situations, specific "object" expense accounts are applied across the organizational units of the local government. An example of how O&M items might be grouped in a government environment is

- personal services
- contractual services
- commodities
- administration
- interdepartmental expenses

Each category could contain numerous expenses to provide further detail.

Many utilities adopt more than one chart of accounts for O&M expenses. One chart might provide for effective rate setting and utility comparability, and another might provide for cost accountability by organizational unit, which permits consistency with state and local government mandated accounting systems. As long as the utility meets the goals of classification of expenses described at the beginning of this chapter, any one or more expense accounting systems may be satisfactory.

Interdepartmental O&M Expenses

As discussed above, many government-owned water utilities are a part of city or county governments. In such cases, these local governments may provide support services to the utility department. Support services might include planning, purchasing, personnel, accounting, and data processing.

To recognize all O&M expenses, it is important to identify interdepartmental O&M expenses incurred on behalf of the water department by other city or county departments. Otherwise, the total expense of providing water service is not identified and, therefore, comparisons with other water utilities are invalid. In addition, the utility may not be recovering the total cost of service from its customers.

To address this issue, many local governments have developed systems that allocate interdepartmental support expenses to various departments. In such cases, it is relatively simple to properly allocate interdepartmental expenses to the water utility. If no system exists, the allocation factors can usually be estimated using some logical basis. For example, the ratio of personnel within the water department to total city personnel might be used to allocate city personnel expense to the water department.

Payments to General Fund

Other cash revenue requirements that may require financing from water system revenues might include payment to the general fund for such items as payment in lieu of taxes, gross receipts taxes, or a dividend payment. These additional requirements depend on each local situation and should be considered when applicable.

ESTIMATING O&M EXPENSES

In projecting future O&M expenses, factors that will affect future expenses must be adequately analyzed. Recent experience regarding O&M expenses, as recorded by the utility, serve as an important base for projections. Trends in such expenses should be recognized, but normalization of past experience is important in the analysis.

Expense projections should recognize such factors as changes in the number of customers served, changes in water demand, inflation, and changes in operating conditions or maintenance needs that may be expected within a projection period. A detailed discussion of forecasting O&M expenses is included in the AWWA book, *Water Utility Accounting*.

Example

Table 3-1 shows projected O&M expenses for an example utility. The projections are assumed to apply equally for a government-owned or investor-owned utility. The expenses for the most recent historical year provide a reference point for the reader.

The functional categories of O&M expenses, as shown in Table 3-1, reflect a typical chart of accounts. The various expenses within each functional category are identified and grouped for the application of appropriate price and quantity variables to each line item. For example, in addition to recognizing changes in unit costs caused by inflationary trends, purchased power and chemical expense would also increase in proportion to variations in projected water sales volumes. Customer accounting expenses also tend to increase in proportion to increases in the number of customers served and inflation.

It should be noted that, on line 4, water treatment chemicals, the expenditure for chemicals in projected year 1 is less than the amount in the historical year. This

Table 3-1 O&M expenses*

Line No.	O&M Expense Category	Historical Year, $	Projected Years, $				
			1	2	3	4	5
1	Source of supply	83,000	86,000	90,000	93,000	97,000	101,000
	Pumping						
2	Purchased power	228,000	243,000	259,000	375,000	399,000	425,000
3	Other	178,000	185,000	193,000	200,000	208,000	217,000
	Water Treatment						
4	Chemicals	126,000	116,000	121,000	202,000	211,000	221,000
5	Other	145,000	151,000	157,000	283,000	294,000	306,000
	Transmission and Distribution						
6	Mains	120,000	125,000	130,000	135,000	140,000	146,000
7	Storage	24,000	25,000	26,000	27,000	28,000	29,000
8	Meters and services	143,000	149,000	155,000	161,000	167,000	174,000
9	Hydrants	12,000	12,000	13,000	13,000	14,000	15,000
10	Other	67,000	70,000	72,000	75,000	78,000	82,000
	Customer Accounting						
11	Meter reading and collection	224,000	235,000	247,000	259,000	272,000	286,000
12	Uncollectible accounts	42,000	43,000	44,000	45,000	46,000	47,000
	Administrative and General						
13	Salaries	179,000	186,000	194,000	201,000	209,000	218,000
14	Employee benefits	164,000	171,000	177,000	224,000	233,000	242,000
15	Insurance	108,000	130,000	135,000	141,000	146,000	152,000
16	Other	246,000	256,000	266,000	276,000	288,000	299,000
17	Total O&M expenses	2,089,000	2,183,000	2,279,000	2,710,000	2,830,000	2,960,000

*Information applies to both government-owned and investor-owned utilities.

may be attributed to a change in treatment process or an abnormally high chemical cost incurred in the historical year because of the quality of the raw water. The large increases in projected year 3 in pumping purchased power (line 2), water treatment chemicals (line 4), and other (line 5), and general employee benefits (line 14) are a result of an assumed major water treatment plant expansion and associated O&M expenses. Such adjustments in projecting O&M expenses are often necessary to present a valid picture of future expenditures.

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Chapter 4

Taxes

Investor-owned water utilities are responsible for paying taxes to local, state, and federal authorities. These taxes may include property and franchise taxes paid to local authorities; gross receipts, income, capital stock, and franchise taxes paid to state authorities; and income taxes and payroll taxes paid to the federal government. Although municipally owned water utilities are generally not subject to taxation by the local, state, or federal governments, municipal water utilities sometimes make payments in lieu of property taxes to the local municipalities that own them.

This manual makes no attempt to fully cover the subject of taxation for utilities. This chapter is intended to alert the reader to the complexities of utility taxes and the need for specific tax expertise in considering tax obligations when determining the utility's need for adequate revenues.

LOCAL TAXES

The most common form of local tax is the property tax, but franchise taxes also may be levied. A franchise tax may be a flat fee or based on the utility's gross or net revenues. Property taxes are based on the assessed value of utility property located within the jurisdiction of the taxing authority. Therefore, the water utility must maintain property records in a manner that enables the tax authority to determine the book value of utility plant investment (which is subject to taxation) within individual local taxing jurisdictions. Where multiple municipalities or taxing districts are involved, separate investment records must be maintained. Each local taxing authority will also have its own individual tax rates, making it complicated to calculate total property tax.

Municipally owned utilities are not normally subject to taxation by local, state, or federal authorities. In some cases, however, a municipal water utility may make payments in lieu of taxes (PILOT) to the municipality that owns that utility. Such payments may be calculated as though the utility is privately owned and subject to property or franchise taxes or may be established at some lesser amount. For municipal utilities regulated by a state regulatory commission, the amount and appropriateness of any payments in lieu of property taxes can be an issue in rate cases. Some commissions only allow payments for actual services received.

STATE TAXES

Various states use different methods of assessing taxes, such as gross receipts taxes, franchise taxes, capital stock taxes, and income taxes on investor-owned utilities. The gross receipts tax is usually a fixed percentage of all revenues with no allowance for deductions. Therefore, if the gross receipts tax is 1 percent of revenues and revenues are $10,000,000, the gross receipts tax would be 1 percent of $10,000,000, or $100,000. Any revenue increase, whether because of growth or a rate increase, will result in a higher overall tax payment.

Generally, state income taxes are levied on revenues net of expenses and are usually a fixed percentage of taxable income. However, some jurisdictions have graduated income tax rates. Deductions from revenues permitted in calculating state income taxes may be different from those allowed for federal income taxes. For example, accelerated depreciation and federal income taxes may not be permitted as deductions when calculating state income taxes. Because each jurisdiction has a different approach to income taxes, the utility must verify the particular rules of the jurisdiction where revenues are taxed for details on allowable deductions.

FEDERAL TAXES

Investor-owned utilities are responsible for paying income taxes to the federal government. Federal taxable income is calculated by deducting O&M expenses, tax depreciation expense (which is usually calculated at a higher rate than regulatory depreciation expense), interest expense, various administrative expenses, and state and local taxes from revenues.

It should be noted that tax laws and regulations are subject to change. This manual does not attempt to discuss all current tax matters. However, it should be recognized that taxable income may differ from book income as a result of several items in addition to differences between tax and book depreciation. The following items are not intended to be all-inclusive or to provide tax advice, but are presented to alert the user to some of the potential differences.

- The utility must add the estimated unbilled revenues due at the end of the tax year and subtract the estimated unbilled revenues for the previous year. The difference, whether positive or negative, is included in taxable revenues.
- Uniform capitalization rules require capitalization of construction-period interest, sales and use tax, payroll taxes on construction, and property taxes, thereby increasing the tax liability.
- Bad-debt expense must reflect actual uncollectibles for the tax year rather than reflecting the accrual made under the reserve method for determining bad-debt expense.

Tax Depreciation

Depreciation is permitted as a deduction from revenues for federal income tax purposes. There are several different tax depreciation methods that affect water utilities. These methods reflect accelerated rates of depreciation when compared to rates prescribed by regulatory commissions or book accounting purposes.

Asset depreciation range system. The class life asset depreciation range (CLADR or ADR) system is an elective system of depreciation for assets placed in

Table 4-1 Federal tax rate schedule

Taxable Income	Tax Rate (%)
$50,000 or less	15
$50,001–$75,000	24
$75,001–$100,000	34
$100,001–$335,000	39
$335,001–$10,000,000	34
$10,000,001–$15,000,000	35
$15,000,001–$18,333,333	38
More than $18,333,333	35

service after 1970 and before 1981. This system classifies costs by industry and type of asset, and permits depreciable lives, which are up to 20 percent shorter than the tax guideline class life. The ADR system permits significant increases in depreciation amounts to be recognized in computing taxes.

Accelerated cost recovery system. The accelerated cost recovery system (ACRS) is a mandatory system, with few exceptions, of tax depreciation for assets placed in service after Dec. 31, 1980, and before Jan. 1, 1987. Using ACRS, the cost of eligible depreciable property is recovered over a specified period depending on the class of property. In determining the recovery allowances, the statutory percentage is applied to the unadjusted basis of the property. A great proportion of water utility property may be written off over 15 years.

Modified accelerated cost recovery system. Effective Jan. 1, 1987, the Tax Reform Act of 1986 (TRA-86) modified the former ACRS (modified ACRS, or MACRS) by prescribing depreciation methods for each MACRS class instead of providing statutory depreciation tables. Under MACRS, the method of depreciation was increased from 150 percent declining balance to 200 percent declining balance for property with 3-, 5-, 7-, and 10-year recovery periods. The 150 percent declining balance method still applies to property with 15- and 20-year recovery periods. Investment in office buildings and other nonresidential property is recovered over a period of 31.5 years using the straight-line depreciation methodology.

Tax Calculations

When revenues have been determined and allowable deductions have been taken, the federal tax rates applicable to income, which are shown in Table 4-1, apply. For income between $100,000 and $335,000, there is a 5 percent surtax. The purpose of the surtax is to remove the benefit of the 15 percent and 25 percent tax rate that applies to income below $100,000. For income above $335,000, a water utility pays a straight 34 percent tax on all income up to $10,000,000. For income above $10,000,000, the tax rate becomes 35 percent. A surtax of 3 percent applies to income between $15,000,000 and $18,333,333, which eliminates the benefit of the 34 percent tax rate on the first $10,000,000 of taxable income.

Investment Tax Credit

The TRA-86 repealed the investment tax credit (ITC) for all property placed in service after Dec. 31, 1985, and for all qualified progress expenditures made on or after Jan. 1, 1986. Therefore, the only ITC generated in years subsequent to 1985 is the ITC earned with respect to qualified ITC transitional property.

TAX ISSUES IN RATE CASES

Federal income taxes embedded in customer rates can be broken down into two separate parts: current taxes and the total provision. Current taxes refers to actual taxes payable and is calculated by applying the appropriate tax rate to taxable income. As previously discussed, taxable income is derived by deducting O&M expenses, tax depreciation, interest expense, and any other allowable deductions from revenues.

The total provision adjusts current tax for any tax deferrals reflected in the cost of service. Deferrals serve to normalize the utility's total income taxes to reflect differences in the treatment of items for book and regulatory purposes. Deferrals can be either positive or negative.

Deferred Taxes

As the name implies, deferred taxes are tax liabilities from a current tax period that are deferred to a future tax period. Such liabilities normally result when expenses used to compute current taxable net income are different from expenses used to compute current book net income. However, over a sufficient time period, the totals of both deductions are the same. Differences result when tax laws treat expenses differently than either ratemaking or generally accepted accounting principles. A timing difference then results in the reporting and recording of taxes for an accounting period.

For ratemaking purposes, most utility commissions now recognize a level of taxes in the revenue requirement that does not fluctuate with variations between the level of tax deductions and the corresponding level of book expenses occurring in a particular test year. Rather, most commissions spread tax deductions over the average service life of a unit of property. Such ratemaking treatment is now required if a taxpayer wants to use the ACRS or MACRS tax depreciation. This type of ratemaking treatment produces cash flow for a water utility, because taxes are reflected in the ratemaking revenue requirement that are greater than those taxes owed the federal government. A positive cash flow exists as long as the taxes that are deferred exceed the sum of the amortizations of all the deferred taxes from prior years' transactions.

While such timing differences can result from many differences between tax and book expenses, it is a common practice to record only significant tax-timing differences or those differences that present the greatest potential liability. The most significant and most commonly discussed tax-timing difference, which occurs on an annual and recurring basis, is the difference that results from using accelerated depreciation for tax purposes and straight-line depreciation for book purposes. Table 4-2 shows an example of this process using ACRS and the 34 percent tax rate that applies to companies with less than $10 million of taxable income. Another common timing difference results when large maintenance expenses, such as tank painting, must be claimed as tax deductions in the year the expense is incurred, but the expense is amortized over several years for book and ratemaking purposes. Similar examples include premature retirement of plant facilities or other accounting treatments for extraordinary expenses.

Normalization Process

For ratemaking purposes, deferred taxes are accounted for by a process called "normalization." Normalization is most commonly used to recognize accelerated depreciation effects. By reflecting the amount of a tax liability that has been deferred

Table 4-2 Tax versus book depreciation

	Depreciation Expense				
Year (1)*	Tax, $ (2)	Book, $ (3)	Excess Tax Depreciation, $ (4) = (2) – (3)	Deferred Taxes, $ (5) = (3) × 34%	Accumulated Deferred Taxes, $
1	50,000	20,000	30,000	10,200	10,200
2	100,000	40,000	60,000	20,400	30,600
3	90,000	40,000	50,000	17,000	47,600
4	80,000	40,000	40,000	13,600	61,200
5	70,000	40,000	30,000	10,200	71,400
6	70,000	40,000	30,000	10,200	81,600
7	60,000	40,000	20,000	6,800	88,400
8	60,000	40,000	20,000	6,800	95,200
9	60,000	40,000	20,000	6,800	102,000
10	60,000	40,000	20,000	6,800	108,800
11	60,000	40,000	20,000	6,800	115,600
12	60,000	40,000	20,000	6,800	122,400
13	60,000	40,000	20,000	6,800	129,200
14	60,000	40,000	20,000	6,800	136,000
15	60,000	40,000	20,000	6,800	142,800
16	0	40,000	(40,000)†	(13,600)	129,200
17	0	40,000	(40,000)	(13,600)	115,600
18	0	40,000	(40,000)	(13,600)	102,000
19	0	40,000	(40,000)	(13,600)	88,400
20	0	40,000	(40,000)	(13,600)	74,800
21	0	40,000	(40,000)	(13,600)	61,200
22	0	40,000	(40,000)	(13,600)	47,600
23	0	40,000	(40,000)	(13,600)	34,000
24	0	40,000	(40,000)	(13,600)	20,400
25	0	40,000	(40,000)	(13,600)	6,800
26	0	20,000	(20,000)	(6,800)	0
Total	1,000,000	1,000,000	0	0	

Notes: Basis: $1,000,000
Tax Life: 15 years, 150% Declining Balance
Book Life: 25 years, Straight Line

*Numbers in parentheses represent the column numbers.

†Numbers in parentheses represent negative numbers or credits.

as an expense item, current revenue requirements then reflect tax levels that would exist if the utility was not able to claim tax depreciation deductions. By recognizing a "normal" level of taxes in the revenue requirements, normalization effectively ignores the use of accelerated depreciation. Ratemaking tax liability is calculated using straight-line book depreciation rates applied to tax depreciable property.

Using normalization stabilizes revenue requirements to reflect the spreading of any tax benefits associated with using accelerated tax depreciation rates over the life of the applicable property. This allows all customers who use the property to share the tax benefits. If normalization is not used, revenue requirements would be lower in the early years of an asset's life. This is because tax depreciation rates are greater than straight-line book depreciation rates, which creates a lower taxable income for that accounting period. Revenue requirements would then be higher in the later years of the property's life, when the situation is reversed.

Flow Through

Until ACRS rates for tax depreciation became effective for property installed after 1980, state commissions either normalized the effects of tax depreciation (as previously discussed) or immediately passed on to ratepayers the effects of the tax reductions that resulted from using accelerated depreciation. If the tax benefits were immediately passed on to ratepayers, the practice was known as *flow through*. Flow-through ratemaking occurs when the higher tax depreciation amounts, which occur in the early life of property additions, are used to compute tax liabilities for ratemaking purposes. In later years, when such tax deductions become less than book depreciation amounts, tax liabilities and revenue requirements need to be greater to support the same level of utility plant.

One of the arguments raised to support flow-through treatment is that as time goes on there will be further plant additions and other large tax depreciation amounts to deduct for ratemaking purposes. Also, in a viable growing utility, one tax deduction for a new plant will offset the loss of a deduction for an older plant. Thus, all ratepayers will share tax benefits, even though those tax benefits may not coincide with the property in place to serve those particular customers.

Current law mandates that normalization be authorized for ratemaking purposes for plants installed after 1980 in order for a taxpayer to claim ACRS and MACRS rates when computing the tax depreciation deduction. However, the law permits flow-through ratemaking for other tax benefits.

Interest Synchronization

Most state commissions calculate the level of interest to be used in determining taxable net income for ratemaking purposes using a method called "interest synchronization." This methodology is based on the premise that, for ratemaking purposes, the revenue requirements reflect the recovery of a certain level of interest expense. It is this interest expense that should be used as the tax deduction rather than the interest expense the company actually incurs. In other words, the level of interest expense that the customers are required to pay is the level of interest expense that should be used as a deduction from revenues before calculating the tax liability customers are required to pay.

Synchronized interest expense will differ from interest expense reflected in the records when (1) the appropriate rate base for establishing revenue requirements differs from the total amount of debt and equity used to determine the cost of capital; (2) an imputed or theoretical capital structure is substituted for the actual capital structure; or (3) interest rates are adjusted for issuance expenses or other items.

Consolidated Tax Returns

Current tax law permits a taxpaying corporation with a number of different affiliated corporate identities to file a consolidated tax return. A consolidated tax return is advantageous if one or more of the participating corporations incurs a loss in the tax-accounting period.

Consolidated tax returns raise several issues, including how to allocate consolidated income tax liability. Another issue is the regulatory treatment accorded to the so-called "tax savings" when the pool of taxpayers operates in multiple jurisdictions.

The water utility has several options for handling the tax benefit. The first option is to reimburse the company sustaining the taxable loss for the "negative tax" it contributed to the pool. In effect, this option leaves the companies with taxable income in an unchanged tax position and provides the loss-sustaining company with cash. Another approach is to reallocate taxes to the group that has taxable income.

This brings up the second issue, which is the regulatory treatment of a regulated operating company participating in the consolidated tax return. The question is whether or not to reimburse the loss-sustaining companies for their "negative income tax" contributed to the consolidation if a regulatory commission in another state jurisdiction adopts a portion of that benefit for the ratepayers of its own state. Most state commissions do not impute an effective tax rate under this scenario. However, some state commissions do.

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Chapter 5

Capital-Related Costs

Under both the cash-needs approach and the utility approach to measuring revenue requirements, there are capital-related costs to be met in addition to the O&M expenses.

For utilities using the cash-needs approach, capital-related costs include debt principal and interest, contributions to specific reserves, and the cost of capital expenditures that are not debt-financed or contributed. Required debt-service coverage may also affect total revenue needs. Depreciation expense is not included as an element of capital cost in the cash-needs approach.

For utilities using the utility approach, the capital-related costs include depreciation expense and return on rate base. The return on rate base provides for payment of interest on debt and a return on the equity provided by the investors. Many of the factors that are related to the utility approach apply to the investor-owned utility and to the regulated government-owned utility.

CASH-NEEDS APPROACH

Utilities that determine revenue requirements using the cash-needs approach do so in conjunction with the budgetary process. This is the case whether they operate as a part of a general municipal government or as a separate enterprise. The budget sets out the use of funds to meet the capital-related costs of principal and interest payments on debt, contributions to specific reserves, and the portion of capital replacement and improvements, which is not debt-financed. Revenue requirements do not depend on depreciation expense recovery or on return on rate base. However, they are subject to financial constraints, such as minimum financial ratios. Projections of total capital needs should recognize receipts of contributions from developers or customers, government grants, and from other nonutility sources.

It is common practice for utilities to finance a portion of the capital improvement program from annual revenues. Often, normal annual replacements, extensions, and improvements (such as meters, services, vehicles, smaller mains, and similar items, which occur on a regular basis each year) are financed in this way. Also, utilities may use current revenue to finance a portion of major capital replacements and improvements. However, major capital projects are typically debt-financed, because the repayment of the debt over a number of years reduces fluctuations in annual revenue requirements and more closely matches capital costs to the useful life of the facility. Thus, existing customers will not be required to pay 100 percent of the initial cost of facilities to be used by future customers.

Debt-Service Component

The debt-service component of revenue requirements using the cash-needs approach includes principal and interest payments on bonds and other debt instruments. It may also include debt-service reserve requirements as established by the bond indenture authorizing the debt. Other reserves may be required to provide for emergency, unexpected major repairs and replacements, and routine replacements and extensions.

In the example for the government-owned utility presented in this manual (see chapter 6, Table 6-1), the annual revenue requirement for normal annual replacements, extensions, and improvements is assumed to be approximately 2 percent of gross plant investment, which in projected year 1 amounts to $375,000. In addition to paying for such normal annual improvements from system revenues, it is assumed (for purposes of the example) that the debt-service reserves associated with a bond issue to finance the treatment plant improvements will be equal to 10 percent of the bond issue and will be funded from annual revenues over a five-year period. For an assumed bond issue amount of $3,000,000, the annual debt-service reserve requirement amounts to $60,000 in the example. Again, for example purposes, it is assumed that the bonds are issued in the middle of projection year 1, with one-half year's debt-service reserve payment incurred in that year.

The annual debt service on existing revenue bonds for the government-owned utility example amounts to $560,000. The debt service on the proposed new $3,000,000 bond issue is assumed to be $300,000 annually over a 20-year period, with one-half year's debt-service payment accrued in projected year 1. Thus, while the total debt service for the example utility in projected year 1 amounts to $710,000, the maximum annual future debt-service payment for the utility amounts to $860,000.

In addition to debt service and payments to reserve fund accounts, many utilities are required by their debt indenture to develop sufficient net revenues to cover debt service, particularly if revenue bonds are involved. Coverage requirements vary, but they typically specify that net revenues, after meeting O&M expenses, must be sufficient to exceed the annual debt-service payments by a stated percentage, perhaps as high as 25 percent. Coverage requirements are a test of the adequacy of utility revenues and do not necessarily represent a specific cash requirement or funding obligation. The coverage requirements are intended to provide a measure of security for bondholders, and must be considered in determining the total annual revenue needed.

Financing Constraints

Financing constraints may be set forth in a city ordinance or charter. These limits affect the allowable proportions and amount of the sources of financing from current operating revenues and debt. The typical constraints include equity to debt ratio minimums. Investor-owned utilities may have similar bond covenants.

The budget process would be affected by the financial constraints if the financial model, which is developed in the budget process, indicates that any of the stipulated ratios or coverages are not met. For example, a utility with a bond covenant requiring 1.25 debt-service coverage has financial data as follows:

Annual Operations		
1.	Gross revenue	$3,259,000
2.	Less: O&M expenses	2,183,000
3.	Net revenue	$1,076,000
4.	Less: Debt service	710,000
5.	Net available	$366,000
6.	Non-operating income	50,000
7.	Total available for capital projects	$416,000
Capital Project Financing		
8.	Current capital project obligations	$3,405,000
9.	Available from annual operations	416,000
10.	Borrowings	3,000,000
11.	Total available to meet obligations	$3,416,000

The debt-service coverage would be measured as net revenue divided by the greatest future annual debt service, or $1,076,000 ÷ $860,000 = 1.25. This meets the 1.25 coverage requirements.

If the bond covenant required a 1.35 debt-service coverage, gross revenue would need to be adjusted upward by $86,000 to a total of $3,345,000. Under these conditions, the utility could plan to reduce borrowings to provide a proper balance between debt service and annual net revenues.

In summary, the net revenues available to meet capital-related costs of a cash-needs-oriented, government-owned utility are used for financing current projects and for paying principal and interest on debt. Capital projects are financed from current revenues, bonds and other debt, grants, and CIAC. The financial constraints that apply to a specific utility may affect the proportion and amount of the revenue sources or of the allowable revenue requirement.

UTILITY APPROACH

In the utility approach to measuring capital costs, depreciation expense and return on rate base represent the recovery of and return on the capital the utility expends in providing service. The functional interrelationship of each of these elements of capital costs is discussed below.

Depreciation Expense

Depreciation is the loss-in-service value not restored by current maintenance. Depreciation is incurred in connection with the consumption or prospective retirement of the plant in the course of service. Depreciation is caused by practices that are known to be in current operation (and not covered by insurance), the effect of which can be accurately forecast.

Depreciation expense is the recovery of the original cost of the asset less the estimated net-salvage value, on a uniform basis over the estimated average service life of that asset. For book purposes, depreciation is typically recovered on a straight-line basis, that is, on an equal annual basis over the average service life of the asset. The straight-line approach is intended to assess this cost of doing business equally each year to customers who benefit from the use of the asset during its entire life.

Although the concept of depreciation is simple, considerable statistical work may be required to determine the average service life to be used in establishing depreciation rates. A detailed explanation of statistical studies is beyond the scope of this manual, but readers can obtain an explanation from literature on the subject.

Using the average service life procedure, the depreciation rate is determined as follows:

$$\text{Annual Rate (\%)} = \frac{\text{Total asset value} - \text{Net salvage value}}{\text{Estimated service life}} \qquad (5\text{-}1)$$

The summary of such calculations for each depreciable plant account, when applied to the original cost of the account item, results in the total depreciation expense for the year. Some utilities use a composite rate that applies to all depreciable plant assets. Another method sometimes used for computing annual depreciation expense is the remaining life method wherein the unrecovered balance in the account less salvage is recovered over the average remaining service life.

Computer programs have made it easier to calculate depreciation expense on an individual account basis or on an individual item basis.

Rate Base

Determining the base to which the rate of return should be applied (that is, the rate base) involves a number of issues. In general, rate base consists primarily of plant in service less accumulated depreciation; plus construction work in progress, materials and supplies, and working capital; and less CIAC, customer advances, deferred taxes, and unamortized investment tax credits. Individual regulatory agencies have specific requirements concerning the items allowed in rate base. Issues related to plant in service include the use of historical costs or current value and the used and useful standard.

Including construction work in progress in rate base is subject to considerations such as the allowance of interest during construction, estimated date in service, the nature of the construction, and the materiality of the expenditure. Determining working capital requires estimates (sometimes in total or in great detail) of the lag between paying expenses and receiving revenue. Deferred-tax determinations are affected by changing corporate federal income tax rates.

Rate-base components and issues have been addressed in numerous commission and court cases. Thus, determining rate base requires a knowledge of applicable legal precedent and practice in the utility's regulatory jurisdiction.

The following section discusses several rate-base components. It does not attempt to enumerate the various rules of practice used by individual commissions to establish rate base; instead, it reviews those principles and practices that are generally accepted by many courts and commissions.

Plant in service. In accordance with most, if not all, accounting systems, the original cost of plant in service is recorded on the utility's books. The original cost may be different from the price the current owner paid for the property, but it is the cost of the plant when it was first dedicated to public service. Any difference between the price paid by the current owner and the original cost is classified as an acquisition adjustment, which may or may not be included in the rate base. Nearly all regulatory commissions use an original cost basis for valuing plant in service to be included in rate base.

The primary issue related to including plant in the rate base is whether the plant is used and useful in providing utility service. The used and useful standard includes an examination of the utility's prudence in deciding to construct or purchase the plant. The original cost of used and useful plant, prudently constructed or purchased, is typically the largest element of rate base.

Accumulated depreciation. The deduction of accumulated depreciation from the original cost of plant results in the net book value of plant available to serve current and future customers. From the viewpoint of depreciation as capital recovery, accrued depreciation represents the accumulation of the historical allocations of a prepaid expense (that is, the original cost).

The accumulated provision for depreciation (also called the book depreciation reserve) is available from the books and records of the utility. Whether the book amount reflects the loss in service value or a reasonable approximation of the capital recovered through rates, and whether such depreciation is actually recovered from ratepayers, should be considered before the book reserve is deducted from original cost in rate-base determinations. The standard to be used, loss in value or capital recovery, is a function of the regulatory jurisdiction, although capital recovery is not widely used.

Past depreciation practices, especially the methods used to calculate annual depreciation, should be reviewed for consistency with regulatory practice before the book reserve is used. Also, the basis for recording large acquisitions should be reviewed for consistency. Adjustments should be made if appropriate.

Construction work in progress. Where it is permitted, including construction work in progress (CWIP) in the rate base recognizes the utility's annual requirements for debt payment or return on equity used to finance the construction. Although the plant is not yet used and useful in providing service, it is expected to be in the near future and, therefore, may be considered a benefit or potential benefit to the current ratepayer. Regulators often require that work be completed within a specified time period, evidence that funds were borrowed to finance the construction, and improved quality of service before CWIP can be included in rate base.

The inclusion of CWIP in rate base raises equity questions. Should current ratepayers provide a return on plant that does not provide service to them? Questions such as this one, in addition to considerable customer dissatisfaction associated with the inclusion of CWIP in rate base (especially in the electric industry), have resulted in some state laws that prevent or severely restrict the inclusion of CWIP in rate base.

An alternative to including CWIP in rate base is capitalization of financing costs related to the project as part of the original cost of plant. For lengthy construction projects, interest during construction (IDC) or the allowance for funds used during construction (AFUDC) can become a substantial amount. This amount will increase the rate base and depreciation base throughout the life of the facility. The capitalization of financing costs may cause cash flow problems for the utility until the project is completed and entered onto the books.

Working capital. The primary elements of working capital include materials and supplies and cash working capital. Other elements may include prepayments, unamortized balance of non-annual O&M expenses, and a minimum bank balance.

The allowance for materials and supplies in rate base permits the utility to earn a return on the prudent investment in inventory of parts and supplies required to maintain service. A common method of determining the materials and supplies allowance is a 13-month average of the balance as recorded on the books.

The allowance for working capital in rate base permits the utility to earn a return on the investment required to finance operating costs in advance of the receipt of revenue. Normally, there is a lag between the payment of cost and the receipt of revenues. Sometimes the receipt of revenue leads the expenditure. A detailed "lead-lag" study can be performed to determine a weighted average period of time between cost and revenue. The working capital requirement is the average daily amount of costs times the average time period determined from the lead-lag study. For smaller utilities, the one-eighth method is frequently used. This method simply takes one-eighth of the level of O&M expenses to estimate the needed level of working capital.

Contributions and advances. Contributions in aid of construction (CIAC), that is, capital or plant supplied by customers, developers, or public authorities, is excluded from rate base. In many systems of accounts, nonrefundable contributions are credited against the utility plant in service, and all subsequent rate-base determinations use the amount of plant excluding contributed plant. Customer advances are often deducted from rate base until they are refunded. Unrefunded advances are transferred to contributions where they continue to be deducted from rate base. The ambiguities of what constitutes a CIAC or advance have resulted in numerous legal challenges and court decisions.

Other non-investor capital. The deductions from rate base for accumulated investment tax credits, where applicable, and deferred taxes represent the elimination of capital provided by ratepayers to pay taxes that are either forgiven or delayed to a later date by the government as an incentive to modernize plant facilities. The accumulation of deferred taxes results from the annual differences between normalized income taxes, which are based on depreciation expense consistent with the rate-making allowance, and income taxes based on depreciation expense consistent with the methods and class lives prescribed by the IRS.

The amount of unamortized investment tax credits is developed in a similar fashion. In this case, a credit against taxes paid is not immediately reflected for rate-making purposes. The credit is amortized for rate-making purposes and results in an unamortized balance of non-investor-supplied capital.

Other rate-base adjustments. The above discussion of the components of rate base is not all inclusive. Items such as unamortized acquisition adjustments, prepayments, and minimum bank balances are simply mentioned. Other possible rate-base components, such as the unamortized balance of an extraordinary expense, are not discussed, but deserve consideration.

In today's regulatory environment, the guiding principle in determining the appropriateness of a rate base and its various components is that the amount should represent the capital supplied by the investor. This represents a change from the value or "fair-value" principle applied earlier in the 1900s. Whether or not such a change is an improvement will not be debated here. The use of the investor-supplied capital principle appears to be well-entrenched in the regulatory community.

Table 5-1 shows the total gross plant in service at of the end of the most recent historical year and the projected year-end balances for each five-year study period. The projected additions to total plant in service recognize the capital improvement program of the utility and include both major bond-financed improvements and normal annual additions financed from system revenues and CIAC. The major $3,000,000 water treatment plant addition is shown in projected year 2. Other additions recognize the total additions financed from annual revenues and net of allowances for anticipated retirements. The total plant in service provides the largest element of rate base as previously indicated in this chapter.

Table 5-2 uses the total plant in service from Table 5-1 to determine annual rate base for both a government-owned and an investor-owned utility. Although there are potentially many differences in rate base between the two types of utilities, in the development of rate base for example purposes, the major difference is the deduction of accumulated deferred income taxes for the investor-owned utility. The deductions

Table 5-1 Total (gross) plant in service—Year end*

Line No.		Historical Year, $	Projected Years, $ 1	2	3	4	5
	Intangible Plant						
1	Organization	6,000	6,000	6,000	6,000	6,000	6,000
	Source of Supply Plant						
2	Land	423,000	423,000	423,000	423,000	423,000	423,000
3	Reservoir	549,000	549,000	624,000	624,000	649,000	649,000
	Pumping Plant						
4	Land	23,000	23,000	23,000	23,000	23,000	23,000
5	Structures	507,000	507,000	507,000	507,000	582,000	582,000
6	Electric pumping equipment	530,000	540,000	560,000	560,000	575,000	595,000
7	Other pumping equipment	224,000	224,000	224,000	239,000	239,000	259,000
	Water Treatment Plant						
8	Structures	234,000	234,000	584,000	584,000	584,000	609,000
9	Water treatment	1,716,000	1,781,000	4,431,000	4,456,000	4,496,000	4,526,000
	Transmission and Distribution Plant						
10	Land	35,000	35,000	35,000	35,000	35,000	35,000
11	Structures	65,000	65,000	65,000	65,000	65,000	65,000
12	Distribution storage	1,479,000	1,479,000	1,509,000	1,524,000	1,524,000	1,529,000
13	Mains	8,112,000	8,337,000	8,522,000	8,722,000	8,897,000	9,112,000
14	Services	2,502,000	2,547,000	2,587,000	2,622,000	2,642,000	2,672,000
15	Meters	1,103,000	1,123,000	1,138,000	1,148,000	1,173,000	1,188,000
16	Hydrants	633,000	643,000	648,000	658,000	673,000	683,000
	General Plant						
17	Land	4,000	4,000	4,000	4,000	4,000	4,000
18	Structures	251,000	251,000	261,000	291,000	291,000	291,000
19	Other	244,000	244,000	244,000	289,000	289,000	314,000
20	Total Plant in Service	18,640,000	19,015,000	22,395,000	22,780,000	23,170,000	23,565,000

*Information applies to both government-owned and investor-owned utilities.

Table 5-2 Test-year rate base (in thousands of dollars)

Line No.		Projected Years, $ 1	2	3	4	5
1	Utility plant in service	19,015	22,395	22,780	23,170	23,565
	Less					
2	Accumulated depreciation	(5,030)	(5,444)	(5,896)	(6,356)	(6,823)
3	Net plant in service	13,985	16,951	16,884	16,814	16,742
	Plus					
4	Materials and supplies	280	291	303	315	328
5	Cash-working capital	273	285	339	354	370
6	Construction work in progress	1,100	104	108	112	116
	Less					
7	Contributions in aid of construction	(950)	(1,000)	(1,050)	(1,100)	(1,150)
8	Customer advances for construction	(410)	(445)	(480)	(515)	(550)
9	Test-year rate base (government-owned)	14,278	16,186	16,104	15,980	15,856
	Less					
10	Accumulated deferred income taxes	(1,952)	(2,366)	(2,357)	(2,347)	(2,337)
11	Test-year rate base (investor-owned)	12,326	13,820	13,747	13,633	13,519

of accumulated depreciation (line 2), CIAC (line 7), and customer advances for construction (line 8), and the additions of materials and supplies (line 4), cash-working capital (line 5), and CWIP (line 6) to utility plant in service (line 1) are generally similar for both government-owned and investor-owned utilities in determining rate base. Although future projections of annual rate base may not be a general practice for investor-owned utilities, it provides a useful planning function in evaluating the adequacy of revenues under existing rates and the potential need for future rate adjustments, which will be discussed in chapter 6.

It should be noted that including CWIP in rate base, as shown in this example, is not accepted by all jurisdictions. Some jurisdictions specifically prohibit such inclusion for investor-owned utilities. In other jurisdictions, regulatory commissions, by practice, exclude CWIP from rate base since it requires current customers to pay a return on plant intended to benefit future customers.

RATE OF RETURN

The need to earn income as a source of and a return on capital provides business with the incentive to increase sales and revenues, if adequate capacity exists, and to minimize costs. Participants' ability to compete for this income determines how these resources are allocated to these participants. Those economic activities demonstrating the greatest expected income relative to the perceived risks will generally attract the available resources.

In a competitive economy, risks and income vary over time as some industries or companies become more profitable and others less profitable. These changes in actual results and expected future performance cause resources to shift among industries and companies. This competitive market structure generally provides an efficient allocation of resources.

General Principles of Rate of Return

Whether the utility is government-owned or investor-owned, the return component is intended to pay the annual interest cost of debt capital (and dividends on preferred stock where applicable) and provide a fair rate of return for the equity capital employed to finance facilities used to provide water service. The return to the equity owner should be commensurate with the return in other enterprises competing for equity capital and having comparable risks. The return should be adequate to enable the utility to maintain its credit and to attract new capital.

The dollar return is the product of the rate base and the specified rate of return. Changing either of these components will result in a higher or lower level of dollar return. Both the rate base and the rate of return must be carefully considered to produce a reasonable and equitable dollar return.

There is no single method for determining a fair or reasonable rate of return. The Bluefield Water Works case is a landmark case, decided by the US Supreme Court in 1923, that established the criteria for a fair rate of return. The court stated:

> The return should be reasonable, sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties.*

**Bluefield Water Works and Improvement Co. v. Public Service Commission of West Virginia,* 262 U.S. 679 (1923).

In 1944, the US Supreme Court elaborated on the reasonableness issue in the Hope Natural Gas case by stating:

> It is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock.*

Most of the arguments currently used in rate of return regulation are based on one or more of the principles established in the Hope and Bluefield cases.

One approach to determining a fair rate of return on equity for a water utility is to examine the earning experience of other water utilities, other segments of the utility industry, and unregulated industries. The rationale for examining other companies or industries that are similar in size, customer mix, capital structure, bond rating, and other similar attributes is to demonstrate to the regulatory commission returns for firms with similar risk that justify the requested rate of return.

The comparison to unregulated firms or industries is based on the argument that regulation is supposed to bring about conditions that simulate the competitive environment. Because regulated and unregulated industries both rely on the capital markets, the earnings experience should be analyzed to determine a fair rate of return.

CAPITAL STRUCTURE

Courts and commissions have determined that, for a utility to compete successfully in the capital markets, it should be allowed a return based on its "cost of capital." The cost of capital represents the weighted cost of the various classes of capital (debt, preferred stock, and common stock) used by the water utility. The following example reflects how the total cost of capital for a utility is determined. The resulting 10.5 percent weighted cost of capital is used to determine the required level of revenue for the investor-owned utility discussed in chapter 6.

	Amount, $	% of Total	Component Cost Rate, %	Weighted Cost, %
Long-term debt	6,000,000	50	7.0	3.5
Preferred stock	1,200,000	10	10.0	1.0
Common equity	4,800,000	40	15.0	6.0
Total cost of capital	12,000,000	100		10.5

The concept is quite simple, but numerous issues can affect the total cost of capital.

The actual capital structure of the utility is most often used to determine the weight of each cost of capital. However, the relative components (capital structure) of debt and equity can change over time. Sometimes the actual capital structure of a water utility may have excessive amounts of debt or equity. In such cases, an alternative capital structure is used to determine a fair rate of return. If the water utility is a subsidiary of another company (holding company), the parent company's capital structure may be deemed to provide the appropriate weighting of the costs of capital. In other situations, regulatory agencies have imputed a hypothetical capital structure based on an examination of similar companies or industries.

*_Federal Power Commission v. Hope Natural Gas Co.,_ 320 U.S. 391 (1944).

Based on the previous example, if the amount of common equity in the capital structure is reduced, the total cost of capital is reduced. However, if the amount of debt is increased, the water utility's debt-interest requirements are increased, creating additional financial risk for the utility. If the additional financial risks increase, the relative costs of capital could actually increase. Also, bond indenture coverage requirements may limit the amount of debt capital. Good financial management practice results in a balance between debt and equity capital that minimizes the total cost of capital.

Cost Rates for Capital Components

It is relatively simple to determine the cost of long-term debt; it is usually based on the actual cost of any debt capital outstanding or to be issued in the near future. Occasionally, the cost of recent debt issues of similar companies is used to indicate investors' expectations regarding debt costs, especially in the case of proposed issues. In addition to the interest rate stated on the bond, other costs such as flotation costs, premiums, and discounts should be considered in determining the cost of debt.

Determining the cost of preferred stock is similar to determining the cost of debt. The cost is generally determined by taking the fixed dividend rate and adjusting for costs of flotation and other expenses. Like the cost of debt, the cost of preferred stock of similar firms is occasionally used to estimate the cost of proposed preferred stock issues.

The most difficult issue in determining the cost of capital relates to the cost of common equity. Unlike debt and preferred stock, there is no fixed interest or dividend rate. The issue is how to determine a return on equity capital sufficiently high to enable the utility to maintain its credit and to attract capital, but not so high as to be excessive.

Many factors motivate potential investors to purchase a given stock. These factors include dividends paid, earnings, current book value, growth in book value, and stock appreciation. Analysts do not agree on the relative role of past, current, and expected earnings, dividend, and price. Analysts also disagree over what time periods should be used to compute earnings, dividends, and prices.

Chapter 6

Examples of Revenue Requirements

The previous chapters have described the various elements that comprise the revenues and revenue requirements of government-owned and investor-owned utilities. They have also covered some of the considerations involved in projecting these elements for a future study period. This information will now be used to consolidate the various projections into a flow-of-funds schedule for the government-owned utility and an operating income statement for the investor-owned utility. These schedules can then be used to measure the adequacy of revenues under existing rates to meet projected revenue requirements over the study period.

GOVERNMENT-OWNED UTILITIES

For government-owned utilities, the initial measure of whether revenues under existing rates are adequate is made to determine whether such revenues are sufficient to meet the utility's cash requirements over the study period. Table 6-1 shows a flow of funds under existing rates for the government-owned utility. Operating revenue (lines 1, 2, and 3) and non-operating revenue (line 9) were developed previously in Table 2-3, while O&M expenses (line 4) were projected in Table 3-1. The revenue requirement for total debt service (lines 6, 7, and 8) and other obligations (lines 10, 11, and 12) were discussed in chapter 5.

Line 13 of Table 6-1 shows that the revenues under existing rates for the government-owned utility are adequate to meet projected revenue requirements in projected year 1. However, beginning in projected year 2, annual revenue requirements exceed annual revenues by increasing amounts each year. The percent deficiencies in annual water service revenue are indicated on line 14. Lines 15, 16, and 17 of Table 6-1 show the cumulative water service revenue, cumulative net balance, and cumulative percent deficiency beginning with projected year 2. The cumulative percent deficiency indicates the overall percentage increase in revenues that must be implemented at the beginning of projected year 2 to overcome the

Table 6-1 Flow of funds—Existing rates* (in thousands of dollars)

Line No.		Projected Years, $				
		1	2	3	4	5
	Operating Revenue					
1	Water service	3,234	3,255	3,275	3,295	3,316
2	Other operating revenue	25	26	27	28	29
3	Total operating revenue	3,259	3,281	3,302	3,323	3,345
4	*O&M Expenses*	2,183	2,279	2,710	2,830	2,960
5	*Net Operating Revenue*	1,076	1,002	592	493	385
	Debt Service					
6	Outstanding bonds	560	560	560	560	560
7	Proposed bonds	150	300	300	300	300
8	Total debt service	710	860	860	860	860
9	*Non-operating Revenue*	50	53	56	59	62
	Other Obligations					
10	Capital improvements	375	380	385	390	395
11	Debt-service reserve	30	60	60	60	60
12	Total other obligations	405	440	445	450	455
13	*Net Balance From Operations*	11	(245)	(657)	(758)	(868)
14	*Percent Deficiency of Water Service Revenue*	—	7.5%	20.1%	23.0%	26.2%
15	*Cumulative Water Service Revenue (beginning year 2)*	—	3,255	6,530	9,825	13,141
16	*Cumulative Net Balance*	—	(234)	(891)	(1,649)	(2,517)
17	*Cumulative Percent Deficiency*	—	7.2%	13.6%	16.8%	19.2%

*Information is for government-owned utilities.

indicated deficiency in revenues under existing rates for an initial period of years. A one-year increase would amount to 7.2 percent; a two-year increase, 13.6 percent; and so on. The data from Table 6-1 enable the utility to evaluate its anticipated financial condition and plan for future rate adjustments.

Table 6-2 shows a flow of funds under increased rates for the government-owned utility. Many rate increase options are available to meet the indicated deficiencies shown in Table 6-1. For illustrative purposes, the alternative presented in Table 6-2 provides for an initial one-year revenue increase in projected year 2 of 7.2 percent, followed by an increase of 14.9 percent in projected year 3, which is adequate to meet the revenue requirements for the remainder of the five-year study period.

In addition to meeting annual cash revenue requirements, the net operating revenue shown on line 9 of Table 6-2 provides coverage on maximum year debt service of at least 1.52 times, as shown on line 19. In the event that the bond indenture for the example utility required a coverage ratio in excess of 1.52 to be maintained, an initial rate adjustment would have been required in projected year 1, as discussed previously in chapter 5.

INVESTOR-OWNED UTILITIES

For the investor-owned utility, Table 6-3 shows projected revenues under existing rates and their ability to meet annual revenue requirements, measured as relative to

Table 6-2 Flow of funds—Increased rates* (in thousands of dollars)

Line No.		Projected Years, $				
		1	2	3	4	5
	Operating Revenue					
1	Water services—existing rates	3,234	3,255	3,275	3,295	3,316
2	Additional water service revenue	—	234	236	237	239
3	Year 2—Revenue increase 7.2%	—	—	523	526	530
4	Year 3—Revenue increase 14.9%	—	234	759	763	769
5	**Total water service revenue**	**3,234**	**3,489**	**4,034**	**4,058**	**4,085**
6	Other operating revenue	25	26	27	28	29
7	**Total operating revenue**	**3,259**	**3,515**	**4,061**	**4,086**	**4,114**
8	O&M expenses	2,183	2,279	2,710	2,830	2,960
9	***Net operating revenue***	**1,076**	**1,236**	**1,351**	**1,256**	**1,154**
	Debt Service					
10	Outstanding bonds	560	560	560	560	560
11	Proposed bonds	150	300	300	300	300
12	**Total debt service**	**710**	**860**	**860**	**860**	**860**
13	Non-operating revenue	50	53	56	59	62
	Other Obligations					
14	Capital improvements	375	380	385	390	395
15	Debt-service reserve	30	60	60	60	60
16	**Total other obligations**	**405**	**440**	**445**	**450**	**455**
17	*Net Balance From Operations*	11	(11)	102	5	(99)
18	*Cumulative Net Balance*	11	—	102	107	8
19	*Maximum Year Debt-Service Coverage (line 9 ÷ line 12)*	1.52	1.44	1.57	1.46	1.34

*Information is for government-owned utilities.

meeting the desired overall rate of return, or weighted cost of capital (of 10.5 percent), as discussed in chapter 5. Lines 1 through 4 of Table 6-3 were developed previously in Tables 2-3 and 3-1. Line 5, depreciation, was determined in the development of the accumulated depreciation figures presented in Table 5-2. Taxes other than income tax (line 6) and federal and state income taxes (line 8) are example levels of these revenue requirement elements, which are fairly typical for a utility operation the size of the example utility.

The resulting operating income (line 9) divided by rate base (line 10), which was developed in Table 5-2, results in the anticipated rate of return under existing rates shown on line 11 of Table 6-3. When compared with the desired overall rate of return of 10.5 percent, revenues under existing rates are inadequate beginning in projected year 1.

Table 6-4 shows a projected operating income statement under increased rates for the example investor-owned utility. Investor-owned utilities are generally required to seek annual rate adjustments, rather than multiple-year adjustments as was projected in Table 6-2 for the government-owned utility. Therefore, Table 6-4 shows a series of annual increases required to produce operating income that will result in the desired 10.5 percent rate of return. Although a multi-year projection of revenues and revenue requirements may not be standard practice for investor-owned utilities, schedules such as those shown in Tables 6-3 and 6-4 provide useful planning tools for such utilities.

Table 6-3 Operating income statement—Existing rates* (in thousands of dollars)

Line No.		Projected Years, $				
		1	2	3	4	5
	Operating Revenue					
1	Water service	4,316	4,345	4,373	4,399	4,428
2	Other operating revenue	30	31	32	33	34
3	**Total operating revenue**	**4,346**	**4,376**	**4,405**	**4,432**	**4,462**
	Operating Expenses					
4	Total O&M expense	2,183	2,279	2,710	2,830	2,960
5	Depreciation	380	414	452	460	467
6	Taxes other than income tax	305	360	365	372	380
7	**Subtotal operating income before income taxes**	**1,478**	**1,323**	**878**	**770**	**655**
8	Federal and state income taxes	266	238	158	139	118
9	***Operating Income***	**1,212**	**1,085**	**720**	**631**	**537**
10	*Rate Base*	12,326	13,820	13,747	13,633	13,519
11	*Rate of Return (%) (line 9 ÷ line 10)*	9.8%	7.9%	5.2%	4.6%	4.0%

*Information is for investor-owned utilities.

Table 6-4 Operating income statement—Increased rates* (in thousands of dollars)

Line No.		Projected Years, $				
		1	2	3	4	5
	Operating Revenue					
1	Water service—existing rates	4,316	4,345	4,373	4,399	4,428
	Additional Water Service Revenues					
2	Year 1—Revenue increase—3.1%	134	135	136	136	137
3	Year 2—Revenue increase—10.3%	—	462	464	467	470
4	Year 3—Revenue increase—11.6%	—	—	578	580	584
5	Year 4—Revenue increase—2.2%	—	—	—	121	124
6	Year 5—Revenue increase—2.1%	—	—	—	—	123
7	**Total additional water service revenues**	**134**	**597**	**1,178**	**1,304**	**1,438**
8	Other operating revenues	30	31	32	33	34
9	**Total operating revenues**	**4,480**	**4,973**	**5,583**	**5,736**	**5,900**
	Operating Expenses					
10	Total O&M expense	2,183	2,279	2,710	2,830	2,960
11	Depreciation	380	414	452	460	467
12	Taxes other than income tax	305	360	365	372	380
13	**Subtotal operating income before income taxes**	**1,612**	**1,920**	**2,056**	**2,074**	**2,093**
14	Federal and state income taxes	318	469	613	643	674
15	***Operating Income***	**1,294**	**1,451**	**1,443**	**1,431**	**1,419**
16	*Rate Base*	12,326	13,820	13,747	13,633	13,519
17	*Rate of Return (line 15 ÷ line 16)*	10.5%	10.5%	10.5%	10.5%	10.5%

*Information is for investor-owned utilities.

Section II

Cost Allocation

Allocating Costs of Service to Cost Components

Distributing Costs to Customer Classes

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Chapter **7**

Allocating Costs of Service to Cost Components

The total annual cost of providing water service is the annual revenue requirements that apply to the particular utility, as discussed in chapters 1 through 6 of this manual. A water utility is required to supply water in total amounts and at the rates of use the customer wants, while exercising appropriate conservation considerations in providing service. A utility incurs costs in relation to the various expenses required to meet those customer needs. Since the needs for total volume of supply and peak rates of use vary among customers, the utility's costs of providing service also vary among customers or classes of customers.

The basic premise in establishing adequate rate schedules that are equitable to different customers is that rates should reflect the cost of providing water service. A sound analysis of the adequacy of charges requires that costs be allocated among the customers commensurate with their service requirements. This approach recognizes differences in the costs of providing service to different types of customers. For example, a customer with a higher than average peak rate of use requires larger capacity pumps, pipes, and other system facilities than a customer with an equal total volume of use who takes water at a uniform rate. Accordingly, cost allocation procedures should recognize the particular service requirements of the customers for total volume of water, peak rates of use, and other factors.

The total annual revenue requirements discussed in chapters 1 through 6 are the total costs of service to be derived from water rates and may be considered in the two broad categories of O&M expenses and capital costs. For government-owned utilities, payments in lieu of taxes (PILOT) may also be a part of revenue requirements.

Operation-and-maintenance expenses include both the costs of operating the system and the costs of maintaining system facilities and equipment. Utility records generally break down these expenses into costs related to supply, pumping, treatment, transmission and distribution, customer meter reading, billing and collection costs, and administrative and general costs. Such cost breakdowns also usually separate salaries and wages, materials and supplies (including power and chemicals), and other categories of expense. Such expenses are similar for both government-owned or investor-owned utilities.

Capital costs may be expressed as annual costs associated with plant investment. Under the cash-needs approach, these costs would include such investment-related cash requirements as debt service, contributions to debt service reserve, capital requirements not debt financed, and, in some cases, PILOT. Using the utility approach, capital costs would include depreciation expense and return on rate base, and income taxes and other taxes if applicable.

In allocating costs of service to customer classes, whether for a government-owned or investor-owned utility, revenue requirements may be apportioned among customer classes on a utility basis—that is, in terms of O&M expense, depreciation expense, return on rate base, and, where appropriate, taxes. For a government-owned utility such as the one illustrated in Table 1-2, the total depreciation expense and return is equal to the total cash requirements, other than O&M expense and other revenues, to be recovered from rate-related revenues to meet capital-related costs.

Costs are allocated to express the total utility cost of service, including O&M expense, depreciation expense, and return, in terms of costs associated with supplying (1) both the customer's average and peak rates of use or demands; (2) costs related to customer meters, services, and accounts; and (3) direct costs incurred to provide for fire protection. Those costs by functions, in turn, are further distributed to customer classes based on their particular requirements for service.

The allocation of water utility costs have, over the years, evolved into a variety of bases or methods. In most cases the costs are allocated, or assigned, in two steps: first to appropriate cost components, then to customers. The cost components vary, depending on the basis of allocation used. The two most widely used methods allocating costs are the base-extra capacity method and the commodity-demand method. In their respective ways, both methods of cost allocation recognize that the cost of serving customers depends not only on the total volume of water used but also on the rate of use, or peaking requirements. In addition, both methods recognize customer-related costs as a valid cost function.

Another method of allocating costs, the functional-cost method, has been used in the past but is rarely used today because of its limitations in addressing volume and rate of use. Other methods of cost allocation, involving incremental, marginal, or special-use service, apply only in special situations.

Cost allocation under the base-extra capacity and commodity-demand methods includes:

1. Allocation of costs that apply to the functional cost components of base, extra capacity, and customer costs in the base-extra capacity method, and to commodity, demand, and customer costs in the commodity-demand method.

2. Distribution of costs by the various cost components to respective classes of customers according to the respective responsibility of the customer classes for each of the component costs.

The allocations of costs to cost components by the base-extra capacity method and the commodity-demand method are discussed and illustrated in the remainder of this section. Distribution of component costs to customer classes is discussed in chapter 8.

It is useful to consider the distinctions between variable and fixed cost categories in performing base-extra capacity or demand-commodity cost allocations. Variable costs are those costs that tend to vary directly with the volume of water produced. Examples of variable costs include chemicals used in treatment and the energy portion of the costs of power used in pumping. Water purchased on a charge per unit of volume basis is also a variable cost. Fixed costs are those capital and operating costs that remain relatively unchanged over a given operating period, such as a year. Fixed costs include virtually all capital costs such as debt service, or depreciation expense and return, as well as costs of operating and maintaining system facilities.

Categorizing expenses as either variable or fixed is useful to understanding how the utility incurs costs. This data can help utilities recognize the impact on revenues of significantly changing volumes of production and the revenue instability that may result. Moreover, minimum required revenue levels, based on fixed cost needs, can be evaluated with respect to each customer class. Contractual charges to large customers, which include a fixed cost component, can be appropriately evaluated. Finally, the evaluation process itself provides a useful consideration of a utility's revenue requirements, potentially leading to improved recordkeeping, budgeting, and recognition of the nature of the utility's costs.

BASE-EXTRA CAPACITY METHOD

Using the base-extra capacity method, costs of service are usually separated into four primary cost components: (1) base costs, (2) extra capacity costs, (3) customer costs, and (4) direct fire-protection costs. In detailed rate studies, some of these elements may be broken down further into two or more subcomponents.

Base costs are costs that tend to vary with the total quantity of water used plus those O&M expenses and capital costs associated with service to customers under average load conditions, without the elements of cost incurred to meet water use variations and resulting peaks in demand. Base costs include O&M expenses of supply, treatment, pumping, and distribution facilities. Base costs also include capital costs related to water plant investment associated with serving customers to the extent required for a constant, or average, annual rate of use.

Extra capacity costs are costs associated with meeting rate of use requirements in excess of average and include O&M expenses and capital costs for system capacity beyond that required for average rate of use. These costs may be subdivided into costs necessary to meet maximum-day extra demand, maximum-hour demand in excess of maximum day demand, or other extra-demand criteria (such as the maximum five-day demand) that may be appropriate for a particular utility.

Customer costs comprise those costs associated with serving customers, irrespective of the amount or rate of water use. They include meter reading, billing, and customer accounting and collecting expense, as well as maintenance and capital costs related to meters and services. In detailed studies, the costs for meter reading and billing and for customer accounting and collecting may be considered one subcomponent; maintenance and capital costs on customer meters and services may be considered another subcomponent.

Direct fire-protection costs are those costs that apply solely to the fire-protection function. Usually, such costs are simply those directly related to public fire hydrants and related branch mains and valves. It should be noted that the costs allocated to the direct fire-protection cost component are usually only a small part of the total cost of fire protection. As more fully described and illustrated in chapter 8, a significant portion of extra capacity costs can be allocated to fire protection in distributing costs to customer classes.

In the base-extra capacity method, cost must be carefully separated between base costs and extra capacity costs. The appropriate allocation factors between base and extra capacity usually vary among systems and should be determined on the basis of the actual operating history or design criteria for each system. For example, if a system has an annual average-day use of 7.5 million gallons per day (mgd) and a maximum day use of 11.55 mgd, facilities designed to meet maximum day requirements, such as a treatment plant, may be allocated 65 percent (7.5 mgd/11.55 mgd) to the base cost component and 35 percent [(11.55–7.5)mgd/11.55 mgd] to the maximum day extra capacity cost component. If the system also has a maximum hour use of 16.65 mgd, facilities designed to meet maximum hour requirements, such as distribution mains, inherently meet both maximum day and maximum hour requirements and may appropriately be allocated to the base, maximum day extra capacity, and maximum hour (in excess of maximum day) extra capacity cost components. The base cost component would be allocated 45 percent (7.5 mgd/16.65 mgd); the maximum day extra capacity cost component would be allocated approximately 25 percent [(11.55–7.50) mgd/16.65 mgd]; and the maximum hour extra capacity component would be allocated approximately 30 percent [(16.65–11.55) mgd/16.65 mgd]. Utilities are cautioned to develop ratios with care and sound judgment.

As previously discussed, total costs of service are represented by three principal elements: (1) O&M expense, (2) depreciation expense, and (3) return. In some instances, PILOT must be included as an element in cost of service. Operation-and-maintenance expense and depreciation expense are annual amounts that can be allocated directly to cost components. Return is the balance of annual capital costs not derived through depreciation expense and is expressed as a percentage of rate base. Thus, return is allocated on the basis of the distribution of rate base to appropriate cost components. This serves as a basis for subsequent distribution of responsibility for return to the various customer classes. Payment in lieu of taxes may be allocated similarly.

Table 7-1 presents an example of the allocation of rate base to cost components under the base-extra capacity cost allocation method. The various elements of rate base shown in the table are the net book value (original cost less accrued depreciation) of the water system, based on the accounting records of the utility as projected for the test period. Investment in source of supply, land, land rights, and impounded reservoir structures in this example is allocated 100 percent to the base cost component. Such an allocation recognizes the fact that such facilities are sized principally to meet annual supply requirements in total, whether or not daily needs vary. In some cases reservoirs may function to provide not only total annual supply requirements but also to provide for fluctuations in use on a seasonal or daily basis. Utilities can evaluate each particular local situation to determine if some portion of the impounded reservoir related costs should be allocated to the extra capacity cost function. The source of supply for many utilities may also include well supply. In these instances, a portion of the rate base for source of supply may be allocated to maximum-day or maximum-hour extra capacity, depending on the basis of design or usage characteristics associated with the well supply.

Raw- and treated-water pumping and treatment facilities are allocated 65 percent to base and 35 percent to the maximum-day extra capacity cost components since these facilities are designed to meet maximum-day demands. It is noted that if

Table 7-1 Allocation of rate base—Base-extra capacity method (test year)

Line No.	Item	Total, $	Base, $	Extra Capacity: Maximum Day, $	Extra Capacity: Maximum Hour,* $	Customer Meters and Services, $	Direct Fire-Protection Service, $
	Intangible Plant						
1	Organization	6,000	3,000	1,000	1,000	1,000	
	Source of Supply Plant						
2	Land	423,000	423,000				
3	Reservoir	407,000	407,000				
	Pumping Plant						
4	Land	23,000	15,000	8,000			
5	Structures	369,000	240,000	129,000			
6	Electric pumping equipment	376,000	244,000	132,000			
7	Other pumping equipment	157,000	102,000	55,000			
	Water Treatment Plant						
8	Structures	426,000	277,000	149,000			
9	Water treatment equipment	3,832,000	2,491,000	1,341,000			
	Transmission and Distribution Plant						
10	Land	35,000	4,000		31,000		
11	Structures	48,000	5,000		43,000		
12	Distribution storage	1,020,000	102,000		918,000		
13	Mains	5,842,000	2,628,000	1,461,000	1,753,000		
14	Services	2,264,000				2,264,000	
15	Meters	996,000				996,000	
16	Hydrants	404,000					404,000
	General Plant						
17	Land	4,000	1,000	1,000	1,000	1,000	
18	Structures	190,000	80,000	37,000	31,000	37,000	5,000
19	Other	129,000	55,000	25,000	21,000	25,000	3,000
20	Net plant in service	16,951,000	7,077,000	3,339,000	2,799,000	3,324,000	412,000
	Plus						
21	Materials and supplies	291,000	122,000	57,000	48,000	57,000	7,000
22	Cash working capital	285,000	119,000	56,000	57,000	56,000	7,000
23	Construction work in progress	104,000	47,000	26,000	31,000		
	Less						
24	Contributions and advances	(1,445,000)				(1,445,000)	
25	Test-year rate base	16,186,000	7,365,000	3,478,000	2,925,000	1,992,000	426,000

*Maximum-hour demand in excess of maximum-day demand.

the example were to identify separately reservoir intake facilities or raw water transmission mains, these facilities also would be allocated 65 percent to base and 35 percent to the maximum-day extra capacity cost components. Treated water transmission and distribution mains are allocated 45 percent to base, 25 percent to maximum-day extra capacity, and 30 percent to the maximum-hour extra capacity cost components, recognizing that mains provide maximum-day and maximum-hour service to all customers. Distribution storage related facilities, such as elevated storage tanks, serve principally to assist utilities in meeting maximum-hour extra capacity requirements, and, therefore, in this example, are allocated 90 percent to the maximum-hour extra capacity cost component. Recognizing that distribution storage provides some element of system reliability, the base cost component is assigned 10 percent of such facilities. The percentage factor used to allocate distribution storage largely depends on engineering judgment as well as the operating and design characteristics of the reservoirs in each particular system. Meters and services are allocated to the customer cost component. Fire hydrants are allocated to the direct fire-service cost component.

The value of office buildings, furniture and equipment, vehicles, and other general plant is allocated to cost components on the basis of the resulting allocation of other plant facilities.

The allocation to base and extra capacity components depends on conditions controlling the design of any given system and facilities within the system. It must be recognized that each system requires separate analysis for proper allocation to cost components.

Construction work in progress is allocated to cost components on the same basis as similar elements of plant in service. In the example, it is assumed that all construction work in progress is transmission and distribution mains.

In many water utility systems, the accounting records will show contributions in aid of construction (CIAC) that ordinarily are deducted from the rate base before applying rate-of-return percentages. Contributions should be deducted from plant value according to the purposes for which the contributions were made. The example illustrated in Table 7-1 assumes that all contributions in this instance are related to customer meters and services.

The results of the allocation of rate base to the various cost components, as illustrated in Table 7-1, provide a basis for subsequent distribution of capital costs to these components and then to the customer classes, as further explained in chapter 8.

Table 7-2 illustrates the allocation of annual depreciation expense to cost components. The categories of items of depreciation expense are allocated to cost components in the same manner described in the allocation of rate base.

Table 7-3 presents an example of the allocation of O&M expense to cost components under the base-extra capacity method. In general, O&M expense for each facility is allocated to cost components in a manner similar to that for rate base.

Expenses that tend to vary directly with water usage are assigned directly to the base cost component. Chemical costs are an example of such an expense. Power costs are allocated principally to the base cost component. The demand portion of power costs should be allocated to extra capacity to the degree that it varies with demand pumping requirements. In the illustration, pumping power is allocated 10 percent to the maximum-day extra capacity cost component in recognition of this factor, with the balance of power costs, or 90 percent, allocated to base cost. The extent to which power costs are allocated to the extra capacity cost component depends on the variations in electric demands incurred in pumping and the energy/demand electric rate structure that applies to pumping.

Table 7-2 Allocation of depreciation expense—Base-extra capacity method (test year)

Line No.	Item	Total, $	Base, $	Extra Capacity: Maximum Day, $	Extra Capacity: Maximum Hour,* $	Customer Meters and Services, $	Direct Fire-Protection Service, $
	Source of Supply Plant						
1	Reservoir	11,800	11,800				
	Pumping Plant						
2	Structures	9,600	6,200	3,400			
3	Electric pumping equipment	10,600	6,900	3,700			
4	Other pumping equipment	4,200	2,700	1,500			
	Water Treatment Plant						
5	Structures	11,000	7,100	3,900			
6	Water treatment equipment	83,800	54,500	29,300			
	Transmission and Distribution Plant						
7	Structures	1,200	100		1,100		
8	Distribution storage	28,500	2,900		25,600		
9	Mains	161,100	72,500	40,300	48,300		
10	Services	48,900				48,900	
11	Meters	21,500				21,500	
12	Hydrants	12,300					12,300
	General Plant						
13	Structures	4,900	2,000	1,000	800	1,000	100
14	Other	4,600	1,900	900	800	900	100
15	Total depreciation expense	414,000	168,600	84,000	76,600	72,300	12,500

*Maximum-hour demand in excess of maximum-day demand.

Table 7-3 Allocation of O&M expense—Base-extra capacity method (test year)

				Extra Capacity		Customer Costs		
Line No.	Item	Total, $	Base, $	Maximum Day, $	Maximum Hour,* $	Meters and Services, $	Billing and Collecting, $	Direct Fire-Protection Service, $
1	Source of Supply	90,000	90,000					
	Pumping							
2	Purchased power	259,000	233,100	25,900				
3	Other	193,000	125,400	67,600				
	Water Treatment							
4	Chemicals	121,000	121,000					
5	Other	157,000	102,000	55,000				
	Transmission and Distribution							
6	Mains	130,000	58,500	32,500	39,000			
7	Storage	26,000	2,600		23,400			
8	Meters and services	155,000				155,000		
9	Hydrants	13,000						13,000
10	Other	72,000	13,600	7,200	13,900	34,400		2,900
	Customer Accounting							
11	Meter reading and collection	247,000					247,000	
12	Uncollectible accounts	44,000	20,800	6,300	2,800	5,900	7,700	500
	Administrative and General							
13	Salaries	194,000	70,300	29,100	13,700	33,900	44,200	2,800
14	Employee benefits	177,000	64,000	26,500	12,500	31,000	40,400	2,600
15	Insurance	135,000	77,600	36,300	19,700	1,200	200	
16	Other	266,000	96,300	39,900	18,700	46,500	60,700	3,900
17	Total O&M expense	2,279,000	1,075,000	326,300	143,700	307,900	400,200	25,700

*Maximum-hour demand in excess of maximum-day demand.

Expenses other than power, chemical, and customer-related costs can be allocated to cost components on the basis of the design capacity requirements of each facility. Such expenses, if designed to meet maximum-day requirements, are allocated 65 percent to base cost and 35 percent to maximum-day extra capacity cost. Expenses related to facilities designed to meet maximum-hour requirements are allocable 45 percent to base cost, 25 percent to maximum-day extra capacity cost, and 30 percent to maximum-hour extra capacity cost. Expenses related to distribution storage are allocated in the same manner as for rate base—that is, 10 percent to base cost and 90 percent to maximum-hour extra capacity costs.

Expenses for meters and services and for customer billing and collecting are allocated directly to the customer cost components. In the example, administration and general expense is allocated to cost components in three parts. Salaries and employee benefits are allocated on the basis of the allocation of salaries and wages. Insurance is allocated on the basis of the test year rate base provided in Table 7-1. Other administration and general expense is allocated on the basis of the allocation of all other expenses, exclusive of power and chemical costs.

COMMODITY-DEMAND METHOD

In the commodity-demand method, costs of service are separated into four primary cost components: (1) commodity costs, (2) demand costs, (3) customer costs, and (4) direct fire-protection costs. In detailed rate studies, some of these elements may also be broken down further into two or more subcomponents.

Commodity costs are costs that tend to vary with the quantity of water produced. They usually include costs of chemicals, a large part of power costs, and other elements that increase or decrease almost directly with the amount of water supplied. Costs related to impounded reservoir source of supply or other costs that vary with average daily demands, such as raw water transfer pumping costs, may also be considered as commodity costs. Purchased water costs, if bought on a unit volume basis, would also be considered as commodity costs. However, recognition of recent practices to include a demand charge in addition to commodity charge in purchased water agreements may dictate that demand portions of purchased water costs be allocated to demand components.

Demand costs are associated with providing facilities to meet the peak rates of use, or demands, placed on the system by the customers. They include capital-related costs on plant designed to meet peak requirements, plus the associated O&M expenses. This cost component may be broken down into costs associated with meeting specific demands, such as maximum-day, excess maximum-hour, or other periods of time that may be appropriate to the utility that has to meet these demands.

The definition of customer costs for this method is the same as for the base-extra capacity method. Direct fire-protection costs are also the same as under the base-extra capacity cost method.

Table 7-4 presents an example of how rate base is allocated under the commodity-demand method. In this example, rate base for each facility is the same as in the base-extra capacity method presented in Table 7-1. Each element of the utility plant is assigned to commodity, demand, customer, or direct fire-service functions. Pumping plant and treatment plant, which meet maximum-day demands, are allocated 100 percent to the maximum-day demand component. Treated-water mains, which serve maximum-hour demands, are allocated 70 percent to the maximum-day demand component and 30 percent to the maximum-hour demand cost component. Rate base for distribution storage is allocated 100 percent to the maximum-hour demand component.

Table 7-4 Allocation of rate base—Commodity-demand method (test year)

				Demand			
Line No.	Item	Total, $	Commodity, $	Maximum Day, $	Maximum Hour,* $	Customer Meters and Services, $	Direct Fire-Protection Service, $
	Intangible Plant						
1	Organization	6,000		4,000	1,000	1,000	
	Source of Supply Plant						
2	Land	423,000	423,000				
3	Reservoir	407,000	407,000				
	Pumping Plant						
4	Land	23,000		23,000			
5	Structures	369,000		369,000			
6	Electric pumping equipment	376,000		376,000			
7	Other pumping equipment	157,000		157,000			
	Water Treatment Plant						
8	Structures	426,000		426,000			
9	Water treatment equipment	3,832,000		3,832,000			
	Transmission and Distribution Plant						
10	Land	35,000			35,000		
11	Structures	48,000			48,000		
12	Distribution storage	1,020,000			1,020,000		
13	Mains	5,842,000		4,089,000	1,753,000		
14	Services	2,264,000				2,264,000	
15	Meters	996,000				996,000	
16	Hydrants	404,000					404,000
	General Plant						
17	Land	4,000		2,000	1,000	1,000	
18	Structures	190,000	9,000	106,000	33,000	37,000	5,000
19	Other	129,000	6,000	73,000	22,000	25,000	3,000
20	Net plant in service	16,951,000	845,000	9,457,000	2,913,000	3,324,000	412,000
	Plus						
21	Materials and supplies	291,000	15,000	162,000	50,000	57,000	7,000
22	Cash working capital	285,000	14,000	159,000	49,000	56,000	7,000
23	Construction work in progress	104,000		73,000	31,000		
	Less						
24	Contributions and advances	(1,445,000)				(1,445,000)	
25	Test-year rate base	16,186,000	874,000	9,851,000	3,043,000	1,992,000	426,000

*Maximum-hour demand in excess of maximum-day demand.

Table 7-4 illustrates how the results of the allocation of rate base to the various cost components provide a basis for subsequent distribution of rate base, and related capital costs, to customer classes. This concept is further explained in chapter 8.

Table 7-5 presents an example of how depreciation expense is allocated to cost components under the commodity-demand method. The categories of items of depreciation expense are allocated to cost components in the same manner as described in the allocation of rate base.

Table 7-6 presents an example of how O&M expense is allocated under the commodity-demand method. In general, O&M expense for each facility is allocated to cost components in a manner similar to that for rate base. However, chemical costs, which tend to vary with the amount of water produced, are assigned 100 percent to the commodity-cost function. Pumping power costs are allocated 71 percent to commodity cost and 29 percent to maximum-day demand cost, recognizing that power costs vary with demand.

In the example, administration and general expense is allocated to cost components in a manner similar to that described for the base-extra capacity method—that is, in three parts. Employee benefits are allocated on the basis of the allocation of salaries and wages. Insurance is allocated on the basis of test year rate base in Table 7-4. Other administration and general expense is allocated on the basis of all other expenses, exclusive of power and chemicals.

In comparing allocations under the base-extra capacity and commodity-demand methods, base costs in the base-extra capacity method include commodity costs plus that portion of demand costs in the commodity-demand method related to providing services at average annual rates of water use. In the example, base cost includes all commodity costs plus 65 percent of the maximum-day demand costs. The maximum-day extra capacity costs include the balance of the costs allocated to the maximum-day demand component or, in the example, the maximum-day extra capacity costs are 35 percent of the maximum-day demand costs for such facilities.

It should be noted that, if all elements of cost are properly allocated, use of either the base-extra capacity or the commodity-demand method will result in comparable charges for water service. One particular advantage in using the base-extra capacity method is that it identifies in the base cost element the minimum unit volume cost of service. Such a unit cost would apply as a rate only if perfect load factor or constant rate of use could be achieved. Therefore, the unit base cost provides a measure of the lowest potential charge in a schedule of rates for delivery of uniform service. As such, the unit base cost is an important guide in preventing utilities from establishing a charge that could result in the sale of water below cost.

SPECIAL CONSIDERATIONS

Some water utility systems have customers with water-use characteristics that require special consideration in allocating costs.

Customers provided with firm water service, that is, unlimited service in the amounts and at such times as desired, should be charged rates adequate to recover the full cost to the utility of providing such service.

In establishing charges for non-firm service, such as off-peak or interruptible service, utilities should consider charging special rates that are less than the rates for firm service. Such rates might consist of those direct additional costs, such as for power and chemicals, associated with providing water from existing facilities; however, charges should reflect a recognition of capacity-related and other costs, in addition to purely incremental costs.

Table 7-5 Allocation of depreciation expense—Commodity-demand method (test year)

Line No.	Item	Total, $	Commodity, $	Demand: Maximum Day, $	Demand: Maximum Hour,* $	Customer Meters and Services, $	Direct Fire-Protection Service, $
	Source of Supply Plant						
1	Reservoir	11,800	11,800				
	Pumping Plant						
2	Structures	9,600		9,600			
3	Electric pumping equipment	10,600		10,600			
4	Other pumping equipment	4,200		4,200			
	Water Treatment Plant						
5	Structures	11,000		11,000			
6	Water treatment equipment	83,800		83,800			
	Transmission and Distribution Plant						
7	Structures	1,200			1,200		
8	Distribution storage	28,500			28,500		
9	Mains	161,100		112,800	48,300		
10	Services	48,900				48,900	
11	Meters	21,500				21,500	
12	Hydrants	12,300					12,300
	General Plant						
13	Structures	4,900	200	2,800	800	1,000	100
14	Other	4,600	200	2,600	800	900	100
15	Total depreciation expense	414,000	12,200	237,400	79,600	72,300	12,500

*Maximum-hour demand in excess of maximum-day demand.

Table 7-6 Allocation of O&M expense—Commodity-demand method (test year)

Line No.	Item	Total, $	Commodity, $	Demand: Maximum Day, $	Demand: Maximum Hour,* $	Customer Costs: Meters and Services, $	Customer Costs: Billing and Collecting, $	Direct Fire-Protection Service, $
1	Source of Supply	90,000	90,000					
	Pumping							
2	Purchased power	259,000	183,900	75,100				
3	Other	193,000		193,000				
	Water Treatment							
4	Chemicals	121,000	121,000					
5	Other	157,000		157,000				
	Transmission and Distribution							
6	Mains	130,000		91,000	39,000			
7	Storage	26,000			26,000			
8	Meters and services	155,000				155,000		
9	Hydrants	13,000						13,000
10	Others	72,000		20,300	14,400	34,400		2,900
	Customer Accounting							
11	Meter reading and collection	247,000					247,000	
12	Uncollectible accounts	44,000	9,000	18,000	2,900	5,900	7,700	500
	Administrative and General							
13	Salaries	194,000	16,100	82,800	14,200	33,900	44,200	2,800
14	Employee benefits	177,000	14,700	75,300	13,000	31,000	40,400	2,600
15	Insurance	135,000	8,200	103,600	21,800	1,200	200	
16	Other	266,000	22,100	113,300	19,500	46,500	60,700	3,900
17	Total O&M expense	2,279,000	465,000	929,400	150,800	307,900	400,200	25,700

*Maximum-hour demand in excess of maximum-day demand.

In areas where irrigation or other seasonal uses impose significant demands on the system, utilities might consider separate charges for such use. Costs associated with seasonal use might be recovered through rates applied to separate metering for such services or through surcharges applied to consumption over and above an established normal use.

When allocating the costs of service between inside-city and outside-city customers, government-owned utility systems should give special consideration to factors such as the facilities required, the extent and nature of service, ownership, risk, and other special items. A general approach to this situation is the use of the utility basis to assign cost responsibility to outside customers. This method is presented in more detail in chapter 8 of this manual. Except in specific instances, such as for a metropolitan service approach, as discussed in chapter 8, it is reasonable for utilities to establish separate inside-city and outside-city cost factors in order to properly allocate costs related to serving a particular group of customers.

In certain utility systems, the service area may be subdivided into pressure zones or districts because of the geophysical characteristics of the area. Under these conditions the utility may want to assign the costs related to specific facilities to each pressure district. This will allow the utility to determine the cost responsibility of each section of the system. The results of such detailed studies will indicate whether there are significant differences in the costs of providing service to each pressure district.

In some instances the utility should consider the responsibility for reserve capacity in the system. A typical example would be where a significant portion of the system is being held for the future growth needs of a specific customer or class of customers. Means of recognizing reserve capacity vary from one situation to another but are vital to an equitable allocation of costs.

Chapter 8

Distributing Costs to Customer Classes

The preceding chapters of this manual have dealt with how utilities determine revenue requirements and allocate both operating- and capital-related costs to the functional components of cost of service. This chapter presents the third element in the rate-making process: how utilities distribute component costs to customer classes.

The ideal solution to developing rates for water utility customers is to assign cost responsibility to each individual customer served and to develop rates to derive that cost. Unfortunately, it is neither economically practical nor often possible to determine the cost responsibility and applicable rates for each individual customer served. However, the cost of providing service can reasonably be determined for groups or classes of customers that have similar water-use characteristics and for special customers having unusual water-use or service requirements. Rate making attempts to assign costs to classes of customers in such a manner that rates can be designed that are nondiscriminatory and closely meet the cost of providing service to such customer classes.

CUSTOMER CLASSES

In establishing customer classes, water utilities consider service characteristics, demand patterns, and whether service is provided both inside and outside the city (jurisdiction) limits. Service characteristic differences may be illustrated by recognizing that customers using treated water require facilities that raw-water customers do not need. Similarly, large-volume industrial customers, wholesale customers, and other large users tend to be served directly from major treated water transmission mains, whereas smaller users are served by both large and small mains. Utilities must sometimes consider this factor when establishing customer classes and their costs of service.

Demand patterns of various customers differ, depending on their peak-day and peak-hour rates of demand relative to average demands. For example, the residential customer class, placing summertime lawn irrigation loads on the system, typically has a much higher peak-demand requirement, relative to the average demand, than does a petroleum refinery, which may require water on a relatively uniform basis throughout the year.

The classification of water customers as either inside or outside the city limits is related to each major group's responsibility for overall costs. As explained in a later section of this manual, this classification is critical to government-owned utilities and, in some instances, may have a bearing on investor-owned utilities.

Utilities may need to recognize certain customer classifications from an accounting standpoint because of legal requirements or customs; such requirements can be accommodated in rate studies. However, general service characteristics, demand patterns, and location with regard to city limits are generally the principal considerations in customer classification.

General Classes

Most water utilities typically have three principal customer classes: (1) residential, (2) commercial, and (3) industrial. Utilities define these general customer classes differently, but, in very broad terms, the following definitions are common:

Residential: One- and two-family dwellings, usually physically separate.

Commercial: Multifamily apartment buildings and nonresidential, nonindustrial business enterprises.

Industrial: Manufacturing and processing establishments.

Some utilities may break down these general classes into more specific groups. For example, the commercial customer group may be separated into multifamily customers and commercial customers. Similarly, the industrial customer group may be subdivided into small industry, large industry, and special, the latter typified by a petroleum refinery.

Many systems, particularly larger ones, have customers with individual water-use characteristics, service requirements, or other factors that differentiate them from other customers with regard to cost responsibility. These customers should have a separate class designation. Such classes may include large hospitals, universities, military establishments, and other such categories.

Special Classes

In addition to the general classes of service previously described, water utilities often provide service to certain special classes of customers. Three such classes are wholesale service, fire-protection service, and lawn irrigation.

Wholesale service. Wholesale service is usually defined as a situation in which water is sold to a customer through a master meter at one or more major points of delivery for resale to individual retail customers within the wholesale customer's service area. Treated-water service is provided in most cases, but occasionally raw water is provided to wholesale customers. Usually, the wholesale customer is a separate municipality or water district adjacent to the supplying utility, but it may be in an area within the jurisdiction of the supplying utility. A more detailed discussion of wholesale service considerations is provided in chapter 31 of this manual.

Fire-protection service. Fire-protection service has characteristics that are markedly different from other types of water service. The service provided is principally of a standby nature—that is, readiness to deliver relatively large quantities of water for short periods of time at any of a large number of points in the water distribution system while the total annual quantity of water delivered is relatively small.

There are two principal approaches to determining fire-protection service costs that differ widely in both theory and application. One approach proposes that the costs of fire-protection service, in addition to those of the direct cost related to the hydrants themselves, be determined on the basis of the potential demand for water for fire-fighting purposes in relation to the total of all potential demands for water. A second approach proposes that fire-protection service costs be allocated as an incremental cost to the costs of general water service. This second approach is based on the premise that the prime function of the water utility is to supply general water service and that fire-protection service is a supplementary service. Each approach has advocates among water utility professionals. For the purposes of illustration in this manual, the first approach is used.

Costs allocated to fire-protection service as a class can be subdivided to those related to public fire-protection service and private fire-protection service. The reader should refer to chapter 30 of this manual for further discussion of fire-protection rates and charges.

Lawn irrigation. Residential lawn irrigation is characterized by the relatively high demands it places on the water system, usually during the late afternoon and early evening hours. Throughout most of the United States, lawn irrigation is very seasonal in nature; it is most pronounced during the summer months and virtually nonexistent during the winter months.

In most instances, lawn irrigation service is not separate from other service; therefore, the high-peaking characteristics of lawn irrigation need to be recognized as a part of residential-class water use characteristics. However, a separate class designation is warranted when separate metering for lawn irrigation is provided, as is often the case for automatic lawn sprinkling systems, parks, and golf courses, and where such loads are significant in the system.

Service Outside City Limits

Many government-owned utilities recognize in their rate structures the differences in costs of serving water users located outside the corporate limits of the supplying city or jurisdiction compared with those located within the corporate limits. A government-owned utility may be considered to be the property of the citizens within the city. Customers within the city are owner customers, who must bear the risks and responsibilities of utility ownership. Outside-city customers are non-owner customers and, as such, bear a different responsibility for costs than do owner customers.

The costs to be borne by outside-city (non-owner) customers are similar to those attributed to the customers (non-owners) of an investor-owned utility. Such costs include O&M expense, depreciation expense, and an appropriate return on the value of property devoted to serving the outside-city customers.

Sometimes, those who design or review water rates do not fully understand how the cash-needs approach to measuring total revenue requirements relates to the utility basis of cost allocation with regard to government-owned water systems, and why both elements are used in many rate studies.

A government-owned utility, in most cases where not regulated by a state public utility commission, determines its total revenue requirements, or costs of service, on a cash-needs basis. That is, it must develop sufficient revenue to meet cash needs for O&M expense, debt-service requirements, capital expenditures not debt-financed, and possibly other cash requirements as described in chapters 1 through 6 of this manual. Such cash needs must be met by the utility as a whole. However, when that utility serves outside-city, non-owner customers, it is most appropriate to measure the costs of such service on a utility basis; that is, to assign costs to outside-city customers for O&M expense, depreciation expense, and an appropriate return on the value of property devoted to serving them. The inside-city customers are then responsible for all remaining cash requirements not derived from outside-city customers. Thus, if total utility revenue requirements are relatively low, perhaps as a result of retiring a major part of the bonded indebtedness and thus having a large amount of paid-up equity, the inside-city customers have relatively low rates. Thus, the inside-city customers benefit from having invested in and owning paid-up equity in the system. The reverse situation could also occur. If the rate of return is properly set, the utility basis of allocating cost of service is fair to both the supplier and the outside-city customer.

In some instances, as a matter of policy, a government-owned utility might choose to waive the distinction between owner and non-owner customers and consider the utility to be metropolitan in nature. In such a case, differences in costs between owners and non-owners are not recognized in cost allocation and rate making. This generally would require the owner customers to subsidize the non-owner customers to some degree. Such a policy is a choice to be made by the governing body of the utility.

UNITS OF SERVICE

As a step toward rate design, component costs may be distributed among customer classes in the proportion that the respective class responsibility for those costs bears to the total cost responsibility of all customer classes served by the system. This applies for each of the component costs of service. Responsibility for each component may be expressed in terms of the number of units of service required by each class of customer. The sum of all component costs attributable to a customer class is the total cost of service to be recovered from it.

The total cost of each component, such as base cost, may be divided by appropriate total customer requirements or units of service to express a unit cost for each component. The unit costs of each component serve as a basis for designing rates. As a basis for distributing component costs to customer classes, the units of service attributable to the respective classes must be established for the test year. To do so, the utility must determine or estimate the total quantity of water to be used by each class in the test year and the peak rates of use by the class, usually for both maximum-day and maximum-hour rates of use. (In some systems maximum-week or other periods may be appropriate.) In addition, the utility must determine the number of equivalent meters and services by class, as well as the number of bills by class.

Maximum rates of use may be expressed in terms of capacity factor—that is, a percentage relationship of the class maximum rate of use to average annual rate of use. Thus, if a customer class maximum-day rate of use is 2.5 times its average rate, it is said to have a maximum-day capacity factor of 250 percent.

To estimate customer-class capacity factors, utilities need to investigate and study all pertinent sources of information. Such data should include daily and hourly pumpage records, recorded rates of flow in specific areas of the system, studies and interviews of large users regarding individual and group characteristics of use, special demand metering programs, and experience in studies of other utilities exhibiting like characteristics. Sound and logical inferences can be drawn from customer metering information, provided billing periods are sufficiently short to reflect seasonal differences, usually not to exceed three-month periods. Appendix A of this manual provides some techniques that can be used to determine reasonable estimates of the maximum day and maximum hour capacity factors for each customer class using available system demand data for the utility and customer class billing records.

The total annual quantity of water attributable to fire service is usually negligible, at least in relation to that of other classes; however, peak requirements for fire service can be quite significant. The Insurance Services Office periodically defines desired rates of flow for fire service, which is a good source of maximum-capacity requirements for fire service. Such data must be applied judiciously to achieve practical cost allocations.

Customer-related costs for meters and services may be properly distributed among customer classes by recognizing factors that are generally responsible for those costs being incurred. As an example, one method for distributing meter-and-service costs to customer classes is in proportion to the investment in meters and services installed for each customer class, based on the number of equivalent meters. Distribution of customer costs by equivalent meter-and-service ratios recognizes that meter-and-service costs vary, depending on considerations such as size of service pipe, materials used, locations of meters, and other local characteristics for various sized meters as compared to ⅝-in. meters and services. In this example, typical customer meter-and-service equivalent ratios based on investment are as follows:

Meter Size (in.)	Equivalent Meter and Service Ratio
⅝	1.0
¾	1.1
1	1.4
1½	1.8
2	2.9
3	11.0
4	14.0
6	21.0
8	29.0

Appendix B of this manual further discusses how to develop the meter and service cost ratios shown above, as well as equivalent meter ratios based on factors such as meter capacity.

Costs related to billing and collecting may be distributed among customer classes based on the total number of bills rendered to the respective classes in a test year. In some instances, billing ratios show that billing and collecting for larger services incurs more cost than for smaller services.

Table 8-1 illustrates the development of the test-year units of service for the hypothetical utility, using the base-extra capacity method of cost allocation and distribution. Test-year units of service reflect the prospective average annual customer water use requirements during the test-year study period considered in this example.

For the example, it is assumed that retail service and fire-protection service are provided inside the city to residential, commercial, and industrial classes. Outside-city service is provided on a wholesale basis.

Table 8-1 Units of service—Base-extra capacity method (test year)

	Base		Maximum Day			Maximum Hour				
Customer Class	Annual Use *thous gal*	Average Rate *thous gpd*	Capacity Factor *%*	Total Capacity *thous gpd*	Extra Capacity *thous gpd*	Capacity Factor *%*	Total Capacity *thous gpd*	Extra Capacity* *thous gpd*	Equivalent Meters and Services	Bills
Inside-City:										
Retail Service										
Residential	968,000	2,652	250	6,630	3,978	400	10,608	3,978	15,652	185,760
Commercial	473,000	1,296	200	2,592	1,296	325	4,212	1,620	1,758	14,640
Industrial	1,095,000	3,000	150	4,500	1,500	200	6,000	1,500	251	420
Fire-protection service				960	960		5,760	4,800		
Total inside-city	2,536,000	6,948		14,682	7,734		26,580	11,898	17,661	200,820
Outside-City:										
Wholesale service	230,000	630	225	1,418	788	375	2,363	945	34	48
Total system	2,766,000	7,578		16,100	8,522		28,943	12,843	17,695	200,868

*Maximum-hour demand in excess of maximum-day demand.

Table 8-2 Units of service—Commodity-demand method (test year)

	Commodity		Maximum Day		Maximum Hour				
Customer Class	Annual Use *thous gal*	Average Rate *thous gpd*	Capacity Factor *%*	Total Capacity *thous gpd*	Capacity Factor *%*	Total Capacity *thous gpd*	Extra Capacity* *thous gpd*	Equivalent Meters and Services	Bills
Inside-City:									
Retail Service									
Residential	968,000	2,652	250	6,630	400	10,608	3,978	15,652	185,760
Commercial	473,000	1,296	200	2,592	325	4,212	1,620	1,758	14,640
Industrial	1,095,000	3,000	150	4,500	200	6,000	1,500	251	420
Fire-protection service				960		5,760	4,800		
Total inside-city	2,536,000	6,948		14,682		26,580	11,898	17,661	200,820
Outside-City:									
Wholesale service	230,000	630	225	1,418	375	2,363	945	34	48
Total system	2,766,000	7,578		16,100		28,943	12,843	17,695	200,868

*Maximum-hour demand in excess of maximum-day demand.

Table 8-1 shows, under the heading "Base," the total annual water use in thousand gallons for each customer class, as well as the average rate in thousand gallons per day. Maximum-day capacity factors are applied to average-day rates of flow to develop total capacity by class. Extra capacity is the difference between total capacity and average rate of use. Fire-protection service is considered to require negligible flow on an average basis but 960 thous gpd on a maximum daily basis. Maximum-hour extra capacity is developed similarly. Maximum-hour fire-protection service assumes that flow for fires is concentrated in a four-hour period.

Equivalent meters and services are derived by applying equivalent meter and service cost ratios to the number of meters of each size by class. The number of bills is simply the total number of bills rendered annually for each class.

Table 8-2 shows the development of the units of service that apply to the commodity-demand method of cost allocation. Table 8-2 differs from Table 8-1 only in that the maximum-day extra capacity column is excluded.

The maximum total capacity on both a maximum-day and maximum-hour basis for the total system (shown in Tables 8-1 and 8-2) is the estimate of the sum of noncoincidental peaking requirements on the system; that is, it is the sum of the peaks for each class, regardless of the day or hour in which such peaks may occur. Thus, the total system capacity shown, as related to the average rate, is not to be confused with the coincidental maximum-to-average ratio used in system design.

A test of the reasonableness of the estimated maximum day and maximum hour capacity factors assigned to the various customer classes, the system-wide diversity ratio should generally fall in the range of 1.10 to 1.40. The diversity ratio is defined as

$$\frac{\text{System Noncoincidental Demand, Less Fire Protection Demand}}{\text{System Coincidental Demand, Less Fire Protection Demand}} \qquad (8\text{-}1)$$

UNIT COSTS

Component costs can be directly distributed to respective customer classes in proportion to the respective units of service applicable to each class. For instance, costs of service are distributed among customer classes by applying unit costs of service to respective service requirements. Unit costs of service are based on total costs previously allocated to functional components and the total number of applicable units of service for the test year. The development of unit costs of service for the base-extra capacity method is presented in Table 8-3.

Unit costs are determined simply by dividing the test-year functionally allocated O&M and capital costs by the respective total system units of service requirements in the test year. For example, under the base-extra capacity method, the base unit cost for O&M expense of $0.3887 per thous gal may be derived by dividing the allocated base O&M expense of $1,075,200 by the total base-component units of service of 2,766,000 thous gal. Similar computations are made to determine unit costs for all other O&M expense and depreciation expense. Under the utility-basis method of cost allocation, the resulting average unit costs for O&M expense and depreciation expense apply to all customers, both inside and outside the city. Allocation of O&M expense and depreciation expense to functional cost components is presented in chapter 7 of this manual.

Unit return on rate base is determined by first calculating unit rate base. The functionally allocated total rate base is divided by respective total system units of service to yield unit rate base. Subsequently, unit return on rate base is derived by applying appropriate inside- and outside-city rates of return to the unit rate base.

As discussed in chapters 1 through 6 of this manual, for the government-owned utility to meet total cash revenue requirements under the utility approach, the level

Table 8-3 Unit costs of service—Base-extra capacity method (test year)

Line No.	Item	Total Cost	Base	Extra Capacity: Maximum Day	Extra Capacity: Maximum Hour*	Customer Costs: Meters and Services	Customer Costs: Billing and Collecting	Direct Fire-Protection Service
	Total System Units of Service:							
1	Number		2,766,000	8,522	12,843	17,695	200,868	
2	Units		thous gal	thous gpd	thous gpd	equiv. meters	bills	
	O&M Expense:							
3	Total	$2,279,000	$1,075,000	326,300	$143,700	$307,900	$400,200	$25,700
4	Unit cost, *$/unit*		0.3887	38.2907	11.1888	17.4004	1.9924	
	Depreciation Expense:							
5	Total	$414,000	$168,600	$84,000	$76,600	$72,300		$12,500
6	Unit cost, *$/unit*		0.0610	9.8573	5.9643	4.0859		
	Rate Base:							
7	Total rate base	$16,186,000	$7,365,000	$3,478,000	$2,925,000	$1,992,000		$426,000
8	Unit rate base, *$/unit*		2.6627	408.1372	227.7479	112.5742		
	Unit Return on Rate Base:							
9	Inside-city, *$/unit*†		0.1246	19.0915	10.6534	5.2659		$19,900
10	Outside-city, *$/unit*‡		0.2396	36.7323	20.4973	10.1317		
	Total Unit Costs of Service:							
11	Inside-city, *$/unit*		0.5742	67.2394	27.8065	26.7522	1.9924	
12	Outside-city, *$/unit*		0.6893	84.8803	37.6504	31.6180	1.9924	

*Maximum-hour demand in excess of maximum-day demand.

†At 4.68 percent return on $15,033,000 rate base.

‡ At 9.0 percent return on $1,153,000 rate base.

of return in the example would be $807,000. Based on a total rate base of $16,186,000, the overall rate of return is equivalent to about 4.99 percent. In this example, it is assumed that the utility provides service to both inside- and outside-city customers. Generally, where inside-city owners provide service to outside-city non-owners, a differential rate of return is appropriate. In this example, a rate of return of 9.0 percent is assumed and applied to component unit rate base to determine the outside-city unit return on rate base.

Although it is not presented in Table 8-3, total outside-city return may be calculated by determining total outside-city rate base and applying the 9.0 percent rate of return to it. For the base-extra capacity method, total outside-city rate base is derived by applying the unit rate base from Table 8-3 to the respective outside-city units of service presented in Table 8-1. Application of the 9.0 percent rate of return to an outside-city rate base of about $1,153,000 results in an outside-city return of approximately $103,800. Once outside-city return is determined, the inside-city rate of return is established at a level sufficient to derive the balance of total return—that is, $807,000 less the outside-city return of $103,800, or $703,200, which is not derived from the outside-city customers.

The inside-city rate of return is determined by dividing the balance of total return of $703,200 by the inside-city rate base. The inside-city rate base is calculated in a manner similar to that described for developing the outside-city rate base and totals $15,033,000. Total inside-city rate of return is determined to be 4.68 percent.

Returning to the unit-cost approach presented in Table 8-3, inside-city unit return on rate base is developed by applying the 4.68 percent rate of return to the unit rate base. The differential in inside- versus outside-city rates of return reflects in part the municipality's risk in the ownership of facilities constructed to serve outside-city customers, as well as a return on paid-up equity in system facilities to inside-city customers.

Total unit costs of service are comprised of the O&M, depreciation, and return on rate-base unit costs of service and are shown at the bottom of Table 8-3 for inside- and outside-city customers. Also included in the table are the costs of service directly allocated to fire-protection service.

Unit costs of service for the commodity-demand method are developed using an approach similar to that used for the base-extra capacity method. Total unit costs of service for inside- and outside-city customers under the commodity-demand method are summarized at the bottom of Table 8-4.

DISTRIBUTING COSTS TO CUSTOMER CLASSES: BASE-EXTRA CAPACITY METHOD

The costs of service are distributed to the utility's customer classes by applying unit costs of service to individual customer-class units of water service. The total units of service and the unit costs of service for the test year, from Tables 8-1 and 8-3 respectively, are summarized in Table 8-5.

As discussed previously, base costs are costs that would be incurred in supplying water at perfect load factor (that is, at a continuous, uniform rate), without costs incurred in providing extra plant capacity for variation in the rate of use beyond a uniform rate. The resulting distribution of cost responsibility for base costs is simply a function of the volume of water used by each class.

As shown in Table 8-5, residential customers are projected to use 968,000 thous gal of water in the test year; commercial customers, 473,000 thous gal; and industrial customers 1,095,000 thous gal. Applying the inside-city unit base cost of $0.5742 per

Table 8-4 Unit costs of service—Commodity-demand method (test year)

Line No.	Item	Total Cost	Commodity	Demand: Maximum Day	Demand: Maximum Hour**	Customer Costs: Meters and Services	Customer Costs: Billing and Collecting	Direct Fire-Protection Service
	Total System Units of Service							
1	Number		2,766,000	16,100	12,843	17,695	200,868	
2	Units		thous gal	thous gpd	thous gpd	equiv. meters	bills	
	O&M Expense:							
3	Total	$2,279,000	$465,000	$929,400	$150,800	$307,900	$400,200	$25,700
4	Unit cost, *$/unit*		0.1681	57.7277	11.7418	17.4004	1.9924	
	Depreciation Expense:							
5	Total	$414,000	$12,200	$237,400	$79,600	$72,300		$12,500
6	Unit cost, *$/unit*		0.0044	14.7456	6.1979	4.0859		
	Rate Base:							
7	Total rate base	$16,186,000	$874,000	$9,851,000	$3,043,000	$1,992,000		$426,000
8	Unit rate base, *$/unit*		0.3160	611.8738	236.9384	112.5742		
	Unit Return on Rate Base:							
9	Inside-city, *$/unit*†		0.0148	28.6357	11.0887	5.2685		$19,900
10	Outside-city, *$/unit*‡		0.0284	55.0686	21.3245	10.1317		
	Total Unit Costs of Service:							
11	Inside-city, *$/unit*		0.1873	101.1090	29.0285	26.7548	1.9924	
12	Outside-city, *$/unit*		0.2010	127.5419	39.2642	31.6180	1.9924	

**Maximum-hour demand in excess of maximum-day demand.

†At 4.68 percent return on $15,018,000 rate base.

‡At 9.0 percent return on $1,168,000 rate base.

Table 8-5 Cost distribution to customer classes—Base-extra capacity method (test year)

			Extra Capacity		Customer Costs			
Line No.	Item	Base	Maximum Day	Maximum Hour	Meters and Services	Billing and Collecting	Direct Fire-Protection Service	Total Cost of Service
	Inside-City:							
1	Unit costs of service, *$/unit*	0.5742 per thous gal	67.2394 per thous gpd	27.8065 per thous gpd	26.7522 per equiv. meter	1.9924 per bill		
	Retail Service:							
	Residential:							
2	Units of service	968,000	3,978	3,978	15,652	185,760		
3	Allocated cost of service	$555,900	$267,500	$110,600	$418,700	$370,100		$1,722,800
	Commercial:							
4	Units of service	473,000	1,296	1,620	1,758	14,640		
5	Allocated cost of service	$271,600	$87,100	$45,000	$47,000	$29,200		$479,900
	Industrial:							
6	Units of service	1,095,000	1,500	1,500	251	420		
7	Allocated cost of service	$628,900	$100,900	$41,700	$6,700	$800		$779,000
	Fire-Protection Service:							
8	Units of service		960	4,800				
9	Allocated cost of service		$64,500	$133,500			$58,100	$256,100
10	Total inside-city allocated cost of service							$3,327,000
	Outside-City:							
11	Unit costs of service, *$/unit*	0.6893	84.8803	37.6504	31.6180	1.9924		
	Wholesale:							
12	Units of service	230,000	788	945	34	48		
13	Allocated cost of service	$158,500	$66,900	$35,600	$1,100	$100		$262,200
14	Total system allocated cost of service	$1,614,900	$586,900	$366,400	$473,500	$400,200	$58,100	$3,500,000

thous gal to the respective units of service yields the distributed customer-class base cost of service. By definition, the unit base cost is the minimum rate at which water could be sold (if perfect load-factor use could be achieved) after customer costs are recovered. Outside-city distributed base costs are derived from applying the unit base cost of $0.6893 per thous gal to the outside-city base unit-of-service requirements. The higher unit base cost reflects the rate of return differential discussed previously.

Extra capacity costs for maximum-day and maximum-hour service are incurred in providing facilities to furnish water at varying rates above the average. Customer-class responsibility for extra capacity costs is determined by applying the unit costs of service to the individual customer-class units of service in a manner similar to that used for determining customer-class base costs.

Customer costs, which include the category of meters and services and the category of billing and collecting, are generally treated separately in rate studies. Customer costs associated with meters and services (both capital and O&M costs) may be distributed to customer classes on the basis of equivalent meter and service cost factors. Meter and service costs are based on the total number of equivalent ⅝-in. meters and are applied to customer-class equivalent meter units of service to determine allocated cost of service. Units based on equivalent ⅝-in. meters allow for the fact that customer costs will vary and tend to increase with the size of the customer meter and service.

Billing and collecting costs may be related to the number of bills issued and, in turn, distributed to customer classes on the basis of the number of bills rendered to customers within each class. For the example, customer-class responsibility is determined by applying the billing and collecting unit cost to the total estimated number of bills in each customer class rendered for the average rate year.

The base, extra capacity, and customer costs, summarized by customer classes, constitute the costs of service to be recovered from the respective classes of customers involved. This summation also identifies the responsibility of each class for the functional costs.

DISTRIBUTING COSTS TO CUSTOMER CLASSES: COMMODITY-DEMAND METHOD

Costs are distributed to customer classes under the commodity-demand method with the same method used to distribute base-extra capacity costs. Table 8-6 summarizes the application of units of service to unit costs of service, as developed in Tables 8-2 and 8-4 for the commodity-demand method.

In the commodity-demand method, commodity costs are distributed to customer classes on the basis of total annual use. Demand-related costs are distributed to the various classes in proportion to the class total demand responsibility, and customer costs are distributed based on equivalent meter and billing requirements.

Commodity costs, which tend to vary with the annual quantity of water produced, are distributed to inside-city customer classes by applying the inside-city commodity unit cost of $0.1873 per thous gal to the respective inside-city class units of service. Likewise, demand-related costs for maximum-day and maximum-hour service requirements are distributed to the classes based on the application of total estimated class service demands and the unit costs of demand. Customer costs to be distributed for meters and services and for billing and collecting are the same under both the base-extra capacity and commodity-demand methods and are distributed similarly in both methods. Meter and service costs are distributed to classes in

Table 8-6 Cost distribution to customer classes—Commodity-demand method (test year)

Line No.	Item	Commodity	Demand: Maximum Day	Demand: Maximum Hour	Customer Costs: Meters and Services	Customer Costs: Billing and Collecting	Direct Fire-Protection Service	Total Cost of Service
	Inside-City:							
1	Unit costs of service, *$/unit*	0.1873 per thous gal	101.1090 per thous gpd	29.0285 per thous gpd	26.7548 per equiv. meter	1.9924 per bill		
	Retail Service:							
	Residential:							
2	Units of service	968,000	6,630	3,978	15,652	185,760		
3	Allocated cost of service	$181,300	$670,300	$115,400	$418,700	$370,100		$1,755,800
	Commercial:							
4	Units of service	473,000	2,592	1,620	1,758	14,640		
5	Allocated cost of service	$88,500	$262,000	$47,000	$47,000	$29,100		$473,600
	Industrial:							
6	Units of service	1,095,000	4,500	1,500	251	420		
7	Allocated cost of service	$205,100	$454,900	$43,500	$6,700	$800		$711,000
	Fire-Protection Service:							
8	Units of service		960	4,800				
9	Allocated cost of service		$97,000	$139,300			$58,100	$294,400
10	Total inside-city allocated cost of service							$3,234,800
	Outside-City:							
11	Unit costs of service, *$/unit*	0.2010	127.5419	39.2642	31.6180	1.9924		
	Wholesale:							
12	Units of service	230,000	1418	945	34	48		
13	Allocated cost of service	$46,200	$180,800	$37,100	$1,000	$100		$265,200
14	Total system allocated cost of service	$521,100	$1,665,000	$382,300	$473,400	$400,100	$58,100	$3,500,000

proportion to the number of equivalent 5⁄8-in. meters, whereas billing and collecting costs are distributed on the basis of the number of bills rendered.

Cost of service for outside-city wholesale service may also be derived by applying the outside-city unit costs of service to outside units of service.

A summation of the distributed costs for each cost component for inside- and outside-city customers yields the total distributed customer class cost-of-service responsibility and appears in the right-hand column of Table 8-6.

A word of caution should be added that may prevent misinterpretation of the commodity cost of $0.1873 per thous gal. Under no circumstances is this the cost of water. Even with perfectly uniform use, demand or capacity costs must be added. The base-extra capacity method prevents such a misconception.

Section III

Rate Design

Selecting Rate Structures

Uniform Rates

Declining Block Rates

Increasing Block Rates

Seasonal Rates

Fixed Versus Variable Charges

Marginal Cost Pricing

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Chapter 9

Selecting Rate Structures

A utility is presented with a major challenge when it sets out to select a rate structure that is responsive to the philosophy and objectives of both the utility and its community. It is important to the utility and its customers to select the appropriate rate structure because the majority of the utility's revenues are collected through water rates and because pricing policies may support a community's social, economic, political, and environmental concerns.

A *water rate structure* is a fee or schedule of fees designed, among other things, to recover the utility's costs. Rate structures vary from utility to utility, but generally include three elements. First, they include consideration of the classifications of customers served (i.e., residential, commercial, and industrial). Second, they establish the frequency of billing. Third, they identify the charges or schedule of charges each classification of customer will be assessed.

It is this final element of a rate structure, the schedule of charges, on which utilities and customers tend to focus. These charges vary by utility in level (how high or low) and in design (how customers are charged). For water utilities that use a cost-of-service approach, the level of the utility's rates is a function of the utility's costs and customer demands. The design, however, is a function of many diverse and sometimes competing objectives.

When diverse and competing objectives are well understood and evaluated, a utility has the opportunity to design a rate structure that does more than simply recover its costs. A properly selected rate structure should support and optimize a blend of various utility objectives and should work as a public information tool in communicating these objectives to customers.

PLANNING THE RATE STRUCTURE STUDY

The process of selecting the most appropriate rate structure for a particular utility is not simple. The selection is complex because there are so many types of rate structures. No one rate structure meets all utility objectives equally, and not all objectives are valued the same by the utility or its customers.

Because selecting the most appropriate rate structure is an important undertaking, it is advisable that the utility spend some time up front planning the approach for the selection process. The process described in this chapter divides the study approach into three steps. It is important to remember that there is no one correct way to design a study of this nature. Among other things, planning the study approach is a valuable exercise that will identify ideas and obstacles. The actual study may deviate somewhat from the plan, but the plan should help keep the study moving in the right direction. As with any decision, selecting the appropriate rate structure depends on at least the following three components:

- defining the goals and objectives of the rate structure
- evaluating the available alternatives in meeting these goals and objectives
- understanding and communicating the potential effects on customers

Based on these three components, a rate selection process might include the following steps:

Step 1 Defining Goals and Objectives

This critical starting point is often difficult. Questions such as "Why is the study being conducted?", "Is there a problem with the existing structure?", and "What is the goal of the study?", must all be addressed in order to focus the study scope. As part of this step, it is important to have a clear understanding as to why alternative rate structures are being considered. To determine if the existing method or an alternative rate structure best meets the utility's needs, there must be a comprehensive understanding of the utility's operations, its economic environment, and the customers it serves. It is also important to understand

- the utility's history
- how customers responded to existing and previous rate structures and rate increases
- who are the major classes and major customers
- the availability of water resources
- the level of current or future costs
- customer and utility concerns
- socioeconomic status and concerns of customers
- legal constraints on the utility

These factors play an important part in determining which rate structure best meets the utility's goals.

Next, the utility must determine its rate structure objectives. Rate structures can perform several functions that support the utility's overall objectives. Rate objectives common to many utilities and their customers include

- yielding necessary revenue in a stable and predictable manner
- minimizing unexpected changes to customer bills
- discouraging wasteful use and promoting justified uses
- promoting fairness and equity
- avoiding discrimination

- maintaining simplicity, certainty, convenience, feasibility, and freedom from controversy
- compliance with all applicable laws

Evaluating and weighing alternative rate structures and effects against these objectives is, perhaps, the most important part in the process of selecting a rate structure.

Step 2 Evaluating Available Alternatives

The first item to assess when evaluating alternative rate structures is the level of effort allotted to the study. The availability of resources and time and the inclusion and degree of public involvement are primary drivers in determining this level of effort. More rigorous and technically complete studies, involving significant public input, require ample resources and time.

Public involvement (discussed in detail in chapter 33) can take many forms, but often it includes a core group of individuals who study the issue as a committee and periodically report and consult with the general public at open meetings. Typically, a committee should also have representation from utility management, finance staff, the governing board, and customer groups that would be affected by the rate structure. The composition of this committee is crucial if the results are to be meaningful and responsive to the utility's overall objectives. The committee must have credibility with the key parties involved with the utility, as well as with constituencies in the community they represent.

Next, a list of alternative rate structures needs to be identified. Although rate structures are generally composed of three components (who is charged, how often, and how much), most discussion about rate structures centers around the structure's consumption charge. Typically, there are four basic types of consumption charges, including declining block, uniform block, inclining block, and seasonal. These are discussed in detail in chapters 10 through 13. With these four basic types of consumption charges, combined with the additional option of service charges, meter charges, or minimum charges (see chapter 14), as well as the potential for various customer class configurations, there are numerous rate structures from which to choose. In order to facilitate the selection process, the study must focus on a reasonable number of suitable alternatives.

Finally, evaluation criteria are developed to determine how well each alternative rate structure meets the selected rate objectives. Evaluation criteria can be both quantitative and qualitative. It is commonly thought that a quantitative analysis is less subjective than a qualitative analysis and is, therefore, more favorable. However, most quantitative analyses are based on certain assumptions and data limitations. Hence, a quantitative analysis should not necessarily be construed as precise. In developing evaluation criteria, both quantitative and qualitative analyses may be appropriate depending on the objective being measured. For example, a quantitative analysis might be developed to measure a rate structure's effects on the objective of revenue stability; a qualitative analysis would be used to measure perceived fairness of a rate structure.

Step 3 Understanding and Communicating Outcomes

Most evaluations of rate structures have a technical format. The tendency when presenting the technical trade-offs, such as the revenue effects or typical customer bills under various rate structures, is to present the information in a quantified form. For many audiences, however, a numerical presentation of an evaluation is overly complicated and may not be well understood. The message often becomes lost in the numbers. Simple charts, graphs, and matrix figures tend to work well for a wide range of audiences because the display reinforces the message and the numbers add information. For diverse audiences (including decision makers) to understand them, technical outcomes must be presented in easily understood formats that express and support the technical analysis in nontechnical terms.

RATE STRUCTURE VARIABLES AND CONSIDERATIONS

Availability and Quality of Data

The importance of the availability and quality of data cannot be overemphasized. In order to perform a good rate structure evaluation, there must be reliable and ample data resources. Key types of information are past and projected cost records, water sales data by billing period and customer class, revenue data by billing period and type of charge, and other customer account data. Ideally this data will also include bill tabulation information. A bill tabulation displays the distribution of accounts and usage levels under current conditions. This information is often presented by customer class, meter size, month, season, or year. These data are necessary not only to determine the cost to serve each customer class, but also to estimate the billing effects of various rate structures to different types of customers. See chapter 35 for a detailed discussion of the data requirements for setting rates.

Customer Diversity

The water utility's total system demands, seasonal demands, facility needs, and the resulting costs are a function of the diverse demands among a water utility's customers. Recognizing and recovering the costs associated with different types of demand from the appropriate customer classes avoids subsidies among customer classes and minimizes potential subsidies within customer classes. Differences in demand patterns and facility requirements is typically the basis for distinguishing customer classes. This diversity of demand among classes results in different costs of service per unit of water sold.

Seasonality of Revenues and Costs

The seasonal variability of operating expenses and revenues should be reviewed when selecting a rate structure. It is likely that a utility's revenues will fluctuate to a greater extent over the course of a year than do the utility's operating expenses. The financial integrity of a utility requires that the utility's rate structure, along with other financial controls, support the cash flow needs of the utility by not jeopardizing the utility's ability to meet its annual and seasonal expenses.

It is also important to draw the distinction between operating expenses as they relate to cash flow and as they relate to a cost-of-service analysis. Although the operating expenses on a cash flow basis may not fluctuate dramatically, a cost-of-service analysis may indicate that a portion of the utility's costs are associated with meeting peak demands. For example, the payroll expense at the treatment plant may occur at a relatively level amount each month but, based on cost-of-service principles, some of this cost may be allocated to peak demands.

Ability to Send Price Signals

Many of the desired outcomes of a rate structure depend on customers receiving a price signal, or bill. For a utility to maximize its price signal, customers must have timely information and the signal must be significant to customers.

The element of time is critical to sending a price signal. As long as utilities maintain monthly and bimonthly billing cycles, a customer's bill lags the initial week's consumption by at best one to two months. The customer's ability to respond to the signal quickly is limited because the signal arrives after the fact. Over the long term, however, it may be possible for customers to adjust their water consumption habits based on previous price signals.

Price Elasticity of Demand

Price elasticity of demand is a measurement of how buyers respond to changes in price. Under normal conditions, as the price of a product increases, buyers demand less of the product. This relationship, measured in percentages between the change in price and the change in demand, is called the *price elasticity of demand*.

All products have a different price elasticity of demand. Products that are non-price responsive, i.e., as price changes, the relative change in demand is small, are *price inelastic*. This is generally considered to be the case for water. See chapter 21 for more detailed discussion of price elasticity.

Weather Risks

For many communities, weather is a major concern when estimating annual water sales and revenues. It is important for a utility to examine the extent to which variations in weather may affect customer usage patterns and the utility's ability to meet its financial obligations. It is equally important for the utility and its customers to realize that some rate structures result in greater revenue and bill volatility because of seasonal weather patterns.

Implementing an Alternative

Before selecting an alternative structure, it is important to evaluate the time and cost of implementing the alternative. Elements of the new rate structure that might require additional time include collecting additional data, reclassifying customers into new classes, programming billing and accounting systems, and developing the rates.

SUMMARY

In general, a utility should determine how its rate structure can support its goals and objectives, which might include the following:

- yielding total revenue in a stable and predictable manner
- minimizing unexpected changes to customers
- discouraging wasteful use, and promoting justified uses
- promoting fairness and equity
- avoiding discrimination

- maintaining simplicity, certainty, convenience, feasibility, and freedom from controversy
- complying with all applicable laws

The level of effort allotted should be determined when a comprehensive study of alternative rate structures is to be undertaken, including evaluating the availability of data and how the public will be involved. This step includes listing alternatives to be studied and criteria to evaluate how each alternative meets the selected rate objectives. Finally, the trade-offs for each alternative rate structure need to be evaluated, measured, and communicated to decision makers.

The remaining chapters of this section are designed to evaluate the benefits and detriments of various alternative rate structures. Selecting the most appropriate rate structure is a function of unique circumstances facing each utility and no one rate structure meets all objectives equally. In selecting a rate structure, a utility must evaluate the strengths and weaknesses of each rate structure and select the one that maximizes the overall objectives of the utility.

Chapter 10

Uniform Rates

A uniform, uniform-volume, or uniform-commodity rate is a constant unit price for all metered volumetric units of water consumed on a year-round basis. Unlike flat fees or charges, uniform rates require metered service and can be applied to all customer or service classifications, such as residential, commercial, industrial, wholesale, and so on. Alternatively, uniform rates by class provide separate uniform volume rates within a customer or service classification.

The term *uniform rates* sometimes refers to applying a common rate structure to noninterconnected (as well as interconnected) systems operated by the same water utility, a practice also known as *single-tariff pricing*. Single-tariff pricing can involve a uniform rate structure, a block structure, or other pricing methods described in this manual.

GENERAL CONSIDERATIONS

A uniform water rate is expressed as constant cost per thousand gallons or cost per hundred cubic feet. *Potential cost-of-service differentials among customer or service classifications are not recognized when designing a uniform rate applicable to all general water service customers. In order to capture class-based, cost-of-service differentials, uniform rates must be designed by customer class.* The rate usually accompanies a fixed charge per billing period, defined as a customer charge, meter service charge, or administrative charge. Fixed charges can vary by customer class, meter size, or other service characteristics, but not by the amount of water consumed.

Uniform rates are relatively simple for water utilities to implement and for customers to understand. A uniform rate also sends customers a usage-based price signal. Although the unit price is constant, customer bills will increase with increased water use. However, in comparison to block rates (where unit prices vary with the level of consumption), the uniform rate also implies that all increments of water provided are associated with the same unit cost of service.

Utilities might consider uniform rates when

- Customer groups or service classes exhibit similarities in usage (demand) characteristics.
- Varying rates by customer or service classification is undesirable from an equity or other perspective.
- Simplicity and customer understanding of the rate structure are valued highly.
- Rate uniformity adequately addresses efficiency and conservation concerns.
- Rate structures that vary charges by usage block or other means are not justifiable.
- Cost and usage data by customer or service classifications are not available or too costly to develop (i.e., costs outweigh potential benefits).

The feasibility and ease of implementing a uniform rate structure depends on a variety of factors. Metering is required, as is cost allocation by customer class if uniform rates by class are developed. The transition to uniform rates from block rates affects customer bills. For example, large-volume customers with declining block rates pay more under a uniform rate structure, but uniform rates by customer class could mitigate this effect.

HISTORICAL PERSPECTIVES

Historically, many water utilities began charging for service without the benefit of metering. Property taxes and, eventually, flat fees or charges were used to collect utility revenues. Some utilities began approximating the cost of service by varying user charges according to equivalent residency units, fixture units, or even number of livestock.

With metering came the potential to charge for water on a per-unit basis, but many smaller water utilities opted for the simplicity of the uniform rate. During the 1960s, many middle-sized and larger water utilities used declining block rate structures. Declining block rates were often justified on the grounds that large-volume customers typically had favorable demand and cost-of-service characteristics.

By the late 1970s, concerns about conservation in the energy and water sectors led many legislators and regulators to rethink the prudence of declining block rates. The Public Utilities Regulatory Policy Act (PURPA) of 1978, among other things, required investor-owned electric utilities to justify the continued use of declining block rates over innovative rate design alternatives that were considered more conservation oriented. State public utility regulators began considering efficiency in the context of utility pricing and planning.

At the same time, efficiency emerged as an important consideration in the water sector as well. Metering and volume-based rates are considered vital steps toward efficient water production and consumption. Conservation advocates believe that declining block rates do not send an appropriate pricing signal to encourage conservation. In addition, some consumer advocates believe that declining block rates are unfair to residential customers. In the 1990s, many utilities reconsidered uniform rates as a cost-effective way to simplify rate design. Uniform rates were accepted and approved for use by many unregulated and regulated water utilities.

ADVANTAGES AND DISADVANTAGES

The following section provides a discussion of the benefits and detriments of uniform rates, including considerations of simplicity, equity, revenue stability, conservation, and implementation.

Simplicity

Simplicity is one of the chief advantages of uniform rates. Uniform rates are easily understood and implemented. Other utility functions, such as cost analysis, customer service, and regulatory proceedings, also are simplified with less complex rate forms.

Equity

Uniform rates usually are considered equitable because all customers pay the same unit price for general water service. Uniform rates also might be perceived as equitable during periods of rising costs. Political and public opposition might be less with uniform rates than with other rate structures. With uniform rates across all customer classes, the appearance of large-volume customers subsidizing small-volume customers, or vice versa, is avoided.

Uniform rates might not be perceived as equitable when variations in the cost of serving different customer groups are substantial. Large-volume customers, in particular, might believe that lower costs associated with more favorable demand patterns justify the use of uniform rates by customer class or an alternative rate form.

Revenue Stability

Uniform rates provide utilities with a degree of revenue stability in comparison to increasing block rates and other more complex rate forms. Barring adverse economic or other conditions causing usage to fluctuate widely, uniform rates provide a dependable revenue stream. The transition to a uniform rate can result in short-term revenue instability.

Conservation

A uniform rate facilitates conservation because customer bills vary with the level of water usage. Thus, uniform rates are considered superior to flat fees or charges. In general, uniform rates also provide a more conservation-oriented rate signal than declining block rates. The actual efficiency of the uniform rate depends on the circumstances of the individual utility.

Conservation advocates might believe that the conservation orientation of water prices could be enhanced by more complex rate forms. For example, seasonal or increasing block rates sometimes are favored because higher prices are charged for higher usage.

Implementation

With metered water service in place, uniform rates are easily implemented. Uniform rates across all customer classes avoids the expense of detailed cost allocation. Public education and customer service also may be somewhat easier with uniform rates.

Table 10-1 Uniform rates for all customers

Without Price Elasticity Adjustment	All Customers
Cost of service, *$*	2,109,200
Anticipated sales, *thous gal*	2,536,000
Uniform charge, *$/thous gal*	0.83

EXAMPLE

Developing a uniform rate is relatively straightforward. Some costs can be identified with customer service functions (such as meter reading, billing, and revenue collection), as well as with fire protection. These costs can be recovered through the fixed component of the bill. The uniform rate, based on consumption, applies to general water service. Further allocation of costs to base and extra-capacity functions (or to commodity and demand components) is not required, unless class-based rates are developed.

Table 10-1 provides a sample calculation of a uniform rate. In this instance, the total cost of retail customer service to be derived from volume charges to residential, commercial, and industrial customers ($2,109,200) is divided by the anticipated amount of total sales (2,536,000 thous gal) to arrive at a volume charge of $0.83 per thous gal. The same rate is charged for all classes of customers or service. A usage response to the change in price is not included in this example.

Table 10-2 provides a sample calculation of separate uniform rates by customer class. In this instance, differences in the cost of serving residential, commercial, and industrial customers are taken into account. A separate unit charge is established for each class based on costs allocated by customer class and the anticipated metered sales to each class. In this example, the lower costs of serving commercial and industrial customers, because of the lower demand factors applicable to those classes of customers relative to the residential customer class, result in lower unit charges than for residential customers.

To calculate the effect of the rate on total customer bills, the uniform rate is multiplied by the volume of water usage, and the resulting amount is added to the monthly customer charge. As previously indicated, monthly customer charges often vary by customer class or meter size.

SUMMARY

The uniform rate structure has gained relatively wide acceptance. Uniform rates also afford water utilities a degree of revenue predictability and stability.

As with any rate structure, the effect of a change to uniform rates varies depending on the magnitude of the change and how it is implemented. A transition from unmetered service can be facilitated by a customer education program. Water-use reductions should be anticipated. A transition from block rates can be

Table 10-2 Uniform rates by customer class

Without Price Elasticity Adjustment	Residential	Commercial	Industrial
Cost of service, *$*	934,000	403,700	771,500
Anticipated sales, *thous gal*	968,000	473,000	1,095,000
Uniform charge, *$/thous gal*	0.96	0.85	0.70

accomplished by gradually reducing the number of rate blocks and the differentials among them. A phased approach can reduce rate shock, particularly for large-volume customers served previously under declining block rates.

A uniform rate might not be preferred by every water user. Large-volume customers might believe that favorable cost-of-service characteristics justify the use of declining block rates. Conservationists might believe that efficiency and environmental concerns justify the use of increasing block rates. In balancing these perspectives, uniform rates or uniform rates by customer class can present a compromise.

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Chapter 11

Declining Block Rates

A declining or decreasing block rate is a rate structure in which the unit price of each succeeding block of usage is charged at a lower unit rate than the previous block(s). The number of rate blocks and the size and pricing of each block vary among utilities, depending on the specifics of the customers or classes of customers to which the rate structure is applied.

GENERAL CONSIDERATIONS

As with any rate structure, the declining block rate can be appropriate given certain situations and cost considerations. In an era when conservation and efficient use of water resources has received significant emphasis, water rate surveys show declining block rate structures are still used by many utilities. However, application of the declining block rate structure appears to be more selective than in the past.

There has been movement away from the declining block rate structure in all sections of the country; more so in those areas where water supplies are more limited. In areas in which ample water supply is available, and where a single schedule of rate is applicable to all retail customers, declining block rates continue to be frequently used.

Many customers unfamiliar with the rate design process consider the declining block rate structure to be a quantity discount or “anticonservation” and favorable to large-volume users of water. In actuality, when properly designed, the declining block rate structure reflects the manner in which costs are incurred by the utility. It assesses costs associated with the usage patterns and demand requirements of the various classes of customers served. The declining block rate is often used to develop a single rate schedule that takes into account the different cost and usage characteristics of all customers, yet is equitable to all customers.

The size of the rate blocks and the variability of the declining unit rates should reflect the types of customers served and the cost differences between peak and average use for the different classes of customers. An initial block may be designed to recover costs associated with the volumetric use and demand requirements of residential and small commercial customers. Subsequent blocks may be selected to encompass the water use and associated demand costs for other classes of customers.

Utilities may consider using a declining block rate structure when

- A single rate structure is used for all customer classes of service.
- A class of service has an array of customers with varying usage and demand requirements (e.g., a class of service containing both small and large commercial customers).
- System costs decline with increasing water usage (i.e., economies of scale).
- Economic circumstances dictate that price incentives be provided to encourage specific large-volume customers to remain on the system (e.g., a large-volume customer that can develop its own source of supply by drilling a well). This consideration may be characterized as an economic incentive rate.

A declining block rate structure is generally not difficult to administer, depending on the number and size of the blocks. In designing declining block rates, it is important to accumulate and maintain sound billing data to accurately predict the amount of water usage to be billed in each block.

HISTORICAL PERSPECTIVES

A number of different justifications exist for declining block rate structures. The principal justification is when a single rate schedule is used for all customer classes served. In this case, the declining block rate structure is designed to reflect the differences in water and capacity use for the different classes of customer served.

Generally, large users, as a class, have a lower peak to average demand factor with correspondingly lower extra-capacity requirements and related costs than do smaller users, as a class. A properly designed declining block rate schedule recovers revenue for each class according to how costs are incurred.

Another way to view this approach is to consider the results of the cost-of-service study. Within the cost-of-service study, all base cost or annual volume-related costs should be equal for each class of service on a per unit cost basis, stated in dollars per hundred cubic feet or dollars per thousand gallons. It is the capacity-related costs, stated in dollars per hundred cubic feet or dollars per thousand gallons, that vary by class of service and reflect the overall demand characteristics of each class.

Residential and small commercial customers usually have greater demand (peaking) factors than larger commercial and industrial customers. As a result, residential and small commercial customers typically have a higher unit cost to provide capacity requirements than large commercial and industrial customers. A declining block rate structure attempts to reflect the differences in usage levels and capacity-related costs, between the types of customers served, using the size of the blocks to establish the approximate usage levels of each class and the relative price differences between blocks to recognize demand characteristics of each class.

Another justification assumes that with increased consumption, certain economies of scale may be achieved, and these economies of scale or savings should be reflected within the rates. The economies of scale are assumed to be achieved via capacity expansion or improved capacity use with the existing capacity. While this justification may have applied in the past, it is increasingly difficult in today's environment of limited water resources to justify a declining block rate structure solely on the basis of economies of scale.

One important attribute of the declining block rate structure often cited is revenue stability. Intuitively, it is easy to understand why a declining block rate would provide more revenue stability when compared to an inverted or increasing block structure rate design. Given the potential for variability in consumption between a wet and a dry summer, the declining block rate may minimize revenue swings. In addition, from an economic perspective, under a declining block rate structure customers with the least ability to change consumption (inelastic demand) tend to consume water primarily in the highest priced initial blocks, while those customers with the greatest ability to change consumption (elastic demands) tend to consume more water in the lower-priced tail blocks of the declining block rate structure.

Given the nature of this rate structure, there are mixed views regarding its appropriateness. While proponents of the structure argue that it reflects the costs incurred by the system, critics argue that a declining block rate structure encourages waste and in some cases provides a subsidy to large users. Careful thought and analysis should be used in developing the size and price of the declining blocks to justify them from a cost and usage characteristic basis.

ADVANTAGES AND DISADVANTAGES

The following paragraphs discuss the pros and cons of declining block rates.

Simplicity

For the most part, the declining block rate structure is fairly easy for the customer to understand and for the utility to administer. Designing the rate does require information and analysis of customer usage patterns and capacity requirements, a portion of rate development that can be fairly complex. In addition, ensuring that the proposed rate design collects the appropriate level of revenues is an important test.

Equity

A declining block rate schedule is designed to recover, as a single rate schedule applicable to all retail customers of the utility, the costs of serving different classes of customers while maintaining reasonable equity between customer classes. As discussed previously, declining block rate structures are not designed to provide quantity discounts or lower rates simply because water is sold in large volumes. The declining block rate structure offers a mechanism to recover cost differences based on class water use and demand characteristics in a fair and equitable manner.

Utilities should carefully select the proper block sizes and associated rates, for each block can dramatically affect the equity of the rate design. In addition, as consumption patterns or the composition of the customer classes change over time, the equity of the rate structure may also change. Periodic reviews of the bill frequency analysis and customer demand characteristics should address this issue.

A major assumption in regard to declining block rate structures is that larger customers have lower demand factors, or a better relationship between peak demand and average annual demand, than do smaller customers. This may or may not be true depending on the specific usage characteristics of the utility's customers. Further, the declining block rate structure assumes a direct relationship between volumetric consumption and demand. In other words, the lowest-volume customer has the greatest demand factor, while in contrast, the highest-volume customer has the lowest demand factor. Whether or not this average to peak demand relationship holds true should be determined by each utility.

The final issue in regard to equity is customer perception. While a declining block rate may be properly designed to be cost based and equitable, the customer may still perceive it to be inequitable. This is particularly true for the low-volume user being charged at the highest rate per consumption unit.

Revenue Stability

A properly designed declining block rate should be able to adequately meet target revenue levels of the design. As was noted previously, a declining block rate schedule should have the positive attribute of revenue stability.

Conservation

A declining block rate structure appears to conflict with the goals of efficient water use and resource conservation. Because declining block rates may be perceived as promoting consumption rather than conservation, they are often viewed negatively in regard to conservation. During periods of water scarcity or emergencies, the focus may be shifted away from a declining block rate structure to a rate structure perceived to be more conservation oriented (e.g., uniform rate or perhaps even an inverted block structure). A shift from a declining block structure may be implemented in phases to limit billing effects on particularly large-use customers.

Implementation

The declining block rate structure may be difficult to implement if the utility does not already have the rate structure in place. If conservation is a key factor in establishing rates and rate policy, perceptions regarding this rate structure, right or wrong, may make approval at the regulatory level challenging.

Implementing this particular rate structure also requires that the utility analyze its current metering, billing, and data processing systems to ensure compatibility.

DETERMINING DECLINING BLOCK RATES

In developing declining block rate structures, the key issue is the number and size of rate blocks within the rate structure. As noted earlier, the decision on the number and size of blocks depends on the number of customer classes served by the utility and the variations in demand characteristics of those classes. At the same time, consideration should be given to developing a declining block rate structure that is not overly complex.

Consumption patterns of each class must be reviewed and analyzed to determine the number of blocks and their sizes. This is generally accomplished with a bill frequency analysis or bill tabulation. The bill frequency analysis provides the total amount of consumption, systemwide or by class of customer, within given intervals of customer usage. It also has the number of bills or customers that fall within these consumption intervals. Generally, rate blocks should be set at logical break points. These logical break points may be dictated by a number of different considerations. Often issues such as the average usage within a customer class, the number of customers falling in each block, and the seasonal use or load profile of the class of service help make this determination. See appendix C for an example of how to develop a bill frequency analysis.

Table 11-1 Derivation of typical inside-city cost per thousand gallons by water use blocks (test year)

(1) Line No.	(2) Water Use Block, *thous gal/mo*	(3) Base Cost, *$/thous gal*	(4) Max. Day Extra-Capacity Factor in Excess of Average Day, *percent*	(5) Extra-Capacity Cost, *$/thous gal*	(6) Max. Hour Extra-Capacity Factor in Excess of Maximum Day, *percent*	(7) Extra-Capacity Cost, *$/thous gal*	(8) Total Cost, *$/thous gal*
1	First 15	0.5742	150	0.2763	150	0.1143	0.9648
2	Next 1,485	0.5742	100	0.1842	125	0.0952	0.8536
3	Over 1,500	0.5742	50	0.0921	50	0.0381	0.7044

Once the number of blocks and their sizes are determined, the level or amount of consumption that falls within each rate block must be computed. The declining block rate structure then can be developed to meet the target revenue, using the average demand factors for each class to establish the differential in rate block unit charges.

EXAMPLE

Tables 11-1 and 11-2 illustrate an approach used to design a declining block rate structure. The example provided is fairly straightforward, but contains the elements required for effective rate design. The first item to determine is the total revenue requirement for each class that the rates are to collect from volume-related charges. The number of commodity charge blocks may vary in number and in size. In this example, three rate blocks reflect the usage characteristics of the three classes of customers. Consumption levels for each class of customer within each rate block must be analyzed and determined. An initial commodity charge is determined for each rate block, based on the unit costs developed in the cost-of-service study. Final unit commodity charges typically must be adjusted slightly to recognize, especially for larger-use customers, that they are paying somewhat more than the average unit cost of service attributable to the large-user (industrial) class in the earlier rate blocks.

Table 11-1 shows the initial calculation of the average unit commodity charge applicable to each customer class, recognizing the demand factors assigned to each class as applied to the unit costs of service. Lines 1, 2, and 3 show the development of the average unit cost of service for residential, commercial, and industrial classes, with the total unit cost for each class shown in column 8. These average unit costs are applied to the distribution of consumption by customer class for each of the selected rate blocks to project annual revenue from each customer class.

As indicated in Table 11-2, because initial usage of larger customers must first pass through the lower-use rate blocks before reaching the final rate block consumption level, initial rate blocks overrecover costs for these customers. Accordingly, the actual unit rate for the last rate block must be reduced from the average commodity rate for the class to avoid overrecovery of revenue from the industrial class. Table 11-2 also shows the final determination of commodity charges that recover, as closely as practicable, the total cost of service from each customer class.

Table 11-2 Summary of customer water use by rate block and application of proposed rates (test year)

Line No.	(1) Monthly Use Block, *thous gal*	(2) Percent of Use	(3) Annual Water Use, *thous gal*	(4) Proposed Rates, *$/thous gal*	(5) Proposed Rates, *$*	(6) Cost of Service, *$*	(7) Percent of Cost
	Inside City:						
1	Residential	Service Charge			785,300		
2	First 15	94.0	909,900	0.97	882,600		
3	Next 1,485	6.0	58,100	0.86	50,000		
4	Over 1,500	0.0	0	0.68	0		
5	Total	100.0	968,000		1,717,900	1,722,800	99.7
6	Commercial	Service Charge			76,100		
7	First 15	15.0	70,900	0.97	68,800		
8	Next 1,485	79.0	373,700	0.86	321,400		
9	Over 1,500	6.0	28,400	0.68	19,300		
10	Total	100.0	473,000		485,600	479,900	101.2
11	Industrial	Service Charge			7,500		
12	First 15	0.2	2,200	0.97	2,100		
13	Next 1,485	13.8	151,100	0.86	129,900		
14	Over 1,500	86.0	941,700	0.68	640,400		
15	Total	100.0	1,095,000		779,900	778,900	100.1
16	Public fire-protection service annual charge for 1,155 hydrants at $222 per hydrant				256,400	256,200	100.1
	Outside City:						
17	Wholesale	Service Charge			1,200		
18	All Use	100.0	230,000	1.14	262,200		
					263,400	262,100	100.5
19	Total				3,503,200	3,500,000	100.1

In practice, developing rates that result in revenue meeting costs within the limits indicated in Table 11-2 may involve adjustments to the number of rate blocks, usage allowances in each of the various blocks, and individual block rates within the schedule.

SUMMARY

The declining block rate structure remains in use in many areas, although utilities have begun to move away from this rate design for various reasons. Among these reasons are customer perceptions of inequity, cost justification for its use, and conservation considerations.

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Chapter 12

Increasing Block Rates

Increasing block rates (also known as ascending, inclining, or inverted block rates) charge increasing volumetric rates for increasing consumption. Increasing block rates require metering and defining consumption blocks over which rates increase. Increasing block rates should usually be designed by customer classes (i.e., groups with similar usage patterns).

GENERAL CONSIDERATIONS

While increasing block rates can be more complicated to design than other types of rates, they also provide flexibility in rate design. Properly designed increasing block rates recover class-specific, cost of service while sending a more conservation-oriented price signal to that class. This flexibility places larger analytical demands on the rate analyst, especially when accounting for potential demand responses to block rate differentials (see chapter 21). Increasing block rates can be coupled with fixed or service charges. See chapter 14, Fixed Versus Variable Charges, for further discussion of these charges.

Increasing block rates should be considered by a water utility when the utility

- is able to distinguish separate customer classes for billing
- has the analytical capability to design block rate structures, including defining the amount of water sold per block and potential demand responses to differential rate impacts
- is confronting system capacity constraints or potential system expansion (i.e., in cases where there is a higher payoff to demand-side management)
- would like to send a stronger price signal
- is willing to spend additional effort to communicate the nature and rationale of increasing block rates

Increasing block rates are not a one-size-fits-all solution. Systemwide application of a single increasing block rate structure is likely to result in cost-of-service inequities, especially to commercial and industrial customers with relatively constant consumption patterns (low peak demands but high total usage). These customers may not impose costs on a water system proportional to the costs implied by increasing block rates. Additionally, assigning large price increases on these customer classes, known to have the most price-elastic demand, can make it difficult to predict decreases in consumption. A single systemwide increasing block rate design applied to a customer base with diverse consumption patterns is more difficult to justify on a cost-of-service basis than increasing block rates targeted to specific customer classes with relatively homogenous consumption patterns.

HISTORICAL PERSPECTIVES

Increasing block rate structures, when properly designed and differentiated by customer class, allow the utility to send consistent price signals to customers without overearning or underearning. For this reason, and the heightened interest in water conservation, increasing block rates have been increasingly favored, especially in relatively water-scarce regions.

ADVANTAGES AND DISADVANTAGES

The following paragraphs analyze the benefits and detriments of increasing block rate structures.

Simplicity

Increasing block rates are not as simple to design or explain as many other rate forms. They require information on water sales by block of consumption. This information can be developed through a bill tabulation (see appendix C of this manual). They also require applying judgment and utility policy regarding the number of blocks, the point at which one block ends and the next begins, and the relative price levels of the blocks.

Equity

As with any rate design, overly simple or poorly designed increasing block rate structures run the risk of being inequitable. Increasing block rates can provide the flexibility to address various definitions of equity, while permitting full cost recovery and the use of additional pricing strategies for water utilities.

Revenue Stability

Increasing block rate structures tend to result in more revenue volatility than other rate structures (i.e., decreasing and uniform block rates). This revenue volatility is because an increasing block rate anticipates recovering a proportionately greater percentage of the customer class's revenue requirement at higher levels of consumption. These higher levels of consumption tend to be more subject to variations in seasonal weather and, when coupled with a higher unit pricing, customers tend to curtail consumption in these higher consumption blocks. As a result, a utility implementing an increasing block rate structure is advised to have a good understanding of the distribution of water demand by customer class and of price elasticity of demand. Over the long term, increasing block rate structures can give utilities and rate analysts flexibility with which to achieve predictable cost recovery.

A utility concerned about adverse revenue effects resulting from an increasing block rate design might consider developing a reserve, often referred to as a *stabilization fund*. A stabilization fund allows a utility to draw on the fund balance during revenue shortfalls that result from lower than expected consumption.

Conservation

Increasing block rate structures are usually considered to be conservation-oriented. The most conservation-oriented rate structure maximizes the consistency of the price signal. No customer within a given class and using similar amounts of water should be rewarded more or less than another customer for saving a gallon of water. If properly designed, increasing block rates can send an appropriate conservation signal to certain customer classes. But, care should be taken when determining whether or not increasing block rates apply to a particular class of customers that includes large-volume and master meter customers.

Implementation

The flexibility advantage of increasing block rate structures is accompanied by some disadvantages, including the following:

- These rates are more difficult to design for predictable revenue streams.
- Definitions of rate blocks can be based on more than one rationale.
- The rate structure can be more difficult to communicate to customers.

Water systems requiring more flexibility from a rate structure may find the higher implementation cost of increasing block rate structures to be justified.

EXAMPLES

The first example illustrates how an increasing two-block rate might be designed for residential customers. In this example, annual water sales are anticipated to be 968,000 thous gal and the consumption-related cost of service is $934,000. While there is no single analytical method to define consumption blocks, for this example it is assumed that the utility wishes to set the threshold between block 1 and block 2 at an amount that approximates the difference between indoor and outdoor consumption. The utility's objective is to have block 1 consumption approximate indoor usage and to charge a higher amount for outdoor usage in block 2 to promote conservation.

Based on a review of low consumption (typically winter) billing information and a bill tabulation, the utility determines that a typical residential customer uses 7,000 gallons per month inside their house and that, on an annual basis, 80 percent of the water sales are for 7,000 gallons or less. This equates to annual block 1 sales of 774,400 thous gal and block 2 sales of 193,600 thous gal. In this example, the utility has also made a policy decision that block 2 rates should be set at a level 30 percent higher than block 1. With this information it is possible to calculate block 1 and block 2 water rates as follows:

Block 1 Equation

$$\text{Block 1 Rates} = \frac{\text{consumption-based revenue requirement}}{\text{block 1 sales} + [\text{block 2 sales} \times (1 + \text{price differential})]} \tag{12-1}$$

$$= \frac{\$934{,}000}{774{,}400 + [193{,}600 \times (1 + 0.30)]}$$

$$= \$0.91 \text{ per thous gal}$$

Table 12-1 Increasing block rate design—Residential class

Consumption Block Threshold	Consumption, *thous gal*	Consumption, *percent*	Rate Differential	Revenue, *$*	Rate, *$*
Block 1 (first 7,000 gal)	774,400	80	1	704,704	0.91
Block 2 (over 7,000 gal)	193,600	20	1.3	228,448	1.18
Estimated Total	968,000	100		933,152	
Cost of Service				934,000	
Difference				(848)	

Block 2 Equation

$$\text{Block 2 Rates} = \text{Block 1 rate} \times (1 + \text{price differential}) \tag{12-2}$$

$$= \$0.91 \times 1.30 = \$1.18 \text{ per thous gal}$$

Table 12-1 displays a method of verifying these calculations. The calculated rates would result in a minor undercollection of $848 because of rounding the block 1 and block 2 rates.

Table 12-2 illustrates an alternative method of setting increasing block rates for the residential class using marginal cost information. Block 1 in this example is again defined as the first 7,000 gallons of monthly water use. The second consumption block is any monthly water consumption over 7,000 gallons. For this marginal cost example, the rate in the second block is first set equal to the sum of the 3-year marginal operating cost ($1.47 per thousand gallons) plus the average incremental capital cost ($0.73 per thousand gallons) resulting in the utility's marginal cost pricing estimate of $2.20 per thousand gallons.

The revenue from block 2 water sales equals $425,920, leaving $508,080 ($934,000–$425,920) to be recovered from block 1 water sales. Block 1 rates are then calculated by dividing revenue needed from water sales in the first block ($508,080) by annual water use in the first block (774,400 thous gal) equaling a block 1 rate of $0.66/thous gal.

SUMMARY

Increasing block rate structures have found greater use in areas experiencing strong growth in water demand, threats to existing water supplies, or a regional impetus for improved water efficiency. In all these areas, there can be a payoff to using price as a demand management tool. Such conservation-oriented rate structures require additional analysis to avoid over- or underearning. Utilities willing to perform the additional analysis in rate design and conduct customer communications may find that increasing block rate structures are valuable tools providing additional flexibility to deal with difficult situations.

Table 12-2 Increasing block rate design—Residential marginal cost-based rate

Residential Inside City	Monthly Usage Block, *thous gal*	Annual Water Use, *thous gal*	Percent of Use	Revenue, *$*	Proposed Rates, *$/thous gal*
Block 1	First 7	774,400	80	508,080	0.66
Block 2	Over 7	193,600	20	425,920	2.20
Total Sales		968,000		934,000	

Chapter 13

Seasonal Rates

A seasonal rate is a form of time-differentiated rate, or a rate that varies by time period. It establishes a higher price for water consumed during a utility's peak-demand season, usually reflecting the increased costs of providing service during those periods. The objectives of seasonal rates are to better match price and cost recovery with demand patterns, and provide a price incentive for customers to reduce their consumption during peak-use periods.

GENERAL CONSIDERATIONS

All water utilities experience some degree of peak demands on a seasonal basis. Often peak demand occurs during summer months because of lawn irrigation, but this is not always the case. In some cases, the peak season may occur during the winter months because of an influx of residents during that time or for some other regional reason for higher demand.

Seasonal rates can be implemented to reduce peak use, or at least to appropriately charge customers for such use. These rates provide a price signal to the consumer related to the high cost of providing water resources during the peak period. Seasonal rates have received greater attention in the past several years partly because of localized water shortages and conservation awareness. Recognizing peaking requirements as a significant element of cost has also facilitated greater acceptance of seasonal rates.

The allocated cost of supplying water can vary substantially between time periods, depending on the differences in demand between time periods and the utility-specific resources available to meet those demands. Improper price signals to customers regarding the cost of providing water during peak use may compound peak-use problems and encourage inefficient use of the water system.

Given the premise that water rates should track costs as closely as possible, seasonal rates provide a price signal to consumers that may encourage them to alter their consumption by either reducing it overall during the peak-use period, or shifting consumption to lower-cost, off-peak periods. Because system capacity is essentially designed to meet peak demands, peak users should assume cost responsibility for capacity required to serve peak demand.

Designing a seasonal rate structure involves assigning the lower off-peak costs to the off-peak rate period and recognizing the variance in the unit cost of water between peak and off-peak periods. Higher peak costs—those associated with the higher capacity requirements needed to meet system design peak day or peak hour requirements—are assigned to the peak-period rate. Differences in costs between on-peak and off-peak periods can be determined by a cost-of-service study and by a review of the resources and facility design requirements needed to meet the utility's peak-period capacity requirements.

Two approaches are common when developing a seasonal rate structure. Under either approach, care needs to be taken in defining the seasonal periods and the pricing differential between time periods:

- *On-peak/off-peak approach*. This rate structure contains a specific rate for each season (i.e., a winter rate and a summer rate).
- *Excess-use approach*. This rate structure may be similar to the approach above, but customer consumption above a specified threshold per bill is charged a higher rate.

Several variations of seasonal rates are possible. For example, a seasonal rate structure may be combined with an increasing block rate structure to produce a seasonally differentiated increasing block rate structure.

Seasonal pricing can be effective in several situations, including the following:

- Substantial variation in demand exists between peak and off-peak periods.
- A utility is capacity-constrained as a result of peak-period demands.
- Systems experience seasonal fluctuations in the number or types of customers served.

Both on-peak/off-peak and excess-use approaches are effective in meeting the goals and objectives of implementing seasonal rates. Administrative considerations and data requirements may lead to the choice of one approach over the other.

Under normal circumstances, when introducing a seasonal rate, the initial differential in the level of the peak period rate should be relatively modest as compared with the off-peak rates in order to avoid large rate shocks to customers and to allow time to change behavior and consumption patterns. The price differential between demand periods can be gradually increased over time, if appropriate.

Revenue generated from a seasonal rate can be weather and demand-response sensitive. Customer education and effective communication programs, along with the seasonal rate structure, are the most effective combination for dealing with peak-period usage and pricing issues. Without customer education and communication programs, movement to a seasonal rate structure may not produce desired results or meet the utility's objectives.

In considering a seasonal rate, attention should be given to the degree of variability in usage between seasons by the various types of customers served by the utility. This review may also provide guidance in regard to the magnitude of the difference in rate levels between seasons to bring about the desired degree of change. In some cases, certain customers have a greater ability to adjust their consumption patterns than other customers. Depending on its objectives, the utility may want to consider targeting those customers with the greatest ability to change their behavior and consumption.

Seasonal rates can be an attractive alternative for utilities that have significant fluctuations in usage during different times of the year. Facilities are often constructed to meet peak demands during peak season with a large portion of capacity remaining idle during off-peak season. Peak demands are typically created by lawn irrigation, public sanitation purposes, pool usage, car washing, seasonal industrial operations (vegetable processing, etc.), and, in certain areas, the influx of tourists.

Given that the objective of seasonal rates is to communicate to the customer the cost of their consumption at various times of the year and provide a proper price signal of what this variation in consumption is costing, it is important to consider customer billing frequency. As a general rule, if meters are read only quarterly, customers will not be notified quickly enough to modify their behavior. A billing cycle that is too frequent (such as twice a month) can be too costly. Experience indicates that monthly billing is the most appropriate billing cycle for this type of rate design structure, but utilities with seasonal rates do not always bill monthly. As meter-reading technology allows more frequent meter reading to be accomplished in a more cost-effective manner, billing cycles or other communications to the customer over shorter time periods may be even more effective in modifying customer responses.

HISTORICAL PERSPECTIVES

Seasonal rates for electric and natural gas utilities have been common for many years. As reported by the National Association of Regulatory Utility Commissioners (NARUC), most state commissions have approved seasonal rates.

Large-volume natural gas customers are frequently offered seasonal rates in the form of off-peak rates to encourage natural gas use during the summer off-peak season. According to the American Gas Association (A.G.A.), most gas distribution utilities offered seasonal rates before 1970 because of unbalanced loads and resources.

For water utilities, seasonal pricing has been implemented on a limited basis, mostly within the past decade. It has been used in areas with high irrigation demands, and in areas with seasonal resort activities that affect water consumption and peak demands. In general, however, seasonal pricing for water service in the United States has not been as quickly accepted or placed into practice as for natural gas or electric utilities. The reason for this slow acceptance is primarily related to the water industry's historic ability to provide adequate supply at affordable costs. Economic incentives did not warrant seasonal pricing. In addition, the relative ease and low cost of storing water may explain the reluctance of the water industry to implement seasonal rates. Finally, the historically small cost differential between peak and off-peak services has typically weakened the need for such rates.

Water utilities are becoming more open to the advantages of seasonal rate designs in mitigating or controlling peak demands. Given that alternative or additional sources of water supply usually come at a higher price, it is important that rates reflect the true cost of providing water. Seasonal rates provide an important tool that can be used to defer the need for these additional sources of supply.

ADVANTAGES AND DISADVANTAGES

The following section provides a discussion of the advantages and disadvantages of seasonal rate designs.

Simplicity

There are two perspectives regarding the simplicity of implementing a seasonal rate. From the customer's perspective, seasonal rates need to be understandable in order to be effective. From the utility's perspective, seasonal rates may not be simple to administer. The utility should be sure that their billing system is capable of dealing with seasonal rates. In particular, the billing system needs to address issues associated with a customer's billed consumption, including consumption before and after the change of seasons.

One approach is to prorate the customer's consumption during the transition period for the seasons and bill the customer based on the number of days in each season during the transition billing period. This approach requires a sophisticated billing program capable of dealing with the proration issue. An alternative approach is to have a stated policy that all bills dated after, or meters read after, a specific date will be computed at the higher, peak-season rate levels. Additionally, customer awareness of the change in rates due to the change in seasons is important and may require an extensive education program.

Equity

A seasonal rate structure may be equitable from a cost-of-service perspective because the customers responsible for the higher peak-demand-related costs are charged for such costs.

Revenue Stability

Implementing seasonal rates can place revenue stability at risk, depending on the differential in the peak-season rate and customer response to the higher rate. Variations in metered revenue levels are typically associated with the swings of peak-season consumption, given wet or dry conditions. Since the peak-use period charge is, by definition, the highest rate under the seasonal rate approach, changes in peak-season consumption can potentially have a large impact on revenue.

A utility concerned about the adverse seasonal revenue effects resulting from a seasonal rate design might consider establishing a reserve fund, often referred to as a *stabilization fund*. A stabilization fund allows a utility to draw on the fund balance during revenue shortfalls that result from lower than expected customer consumption.

Effect on Customers

Seasonal rates can have a negative effect on those customers that exhibit relatively high peak-to-average demand characteristics. Customers who exhibit relatively low peak-to-average demand characteristics during the peak season may see a reduction in their water bills.

In the long run, a seasonal rate may reduce the cost of water to all customers. If customers reduce peak demands in response to seasonal rates, the utility may be able to delay or avoid construction of additional supply projects that would have otherwise been required. Even if demand is not reduced, customers contributing to peak demands pay the costs associated with that demand.

Implementation

The implementation of a seasonal rate structure requires identifying peak system consumption periods, determining associated costs, providing accurate and frequent (monthly is preferred) meter readings and billings, and educating and notifying customers. As discussed previously, the administrative issue of the change in billing periods is an important consideration. Ideally, meter readings should be scheduled to coincide as closely as possible with the beginning and end of the peak season. Under the excess-use method, base-period water use must be accurately determined. In addition, for new customers, the issue of determining base-period use must be resolved. Residential customers are usually assumed to be typical of the class and the residential class base-period average is used until customer-specific data are collected. Average usage by meter size may be a means of establishing base period use for new nonresidential customers.

The utility should communicate with all customers before each peak season to increase customers' awareness of the intent of seasonal rates and the impending higher rates.

DETERMINING SEASONAL RATES

A number of ways exist to quantify the seasonal rate component of the rate structure. One technique is to determine excess costs associated with supplying water during peak months. This approach could look at the specific costs associated with peaking facilities (e.g., wells used only in the summer). Another technique requires estimating the present value of all future operating and capital cost savings realized by deferring construction of additional capacity to meet excess consumption in the future. The resulting present value savings divided by the estimated excess gallons of usage over a prescribed period equals the rate per thousand gallons. This rate would apply during the peak billing period.

One might also use the base-extra capacity allocations to determine the cost of supplying water beyond average-day demands. Excess capacity costs attributed to delivering incremental peak seasonal demands plus base costs during the peak season divided by the total quantity of water sold during the peak season can yield a basis for charging on a seasonal basis.

Once the structure and amount of a seasonal rate has been determined, estimates of and adjustments for potential consumer demand response to seasonal pricing should be made. These estimates can be based on management judgment and the results of detailed customer response or elasticity studies.

Developing seasonal rates is not an overly complex exercise but does have a number of considerations that make it more complex than other rate structure alternatives. Following is a discussion of some of the more important considerations in this process, along with a numerical example for developing a seasonal rate structure.

Rate Types

As noted previously, there are two basic types of seasonal water rates. The simplest type has a higher charge for the peak as compared to the off-peak period. Under this approach, the price differential between seasonal periods could be based on an analysis of additional costs required to meet peak demands. This can be determined by comparing average demands to peak demands, or by reviewing various resources and facilities used exclusively during peak-use periods (e.g., peak-use wells). From this cost information, an initial determination can be made as to the cost difference between meeting peak and off-peak demands.

A more sophisticated and complex method to develop seasonal rates is the excess-use approach. Excess-use charges have one schedule of charges for peak use, with an additional charge during this period for use in excess of a base consumption amount. One of the more challenging aspects of developing the excess-use charge rate structure is determining the base level of usage. Typically, the off-peak period is analyzed to determine the base level of usage. By reviewing the off-peak period, usage related to lawn irrigation, recreational activities, etc., is typically reduced or eliminated. The excess-use approach may not be appropriate or equitable for a general service or commercial type of class of service with large variations in usage, but it may be appropriate for classes of service with homogenous or similar usage characteristics.

Base use–excess use is typically determined by customer class. For example, a review of single-family residential customer consumption patterns may indicate that the monthly base usage should be 10,000 gallons. Excess usage would be defined as all consumption above this. Another, more rigorous approach to determining base usage–excess usage is on an individual customer basis. This is a much more sophisticated approach and raises a number of complex administrative and billing issues.

A variation on the excess-use approach entails granting an additional allowance, above the computed base level of use, to allow customers some limited additional use at base level rates. This approach may also make the rate more acceptable from the customer's perspective. The allowance above the base level of usage is a policy decision. Provisions may also need to be made to account for permanent changes in a customer's base-period usage, which could occur with an expansion of operations, new operations, or a reduction of operations.

Defining Periods

The final key issue in developing a seasonal rate involves defining seasonal periods. To do this, a number of issues and considerations need to be addressed. The first issue is frequency of meter readings. Monthly meter reading is preferred to provide the customer with timely feedback regarding consumption patterns and the effect on their water bill. Consideration should be given to the basis for the billing and whether bills will be prorated between seasonal rate periods, or conversely, whether bills will be based on the rate in effect at the time the bill is calculated or the meter is read.

Next, the number of seasonal time periods should be administratively feasible. A simple winter and summer time period definition should be sufficient for most utilities. Utilities attempting to more closely match cost to price may consider more than two time periods. For example, time periods could be defined as peak (June–September), off-peak (November–February), and mid-peak (October; March–May). In making a final determination, other related issues to consider include the practicality of the definition, customer understanding of the approach, and potential administrative constraints and added costs related to metering, billing, and data processing.

Determining Cost Basis

Determining the cost basis for the cost differential is the last step of the process. Given that sufficient variation exists between seasonal and nonseasonal use, and that the seasonal months can be defined, the next step is to allocate operating and capital costs between peak and off-peak periods. No one method exists for performing this step, but the following three basic approaches can be used to make this determination:

- the base–extra-capacity cost of service method
- directly allocating or assigning costs to seasonal periods
- reviewing specific facilities and costs

The first approach uses the base–extra-capacity method of cost allocation. By definition, base costs include O&M and capital costs associated with meeting average load conditions. Operation and maintenance and capital costs incurred to meet peak use should not be included as a base cost. Extra-capacity costs are those related to meeting rate of use requirements in excess of average day demands.

Table 13-1 Seasonal residential class rates using the peak and off-peak approach

Peak/Off-Peak Seasons	Consumption, *thous gal*	Consumption, *percent*	Allocated Costs, *$*	Rate, *$/thous gal*	Estimated Revenue, *$*
Winter (Off Peak)	387,200	40	316,885	0.82	317,504
Summer (Peak)	580,800	60	617,115	1.06	615,648
Estimated Total	968,000	100	934,000		933,152
Difference from cost of service due to rounding					848

The next method is to directly allocate or assign costs to seasonal periods. Under this approach, the cost-of-service methodology may, for example, split demand-related costs between summer-demand and winter-demand costs. This approach requires detailed cost accounting information that allows costs to be split between seasonal periods.

A final method to determine cost differences between seasonal periods is a use-of-facilities approach. Often, the major cost differences between seasonal periods are a function of water supply resources. Certain water supply resources may be in place to meet base or year-round demand requirements. In contrast, utilities may have resources used only during peak-use periods to meet peak-demand requirements. These costs should be assigned to the peak-use period, creating the cost differential between seasonal time periods.

EXAMPLES

The numerical examples of developing seasonal rates that follow show that the analytical process is similar to the other rate design approaches discussed in this manual. Both examples use the base–extra-capacity cost of service method to determine the level of the seasonal rates.

Table 13-1 develops seasonal rates using the peak/off-peak approach for the residential class. In this example, the utility has determined that the peak (summer) period is five months long, from May through September, and the off-peak period is the remaining seven months, from January through April and October through December. During the peak (summer) period, the residential customers are estimated to use 580,800 thousand gallons (60 percent of the annual consumption) and during the off-peak (winter) period they are expected to consume 387,200 thousand gallons.

The base–extra-capacity allocations, as calculated in Table 8-5, indicate the consumption-related cost of service for the residential class totals $934,000. This total cost includes $555,900 of base costs and $378,100 for maximum day and maximum hour costs (extra-capacity costs).

In this example, it is the utility's objective to have a higher rate in the summer than in the winter and to set the rate at a level reflecting the increased cost of providing water during peak periods. As a policy decision, the utility decides the winter rate should recover base costs in proportion to winter consumption plus 25 percent of extra-capacity costs. The allocated winter costs therefore equal $222,360 of the base costs and $94,525 of the extra-capacity costs for a total of $316,885. This cost divided by the expected winter consumption equals a rate of $0.82 per thousand gallons. Next, estimated summer costs equal $617,115, divided by summer consumption of 580,800 gallons to yield a summer rate of $1.06 per thousand gallons. The projected winter and summer revenue differ slightly from the allocated cost of service because of rounding in the rates.

Table 13-2 Excess-use approach to seasonal residential class rates

Base–Extra-Capacity Allocations				
Seasons	Consumption, *thous gal*	Consumption, *percent*	Rate, *$/thous gal*	Revenue, *$*
Winter (Off Peak)	387,200	40	0.82	317,504
Summer (Peak) Block 1	290,400	30	0.82	238,128
First 10,000 gal/mo. Block 2	290,400	30	1.30	377,520
Over 10,000 gal/mo. Estimated total	968,000	100		933,152
Difference from cost of service due to rounding				848

Table 13-2 provides a second example of seasonal rates using the excess-use approach. In this example, the summer charge includes two rate blocks. Block 1 of the summer rate is set equal to the winter rate, based on the concept that there is an average or base level of usage throughout the year that should be priced at one level regardless of the season for residential customers. Summer usage in excess of this base level is considered to be *excess use* and is priced at a higher rate.

Using the same information as for the first example, the winter rate and block 1 of the summer rate are both set at $0.82 per thousand gallons. Summer consumption must then be divided into a base amount per customer and an excess use amount per customer. In this example, the utility determined that the base amount per customer was 10,000 gallons per month. Summer base use equals 30 percent of the annual water sales for the residential class, or 290,400 thousand gallons. The remaining 290,400 thousand gallons are determined to be excess use. As a result, summer water consumption in block 1 will yield $238,128. To generate the remaining $378,368 needed to meet the consumption-based revenue required for the residential class, the excess-use rate (summer block 2 rate) equals $1.30 per thousand gallons and generates an estimated $377,520 ($848 less than the cost of service due to rounding the rates).

Both approaches presented reflect typical examples of seasonal rates. Each may be developed based on available utility information, in conjunction with specific goals, objectives, and judgments of the utility. While no single method exists to determine the level of differential between the on-peak and off-peak periods, these two examples are based on dividing the base and extra-capacity costs into seasonal costs as part of the rate design. Often it is more efficient to calculate seasonal allocations of base and extra-capacity costs as part of the cost-of-service allocations. Performing a seasonal allocation of base and extra-capacity costs provides a utility with an indication of its seasonal cost differences based on the allocation method.

SUMMARY

Most utilities experience some differences in cost throughout the year, particularly in meeting peak capacity requirements. Seasonal rates attempt to pass on cost differences to the customers creating the demand. While there are distinct advantages to allocating costs to the customer as the utility incurs them, there are also some disadvantages worth considering before implementing seasonal rates. The primary concern is revenue stability, which can be adversely affected by weather conditions. Seasonal rates are usually considered equitable, and can bring about significant long-term savings if peak demands are reduced and new capital facilities required to meet peak demands can be postponed.

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Chapter 14

Fixed Versus Variable Charges

Cost-of-service water rate designs often include a fixed and a variable charge. The fixed charge in a rate design may take many forms, but this portion of a customer's bill will be the same, or fixed, for each bill regardless of the amount of water the customer uses. Variable charges, often referred to as *consumption charges*, are rates applied against the amount of water a customer uses. As described throughout this manual, these charges can take many forms. The common thread to these charges is that as a customer uses more water, this portion of the customer's bill increases. In other words, this portion of a customer's bill varies with consumption.

GENERAL CONSIDERATIONS

A cost-of-service approach to setting water rates allocates costs to each customer or customer class based on the theory of cost causation. A dual set of fees—fixed and variable—is an extension of this cost causation theory. A utility incurs some costs associated with serving customers irrespective of the amount or rate of water they use. These types of costs are referred to as *customer costs* and typically are costs that would be recovered through a fixed charge. These costs are usually recovered on a per customer basis or some other nonconsumption basis.

Utilities also incur costs associated with meeting average and above average consumption. As described in chapter 7 of this manual, these costs may be categorized as base and extra-capacity costs, or commodity and demand costs, depending on the allocation method used. Regardless of the allocation method selected, a utility incurs these costs because of the amount and pattern of its customers' water demands. Based on cost causation, these costs are most appropriately recovered through a consumption charge that varies with the customer's consumption.

Fixed and variable charges for cost recovery in a cost-of-service water rate analysis is not the same as recovering fixed and variable costs from an accounting

Table 14-1 Meter-size charges example

Meter Size, *in.*	Billing and Collecting,* *$*	Meters and Services,† *$*	Meter Charge, *$*
5/8	1.99	2.23	4.22
3/4	1.99	2.45	4.44
1	1.99	3.12	5.11
2	1.99	6.47	8.46
3	1.99	24.53	26.52
4	1.99	31.22	33.21
6	1.99	46.83	48.82

* From Table 8-3, rounded to nearest cent.

† Based on inside-city unit costs of service, Table 8-3 as follows:
$26.7522/equivalent meter per year divided by 12 bills = $2.23 per equivalent meter.
Meter equivalents based on page 67.

standpoint. Accountants define fixed costs as costs that do not change in total as the volume of activity changes. Variable costs are costs that do change in total as the volume of an activity changes. In a cost-of-service water rate analysis, these definitions do not necessarily apply. For example, debt service incurred for a new treatment plant is fixed from an accounting standpoint, but debt service is also related to consumption because the treatment plant treats water that customers demand. Based on cost causation, this cost is recovered from a consumption charge. Likewise, a cost that increases with production, such as billing costs when a new customer comes on-line, would be considered variable by an accountant. From a cost-of-service standpoint, new customer billing costs would be considered a customer cost (it is a function of customers, not their consumption) and would be recovered using a fixed charge.

Fixed Charges

Water utilities use many different types of fixed charges in their rate designs. Three commonly used fixed charges are service (also called customer charges), meter, and minimum.

Service charges and customer charges. The terms *service charge* and *customer charge* are often used interchangeably. This type of fixed charge is the same for all customers. It typically recovers costs such as meter reading, billing costs, and other costs that the utility incurs equally per customer or per account. These costs are not a function of the amount of consumption a customer uses. An example of a service or customer charge is $1.99 per bill. This charge might be applied to all customers or it might be specifically designed for each customer class.

A service charge or customer charge is normally easy to calculate, implement, and understand. A service charge is usually lower than other types of fixed charges.

Meter charge. A meter charge is a fixed fee that increases with meter size. Often this fee is the same by meter size for all classes of customers. It typically recovers the same costs as a service charge plus other customer-related costs that change as a function of meter size, such as meter repairs and replacements.

Table 14-1, based on inside-city unit costs of service, shows an example determination of meter charges. Because meter charges vary by meter size, they may be more complicated to explain and require additional data to allocate costs to each meter size in a fair and equitable manner.

Table 14-2 Minimum charge example

Meter Size, *in.*	Meter Charge, *$*	Minimum Charge,* *$*
5/8	4.22	6.14
3/4	4.44	6.36
1	5.11	7.03
2	8.46	10.38
3	26.52	28.44
4	33.21	35.13
6	48.82	50.74

*This charge includes consumption of first 2,000 gallons.

Minimum charges. A minimum charge is a fixed fee that includes an allotment of water consumption. The allotment is the minimum amount of consumption for which a customer is billed regardless of whether or not the water is used. The allotment is generally set at a low level based on the assumption (and usually verified by billing data) that most customers use that amount of water. Also, some utilities may view this charge as a means to recover costs associated with investments to which all customers should contribute, regardless of whether or not they consumed water during that billing period.

This fee typically recovers the same costs as a service or meter charge plus the allotted units of consumption allowance multiplied by the consumption rate. For example, if a utility had a service charge of $1.99 per bill and a consumption charge of $0.96 per thousand gallons (based on the inside-city cost per thousand gallons for the first 15,000 gal/month as displayed in Table 11-1) and it wanted to set a minimum charge that included 2,000 gallons, the minimum charge would be $3.91 per bill ($1.99 + [2 × $0.96]). Table 14-2 shows how to calculate a minimum charge by meter size. This example assumes the meter charges in Table 14-1 and a consumption charge of $0.96 per thousand gallons.

Minimum charges generally result in the highest fixed fees. Often they are criticized for being unfair in that they charge a customer for consumption even when the customer does not use the water. Minimum charges are often considered to be a fee that works counter to conservation goals. Utilities often assume that a minimum charge adds to the utility's revenue stability. However, because the consumption allotment for a minimum charge is often set at a low level, a utility may actually receive little benefit in terms of revenue stability. The amount of revenue generated from the consumption component of the minimum charge is revenue that, for the most part, would normally be generated from water sales using the consumption charge. Because most customers use the minimum consumption allotments in the minimum charge, a utility may accept the shortfalls of the minimum charge and gain little in terms of revenue stability.

Variable Charges

The rate design for metered water sales usually includes a charge per unit of water consumed. This charge, often called a *consumption charge*, is variable in that the amount the customer pays varies based on the amount of water the customer consumes.

The charge can take many forms. The four basic types of consumption charges are discussed in chapters 10 through 13 and include uniform, declining block, inclining block, and seasonal rate structures.

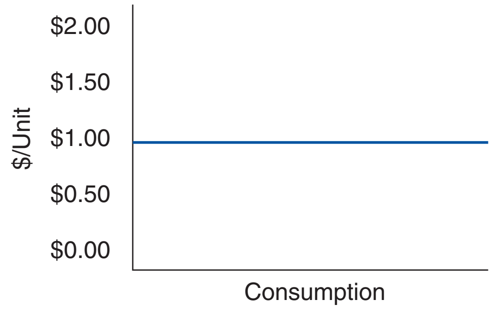

Figure 14-1 Uniform consumption charge

As displayed in Figure 14-1, a uniform rate (see chapter 10) is a single charge per unit of consumption. The charge remains constant for all metered consumption of water on a year-round basis. As a customer uses more water, the bill increases at a steady rate per unit of consumption.

Decreasing block rates (see chapter 11), displayed in Figure 14-2, divide a customer's consumption into blocks of usage and charge more for initial units of consumption and less for greater units of consumption. No standard limit exists for the number or size of blocks used in a decreasing block structure, although more than four or five blocks is unusual for cost-of-service-based rate structures. Also, there is no standard for how much the unit rate for the larger blocks decline. The variability in the unit rates among the rate blocks is generally a function of the respective costs of producing service to the various classes of customers that are charged under the declining block rate schedule. Under a declining block rate schedule, a customer's bill increases at a steady rate for consumption in the first block. Then, for consumption in later blocks, the customer's bill continues to increase, but at a slower rate per unit of consumption.

As displayed in Figure 14-3, increasing block rates also divide a customer's consumption into usage blocks but charge less for the initial units of consumption and more for greater units of consumption. As with declining block consumption charges, no standard number or size of the blocks exists, nor is there a standard for how steeply the unit charges for each of the blocks increase. Generally, however, increasing block consumption charges consist of two or three blocks. In this case, a customer's bill increases at a steady rate for consumption in the first block, and then in later blocks continues to increase at a faster rate per unit of consumption.

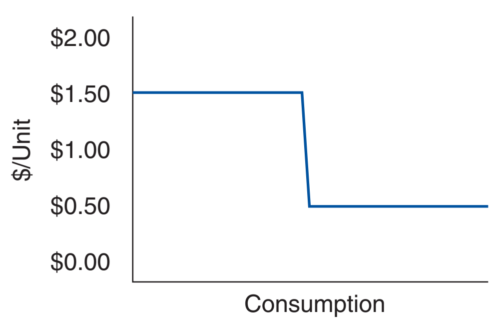

Figure 14-2 Declining block consumption charge

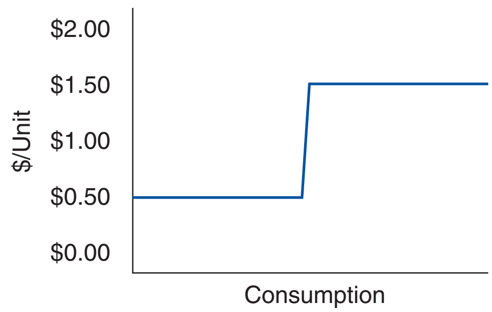

Figure 14-3 Inclining block consumption charge

Figure 14-4 displays a fourth type of charge called a *seasonal rate* (described in chapter 13). This type of consumption charge determines the price that a customer pays for consumption based on the time of year. A utility usually charges more per unit of consumption during the peak-demand season and less during the low-demand season. Often a uniform block consumption charge is used for each season, but increasing and decreasing block consumption charges may also be used. Utilities usually separate the charge into two seasons (i.e., summer and winter), but it is possible to have more seasonal divisions.

Each consumption charge can be designed to recover the same amount of revenue. In selecting between them, it is important to realize that each of them has strengths and weaknesses. Also, trade-offs exist in terms of shifting costs between small and large consumers as well as increases and decreases in the seasonality of a utility's revenues.

HISTORICAL PERSPECTIVES

Historically, dual systems of charges (fixed charges and variable charges) to recover water costs have not existed. The ability to charge a customer based on actual water usage has been made possible because of water meters. Before meters were used, water utilities were restricted to a fixed fee system of charges. Often this system was based on a fee per account or per customer. In other cases, the utility might apply the fee against some measure of potential water use. For example, utilities often used a fee per house plus square foot of lawn, number of fixture units, number of hospital beds, number of bar stools, number of cows, number of barbershop chairs, etc.

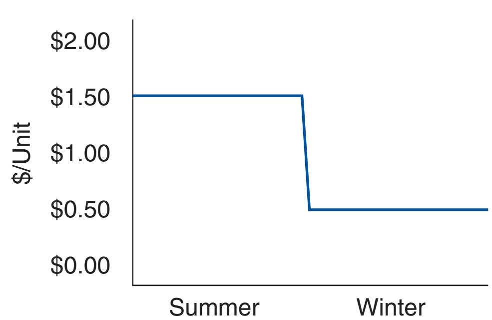

Figure 14-4 Seasonal consumption charge

In designing rates, a utility has many objectives to balance. These objectives may have distinct implications on the type of fixed and variable charges that a utility develops. As a general model and based on cost causation, a utility may want to recover its customer-related costs using a fixed charge (i.e., a service charge, meter charge, etc.), and its consumption-related costs using a variable charge (i.e., consumption charge).

EXAMPLE

Trade-offs exist when a utility decides to recover more or less of its costs from a given charge. For example, if a utility decides to eliminate its fixed charge in order to continue recovering its full revenue requirements, it must now recover all of its costs through its consumption charge. This would increase the overall level of the consumption charge. A customer's bill would then likely be lower for small amounts of consumption, but it would increase at a faster rate for each unit of water consumed. In this situation, small consumers would pay less and large consumers would pay more.

If, on the other hand, a utility decided to recover more of its costs from its fixed charge and less from its consumption charge, then the utility would need to increase its service charge and decrease its consumption charge in order to recover the same amount of revenue. A customer's bill would then typically be higher for small amounts of consumption and would increase at a slower rate. Large consumers would generally have lower bills than they would if the service charge were lower.

SUMMARY

From a utility's standpoint, both revenue stability and equity are generally enhanced as appropriate types of costs are recovered through fixed costs. The significance of this enhancement depends on several variables unique to each utility's customer base and overall fiscal tools. Also, it is commonly accepted that as a utility increases the fixed fee component of the rate structure, it decreases, to some extent, customers' ability to control the size of their bills. This relationship needs to be considered as utilities become more active in trying to affect demand through price signals.

Chapter 15

Marginal Cost Pricing

Marginal cost pricing has been the topic of extensive discussion in rate-setting theory over the last 25 years. From a purely theoretical viewpoint, it results in an optimal rate schedule that sends accurate price signals to system customers. In practice, however, rate setting based on marginal costs has limitations that preclude its widespread use. Some limitations arise from everyday issues, as when bills for water bundled with other services fail to send proper signals for the marginal cost of water; some arise from practical concerns such as the typical mismatch of revenues with actual costs. More esoteric issues include limitations on data necessary to develop accurate marginal costs and consensus on the best way to make such calculations. Despite these apparent limitations, marginal cost pricing theory has received serious consideration in rate setting in recent years.

GENERAL CONSIDERATIONS

The marginal cost of water service is the added cost of producing or acquiring incremental supplies or capacity, i.e., the cost of delivering additional water service. If the water utility is operating at less than full capacity, short-run marginal costs are limited to the additional operating costs to produce more water service within existing capacity. This amount is typically less than the average embedded cost of water, and it encourages use of extra capacity. Conversely, if new capacity is needed or imminent, long-run marginal costs include new capacity cost as well as operating costs associated with new capacity. These costs are typically higher than average embedded costs, perhaps encouraging wiser water use to delay capital investment. In addition to new capacity, marginal cost analyses can be applied to other sources of supply, including purchased water and reclaimed water.

One component of marginal cost is the change in operating costs caused by a change in the rate of capacity use. This is known as *short-run marginal cost* or *incremental operating cost.* Marginal or incremental operating costs reflect the cost consequences of use changes in the context of a specified system capacity. Incremental operating costs can constitute a floor or absolute minimum for water rates, e.g., volumetric rates should never be set below incremental operating costs.

Another component of marginal cost is the cost associated with expanding system capacity. This element is known as *long-run marginal cost* and includes marginal operating costs and marginal capacity costs. Estimating marginal capacity costs involves identifying costs that will be incurred in the future if consumers do not change their current patterns of water use. Estimating also involves identifying future costs that can be avoided for some period of time if consumers resort to more efficient water use, extending the period of adequacy of existing facilities. Long-run marginal costs can convey signals regarding long-term cost consequences of changes in consumer use.

Marginal cost pricing is a departure from the conventional average embedded cost approach to water costing and rate design. However, marginal cost theory and average cost approaches can often be successfully blended in water rate design. Economic theory suggests that water rates be set equal to long-run marginal costs to ensure an efficient allocation of water service. Rates based on marginal cost theoretically provide the foundation for efficient use of existing system capacity as well as efficient capital investment in future capacity. True marginal cost rates, however, typically produce revenues that differ substantially from average cost rates, requiring modifications to collect the proper level of revenue.

Rates based on the marginal cost of water provide signals to consumers about the cost consequences of their consumption decisions, and conversely, reflect future cost consequences of usage decisions. The basic premise of marginal cost pricing is that, because rates affect future usage decisions, future costs of water provision are those most relevant for setting rates.

Most customers do not understand or appreciate the theoretical underpinnings of water service pricing. Their primary concern is (appropriately) the overall level of their water bill. In addition, it should be recognized that the theoretical basis for marginal cost pricing rests on an analytical framework of market conditions that is uncharacteristic of monopoly water service providers. As a consequence, marginal cost pricing may not yield the efficient resource outcomes that may be realized under perfect market conditions.

Policy Issues

In estimating the marginal cost of water service, an important issue is where the next increment of supply comes from and the cost of this supply increment. Several supply options with different cost consequences may be available to the water utility. The cost estimation of these supply alternatives is critical to marginal cost estimation.

Marginal cost estimation is a forward-looking process, involving forecasts of future costs and future use. In addition, the marginal cost of water service can vary with time (e.g., peak demand versus off-peak demand) and location (e.g., consumers located at different points within the service area). Calculating marginal cost involves forecasting operating costs, capacity costs, and demand over a future time horizon. Selecting the time horizon has important implications for estimating both long-run and short-run marginal costs.

Differences between the average or embedded cost and marginal cost approaches can be overstated. For example, estimates of marginal operating costs may be close to actual average embedded operating cost. Average customer-related costs can also be used as a proxy for incremental customer costs, because this marginal cost calculation may be more complex than the marginal cost calculation for water service production.

Another important difference between embedded and marginal cost approaches is procedural. With embedded cost methods, the process starts with the premise of the equality of total revenues and total costs followed by an interclass cost allocation that achieves that equality. With marginal cost methods, the process begins with the premise of price-marginal cost equality followed by adjustments to ensure that the final rates are compatible with revenue requirements. Both cost methods involve numerous judgments. In embedded cost approaches, judgments occur in cost assignments and capacity cost allocations. In marginal cost approaches, judgments occur in selecting an estimation method, defining incremental production, determining the appropriate time horizon, and reconciling revenues and costs.

HISTORICAL PERSPECTIVES

Attempts have been made to incorporate elements of both embedded and marginal cost in the rate-setting process. For example, embedded costs could determine revenue requirements attributable to customer classes and usage blocks, while marginal costs could be used to design rates for customer classes and usage blocks. In these instances, embedded costs serve as the revenue requirement standard while marginal costs serve as one of the rate design standards. This method has been most prevalent in areas where costs are increasing quickly, expansion of the system is needed, or water supplies are scarce—all situations where high long-run marginal costs exist.

ADVANTAGES AND DISADVANTAGES

Advantages of using marginal costs as a basis for water rates include

- Rates are based on costs that are forward-looking.
- If they are based on realistic costs, these rates can provide price signals that help encourage efficient use of system resources.
- Rates are based on costs that are relevant for long-term capacity planning.

These advantages must be assessed in the context of the following disadvantages of marginal cost rates:

- Rates may not generate revenues that match utility revenue requirements.
- Because long-run marginal costs typically exceed embedded costs, marginal cost rates may require adjusting marginal cost estimates, reducing their efficiency advantage.

These disadvantages must be addressed if there is to be widespread implementation of elements of marginal cost pricing in water service. A tenable solution to the revenue and cost mismatching is critical to both managerial and public acceptance of the concept of marginal cost as a basis for rates. Mismatching arises because pure marginal cost rates generate greater revenues than the utility's rate revenue requirements, demanding utility decision-makers to balance potential efficiency benefits of marginal cost rates with the difficulties of excess revenue generation.

EXAMPLES

Several techniques exist to estimate marginal operating costs. The techniques tend to produce modifications of average operating cost, and cost estimates can deviate substantially from theoretical short-run marginal cost. However, the techniques are

Table 15-1 Calculating marginal operating cost

Data	Year 1	Year 2	Year 3
Operating cost, *$ million*	6.200	6.386	6.578
Revenue-producing water, *thous gal*	4,100	4,346	4,606
Marginal operating cost, *$/thous gal*	1.51	1.47	1.43
Average marginal cost, *$/thous gal*	1.47		

relatively uncomplicated, do not typically involve significant data requirements, and provide reasonable estimates of marginal operating costs.

Marginal operating costs can be expressed on either an annual or seasonal basis. For some systems, purchased water expense and electric power expense can be higher in the summer than in the winter. If a water system exhibits these cost patterns, it may be appropriate to estimate seasonal marginal operating costs.

One marginal operating cost estimation technique is to forecast annual operating costs for the first year the new capacity is expected to be operational and divide that cost estimate by the forecasted production of the new capacity for the same time period. An alternative technique is to forecast annual operating costs for a longer time period and divide that cost estimate by the revenue production of the new capacity for the longer time period.

Table 15-1 illustrates the two calculations of marginal operating costs. The example assumes that the new treatment plant becomes operational in year 1. Data are provided on the annual operating expenses and the annual revenue-producing output (i.e., metered sales) of the new facility. The calculation method using year 1 data generates marginal operating costs of $1.51 per thousand gallons. The calculation method using data for years 1 through 3 generates average marginal operating costs of $1.47 per thousand gallons.

Examples of Marginal Capacity Cost

Most marginal capital cost techniques suitable for water service are variations of two basic approaches—avoided cost and average incremental cost. Marginal capital costs results are sensitive to both the choice of the cost numerator and the choice of the usage denominator in both approaches. The marginal capital costs method selected is influenced by factors including availability of data, unevenness of future capacity requirements, desire for rate stability, and revenue consequences. Applying any marginal capital cost approach requires information including

- demand projections to determine the output denominator and the timing for capacity increment
- cost projections to determine the cost numerator
- appropriate inflation and discount rates
- service life of the new capacity

Other information may be required, including cost and operating data on sources of supply, such as purchased water and reclaimed water.

Avoided cost approach. The basic avoided cost approach expresses marginal capital costs as cost savings from a slowdown in demand growth that postpones the need for new capacity. In brief, the avoided cost approach calculates avoided capacity costs. In some cases, data can be separated to provide marginal capital costs estimates for peak and off-peak usage periods.

In the avoided cost approach, the cost numerator is the capacity cost avoided by consumers practicing conservation. This capacity cost is measured by the change in the present value of capacity expenditures from moving the capacity increment forward into the future. Conceptually, the usage denominator is the demand or usage change that produced the delay in the need for the new capital facility. More pragmatic versions of the avoided cost approach incorporate output denominators, such as the designed yield of the new facility.

A simple example illustrates how marginal capital costs are calculated under the avoided cost approach. It is assumed that the water utility originally planned to construct a treatment facility the next year, or year 1. As a result of demand management programs, the treatment facility is not needed until year 5. The treatment facility involves $17.0 million in capital expenditures and has a designed maximum-day capacity of 7.5 million gallons per day (mgd) and an estimated annual average day demand of 5.0 mgd, or 1,825,000 thousand gallons (thous gal) annually. Assuming a discount rate of 4.0 percent (a discount factor of 0.8548 in year 5), the present value of the capital expenditures in year 5 is $14.53 million. The cost numerator under the avoided cost approach is the difference in the present value of capital expenditures by delaying the capital project 4 years, or $2.47 million. Dividing the avoided costs of $2.47 million by the annual average day demand of 1,825,000 thous gal produces a marginal capital cost of $1.35/thous gal. This marginal capital cost estimate plus the marginal operating costs associated with the new facility equals the estimated total marginal cost of the new capacity. The total marginal cost could be the basis for either a uniform commodity rate or the second tier rate in an increasing block rate structure.

The avoided cost method provides a wide range of marginal capital costs estimates under modestly differing circumstances. For example, if demand management is expected to delay the facility for 10 years (a discount factor of 0.7026), the marginal capital cost is $2.77/thous gal, or $5.06 million divided by 1,825,000 thous gal. Conversely, if demand management is anticipated to delay the new treatment facility by only 3 years (discount factor of 0.9246), the marginal capital costs is $0.70/thous gal, or $1.28 million divided by 1,825,000 thous gal. If the project is delayed indefinitely (the cost numerator is the present value of the cost of the facility at its original planned date), the marginal capital costs is $9.32/thous gal. This particular characteristic of the avoided cost approach may lead the rate analyst to consider the average incremental cost approach.

Average incremental cost approach. The average incremental cost approach to estimating marginal capital costs involves annualizing total marginal capacity cost. The average incremental cost method first calculates annualized capacity costs, defined as the annual payment over the service life of the new capacity that is required to recover both the financing and additional capacity costs.

$$K = \frac{Ci[1+i]n}{[1+i]n-1} \tag{15-1}$$

Where:

K = annualized incremental capacity costs
C = total capital expenditure required
n = the service life of the new capacity
i = the appropriate interest rate

K can be segregated into peak and off-peak components. Similar to the avoided cost approach, an important step in the average incremental cost method is selecting the output or demand denominator to arrive at an estimate of marginal capital costs. Alternative output measures include the annual designed yield of new capacity or annual revenue-producing water.

Continuing the example used to illustrate the avoided cost approach, it is assumed that the water utility is constructing a treatment plant to become operational next year. The new facility, involving a capital expenditure of $17.0 million, will have a useful service life of 25 years and is being debt financed at an interest rate of 6.0 percent ($1.33 million annual debt service cost). The output denominator used in the marginal capital costs calculation is the same as in the avoided cost approach, i.e., the designed annual average day demand of the new facility (1,825,000 thous gal).

Under these assumptions, the average incremental cost approach produces marginal capital costs of $0.73/thous gal. Similar to the avoided cost marginal capital costs estimate, this marginal capital cost estimate, when added to the marginal operating costs for the new facility, serves as the basis for either a seasonal usage charge or for a second tier rate in an increasing block rate structure.

The average incremental cost method generates marginal capital costs estimates that are not very sensitive to either changes in service lives or changes in financing rates. For example, changing the service life (while retaining the 6.0 percent financing rate) to 20 years produces a marginal capital cost of $0.81/thous gal. Similarly, changing the financing rate to 7.0 percent (while retaining the service life of 25 years) produces a marginal capital cost of $0.80/thous gal.

Selecting an approach. Obviously, the choice between the avoided cost, average incremental cost, and other marginal capital costs approaches involves trade-offs. In this context, it is instructive to note that the marginal cost estimation could borrow from both approaches. For example, the avoided cost of a future supply option, such as purchased water or reclaimed water, may be estimated by the average incremental cost approach.

Several assumptions underlie the estimation of both marginal operating costs and marginal capital costs.

- It is assumed that operating and cost data on new capacity (or other supply options) are either readily available or can be easily estimated.
- It is assumed that capacity service lives, appropriate financing rates, and the duration of capacity postponement from demand management can be identified with reliability.
- It is assumed that reasonable estimates can be made regarding annual designed yield and revenue-producing water output.

SUMMARY

Rates based on marginal costs reflect future costs to be incurred or avoided in supplying water service. Rates based on marginal costs are forward-looking, provide price signals that may promote efficient resource use, and are appropriate for long-term capacity planning. The important issue is whether or not the efficiency advantages of rates based on marginal cost more than offset their implementation problems. These implementation problems include complications in marginal cost estimation, excess revenue generation, revenue instability, uncertain effects on consumer bills, ease of customer comprehension of bills, and possibly substantial administrative costs.

Marginal cost estimations can be subjective. An embedded cost analysis can result in a close approximation of marginal cost. Both embedded cost calculations and marginal cost estimations provide water utilities with important benchmarks or guidelines for rate design. Marginal cost and average cost approaches can be blended in water rate design. It is possible to complement embedded costs with marginal costs in water rate design to provide both efficient price signals as well as to achieve the mandated matching of generated revenues with revenue requirements.

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Section IV

Customer-Specific Charges

Low-Income Affordability Rates

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Chapter 16

Low-Income Affordability Rates

GENERAL CONSIDERATIONS

If the cost of water or wastewater service grows to a significant portion of a household's disposable income, then the customer will have difficulty paying the bill. Customers with limited resources often must choose which bill to pay first. Because water is a necessity, permanently discontinuing service is not feasible.

Large and rapid increases in water and wastewater bills are perhaps the most difficult expenses for low-income families. Less-affluent households have less flexibility in their budgets to absorb water bill increases. Because there are no real substitutes for potable water, customers cannot choose lower priced alternatives.

Appropriately designed programs oriented toward affordability issues (lifeline and lower income) help both the targeted customers and the utility. When customers have trouble paying utility bills, the cost to the utility is manifested in increased arrearages, late payments, disconnection notices, and service terminations. The associated increased collection costs and bad debt write-offs increase all other customers' bills.

Increased nonpayment and bad debt write-off is also a concern to potential purchasers of a utility's bonds—particularly revenue bonds. As bad debt increases, costs to other ratepayers rise, creating concern about the affordability of water service to all customers. Security for the bonds (the revenue stream) may be brought into question, perhaps ultimately increasing the utility's cost of borrowing.

Common Affordability Programs

Affordability programs are intended to provide water to customers who are less able to pay for service. Lifeline rates are often thought of as providing a minimal amount of water at a reduced cost to all customers, independent of income level or ability to pay.

As discussed in this chapter, all forms of low-income affordability rate alternatives are targeted only to those who are defined by specific criteria as requiring assistance.

A number of different programs implemented across the country provide rate assistance to customers. These programs target low-income customers and should not be made available to all customers. Participants may be required to provide some form of income verification.

Affordable rate alternatives are typically developed as part of a larger program. These programs frequently include such strategies as arrearage forgiveness and budget billing. Water rate affordability programs can include the following:

Straight discount. A straight discount involves an across-the-board reduction or discount on the total water bill. The discount can be a set percentage for all eligible customers, vary by income level with larger discounts for more impoverished customers, or can be discounted for total amounts of the water bill over some set level.

Discount variable (usage) portion. Rather than discounting the entire bill, only the portion based on use is discounted. The fixed portion of the bill is left untouched. This method provides greater dollar discounts to customers that use greater amounts of water, thus may be most helpful to larger families that require more water. Under this program, the water rate is reduced for eligible customers. The program can also be modified to provide discounts only for use up to a certain level per month or up to a specified use per family member. This would reduce wasteful use by providing no discount for excessive consumption.

Discount fixed (minimum) portion. Another alternative is to discount only the fixed portion of the bill, i.e., the meter charge, service charge, or demand charge. This method can provide the overall reductions that may be required to make service affordable yet maintain incentives to conserve. By charging normal, rather than discounted rates for water use, there is no incentive to waste discount-priced water.

Percentage of income. A percentage of income plan usually involves a system that charges customers for service based on a percentage of their individual income. This can include a system where customers always pay a predetermined percentage of income that is considered affordable. An alternative to this is a system where a percentage of a typical bill is determined based on the income level. That percentage is then applied to all bills (similar to a discount program). If customers use more water, the bill increases; if they conserve, they save even more.

Fixed credits. In situations where assistance is provided to water consumers who may not be direct customers (e.g., renters living in a master-metered building), credits can be provided. If the utility provides another service directly to customers, such as electric service, credits can be provided on the electric bill. Another suggested form of credit is providing script or coupons used to make rent payments to landlords who, in turn, can use these coupons to pay a portion of the water bill for the building.

HISTORICAL PERSPECTIVES

Costs for other utility services, such as gas, electricity, and telephone, have traditionally been much higher than water service. Many of these utilities have already faced the issues of affordability. Nearly every state regulatory commission has addressed the issue of affordable energy bills and the ability of low-income customers to pay those bills. Low-income discounts, consumer assistance programs, budget billing, waivers of customer charges, and lifeline rates are common in the energy industry.

Outside North America, low-income discounts, lifeline rates, and affordable water programs are common. For example, through various lending agencies, the US government provides assistance to less affluent countries to make water service available at more affordable prices. Within North America, an increasing number of water utilities have adopted affordability programs. It is not uncommon to find some elements of affordability rates in many major cities.

POLICY ISSUES

Low-income affordability alternatives are intended to address social issues, and utility involvement in such issues may be controversial. Although each utility needs to decide whether or not it will participate in such programs, an increasing number of utilities are addressing water affordability in their rates.

These types of rate alternatives should be considered when a utility's cost of water is high and some customers have problems paying their bill. Indications of this scenario can include rising arrearages, higher collection costs, and more frequent shutoffs for nonpayment. In making this determination, the cost-of-service analysis should be done first without any affordability considerations. During the rate design portion of the analysis, affordability considerations can be taken into account. The rate analyst then can measure the effects of affordability alternatives and better quantify any discounts and subsidies involved.

Low-income rates typically require some degree of subsidy. The question of which customer groups should provide the subsidy needs to be addressed. Utilities should recognize that adopting more affordable rates can reduce the utility's costs if the low-income rates result in increased collections and reduced collection costs.

The first issue to consider is at what point a water bill becomes unaffordable. While there is no clear answer to this question, the following guidelines can help utilities make such a determination:

- The Safe Drinking Water Act (S. 1547) established special assistance in communities where the average residential water bill exceeds 2 percent of median income.
- The US Department of Agriculture has a program to provide funds for water and wastewater systems. Loans are made for projects where the residential water bills are 1.5 percent of the community's median income. Grants are awarded for costs in excess of 1.5 percent.
- The AWWARF report, *Water Affordability Programs*, suggests that programs should not be based on median income but on rates that cause water bills to exceed 2 percent of income for impoverished households. Because of the focus on impoverished households, a measure of 2 percent was selected to determine if water service costs were burdensome.

Different measures of poverty can be used to determine eligibility. These include Aid to Families with Dependent Children (AFDC), Supplemental Social Security Income (SSI), minimum wage incomes, and US poverty level. Many of these measures vary with family size.

Based on the results of national water and wastewater rate surveys, bills have become unaffordable for low-income households in some of our major cities. For those living on SSI, water and wastewater bills exceeded 5 percent of income for these households in a number of cities.

Perhaps the biggest issue involved with affordable rate programs is how to determine eligibility. Utilities are often uneasy about gathering, administering, and verifying income data. Fortunately, a number of existing programs can help.

Other utilities, including many electric, gas, telephone, or cable television companies, offer discount programs based on income. Many are willing to share this data with municipal water or wastewater utilities.

A number of income-based government assistance programs are already in place. Proof of eligibility in one or more of these programs often provide adequate income verification. These programs include

- AFDC
- SSI
- LIHEAP (Low Income Home Energy Assistance Program)
- Medicaid
- Food stamps

Utilities must also decide the quantity of water to discount. If only a portion is to be discounted, it is necessary to determine a minimum sanitary level of water use. Minimum water requirements vary by family size, further complicating this analysis.

ADVANTAGES AND DISADVANTAGES

Advantages of adopting affordable rate programs include

- providing a necessity of life (water) to all customers at an affordable price
- helping to reduce utility collection costs, reduce arrearages, disconnects, and reconnects
- increasing levels of financial sufficiency for the customer and utility
- helping enhance public acceptance of water rates by making them affordable

Disadvantages of affordable water rate programs include

- being inconsistent with water conservation goals if a discount encourages wasteful use
- requiring subsidy from other ratepayers, although this is typically minimal
- creating controversy over water utility participation in social programs
- implementing and administering affordable rate programs can be costly and difficult

EXAMPLE

Two lifeline rate examples are discussed in this section—reduction to the rate for a minimum volume of use and reduction to the monthly service charge. It is assumed the minimum sanitary needs for a family is 5,000 gallons per month. The utility has also determined that 200 families with annual incomes at or below $5,000 should be eligible for special lifeline rates. Because a low eligibility level was selected, it was decided the annual water bill should be no more than 1.5 percent of the annual income. This limitation results in a maximum annual water bill of $75. Table 16-1 presents this data as well as the calculation of the water bill under current rates. A reduction of $33 per year is necessary to make water affordable to the targeted customer group.

Table 16-1 Requirements for affordable rates

Item	Quantity
Minimum sanitary use	60,000 gal/year 5,000 gal/month
Eligibility (annual income)	$5,000 maximum
Eligible customers	200
Maximum annual water bill (1.5 percent annual income)	$75 per year

Current Annual Charge	Rate, *$*	Use, *gal*	Cost, *$*
Consumption charge	0.9648/thous gal	60,000	57.89
Service charge	4.20	12	50.40
Total			108.29
Necessary reduction per year			33.29

Table 16-2 shows the calculation for two options to make the water bill affordable to eligible customers. Option 1 reduces the metered rate or consumption component of the bill. Because only the minimum sanitary use should be included, this reduction applies only to the first 5,000 gallons per month. Option 2 reduces the service charge component of the bill. This option provides the necessary bill reduction and still allows customers to reduce their bills through conservation.

Because affordability options reduce revenues, rates charged to other customers will have to be adjusted to recover the required revenues. Table 16-3 shows the potential revenue reduction of all eligible customers applying for the lifeline rate. The utility's projected savings in collection costs from a lifeline rate is also shown. Net costs have to be recovered through increases in the metered rates or service charges to other customers. As shown in this example, the effect is minimal.

Table 16-2 Calculation of lifeline rate options

Option 1 Reduce Consumption Charge	
Current annual consumption charge	$57.89
Reduction required	$33.29
Desired consumption revenue	$24.60
Calculation of lifeline metered rate	
Revenues desired	$24.60
Consumption, *thous gal/year*	60
Rate, *$/thous gal*	0.41

Option 2 Reduce Service Charge	
Current annual service charge	$50.40
Reduction required	$33.29
Desired service charge revenue	$17.11
Calculation of lifeline service charge	
Revenues desired	$17.11
Bills per year	12
Charge per month*	$1.43

*Charge is only applicable to customers meeting eligibility criteria.

Table 16-3 Effect on other charges

Item	
Annual revenue reduction per customer	$33.29
Customers eligible	200
Potential annual revenue loss	$8,658
Less savings in collection costs	($1,200)
Increase in other rates needed	$5,458

Blocks, *gal/month*	Current Rates, *$/thous gal*	Lifeline Rates		
		Option 1*	Option 2*	Ineligible†
First 5,000	0.9648	0.4100	0.9664	0.9664
Next 10,000	0.9648	0.9664	0.9664	0.9664
Next 1,485,000	0.8537	0.8551	0.8551	0.8551
Over 1,500,000	0.7044	0.7056	0.7056	0.7056
Service charge, *$/month*	4.20	4.21	1.43	4.21

*Charge is only applicable to customers meeting eligibility requirements.

†Applicable to customers that do not meet eligibility requirements.

SUMMARY

Various affordability programs may be more widely used as the cost of water service grows relative to other goods and services and as utility costs for collections and bad debt grow. Because water is considered a necessity, utilities may determine that arrangements to provide minimal quantities to customers that cannot afford water service is a proper utility function. In developing affordability alternatives, utilities should apply rates and charges that ensure that only eligible customers receive the benefits.

Chapter 17

Negotiated Contract Rates

As discussed in previous chapters of this manual, it is standard rate-making practice to design and develop water rates that reflect the average cost of providing service to the utility's various classes of customers. From time-to-time, however, it may become necessary to develop a special rate to meet specific circumstances or needs of an individual customer. In such cases, a utility may enter into a negotiated contract rate tailored to meet that customer's special circumstances.

GENERAL CONSIDERATIONS

Entering into a customer-specific negotiated rate contract represents a deviation from the traditional practice of setting rates for broad classes of similar customers. As such, negotiated contract rates should only be made available to specific customers under special circumstances.

Applicability

Criteria such as size and pattern of usage, the availability of an alternative supply, or other unique characteristics must exist to justify application of a rate other than that applicable to other customers. One example of when a negotiated contract rate might be applied is when a large industrial customer might otherwise leave the system unless a special rate can be negotiated. Another example might be when a customer has unique use patterns that cause the costs of serving that customer to be significantly different than the average.

Components of Negotiated Contract Rates

Negotiated contract rates can include a variety of different types of charges depending on the circumstances. In developing the structure of the contract rate, the objective should be to design a rate tailored to the circumstances and costs involved.

Examples of rate components include a customer charge, a demand-related charge, and a volume or commodity charge.

Customer charge. The customer charge is typically a fixed amount to recover metering, billing, collection, contract administration, and accounting costs related to serving the customer. In addition, investment and operating costs of any facilities specifically constructed to serve the customer can be directly recovered in the fixed-charge component.

Demand charge. A demand charge can recover capacity costs associated with providing maximum-day and maximum-hour rates of flow to the customer. Costs associated with facilities that are not required to provide service to the customer can be excluded. The demand charge can be administered as a monthly charge based on either contracted or metered maximum-day or hour demands. A monthly minimum charge can also be structured to recover all or a portion of the fixed demand-related costs.

Volume or commodity charge. These charges could be used to recover expenses that vary directly with water use, including such items as purchased water costs, power for pumping, chemicals, and sludge disposal. If a demand charge is not used to recover capacity costs, such costs can also be recovered through the commodity charge.

HISTORICAL PERSPECTIVES

Contracts have been negotiated between utilities for wholesale service for many years. The practice of negotiating contracts with large retail customers is less common and has only recently become an issue for some utilities. The greater frequency of negotiating rates with individual customers is largely due to increasing costs of supplying water. As costs of supplying water increase, the significance of these costs to large customers also increases. This has caused large customers to focus more attention on ways to reduce water utility costs in much the same way they have traditionally done with other utility services. In addition, as costs of purchasing water from the utility increase, the economic feasibility of developing an alternative supply, exploring conservation measures, or otherwise bypassing the utility increases.

ADVANTAGES AND DISADVANTAGES

The following section examines some advantages and disadvantages of negotiated contract rates.

Financial Sufficiency

A negotiated contract rate can help maintain the financial condition of a utility by retaining a revenue stream that provides continued fixed-cost recovery that might otherwise be lost.

Equity

Negotiated contracts can promote equity so long as the negotiated rates are based on the cost of providing service to the customer involved. In developing negotiated rates, rates should recover the costs of any facilities used solely to serve the customer, recover the variable costs of treating and supplying water, and contribute toward the fixed costs of the water system. When the water utility purchases water from another utility, the unit cost of that water should be considered in setting the negotiated rate to the extent that the utility would avoid purchasing at least some of that water if it no longer served the negotiated rate customer.

Effect on Customers

The financial effect on other customers depends on existing rates and their relation to cost. To the extent that contract rates reflect the costs of providing service, the effect on other customers is determined by the relationship between existing rates and the costs allocated to them.

Implementation

The use of contracts between two entities to accomplish a specific project or provide a specific service is a common business practice. Similarly, a water service contract between a water utility and a large customer should specify the obligations of each party, the service standards to be met, the basis for initially establishing rates and making subsequent changes to those rates, the process for resolving disputes, and the terms of the agreement. Establishing a contractual arrangement can be a complex process. Typically, a cost-of-service study is needed, and the specific contract terms must be established. Negotiations take time and effort, and outside technical consulting assistance is often required by both parties.

Conservation

Water conservation is not normally a consideration in determining the appropriateness or level of negotiated contract rates. However, in the event that conservation is a particularly important issue for a utility, the negotiated rate contract and the associated rate form may specifically address conservation matters.

EXAMPLE

An industrial customer is seeking to negotiate a special contract rate with the local water utility. The customer is the utility's largest, using approximately 2 million gallons per day (62.5 million gallons per month). Under the utility's existing rates, the customer pays $42,822 per month or $513,860 per year (see Table 17-1). The utility is willing to offer a negotiated contract rate because the following conditions exist: the utility has adequate capacity to meet its customer's needs and does not need to undertake any significant expansion in the near future, the customer has a viable supply alternative, and the customer has favorable load characteristics with a maximum-day demand ratio of 1.25 times average day, and on-site storage facilities ensure no discernable peak-hour demand.

To develop a rate for the customer, the utility uses the unit base cost of water ($0.5742 per thousand gallons) and the maximum day extra-capacity unit costs ($67.2394 per thousand gallons per day) developed in its recent cost-of-service study. Based on these unit costs and the customer's ratio of maximum day to average day usage of 1.25, a contract rate of $0.62 per thousand gallons is established for the customer. In addition, the customer also continues to pay the $50 per month service charge that recovers customer-related costs. Under the negotiated contract rate, the customer pays $38,800 per month, or $465,600 per year.

Table 17-1 Example of contract rate determination

General Service Water Rate Item	Monthly Use, *thous gal*	Rate, *$/thous gal*	Total Monthly Cost, *$*
Customer Charge	1–6-in. meter	$50/month	50.00
Monthly Rate Block, *thous gal/month*			
First 15	15	0.97	14.55
Next 1,485	1,485	0.86	1,277.10
Over 1,500	61,000	0.68	41,480.00
Total	62,500	—	42,821.65
Annual Cost			513,860.00
Monthly Contract Rate			
Type of Charge	Monthly Usage, *thous gal*	Rate, *$/thous gal*	Total Monthly Cost, *$*
Customer Charge	1–6-in. meter	$50.00/month	50.00
Commodity Charge, *thous gal*	62,500	0.62	38,750.00
Total			38,800.00
Annual Cost			465,600.00

SUMMARY

A negotiated contract rate may be desirable for both the utility and its large-volume customers. The utility can benefit from the greater certainty of a stable stream of revenues to cover costs, including the cost of special facilities applicable to the customer. Negotiated contracts also allow the utility to address the specification of contract demands, customer operating practices, and its commitment to be a long-term customer. The large water user benefits because the contract ensures access to an adequate supply and establishes standards for determining cost-based rates.

Chapter 18

Economic Development Rates

An economic development rate encourages community-related economic development by setting the rate for water service at a level that retains existing customers, attracts new customers who are critical to the community's development and economic welfare, and encourages new and expanded uses of water from existing customers. The rate is normally made available to targeted customers who provide an overall economic benefit to the community in terms of employment, local tax revenues, and community services.

GENERAL CONSIDERATIONS

To be effective, an economic development water rate should be part of a comprehensive community plan. On its own, an economic development water rate is not likely to provide sufficient benefits to existing or new business and industrial customers to cause them to change their strategic decisions. However, a water utility's economic development rate, when coupled with other economic and financial advantages from the community as a whole, may be significant to the targeted customer.

Economic development rates from a water utility imply the utility is willing to sell water to the targeted customer at a rate lower than that charged to similar customers. As such, some level of subsidy exists. In general, the amount of this subsidy is based on community and utility–customer considerations at the local level. To be successful, the subsidy must be enough to entice the targeted customer and, at the same time, result in a positive economic benefit to the community and the utility. If this is not the case, the cost of the subsidy would outweigh the community benefit.

Conditions for Implementation

At least three criteria should be met before a water utility considers an economic development rate.

- A comprehensive economic development plan. The plan should identify financial and economic benefits that the community is willing to offer targeted customers. It should also identify how subsidies will be met.
- A financially sound utility. The comprehensive economic development plan should address any threats to the financial integrity of the water utility.
- A long-term economic gain. The potential long-term economic gain to the community should be greater than any short-term subsidies provided.

Key Factors in Rate Development

This section discusses a number of factors to consider when formulating an economic development rate.

Cost basis of existing water rates. The utility should consider how well its current rates recover costs from existing customers. To properly gauge the true effects of an economic development rate, it is important that the utility's rates meet its financial needs. This usually means recovering costs from each customer class in proportion to the costs of serving that class. Similarly, it is important to account for any transfers to, or from, the general fund. If a utility is not self-sufficient and is receiving transfers from the general fund, water rates are already set below full cost. Alternatively, if a utility is providing transfers to the general fund, other than for services provided by the municipality, the rates are set above full cost. Any discount of water utility rates in these situations must be considered in the context of the tax considerations of the community's comprehensive economic development plan.

Supply and capacity considerations. Excess source of supply and treatment capacity mean potential short-run economies of scale. The utility can use otherwise idle resources without requiring the additional capacity with its associated fixed cost. If excess capacity is available, the marginal cost of adding a new customer is equal to the variable costs of water production. This additional capacity minimizes the impact to existing customers.

If the system requires additional capacity to serve targeted customers, additional fixed investments must be made. If the targeted customer is to pay less than existing customers for water service, then it will have greater effects on existing customers. These cost implications require special consideration and evaluation relative to the benefits gained from adding the targeted customer. First, the utility needs to consider the effect of the rate on existing customers from increasing the utility's fixed costs by adding the new capacity. Second, assuming that the capacity additions would be in excess of that needed by the targeted customer, the utility needs to determine who will bear the burden of financing the new reserve capacity.

Duration. The economic development rate should only be available for a specified period of time. It should be considered a short-term benefit to targeted customers, not a permanent benefit. The utility should conduct an annual review of the effectiveness and impact of the rate, and have a structured phase-out plan. Ideally, the economic development plan would be phased out before it is necessary to add capacity to the system.

Short-term economies of scale. Short-term economies of scale may allow the utility to serve targeted customers with minimal cost implications. Consequently, the economic development rate can be developed with limited effects on existing customers. To the extent that the utility has ample source of supply and treatment capacity, the short-run marginal cost of adding another customer should be less than the average cost of water service. By setting the economic development rate at a level at least equal to the short-run marginal cost of service, existing customers are largely insulated from the rate impacts of an economic development rate. Providing service to a new customer may be possible without increasing existing rates.

Targeted customer. Usually economic development rates are thought of as applying to new customers. The idea is that a community attracts a new customer to their service area with an economic package (including lower water rates) that is beneficial to the targeted customer. In return, the community increases its tax base, employment, community services, and general welfare. Selecting the targeted customer is a complicated issue that varies from community to community. It is important to consider that if the targeted customer is providing a service or manufacturing a product that is similar to that provided by an existing customer, then the community and utility may have put its existing customer at a competitive disadvantage. As a result, the gain of the new customer may be offset by the loss of an existing customer.

A community or a utility may not want to limit its targeted customers to only new customers. It may be reasonable to apply an economic water rate to new uses of water by existing customers. For example, if an existing commercial customer plans to expand production and requires significant increases in water as part of its expanded production, the utility may consider offering an economic development rate for the water used as part of the expanded production. The community and utility can capture the benefit of the increased water sales to an existing customer and keep the customer from expanding its production at a different location.

Effects of the subsidy. The concept of average cost rate setting assumes that increases or decreases in the cost of providing a utility's services are shared proportionally by all customers causing the change in costs. Thus, economies or diseconomies of scale generated by the addition of new customers are shared by all existing and new customers.

This is not the case for economic development water rates. In this case, targeted customers benefit at the expense of existing customers. For example, if the utility sets the economic development rate at a level equal to the short-run marginal cost, assuming this is less than the average cost, existing customers would not need a rate increase in order for the utility to recover all of its costs. However, in this case, existing customers would not receive a benefit from the economies of scale. It is the lack of a benefit to the existing customers that is the subsidy; the subsidy is the difference between the existing rate and what the existing customers would pay if the economies of scale were shared by all customers.

Similarly, if the economic development rate is set above the short-run marginal cost, then existing customers receive some benefit from the economies of adding the new customer. This is because the new customer covers the variable costs incurred serving him or her, plus sharing in the system's fixed costs. While this arrangement is clearly more beneficial to existing customers, a subsidy still exists that is equal to the portion of the fixed costs not covered by the new customer.

Finally, if the economic development rate is set below the short-run marginal cost, the new customer is not even covering the additional variable costs that it creates, and the existing customers must pay for all of the system's fixed costs, plus a portion of the new customer's variable costs. In this case, existing customers are actually harmed by adding a new customer. Thus, based on the concept of average cost rates, subsidies in the form of inequities exist even if current customer rates are not increased to serve the targeted customers.

Burden of the subsidy. Any subsidy required could be met by allocating additional costs to existing water customers, utility stockholders (for private utilities), or local tax revenues (for municipal utilities).

Revenue stability. The utility should determine any potential effects on revenue stability to ensure a full recognition of the impact of the rate, including changes in use by the targeted customer or the customers providing the subsidy.

HISTORICAL PERSPECTIVES

Economic development rates are not common in the water industry. Electric utilities, however, have historically offered below-cost rates for service in order to retain existing loads or to attract new industry loads. These rates are generally referred to as *incentive rates*, *load retention rates*, *revitalization rates*, or *economic development rates*. They have been approved by public service commissions in more than 30 states.

The method of subsidy allocation varies greatly among the various states. Because private companies are involved, local tax revenues or other local funding sources are not usually available, and the subsidy is allocated to other ratepayers or to utility stockholders. Although such trends change over time, as of 1998, electric utilities in all but 11 states offered economic development rates as defined in this chapter.

ADVANTAGES AND DISADVANTAGES

The following paragraphs examine the benefits and detriments of economic development rates.

Financial Sufficiency

A water utility can remain financially sufficient, and, in fact, may improve its financial position while offering economic development rates. The utility may generate additional revenue from a targeted customer that exceeds the incremental cost of providing service to that customer. In this case, financial sufficiency will improve. Alternatively, where a revenue shortfall exists, the amount of shortfall must be offset by

- increases in the rates to all nonsubsidized users
- additional funding from utility stockholders (for private companies)
- local tax revenue supplements
- revenue from other sources

Equity

Since the economic development rate provides a subsidy to the targeted customers, based on the theory of average cost pricing, an inequity exists within the water utility's customer base. However, from a communitywide perspective, if the water utility subsidy strengthens the economic base of the community, the water utility inequities may be outweighed by the communitywide benefits.

Effect on Customers

An economic development rate obviously benefits the customer who receives the subsidy, but may increase the water bills of other customers. At a minimum, existing customers do not enjoy the benefit of the economies of scale from adding a new customer to the system. The degree of the effect on an individual depends on the size of subsidy provided, size of the remaining customer base, available system capacity, system efficiency, cost levels of existing rates, and several other variables. If properly structured, the impact of an economic development water rate on customers should be measured as a component of the community's comprehensive economic development plan.

Simplicity

The simplicity of an economic development rate is a function of existing rates because the concept can be applied to any particular rate form. However, determining the amount of subsidy to be provided, the mechanism used to evaluate and provide the subsidy, qualifying criteria, and the resultant increase for all other customers may be difficult to understand.

Implementation

Implementation of an economic development rate could create public acceptance problems. Some customers may not understand or agree with the need to provide a subsidy to one particular customer. In economically depressed areas trying to attract new customers, this concern may be particularly acute. Long-term benefits of economic development rates and their application on a temporary basis should be stressed in such cases. Once the form and level of the rate have been decided, actual implementation should present less difficulty.

Conservation

Water conservation is not normally a consideration in determining the appropriateness or level of economic rates. However, in areas where water supply is extremely limited, it may not be appropriate to provide such concessions to a major water user through such a rate structure.

EXAMPLE

In this example, an economically failing community has decided to try to attract a large manufacturer that is evaluating where to locate its new production plant. The community's water system has ample water supply and treatment capacity to serve the new plant, and the community has developed a conceptual benefit package for the manufacturer to attract it to their community.

The community is evaluating how much of a water rate discount it can provide to the manufacturer. The annual revenue requirements of the water utility are $3.5 million as shown in Table 18-1, based on Table 1-2 of this manual. The utility has determined that in the short term these costs are fixed, with the exception of some of the O&M expenses. Short-term variable expenses include source of supply costs, power costs, and chemicals. The utility's cost-of-service analysis has allocated the portions of these costs that vary directly with water use to the commodity cost

Table 18-1 Annual revenue requirements

Item	Cost, $
O&M expenses	2,279,000
Debt service	860,000
Debt service reserve	60,000
Capital improvements	380,000
Other revenue	(79,000)
Total revenue requirements from rates	3,500,000

Table 18-2 Short-term variable expenses

Item	Total, $	Commodity, $	Maximum-Day Demand, $
Source of supply	90,000	90,000	—
Purchased power	259,000	183,900	75,100
Chemicals	121,000	121,000	—
Total variable expenses	470,000	394,900	75,100

component and the remainder, such as the demand portion of power costs, to the demand cost component. A summary of this allocation is displayed in Table 18-2, based on Table 7-6 of this manual.

The utility's annual metered use without the new customer is 2,766,000 thous gal based on Table 8-2. As a result, the variable expense unit commodity cost is $0.1428 ($394,900 ÷ 2,766,000 thous gal). The manufacturer is estimated to use 50 million gallons per year resulting in an increased systemwide cost of providing water service of $7,140 ($0.1428 × 50,000 thous gal).

The overall consumption-related cost of providing service to all the utility's existing customers is currently $2,568,400, based on the summation of the total commodity ($521,100) and demand ($1,665,000 + $382,300) costs displayed in Table 8-6. The overall average cost per thous gal for the existing customers is therefore $0.9286 ($2,568,400 ÷ 2,766,000 thous gal). If the cost and sales to the new manufacturer were blended with the cost and sales to existing customers, there would be an economy of scale benefit to all customers. The new total cost to serve all existing and new commercial customers would be $2,575,540 ($2,568,400 + $7,140) and the new total sales would be 2,816,000 thous gal (2,766,000 + 50,000), resulting in a reduction of the average cost per thous gal from $0.9286 to $0.9146.

If average pricing methods are used, existing customers would save $38,724 (2,766,000 thous gal × [$0.9286 – $0.9146]). If rates to existing customers are not adjusted, $38,724 will be generated that can be used to subsidize the new manufacturer. The cost borne by the manufacturer would then be equal to their demand (50,000 thous gal) multiplied by the new system average cost per thous gal ($0.9146) less the subsidy ($38,724), or $7,006 ($0.1401 per thous gal), which approximates, with allowance for rounding, the short-run marginal cost of providing service to the new customer.

After determining the relative boundaries between the short-run marginal cost ($0.1428) of extending service to the new manufacturer and the average cost per thous gal ($0.9146) of serving new and existing customers, the community is in a good position to make a policy decision about how much of a subsidy to provide to the new manufacturer. The utility could extend service to the new manufacturer at a rate of $0.1428 per thous gal without adversely affecting existing customers. If the new manufacturer pays more than $0.1428 per thous gal, some of the economies of scale will be shared with the existing customers. If the new manufacturer pays less than $0.1428, the existing customers will be required to pay an additional amount to maintain revenue neutrality.

Chapter 19

Standby Rates

Situations sometimes arise that prompt a water utility to develop rates for nonstandard services. In such instances, it may be appropriate to unbundle the costs associated with general water service and assign relevant costs of nonstandard services to the customer who uses them. This allocation of costs can be accomplished via standby rates, discussed in this chapter, and interruptible service rates, described in the following chapter.

GENERAL CONSIDERATIONS

Rates and Charges for Standby Service

Standby, or backup, water service provides supplemental water during an emergency to protect against an interruption in the primary source of water. Standby service is intended to meet emergency or unscheduled service outages or a reduction in supply from the primary water source. Standby service is somewhat similar in nature to fire protection service. Both types of service place random, infrequent loads on the system. These loads may be large, and they will continue to be imposed until the emergency situation is over. In the case of standby service, however, the service may last for several days.

A water utility may wish to acquire finished water from an outside source in the event of an interruption in its own operations. This could arise from a temporary lack of access to the source water supply, a compromise in the quality of source water supply, or a major breakdown in its system. In such instances, the purchasing utility receives water through its interconnections with the standby supplier, most likely another water system, and distributes that water until its own facilities are functioning normally again.

Large industrial or institutional customers may also pursue arrangements for standby water service to back up their own private water supply. In locations served by adjacent water utilities, the customer may contract with a second water utility to provide backup service in the event of an interruption of service from its primary supplier. The request for standby service could be prompted by the quality of service afforded by the primary provider, or the need to support a continuous manufacturing process that requires an uninterrupted water supply.

The water utility providing standby service must have the necessary reserve capacity to supply the level of standby demand requested by the customer without compromising the safe yield commitment to its own customers. Additionally, transmission main interconnections must be in place to transfer the water on demand, and provisions should be made to prevent backflow to the emergency provider.

The provider must be careful to specify where the standby customer falls in the hierarchy of those demanding water. This is especially important when there are constraints on the utility's sources of supply, including drought or limitations on storage. If these constraints are severe enough, the utility should not consider providing backup service.

HISTORICAL PERSPECTIVES

Standby rates have been offered in the electric utility industry for many years. At the present time, standby rates are most commonly offered to electric power cogenerators. According to the Public Utility Regulatory Policy Act (PURPA) and regulations published by the Federal Energy Regulatory Commission (FERC), electric utilities are required to provide backup power service to cogenerators. The backup power is provided on a firm basis, i.e., the power is available on demand by the customer. The backup power is supplied by the utility to replace all or part of a cogenerator's output in cases of unscheduled full or partial outages.

Standby service is not commonly offered in the water utility industry. This is because water utilities, as a rule, are not close enough to one another to offer such services. In addition, the number of nonutility customers who would desire backup service is quite small, being restricted to a few very large users. This is not to say, however, that interconnection and standby arrangements do not exist where two or more water utilities are located in the same vicinity.

ADVANTAGES AND DISADVANTAGES

The following paragraphs describe advantages and disadvantages of standby rates.

Financial Sufficiency

By definition, standby service is intended to be used on a random and infrequent basis. Therefore, such service is not intended to be a major source of revenue and is not likely to have a material effect on a utility's financial sufficiency as long as the standby rate recovers any additional costs incurred to provide the service.

Equity

To ensure rate equity, a standby customer should be required to bear any direct costs incurred to provide the service connection. In addition, applying a capacity or availability charge to recover the costs of providing capacity along with a consumption charge for water actually taken will ensure that the standby customer is not subsidized by other customers.

Effect on Customers

The availability of standby service should have little or no effect on other customers, provided the utility has sufficient capacity to provide the backup service without compromising the water pressure or volumes available to other customers. In addition, the receipt of additional revenues for standby service decreases the water utility's need to recover its fixed costs from firm, general-service customers.

Simplicity

Because standby service normally will be offered to either another water utility or to a large, nonutility consumer of water service, the issue of simplicity and understandability is not crucial. However, as will be seen in the following example, it is possible to design a simple standby rate that incorporates demand, commodity, and customer-related costs. Customer acceptability should not be a problem, as the rate will in all likelihood be negotiated between the supplier and the consumer of the service. Other customers should not object to the existence of this service, as the associated revenues will help to defray the utility's costs.

Conservation

By its nature, standby service is used randomly and at infrequent intervals. The standby customer will not use this service unless there is an emergency. Thus, there is no incentive to use any more water than necessary during a given emergency situation.

If, however, the customer exceeds the capacity demand specified in the rate, or if the customer uses standby water service on a relatively frequent basis, then the water utility can guard against the cost consequences of such behavior by building a surcharge into the rate, or by placing the customer on the general service rate if it uses standby service above a specified number of times during, for example, a one-year period.

Conservation should be a part of any standby agreement. Any emergency services provided to another utility should take into account how wisely the receiving utility has used its resources before requesting assistance from the provider. In making standby service available, the providing utility may consider including provisions that require the customer to have a proactive conservation program.

EXAMPLE

A water utility agrees to provide backup service to a neighboring utility that desires to provide a greater level of service reliability to its customers. The provider utility's cost per unit of maximum-day capacity (per thousand gallons per day) is $127.54 (see Table 8-4). The standby customer reserves the right to take up to 1 million gallons per day. At this level of capacity reservation, the full service demand cost per year, which includes O&M, depreciation, taxes, and return, is $127,540, as shown in Table 19-1. The equivalent cost per month is $10,628.

Table 19-1 Example of standby charges

Demand Charge	
1. Cost, *per thous gal of peak-day capacity*	$127.54
2. Capacity reservation, *per thous gal per day*	1,000
3. Annual demand cost	$127,540
4. Cost, *per month*	$10,628
Meter Charge	
5. Monthly cost, *per 8-in. meter*	$50
Commodity Cost	
6. Outside city charge, *per thous gal*	$0.201

Because the standby service will be metered, an appropriate meter charge for this service is also applicable, as shown on line 5 of Table 19-1. The total demand and meter charges will be paid monthly by the standby customer. In addition, the standby customer agrees to pay a charge per thousand gallons to cover the variable costs, such as power and chemicals. This rate is $0.201 per thous gal (see Table 8-4).

SUMMARY

Standby water arrangements offer advantages to both the water supplier and the customer. For a water utility, standby service provides a backup source of supply to assure its customers that service is not likely to be interrupted or that any service interruption will be of shorter duration. Standby service to a large industrial customer provides assurance that its production processes can continue uninterrupted if its primary source of supply is not available. The utility providing standby service will have an additional source of revenue, whether or not it is actually called on to supply backup service. The additional revenues will help defray a portion of the standby provider's operating and capital costs.

Section **V**

Alternative Rates

Demand-Side Management

Price Elasticity

Value-of-Service Pricing

Drought Pricing

Rate Surcharges

Indexed Rates

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Chapter 20

Demand-Side Management

While chapter 21, Price Elasticity, discusses study results about the measurable response of water demand to price, this chapter provides guidance on what water utility managers can do with that knowledge. The chapter describes how water rates and rate design can play an important role in an integrated demand-side management (DSM) program.

Demand-side management is usually considered any effort to manage or control system demand characteristics and is commonly included as part of a utility's conservation program. Whether used over the long-term to slow the rate of growth in total system demands, or in the short-term to help manage the effects of a drought, DSM can be accomplished by a combination of the following programs:

- physical modifications made to the targeted end use (e.g., indoor water use)
- public–customer education
- pricing or rates

Rates can play both a passive and active role in a DSM program. Over time, the higher costs of providing a reliable and safe drinking water supply are reflected in a utility's rates. The resulting higher rates may have a passive effect on demands. Additionally, many utilities actively design their rate structure to induce additional conservation.

GENERAL CONSIDERATIONS

Before implementing a DSM program, a utility should establish clear program goals to integrate into the planning and operations of the utility. Whether a DSM program involves changes in rates and rate design, plumbing retrofit programs, or education, the utility should consider the program's effect on short-term and long-term operations, planning, and financing of the utility.

Integrated resources planning (IRP) is becoming a more commonly used planning framework in the water industry. In terms of cost and feasibility, the IRP framework requires a utility to consider all elements of a reliable system. These considerations usually include DSM. To this end, it is important to understand system demands and how they may be affected by future rate structures and related conservation incentives.

A rigorous demand forecasting procedure should be one of the first evaluations made by a utility considering use of a DSM program. An educated forecast of future system demands can potentially reduce the costs to existing ratepayers, as the utility, guided by the DSM-adjusted forecast, follows the least-cost path of expansion while maintaining system reliability.

Demand forecasting techniques range from the relatively simple (linear regression trend analysis or extrapolation) to the more complex (disaggregate forecasts by customer class and even end-use forecasts that examine the "end-use" components of customers' total consumption). The increasing use of these forecasts is driven by the need to identify and evaluate the following:

- differing growth rates and use per customer among different classes of service
- the effect of price on water demands
- the effects of active and passive conservation measures

A utility should not initiate a DSM program until adequate demand forecasting tools are in place.

HISTORICAL PERSPECTIVES

Before the mid-1980s, a water utility's long-run marginal cost was primarily defined by the investment in treatment, transmission, storage, and supply facilities that increased the system's capacity and reliability. In recent years, increasing costs of investment in water resources, driven by economic, environmental, and regulatory pressures, has brought DSM to the forefront in an attempt to manage future demand for water rather than simply adding supply to meet increased demands. In addition to programs designed for plumbing fixtures (e.g., low-flow toilet and showerhead retrofits), water rates also play an important role in many demand-side management efforts.

ADVANTAGES AND DISADVANTAGES

Following are some benefits or detriments of demand-side management.

Delaying System Expansions

The advantages of a DSM program are best realized when working with customers to affect their demands results in a delay in the need to invest in supply expansions. In addition to reducing the long-run marginal costs of the utility by deferring capital costs, DSM can also reduce short-run incremental costs for energy and chemicals. Utility customers benefit from overall lower utility bills in the long-run. Other advantages may include avoided environmental impacts caused by facility or supply expansions.

Indirect Costs

Significant indirect costs can result from a failure to properly integrate into a utility's operations and planning the effect of rates and rate design on customer demands. These indirect costs include revenue instability, equity issues between customer classes, and political and customer relations problems associated with raising rates or building additional capacity while customers are reducing their consumption.

To avoid introducing revenue instability, the relationship between demand and price must be carefully studied and balanced between avoiding the costs of system expansion and jeopardizing the financial integrity of the utility. If the rate structure decreases demand below a level that adequately sustains the utility's current revenue stream, it may be necessary to increase rates to cover fixed costs. Higher rates may, in turn, lead to additional customer conservation and, again, to higher rates. This spiraling effect on rates is not advantageous to either the utility or its customers.

Equity

Equity between customer classes with regard to their respective costs of service should be another concern of the utility manager in trying to induce DSM responses through rate design. Many different types of rate structures may be used to achieve certain conservation goals and the fundamental concepts of cost of service need not be abandoned for this purpose. For example, a utility that can achieve conservation savings by implementing an inclining block structure for the single-family customer class may find it difficult to justify this type of rate structure from a cost-of-service standpoint, if increasing system demands are driven by growth in the commercial and industrial customer classes.

EXAMPLE

The following example illustrates the importance of incorporating DSM, particularly the effect of price on demand, into utility planning. In this example, the existing water resources capacity of a utility serving a suburban community are being outstripped by growth in demand. To simplify the example, it is assumed that the utility serves only one customer class. The utility must invest in additional supply resources, apply DSM, or some combination of both, to meet its future demands. If the utility does not incorporate the effect of price on demand in its system planning (see Table 20-1, case A), it is estimated that active and passive conservation measures will slow demand growth by 3.7 million gallons per day (mgd) over the next five years.

On the other hand, if the utility reflects an educated allowance for the effect of price on demand in its demand forecast, using a price elasticity of –0.3, it is estimated that growth in demand will slow by an additional 8.4 mgd through the effect of higher rates alone (case B). Without accounting for the effect of price, the utility will likely make investments in supply resources to develop the 8.4-mgd surplus capacity that will be achieved through the passive effect of higher rates. Case C shows the effect of failure to incorporate the effect of price. The result is an overinvestment in additional supply capacity that drives up the price to the point that existing system capacity is available and additional supply capacity is unused. By accounting for the effect of price on demand, the utility may save the single-family ratepayer $0.20 in real terms per 1,000 gal, an annual savings of about $28 for a customer using about 138,000 gal per year.

Table 20-1 Rate impact of including price effects in demand-side management planning

	Year 1	Year 5: Case A (Price Effect Not Included)	Year 5: Case B (Price Effect Included)	Year 5: Case C (Price Effect Included)
Total System Demand Without Conservation, *mgd*	100.0	120.0	120.0	120.0
Price Elasticity of Demand for Single-Family Customer Class Less Conservation Measures			–0.30	–0.30
Price Elasticity of Demand*		0.0	8.4	17.2
Passive (Plumbing Codes)		1.7	1.7	1.7
Active (Toilet Retrofit Program)		2.0	2.0	2.6
Estimated System Demand With Conservation, *mgd*	100.0	116.3	107.9	96.4
Additional Supply Requirements for Which Infrastructure Investments Are Made, *mgd*		16.3	7.9	16.3
Annual Cost of Toilet Retrofit Program, *$ thous*		$1,688	$1,688	$1,688
Annual Cost of Estimated Required Investment in System Supply Capacity, *$ thous*		$9,454	$4,572	$9,454
		$11,142	$6,260	$11,142
Revenue Requirement, *$ thous*				
Increase for Toilet Retrofit Program and Supply Investment		$11,142	$6,260	$11,142
Existing Operations†	$25,000	$32,138	$32,138	$32,138
Total Annual Revenue Requirement	$25,000	$43,280	$38,398	$43,280
Average Single-Family Water Rate, *$ Nominal/thous gal*	$0.68	$1.02	$0.98	$1.20
Average Single-Family Water Rate, *$ Real/thous gal*‡	$0.68	$0.91	$0.87	$1.07

*A price elasticity of demand of –0.3 was assumed for the purposes of this example.

†Current operating costs are assumed to increase by 3 percent per year.

‡An average inflation rate of 3 percent per year was used to adjust nominal rates into real rates for the purpose of estimating the effect of price on demand.

SUMMARY

Demand-side management is often included as a part of the evaluation of the necessity for increased investments in supply resources and transmission and treatment capacity to meet future water supply reliability requirements. Water utilities should consider DSM as part of an integrated planning process, paying particular attention to understanding and forecasting system demands and the price responsiveness of demand. Recognizing that future rates can influence demands, a utility can potentially reduce its future needs for expansion and related costs by integrating the effect of price into a DSM program. Although there are many advantages of using pricing as part of a DSM program, the potential disadvantages of revenue instability and equity issues between customer classes must be considered.

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Chapter 21

Price Elasticity

Price elasticity of water demand measures the sensitivity of water use relative to changes in the price of water, after controlling for the influence of other factors that can also alter water demand, such as income and weather. Price elasticity measures the responsiveness of use to price changes. Estimating price elasticity is an important component of water revenue forecasting and rate design. If a rate change is anticipated, the water utility must consider its effect on usage and revenues.

Mathematically, price elasticity is the ratio of the percentage change in use to the percentage change in price. More specifically, price elasticity e is calculated as

$$e = \frac{\frac{\text{change in usage}}{\text{original usage level}}}{\frac{\text{change in price}}{\text{original price level}}} \tag{21-1}$$

Because there is an inverse relationship between price and use, price elasticity coefficients have negative values. Given a price elasticity of –0.30, for example, a 10 percent increase in water rates could produce a 3 percent reduction in water use. If water use is relatively responsive to rate changes, demand is described as price-elastic; price elasticity coefficients have absolute values exceeding 1.0 (e.g., –1.2). In contrast, if water use is relatively unresponsive to rate changes, demand is described as price-inelastic; price elasticity coefficients have absolute values less than 1.0 (e.g. –0.2).

GENERAL CONSIDERATIONS AND POLICY ISSUES

Price elasticity is not always used in determining the overall adjustment in rate levels needed to recover the utility's revenue requirements. In these instances, water demand is basically viewed as perfectly price-inelastic in the rates process (i.e., having price elasticity coefficients equaling zero); thus, the potential for price-induced use changes are ignored. However, demand forecasts should account for price effects on use as an essential element in developing accurate revenue forecasts.

Price elasticity is an important tool for estimating the effect of a rate change on water use and utility revenues. The omission of price elasticity from rate analysis creates the potential for revenue shortfalls. Shortfalls can be particularly traumatic for the utility if the rate structure is substantially modified (e.g., shifting from decreasing block to increasing block rates) or if a large rate increase is implemented.

In some cases, rates may not be a major influence on water use, for a variety of reasons. The price effect on usage can be small if there is little change in real water prices over time (real prices being actual prices adjusted for inflation). In addition, effects of rate changes can be dominated by the effects of other demand parameters, including temperature, rainfall, and household income. In other words, the response of actual use to rate changes can be relatively small when compared to the use responses to climatic and demographic factors.

Measuring the responsiveness of use to rate changes is further complicated by the timing or lags in consumer responses. Residential consumers may not immediately react to rate increases. In contrast, industrial users may immediately implement a variety of water cost reduction strategies. Finally, the conservation ethic among consumers in a specific locality can either enhance or impede use responses. The existence of a strong conservation ethic can produce substantial use reductions even with modest rate increases; the absence of a conservation ethic may result in only minimal changes in use.

HISTORICAL PERSPECTIVES

More than 100 studies of the effects of price on water demand have been completed during the past three decades. Most of these studies focus on either municipal demand or on residential demand; only a few examine commercial and industrial demand. These studies reach the following conclusions regarding the price elasticity of water service:

- Governmental customer demand is relatively price-inelastic.
- Price elasticity of residential demand is similar to that of municipal demand except when divided into seasonal (outdoor) and nonseasonal (indoor) uses, in which case, seasonal demand is more price-elastic than nonseasonal demand.
- Price elasticity appears to vary positively with rate levels, i.e., there is more use responsiveness at higher rate levels than at lower rate levels.

Each user class responds differently to rate increases. A review of elasticity studies indicates that the most likely price elasticity range for long-term overall (outdoor and indoor) residential demand is –0.10 to –0.30, with price elasticity coefficients for long-term industrial and commercial demand ranging up to –0.80. Commercial and industrial users usually reduce use in response to a rate increase by a larger proportion than residential users. A review of the water demand literature indicates that price elasticity of overall system demand can be difficult to interpret unless the weights of the individual demand sectors can be specified. In this context, price elasticity coefficients are comparable only for well-defined user classes.

Although relying on a literature review to estimate the price elasticity of water service for a specific locality is an imperfect approach, such a review can provide benchmarks or guidelines to establish reasonable price elasticity estimates. Existing demand studies do not help analysts predict actual usage responses to rate changes for other utility systems in other service areas. However, given the general nature of municipal and residential water demand, comparing demand studies for similar service areas can be appropriate for benchmarking purposes.

Additional study results contributing to the use of price elasticity in the rate determination process are summarized as follows:

- Wastewater charges affect the price-elasticity results (excluding usage-dependent sewer rates from analyses reduces the absolute values of the elasticity coefficients).
- Fixed charges affect water use (incorporating fixed charges in analyses produces higher short-term and long-term price elasticities).

  (These two conclusions indicate that consumers may react to average rates, which are a blending of service and use charges, and to total bills more than they do to the rate of the final block of use.)
- Rate design affects water use but not necessarily price elasticity. Price elasticities do not vary substantially across uniform, declining block, and inclining block rates.
- Each user class responds differently to rate changes. Price elasticities vary substantially across customer classes.
- The components of residential demand have different sensitivities to rate changes. Summer use is more sensitive to rate changes than is winter or domestic use, both in the short- and long-term.
- Water demand varies between peak and off-peak periods. Peak usage is more price-sensitive than off-peak usage.
- Geography affects usage responses to rate changes, e.g., usage sensitivity to rate changes in the Midwest tends to be less than in the Southwest.
- Consumer education programs affect price elasticities.
- A key factor is the change in real water prices. Use is more affected by increases in real (adjusted for effect of inflation) water rates than by increases in nominal water rates (not inflation adjusted).

In the rate-setting environment, important elasticity issues concern the validity and importance of price-elasticity estimates. As indicated above, price elasticities for different customer classes must be considered. For example, the usage patterns for large users are generally more price-elastic than the patterns of residential customers. Eliminating volume discounts (e.g., replacing declining block rates with a single uniform rate) may trigger a substantial usage response. Large users may reduce their use through efficiency improvements or bypassing the water utility for their own supply, resulting in revenue instability and revenue shortfalls. Revenue problems may be exacerbated if price elasticity is excluded from the rate-setting process.

EXAMPLES

To illustrate the importance of price elasticity in rate design, two hypothetical examples are provided. Examples are based on a water utility that has replaced its two-tier declining block rate structure with a uniform commodity rate. The example water utility has residential customers and one large industrial user.

The Residential Case

For residential customers, it is assumed that the shift from the declining block tariff to the uniform rate involves a 30 percent overall increase in rates. Under the declining block rate structure, it is assumed that the residential class is generating $600,000 of annual revenues for the water utility. A demand analysis for the water utility indicates that the long-run price elasticity for the residential class is approximately –0.20. The result of adopting the uniform rate is a residential use reduction of 6 percent.

Given that the residential class formerly provided $600,000 of annual revenues, the water utility cannot presume that residential revenues will increase to $780,000, a 30 percent increase. With a price elasticity factor of –0.20, residential revenues will most certainly be greater than $600,000 but will fall short of $780,000. If the price elasticity effect on residential usage is not incorporated in the rate-setting process, it will result in a revenue shortfall for the water utility.

The Large Industrial User Case

For the large user, it is assumed that the shift from declining block tariff to uniform rate results in a 60 percent increase in rates to this customer. Under the declining block rate structure, it is assumed that the large user generates $400,000 of annual revenues for the water utility. A demand analysis for the water utility indicates the long-run price elasticity for the large user is approximately –0.50.

The result of adopting the uniform rate is a use reduction of 30 percent for the large customer. Given that the large customer formerly provided $400,000 of annual revenues, again the water utility cannot presume that revenues from this large user will increase to $640,000, a 60 percent increase. Given the elasticity of demand for large customers, it can be assumed that the revenues from the large user will be greater than $400,000 but will fall short of $640,000. If the price elasticity effect on the use of the large user is not incorporated in the rate-setting process, again it will result in a substantial revenue shortfall for the water utility.

SUMMARY

The consequences of omitting price elasticity from the rate design process are becoming increasingly important. Evidence suggests that the price sensitivity of water use increases with the increase in real water rates. It is difficult to provide practical benchmarks for assessing how much effort should be expended on developing price elasticity estimates for a given service area. Where it is not cost-effective for water utilities to conduct demand studies, results of existing research can be used to develop benchmarks for estimating the usage effects of rate changes.

Chapter 22

Value-of-Service Pricing

Value-of-service pricing suggests a departure from conventional rate-making methods. Instead of analyzing and allocating costs alone, value-of-service pricing involves factors that reflect customer perceptions about the value of utility service, as well as their willingness to pay for different levels or types of service. In other words, value-of-service pricing considers customer preferences beyond those traditionally represented in cost-based pricing.

GENERAL DISCUSSION

Prices based on cost of service usually are considered efficient and fair from the standpoint of establishing prices for monopolistic service providers. Value-of-service pricing suggests the possibility of introducing criteria in addition to, or even instead of, costs when setting prices.

The value of service can be assessed in part by analyzing customer demand patterns. The effects of seasonal rates on usage, for example, indicate in part the value customers place on seasonal usage. Customer preferences also can be measured through surveys and related contingent valuation methods that address willingness to pay for services under various circumstances. Customers might be surveyed, for example, about how much they would be willing to pay for a higher degree of reliability or for additional treatment for a taste or odor issue.

Implementing value-of-service pricing is complex and raises a variety of concerns about equity, efficiency, and effectiveness. Value-of-service pricing has typically not been accepted by prevailing institutions. The central issue is that value-of-service pricing would introduce considerable uncertainty about revenues, as well as the potential for over- or underachieving revenue requirements. However, the concept of value might be incorporated into some elements of cost-based pricing.

Although not widely accepted or explicitly practiced, value-of-service pricing raises potentially important issues, particularly in the context of the utility's service orientation toward customers and the growing competition for customers based on service quality. Some methods of conventional rate making also incorporate ideas about the value of service and how costs should be allocated.

HISTORICAL PERSPECTIVES

The water industry has experienced persistent historical problems in conveying to stakeholders the value of service provided. Consumer expenditures for water are frequently lower than for energy or other household needs, giving the appearance to some that water is very affordable and less valuable. In some cases, prices might not have reflected the true cost of water service; the effect of underpricing is to understate water's true value. As prices rise, perceptions of value are affected. At low prices and high levels of reliability, customers might tend to undervalue water service, at least until a major service disruption is experienced.

In a rudimentary way, old-fashioned flat rates based on the number of water-using fixtures (which preceded metered rates) were an attempt to link prices both to utility costs and the value of service provided. Thus, a water bill based on whether or not a household had a sink and a bathtub not only roughly captured potential demand and the cost of service, but also reflected the value of indoor plumbing.

Rates for monopolies have been governed by cost-of-service principles to avoid exploitation of captive ratepayers. This is a particularly sensitive issue with respect to profit-motivated, investor-owned utilities. Utility services are considered essential and, unlike customers in competitive markets, water utility customers traditionally have had little or no choice about their service provider. Prices based on costs protect ratepayer interests and ensure that the utility remains financially viable.

Recently, the traditionally monopolistic utility industries have been exposed to the forces of competition, and competition's focus on prices and service quality. Prices that reflect the value of service can be consistent with the competition for customers based on perceptions of value. Competitive providers of desirable goods and services seek prices that cover costs and reflect the value that customers place on those goods and services. In highly competitive markets, however, efficiency drives prices toward costs.

The trend toward competition has heightened awareness of customer service issues. Although this trend does not necessarily translate into value-of-service pricing, it does raise the possibility for evaluating prices in terms of if and how well they reflect both the cost and value of service. Prices that incorporate consumer preferences can help promote economic efficiency in terms of resource allocation.

ADVANTAGES AND DISADVANTAGES

This section discusses the advantages and disadvantages of value-of-service pricing in terms of simplicity, equity, revenue stability, conservation, and implementation.

Simplicity

Value-of-service pricing is considerably more complex than other pricing methods. A reasonable method of determining value must be established, understood, and accepted by customers. Customers might find it difficult to accept a pricing methodology that departs from the cost-of-service approach.

Equity

Value-of-service pricing is perceived as equitable by those who believe that prices should reflect differences in value and who also agree with the valuation methodology. However, value-of-service pricing clearly challenges the conventional perspective that cost-based rates (i.e., costs are allocated through prices to those who cause the costs) are fair and equitable. Some forms of value-of-service pricing might be considered highly inequitable in terms of their effects on different customer groups. For example, pricing approaches that allocate costs to the least price-elastic (or most captive) customers might be considered inequitable.

Revenue Stability

Value-of-service pricing might enhance revenue stability if a substantial share of revenues come from highly valued services with relatively stable patterns of demand. Likewise, the volatility of demand for services with low values might not present a significant problem if these services account only for a small share of revenues. However, the disconnect between costs and values, the potential for costs to exceed perceived value, and the uncertainty associated with setting prices based on values, also mean that value-of-service pricing can introduce revenue instability and the possibility of revenue excesses or shortfalls.

Conservation

Value-of-service pricing can be consistent with conservation goals. Some analysts might find, for example, that marginal cost pricing reflects the value of service more accurately than average cost pricing. Some variations of value-based pricing, however, might be inconsistent with conservation goals.

Implementation

Implementing value-of-service pricing is difficult and potentially costly. Implementation involves establishing a method for measuring consumer preferences, incorporating this information into rates, and gaining acceptance from rate-making bodies and consumers who are accustomed to cost-based rates. Changes in values must be translated into changes in rates.

EXAMPLES

Value-of-service pricing can be demonstrated by a number of examples, some of which have been implemented to some degree in the broader context of cost-of-service rate making.

Demand-Based Pricing

Different customers demonstrate different responses to changes in prices and these patterns reflect, to some extent, how service is valued. According to one pricing theory (known as *Ramsey pricing*), customers who are less responsive to changes in price (those with price-inelastic demand) should be charged more than customers who are more responsive to changes in price (those with price-elastic demand). This kind of pricing generally translates into price breaks for large-volume customers (who might have more supply options) and higher prices for residential customers (who are captive to the utility monopoly).

Reliability Pricing

Reliability pricing can be used to offer some customers, usually large-volume customers, a price discount based on their willingness to accept the possibility of a service interruption during an emergency or shortage. Conversely, customers requiring a high level of reliability are charged more for this benefit. Reliability pricing also can be cost-based.

Quality-Based Pricing

Drinking water must be treated to meet federal and state standards. However, these standards do not extend to all variations in water quality, including some variations in pressure, taste, and odor. Customer preferences about these service characteristics are expressed in part through the market for end-use treatment devices and bottled-water purchases. Within certain limitations, customer preferences can be measured and used to adjust service quality levels by the water utility.

Water-Reuse Pricing

Another variation in water quality is between potable water and graywater. Prices vary for these types of water because of differences in costs and value. Drinking water, which must meet drinking water standards, has a higher value than water used for other purposes (particularly outdoor uses). The use of graywater in some areas has been promoted by establishing a low, fixed charge for unlimited usage.

Property-Value Pricing

In Great Britain, charges to unmetered customers are based on rateable property values; customers with more expensive properties pay more for service than customers with less expensive properties. Owners of expensive properties with expensive landscaping might value outdoor water use to a higher degree than others.

Water distribution systems are, in part, designed to meet fire-protection standards and this fact is not easily reconciled with the allocation of costs based on patterns of usage unrelated to fire protection. Conventional rate design methods might not fully recognize the value that fire protection brings. Thus, another rationale for varying water prices based on property values is that properties with more value have more to lose in case of a fire.

Single-Tariff Pricing

Single-tariff pricing applies a common rate structure to all water systems operated by the same utility, regardless of interconnection. Single-tariff pricing averages spatial differences in costs and smoothes temporal differences in rate changes. Some utilities have justified this approach because all customers of the common utility are provided service with a comparable value at a comparable price.

Negotiated Rates

Some water utilities have had occasion to negotiate rates with large-volume users, including wholesale customers. Negotiated rates might be premised on the cost of service, but the negotiation process can introduce other values and preferences.

SUMMARY

Value-of-service pricing is a complex and controversial subject. Ideally, the price of water reflects both its true cost and value. This unrealistically assumes that agreement can be reached about how to measure costs and preferences in the first place.

Actual experience with value-of-service pricing is limited, and little guidance is available for implementation purposes. Rates institutions often favor more familiar methods of cost-based pricing. Nevertheless, in more competitive environments, pricing experiments might become more common. Cost-based prices, while also incorporating customer preferences, could further certain service and efficiency goals.

Chapter 23

Drought Pricing

During drought situations, a water utility typically has two overriding objectives. One objective is to quickly reduce the volume of water used by its customers. This reduction is usually accomplished by a combination of actions, such as appealing to customers to voluntarily reduce water demands, limiting or discontinuing water supplies to any interruptible customers of the system, placing mandatory restrictions on discretionary water uses (usually outdoor uses such as irrigation and car washing), and increasing rates or adding surcharges as incentives to reduce water demands. The goal is to limit demands on water supplies made scarce by the drought.

The second objective is to maintain adequate revenues to meet system revenue requirements. To the extent that the first objective (i.e., water use reduction) is being met, it is often correspondingly more difficult to meet the second objective. To deal with this situation, many utilities draw on financial reserves. Sometimes these reserves include specific rate stabilization funds established to provide funds during years of low water sales. Another approach is to implement a form of drought pricing designed to recover revenue shortfalls.

GENERAL CONSIDERATIONS

While several forms of drought pricing exist, their common objective is to achieve a targeted reduction in sales proportional to the severity of the drought while maintaining the utility's financial integrity. Drought pricing approaches may be in the form of an overlay to a utility's existing rate structure (such as a surcharge), or may be a separate rate structure implemented during the emergency.

Types of Drought Pricing

The following is a discussion of several drought pricing options.

General rate surcharge. One method for rate setting during a drought is to implement a drought surcharge on all commodity rates. For example, all volume rates (regardless of the rate structure) could be increased by a specific percentage estimated to both yield an acceptable level of demand reduction and generate required revenues. The utility may choose to adopt a schedule of surcharges based on increasing levels of targeted reductions in sales that correspond to increasing levels of supply shortages.

Public acceptance is likely to be greater for this option than for other options, because it is perceived that all customers are being treated equally. A general surcharge is relatively easy to explain to customers and implement for bill calculations. A disadvantage of this method is that it may not target those users who are most likely to be able to reduce water demands or most likely to respond to price changes. A general rate surcharge could also result in negative economic effects on the community that could be avoided with a different approach. An understanding of the characteristics of the utility's customer base helps the utility to decide the merits of this approach.

Individualized rate surcharge. Another approach is to apply surcharges to users whose water demands exceed a specified percentage of their base-period water use. For example, the utility might apply a 25 percent surcharge to any customer with water use greater than 80 percent of that customer's average demand during a previous base year. This approach sets a clear water reduction target for each individual user and provides conservation incentives to all customers. A significant disadvantage is that customers who have already undertaken conservation measures and use water efficiently have the lowest potential for avoiding the surcharges, and customers whose water use has been the least efficient have the greatest opportunity for avoiding the surcharges. Therefore, previous conservation efforts are penalized, which may raise customer expectations for an appeals process.

Class-based rate surcharges. A variation of the surcharge approach is to establish quantity limits per customer for different classes of users and to apply a surcharge to any user exceeding the limit for that class. This approach does not penalize users who are already conserving water, but it requires that reasonable targets be set for each class.

The target-setting can be performed in a reasonable and equitable manner for single-family and multiple-family residential customers, with the latter group being set on a per-dwelling unit basis. However, variations within a class, such as household size, lot size, or presence of a pool, may cause concerns for some customers in regard to setting the use level. Agricultural and irrigation limits might be based on the type of crop or plant being watered and the acreage.

It is more difficult to set fair quantity limits for commercial and industrial customers than residential customers. Because of the extreme diversity in the number, types, and sizes of commercial and industrial customers, specific quantity targets or rate limits are unreasonable for a large number of these customers. The economic effects of setting limits on use for the business sectors should also be evaluated.

Targeted rate increases. A utility could target certain customer classes for rate increases. Such classes would include those that could reduce water use or classes whose demands are deemed to be partially discretionary. For example, rates to one class might be increased by a given percentage and rates to another class might be changed by a different percentage. This approach avoids affecting customers whose water demands are extremely inelastic or are desirable from a public health or other policy perspective. However, a significant disadvantage is that this method may be applied arbitrarily or give the appearance of unfairly singling out some groups for rate increases.

Marginal cost rates. During a drought, a utility typically has limited water supplies. Presumably an additional water supply would alleviate the water shortage, unless the shortage is exceptional. Because of the implied costs associated with supplies, it is consistent in a drought emergency for a utility to implement some form of marginal cost pricing. This pricing method is typically based on the unit cost of the next increment of supply, so pricing water equal to the marginal cost per unit usually reflects the implied unit cost of alleviating or mitigating the water shortage. Stated another way, each unit of water used by a customer during a drought puts additional pressure on the utility to build the next increment of supply. If this pressure is real, pricing at marginal cost rates sends a signal indicating the ultimate cost of that water to customers. That ultimate cost is the amount of O&M expense and the capital cost incurred for the additional supply facilities to meet that demand, which is the total marginal cost.

Marginal cost rates can be charged for all water use during a drought emergency. This approach is usually recommended by traditional economists. A practical approach in most situations is to use the marginal cost rate as the last block in an inverted block rate structure. This is also an application of marginal cost pricing commonly used in utility rates.

The benefits of marginal cost pricing in a drought include the link between the implied need for additional supply and the price (outlined above), the likelihood that adequate revenues will be generated if the marginal cost rate is sufficiently high (because water is a relatively inelastic commodity), and the strong price signal sent to users. However, a drawback to the last block version is that only the largest users receive the price inherent in the high marginal cost rate. Small and moderate users do not receive the strong incentives, and therefore only large users are targeted for demand reductions. Also some users may find it difficult to pay for the water they need under either application of this method.

Policy Issues

In planning for droughts, a utility should anticipate budgetary effects in order to project realistic revenue requirements. The effects of austerity measures to reduce costs, as well as the effects of any actions that will incur additional costs, must be identified. Ideally the utility will include drought pricing as part of an integrated resource plan that addresses a wide range of factors.

Customer acceptance and ease of implementation are other important considerations in selecting a drought pricing approach. In general, customers expect their water conservation efforts during a drought to be rewarded. Unless the utility is able to convey to its customers that respond appropriately to a drought emergency that they are not being penalized, a potential backlash may develop. Should such a backlash occur, the negative effect on customer relations is likely to linger long after the emergency is over. A vigorous educational campaign can help the utility in explaining the drought pricing rationale and gaining its acceptance by its customers.

Having a drought pricing plan adopted in advance helps a utility to focus media attention constructively on the utility's message to its customers, and minimize negative or controversial news stories about billing effects and policies. Protracted public debate during an emergency about equity issues and pricing options can seriously undermine a utility's efforts to convince its customers of the wisdom of the plan that is eventually adopted. Public utilities should consider adopting rules that automatically trigger drought pricing when an emergency is declared by their governing body. Such automatic triggering policies should be periodically promoted so as not to come as a surprise if a drought emergency occurs.

Implementation of drought pricing can be complicated, expensive, and time-consuming to plan and administer. The capacity of the utility's billing system, including the computer programming, data storage, and bill print capability, usually limit the options that realistically can be implemented. The need for thorough planning and testing is another reason for having drought plans in place and ready to be implemented before emergencies occur.

HISTORICAL PERSPECTIVES

Rapid growth in urban demand, limited regional water supplies, and a growing public concern for environmental issues has increased interest in water resource management and pricing strategies. New standards for water quality limit water supply options for many utilities in times of drought, adding to concerns for long-range planning. As a result, quantitative analysis in the areas of water supply reliability, the economic effects of water supply shortages, price elasticity, and customers' willingness to pay for improvements have advanced.

Recent experiences of water utilities in managing droughts in the past decade provide a wealth of experience with a variety of drought pricing approaches. Successful efforts have ranged from voluntary programs with modest rate increases to water rationing coupled with sharp penalties. Public debate was often intense, and water utilities had a difficult job explaining the problem of covering fixed system costs to their customers who were being asked to use less and pay more. It is clear from recent experience that no single drought pricing strategy is the best answer. Customer acceptance and cooperation is essential to the success of any approach, and the key to success is sound policy decisions and effective communication.

ADVANTAGES AND DISADVANTAGES

Drought pricing has the advantage of conveying a price signal to customers that helps to reduce overall demand. It is possible to design the pricing to reward customers that reduce demand and place much of the cost burden on customers that are willing and able to pay. However, water as a commodity is uniquely valued by the public, and any drought pricing approach risks raising the ire of a utility's customers. That disadvantage can be overcome to some extent by designing pricing to be in proportion to the degree of the emergency and by getting the public involved in policy decisions.

A rate stabilization fund is an alternative to implementing drought pricing, assuming that demand management goals will be accomplished by other means. The reserve fund may be based on a surcharge added to rates during nondrought years and removed when a specified reserve fund ceiling is achieved, or it may be factored in the calculation of base rates. This approach has the advantage of avoiding the sting and controversy that may accompany drought pricing, but it does not take advantage of the conservation price signal that can be sent with some form of drought rates. Reserve funds are also subject to criticism for reducing customers' financial resources and may be raided if restrictions on permitted uses of the fund are not firmly in place.

EXAMPLE

In this example, the rate approach during a drought is triggered according to the severity of the drought. For increasing levels of severity, more aggressive pricing policies are implemented as part of a comprehensive drought management plan to reduce water demand.

During the first phase of a drought, an equal rate surcharge is applied to all commodity rates. This is instituted when a declaration is made that a drought emergency exists. With an average price elasticity response of –0.1 to –0.2 for a relatively large change in price, a 25 percent increase in the commodity charge would yield a demand reduction of about 3 to 5 percent, all other factors remaining constant. Other drought responses could add to this reduction. In the example, lifeline rates are exempt from the surcharge. However, the decision to apply price incentives to the smallest users with low incomes as well as other customers is a policy matter.

If the drought situation worsens, a marginal cost block rate is implemented (in addition to the surcharged rate). The last block for single-family users would be increased to the marginal cost rate. Multiple-family water use beyond a certain level per dwelling unit would also be subject to the marginal cost rate. For commercial and industrial users, the marginal cost rate can be used as a second rate block set at a percentage of the use in the comparable period during the previous year. For example, the marginal cost rate might apply to water use exceeding 80 percent of that customer's water use in the comparable months in the previous (nondrought) year. To minimize any penalty in this approach for users that have already undertaken extensive conservation activities, commercial and industrial customers who have implemented the recommendations of a water audit are exempted from the marginal cost rate—the regular rate would apply to all of those customers' water use.

Finally, if the drought situation became extreme, the utility might charge the marginal cost rate to all water use for all classes, except perhaps to the users paying under a lifeline rate. The marginal cost rate would provide the maximum possible incentive for water demand reductions. Ultimately, the utility would also curtail certain water uses.

This example for drought rate adjustments is summarized in Table 23-1. A utility should carefully plan the details for implementation. This phased-in approach to rate

Table 23-1 Drought pricing example

	Price, *$/thous gal*			
Customer Class	Nondrought	Moderate Drought	Severe Drought	Critical Drought
Single-Family Residential				
Lifeline Rate (if applicable)	$0.75	$0.75	$0.75	$0.75
Block 1	$1.20	$1.50	$1.50	$2.90
Block 2	$1.40	$1.75	$1.75	$2.90
Block 3	$1.60	$2.00	$2.90	$2.90
Multiple-Family Residential				
Block 1	$1.25	$1.56	$1.56	$2.90
Block 2	$1.25	$1.56	$2.90	$2.90
Commercial/Industrial				
Block 1	$1.30	$1.63	$1.63	$2.90
Block 2	$1.30	$1.63	$2.90	$2.90
Irrigation				
Block 1	$1.30	$1.63	$1.63	$2.90
Block 2	$1.30	$1.63	$2.90	$2.90

NOTES:
1. Single-family rates assume a lifeline rate.
2. Multiple-family blocks are based on a specified use per month.
3. Block 2 for commercial/industrial and irrigation would apply at 80 percent of the nondrought period average for that user.
4. Definitions of drought levels would need to be defined in an implementation plan.
5. The marginal cost of new supplies is determined to be $2.90 per thous gal.

setting in a drought is designed to reduce water demand and yet maintain as much of the revenue stream for the utility as possible under various levels of water shortage.

SUMMARY

Drought situations raise serious problems for most water utilities in terms of resource management, revenue sufficiency, and customer relations. A utility can follow several pricing approaches in planning for such emergencies, including surcharges, targeted rate increases, and marginal cost pricing. The characteristics of the utility's customer base, water supply, and constraints on resources should be evaluated in tailoring an approach that will best meet the utility's needs. Careful planning and effective customer communication will optimize the likelihood of a favorable outcome for all concerned.

Chapter 24

Rate Surcharges

A rate surcharge is a charge added to current rates to collect a targeted amount of revenue, generally more than the utility's current annual revenue requirements. Water utility rate surcharges are not frequently used, but in certain circumstances, can be an effective tool for meeting the utility's short- and possibly long-term financial requirements. These rates are usually placed into effect for limited periods and have a specific revenue target, often directed toward emergency purposes, or to establish a reserve fund. The term *surcharge* is often interchangeable with the term *excess-use rate*. For example, an inclining block rate may have a block for excess use that some individuals may refer to as a surcharge. However, for purposes of this chapter, the term *surcharge*, and the focus of this discussion, will apply to situations such as a drought or disaster surcharge or to the buildup of a reserve.

GENERAL CONSIDERATIONS

A rate surcharge is, as the name implies, an amount charged in addition to the rates currently in effect. Surcharges are generally implemented for a specific purpose (issue) and for a specified period of time. In many cases, these additional charges are not labeled as surcharges, but are in reality a form of a surcharge. A charge to develop a rate stabilization fund is an example of a surcharge not directly labeled as such.

As with establishing all water rates, careful consideration should be given to implementing a rate surcharge. For utilities regulated by a public service commission, the ability to implement rate surcharges is subject to regulatory approval. Public utilities generally have more flexibility in the policy decision to establish a surcharge rate. The reason for the surcharge must be readily understood and valid from the customer's perspective.

Some common reasons for implementing rate surcharges include the following:

- supplying funds for significant one-time financial and cash-flow burden on the utility caused by a natural disaster and the need for emergency infrastructure repairs

- paying for additional costs associated with emergency water supplies for severe drought conditions
- developing a rate stabilization fund in anticipation of the need for a major rate change
- prefunding a major capital project to minimize long-term rate impacts
- providing timely revenue recovery and rate stability in connection with water distribution system improvements.

The first reason listed for implementing a surcharge involves emergency infrastructure repairs required as a result of a natural disaster. As an example, an earthquake is a highly unusual occurrence that can create the need for massive expenditures for repairs. In that case, implementing a surcharge would be one method of dealing with the financial aftermath of the disaster. Generally, the surcharge would be instituted for a specified period of time and to collect a specified amount of revenue.

The second reason for a surcharge—to cover the additional costs associated with obtaining emergency water supplies during a severe drought—was used in California during the late 1980s and early 1990s. The surcharge covers the cost of emergency water supplies and purchases. In essence, these surcharges simply pass along the additional cost of acquiring these high-cost water resources to the current users who require the water supply. In some cases, because of the extreme level of the surcharges, it may also provide an additional price incentive for customers to conserve water.

The next reason a surcharge may be implemented is in developing a rate stabilization fund. The purpose of the surcharge in this case is to develop a fund that will be used at a later date to phase-in a major rate change. In essence, funds are collected over a period of time, and then at the time of the major rate change, rates are not adjusted to the full level of then existing revenue requirements. The rate stabilization fund is drawn down and used as a financial resource to meet a portion of the utility's revenue requirements. Rates are gradually increased, while the rate stabilization fund is drawn down. While rate stabilization funds have not been used extensively in the water utility industry, they have been used effectively in the electric utility industry, often to transition from one power supply resource to another when significant cost differences exist between the two resources.

Another situation in which a surcharge may be effective is in accumulating funds for a major capital project. For example, if a water utility needs a major expansion of the water treatment plant, a surcharge may be put in place to prefund the project. This prefunding helps to minimize long-term borrowing and, at the same time, minimizes rates over time. It should be understood that prefunding typically does not cover 100 percent of the capital construction cost of the improvement. This approach typically funds only a portion of total project costs.

Finally, surcharges are now being used to help water systems accelerate the pace of needed improvements to the water delivery system. With the approval of state legislators and utility regulators, investor-owned water utilities in Pennsylvania are implementing a Distribution System Improvement Charge (DSIC). By allowing utilities to make incremental rate adjustments to pay for improvements, the mechanism enhances rate and revenue stability, reduces regulatory lag, and lengthens the time between formal rate cases. Less frequent rate cases reduces rate case expenses for all parties. The DSIC mechanism is subject to a cap, a reconciliation audit process, and reset provisions to protect ratepayers.

HISTORICAL PERSPECTIVES

Rate surcharges have been used when a specific situation dictated the financial need for such charges. Given the political sensitivity of implementing surcharges, it is clear that there must be compelling reasons for their use, and that their use is somewhat limited. As noted previously, in many cases surcharges under different names are used by utilities. Regardless of the term used, it is important to be clear about the need for and the use of the surcharges. For example, capital projects may be prefunded within the revenue requirements and the surcharge buried within implemented rates. From a strict cash flow basis, this excess collection of revenues would be considered a surcharge on the rates.

ADVANTAGES AND DISADVANTAGES

This section discusses the pros and cons of rate surcharges in terms of simplicity, equity, revenue stability, conservation, effect on customers, and implementation.

Simplicity

For the most part, rate surcharges are simple to understand, implement, and administer. Surcharges can be applied and collected in different ways, but utilities typically strive to implement a surcharge that is easy to administer, given the typical short-term nature of this type of charge.

Equity

The issue of equity can often be addressed by considering the specific circumstances that create the need for the surcharge and the way in which the surcharge is collected. For equity to prevail, there should be a reasonable relationship between the use of surcharge revenues and the reason for the charge.

Revenue Stability

By definition, a rate surcharge is assessed to collect revenues above those generated from existing rate levels. Accordingly, no major issues are usually associated with revenue stability. However, in a limited number of case studies, the issue of consumption patterns after the surcharge has been removed has drawn some attention. In essence, when severe drought conditions exist and large surcharges are put in place, it often takes time for customers to readjust their consumption back to normal levels after the drought subsides. For that reason, consideration should be given to this rebound effect in projections of revenues and consumption subsequent to a surcharge.

Conservation

Depending on the situation and the reason for the surcharge, these rates can offer tremendous potential for conservation. As noted previously, in periods of emergency supply shortages or droughts, a surcharge can be both an effective tool for revenue generation and to encourage conservation. However, in most other situations, rate surcharges have a limited effect on long-term consumption levels.

Effect on Customers

The effects of rate surcharges on customers vary in relation to the level of the surcharge and the length of time the surcharge is in effect. In most cases, the relative effect on individual customers is minimal. If there appears to be a major effect on customers, then consideration should be given to implementing surcharges over a longer span of time to minimize those effects.

Implementation

Implementing rate surcharges should be easy and straightforward. In the planning process, the utility should strive for an approach that is equitable, easy to implement, and easy to administer.

DETERMINING RATE SURCHARGES

Determining rate surcharges is a fairly simple matter, but the method of collection can take many forms.

Fixed Amount

The surcharge is a fixed amount or flat rate applicable to all customers, i.e., each customer's bill includes a fixed dollar amount surcharge. For example, each customer may be charged a $5.00 surcharge on their bill regardless of the volume of usage or the type of customer. This may be an appropriate and equitable approach to addressing surcharges in limited situations.

Volumetric

This surcharge approach is typically more equitable and more commonly used. The volumetric charge (all rate blocks) is increased in a uniform manner. This usually implies an equal percentage adjustment across all rate blocks (e.g., a 5 percent surcharge).

Inverted Block

The inverted block method is more specific in the customers that it targets. In this method, the surcharge may be placed on a specific level of excess usage. For example, only the tail block has a surcharge placed on it, or any usage over a specified consumption level is surcharged. In cases of drought, this may be an appropriate response, particularly in the early stages of the drought. This approach is more complex than the other surcharge methods and will be more volatile with consumption changes.

Percentage Bill

This approach simply places a fixed percentage surcharge on the total bill of the customer. The percentage bill approach is simple and straightforward and can be accomplished in two different ways. First, each of the rate components of the entire rate structure may be increased equally to produce the incremental amount of revenues. Alternatively, the bill can be computed at current rates, and then a percentage surcharge placed on top of that amount.

SUMMARY

In certain situations, rate surcharges can be an effective means of financially protecting the utility during periods of severe drought, natural disaster, or in building necessary reserves for future requirements. While rate surcharges have limited application and may be politically sensitive to implement, they can help stabilize rates over the long term and provide other nonfinancial benefits, such as conservation incentives during drought periods.

Chapter 25

Indexed Rates

Some utilities seek annual rate adjustments driven primarily by the need to keep pace with the rate of inflation. Rate indexing provides an alternative to a comprehensive rate proceeding (such as a rate case for an investor-owned utility). Indexing enables periodic adjustments to rates based on changes in a generally accepted cost or price index, usually the national Consumer Price Index (CPI). Other indexes, such as the gross domestic product with implied price deflator (GDP-IPD), can be used as well. Rate indexing ensures that rates keep pace with overall inflation, but it does not ensure that rates will be adequate when costs escalate at a pace greater than inflation or when additional investments are needed to maintain or upgrade the water utility system.

GENERAL CONSIDERATIONS

Rate indexing allows for regular and relatively simple rate adjustments based on overall fluctuations in costs or prices. During inflationary periods, rates might fail to produce revenues that meet the utility's requirements. The CPI has been used to calibrate rate changes based on the rate of national price inflation. Thus, a percentage increase in consumer prices can be translated into a comparable percentage change in utility rates.

Some of the state public utility commissions that regulate water utilities have used indexing as a method of greatly simplifying the rate-making process, particularly for smaller water utilities. The indexed rate adjustment substitutes for a more lengthy and sometimes cumbersome regulatory review of costs and rates. Indexing is a less costly way to adjust rates, both for utilities and regulatory agencies. A generic order can be issued periodically (usually annually) to specify the allowable rate increase. Utilities typically must file appropriate forms with regulators and notify customers of the change in rates. Rate indexing also can be combined with other automatic cost-adjustment mechanisms sometimes used for such items as purchased water, energy, and taxes.

In the regulatory context, rate indexing also can be used with alternative rate-making methods (such as efficiency-oriented incentive regulation or price caps), which impose less regulatory oversight and allow greater pricing flexibility on the part of utilities. Great Britain uses indexing along with its price-cap model of regulation for the nation's large regional water systems. The Office of Water conducts a periodic review to determine allowable changes in prices. For larger systems, a price-cap model with an inflation adjustment could provide a new system of performance incentives.

Price indexing might be considered for smaller utilities who need to make more frequent rate adjustments to keep pace with inflation and for larger utilities in the context of incentive-based regulation. For utilities of various sizes, indexing also can help bridge the years between comprehensive cost-of-service studies.

HISTORICAL PERSPECTIVES

Experience with rate indexing is relatively recent. Indexing for smaller systems is closely tied to the concern that small systems might need more frequent rate adjustments but also might be unduly burdened by comprehensive cost and rate evaluations. Only a limited number of regulatory commissions use rate indexing and this approach is limited to qualifying utilities that also may be subjected to other forms of review.

Indexing for larger systems is related to alternative regulatory methods being explored for increasingly competitive telecommunications and energy utilities. When Great Britain privatized its utilities in the 1980s, price-cap regulation was favored over the ratebase–rate-of-return method used in the United States. Setting price caps involves a sophisticated form of indexing that recognizes inflationary factors while also promoting efficiency and other goals. Utilities have flexibility in pricing as long as rates remain under the charging limit.

ADVANTAGES AND DISADVANTAGES

The following paragraphs examine the advantages and disadvantages of rate indexing in terms of simplicity, equity, revenue stability, conservation, and implementation.

Simplicity

Simplicity is a key advantage of rate indexing. The simplicity of rate adjustments tied to inflation also tend to enhance customer understanding and acceptance.

Equity

The equity of rate indexing depends on the equity of the initial rate structure, as differentials among customer and service classifications are maintained. Inequities built into initial rates are not remedied through simple indexing. Also, emergent cost-of-service differentials among classes of service are not recognized if indexed changes are uniformly applied. For example, if a cost increase is related to the need for capacity for peak demand, price increases that do not allocate costs proportionately to peak users might be considered inequitable.

Revenue Stability

Rate indexing ensures that revenues grow at the rate of inflation, neither more nor less. If costs rise below the inflation rate, revenues might be in excess of the cost of service; if costs rise at a rate above the inflation rate, revenues might be insufficient to cover the cost of service.

Rate indexing is particularly problematic if historical underpricing has occurred or if significant cost increases are experienced because revenue shortfalls will be maintained or increase over time. Rate indexing also is insufficient to ensure adequate investment in utility infrastructure. Finally, rate indexing provides no incentive to control costs beyond what is needed to keep cost increases in line with inflation.

Conservation

Rate indexing can have mixed implications for conservation. Maintaining real water prices (that is, inflation-adjusted prices) at a constant level means that price changes will not induce water-usage changes. Price increases below the rate of inflation can encourage use; price increases exceeding the rate of inflation can discourage usage. If costs are increasing at a rate greater than inflation, simple indexed rates might not send an efficient, conservation-oriented price signal.

Implementation

Changes in rates tied to the CPI can be implemented relatively easily and at a lower cost than full rate reviews. Rate-setting bodies must specify the approved indexing method, rate, and the procedures by which it is used. Customers usually must be notified of the rate change.

The ease of rate indexing might be attractive to utilities and rate regulators, but indexing should not be used to avoid an appropriate review of costs and cost allocation, particularly during periods of growing costs and changing cost profiles. Indexing could unduly postpone investments and accompanying rate adjustments needed to maintain adequate service.

EXAMPLE

A simple example of rate indexing based on the rate of inflation is provided in Table 25-1. The price charged in the base year is simply adjusted upward by the inflation rate (as expressed in a percentage).

The British model of rate indexing is considerably more complex. Price limits are defined according to inflation but also adjusted for a *K* factor. The charging year begins in April and inflation rates for the preceding November are used to set charging limits. The *K* factor is applied in accordance with a formula set forth in the each water company's license. Annual price increases are limited to what the Director General of Water Services believes is necessary to finance water service. The director does not approve tariffs, as in the US model of regulation, but instead ensures that price adjustments are consistent with each company's charging limit.

In the 1994 review, price adjustments were based on a *K* factor and defined simply according to anticipated expenditures for improving quality (+*Q*) and efficiency improvements (–*X*). The proposed framework for the 1999 periodic review expands the composition of *K* to include several factors, including efficiency gains

Table 25-1 Simple rate indexing based on inflation

Year	Rate of Inflation, *Percent*	Price Increase, *\$/thous gal*	Price, *\$/thous gal*
Base year	—	—	0.8300
First-year adjustment	3	0.0249	0.8549
Second-year adjustment	5	0.0427	0.8976
Third-year adjustment	4	0.0359	0.9335

delivered (*Po*), expected efficiency in the future (*X*), expenditure on quality enhancements (*Q*), enhanced service levels expenditure (*S*), and a supply–demand balance expenditure (*V*) (Office of Water Services 1997).

SUMMARY

Price indexing through the use of an inflation adjustment might be useful for reducing the cost of regulation and maintaining the revenues of small systems, but it does not ensure that additional investments in maintenance or improvement will be made. The ease of implementing an indexing rate runs the risk of postponing needed cost and rate reviews. Thus, inflation adjustments should be used with caution.

For larger water utilities, particularly regulated investor-owned utilities, rate indexing could be used in conjunction with an alternative model of rate regulation (such as price-cap regulation) to provide pricing flexibility along with different efficiency and performance incentives. This would be a major departure from conventional practices in rate setting, especially for water utilities.

Section VI

Capacity and Development Charges

Connection and Customer Facility Fees

Policies and Procedures for Water Service Extension

System Development Charges

Dedicated-Capacity Charges

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Chapter 26

Connection and Customer Facility Fees

The cost of constructing lines and facilities to dedicate, expand, or extend service capability and to connect new properties to a water system can be recouped through capital cost recovery mechanisms. Capital cost recovery has been handled in various ways.

As water rates increase, separate capital charges are often considered as a way to relieve, reduce, or forestall general rate increases. Typically, capital charges are used where costs and revenues are significant, specific beneficiaries or customers can be clearly identified, and associated costs can be reasonably and accurately determined. Examples of special capital charges include fees related to costs for facilities installed between the water main and property line or for facilities located on the customer service site.

It is common policy for government-owned utilities to recover directly from the customer the costs of installing a tap or connection to a water main, the service line to the property, and the water meter. Many utilities have developed a standard connection and customer facility fee schedule based on meter or connection size. Other utilities develop customized charges based on site-specific costs. Still other utilities use a combination of standard and customized fees. In most cases, the fee is assessed when the customer or agent applies for new or expanded water service. In general, such fees increase with the size of the meter or connection and, in the case of customized charges, with the complexity and conditions of the service site.

This chapter addresses policy, cost, and pricing assumptions and concerns related to establishing customer facility and connection fees in the following areas:

- allocation of costs
- capital cost component
- calculation of charges

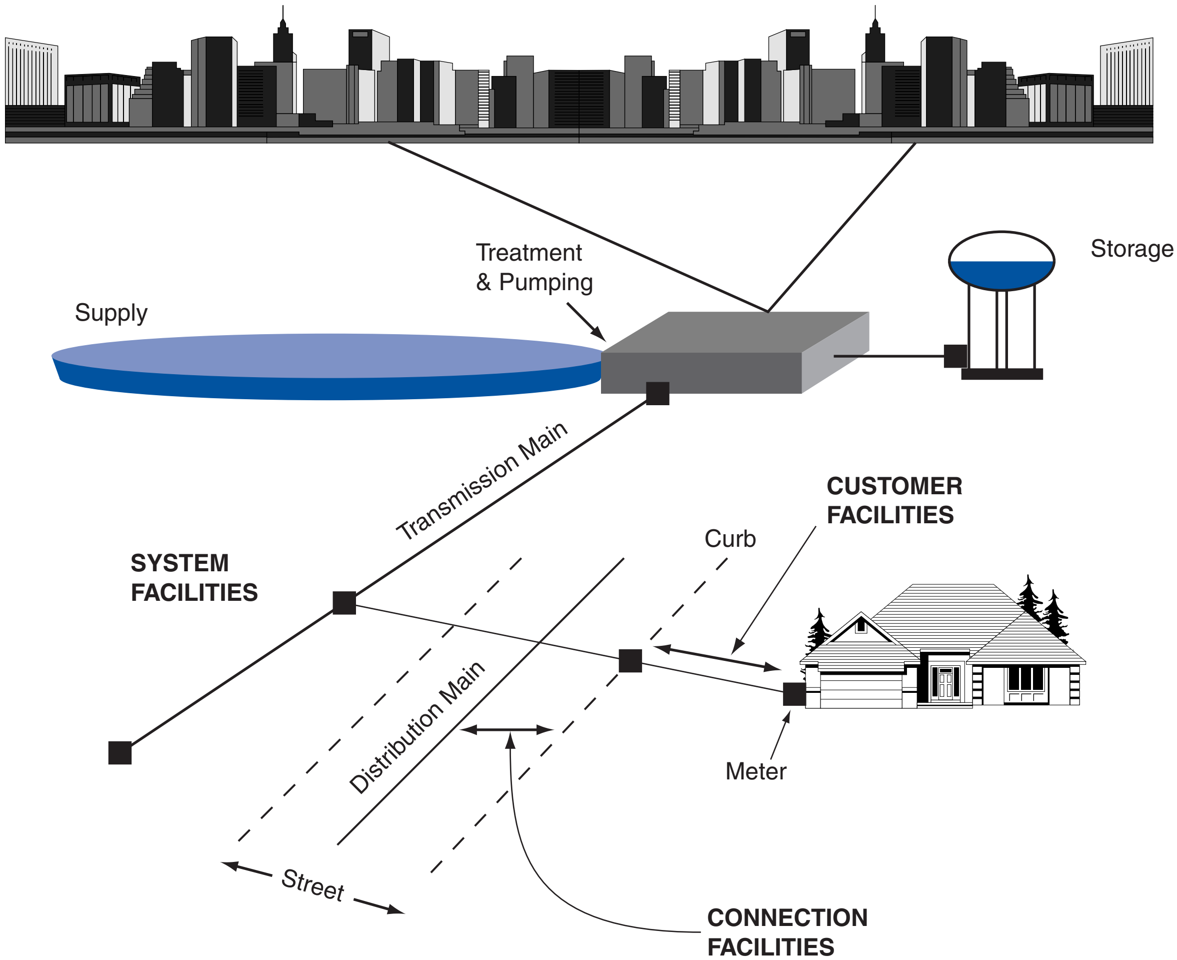

Figure 26-1 Typical water system components

In viewing a water system's capital charging practices, the source of supply, treatment plant, system storage, mains, and other facilities can be classified as customer facilities, connection facilities, and system facilities, as shown in Figure 26-1. Customer facilities include the service line, meter, and other facilities that must be constructed on the property to be served, from the installation site (house or building) to the property line or curb stop. Connection facilities are defined as the line, tap, and other facilities that must be constructed from the property line or curb stop to the main in the street or right-of-way.

A key step in determining customer facility fees is the appropriate allocation of costs. In most cost-of-service analyses, the basis for allocating costs is cost causation, by recognizing the key parameter or parameters that most influence the level of cost incurred. Determining the appropriate method of cost recovery, whether through the general rate structure or an up-front charge, is critical. Also, costs associated with appurtenances that are on site or customer specific (rather than off site or common to all customers), need to be considered in the allocation process.

When identifying the capital cost to be recovered through customer facility and connection fees, the utility needs to define what portion of the cost of installing the facilities between the utility main and the customer's property is allocable to the utility and what portion is allocable to the customer. Also, the utility needs to determine the variation in capital costs of installation caused by the differences in material costs and methods of construction.

Example calculations of a basic model for both a connection fee and a customer facilities fee are provided. The specific method of calculating these fees, however, will vary from one utility to another because of the unique circumstances of each utility. When fees are established for an investor-owned utility, the taxable nature of fee revenues needs to be recognized.

ALLOCATING COSTS

The purpose of a cost allocation process in rate setting is to assign, as much as is practical, costs to the customers who benefit from or cause those costs to be incurred. In allocating costs associated with installing customer connections, the utility must first address these questions:

- Are there legal constraints on the ability of the utility to charge a connection fee or on the amount of the fee?
- Should the costs of connecting new customers be included in the system revenue requirements for allocation to all customers through general water rates?
- Should these costs be allocated to a specific customer class and recovered through rates for that class?
- Should the cost be recognized as an incremental capital cost and recovered directly through a specific customer connection fee?

Utilities may choose to allocate and recover all, or a portion, of such costs through the general water rates rather than through a specific connection or customer facilities fee.

To determine whether a specific capital fee should be established for a new connection, the utility should consider the following issues:

- Frequency. Is the number of occurrences significant enough to justify a specific connection fee?
- Data availability. Is there reasonable and sufficient information available to support a charge for the installation?
- Justification. Are costs sufficient to justify creating such a fee?
- Affordability. Is the magnitude of the calculated charge cost-prohibitive to economically disadvantaged customers?
- Consistency and predictability. Are the material costs and labor requirements relatively consistent and uniform?
- Equity. Would isolating of customer-connection costs significantly increase equity among customers?

After evaluating these key issues, the utility may determine that a separate capital fee to recover the cost of new connections is not needed. Alternatively, the utility may determine that a policy for collecting all or some of the costs associated with new connections is justified through either a standard or a customized system of charges. Or, the utility may determine that a separate standard fee is justified only for residential, small business, and other small service connections. The policy for customers with larger connections, on the other hand, may require customized fees or, alternatively, recovery of the actual cost of installing customer facilities.

Standardized Versus Customized Fees

Usually, connection and customer facility fees for small customers are standardized because the installation of smaller connections tends to be more frequent; thus, the cost is generally affordable and relatively consistent from one installation to another. These fees can be standardized with limited financial risk to the utility and without undue equity burdens on individual customers. However, the utility may determine that certain large connections do not satisfy the criteria for standard fees. In such cases, it would be more appropriate to charge the customer for the actual cost of the service connection and meter installation, thereby customizing the fees based on site-specific conditions. Because of the high cost often associated with larger installations, it also may be appropriate to require payment of an advance deposit based on the estimated cost of installation. A similar deposit may be required of a developer who is concurrently applying for service to several smaller properties.

CAPITAL COST COMPONENT

After a utility has determined the need for separate capital fees to recover new connection costs, it needs to delineate the capital costs to be included in such fees at the point where responsibility for installation shifts from the utility to the customer. Factors that may affect the actual cost of a service connection include the size of the service connection, requirements for backflow or cross-connection protection, and meter location (on a public right-of-way or private property). In addition, building restrictions, such as local building code requirements or pressure problems related to a building's height, may impact cost.

Another important consideration is whether it is necessary to install water meters. Measuring water consumption is essential to the financial planning of water utilities and is usually required for new service connections. Metered services provide:

- an equitable basis to charge customers for services
- a history of water consumption
- the means to evaluate growth and changes in water use patterns
- the means to measure conservation
- an indication of water loss or leaks
- a method of establishing long-term consumption trends
- a method of establishing seasonal consumption trends

Nonetheless, some utilities do not currently meter individual customer water consumption. The decision to install a metered service connection may have ramifications when establishing connection and customer facility fees. The cost of metering needs to be balanced against the benefits and the increased equity in billing customers. In some cases, regulatory orders, local ordinances, or resolutions require the installation of meters for all customers.

Additional factors related to installing service line appurtenances may have a significant bearing on the proposed installation pricing structure. One factor is determining where the utility's responsibility for the cost of the installation ends and where the customer's responsibility begins. Often, the responsibility shifts at the customer's property line. The issue of cost responsibility is less clear if the utility must incur significant costs to extend the existing system to the customer's property line. In this case, the customer is likely to bear a portion or all of the costs to extend the system to the property line. After the responsibilities of the utility and the customer are determined, it is relatively simple to calculate the associated fee or charge.

Typically, a residential service connection involves the installation of connection facilities (including a corporation stop, service line, curb stop, and miscellaneous fittings) and customer facilities (including the meter box, meter, and miscellaneous fittings). It is common practice for utilities to install this equipment in the road right-of-way up to the customer's property line. This delineates a clear point of cost responsibility and establishes a level of consistency relative to the average cost of a service connection. Utility systems in areas that experience freezing temperatures may require meters to be installed inside the customer's building.

In contrast to the basic installation of a residential service connection, large, complex service connections serving high-rise buildings, shopping centers, industrial sites, and high-density apartment complexes involve far greater capital investment. In these situations, capital costs typically vary significantly from one location to another.

It is important to determine the portions of the connection and customer facilities that will be capitalized, rather than expensed, by the utility. This has specific ramifications for utilities that calculate general water rates according to the utility method of developing revenue requirements, where the calculation of rate base is required.

CALCULATING CONNECTION AND CUSTOMER FACILITY FEES

Direct Costs

The first step in determining connection and customer facility fees is to collect data on both direct and indirect costs. Individual work orders provide a primary source of direct-cost data. By examining historical work orders, utilities can determine the consistency in the cost and type of materials used, the amount of time and cost for labor, and the cost associated with equipment. Analysis of work orders as well as inventory reports also may yield information about how these costs fluctuate with the size of the connection. Average costs for each component of the installation can be calculated by examining the direct-cost data. Because future costs often vary from historical costs, it is appropriate to use an allowance for inflation when forecasting costs for parts and materials. This escalation may be appropriate when fees are being set for several subsequent budget years.

Labor costs. Direct labor rates also need to be examined to determine the average labor cost of installation. Often, this is done by considering the staff positions required and is based on personnel cost records and related pay rates for these positions. Typically, estimated hourly labor costs are forecast based on expected salary increases. Total labor costs are based on estimated hourly salaries in conjunction with expected hours of labor.

Equipment costs. Equipment costs can be developed based on accounting data, including depreciation and maintenance records. The average cost of renting similar equipment is sometimes used for these estimates.

Indirect costs. Indirect costs should also be factored into the development of appropriate connection fees. These costs are not directly attributed to one specific cost center and generally include, but are not limited to, such overhead items as administrative salaries, administrative supplies, and employee fringe benefit programs. Direct labor costs, as well as materials, supplies, and equipment expenses, should include an allowance for indirect costs. Typically, an indirect cost multiplier, obtained by relating the indirect costs as a percentage of direct costs, is used to establish a "fully loaded" cost.

EXAMPLES

Tables 26-1 through 26-3 illustrate the calculation of a connection fee and a customer facility fee. The tables show the determination of average current cost, inflated for expectations of direct cost changes, and the use of an indirect cost multiplier to account for all indirect costs as a function of direct labor.

Table 26-1 Calculation of connection and customer facility fees

	Labor Costs		
	Current Direct Labor Costs, *$/h*	Adjusted Direct Labor Costs,* *$/h*	Fully Loaded Rate,† *$/h*
Crew foreman	11.00	11.33	22.66
Crew member	8.00	8.24	16.48
Engineering technician	10.00	10.30	20.60
	Materials Costs Current Cost by Meter Size		
	¾ in., *$*	1 in., *$*	1½ in., *$*
Connection Facilities			
Asphalt repair (25 sq ft)	136.25	136.25	136.25
Service line (30 ft)	6.62	14.80	16.00
Corporation stop (1)	8.61	15.99	20.95
Miscellaneous fittings	6.00	12.00	18.00
Total Current Costs	157.48	179.04	191.20
Adjusted Costs*	162.20	184.41	196.94
Customer Facilities			
Meter box (1)	41.15	106.20	125.00
Meter (1)	31.00	94.90	210.00
Saddle (1)	10.50	12.75	18.90
Total Current Costs	82.65	213.85	353.90
Adjusted Costs*	85.13	220.27	364.52

	Equipment Costs	
	Current Cost, *$*	Adjusted Cost,* *$*
Compressor	9.00/h	9.27/h
Backhoe	22.00/h	22.66/h
Service truck	0.35/mi	0.36/mi

*Reflects 3-percent salary or inflation adjustment.

†Reflects indirect cost multiplier of 2.0 to include all applicable administrative and general overhead costs.

Table 26-2 Calculation of connection fees

		Connection Fee by Meter Size		
	Quantity, *hours*	¾ in., *$*	1 in., *$*	1½ in., *$*
Labor Cost				
Crew foreman	1.5	33.99	33.99	33.99
Crew member	3.0	49.44	49.44	49.44
Engineering technician	0.5	10.30	10.30	10.30
Subtotal		93.73	93.73	93.73
Materials Costs				
Subtotal		162.20	184.41	196.94
Equipment Costs				
Compressor (hours)	1.5	13.91	13.91	13.91
Backhoe (hours)	1.5	33.99	33.99	33.99
Service truck (miles)	10.0	3.60	3.60	3.60
Subtotal		51.50	51.50	51.50
Total Connection Fee		307.43	329.64	342.16

For this example, a one-year time horizon was used to project the fees. In some cases, a multi-year time horizon may be applicable and the salary adjustment and inflation assumptions should be adjusted to reflect the multiple year time horizon. However, state commissions may not allow a projected multi-year method to be used for investor-owned or regulated government-owned utilities. The method allowed by a particular state commission should be followed in determining appropriate costs for use in that particular jurisdiction. Also, if an inside meter setting is used, costs associated with that type of installation would apply; this would eliminate the

Table 26-3 Calculation of customer facilities fees

		Customer Facilities Fees by Meter Size		
	Quantity, *hours*	¾ in., *$*	1 in., *$*	1½ in., *$*
Labor Costs				
Crew foreman	1	22.66	22.66	22.66
Crew member	2	32.96	32.96	32.96
Engineering technician	0.5	10.30	10.30	10.30
Subtotal		65.92	65.92	65.92
Materials Costs				
Subtotal		85.13	220.27	364.52
Equipment Costs				
Compressor (hours)	1	9.27	9.27	9.27
Backhoe (hours)	1	22.66	22.66	22.66
Service truck (miles)	10	3.60	3.60	3.60
Subtotal		35.53	35.53	35.53
Total Customer Facilities Fee		186.58	321.72	465.97

outside meter box but would include a meter yoke and possibly installation of a remote reading device.

Table 26-1 provides a summary of the information obtained when gathering data to determine indirect costs. The table is divided into three sections. The top portion lists applicable utility staff positions, current average hourly salaries, and projected average hourly salaries. Projected hourly salaries are based on the current hourly salaries multiplied by an expected average wage increase. In addition, an indirect overhead multiplier is applied to compensate for fringe benefits and other costs related to administrative, general, and indirect overhead.

The middle section of Table 26-1 lists typical materials and their per-unit cost. In the example, costs are escalated by applying an estimated allowance for inflation.

The current equipment costs shown in the third section of the table are based on average unit costs for the types of equipment required. Future equipment costs are estimated based on the same inflation allowance used for materials costs.

Based on historical records obtained during the data gathering phase, the average time required for each crew member to install a new connection was multiplied by the hourly labor rates from Table 26-1 to determine total labor costs (see the labor costs sections of Tables 26-2 and 26-3). It is assumed that the number of hours required for each crew member is the same for all three meter connection sizes. This may vary for each utility, and actual field experience should be relied on in establishing charges for a particular utility.

The total average materials costs as developed in Table 26-1 are further developed in Tables 26-2 and 26-3. Similarly, Tables 26-2 and 26-3 state the expected equipment cost obtained by applying the required number of hours or miles to the equipment rates developed in Table 26-1. Finally, all costs are totaled and the connection and customer facility fees are shown in Tables 26-2 and 26-3, respectively.

Chapter 27

Policies and Procedures for Water Service Extension

Policies and procedures regarding cost responsibility for extending distribution mains and other local facilities for water service vary considerably in the water industry. Variations may be based on local conditions, as well as factors related to growth, levels of service, utility practices and policies. Policies also differ between investor-owned and government-owned utilities. This chapter provides general guidance in establishing cost responsibility for local facilities.

The provision of water service is characterized by several distinct functions:

- water supply (surface supplies and groundwater)
- source water conveyance through source water transmission lines and source water pumping
- purification and treatment facilities, including clearwell storage and high-service pumping
- treated water transmission mains
- booster pumping
- treated water storage (elevated and ground)
- distribution mains
- connection facilities
- customer facilities

GENERAL CONSIDERATIONS

Generally, the utility is responsible for designing and building facilities that meet customer water supply needs. As is discussed in chapter 28, the financing of these facilities may be shifted, in part, to new customers through the assessment of system development charges.

In the design and construction of local facilities, the utility often forms a partnership with a developer or applicant for service. It is difficult to generalize about the construction requirements associated with a request for new service. Growth will likely occur as speculative in fringe areas, developmental in suburban areas, or individualized within the core of a community. Individualized growth may require only construction of the metering, service line, and related facilities necessary to tap into an existing water main. A new housing development will require an approach main and on-site facilities within the planned area. Additional off-site facilities, such as storage and pumping, may be needed. Backbone facilities may be necessitated by developmental growth and required by speculative growth. Speculative ventures are more likely to occur in areas where water service is not currently available. Comprehensive development of off-site facilities (i.e., transmission, pumping, storage, and even treatment and supply), often is necessary to extend water service to a speculative area.

Because of the capital-intensive nature of on-site and off-site facilities to serve developmental and speculative growth, in particular, utilities must consider a number of related policy issues. First, the issue of who pays and at what time must be addressed. As water providers have become burdened with capital requirements for renewal, replacement, or water quality compliance, sometimes little additional investment capital is available to expand the system. At the same time, growth may be beneficial for leveraging the fixed costs of providing water service to the community. Cost sharing between the utility and the developer may be appropriate. Many communities have adopted service-extension policies that establish uniform requirements and procedural standards for the amount and timing of up-front payments as well as any developer design and construction responsibilities. State commissions imposed rules concerning advances for construction or contributions in aid of construction (CIAC) for the extension of service by regulated water utilities. A standard review and approval process within the utility is activated with each request for new service. In many jurisdictions, mandatory connection to the water system is required.

Determining responsibility for the construction of certain facilities is an important issue relating to the extension of service. A water utility may choose to share the cost of constructing certain facilities with the developer. For example, it may be necessary to design and construct elevated storage to serve a new development. In some instances, the developer may be responsible for the construction of the storage tank based on the specifications and subject to the final inspection of the utility. Other utilities may require the developer to advance the monies required for construction of the facility by the utility.

A number of related issues are important to this process. The basis for cost determination (that is, actual cost, pre-established unit costs, or bid costs) and its uniformity or application should be addressed. Performance and warranty bonds may be required, and an appropriate basis for assessing a proportionate share, or all, of the cost of the added facility must be determined. In certain cases, credits may be provided to the developer based on the number of new connections completed over a period of time.

Utilities often require facilities to be oversized to provide for expected increases in demand following the initial development. For instance, a developer may require only an 8-in. distribution main to serve the incremental residential and fire demand of the current development. However, the utility may require a 12-in. line in anticipation of subsequent development extending from the same line over a future period. In such instances, the cost of oversizing should be delineated and borne by the utility.

To summarize, the following issues should be addressed as a part of the service-extension process:

- cost responsibility for design and construction
- basis for cost sharing between the utility and the developer or applicant for service
- basis for cost determination (actual cost incurred, pre-established unit prices, or estimated cost)
- responsibility for the construction of facilities
- need for performance bonds and warranty bonds
- basis for assessments on the properties (e.g., total cost of new facilities or a portion of the cost)
- credits provided (to a developer) based on the number of new connections for a defined period of time
- oversizing of facilities to accommodate system demand beyond what is needed for the immediate extension (If oversizing is implemented, cost responsibility for the oversizing should be established.)
- review and approval process for the development plan
- requirements for mandatory connection to the water system

EXTENSIONS FOR NEW DEVELOPMENT

For new developments on parcels of land that are undeveloped or where no infrastructure improvements have been made (i.e., no streets, water system, sanitary sewer system, electric, gas, telephone, or storm drainage facilities), water utilities frequently require developers to pay the full cost of designing, constructing, and testing water distribution system facilities. A utility may require the developer to design the improvements and submit the engineering design to the utility for review and approval. Often, the developer is then required to construct the water system extensions subject to inspection by the utility.

Distinguishing between on-site and off-site water facilities is essential. On-site facilities are defined as water facilities located within a new development. Off-site facilities are water facilities that must be designed and constructed to provide water to the boundary of the new development. Typically, the developer (applicant) is responsible for all or most of the costs of on-site facilities. The cost of developing off-site facilities is just as likely to be borne by the utility or the developer or both, depending on the water provider's jurisdictional control.

The authority to review these issues rests with the regulatory body with jurisdiction over the water provider and service territory. Most municipal water utilities are regulated by municipal ordinance or resolution. Independent authorities may be empowered to serve by state statute. Investor-owned utilities and municipalities serving areas outside of their jurisdictional limits may be subject to regulation by the state public utility commission.

Local governments typically require the developer to construct all on-site facilities to specification and contribute those facilities to the utility. State public utility commissions may require a regulated water utility to invest in the on-site distribution system that will serve new customers, or may require the utility and developer to share the cost of those facilities.

However, public utility commission practice varies by state. Some commissions base the amount of a utility's investment in distribution system capital on a revenue test, meaning the amount of additional revenue expected on a per-customer basis. Up-front payments may be recorded as either CIAC or advances for construction, depending on the state policies and practices. The tax implications, if any, of the developer contribution must be addressed by investor-owned utilities.

A utility should not risk public capital investment in supporting private development, unless such action has been specifically authorized by the utility's governing body. Therefore, the developer is responsible for any on-site facilities; off-site facility investment by the utility should be limited to improvements that clearly benefit, either now or in the near future, the utility and its customers.

Off-site investment can be delineated as:

- facilities that predominantly or exclusively benefit the applicant
- facilities that benefit the system (i.e., joint or common-to-all facilities)

Utility investment in off-site facilities that predominantly or exclusively benefits the applicant should be limited to an amount that the utility can reasonably expect to recover through additional revenue within a reasonable period of time. Utility investments in off-site improvements that benefit the system as a whole can be economically justified. An allocation of costs can help determine which off-site expenditures principally benefit a new development and which off-site improvements principally benefit the system. If the off-site improvements benefit both the developer and the system, then cost sharing is appropriate.

If the developer is required to finance off-site facilities that generally benefit the entire system, the utility may provide a mechanism to reimburse the developer. Generally, reimbursement is limited to a portion of revenues received from connection charges or from a portion of water sales revenues from customers in the new service area. As new connections are made, the developer receives (at the end of each year) reimbursement based on a specific dollar amount per connection. A time limitation for the reimbursement is generally established, such as 10 years. If the developer has not been fully reimbursed within that time period, no further reimbursement is provided. The utility or the regulatory authority for regulated utilities establishes the dollar amount per connection and the length of time to provide reimbursement. If the utility makes an investment in the off-site facilities, the utility may reimburse itself (again based on new connections) before providing reimbursement payments to the developer.

Performance Bonds

If the developer or applicant for service proceeds with the construction of water facilities, it is recommended that the developer provide performance bonds to ensure that construction of the water facilities is completed according to the utility's specification. A performance bond protects both the utility and the customer who will connect to the system. If the developer is financially unable to complete the extension of service, then the utility can exercise the provisions of the performance bond. Upon completion of the distribution facilities, final inspection and testing is conducted in accordance with the standards of the utility.

Oversizing Facilities

In certain instances a utility may require a developer to oversize water distribution facilities beyond what is needed to serve the particular development. This requirement for additional capacity ensures that the new facilities are compatible with overall system planning requirements. Requiring additional capacity or oversizing often captures scales of economics in construction and reduces overall utility investment by eliminating the potential need for duplication of facilities to serve future developments.

To determine how much additional capacity is needed, an engineering hydraulic analysis must be undertaken to design and define the size of facilities (storage, pumping, and mains) for the new development. The results are integrated with the water distribution master plan for the utility's service area. Utilities or their governing bodies should have the authority to require the developer to oversize facilities; however, an appropriate portion of the oversizing costs should be paid by the utility.

Requirements for additional capacity often are defined through formal agreements between the utility and the developer. In some cases, a three-way contract among the utility, the developer, and the contractor may be appropriate. Compensation to the developer for building the additional capacity falls into three categories based on:

- the actual cost of work performed
- an agreed-on unit price for actual quantities placed in service
- a dollar amount agreed to in advance of construction

When the developer is required to provide the initial, or up-front, financing for oversizing, there often is a reimbursement contract established between the developer and the utility. Under such a contract, as additional customers outside of the developer's subdivision area connect to the oversized main extension, the original developer is paid an established unit cost per customer connected until the developer is fully reimbursed for the cost of oversizing. Typically, a time limit (e.g., 10 years) is established for these types of reimbursement contracts.

Before the utility enters into these contractual agreements, appropriations for such work may need to be authorized by the utility's governing body. Additionally, a source of funds for the utility's cost participation may need to be identified. The sources of funding generally are

- pay-as-you-go funding (often referred to as equity funding or the use of current earnings produced from general water rates)
- bonds (typically revenue bonds)
- retained earnings

The process described ensures that capital costs associated with extending service to new development are carried by the entities that will directly benefit from the service. The developer pays the cost of design and construction of water main extensions and recovers the cost through the sale of the land to a builder, homeowner, or water customer. Additionally, review of engineering plans by the water utility and other appropriate regulatory agencies ensures that (1) main extensions are consistent with the utility's design, construction standards, regulatory policy, and the long-range water distribution master plan; and (2) the main extensions can be fully integrated with the existing water system.

DESIGNING AND CONSTRUCTING WATER MAINS FOR REDEVELOPMENT

For areas that are changing dramatically in land use and density, local policies dictate whether the utility is obligated to provide an enhanced water distribution system. In situations where a developer has purchased many individual parcels and a new subdivision is being platted with street closures and abandoned utilities, the developer may be assessed costs associated with designing and constructing water mains to serve the redeveloped area. The process of determining both the developer's and the utility's responsibilities for this type of redevelopment is the same as if the redevelopment were a new development (see previous section on extensions for new development).

Redevelopment usually occurs where there is a change in land use and density but streets are not necessarily closed and utilities are not abandoned. In some jurisdictions, the developer may be required to design and build new, upgraded facilities to serve the redevelopment if the existing mains do not have sufficient capacity or reliability to serve the redeveloped area. Some jurisdictions strongly encourage redevelopment of areas (such as a downtown area), and in those instances the utility may be obligated to upgrade facilities and absorb the cost. The long-term reward for such investment could be an increased revenue base for the utility and an increased tax base for the municipality.

EXTENSIONS TO SERVE DEVELOPED AREAS SERVED BY INDIVIDUALLY OWNED WELLS

The utility may be responsible for designing and constructing water distribution facilities to serve areas that are essentially fully developed but are served by individual private wells. Policies vary greatly regarding the conditions under which the local utility is required to extend service to such areas.

The utility may elect to extend service to such previously developed areas to respond to some or all of the following:

- abandonment of contaminated wells (usually documented or required by the local or state health department)
- insufficient flow of well water
- property owners' petition for service
- property owners' offer to contribute to the cost of the extension

In many cases, property owners petition the utility to extend service because of either water quality or water quantity problems associated with their individual wells. For residential usage in an area served by individual wells, both water quality and quantity can vary. For that reason, the local health department and the utility should obtain a representative sample of water from area wells to decide whether extension of public water service is justified for health reasons. Some problems with individual wells can be corrected by constructing a new well, redeveloping an old well, or adding treatment facilities for the existing well.

A utility may develop a policy for extending service by requiring that a certain percentage (i.e., 50 percent) of the property owners in an area petition for public water service. Such a policy may be supported by the utility's mission to provide public water service to all customers in its service area.

When a utility decides to extend service, several significant policy issues should be addressed including the following:

- requiring all property owners to connect to the public system (e.g., Does the utility have a mandatory connection policy or ordinance, or does it have authority to require a connection?)
- handling later connections if all property owners are not required to connect to the new distribution main
- giving the utility authority to assess property owners for water system improvements
- determining responsibility for the cost for extending service
- assessing fees for new connections and timing of collection
- requiring cross-connection control, such as backflow prevention devices, to protect the integrity of the public water supply
- establishing water rights and source water protection issues

Mandatory Connection Policy

Some government-owned utilities have a mandatory connection policy that applies to cases in which the utility may not be able to fund service extensions to a developed area without assurance that new connections will be made. A master resolution that authorizes revenue bonds may contain language that requires the utility to have a mandatory connection ordinance. A policy or ordinance that requires all existing properties to connect to the system can create public relations difficulties for the utility. Not all property owners may have petitioned for the provision of public water service. With a mandatory connection policy, all property owners would be required to connect with the extension of service.

The requirement to connect can be mitigated by allowing a period of time, e.g., 12 months, for customers to connect after the service is made available. The utility also may offer financing for new connections. For example, the utility may allow fees or assessments to be paid over a number of years with a nominal interest rate.

Who Pays the Extension Cost?

Generally, the utility provides the necessary funds to pay for designing and constructing service extensions, but the benefited property owner often shares the cost. Local and state policies dictate the amount of cost sharing and the method of cost recovery. Although the utility or the developer could pay 100 percent of this cost, it generally is appropriate to provide for some cost sharing between the utility and the developer or property owner to reflect the relative benefits received.

As mentioned above, property owners may finance the extension with a one-time fee or a series of payments over time. Some government-owned utilities have the authority under state law to establish a special assessment district and recover the cost of extending service through the levy of special assessments. A special assessment may be paid in a lump sum or installments in accordance with terms of the authorizing ordinance and state law. In some jurisdictions, special funding from other sources may be available to pay for connections needed to protect public health.

Chapter 28

System Development Charges

A growing number of water utilities employ *system development charges* to assign to future customers the capital cost responsibility of system capacity that is or will be available for future customers. The financing and construction of water system infrastructure are core water utility functions. Customers expect their local water utilities to provide safe and reliable water service and facilities. Utilities use many different methods for this funding. Five types of water utility capital financing are

- pay-as-you-go financing through user rates
- debt financing
- system development charges (SDCs)
- up-front reimbursement from developers
- stock issuance

Debt financing requires future repayment from revenues, often through user rates, and equity financing is available only to investor-owned utilities.

Throughout the United States, SDCs (also referred to as impact fees or plant investment fees) are used to finance some capital improvements. These charges are designed specifically to pay for the capacity costs associated with growth. Special charges for new developments date back to the 1930s. System development charges are more frequently used as a source of capital financing in large- and medium-sized urban areas, in high-growth locations, and in areas of scarce water supply. Existing customers in regions with extensive growth or potential growth may benefit greatly from these charges. SDCs assign the capacity cost of growth, at least in part, to those causing the growth rather than to existing customers.

Though new development in a water utility's service area may be viewed as positive, the appropriate source of funding for the water system's expansion to support the new development is a recurring debate. During times of extensive system growth, the utility must make investments to provide service to the new development. An SDC is one method of funding these new facilities. Facilities most commonly financed with SDCs include backbone facilities, such as source of supply, source water transmission, treatment facilities, high-service pumping, and major transmission mains. Depending on local circumstances or applicable state statutes, the costs of distribution mains and other facilities also may be recovered by the SDC.

SELECTING A METHOD BASED ON FINANCIAL GOALS AND OBJECTIVES

The first step in implementing SDCs should be to identify the objectives to be achieved by the management of the water utility's services. These objectives might include to

- have new development pay its own way
- fund major system expansion
- generate sufficient cash to fund a portion of capital improvements
- minimize debt
- equitably recover capital costs from current and future customers
- maintain appropriate level of retained earnings and cash reserves to meet other capital needs of the system

Though SDCs can be used to minimize the amount of debt financing required for capital expansion, these charges may not entirely eliminate the need for future debt issues. The decrease in debt financing needed will, however, reduce debt service costs included in utility rates. Additionally, SDCs may give a utility flexibility in timing debt issuance. For example, with sufficient funds from SDCs, the utility may be able to delay a debt issuance to avoid a period of high interest costs. In most situations, the utility will not collect sufficient funds from SDCs in the short term, or perhaps even in the long term, to fully fund a major system expansion.

Some groups have opposed the use of SDCs. Frequently, opposition results from a lack of understanding of the purpose and use of the charges. Builders and developers have opposed the charges because they add to up-front development costs. However, in some communities, builders and developers support SDCs because the utility could not otherwise finance the facilities needed to accommodate growth.

The implementation of SDCs should be guided by

- compliance with any local and state legal and regulatory requirements
- financial objectives of the utility
- generally accepted water utility industry financing and pricing practices
- maintaining fairness between existing and future customers
- uniform and consistent methodology

An SDC is a financial commitment on the part of both the utility and the development community. Developers are committing funds to provide for utility expansion; the utility is committing to ensure that utility's services are available when needed.

LEGAL ISSUES RELATED TO METHODOLOGY

The preliminary planning to establish an SDC should include a review of the legal authority and issues associated with capital recovery in the utility's operating environment. Legal authority may be granted through enabling legislation, state statutes regarding general law or home rule authorities, local charter, utility operation permits, utility service certifications, or judicial rulings.

Many states govern the system development and impact fee practices of municipal agencies. Some state public utility commissions have rules of practice concerning capital cost recovery and rate making for the jurisdictional investor-owned utilities and, in certain states, for publicly owned water systems. When considering the design and implementation of a system development charge, an analyst should:

- study state statutes or state public utility commission rules of practice (many state legislatures have searchable statutes on their internet sites)
- review the relevant case law for commission and judicial decisions influencing capital charge practices
- seek competent legal advice, particularly when litigation risks are uncertain
- evaluate the underlying criteria important to a specific water system or jurisdictional environment

Table 28-1 provides examples of state statutes governing the use of system development charges and impact fees.

Legal issues addressed in court opinions and rulings help establish procedures for implementing SDCs. The judicial system has provided guidance for establishing SDCs in several states. A primary legal issue related to SDCs is establishing a reasonable connection, or rational nexus, between the amount of the SDC and the cost associated with serving the new development. This rational nexus test is common in both the enabling statutes and court decisions. In short, this test requires that the charge be based on a reasonable connection between the cost to the utility of new development and the amount of the SDC collected.

Some water utilities are under the authority of a regulatory utility commission. Regulatory commissions generally have procedures for instituting various fees and charges. A regulated utility should verify with its regulatory agency the process used for establishing an SDC before initiating the process. The ability of an investor-owned utility to "sell" its assets, along with the taxing of SDC receipts, generally reduces the desirability of implementing SDCs for such systems.

METHODS OF CALCULATING SDCs

The two basic methods for calculating SDCs are the *equity method* and the *incremental cost method*. Either method may be appropriate, depending on the utility's financial circumstances, legal constraints, goals, and objectives. In many instances, particularly where some existing reserve capacity for growth is available and new capacity is planned, a combination of the two methods may be appropriate.

The equity method is based on the principle of achieving capital equity between new and existing customers. Sometimes referred to as the *system buy-in method*, this approach attempts to assess new customers a fee to approximate the equity or debt-free investment position of current customers. The financial goal is to achieve a level of equity from new customers by collecting an SDC representative of the average equity attributable to existing customers.

Table 28-1 Examples of state statutes governing the use of system development charges and impact fees

State	Statute	Effective Date	Description
Arizona	Rev. Stat. Ann. § 9-463.05 (Supp. 1988)	1982	"A municipality may assess development fees to offset costs to the municipality associated with providing necessary public services to a development"…resulting "in a beneficial use to the development." Fees "must bear a reasonable relationship to the burden imposed upon the municipality to provide additional necessary public services to the development."
Georgia	Ga. Code Ann. § 36-71.	1990	"'Development impact fee' means a payment of money imposed upon development as a condition of development approval to pay for a proportionate share of the cost of system improvements needed to serve new growth and development." Impact fees: 1) shall not exceed a proportionate share of the cost of system improvements, 2) shall be calculated and imposed on the basis of service areas, 3) shall be calculated on the basis of levels of service for public facilities. This statute does not limit a local government from collecting a proportionate share of the capital cost of water or sewer facilities by way of hook-up or connection fees as a condition of water or sewer service to new or existing users.
Indiana	Ind. Code 36-7-4-1300 to 1342 § 4354 (Supp. 1991)	1991	The legislative body of a unit may adopt an ordinance imposing an impact fee on new development in the geographic area over which the unit exercises planning and zoning jurisdiction. The ordinance must aggregate the portions of the impact fee attributable to the infrastructure types covered by the ordinance so that a single and unified impact fee is imposed on each new development. Must adopt a comprehensive plan and establish an advisory committee.
Maine	Me. Rev. Stat. Ann. Title 30-A	1989	"A municipality may enact an ordinance under its home rule authority requiring the construction of off-site capital improvements or the payment of impact fees instead of the construction. Notwithstanding section 3442, subsection 2, an impact fee may be imposed that results in a developer or developers paying the entire cost of an infrastructure improvement. A municipality may impose an impact fee either before or after completing the infrastructure improvement. The amount of the fee must be reasonably related to the development's share of the cost of infrastructure improvements made necessary by the development or, if the improvements were constructed at municipal expense prior to the development, the fee must be reasonably related to the portion or percentage of the infrastructure used by the development."
Oregon	Ore. Stat. § 223.297-314	1989	Municipalities are empowered to impose system development charges at issuance of permit or connection to the capital improvement. Applies to water, wastewater, drainage, transportation, and parks and recreation. Reimbursement fees shall consider the cost of the existing facility or facilities, prior contributions by existing users, the value of unused capacity, rate-making principles employed to finance publicly owned capital improvements, and other factors. Future system users can contribute no more than an equitable share of the cost of existing facilities.
Virginia	Va. Code Ann. § 15.2-2318-2327	1989	Certain counties, cities, and towns are empowered to impose impact fees to offset the cost for road improvements attributable to the development if supported by needs assessment and road improvement plans and assisted by an advisory committee.

Source: State statutes.

The incremental cost method is based on the concept of new development paying for the incremental cost of system capacity needed to serve new development. This approach proposes to mitigate the cost impact of new growth on existing customers' user rates. The goal is to charge a fee for new customers sufficient to allow customer user rates to be revenue-neutral with respect to growth of the system. However, in systems undergoing rapid and expensive growth, this may be difficult to achieve.

Equity (Buy-in) Method

The goal of the equity method is to achieve an equity position between new and existing customers of the system. The method assumes that existing customers have provided equity in the existing system and that built-up equity should accrue to benefit existing customers. Under the equity method, the base level of the SDC is established at the current level of system equity related to the capacity used to serve an existing equivalent residential customer. This approach is most appropriate where current system facilities adequately serve existing and future customers, where no new significant system investment is anticipated, and where existing facilities are not scheduled for replacement in the near future.

System equity. A key component in developing an equity method SDC is determining system equity. The major components include the valuation of system assets, accumulated depreciation, system liabilities, sources of equity, and system capacity.

System assets. For SDC purposes, one measure of the valuation of the system assets is the original value of the total plant less accumulated depreciation. This valuation may be adjusted to recognize the cost of reproducing or replacing assets, depending on the rules and regulations of the applicable regulatory body. The reproduction cost estimate is an indication of the cost to duplicate the system at current prices. Additionally, reproduction cost valuation reflects equity contributions made by existing customers in terms of current dollars. Whether using original or reproduction costs, asset values are often expressed as net of depreciation to reflect the valuation of the system available to new customers.

System liabilities and equity. Balance-sheet liabilities and equity that are recognized in the equity valuation encompass outstanding long-term debt as well as any applicable contributions, such as grants or other non-SDC contributions, to SDC facilities. Both of those liabilities should reflect book value. In a situation where the SDC is separated in component costs by function (such as source of supply, production, storage, or transmission), any applicable contributions may need to be allocated to these functional categories. For example, if grants were provided specifically for the production facilities, these contributions should be credited to the cost of those specific facilities.

Equity sources. Equity in the water system established by existing customers can accrue from various sources, including the retirement of debt, cash financing of capital improvements, or previous SDC payments. All of these sources are provided by existing customers through annual revenues. It should be noted that the term equity refers to that portion of system value for which there is no offsetting debt. It does not imply ownership of, or title to, utility facilities.

System usage. An analysis of existing system usage is necessary to determine the equivalent units of current customers. System usage is often expressed in terms of equivalent units, such as ⅝-in.-meter equivalents.

Table 28-2 Equivalent meter factors

Meter Size, *in.*	Maximum Flow, *gpm**	Equivalents Relative to ⅝-in. Meter†
⅝	20	1.0
1	50	2.5
1½	100	5.0
2	160	8.0
3	300	15.0

**Source: AWWA Manual M6,* Water Meters—Selection, Installation, Testing, and Maintenance.

†Using standard maximum meter-flow capacity ratios.

Column 3 of Table 28-2 shows equivalent meter ratios expressed in terms of the ratio of rated meter capacity for each meter size relative to a ⅝-in. meter, as stated in AWWA Manual M6, *Water Meters—Selection, Installation, Testing, and Maintenance.* As an alternative, utilities often analyze their own actual annual water use data, and weight it by applicable maximum-day demand ratios, for each meter size within its service area to establish utility-specific equivalent-meter factors.

SDC determination. For purposes of the example SDC calculation under the equity method shown in Table 28-3, the average equity per equivalent unit in the system is determined by dividing the net system value by the number of ⅝-in.-equivalent customers the system is capable of serving. The applicable SDC is determined by multiplying the average equity per existing equivalent customer ($720) by the appropriate equivalent-meter ratio from Table 28-2.

Though meter-equivalent ratios may be computed for meters larger than 3 in., the use of these ratios as a basis for computing the SDC for larger meters may or may not be indicative of the potential demand requirements of any particular customer. It is recommended that a specific determination of the SDC be made for customers with larger meter sizes. In addition, where the basis of design of certain SDC-related facilities is not based on peak system demands, such as large impounding reservoirs, sole use of meter-equivalent ratios may not provide an equitable basis of allocating such costs.

Incremental Cost Method

The incremental cost method assigns to new development the incremental cost of system expansion needed to serve the new development. The financial objective is to provide system expansion to serve new development without an undue impact on existing user rates. Generally, this method is considered most appropriate when a significant portion of the capacity required to serve new customers must be provided by the construction of new facilities.

Determining SDC. To calculate SDCs under the incremental cost method, the practitioner must determine various factors, including the period of growth, growth rates, type of growth, capacity associated with the various improvements needed to serve the projected growth, and cost of these improvements.

Service area. The service area must be determined before the SDC can be computed. Commonly, the total service area of the utility system is used, but some utilities divide their system into separate service areas. Particular care should be used when dividing a utility system into subsets to ensure that the subsets are based on identifiable differences from the system as a whole.

The delineation of the utility service area is important for growth planning and for assessing capital improvements needed for new development. Though the service

Table 28-3 Illustrative determination of system development charge using the equity method

	Original Cost, *$thous*	Accumulated Depreciation, *$thous*	Net Cost, *$thous*
Plant			
Source of supply	4,000	(1,000)	3,000
Treatment and pumping	7,200	(1,200)	6,000
Transmission system	9,300	(1,300)	8,000
Distribution mains	4,300	(500)	3,800
Services, meters, and hydrants	5,600	(800)	4,800
General structures	1,600	(200)	1,400
Subtotal	32,000	(5,000)	27,000
Less Net Cost of			
Distribution mains			(3,800)
Services, meters, and hydrants			(4,800)
Net investment in plant			18,400
Less			
Outstanding bonds allocable to SDC facilities			(4,000)
Total Equity Investment			14,400

NOTES: Number of equivalent 5⁄8-in. customers the system is capable of serving: 20,000.
Average net equity investment per equivalent 5⁄8-in. customers ($14,400,000/20,000) = $720.

area usually is easy to determine, the conclusion is critical to the analysis and development of the SDC. Typical service areas are municipal corporate limits and public utility commission certificated or franchised service areas. The inclusion of extraterritorial jurisdictions may be appropriate where service is currently provided or the provision of service is imminent.

Planning period. The SDC planning period is needed to project the growth and service requirements of the system. Though utilities have used various lengths of time, the planning period for determining SDCs should equal the normal planning period of the utility. Usually, this ranges from 10 to 20 years for distribution and treatment facilities planning, but may exceed 50 years for supply planning. Another criterion for determining a planning period is the financial cycle for long-term financing. For example, the normal financing term for long-term debt is useful in determining the duration of the SDC planning period. This is typically 10 to 30 years. The normal system financial planning period should be the minimum planning period for SDCs; analyzing a shorter period might limit the utility's view of its ability to repay debt on system expansion projects that are to be funded from SDC revenues.

Growth rate and magnitude of expansion. A projection of the future system growth is an integral part of the incremental cost method. The rate and type (customer class) of growth has a direct impact on the type of system expansion needed to serve new development over the planning period. A breakdown of growth by type or class of customer is important because different customer classes have different water demands. For example, types of growth may include residential, commercial, industrial, and institutional. There may be additional subcategories or fewer types of customers, but a sufficient number of categories should be used to describe the utility's customer base and to identify any expected changes in the customer base.

Growth rates usually are estimated in terms of population, employment, and commercial or industrial floor area. Planned types of growth must be assigned a utilization or equivalency factor, generally stated as a function of an equivalent residential customer. This factor equates growth-rate elements for each type of growth to common terms for estimating capital improvements needed to serve future customers. For example, growth in residential customer demand can be evaluated on the basis of water usage of a single-family unit. Larger commercial, industrial, and institutional growth in demand can be assessed by analyzing existing water usage or by tabulating usable square footage of similar businesses and buildings.

Capital improvements plan for system expansion. After the projected growth and future demands for the system are established, the capital improvements needed to meet new growth can be planned. Capital planning also considers the timing and magnitude of the projected growth. Because growth and related increases in system demand may be incremental or occur in stages over the planning period, care should be used to match the system capacity with the growth in demand and revenue flow from the associated SDCs. A large investment in system capacity without a comparable increase in demand will result in an undesirable under-utilization of the system and will have a negative impact on current rate payers.

SDC-related capital improvements should be restricted to common-use facilities; generally, they do not include site-specific or local facilities. Examples of common-use facilities are supply sources, source water intakes, source water transmission, treatment facilities, and major water transmission mains. Capital costs associated with environmental-regulation compliance are becoming an increasingly significant portion of water utility capital program budgets. Such costs can be included in the SDC. However, it is important to recognize that such costs, generally, are common to existing customers and new customers. In determining SDCs, care should be exercised to charge the new customers only for their proportionate share of these costs.

When long-term financing is required to provide funding for a part of the capital improvement plan, all or a portion of the financing cost (i.e., interest on debt and debt issuance cost) may be included in the incremental cost for SDC determination purposes. This is particularly important where the SDC is intended to be the sole funding source for system expansion. In cases where capital improvement financing is also included in user rate revenue requirements, the utility must be careful to avoid double counting the financing costs in both the SDC and the user rate revenue requirements. For example, to the extent that debt service on bonds issued to finance major capital improvements for SDC facilities in previous years are included in the current year revenue requirements recovered through general water rates, an allowance, or credit, in the level of the current SDC must be recognized to avoid a double cost recovery of the debt service applicable to such SDC facilities.

Excess capacity in the existing system available for future development. The efficient economic expansion of the system often requires that improvements be built in increments that exceed the immediate level of demand. The unused capacity is available for future growth and may be included to determine the incremental cost to serve new development. Including the excess capacity cost in the SDC shifts financing of this excess capacity from the existing rate payers to the new development. If existing facilities are included in the incremental cost method, the amount of available capacity and investment of these existing facilities should be documented to substantiate the actual cost and value of the facilities.

Determining development units. To calculate the SDC, the projected system growth in demand must be converted into common units. Units used to establish the SDC will vary with available information, timing of the SDC assessment and collection, and the billing practices used by the utility. Units may be derived from the system growth analysis and capital improvements planning.

Most SDC-related facilities are designed on the basis of annual average day use, maximum day demand, or maximum hour demand. After the SDC-related capital investment is determined, it must be divided by the applicable design capacity to obtain a cost per unit of capacity. Each type of customer (i.e., residential, commercial, or industrial) has a particular demand or capacity requirement that, when applied to the unit cost of SDC facilities, provides a measure of the investment in SDC facilities applicable to that type of customer. It is common to develop an SDC for a residential customer, or equivalent residential unit, using this unit cost approach, then develop a schedule of SDCs using common billing determinants that relate potential demands of other types of customers to that of the base, or residential, demand. Among the more frequently used units for this purpose are meter size, fixture units, and land area with associated land-use characteristics. Meter size is the most common determinant for assessing SDCs, and the capacity factors developed in Table 28-2 often are used to establish charges for customers with meters greater than ⅝-in.

When charges are collected at the time of service initiation, meter size is often used as a basis for computing SDCs although many utilities use alternative approaches in defining the base service unit, including equivalent residential units (ERUs) or fixture units. Usually, equivalent service units are developed for customers with more intense uses or potential demand. For example, charges for larger meters may be based on AWWA-rated meter capacity using a ⅝-in. meter as the base service unit. Total overall premise use, facility size, capacity requirement, and number of fixtures also are used with ERU-based charges.

The meter size approach may be easiest to explain to customers. It is based on the potential maximum demand that the customer may put on the system, but it does not consider patterns or intensities of customer usage. Meter sizes are expressed in terms of equivalent meters, generally based on the relative capacity of various meter sizes. The ERU approach differentiates among customer classes, but it can be difficult to explain and, in some situations, difficult to determine and apply consistently. The ERU approach is often directly related to the number of fixture units and is based on the potential loading of various fixtures. As a result, the charge for each new customer must be computed individually, which is a disadvantage to this approach.

If collection of the SDC is made at the time of platting, the service unit usually is based on an equivalent dwelling unit. The equivalent dwelling unit is based on the estimated demand of a single-family residential unit in the service area. The charge is then based on the size of the dwelling, the types and number of fixtures, or both. Utility billing records are a data source related to system utilization. Water demand characteristics are normally expressed in terms of equivalent units to quantify the capacities of system expansion projects.

An example of the calculation of an SDC on an incremental cost basis is shown in Table 28-4. For purposes of the example in Table 28-4, it is assumed that all local, on-site facilities, such as distribution mains, meter, services, and hydrants, are contributed by the developer through charges and assessments other than the SDC.

Table 28-4 Illustrative determination of system development charge using the incremental cost method

	Five-Year Capital Improvements Plan,* *$thous*	Maximum-Day Design Capacity, *mgd*	Unit Cost, *$/mgd*
Plant			
Source of supply	7,500	25	300,000
Treatment and pumping	8,000	15	533,000
Transmission system	3,000	10	300,000
Distribution mains	2,000	N/A	N/A
Services, meters, and hydrants	1,800	N/A	N/A
General structures	500	50	10,000
Subtotal	22,800		1,143,000
Less net cost of			
distribution mains	(2,000)	N/A	N/A
Services, meters, and hydrants	(1,800)	N/A	N/A
Net Investment in Plant	19,000		1,143,000

NOTES: Maximum-day demand for average equivalent ⅝-in. customer: 1,100 gpd.

Average investment per equivalent ⅝-in. customers ($1,143,000 × 1,100/1,000,000): $1,257.

*Current-year cost levels.

N/A-not applicable; assumed to be contributed by developer for purposes of this example.

REIMBURSEMENT POLICIES

Utilities frequently require developers to construct facilities that provide service beyond the requirements of the new development. When this occurs, developers should be reimbursed for the facilities constructed in excess of their own requirements. This may be in the form of a reduction in the SDC for the new development. Because the purpose of the SDC is to pay for system expansion, the utility must also consider contributions to system expansion in the form of physical improvements and additions. Payments of SDCs, together with other system contributions for the same facilities, could result in a double contribution to the system. Many utilities remedy this potential double contribution by implementing credits to the SDC or a development agreement where the developer agrees to contribute infrastructure needs in lieu of paying an SDC. In addition, reimbursement contracts for infrastructure contributions help eliminate double counting.

Credits are reductions to all or part of SDCs. The credits may be allowed for any contributed infrastructure or may be limited to specific types of contributions. Credits should not exceed the total amount of the SDCs due.

A development agreement is another method used for contribution of utility infrastructure. The developer contractually agrees to make contributions in place of all or a part of the SDCs. It should be noted that policy objectives regarding credits will affect the range of SDC values.

Reimbursement contracts often are used by water utilities for infrastructure contributions. These contracts typically provide for reimbursement of some contributed facility costs from SDCs collected from future customers who will use the contributed facility. Limitations on the amount of and the time period for reimbursement are included in the contracts.

ECONOMIC DEVELOPMENT ISSUES

The utility should be aware of the possibility of deterring growth of its service area or customer base. When SDCs are collected at the time service commences, the developer can defer the charges to a time near the end of the development process. In some circumstances the charge is paid directly by the new customer. Usually, SDCs have the greatest negative economic impact on development projects that are in the planning stage. This can be mitigated by phasing in the SDCs over a period of time or setting an effective due date in the future.

The practitioner must consider the effect of SDCs on competition for new development. Some utilities serve an area that is in competition with nearby regions or other major economic centers. Whether competition is local or global, the utility, in conjunction with the local or state government, may wish to promote its competitive standing when considering the implementation of an SDC.

Assessing SDCs

The utility must decide which new customers will be assessed and when the assessment will occur. Some or all of the following should be considered:

- new plats
- unplatted properties
- previously platted properties
- new service
- additional service

Timing Assessments

Timing of the SDC assessment and collection has both financial and administrative impacts. Typical points of time for assessing an SDC are at the time the plat is approved, at the time the building permit is issued, or at the time service begins.

At the time of platting. Many utilities assess and collect SDCs at the time of platting a new development. This approach allows the utility to collect the charges earlier in the project. The disadvantage of this approach is that, often, it is difficult to determine the number of service units the development will demand. Because of the number of estimates that must be made if the SDC is paid early in the development process, the computation is less accurate and more difficult to defend. In addition, the utility is required to make a significant investment in facilities on a somewhat speculative basis.

At the issuance of the building permit. Some utilities assess and collect the SDC at the time the building permit is issued for new developments. This is closer to the time of service, and the new development's impact can be estimated. The disadvantages of this approach are that the exact impact is not known, the utility must invest in facilities on a speculative basis, and the funds may not be available to the utility in time to construct the necessary facilities.

At the time service is requested. Other utilities assess and collect SDCs at the time service is requested. Usually, this is when the certificate of occupancy is issued or when a customer applies for a meter or for service. Utilities receive funds later with this approach, but the service units are easier to determine and explain to the customer. Most builders and developers favor payment at the time of service because delayed payment lessens their carrying costs during the project. This approach may, in fact, result in homeowners directly paying the charge.

The timing of collection involves two conflicting issues that must be reconciled. First, the utility needs to collect the SDC early enough to make funds available for system improvements. Second, the utility can accurately assess the SDC only later in the development process, when the actual meter size or number of fixture units is known.

Timing differences exist between user rates and SDCs. Many major projects related to system expansion require substantial funds for design and construction before sufficient funds are available from SDC receipts. Therefore, usually some funding from user rates is needed to pay for the facilities, generally in the form of paying for debt service on the bonds to finance facilities. This may result in double cost recovery if user rate funding of debt service on SDC-related facilities is not considered in establishing the level of SDC. For example, debt service payments included in the user rate analysis are partially offset by the projected receipts from the SDC.

ADMINISTRATIVE AND ACCOUNTING PROCEDURES

The utility should adopt general administrative and accounting procedures that assure the collection of SDCs are managed and used for the facilities needed to provide service to new development in the utility's service area. Some state statutes require all such funds to be used for the specific facilities that the SDCs were designed to finance. SDC funds should be identified and segregated from the utility's unrestricted assets. To avoid spending a large portion of revenues on administration, the utility may find it helpful to first document the current development process and try to integrate the SDCs into the existing organization. In no case should SDC funds be used to fund annual O&M expenses.

Administrative Issues

Utility managers should develop procedures to administer the SDC program, including establishing a process for hearing appeals and exceptions to the SDC policies and procedures. In the case of regulated utilities, the regulatory authority may oversee this process. The multitude of development and contribution scenarios require some procedure for dealing with unusual circumstances.

Reimbursements. Some utilities have policies to reimburse contributions when facilities are later used by others. These circumstances usually involve a developer contributing major system facilities without using utility funds. Reimbursements are typically limited in time and for specific situations. For example, reimbursements may be limited to a period of 10 years after the contribution and limited to the same component (i.e., source, treatment, distribution, or transmission) of the SDCs collected in the service area of the contributed facilities.

Refunds. The utility should consider refunds of SDCs under the following circumstances:

- When service is not provided in a reasonable period of time after the charges are paid.
- When collected charges are not spent on system expansion within a reasonable time period.

Interest income. The utility may wish to dedicate interest income from SDCs to the SDC accounts. This helps to offset inflationary cost increases for system expansion projects. In some jurisdictions, such dedication of interest income is a legal requirement.

Income taxes. For investor-owned utilities, SDCs are generally included as ordinary taxable income for federal tax purposes.

Regulatory issues. Under the utility approach to rate making, most regulatory commissions exclude contributions of facilities and the related depreciation on contributed assets from the rate base in the rate-making process. Generally, SDCs would be considered as an offset to plant investment in determining rate base. Typically, any income tax liability generated from the collection of SDCs would be included in the rate base to determine rates for an investor-owned utility, unless such liability is already included in the SDC. When the cash approach to rate making is used, SDCs do not reduce annual revenue requirements. Over the long run, however, annual debt service costs will be less as major capital improvements are financed through SDCs rather than through the issuance of debt.

Accounting Issues

Collection. Because SDCs are imposed to recover the cost of new development, proper accounting of receipts is important to document authorized use of those funds. Assessment and collection records should be maintained by individual lot if charges are collected at the time of platting. This practice requires accounting for each new lot in all subdivisions. Assessment at the time service is requested requires accounting for SDC by service connection. With this approach, collection of SDCs is similar to regular customer service accounting.

Receipts. The utility should account for SDC receipts with the same procedure used for contributed facilities. Specifically, SDCs should not be included as a part of general operating revenues. SDCs should be used for capital-related purposes, including either retiring debt or constructing capital facilities related to system growth.

Expenditures. SDCs should be expended in a manner consistent with the financial goals and basis for which the charges were established. Expenditure accounting for SDCs should be maintained to support the revenues derived from the charges.

UPDATES OF THE SDC ANALYSIS

As development occurs and the economic mix of the community that the utility serves changes, growth and development assumptions also change. At that point, utilities should reassess their initial assumptions and compare the historical development achieved with that originally planned or projected. Utilities that use SDCs as a funding source commonly update their SDC levels at three- to five-year intervals.

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Chapter 29

Dedicated-Capacity Charges

Charges to dedicate a portion of the capacity to future and existing customers in the form of an availability charge or a contract demand charge are used in certain settings. Dedicated-capacity charges are intended to recover capital costs for system expansion associated with a capacity addition to serve an established area or for capacity reserved for a specific customer. Two such charges are the availability charge and the contract demand charge.

AVAILABILITY CHARGE

Some systems impose a periodic charge, called an *availability charge*, on frontage or similar basis to properties with access to the water main in the street, whether or not the property is physically connected to the system. The availability charge covers the costs incurred to extend service to a specific area to serve potential future customers. The charge reflects the benefit provided to property by the availability of water services.

Even when the utility has an effective program for customer contribution of capital outlays for approach mains and local facilities, the utility can incur other fixed costs for backup facilities. In establishing availability charges, these costs may be apportioned among the existing customer base and the benefiting property owners. However, because the costs of backup facilities not allocable to existing customers may also be included in the calculation of other charges, i.e., system development charges (SDCs) and standby charges, utilities should be careful to avoid double recovery in determining fees through related capital charges.

The availability charge typically is applied to property owners of benefiting properties not connected to the system. The charge can be incorporated under ordinance into the regular water rate as a distinct charge or as a separate fee schedule, but it only applies until the property is connected for service.

For rural water systems or systems with mature service areas, the availability charge may be used effectively as a financial tool to allocate such costs to properties within the dedicated service area. New water systems with a finite customer base and limited growth potential can apply the availability charge to ensure sufficient revenues to justify the financial feasibility of the district.

The availability charge also applies where the majority of costs of public fire protection service are to be recovered through water rates. Adjacent properties not connected to the water system would benefit from the availability of fire protection provided by the water system. An availability charge can be determined to equate the proportionate share of public fire protection costs to the benefit received.

Other suitable applications of the availability charge may be identified, but the principal need for the charge is to recoup the significant investment required to extend facilities with the capability to serve properties not presently connected to the water system.

In establishing the form and amount of the availability charge, the utility must determine the specific facilities for which costs are to be recovered, and establish an equitable unit basis for assessing the charge. For public water systems, appropriate costs include related capital expenditures, either in the form of the capital expenditure of the project plus indirect costs, or debt service as applicable, plus apportionment of related annual O&M expenses, e.g., certain maintenance and inspection costs, customer billing, payment in lieu of taxes, and administrative expenditures. For investor-owned utilities, a fixed rate would include depreciation expense, taxes, and return (as applied to the value of the plant in question), as well as O&M expenses.

After the utility determines total costs, it must define the appropriate unit basis for applying the charge. Though several methods have been adopted, a generally acceptable unit basis is linear feet of main frontage accessible to benefiting properties. A charge per frontage foot is established by dividing the total annual cost of the dedicated facilities by the total frontage length of mains. The example in Table 29-1 illustrates the calculation of an availability charge.

One of the difficulties a utility may encounter with availability charges is enforcing payment. Because the entity to whom the charge is assessed is not connected to the water system, discontinuing service is not an option in response to nonpayment of the availability charge. Accordingly, the utility must use other means to enforce payment, such as placing a lien on the property. Typically, investor-owned

Table 29-1 Example calculation of availability charge

Line No.	Item	
1	Total invested capital	$200,000
2	Total annual cost of capital (at 10 percent)	$20,000
3	Annual operation and maintenance (O&M)	$16,000
4	Payment in lieu of taxes (PILOT)	$14,000
5	Total annual dedicated facilities cost (sum of lines 2–4)	$50,000
6	Linear feet of main frontage	20,000 ft
7	Number of benefiting properties	200
8	Average linear footage per property (divide line 6 by line 7)	100 ft
9	Unit charge per frontage foot per month*	$0.2083
10	Average monthly cost (availability charge) per property (multiply line 9 by line 8)	$20.83

*$50,000/20,000 ft = $2.50/ft; $2.50 per ft/12 months = $0.2083/ft/month.

utilities do not have the same enforcement powers as do municipal utilities. Accordingly, investor-owned utilities may find availability fees to have limited usefulness.

CONTRACT DEMAND CHARGE

A contract demand charge may be an appropriate cost recovery option to consider when a customer or neighboring utility seeks a commitment of a significant amount of a utility's capacity. A contractual demand basis can be established to match the conditions of capacity available for the annual, seasonal, or daily customer demand. A contract demand charge is advantageous to a water utility if its customers' revenue contribution is significant to the system and its loss would adversely impact the financial integrity of the utility.

A contractual payment for a given demand not only protects all other customers from the fixed costs of that demand, it may be essential to finance system expansion. For example, when a government-owned utility issues revenue bonds, the bond rating agencies and the utility's investors require reasonable assurance as to the security of the revenue projections supporting the investment. Such security is enhanced by an agreement with a financially secure business that will contractually assure investors of a significant portion of the future revenues necessary to repay the bonds.

Implicit in this type of a dedicated capacity charge is the need for both parties to enter a long-term agreement that will ensure the customer the availability of the increment of capacity required, and will ensure the utility recoupment of the fixed costs associated with that increment of capacity. Without such an agreement, the water utility may be adversely impacted by the loss of a large user of dedicated capacity, forcing the utility to reallocate fixed costs related to the incremental capacity among the remaining customers. This is particularly troublesome if the utility had originally constructed additional capacity in order to fulfill the incremental demand requirement.

Customers contracting for a given capacity should agree to pay the fixed costs related to that capacity for a stated period of time. The term *take or pay* has been used to describe this type of a contract because it requires the customer to agree to pay for a minimum or scheduled demand during a specified period whether or not the service is used.

The contract typically requires the utility to commit capital and operating resources and set aside incremental capacity for the customer for a specified number of years. The customer agrees to pay for incremental demand in the form of a demand charge to recover the costs of the dedicated capacity.

The charge could consist of a fixed monthly charge to recover capital costs associated with the dedicated capacity. In addition, the costs of operation and maintenance that are somewhat fixed, such as labor, fringe benefits, and maintenance of facilities used by the contract customer, could be included. A separate volume charge to recover the variable costs of power and chemicals would apply to the monthly metered volume. In some instances, the customer may have its own supplemental water storage or supply that could provide flexibility in scheduling a utility's available capacity throughout the period. This capability and the cost savings can be reflected in the charge calculations.

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Fire Protection Charges

Rates for Fire Protection Service

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Chapter 30

Rates for Fire Protection Service

Fire protection service differs from other services provided by the utility. Essentially, this is a standby service that the utility makes available on demand. Although most fire hydrants and sprinkler connections are rarely used, the utility must be ready to provide adequate water quantities and pressures at all times throughout the distribution system. The costs associated with maintaining the supply, treatment, pumping, storage, and distribution capacity for fire protection services include annual O&M costs and capital costs invested in facilities that are sized larger than necessary for nonfire fighting purposes.

Section II of this manual presents examples of the allocation of costs to fire protection and to general water service. These examples illustrate the cost allocation principles used to determine the amount of revenue that should be derived from fire protection charges. After the total revenue requirements associated with fire protection service are determined, the utility must ascertain an equitable method for recovering this cost from those benefiting from fire protection services.

The example presented in section II allocates all costs to public fire protection and proposes recovery of those costs based on a charge per public fire hydrant. The per-hydrant charge is assessed to the municipalities served by the utility, and the municipal governments pass on the cost to individual taxpayers, possibly as part of the *ad valorem* or other property tax. In this way, individual property owners are assessed a portion of the fire protection costs based on the value of their property. This method assumes that the benefits of fire protection services are related to property value.

This chapter examines additional issues in fire protection cost allocation and is intended to supplement section II. The allocation of fire protection costs between public and private fire service, alternative mechanisms that can be used to assess these charges, and some emerging issues associated with fire protection charges are discussed.

HISTORICAL PERSPECTIVE

The concepts, policies, procedures, and practices related to fire protection service charges have evolved over the past 100 years. During this period, numerous papers that present differing theories and opinions on establishing rates and charges have been published and debated. In 1888, F.L. Fuller wrote the first paper published by AWWA on the subject of fire service rates and charges. This was followed in 1911 by a study by Metcalf, Kuichling, and Hawley proposing that costs be prorated between general water service and fire service based on the comparison of the capacity of the facilities required. Robert Nixon published a paper in 1937 that suggested an allocation between general water service and fire service based on a capacity-ratio method.

In 1955, D.A. Root and T.R. Camp determined that systems without a fire protection function should be designed to meet peak loads, and a system designed to include fire protection should be sized to meet the maximum-day demand plus required fire flow demands. The authors noted that the cost of distribution piping is not proportional to capacity, and they argued that the cost of the fire system should be equal to the incremental cost associated with fire protection.

In 1961, the Maine Water Utilities Association Committee on Fire Protection Charges published a report that included a curve that indicated the percentage of total revenue allocated as fire protection costs, based on the number of customers served. An adaptation of this curve is shown on Figure 30-1.

In 1987, the Maine Public Utilities Commission adopted the use of this curve. Its regulations state that, except under extraordinary circumstances, fire protection charges will be no more than 30 percent nor less than 6 percent of gross revenues. In 1996, the Maine Public Utilities Commission adopted amendments to its regulations that clarified that the percentage of the revenue established by the curve applies to public fire protection services. The amendments also set forth procedures to determine private fire protection charges based on demand requirements. As an alternative to the use of this curve, utilities are permitted to prepare fully allocated cost-of-service studies.

In general, three approaches have been used in allocating costs to fire protection. They include

- allocating primary cost to general water service, with incremental costs allocated to fire protection service
- allocating primary cost to fire protection service, with incremental costs allocated to general water service
- allocating costs to general water service and fire protection service on a proportional basis

The use of each approach results in a significantly different allocation to fire protection service. Section II of this manual illustrates the use of the last method—allocation on a proportional basis. This method recognizes that the dual function of water systems—to provide basic water service and to provide a readiness-to-serve capacity for fire protection—are equally important.

PUBLIC VERSUS PRIVATE FIRE PROTECTION

Utilities typically provide fire protection services in two distinct ways. The first level of service, public fire protection, is provided to all customers on a community-wide basis through public fire hydrants located throughout the water system.

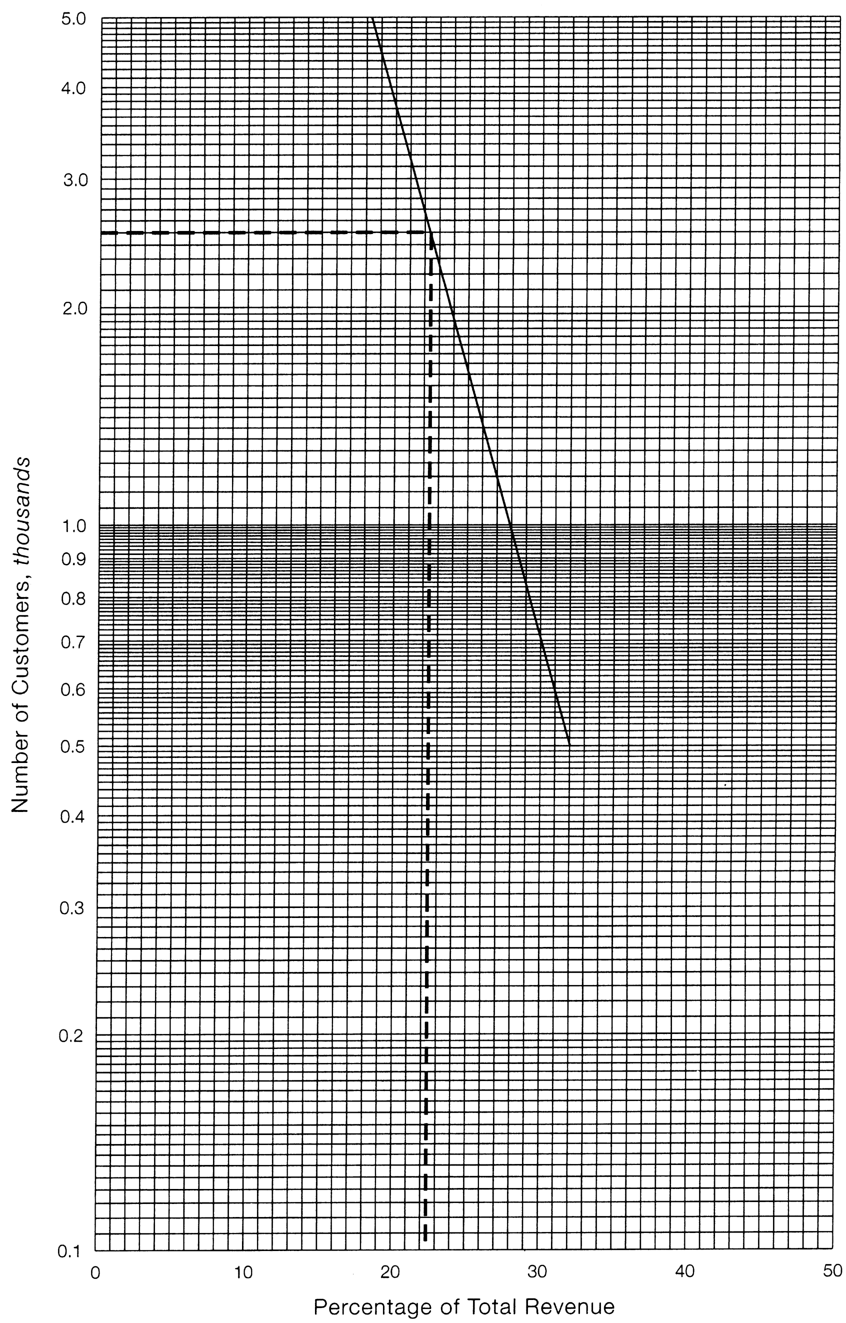

Figure 30-1 Percentage of total revenue allocated as fire protection service cost

Usually, public fire hydrants are owned by the utility, located on public rights-of-way, and available for use primarily by fire departments (or other authorized parties) for the purpose of extinguishing fires. Hydrants may also be used for system purposes, such as flushing or testing. The second level of service is provided to individual customers that receive additional fire protection service through private hydrants, standpipes, or sprinkler connections. These connections provide a direct fire protection service to the individual customer's property that is not available to customers without such connections.

Because utilities provide both public and private levels of fire protection service, they typically allocate the total costs associated with providing fire protection service to each level. Generally, costs associated with providing public fire protection are shared jointly by all customers, and costs of private fire protection are directly allocated to the beneficiary of the private service. Details of the allocation process are discussed later in this chapter.

REGULATED VERSUS NONREGULATED UTILITIES

In theory, there should be no difference between how regulated and nonregulated utilities allocate costs and determine public and private fire protection charges. Though elements of the cost allocation process are certainly subjective and require the application of judgment and consideration of the unique operating characteristics of each utility, the process should be unaffected by the presence or absence of a regulatory body.

In practice, this is often not the case. Municipally owned and operated utilities (typically not regulated by a state or provincial utility commission or board) must be cognizant of the goals, policies, and political objectives of the municipality within which they operate. Because public fire protection charges often are recovered through a charge to the municipal general fund, these charges have a direct bearing on the municipality's property tax rates. It is common to find that the municipality may resist increases in the charges for fire protection services, especially if municipal water rates and charges are set by the same board or commission that also approves tax rates.

Investor-owned utilities (which are typically regulated) are not as concerned with municipal policies. Because rates charged by investor-owned and other regulated utilities are set by state regulatory commissions, there is a certain degree of insulation from local political processes.

DETERMINING FIRE PROTECTION COSTS

Section II of this manual presents information about commonly used methods to determine the portion of total revenue requirements that should be recovered from fire protection charges. The cost allocations presented under the base-extra capacity method in section II are used here to illustrate these methods.

Unit Costs

The allocation of rate base, under the base-extra capacity method from section II of this manual, is presented in Table 30-1; the allocation of depreciation expense is shown in Table 30-2; and the allocation of O&M expense is shown in Table 30-3. (Refer to section II for a complete description of the derivation of these tables.)

The total allocation to fire protection service, including the direct fire protection allocations presented in Tables 30-1 through 30-3 and the portions of average-day, maximum-day, and maximum-hour extra capacity costs that are allocable to fire protection, are shown in Table 30-4. Line 1 of Table 30-4 presents the total unit cost of service for each cost-of-service category developed in section II. The derivation of the unit cost of service is provided in section II.

To determine the amount of each category allocable to fire protection service, it is necessary to determine the average-day or base quantity of water used for fire fighting plus the contributions toward maximum-day and maximum-hour fire demands. The total quantity of water used for fire fighting is minimal in comparison to other uses and is ignored in some studies. In other studies, a nominal amount of base use (between 0.5 and 1.0 percent) is assigned to fire protection. Accordingly, a

Table 30-1 Allocation of rate base using the base-extra capacity method (test year)

Item	Total, $	Base, $	Costs of Extra Capacity: Maximum-Day, $	Costs of Extra Capacity: Maximum-Hour,* $	Customer Meters and Services, $	Direct Fire Protection Service, $
Intangible Plant						
1 Organization	6,000	3,000	1,000	1,000	1,000	
Source of Supply Plant						
2 Land	423,000	423,000				
3 Reservoir	407,000	407,000				
Pumping Plant						
4 Land	23,000	15,000	8,000			
5 Structures	369,000	240,000	129,000			
6 Electric pumping equipment	376,000	244,000	132,000			
Water Treatment Plant						
7 Other pumping equipment	157,000	102,000	55,000			
8 Structures	426,000	277,000	149,000			
9 Water treatment equipment	3,832,000	2,491,000	1,341,000			
Transmission and Distribution Plant						
10 Land	35,000	4,000		31,000		
11 Structures	48,000	5,000		43,000		
12 Distribution storage	1,020,000	102,000		918,000		
13 Mains	5,842,000	2,628,000	1,461,000	1,753,000		
14 Services	2,264,000				2,264,000	
15 Meters	996,000				996,000	
16 Hydrants	404,000					404,000
General Plant						
17 Land	4,000	1,000	1,000	1,000	1,000	
18 Structures	190,000	80,000	37,000	31,000	37,000	5,000
19 Other	129,000	55,000	25,000	21,000	25,000	3,000
20 Net plant in service	16,951,000	7,077,000	3,339,000	2,799,000	3,324,000	412,000
Plus						
21 Materials and supplies	291,000	122,000	57,000	48,000	57,000	7,000
22 Cash working capital	285,000	119,000	56,000	47,000	56,000	7,000
23 Construction work in progress	104,000	47,000	26,000	31,000		
Less						
24 Contributions and advances	(1,445,000)				(1,445,000)	
25 **Test-Year Rate Base**	16,186,000	7,365,000	3,478,000	2,925,000	1,992,000	426,000

*Maximum-hour demand in excess of maximum-day demand.

Table 30-2 Allocation of depreciation expense using the base-extra capacity method (test year)

Item	Total, $	Base, $	Costs of Extra Capacity: Maximum-Day, $	Costs of Extra Capacity: Maximum-Hour,* $	Customer Meters and Services, $	Direct Fire Protection Service, $
Source of Supply Plant						
1 Reservoir	11,800	11,800				
Pumping Plant						
2 Structures	9,600	6,200	3,400			
3 Electric pumping equipment	10,600	6,900	3,700			
4 Other pumping equipment	4,200	2,700	1,500			
5 Structures	11,000	7,100	3,900			
6 Water treatment equipment	83,800	54,500	29,300			
Transmission and Distribution Plant						
7 Structure	1,200	100		1,100		
8 Distribution storage	28,500	2,900	25,600			
9 Mains	161,100	72,500	40,300	48,300		
10 Services	48,900				48,900	
11 Meters	21,500				21,500	
12 Hydrants	12,300					12,300
General Plant						
13 Structures	4,900	2,000	1,000	800	1,000	100
14 Other	4,600	1,900	900	800	900	100
15 **Total Depreciation Expense**	414,000	168,600	84,000	76,600	72,300	12,500

*Maximum-hour demand in excess of maximum-day demand.

nominal amount of costs associated with public fire hydrants can be assigned to the base category because hydrants are used for system purposes, such as pressure testing, *C*-value tests, and for flushing mains. In the example presented in Table 30-4, it is assumed that approximately 0.5 percent of the total in-city annual water use (2,536,000 thous gal, from Table 8-1 in section II) was related to fire fighting. This represents a total of 12,680 thous gal.

The potential maximum-day and maximum-hour demands that result from providing fire protection service can be significant. In general, these demands are determined based on maximum fire demands and individual system performance. Fire flow requirements can be determined from fire flow test reports conducted periodically by the Insurance Services Office or by other engineering studies.

For this example, a fire demand equal to 4,000 gallons per minute (gpm) with a duration of four hours is assumed to be consistent with the example in section II. To determine the total maximum-day units of service presented on line 2 of Table 30-4, a 4,000-gpm fire demand was assumed. This rate of flow is equal to 240,000 gallons per hour (gph). With a four-hour duration, the total maximum day demand is 960,000 gal. The maximum-day extra capacity demand is the total maximum-day demand less the average-day, or base, use of 35,000 gpd (12,680,000 gal/365 days), or 925,000 gpd.

To determine the maximum-hour units of service, the same 4,000 gpm fire is assumed to have a daily flow rate of 5.76 mil gal (240,000 gph × 24 hours). The maximum-hour extra capacity units in excess of maximum-day demands are 4,800,000 gpd.

Table 30-3 Allocation of O&M expense using the base-extra capacity method (test year)

Item	Total, $	Base, $	Costs of Extra Capacity: Maximum-Day, $	Costs of Extra Capacity: Maximum-Hour,* $	Meters and Services, $	Billing and Collecting, $	Fire Protection Service, $
1 Source of Supply Plant	90,000	90,000					
Pumping							
2 Purchased power	259,000	233,100	25,900				
3 Other	193,000	125,400	67,600				
Water Treatment Plant							
4 Chemicals	121,000	121,000					
5 Other	157,000	102,000	55,000				
Transmission and Distribution Plant							
6 Mains	130,000	58,500	32,500	39,000			
7 Storage	26,000	2,600		23,400			
8 Meters and services	155,000	155,000					
9 Hydrants	13,000						13,000
10 Other	72,000	13,600	7,200	13,900	34,400	2,900	
Customer Accounting							
11 Meter reading and collection	247,000	247,000					
12 Uncollectible accounts	44,000	20,800	6,300	2,800	5,900	7,700	500
Administrative and General							
13 Salaries	194,000	70,300	29,100	13,700	33,900	44,200	2,800
14 Employee benefits	177,000	64,000	26,500	12,500	31,000	40,400	2,600
15 Insurance	135,000	77,600	36,300	19,700	1,200	200	
16 Other	266,000	96,300	39,900	18,700	46,500	60,700	3,900
17 **Total O&M Expense**	2,279,000	1,075,200	325,300	143,700	307,900	400,200	25,700

*Maximum-hour demand in excess of maximum-day demand.

Table 30-4 Distribution of costs to fire protection service

Item	Base	Costs of Extra Capacity: Maximum-Day	Costs of Extra Capacity: Maximum-Hour	Direct Fire Protection	Total Cost of Service
1 Unit cost of service	$0.5742 per thous gal	$67.2394 per thous gpd	$27.8065 per thous gpd		
Fire Protection Service					
2 Units of service	12,680,000 gal	925,000 gpd	4,800,000 gpd		
3 Allocated cost of service	$7,281	$62,196	$133,471	$58,100	$261,048

Table 30-5 Allocation of fire service costs to public and private fire service

	Number in Service	Demand Factor*	Equivalent Connections	Percent of Total Fire Protection Costs	Allocation,† $
Public Fire Service					
City A	953				
Town B	202				
Total public hydrants	1,115	111.31	128,564	71.5	145,108
Private Fire Service					
Size of connection, *in.*					
1.5	4	2.90	12		
2.0	6	6.19	37		
3.0	12	17.98	216		
4.0	24	38.32	920		
6.0	80	111.31	8,905		
8.0	120	237.21	28,465		
10.0	23	426.58	9,811		
12.0	4	689.04	2,756		
Subtotals	273		51,122	28.5	57,840
Totals	1,428		179,686	100.0	202,948

*Demand factors based on nominal size of connection raised to the 2.63 power.

†Includes all capacity-related costs but excludes direct fire protection costs of $58,100 presented in Table 30-4.

The unit costs in line 1 of Table 30-4 are multiplied by the units of service in line 2 to derive the total allocation for each category in line 3. These individual unit costs are then added to the direct fire protection allocation of $58,100, resulting in a total allocation for fire protection service of $261,048.

Public/Private Fire Service Allocation

Total fire service costs can be further allocated to public and private fire protection service by using the relative demands of various size hydrant branches and private sprinkler connections. Table 30-5 presents the allocation of the total fire protection costs from Table 30-4 to public and private fire service. Because a utility's fire protection costs depend on the potential demands for fire fighting purposes, total costs may be allocated between public and private fire service based on the relative potential demands from each type of service. To measure this relative potential, demand factors for each size service or connection can be derived based on the nominal size of the cross-sectional area of the connection. Using the principles of the Hazen-Williams equation for flow through pressure conduits, the relative flow potential for various size pipes is dependent on the diameter raised to the 2.63 power. (In many studies, a factor of 2.0 is used.) The 2.63 factor was used in Table 30-5 to derive the demand factors shown. All public fire hydrants were assumed to have a 6-in. connection.

Demand factors for each size service are multiplied by the number of connections of each size to derive the total number of equivalent connections. Comparing the total public fire hydrant equivalents to the total public and private equivalents indicates that 71.5 percent of the total fire protection costs should be allocated to public fire service. The percentage of costs that should be recovered through private fire service charges (28.5 percent) is derived in a similar manner.

The example presented in Table 30-5 distributes the allocated fire service cost, excluding the direct fire protection costs of $58,100, between public and private fire service based on relative demands. Total costs typically include some costs that apply only to public fire hydrants maintained by the utility. In this example, costs associated with the maintenance, depreciation, return on rate base, or associated debt service for public hydrants are deducted from the total fire service amount before allocating costs to public and private fire service. Costs applicable only to public fire hydrants are then added back to the public fire service costs to determine the total public fire service allocation.

Public Fire Protection Charges

After the costs associated with public fire protection are determined, a method must be found to recover the costs. A number of methods have been used or suggested to recover costs.

Charges to Municipalities

In most cases, water utilities assess the public fire protection charge directly to one or more municipalities. The municipality then recovers this charge along with all other general fund expenses—typically by assessing *ad valorem* taxes. Such a method of recovering costs is believed to be generally equitable in that individual property owners pay for fire protection service based on the value of their property—a measure of the benefit they receive for fire protection.

Hydrant charges. The most common method to recover costs is to assess the total public fire protection cost to the municipality. Often, the cost is divided by the number of public fire hydrants to determine a per-hydrant cost. This method is especially useful in situations where the utility serves more than one municipality, because it provides a mechanism to divide costs among the various communities. It also provides the utility with increased revenue to meet fire protection costs as the number of hydrants increases with growth.

To determine the per-hydrant charge, the total public fire service allocation from Table 30-5 ($145,108) plus the direct public fire protection allocation ($58,100) are added to derive a total public fire protection cost ($203,208). This value is then divided by the number of public fire hydrants. The top portion of Table 30-6 presents the calculation of a per-hydrant charge. In this example, there are two communities served and the number of public fire hydrants in each community is determined. After the per-hydrant charge is calculated, the annual public fire protection charge for each community can be calculated.

Inch-foot hydrant charges. For purposes of allocating public fire protection costs between two or more communities, charges based on the number of fire hydrants in a community do not necessarily reflect an appropriate allocation of the full costs associated with providing public fire protection. The direct cost of fire hydrants is a relatively small portion of total fire protection costs. Usually, the majority of costs are associated with providing distribution capacity to deliver sufficient quantities of water to fire hydrants. To reflect this, an alternative to the per-hydrant charge is to combine hydrant charges and charges based on the size and length of pipe used to support the fire hydrants.

To determine the quantity of piping used to provide water to hydrants, a measure that reflects both the size and length of pipe is commonly used—the number of inch-feet of pipe. The total number of inch-feet of pipe in a community is determined by multiplying the length of each size pipe by its nominal diameter. (For example, 1,000 ft of 6-in. diameter pipe would equal 6,000 in.-ft.) In many studies, pipe less than 6 in. in diameter is excluded from the calculation because smaller pipes provide minimal fire protection capability. A relatively small percentage of the

Table 30-6 Calculation of public fire protection charges

Per-Hydrant Charge

Allocated public fire protection cost	$145,108
Direct public fire protection cost	$58,100
Total public fire protection cost	$203,208
Number of public fire hydrants	1,155
Annual charge per hydrant	$175.94

Community	Number of Hydrants	Charge per Hydrant, $	Annual Fire Charge, $
City A	953	175.94	167,669
Town B	202	175.94	35,539
Total	1,155		203,208

In.-ft Hydrant Charge

Total public fire protection cost	$203,208
Hydrant allocation, 30%	$ 60,962
In.-ft allocation, 70%	$142,246

$$\frac{\text{Total Allocation for Public Hydrants}}{\text{Total Number of Public Fire Hydrants}} = \frac{\$60,962}{1,155} = \$52.78/\text{hydrant}$$

$$\frac{\text{Total Allocation for In.-ft of Mains}}{\text{Total Number of In.-ft in System}} = \frac{\$142,246}{3,691,000} = \$0.0385/\text{in.-ft}$$

Community	Number of Hydrants	Hydrant Charge, $	In.-ft of Mains	In.-ft Charge, $	Total Annual Fire Charge, $
City A	953	50,300	3,150,000	121,397	171,697
Town B	202	10,662	541,000	20,849	31,511
Total	1,155		3,691,000		203,208

capacity in large transmission mains is typically allocated to fire flow. For that reason, such mains are often excluded from the calculation of inch-foot of pipe. In cases where the larger transmission mains that serve several jurisdictions are included in the inch-foot calculations, they may be distributed on the basis of population or other appropriate criteria in order to recognize varying demand requirements.

The calculation of a combination of inch-foot and hydrant charges is shown in the lower portion of Table 30-6. Typically, the costs directly associated with fire hydrants as well as some portion of administrative and overhead costs are assigned to the hydrant charge. The remaining costs are assigned to the inch-foot fire protection charge. In the example presented in Table 30-6, approximately 30 percent of the total public fire protection costs are associated with direct costs for public fire hydrants. These costs are divided by the total number of public fire hydrants to derive a per-hydrant charge. The remaining costs are associated with the delivery of water to the hydrants. These costs are divided by the total number of inch-foot of pipe in the system to derive a charge per inch-foot of pipe.

Table 30-6 shows the resulting calculation of hydrant and inch-foot charges for two communities. Relative to the number of hydrants, City A has proportionately more inch-feet of pipe than does Town B. As a result, the combined inch-foot hydrant charge method assigns more public fire protection costs to City A than does a charge based solely on the number of hydrants. The inch-foot hydrant charge may better reflect both greater fire demands in City A as well as the greater capacity available to provide water to hydrants for fire fighting.

In most areas, assessing public fire protection charges to the municipalities, which in turn recover costs from property owners, works well. However, there are situations where the use of property taxes can result in some inequities. The most obvious problem arises with the treatment of tax-exempt properties. Because these properties do not pay property taxes, they do not contribute toward public fire protection even though they receive the service. This problem is most acute in communities that have numerous state and federal office buildings or in communities with other large tracts of tax-exempt property, such as schools and universities.

Another problem that many utilities encounter when developing public fire protection charges is resistance from municipalities to another general fund charge. Because municipalities have little recourse other than to increase tax rates when there are increased or new public fire protection charges, they can be expected to resist such charges or to try to minimize the charges.

DIRECT PUBLIC FIRE PROTECTION CHARGES

Direct charges to individual properties can be used to overcome the problem of recovering public fire protection cost from tax-exempt properties. Perhaps the most common method is to simply recover the cost of public fire protection through all other water rates and charges. While water use does not necessarily reflect cost responsibility for public fire protection, there may be some correlation in that customers using a greater volume of water may have larger properties with greater fire flow requirements. This presumed correlation may be only generally true and is certainly not valid in all cases. (Other methods of recovering public fire protection costs through direct charges are discussed later in this chapter.)

Rather than charging the municipality based on the number of hydrants or hydrants and inch-foot of pipe, a public fire protection charge may be assessed by the utility to individual properties based on the value of the buildings or structures on the properties. Building value may be a better indicator of the value of public fire protection provided than total property value because the land portion of property typically is not lost to fire. Charges based on the value of structures should be carefully evaluated by the utility's legal counsel to ensure that such charges are not an illegal tax. An additional concern with this method is obtaining and maintaining the data base necessary to bill for fire protection based on the value of structures.

An alternative direct-charge mechanism is a fixed charge that is unrelated to water use included on the water bill. Under this method, classes or types of customers can be classified and assessed various fire protection charges. It is necessary to determine an assessment method or basis for billing that equitably recovers costs from each user and can be easily administered. One alternative is to charge each customer a fixed amount. While easy to administer, this method does not recognize any differences in the level of fire protection service provided.

Another method is to have fixed charges by customer class, with the larger properties (associated with commercial and industrial classes) assessed a higher charge to reflect the presumed greater potential fire demands. Another option is billing based on equivalent meters, where it is assumed that customers with larger meters have larger properties to protect. Public fire protection charges can be included in the volume rate charged to all customers, and the amount of such charges can be identified as a fire protection surcharge.

Table 30-7 Private fire service charges

Private fire service allocation	$57,840
Fire service equivalents	51,122
Charge per equivalent	$1.1314

Service Size, *in.*	Number in Service	Demand	Fire Service Equivalent	Annual Charge, *$*
1.5	4	2.90	12	3.25
2	6	6.19	37	7.00
3	12	17.98	216	20.34
4	24	38.32	920	43.36
6	80	111.31	8,905	125.94
8	120	237.21	28,465	268.38
10	23	426.58	9,811	482.63
12	4	689.04	2,756	779.58
Totals	273		51,122	

PRIVATE FIRE SERVICE CHARGES

Table 30-5 presents the allocation of total fire service costs to public fire protection and private fire protection. Costs associated with providing private fire service may be recovered in several ways as described in the section that follows.

Charges Based on Service Size

The most common method of charging for private fire service is to base the charge on the size of the customer's fire service connection. The service size is the best measure of the demand that can be put on the system in case of a fire. The service is also what the water utility provides service to; what the customer does with the water beyond the property line is largely outside the control of the utility.

Table 30-7 provides a calculation of private fire service charges based on service sizes. As presented in the table, the private fire service allocation is divided by the total number of private fire service equivalents. (Both numbers are derived in Table 30-5.) The per-equivalent charge is then applied to the demand factor for each size service to find the private fire service charge.

Additional Considerations

Another methods of charging for private fire service include charges based on the number of sprinkler heads. Because most modern sprinkler systems function so that only the sprinkler heads in the vicinity of the fire operate, the number of sprinkler heads is not particularly relevant. Also, charges based on the number of sprinkler heads require an additional administrative burden of (1) initially determining the number of sprinkler heads at each location with a private fire service and (2) periodically updating or checking the number in each customer's property.

Section III of this manual discusses customer service charges. These charges consist of two components: (1) a per-meter charge to recover costs associated with customer meters and (2) service lines and a per-bill charge to recover costs associated with billing and collection. Though private fire services do not require meter readings, they should be checked periodically to ensure that unauthorized uses of water through private service lines do not occur. In many cases, it is appropriate to add an inspection, billing, and collection charge component to the private fire service charge.

Some customers install their own storage facilities for fire fighting purposes. These storage facilities may be directly connected to the customer's fire protection system. In these cases, the customer places less of a peak demand on the utility's storage and distribution system. Accordingly, the utility may wish to provide a credit in the private fire protection charges for such customers.

Because the utility often must maintain the service connection to a customer's private fire service, an additional charge for this cost component may be added. The utility should be careful not to include costs associated with water meters unless the utility meters private fire services.

EMERGING ISSUES

Recently, a separate allocation of costs to private fire service and the resulting charges to customers with private fire service connections have become issues in some locations. It has been argued that private fire connections place no additional demand on the utility water system and in fact can reduce fire demands by faster, more efficient extinguishing of fires. Accordingly, it is argued, there should be no additional charges for private fire service. The basis for this is that the water system is design to meet fire protection demands based only on the demands from public fire hydrants. Customers with private sprinkler connections share in and pay their fair share of fire service costs. Water used through private sprinkler connections is used to control or to quickly extinguish the fire before fire fighters arrive. In addition, private sprinkler connections use significantly less water than hydrants for fire fighting; as a result, they may reduce actual fire demands, because water is typically supplied only to the area of the fire.

The alternative view is that customers with private sprinkler connections do indeed receive a service that customers without such connections do not receive. They have water provided on demand for their sprinkler systems. Such customers typically receive substantial insurance savings as a result of having sprinkler connections. In some cases, the building could not be constructed or occupied without the private fire connection, which would clearly indicate that an additional service is being provided. Those opposed to eliminating private fire service charges contend that the community as a whole should not carry the cost of a special service to a relatively few customers who wish to take advantage of fire service capacity in a particular way. In addition, opponents argue that these individuals want additional protection against a special hazard that they create or that is inherent in their business.

The debate about the appropriateness of assessing charges for private fire protection and the appropriate level of such charges will continue as long as

- the benefits of private fire connections increase (by savings lives and extinguishing fires more quickly)
- more municipalities require private sprinklers for certain buildings
- water service costs increase

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Section VIII

Wholesale Rates

Wholesale Rates

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Chapter 31

Wholesale Rates

WATER SERVICE

Wholesale service may be defined as "a situation in which water is sold to a customer at one or more major points of delivery for resale to individual retail customers within the wholesale customer's service area." Most wholesale customers are communities purchasing water to distribute and resell to their own citizens. In some cases, investor-owned water utilities may purchase wholesale water service from other water utilities. A provider of wholesale service that is growing in importance is regional water authorities. The rates developed under regional water authorities benefit from the economies of scale associated with efficiently meeting territorial water demands.

In providing wholesale service, most utilities are dealing with a few high-consumption customers. In most cases, wholesale customers do not use certain facilities and services required by retail customers. Usually, the wholesale customer provides these additional services to its customers. Thus, the utility provides water at one or more delivery points, and the wholesale customer provides the distribution system, meter reading services, individual customer billing, and customer service. The wholesale customer also frequently repumps and provides ground or elevated storage of water.

DETERMINING COST OF SERVICE

A cost analysis is required to determine revenue requirements of wholesale water service and to allocate this revenue requirement to individual wholesale customers or to the wholesale group as a class. The analysis should include specific conditions of service to wholesale customers, specific type and level of service provided, and consideration of the way in which the utility actually provides service to its customers. Properly designed rates should recover the cost, as nearly as is practicable, of providing service to a customer, or a class of customers, with minimal cross-subsidizing among customer classes.

Section II of this manual describes cost allocation methodologies. These methods emphasize that the cost of providing water service varies with the total amount of

Table 31-1 Customer class demand factors

Customer Class	Maximum-Day Factor* (*range*)	Maximum-Hour Factor (*range*)
Residential	1.50–4.00	2.00–8.00
Commercial	1.20–3.00	1.75–4.50
Industrial	1.05–2.25	1.30–3.00
Wholesale*	1.20–2.50	1.50–4.00

*Maximum-week factors, where applicable, are somewhat lower than maximum-day factors.

water consumed and the relative peak demand of customers or classes of customers. This fact has important implications for wholesale customers. Peak demand often is expressed as a ratio or demand factor (peak demand divided by average-day demand). Thus, if the peak demand of a customer or class of customers is 2.0 mgd and the average-day demand is 1.0 mgd, the peak demand factor is 2.0. Peak demand, usually measured based on maximum-day and maximum-hour demands, is the primary variable (other than overall annual average-day consumption) that influences both water system design and the cost of providing service. For larger regional utilities, maximum-week demand and their wholesale customers may be the primary design and cost variable. Demand factors determine cost by customer class. Table 31-1 shows typical demand factors exhibited by customer classes.

Typically, rates and rate structures for wholesale customers must be developed for many political jurisdictions. As a result of political considerations, variations in legal precedents, and unique customer/supplier relationships, wholesale rate methodologies vary widely. The rate structures of investor-owned water utilities are approved by regulatory authorities and may vary, but discrimination across customer classes, largely, is prohibited. This chapter provides general background on several approved wholesale rate structures used in public and private sector water companies. Sometimes, compromises are made to meet the cost allocation objectives of the various political and regulatory jurisdictions. As a result, wholesale revenue requirements for governmental utilities may be based on the cash methodology, the utility methodology, or some combination of the two. Investor-owned water companies primarily rely on the utility methodology when developing wholesale revenue requirements. Wholesale rate structures may be a uniform volume rate for the wholesale customer class; a uniform volume rate that is unique for each wholesale customer; a seasonal, block, or demand rate; or some combination or variation of these.

Table 31-1 illustrates that the maximum-day and maximum-hour demand factors for wholesale water service may vary widely; however, as the illustration depicts, the range of intra-class diversity for the wholesale class is somewhat greater than is present within the industrial class, and lower than is exhibited within the residential class. Such variability is understandable when one considers that a typical wholesale customer serves a mix of residential, commercial, and industrial customers. The many types of customers served by the wholesale customer translate into a more uniform demand on the supplying utility. In addition, the wholesale customer may modify its system with purchased water to better manage system water resources. For example, a wholesale utility may purchase water to recharge a water storage facility. Allowing the storage tank elevation to rise or fall with demand of end-use customers, the wholesale customer's demand profile may more resemble that of a large industrial customer and can actually result in reducing the maximum-hour demand placed on the water supplier.

Another consideration in cost analysis is recognition that a wholesale customer typically provides and maintains its own distribution facilities. Thus, depending on specific circumstances, the cost analyst may determine that costs for some of the smaller distribution mains should not be allocated to the wholesale customer class.

Factors that affect the relative demand, or load, factor exhibited by a wholesale water customer, include

- Wholesale purchaser's customer-class characteristics
- Wholesale purchaser's distribution system arrangement
- Number and location of booster pumping stations operated by the wholesale purchaser
- Number, location, and size of distribution storage reservoirs operated by the wholesale purchaser
- Limitations imposed by the selling utility's own transmission and distribution system

TYPES OF SERVICE

Cost allocations vary according to the type of service provided to a wholesale customer. Types of service are defined in terms of the nature of the contract for service. They include a firm commitment contract, surplus water contract, emergency reciprocal contract, and peak requirement contract. A firm commitment contract is the most typical service for wholesale customers.

Firm Commitment Contract

In this type of contract, the supplier agrees to provide water to the wholesale customer with the same level of service it gives its own customers. If a water shortage occurs, the supplier and the wholesale customer may experience relatively equal reductions in the level of service, depending on the exact terms of the contract, provincial, state, and local regulations. For the providing utility, this type of service is more costly than other types of wholesale water service because water supply, treatment, storage, transmission, and pumping facilities are designed and operated based on the total demands of both the utility and the wholesale customers combined.

Because a firm commitment contract requires the utility to build facilities for wholesale customers in advance of need, the contract may be long term, typically 20 years or longer. The contract probably would impose a financial penalty to the wholesale customer for leaving the system before termination of the contract. This practice reduces, but does not eliminate, the financial risk of constructing expensive facilities to provide additional capacity required by the wholesale customer. It is possible that the utility will be left with unused and unnecessary capacity if the wholesale customer leaves the system with little advance notice to develop its own system or to purchase water from another utility. At the other extreme, some retail utilities are required to obtain supplies from the regional provider so there may be almost no such risk.

Surplus Water Contract

In surplus water contracts, the utility agrees to provide to the wholesale customer only water that is available in excess of the utility's needs. Caution should be exercised with this type of contract in situations where the wholesale customer may become permanently dependent on this source of water. A surplus water contract probably will include a fixed termination date, typically tied to the construction of additional facilities by the wholesale customer to make the customer self-sufficient. If a period longer than five to seven years is required, a firm commitment contract may benefit both contracting parties.

Emergency Reciprocal Contract

An alternative method of contracting with a wholesale customer with its own water supply is through an emergency reciprocal contract. With this type of contract, each water provider stands ready to provide service on an emergency basis to the other provider.

Typically, the utility that constructs, maintains, and operates the emergency connection charges a fee to recover these limited costs. Any water taken by either party during an emergency could be returned in kind to the other party after the emergency condition ends. This type of service is inappropriate for drought condition peaking, because compensation to the supplying party would be inadequate to cover the actual costs incurred.

Peak Requirement Contract

A peak requirement contract commits the supplier to stand ready to provide service during peak use seasons or drought conditions only. Unless the supplier has large surplus capacity, this can be an expensive service to supply. Facilities might be constructed and maintained but remain unused for years. Setting rates for this type of service is probably the most difficult and controversial, because relatively large costs must be spread over a small quantity of water.

Finally, interruptible service is rarely used for wholesale customers. The need for predictable revenues and a public utility's legal obligation to maintain service to a municipality make this type of relationship risky to the utility.

RATE DESIGN

Wholesale rates should be designed to recover the costs of providing service based on usage, pattern of usage, and level of service of individual wholesale class members. Often, in developing a rate design to recover the cost of providing wholesale service, customer-related costs are a small percentage of the total cost of service. Rather than use a wholesale service charge, some utilities recover customer-related costs through the commodity, or volume, charge. This may be appropriate particularly if the wholesale customer must pay for a minimum amount of water each month (a "take-or-pay contract"). If wholesale customer costs are significant and other classes are assessed a service charge, then it is reasonable, based on the objectives of consistency and revenue stability, to develop a service charge for wholesale customers.

Typical Wholesale Rate Designs

The more typical wholesale rate designs are uniform volume, seasonal, declining block, and demand rates. The advantages and disadvantages of these methodologies, as applied to wholesale service, are discussed in this section. Water utilities typically have limited the use of demand rates to wholesale customers. In addition, a contract demand charge can be incorporated into a wholesale rate structure. Further discussion of the contract demand charge is presented in section IV of this manual.

Uniform volume rate. A widely used rate structure for wholesale customers is a uniform volume rate to recover the costs of the wholesale customer class. In this structure, the average price for water is the same for all wholesale customers. This is the most easily understood rate structure and is the simplest to calculate and implement. Where demand characteristics do not significantly differ among individual wholesale customers or between wholesale customers and retail customers, a uniform volume rate for the wholesale customer class or a seasonal rate for the wholesale customer class may be appropriate and cost-effective choices.

Where the wholesale purchaser has other supply options, a minimum-purchase (take-or-pay) requirement may be added to the wholesale customer's rate structure. The purpose of such a requirement is to discourage a customer from using the utility system as a supplemental source of supply to meet peak requirements. This take-or-pay requirement may complicate the rate design if the minimum purchase quantity is not likely to be met by some of the wholesale customers.

Seasonal rate. This rate structure allows the utility to recover costs associated with high demands imposed by the wholesale customer during a few months of the year. Where wholesale customers have large seasonal variations in usage as a result of large numbers of seasonal residents, this may be the most appropriate rate structure. In cases where seasonal increases are weather related, applying seasonal rates to large wholesale customers may affect the utility's financial stability or require it to establish a rate stabilization fund. Setting seasonal rates is more complex than setting a uniform volume rate for the wholesale customer class.

Declining block rate. Traditionally, this rate structure has targeted large commercial and industrial retail customers and, in some cases, wholesale customers. Some believe the rate reflects the lower unit costs associated with serving large customers, who have better load factors than the majority of smaller customers. Others use the declining block rate because it recovers fixed costs first and then variable costs. This rate design has several disadvantages. The largest customer may or may not impose the least cost for service on a unit of consumption. Traditional pricing of the highest consumption block has imputed an average-demand factor to the entire group purchasing water in that block. The likelihood is that the majority of very large customers exhibit lower-than-average demand factors. However, the customer who actually exhibits the lowest demand profile among the eligible group is not necessarily the customer with the greatest usage. Additionally, the declining block rate is viewed with disfavor in many jurisdictions because of the perception that it is a volume-discount scheme unrelated to cost and because of environmental considerations. Gaining approval of this rate structure can be difficult where the approval body is concerned with source of supply issues. The rationale for providing this rate must be thoroughly supported and explained to the board or council.

Demand rate. The use of demand rates has been less common in the water industry than in the electric industry. The factors that have restricted the use of demand rates in the water industry include cost of demand metering in relation to the cost of water sold, lack of availability and transferability of demand data among water utilities, and complexity of establishing and understanding demand rates. Recently utilities have been under additional pressure to examine their rate structures because of the increasing cost of water and concerns for the environment.

In essence, this rate structure allocates, or, from a costing standpoint, reserves, a portion of water production facilities for a given customer or customer class. The capacity allocated or reserved is the peak-daily or peak-hourly demand allowed for the customer or customer class. For this reserved capacity, the wholesale customer pays a fixed charge per month to cover demand or extra capacity-related costs. Commodity or base-related charges are then recovered through a uniform charge per unit of volume. Thus, the average cost to a wholesale customer decreases up to its reserved capacity allocation. Another way of implementing a demand rate is to levy a charge based on the annual maximum daily or weekly demand of the wholesale customer, in addition to a uniform charge per unit of volume.

When capacity is reserved, any excess capacity used could be billed at a penalty rate, discouraging inordinate peaking and low estimates of reserved capacity. A utility with highly seasonal demands may choose to implement the penalty only during peak-usage times of the year to maximize use of facilities. Each demand-rate customer needs to be monitored on a daily and hourly basis to determine whether penalty charges are appropriate. This requires the use of special metering equipment. Similar charges should apply to large retail customers of the wholesale utility as well.

A demand rate is one option generally acceptable in all states and provinces. The major restriction in the use of a demand rate is the cost of metering necessary to allocate costs and to bill customers. A metering system with flow rate recording equipment and a rate of flow controller can cost hundreds of thousands of dollars, which may be impractical for smaller wholesale customers. For these smaller users, the rate of flow controller can be eliminated and data from the flow rate recorder used instead. If members of the wholesale customer class have similar usage patterns, the expense rate of flow controllers may not be justified. The use of a restriction, or orifice, plate to limit the demand to a maximum specified level might be a cost-effective alternative, if the utility is able to maintain a constant pressure at the point of service to the wholesale customer.

A demand rate is similar in complexity to seasonal rates. To allocate costs properly among wholesale and, if necessary, retail customer classes, maximum-day and maximum-hour data for both wholesale customers and any retail customer class or classes must be determined. A demand rate requires frequent meter reading. Recording equipment to retain hourly demand information is recommended when using demand rates. Another alternative is the use of telemetry equipment to send consumption and flow-rate data to a central location, either by leased telephone lines or by radio or microwave transmission. Because of the importance of daily and hourly demands, meter calibration must be verified more frequently than residential meters, which register only total volume.

Unless the utility already has metering facilities to determine hourly and daily demands for both system and wholesale customers, implementing a demand rate can require several years of lead time. Flow readings should be taken during peak usage to acquire adequate information to allocate costs before implementing demand rates. Unless wholesale customers are willing to base their upcoming rates on flow rate information they have collected, at least one full year of data should be accumulated before demand rates are implemented.

Utilities plan the size of most facilities used by wholesale customers to meet maximum-day or maximum-week demands. Therefore, demand rates offer one equitable method of recovering costs from customers or customer classes whose usage characteristics vary significantly. A rate design that separates demand and volume charges for wholesale customers provides a financial incentive to construct storage facilities and to implement policies and programs to reduce peak usage.

Rate methodologies that recognize the demand characteristics of individual customers or customer classes can be of long-term benefit to the utility and the wholesale customer. The utility can defer construction of additional facilities that will be used only one or two days per year. Those customers with abnormally high peak-to-average ratios pay a higher effective rate per unit of water purchased. Customers with significant amounts of storage and low peak-to-average ratios benefit from a low effective rate per unit of water.

While demand rates can effectively reduce peak usage, they may not be as effective as seasonal rates at reducing total annual usage. Any effective conservation program that reduces average day demand will generally also reduce peak day demand (allowing peak demand days to be reduced) and reduce total annual volume (reducing volume-based component of the rate). This points out the importance of having wholesale rates that adequately reflect cost-causation factors. If peak demand is a major determinant of system capacity and the need for system expansion, a demand charge is appropriate. If system expansion is driven more by total annual use, a demand charge is less appropriate.

Some utilities using demand rates have a ratchet, or penalty, clause in their contracts that holds customers liable for a future period of time for exceeding their requested maximum-flow or maximum-demand rate. (A penalty clause could be added to a seasonal rate contract to accomplish the same objective.) A wholesale utility using metered demand can base the charge on the largest maximum demand rate in the past period of time. This practice is equitable because it reflects the fact that a system cannot be expanded and contracted from year to year to meet fluctuating annual system demands. After a system is constructed, it will remain in place, even if unused. To the extent that demand in the wholesale customer's service area is growing, the ratchet may have an impact for only a few years. If demand in the wholesale customer's service area is static or declining, the effect could last much longer.

The demand component of a demand-type rate is somewhat higher under the commodity-demand method of cost allocation than under the base-extra capacity method. This fact is illustrated in the following example.

To the extent that costs of providing service are related to peak demand, a uniform volume rate by itself may be less equitable than one with a demand rate or a seasonal rate. A uniform rate provides little incentive for the wholesale customer to reduce peak demand. Even with a seasonal rate, reduced peak demand by a wholesale customer results in reducing the revenue received from the wholesale customer, potentially requiring an increase in rates. This is minimized by the use of a properly designed demand rate.

Developing and implementing demand rates requires some effort. However, where the wholesale class purchases a significant portion of the total water sold by a utility, use of a demand rate instead of a uniform rate can improve the utility's revenue stability.

EXAMPLE

Based on data from the tables in section II of this manual, Table 31-2 shows the unit cost, units of service, and the allocated cost of service for the wholesale customer class using both the base-extra capacity method and the commodity-demand method.

In this example, the wholesale customer class has an annual use of 230 mil gal. This is an average rate of 630 thous gpd. Assuming a maximum-day demand factor of 225 percent of average-day demand, the total maximum-day demand for the wholesale class would be 1,418 thous gpd, or 788 thous gpd in excess of average-day demand. Assuming a maximum-hour demand factor of 375 percent of average-day demand, the total maximum-hour demand for the wholesale class would be 2,363 thous gpd. Because maximum-hour demand typically is expressed in either base-extra capacity or commodity-demand methodology as maximum-hour extra demand in excess of maximum-day demand, maximum-hour demand would be 945 thous gpd (2,363 – 1,418).

Table 31-2 Wholesale customer class units of service and annual allocated costs by two methods

Method	Annual Volume	Maximum-Day Demand	Maximum-Hour Demand	Equivalent Meters	Billing	Annual Allocated Costs
Base-Extra Capacity						
Unit costs	$0.6893	$84.8803	$37.6504	$31.6180	$1.9924	
Units of service	230,000*	788†	945†	34	48	
Allocated costs	$158,500	$66,900	$35,600	$1,100	$100	$262,200
Commodity-Demand						
Unit costs	$0.2010	$127.54191	$39.2642	$31.6180	$1.9924	
Units of service	230,000*	1,418†	945†	34	48	
Allocated costs	$46,200	$180,800	$37,100	$1,000	$100	$265,200

*thous gal

†thous gpd

Unit costs in Table 31-2 provide a basis for developing rates applicable to the wholesale customer class. The unit rate per thousand gallons is the base, or commodity, cost shown. Under the base-extra capacity method, the maximum-day demand charge, applicable to demands in excess of annual average-day demand, is $84.880 per thous gpd. The maximum-hour demand, applicable to hourly demands in excess of the maximum-day demand, is $37.650 per thous gpd. Similarly, under the commodity demand method, the maximum-day demand charge, which is applicable to the total maximum-day demand, is $127.542 per thous gpd. The maximum-hour demand charge under the commodity-demand method is $39.264 per thous gpd and is applicable to hourly demands in excess of maximum-day demand. The equivalent meter and billing charges are the unit rates shown in the table. Utilities using maximum-week demand would use a similar methodology.

Under these charging methods, particularly the base-extra capacity method, the maximum-day or maximum-week-demand charge units of service for billing purposes will not be known with certainty until the actual annual average-day demand for a particular wholesale customer is known. Annual average-day demands from the previous year can be used to determine maximum-day extra capacity units on a preliminary basis, with a year-end settle-up used to recognize any variances above or below the estimated annual average-day demand used for initial billing purposes.

The application of rates to a wholesale customer is illustrated in Table 31-3. For simplicity, the example shows the development of a single annual bill. Basic data about the customer is shown at the top of the table, with billing rates as applied to the basic data shown in the lower portion of the table. In this example, the customer would receive a bill of $136,555 using the base-extra capacity method and $135,202 using the commodity-demand method. Under normal conditions the differences are relatively small.

In certain circumstances, a utility may bill demand charges to wholesale customers based on their rate-of-flow controller (ROFC) settings. When this is the contractual basis for service, wholesale customers are allowed to determine the amount of capacity they wish the utility to "reserve" for them; thus, they know their annual demand costs. Because customers are billed based on their requested ROFC setting, whether or not they use the full demand, a settle-up at year end is not needed.

At times, a utility may have excess supply, treatment, and transmission capacity. This may be a result of shrinkage in the population served, loss of service area, or loss of a major water-using customer. In these situations, competitive or

Table 31-3 Wholesale customer class annual bill calculation

Days in billing period	365
Meter size	6 in.
Volume of water used	126,550 thous gal
Total maximum-day flow	709.0 thous gpd
Total maximum-hour flow	1,184.0 thous gpd
Average-day flow	346.7 thous gpd
Maximum-day extra flow	362.3 thous gpd
Maximum-hour extra flow	475.0 thous gpd
Equivalent meters	21

	Calculation of Revenues Related to					
Method	Annual Volume	Maximum-Day Demand	Maximum-Hour Demand	Customer Meters	Billing	Annual Revenue
Base-Extra Capacity						
Unit costs	$0.6893	$84.880	$37.650	$31.62	$1.99	
Billable units	126,550*	362.3†	475.0†	21	12	
Revenue	$87,231	$30,752	$17,884	$664	$24	$136,555
Commodity-Demand						
Unit costs	$0.2010	$127.542	$39.264	$31.62	$1.99	
Billable units	126,550*	709.0†	475.0†	21	12	$135,202
Revenue	$25,437	$90,427	$18,650	$664	$24	

*thous gal

†thous gpd

negotiated water pricing to wholesale customers may benefit retail customers. If surplus capacity can be sold to a wholesale customer, the revenue requirement for retail customers is reduced. However, the sale of water at a price less than allocable cost has several disadvantages. Many communities consider water availability an important marketing strategy and hesitate to sell water at less than its allocable cost of service, even if such a move reduces rates to retail customers. In addition, future growth in demand by retail customers or gaining a major water-using customer can significantly raise the cost to existing retail customers by requiring the construction of new facilities while contractually providing service to wholesale customers at below cost.

Other Rates

Off-peak rates generally do not apply because most wholesale customers receive peak service on a similar basis to retail customers. This rate design would be appropriate for wholesale customers who had other supply sources and were willing to use the other sources during peak periods. Off-peak rates are a variation of a demand charge and also require reliable maximum-day and maximum-hour data.

A single inverted-block rate for all classes usually is not equitable for wholesale customers because it fails to reflect load factors and economies of scale. This rate structure may be more appropriate if supply sources are nearing full capacity and additional, expensive sources of supply must be obtained. However, utilities should use care in selecting rate blocks for service to wholesale customers. Blocks may need to be unique to the wholesale class because of the significantly larger quantities of water purchased by the wholesale customer.

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Section IX

Miscellaneous and Special Charges

Miscellaneous and Special Charges

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Chapter 32

Miscellaneous and Special Charges

In recent years, water utilities have begun to unbundle some of the costs of miscellaneous ancillary services related to producing water, creating special service charges to cover these costs. These service charges are designed to require the customer who uses the services to pay for these costs through separate fees and charges.

Several factors are involved in cost unbundling. First, any practice that matches a customer's rate with the cost to serve that customer enhances equity. Second, by charging for a particular service, utilities can manage demand for that service. Often, the absence of a fee for a service results in overuse of the service. Consequently, the utility incurs extra costs that must be covered through other revenue sources, most commonly through general water rates. By managing demand for a service, the utility can more effectively manage its own costs.

As general water rates increase because of water resource limitations, development costs, new plant requirements, more stringent water quality standards, and general inflation, policymakers and utility management may view miscellaneous and special charges as a way to slow increases in general water rates.

The combination of fairness and improved efficiency make miscellaneous services charges an attractive way to minimize cost increases for the majority of customers. In essence, the miscellaneous service charge is a refinement and expansion of cost-of-service pricing.

This chapter examines the following issues related to miscellaneous and special service charges:

- The basic legal authority for miscellaneous user fees and charges
- Factors to consider in establishing user fees and charges
- A general outline of the steps necessary to calculate fees and charges for full-cost recovery

- Common types of charges used in the water utility industry (Not all charges apply to all water utility operations.)

Each utility must determine what types of charges are appropriate to its operations. Through awareness of special problem areas, a utility can ensure that the benefit of a particular charge will be achieved without creating operation and management problems.

DEFINITION OF CHARGES FOR SERVICES

Charges for services, also sometimes referred to as *user fees*, are broadly defined as charges to the customer for a specific good or service or for the use of public facilities. The amount charged usually is based on both the cost of providing the service or facilities and the frequency and level of use. Charges for services differ from taxes. Service charges are incurred at the option of the customer and recover the specific costs of service. Taxes are assessed to all customers and may or may not be levied to recover specific costs of service.

Water rates are a type of service charge and are generally the primary source of revenues for a utility's operations. Because water rates can be varied and complex, they are discussed separately and comprehensively in the previous sections of this manual.

Typically, charges for miscellaneous services are used only where

- the user or customer is readily identifiable
- the unit of use and its costs can be determined with reasonable accuracy
- the utility wants to encourage or discourage certain behavior

As a matter of policy, generally, the service for which a separate charge is applied is not compulsory, although, from a practical point of view, it may appear to be. The individual customer decides whether or not to use a particular service. The assumption is customers will use or consume only those goods and services they want or need.

General Principles for Establishing Charges

In deciding whether to establish various service charges, a utility should consider general policies and a philosophy for governing such charges. Six basic guiding principles to establish charges for miscellaneous and special services include:

- Beneficiaries of a service should pay for that service.
- Services provided for the benefit of a specific individual, group, or business should not be paid from general utility revenues.
- Services provided to persons or entities that are not customers of the utility should not be paid from water rate revenues or other general utility revenues.
- Services for which there are charges are generally voluntary.
- The price of services may be used to change user behavior and demand for the good or service.
- The level of service charges should be related to the cost of providing service.

EXAMPLE

An example of a situation that would justify establishing service charges is a water utility that owns and manages extensive watershed lands for the purpose of water supply development. Activity within the watershed may be regulated and controlled to ensure high water quality and to protect other environmental resources. However, utilities frequently allow recreational uses of the land for fishing, camping, hiking, biking, horseback riding, picnicking, and other activities.

Associated with recreational uses are additional costs for rangers, trail maintenance, parking and other facilities, and a host of other activities that could vary with the extent of the land's use. These costs are not related to the provision of water service to the utility's customers and, arguably, the customer should not have to pay for them. Recreational service charges, such as day-use permits, camping fees, annual permits, and trail permits could be developed to recover the cost of making the recreational resource available to the general public. Other charges could be arranged to offset costs, such as franchise fees with private concessionaires.

This example illustrates that a utility often provides goods or services for individuals who may not be general water service customers, or it provides goods and services that are separate and distinct from its primary activity.

LEGAL AUTHORITY FOR SERVICE CHARGES

The legal authority to impose various fees and charges often is included in a utility's authorizing or enabling legislation. For regulated utilities, public utility commissions may have specific requirements for the imposition of fees and charges. Any utility should consult its legal advisors and examine local and state regulations before implementing or changing any fee or charge program.

Generally, local governments are given wide latitude in establishing fees to pay the cost of individual services provided, although this is a power granted to local agencies as extensions of the state's governance authority. The US Supreme Court has allowed government agencies to recoup the cost of service delivery by charging the recipients of government services fees based on the cost of the service and the value of the service to the recipient. A three-part test, established through various state court rulings, includes:

- The utility must, in exchange for payment of the fee, provide a direct benefit to a party in a way not shared by other members of society.
- The fee must be optional, with the party given the option of not using the government service.
- The charge must compensate the specific government entity for the provided service only fees received must not be collected for raising revenue beyond the cost of the provided service. The amount in excess of cost would be a tax.

Judicial opinion has held that the burden of proof in showing that charges for services are not valid rests on those who challenge their legality.

In the case of many government-owned water utilities, water service is furnished to the property owner and fees are charged to the property owner. Provisions in enabling legislation that allow the operation of government-owned utilities may contain language similar to the following:

> Such rates or charges, if not paid when due, shall constitute a lien upon the premises served and a past-due charge shall bear interest at the same rate as would unpaid taxes.

In general, the enabling legislation specifies that bills must be paid within a definite number of days or the lien provisions become operative. Appropriate utility officials are authorized to record liens in the public records of the governmental unit, with the cost of recording added to unpaid water charges and interest. All charges must be paid in full before the lien is released.

When a utility holds the property owner responsible for payment of water bills, it must develop effective procedures to ensure that the property owner is kept informed as to the status of the account when it becomes delinquent or when a tenant leaves with an unpaid balance. Often, a property owner may be able to offset amounts outstanding against rent deposits to prevent tenants from avoiding unpaid obligations. Good communications between the property owner and utility about changes in tenant status will result in timely billings and streamline the payment/collection process.

SELECTING AND IMPLEMENTING CHARGES

There are a number of issues and factors that should be considered in evaluating whether specific service charges should be established for miscellaneous services.

Policies Related to Service Charges

The principle of unbundling costs for miscellaneous services dictates that those who use a service pay the cost of producing or supplying it. Though this principle is established in private enterprise, there may be local government activities for which it is regarded as inappropriate. Subsidies are provided for three basic reasons:

1. To permit an identified group to participate in services it might not otherwise afford.
2. To provide benefits for groups beyond the immediate recipients of a service.
3. To influence behavior or use of the service.

Frequently, governing boards or councils have policies that address public access to important services. Ease of administration and concerns for dignity and privacy suggest subsidies may be appropriate for particular groups (for example, senior citizens and public assistance recipients) through discounted fees and charges. Another type of subsidy is based on the premise that a service may provide benefits for those not qualifying as immediate recipients of the service. For example, construction inspections of developer-installed facilities not only benefit the developer but also the eventual user of those facilities. In situations where a developer constructs pipelines, storage tanks, and related facilities, the utility may not wish to charge full-cost inspection fees. It may be appropriate to spread the cost of certain services over the large base of potential beneficiaries.

Following are important questions to answer before implementing miscellaneous charges or special charges.

Are proposed charges for miscellaneous services equitable? An advantage of service charges is that they increase equity in the sharing of utility costs by directly linking costs of service to the user of that service rather than to the general rate payer, who may or may not use the service. However, an argument frequently made against service charges is that they create a burden on low-income individuals who may need the service but are unable to pay for it. To offset the potential regressive nature of service charges, utilities can include sliding scales, offer low-income discounts, or offer payment deferral plans.

Is the good or service readily identifiable and measured? Goods and services should be defined in a way that (1) clearly identifies and distinguishes them from other goods or services and (2) quantifies them so that the amount of the good or service rendered is known. In situations where there is variation in the level of service provided, the utility should consider defining more than one service. For example, a charge for an application for new water service may differ depending on the nature of the new service (new subdivision versus in-fill along an existing main). The various levels of review could justify different charges and planning required.

Can those who will benefit from the provision of specific services be readily identified? In considering a particular service charge it is important to evaluate who will benefit from the particular service. The user should be the primary beneficiary of the service. When considering what fee to charge, a utility should consider the cost of the service and the extent to which the user is the beneficiary. If general water service customers also receive some benefit from the particular service, then the fee may be set at something less than full cost. For example, utilities frequently provide main location services free of charge because the benefit to all customers of avoiding accidental main breaks far outweighs the benefit to the individual receiving the service.

Is the service related to the performance of the utility's primary business activity? It would not be appropriate to charge for a service if the service affects the quality of water or the integrity of water service delivery. For example, a utility would want to respond to reports of taste, odor, or color problems as quickly as possible to determine the cause and take corrective action. A utility would not want to discourage customer reports of this nature by charging for the cost of investigations. This type of service call benefits all water system users, not just those registering the complaint. Pressure tests, restoration of water service due to breaks in the utility's facilities, leak-detection programs, and similar activities that affect service and safety for all customers normally are associated with furnishing water service and are financed with general revenues.

What is the full cost of providing the good or service? The key to establishing a service charge is determining the cost of providing the service. The basic steps to determining the cost of service are outlined later in this chapter. Cost analyses should include both direct and indirect costs. Even if a decision is made not to charge the full cost of a service, it is useful to know the full cost so that decision-makers are fully informed about the consequences of their decisions.

What costs are incurred in administering the levy, collection, and accounting of charges for miscellaneous services? If the cost to administer a service charge greatly exceeds the cost of providing the service, then the need for the service should be questioned. Frequently, the cost associated with documenting service provision, receiving cash, recording transactions, and establishing adequate controls exceeds the actual cost of providing the service. In these instances, a utility should consider whether a charge is appropriate. An example of a service for which fees may not be practical is charging for the use of a photocopy machine. Often, a customer needs a single copy of a document or record and it may not be practical to charge ten cents for the convenience of using a copy machine. When customer use of copy machines is very frequent, then coin-operated machines might be justified.

How will the charge or fee for a good or service affect the demand for the service? The degree to which demand is affected by the fee level is referred to as the price elasticity of demand. Demand for some services, such as a design review for distribution facilities constructed by a developer, is likely to be inelastic and the fee usually is a negligible portion of the overall cost of development. In contrast, fees for recreation services may be highly price elastic, particularly if alternative recreational opportunities exist nearby; the pricing of miscellaneous services may serve to encourage or discourage the use of particular services. Though service charges usually are limited to the full cost of service provision, lower-than-cost prices are common in some situations. For example, the utility may wish to discourage return check charges by setting the charges at full cost. Many states, however, place limits on the amount that can be charged for returned checks.

Are there legislative, legal, or regulatory constraints under which the utility is required to operate? A utility considering implementing new service charges should evaluate any legal or regulatory constraints that may affect its decision. Laws vary from state to state, and investor-owned utilities are subject to the rules and procedures established by public utility commissions. Typically, state public utility commissions require that the schedule of service charges be approved before it is implemented.

Clearly, a system of charges for miscellaneous services can offer many advantages to utilities. This is evidenced by the large number of utilities currently using them as well as the growing number of types of fees in use.

COST BASIS AND RATIONALE FOR MISCELLANEOUS AND SPECIAL SERVICE CHARGES

Determining cost and estimating the demand for a service are key functions in the proper implementation of service charges. Cost and activity data are essential to

- measure the cost of service
- plan the expenditures associated with the service
- evaluate the cost/benefit ratio of the service charge
- project revenues from the service

It is impossible to accurately price the service if utility managers are unable to accurately measure the total cost of providing it. Without proper pricing, funding may be more or less than the amount necessary to provide the service. Furthermore, without adequate documentation of costs, service charges may be subject to challenge.

DETERMINING THE COST OF PROVIDING SERVICE

If a utility does not have the accounting capabilities necessary to develop cost data for each activity, a time-and-material study can be used to determine the average cost for various activities. These standard time-and-material studies can be the basis for developing fees. Where the cost differential between activities does not warrant a separate fee, groups of activities may be combined, and a standard rate can be charged. To the extent that the utility can simplify its system of charges within the possible constraint of cost-based charges, it can reduce the costs of administering its miscellaneous charge system.

The following steps can be used to determine the full cost of specific services. The specific analyses for a particular service may vary somewhat. This outline is offered as guidance only; additional judgment will be required on the part of the utility.

Step 1: Define the Service to Be Provided

The first step in determining the cost of a service is to clearly define the service being provided. This may seem obvious; however, a complete statement of the service facilitates the cost analysis and exposes possible capital, direct, and indirect costs. In defining the service, the utility should first describe the specific activities involved by identifying who the users of the service are, why the service is needed, how it is measured, and how it is controlled. In many situations, what initially appears to be a single service is actually various related services. For example, accepting an application for water service will entail different activities for a new subdivision requiring an extension of service than it will for service within an existing service area.

The next two steps are necessary to determine the cost of services that require the use of facilities and infrastructure. Examples of services that may require the use of facilities and infrastructure, and therefore appropriately include capital costs, include standby service arrangements and the conveyance of water not owned or controlled by the utility through the utilities' facilities. This later service is commonly referred to as *wheeling*.

Step 2: Identify Capital Investments Made in Order to Provide the Service

Once the specific service is clearly defined it should be apparent whether or not capital costs may be appropriately included in a special charge or miscellaneous fee. In general, a service that requires the use of facilities or operating equipment recorded in a utility's fixed asset or operating equipment accounts should be considered to include capital costs. Care should be taken to ensure those facilities and or equipment are clearly identified as being necessary to the provision of the service. A careful review of how the service interrelates with a utility's day-to-day operations will help identify the use of facilities and equipment that may not otherwise be readily apparent.

Determine an appropriate allocation of capital costs. To avoid adverse rate impacts to utility customers that have not requested a special service, an equitable allocation of capital costs to a party requesting a special service should first consider how capital costs are currently recovered from existing utility customers. For example, a special charge for capital intensive standby service provided to a particular customer will only be an equitable charge if the capital costs necessary to provide the standby service are included in the charge. Otherwise, the capital costs will be recovered from other revenue sources and therefore other customers who may not receive the benefit of the service. Appropriate capital cost recovery and allocation methods that apply to general rate setting principles can often be applied to special charges and are discussed in detail elsewhere in this manual.

Step 3: Estimate Direct Labor Costs

Employee wages and fringe benefits may represent a significant portion of the cost of providing services. It is the salary cost of those who directly supply the service that is used as a building block to allocate the indirect costs of supplying the service. Because of this, it is critical to accurately estimate the true and full cost of labor that goes into service delivery. At this point in the calculation, only the efforts of those who directly supply the service should be considered. Supervision, clerical support, and other similar positions are better classified as indirect costs.

Accounting records can be used as a checklist to ensure that all costs associated with a project are reflected in the cost analysis for a particular fee or charge. Historical costs must be adjusted to reflect any changes in labor rates or benefit costs; for example, such costs can give valuable information about normal labor usage levels. Historical costs also can indicate when costs for various activities differ significantly, so that separate fees may be designed.

Work activity can also be measured through interviews, detailed work logs or time sheets, or direct observation. The average amount of time required to perform a service should be determined by evaluating activity levels over a period of time. However, variations in overall work loads also should be taken into consideration. If the time required to perform a specific service varies greatly, it may be necessary to review how the service is defined and whether more than one service is being provided.

Labor costs should include full costs of salaries and fringe benefits. Total annual wages and benefits should be divided by the number of productive hours in a year, which have been adjusted for vacation, holidays, sick leave, training, meetings, breaks, and other downtime, to determine an hourly rate for labor. Typically, the work force for a particular classification has little turnover, then actual costs may average for a salary range applicable for each position can be used in the analyses. If the work force for a particular classification has little turnover, then actual costs may be closer to the top of the range. Wage increases that occur mid-year should also be factored into cost calculations.

Step 4: Determine Other Direct Costs

In addition to labor costs, many services result in either the consumption of materials or the use of equipment or vehicles. Again, accounting records may help to identify material unit costs and, possibly, usage levels for each service rendered. Often, when materials are directly used in the provision of a service, it is possible to measure the amounts used. Similar to labor costs, averaging techniques may be used to determine typical materials usage quantities.

Field services may require the use of vehicles and equipment. If the utility has internal service funds established for the use of vehicles and equipment, then standard charge rates should be available. Internal service funds are fiscal and accounting entities created to account for resources used in providing centralized service within an organization. A motor pool is a good example: the cost allocations and overhead assignments for each vehicle and piece of equipment are in the internal service fund. These allocations will result in standard internal charge rates for each item.

Other direct costs to be considered in developing service charges are external costs, which are those costs the utility incurs in providing a good or service. For example, a bank's charge for insufficient funds should be included in the determination of a return check charge.

Step 5: Determine Indirect (Overhead) Costs

Indirect costs related to specific goods or services are determined by considering the level of central service support that can be allocated to specific departments and functions. Indirect costs typically include a distribution of costs associated with items such as purchasing, building maintenance, electricity, telephone charges, supervision, and clerical support. Formulas can be established to quantify the relationship between indirect support services and the applicable service charge supported program.

The use of a cost allocation plan is one way to determine indirect costs. These plans are frequently prepared in compliance with federal standards (Office of Management and Budget [OMB] Circular A-87) or other requirements so that the utility can qualify for maximum cost reimbursement in performing state or federal programs or grants and loans.

A number of approaches can be used to prepare a central service cost allocation plan that, under given circumstances, complies with the OMB A-87 and local government cost allocation needs. Some of the basic approaches follow:

Single tariff/consolidated rate method or multiple rate approach. These methodologies are regarded as acceptable cost allocation methodologies within OMB A-87. The essential problem with each (to a lesser extent the multiple rate approach) is that central service costs are accounted for in cost pools and distributed in a manner such that actual costs allocated may not reflect the services received. Also, direct billing systems are difficult to accommodate with these rate methodologies. Generally, rate methods are not acceptable in the context of more sophisticated accounting systems.

Single step-down approach. This approach is occasionally used in the preparation of some basic plans. In this methodology, a central service department allocates only to a central service department below it on a hierarchical list. The allocations, to some degree, can be controlled to selected departments, and so recoveries may be maximized. However, some distortions may exist between costs and services received. Many local governments appear to be equally interested in cost recovery and accounting information, so this method has not been widely used.

Cross allocation approach. Some state controllers have, over a period of years, suggested a cross allocation methodology for use by some jurisdictions. This methodology consists of two steps. In the first step, central service departments allocate to other central services and to the operating departments. In the second step, the residual in the central service departments is allocated to operation departments. The resulting allocations generally reflect the cost of services rendered. This methodology can be used to manually prepare a cost allocation plan, but the resulting plan can be extremely difficult to modify.

Step down-double allocation approach. In this methodology there are two steps. In the first step, the central service departments allocate to central service departments and to operating departments (as in the cross allocation approach). In the second step, the central service departments allocate to central service departments below them on a hierarchical list and to the operating departments. It can be argued that this methodology theoretically provides the most accurate allocations of any of the methods described. It is commonly used and accepted, cost-effective and flexible, and allows for convenient update.

In the absence of a complete cost allocation plan, utilities can develop indirect cost estimates using individually developed indirect cost rates. These estimates are developed by examining the level of overhead activities associated with each direct cost activity. For example, staff that perform a given service will be supervised by a manager; occupy office space; use phone, facsimile, and copy machines; and rely on other central services, such as accounting, purchasing, and the motor pool.

Determine indirect costs. To determine the cost of providing a good or service, all direct and indirect costs associated with the good or service are added together. A final unit cost is determined by dividing the total cost by the number of service units rendered. The procedures for calculating unit costs used as the basis for charging for a particular good or service vary with each utility and may depend on the particular good or service involved.

Annual review of miscellaneous charges and related costs. Charges for miscellaneous services should be considered within the annual budget process, with revenues balanced against costs and included in the complete revenue analysis. The annual review makes the legal review of service charges easier, because all existing fees and charges can be acted on by the governing board or council in a single action. In addition, the annual review provides a regular mechanism to examine any cost changes or even the specific time and material requirements for performing services.

Fee policies can be considered in a broader context than a single fee program when all service charges and fees are reviewed at one time. In addition, utility attorneys will have little difficulty demonstrating the legitimacy of any fee or charge, and fee schedules are kept current with economic realities.

SAMPLE SERVICE CHARGE CALCULATION

The procedures for calculating unit costs used as the basis for charging for a particular activity will vary with each utility. One method is to make a time study of labor requirements, material needs, vehicle and other equipment uses, and other costs to determine the resource requirements for the average task using statistical procedures. As an alternative, when the utility's operating and accounting records permit, actual historical costs for the operations can be determined. These costs are adjusted for price changes or changes in operating requirements for labor, materials, or equipment used. Each method should include all appropriate overhead costs.

Under a time-study procedure, the utility (1) identifies those operations needed to complete the required service and those required to be done by the customer or applicant and (2) studies the time required to perform its tasks. Material and equipment requirements and the average time needed to travel to and from the job site are added to these requirements. These units of labor, materials, and equipment reflect the utility's current prices, including appropriate overheads. Normally, unit costs are rounded to provide a fixed-fee schedule for various service sizes. For job conditions that are not typical, an actual-cost price based on appropriate applicable labor rates and materials charges may be used when the resulting projected costs differ from the average by a substantial amount.

EXAMPLES

A variety of miscellaneous charges in the water utility industry include collection and delinquency charges, turn-off and turn-on charges, various application fees, tapping charges, and jobbing and merchandise sales. When special charges are used, the utility should coordinate these rates and charges with its customer-service section. Procedures must be developed to ensure that the customer has advance warning about requests for services that will trigger a charge. Billing procedures must be in place to properly account for special charges. Bill inserts and other forms of customer notification are effective tools for keeping customers informed. As with all utility operations, a well-developed employee-training program is a solid foundation on which good public relations can be built. Customer service personnel must have all necessary information available so they can explain the intent and circumstances to which each charge applies. Information preparedness will minimize the perception that these charges are punitive and will enhance the utility's effort to promote customer support.

A summary of several service charges follows. This list is intended to illustrate the broad range of potential fees, but it is not exhaustive. The specific application of service charges depends on the specific nature of a utility's operations. For example, some utilities have separate charges for turning off and turning on water service following a period of delinquent payments. Other utilities find it more convenient to charge once for both turning off the service and the subsequent expected service turn-on.

FIELD SERVICE CHARGES

The more common types of field service charges and fees relate to activities associated with water turn-off (or turn-on), meter setting or removal, special meter readings, meter testing, and temporary hydrant meter settings. Each type of charge has its place in the fee setting process for certain operational conditions. These charges are used only when there is a customer group that can be identified, the activity produces significant costs that are not common to all customers, and costs can be identified and related to the units of activity. Some of the common types of field service charges include the following.

Turn-off and turn-on fees. A utility may charge to turn off or turn on water service. Typically, this activity occurs under one of two conditions. First, service may be discontinued when a customer vacates a premise and no one moves in immediately. This differs from a simple change in account status, which is more common and may not require water service turn-off. The second occurrence is associated with the failure to pay water bills. After a specified delinquency period, many water utilities turn off water service until past-due payments are made or a payment plan is arranged. Frequently, when this occurs, a separate turn-off and turn-on charge is imposed.

In the first example, follow-up turn-on charges are common because they are easy to administer and collect. Turn-off charges are unusual, because utilities have found it important that the customer report when service is to be discontinued. This enables the utility to remove the meter or take other necessary actions to avoid waste or illegal usage. When a utility employs turn-off charges, normally, emergency turn-offs are exempted.

The turn-on charge can be imposed for a new service turn-on, seasonal turn-on, other situations where the service is temporarily discontinued, or when delinquent accounts have been shut off. The utility may add a surcharge for turning on service at night, after office hours, or when requested in a short period of time. A surcharge would compensate for shift-pay differential or for the need to dispatch employees outside of a normal schedule. Many utilities incorporate all routine turn-on activities into one turn-on charge when the cost differential between various activities does not justify separate fees or when the cost of administering a complex fee structure is greater than the benefit.

Employee travel time to the customer's premises, actual labor costs involved in operation of the shut-off valve, use of equipment and a vehicle, and appropriate overhead costs associated with the activity must be included in the cost of turn-on or turn-off activities.

Field collection charge. Often, utility service personnel are permitted to collect delinquent water bills at the customer's premises, especially if such payments are not in cash. When a delinquent payment is made to the service person that goes to the customer's premises to shut off the water, the service fee can be reduced because the cost is less than the normal turn-off fee, provided suspension of service actions did not commence. This type of collection policy can significantly reduce the number of turn-offs, decrease the workload for office and field services personnel, and improve customer relations. The customer benefits from uninterrupted service and a smaller service charge and avoids the inconvenience of traveling to the utility office to pay the delinquent bill. Such a policy also eliminates the need to impose a collection fee, except in the most difficult cases.

Some large urban utilities have reconsidered the benefits of on-premises collection because of problems that sometimes occur when collectors or field personnel confront delinquent customers who are unwilling to pay. Though bill collection by field personnel may prevent the need to shut off a service, utilities should consider the environments to which field personnel are dispatched. Some utilities have discontinued seeking payments from customers because of concerns for personal safety and damage to vehicles and equipment.

Repair of damaged facilities. On occasion, a customer will operate a service and, in the process, make the stop box inoperative. In this case, the utility should (1) instruct the customer to take corrective action within a prescribed period of time or (2) send a field-service crew to clean out or dig up the stop box so that the service can be shut off during repair. Normally, a uniform fee plus a surcharge is imposed, but only when it is necessary to dig up or replace the stop box.

Routine clean-outs and dig-ups of stop boxes or meter pits sometimes are undertaken without a separate charge to the customer. This occurs where the special service is not a result of illegal customer activity and is justified because utilities have found that quick access to these boxes benefit the system as a whole.

Special meter readings and final readings. A fee may be charged when customers request a special meter reading or ask that a meter be reread though, in the opinion of the utility, no reading is warranted. The charge is designed to recover the higher-than-normal cost of this reading. For example, a customer may believe that the meter reading is in error and request that it be read again. To prevent abuse of this service, a utility may charge for a second reading under certain conditions. If a substantial reading discrepancy is found or if the individual customer seldom demands this service, it is common practice for the utility not to impose a charge. The definition of *an excessive number of requests* varies with each utility, but one standard might be that no more than one such request is made during a calendar year. A meter-reading charge is usually a fixed fee based on historical costs for performing special readings.

A final-bill reading is a common type of special reading. This may occur when a home or business is sold, leased, or vacated, or when a new owner or tenant occupies the premises. Service personnel rather than meter readers usually record final readings because the request for a specific day or time seldom coincides with the scheduled day of the specific meter route. The final meter-reading charge can take the form of a uniform fee added to the final billing statement. The charge recovers the meter reading cost plus additional clerical costs for issuing a final statement.

Meter resetting fee. A charge may be made to a customer for resetting a meter when the meter has been removed at the request of the customer. Normally, this charge will vary with the size of the meter. It may be combined with a turn-on charge when both meter set and service turn-on are performed at the same time.

Appointment charge. In certain instances, a customer may request a field-service call at *a specified time* during the working day Often, in such cases, a field-appointment charge is made for the added cost of making a service call at a specific time. The cost could include the added travel time because of the disruption to the field representative's normal scheduled work activity.

To promote effective customer service, many utilities try to schedule service calls within a window of time, for example between 8:00 a.m. and 11:00 a.m. This approach is more convenient to the customer than a completely open-ended service call and more manageable for the utility to schedule. This type of approach may eliminate the need for a field appointment charge, unless the customer insists on a specific time for the appointment.

Meter testing charge. Water bill complaints that are not resolved by telephone may necessitate that a meter be reread or that the customer's service line or water-using appliances be inspected for leaks. If the matter is not resolved to the customer's satisfaction, then the meter may be removed and tested at the request of the customer. If the field service representative suspects that the meter has become inaccurate, a test may be ordered at the utility's expense. If a meter is removed and bench tested at the request of the customer, and it is found to be accurate, the utility may impose a fixed fee that reflects the average removal and testing costs for that particular meter size or type. As an alternative, some utilities may require the customer to make a deposit to cover the actual cost of the test. If the meter meets the utility's standards, the deposit is used to pay the cost. If the meter tests outside these standards, the deposit is returned to the customer. With investor-owned utilities, the requirements of the regulatory agency will be reflected in the procedures that are followed.

Determination of financial responsibility for meters that test outside the prescribed accuracy range depends on the maintenance and replacement policy of the individual utility. Payment for replacement of the meter also depends on individual utility policies; some utilities require the meter to be replaced by the customer, and others replace the meter at the utility's expense.

Backflow-prevention testing. Periodic backflow-prevention testing is required by many utilities to assure the integrity of the water system. Usually, when a utility tests a customer's backflow-prevention devices, a charge for the test is assessed. The amount charged may depend on the type of backflow device and the number checked at each site. For example, a utility may charge $25 for the first device checked and $15 for each additional device checked at the same time.

Pressure testing. If a customer requests that the water pressure at a service be tested, a utility can dispatch a field crew to perform this check. Concerns about water pressure can result from either too high or too low pressure, which adversely affect the water service. Pressure testing may also involve examining a customer's pressure-reducing valve.

Fire-flow test. Occasionally, customers may request verification of fire-flow capabilities at a given location. This may be because of fire insurance ratings or related concerns about the adequacy of the system to provide a specified level of fire protection.

Water audits. Commercial, industrial, and residential water audits performed by utility personnel are becoming an increasingly common service among water utilities. Water audits help customers identify ways of conserving water, either by changing water-using fixtures and processes or by operational changes. There is seldom a charge for a water audit because it is intended to provide conservation that ultimately benefits all customers, and utilities want to encourage participation in water audit programs. Nevertheless, this service does have a cost, and it may be useful for the utility to know what the cost of the service is, particularly when evaluating the cost-effectiveness of water conservation programs.

In areas where water audits are in high demand, it may be desirable to establish a small nominal charge to deter those customers who are not serious about implementing audit recommendations. Alternatively, utilities could rebate audit charges if customers implement certain recommendations within a specified period of time. Again, charges for water audits are generally considered only when demand for the service exceeds the utility's ability to provide the service.

Temporary hydrant meters. Water uses from public fire hydrants, for purposes not related to fire fighting such as street washing, dust control, filling tank trucks, or construction, are usually allowed, provided a special permit is obtained from the water utility. Amounts charged for the hydrant permit can include the office and field costs to administer and monitor the metered or unmetered connection and the cost of water used. Many water utilities prefer to carefully control and meter these limited activities and initially charge a uniform fee that provides for a minimum water-use allowance. Metered water use in excess of the base allowance becomes subject to the general retail water rates, in addition to the fire hydrant permit cost. A separate and refundable deposit for rental of the meter and hydrant wrench normally is set at an amount sufficient to assure their safe return. Inspections usually are required to ensure that use of the hydrant meets all utility operating standards, and the cost of inspection is normally included in the fee.

OFFICE SERVICE CHARGES

Some of the more common types of office service charges include the cost of setting up a new account or transferring an existing account, the cost of collecting delinquent accounts, or checks returned by the bank for insufficient funds. Some of these activities include initial efforts that may require follow-up work.

New account or transfer charge. Depending on the level of activity and overall costs, a new applicant may be charged an initial administrative fee for the average cost incidental to opening a new account or transferring an existing account. Such fees directly reimburse the utility for the cost of additional utility services that may be performed before the new or existing service becomes active or is reactivated. These fees reflect the status of the service connection. If the service connection is already established, the transfer fee can be designed to recover office-related costs for completing the application form, determining the applicant's credit rating or water-use-related deposit, collection of any unpaid water bills or assessments, and any other activities preliminary to instituting water service. Most government-owned utilities do not require a credit investigation because the water charges usually are considered under the applicable state or local laws as a lien against the property. When water-suspension policies require that the water be disconnected and where the stop box or water meter already is installed on the customer's premises, any additional office and field costs for initiating the turn-on order also can be incorporated into this charge.

An account fee for new construction can incorporate additional office expenses incurred for administering any special capital cost payments, as discussed in chapter 2. The fee also can be used to cover the cost of administering and monitoring construction of the new service line during the construction phase.

An administrative fee can be used to recoup the added cost of processing a new water-service cancellation, which results in a refund of any capital cost payments or other deposits (water main extension, tapping fee, or connection charges) previously paid when a water service was issued. This fee can be deducted from the refund and the net balance returned to the applicant.

Whether one fee is used for all activities or separate fees are developed depends on the amount of activity and the cost differential among fees. Efficiency in the administration of a fee program must be considered when determining each fee.

Collection-related charges. The following service fees pertain principally to the collection and billing functions of the water utility. Because most charges relate to the collection of delinquent water bills, each charge should be reviewed periodically to determine whether the utility's overall collection program is providing optimum collection and billing control.

A *late-payment charge* can be an incentive for prompt payment. This charge recognizes the time value of money and other added costs. It is common practice for a water utility to designate a period during which a bill must be paid to avoid late payment charges. Many utilities use 15 days, with a 3-day grace period to reflect mail delivery problems, before collection procedures are initiated. If water bills remain delinquent following subsequent billing with late-payment charges, it may become necessary to initiate collection procedures. Typically, a utility will coordinate office and field work to find an efficient balance between the length of time accounts are allowed to be delinquent and the amount of effort (number of collections) required to collect payments.

A *returned-check charge* is made when a check is not honored by the customer's bank, regardless of the reason. This charge reflects the added cost to the utility for processing a returned check. A utility should ascertain the legal limits on returned check charges within its jurisdiction. In addition to including any bank charges for insufficient funds, the fee may also include added costs for processing the returned check, issuing a new bill, and telephone or letter notices to the customer. When a customer has a sustained record of returned checks, the utility may require a deposit account until a good credit rating is re-established. When checks are not made good within a prescribed period, the utility may initiate service shut-off because the account is delinquent. With investor-owned utilities, regulatory agency requirements must be reflected in policies, procedures, and charges; usually, all policies are required to be filed with the regulatory agency.

Some utilities are authorized to issue a *lien certificate* following reasonable attempts to collect past-due payments for water service. Certain documentation and, usually, a fee payable to the assessor's office are required when placing such liens. A charge for obtaining the lien can be developed and included in the lien certificate.

Some utilities provide individual water bills to tenants of a master metered complex, such as an apartment building. Typically, this *multiple tenant billing* is performed at the request of a landlord and accomplished by dividing the total water bill by the number of dwelling units. This procedure requires the utility to maintain information about each tenant. In addition, it is the landlord (owner) who is ultimately responsible for payment of the total water bill. Utilities providing this service charge a fee for each separate dwelling unit billed; usually this fee is charged to the landlord. This billing method, however, is a practice many utilities discourage because of its cumbersome administration.

Account status at property sale. In some locations, a title or escrow company will verify account status when a property is sold. This action is taken because any delinquent payments may not result in recorded liens against a property until after a sale is completed. A review of account status at the request of a customer, usually over the phone, is a standard service for which no charge is made, but a third-party request requiring written verification of account status sometimes is subject to a charge.

Meeting agendas and related materials. The public meetings of a utility's governing body (board of directors, city council, etc.) should include proper notification, information packets, and a formal agenda to be considered during each meeting. It is common for a number of interested individuals or groups to request copies of these materials on a routine basis. Often, utilities maintain a list of individuals and groups who routinely receive meeting agendas; a much smaller group may receive the entire information packet. Meeting agendas may be distributed free of charge to anyone requesting a copy and are available at all public meetings. Some utilities, however, impose a regular subscription service charge to defray the costs of copying and distributing agendas on an ongoing basis. By charging a nominal fee, only those individuals or groups with a serious, ongoing interest in a utility's activities will subscribe. Generally, meeting materials, or board packets, are not widely distributed on a regular basis because of the high cost of distribution, although a subscription service similar to that used for agendas is possible. Usually, materials are made available for public review, with individual items distributed on request.

Before a utility implements any charges for public information documents, a review of applicable laws should be undertaken. In some states, charges for public information are limited to the direct cost of providing copies.

Public documents. Utilities frequently receive requests for recent studies and reports, public information materials, financial reports or budgets, or design standards. The utility should have a clear policy governing the distribution of such documents and, if charges are to be imposed, a specific price for each document with ordering instructions (perhaps through the customer service counter) should be established. Prices for such documents may be limited to production costs, although an allowance for the administrative cost of stocking and selling documents could be included. Single copies of many materials, such as water conservation pamphlets, may be distributed free of charge. However, for multiple copies for subsequent distribution (for example, water conservation materials to be distributed to 1,000 schoolchildren), the utility should consider charging a nominal fee to cover costs.

Construction plans, drawings, and maps. Developers, other utilities, cities, and others occasionally request plans, drawings, or maps of existing water facilities. Like other public documents, these items should be made available. Many utilities charge a fee for each copy. Charges may vary for prints, paper sepias, or mylar sepias. Charges for these prints should include copying and administrative costs. Some utilities sell mylar plans only to other government agencies.

Consultation services. Some utilities impose hourly rates for consultation services rendered by staff to persons other than customers and for special engineering, professional, and legal services. Hourly rates should be fully loaded rates, including fringe benefits and applicable overhead charges.

SERVICE APPLICATION, ENGINEERING, AND INSPECTION FEES

Many types of water service application, engineering, and inspection fees are used in the water utility industry. Some fees are designed to recover only direct costs associated with certain customer activities. Others are designed to recover both direct overhead costs of processing the application and some indirect costs incurred when determining the background data required to process new applications for service. For example, if the utility must expend funds for an engineering study to ensure that expansion into a new area can be undertaken, a portion of this cost might be added to new-service application fees. As an alternative, these costs may be included in system development charges (SDCs).

Because processing an application incurs costs even if no construction work is performed, the utility is justified in requiring that applicants who have preliminary inquiries pay the costs associated with the planning or design work. Otherwise, if no construction is undertaken, then costs must be absorbed either by other applicants who do commit for work or by general water service customers. A nominal preliminary application fee can help to deter unnecessary inquiries and to pay costs when such inquiries do not result in construction.

The amount of application fees will vary and, as with all service charges, should be based on a cost analysis of those activities required to process the application. Direct administrative costs for personnel handling the application, engineering services used, field-service needs, and other related activities should be determined and a fee structure developed based on the level of activity. A description of some of the more common types of application and inspection fees follows.

Main inspection, filing, and contract fees. When preparing a main-extension agreement, a fee may be charged for filing the application, developing the contract, and for field inspection and engineering record reviews. The flat fee is paid when the application is received. The fee is applied to the cost of the work when the contract for an extension is signed. If no work is undertaken, then the application fee is retained by the utility to defray costs of administration. Some utilities require a nonrefundable, flat filing fee from each applicant.

Administrative fee for service-connection inspection. Where a new service line stub-in is connected to the distribution system before service is required, the utility may charge a fee to defray the cost of administering and monitoring the new connection. After water service begins, the account can be transferred to permanent status.

Cross-connection inspection. A periodic inspection fee is used to recover costs associated with high-risk installations to ensure that no cross connection has occurred. The utility adds this fee to its overall cross-connection control program, including adequate records of installations, regulations, and periodic inspections sufficient to ensure that infractions will be promptly corrected to avoid possible system contamination.

Engineering design fee. Where substantial engineering design and study are required to provide new facilities, the cost of the extraordinary engineering service may be charged to the applicant in addition to the administrative fee. This can be charged either as a flat fee or on an actual-cost basis, with a deposit of the estimated cost required before the work is undertaken. Often, an extension of service requires engineering work to determine what additional facilities (mains, distribution storage, pumping, and so forth) will be needed. Frequently, such facilities must be designed and plans and contracts prepared. Any extraordinary costs benefiting only the individual applicant or developer should be assessed against the property owner.

When facilities are constructed, these extraordinary costs may be capitalized as part of the total construction cost of the extension of service. The amount received becomes part of the customer-contributed capital for the project. When work is not undertaken, as when a project is abandoned, the funds received are accounted for in accordance with the utility's system of accounts. Expenses incurred are charged against revenues. With a sound cost estimating program, revenue and expenses should be equal, and costs will not be borne by the utility and its general service customers. If overall systems planning is necessary to develop an area in the utility's system, a planning fee may be assessed against the developer of the area for which plans are designed.

CONTRACT WORK AND MERCHANDISE SALES

A service charge is assessed when the utility performs work on a customer's premises, such as repairs, replacement, and improvements, or sells equipment to the customer or the plumber who will install the equipment. Some utilities provide financing to the customer for such services and allow the customer to pay the cost over a period of time. The utility may charge for these services at a higher rate of interest than it pays and still provide financing to the customer at a cost less than commercial interest rates. In some instances, utilities offer services or merchandise at reduced cost or at no interest to encourage customers to install water-saving devices, such as ultra low-volume (ULV) toilets. Deferred payment programs should be instituted only where adequate protection against bad checks or nonpayment can be designed into the system, for example, where the utility can place a lien on the property to ensure collection.

Through contract work and merchandise sales a utility may be in competition with plumbers or suppliers. This is a policy consideration that must be taken into account when determining what services the utility will provide. Where there is little competition among contractors, the utility can ensure that a fair and competitive price is developed and that the customer receives the best service possible. By setting installation standards and acting as an alternative contractor to do the work, the utility can provide benefits to the customer. In performing services for private parties, or working on a customer's property, a utility should consider legal and liability issues associated with these activities.

For many services, special fee schedules can be developed. Alternatively, the utility may charge individual customers on the basis of actual cost. In either case, the utility needs to determine standard rates for use of vehicles and equipment, along with labor costs, to determine fees. If the average cost of an installation does not vary too greatly from extremes (high or low), then a fee schedule may be used.

Some of the areas in which a utility might undertake contract work and merchandise sales are described in the following sections.

Service line repairs. Normally, the maintenance of service lines beyond the water meter is the customer's responsibility. A utility could charge fees if a customer requests a service line repair. Telephone companies provide similar fee-based services.

Leak detection. Though leak detection of the utility's system is a responsibility of the utility, detecting leaks on a customer's property may be a sought-after service. Leak detection assistance may result from sudden and unexplained increases in water usage.

Service tap installation. Most utilities have a fee schedule for installing taps into the main when connecting to customer service lines. The fee is collected when a customer or customer's plumber applies for a tap. The fee is based on the size of the tap needed to make the service connection. When large taps are required or special costs are involved, such as a large tap in a reinforced concrete main, the utility may require that payment reflect the added costs. If so, at the time of application the customer is charged according to the fee schedule. Included in these charges are costs for any permanent repairs to the pavement, which normally would be completed at a later date.

Meter installation. In large developments, it is common for developers to install water meters and meter boxes at new service connections. For individual or smaller developments, the utility may be requested to install the water meter for a new service. This may be combined with the service tap installation. If the utility installs the water meter, a connection fee is charged. This fee includes the cost of the meter, meter box, service lateral, and related materials, plus labor. Fee schedules are developed for common meter sizes, although, for large meters, many utilities charge the actual cost of installation. For additional discussion, see the example in chapter 2.

Meter size change. When a customer with an existing service and meter, such as a 1-in. service line with a ⅝-in. or ¾-in. meter, wants the meter changed to a larger size, the customer may be required to pay the increased cost of the meter and the cost of installation. This may be a special situation in which customers, for their convenience, want a larger meter installed but where the utility does not deem that the change is necessary In instances where the customer's use pattern has increased and a larger service line has been installed at the customer's expense, and where such use requires a larger meter, the customer would pay on the basis of the regular rates of the utility. If, as is the case for many utilities, there is a charge for the meter and its installation, this policy forms the basis for the charge. A meter size change fee may discourage changes where, in the judgment of the utility, such a change is not necessary.

Some utilities receive requests to downsize water meters, frequently to lower the monthly or bimonthly service charge, because charges often are based on meter size. A charge for meter size change could help to discourage this activity.

Main location services. Utilities are frequently asked to locate water mains for other utilities or in conjunction with nearby construction activity. Main location services are an example of a service for which a charge should not be assessed. A utility should encourage other utilities and construction contractors to determine the location of water facilities before construction begins. This minimizes the chance of main breaks and related damage and repair expense. It also helps ensure continued and reliable water service to all customers. For these reasons, main location services usually are provided free of charge.

Main relocation services. Occasionally, a utility's water mains need to be relocated to make room for other utilities or infrastructure improvements. When relocations are required, they typically are paid for by the party requiring the relocation, usually another public agency or utility These services are paid for on an actual cost basis, rather than through uniform fees or charges.

Remote meter reading device installation. For the convenience of the customer, some utilities provide an outside remote meter reading device in areas where a meter is normally installed inside the premises. When this is a special service and not available to all customers, a charge may be made.

Backflow-prevention device installation. Some water services require the installation of backflow-prevention devices. Usually, these are the responsibility of the customer to install and maintain, but a utility may wish to provide this service.

Miscellaneous work. Often, a developer will provide a development map with elevations that subsequently are changed. Consequently, it will be necessary to raise, lower, or even move mains, fire hydrants, meter boxes, service lines, or backflow-prevention devices. The developer normally pays for these relocation costs, which are the result of the builder's actions. The utility usually requires advance payment for the work and withholds service to the property until the facilities meet with the utility's operating and construction standards. A deposit from the developer usually is required. After the actual cost is determined, the final bill is adjusted.

Sale of water meters and meter boxes. In instances where developers install water meters for new service connections, the utility may wish to sell the meters to be installed. This assures uniformity and decreases future maintenance and repair costs. Also, with the growing use of remote meter reading devices or automatic reading equipment, it is important to ensure that water meters are compatible with meter reading equipment.

Sale of ULV toilets and other conservation devices. With increased emphasis on water conservation, many utilities have instituted programs to encourage customers to install water-saving fixtures and devices. Low-cost items, such as leak detection kits, low-flow showerheads, or toilet tank dams, frequently are given away. Other water conservation devices and fixtures, such as ULV toilets, automated irrigation timers, and irrigation supplies, sometimes are sold to customers at cost or near cost. Increasingly, cash rebates are given for installation of ULV toilets. Another way to make the purchase of conservation devices more appealing is to offer low- or no-interest loans and allow the payment over an extended period of time. Utilities should provide for adequate protection against nonpayment of loans by having the authority to place liens on property or through some other mechanism. Some utilities install ULV toilets and other devices and fixtures and bill the customer an amount equal to the reduction in the customer's charge for water (and wastewater, if appropriate) until the installation cost is repaid.

WHEELING CHARGES

Wheeling is the conveyance of water not owned or controlled by the utility through the utility's facilities, for delivery to a customer or other party. To different degrees wheeling has taken place within water systems for many years. However, water wheeling is becoming more of an issue for water utilities as water transfer markets play an increasingly important role in ensuring supply reliability, particularly in the more arid western states. Generally, water utilities have treated wheeling as a special service and have developed rates and charges for this service on a case by case basis. Few utilities have implemented wheeling rates or charges as a component of their rate structure. Depending on the demand for wheeling services this trend may change over time.

General Policy Issues

There are several general policy issues that should be considered in the development of a wheeling rate or charge. A utility should first determine how the use of facilities to provide wheeling service might impact system operations and service levels to utility customers. Second, the costs associated with the use of the facilities should be determined and recovered through a wheeling charge to provide the utility fair compensation for the provision of wheeling services. Third, evaluating the wheeling charge within the context of the overall rate structure should help identify potential customer equity issues.

A comprehensive review of all system operations and how they are likely to be impacted by a wheeling transaction will help utility managers and rate analysts identify the costs of providing wheeling service and potential customer equity issues. This review should consider the availability of capacity for wheeling, changes in pumping costs, the need for and use of system storage, and potential issues with source water quality and the need for water treatment. Once these and other operational issues are identified it is possible to begin to assign costs to a particular wheeling transaction.

Cost of Service and Fair Compensation

To the extent that a party requesting wheeling service pays for the costs incurred by the utility for providing wheeling service it generally can be said that the utility has been fairly compensated. A cost of service study that clearly identifies the costs of the various service functions (e.g., transmission, distribution, storage, treatment, etc.) that may be involved in providing wheeling service can provide the majority of cost information needed to develop a wheeling charge. The rate analyst should also take into account the manner in which the cost of service study classifies and allocates costs to the various service classes. As the wheeling charge is developed, it is important to consider how costs are recovered from existing utility customers in order to identify customer equity issues. For example, if utility customers pay for peak capacity through a demand charge and peak capacity is used to provide wheeling service then, it is appropriate for the wheeling party to help pay the cost of providing peak capacity and offset the utilities demand charge to its customers.

Customer Equity

One of the foremost concerns of determining a wheeling charge should be customer equity. From a cost of service perspective, for like services, the utility's customers should pay no more or no less than a party requesting wheeling service. If a utility recovers transmission, distribution, and regulatory storage costs through either fixed charges or commodity charges, and water is conveyed for a wheeling party at a lower cost than what the utility's customers pay, then the utility's customers are most likely paying a portion of the cost of providing the wheeling service. This type of situation may cause utility customers to question their cost of service and can lead to economically inefficient resource investments on the part of the wheeling party. In cases where a wheeling transaction provides benefits to the utility's customers (most often in the form of avoided source of supply costs) it may be appropriate for the utility to consider these benefits in the final transaction with the wheeling party. Conversely, in cases where a wheeling transaction displaces a sale that the utility otherwise would have made (no benefits are provided to the utility's customers in the form of avoided cost), it may be appropriate, as a part of the wheeling arrangement, to consider the utility's opportunity costs for the programs, resources, and facilities developed to provide the now displaced supply. In any case, wheeling arrangements should be made in accordance with state laws and regulatory rules that apply to the utility.

SUMMARY

The discussion of charges for miscellaneous and special services provides general guidance for appropriately determining such service charges. In developing these types of charges, each utility should base its decisions and cost analyses on explicit policies and costing procedures. The utility also should carefully analyze its operations to identify what services should be subject to charges and what activities are involved in performing each service.

Each utility operation is unique to a certain extent. For that reason, an appropriate combination of charges should be developed based on the individual utility's needs and goals. For dynamic utility operations, these needs will change over time. In selecting a charge, the size of the customer base affected and the ability to identify individual users of the particular service are important factors.

The significance of the revenue/cost/use pattern is also an important consideration. Administrative costs can be an important part of any rate setting process, thus the utility must be sure that revenue generated by the activity and related costs are sufficient to justify processing the miscellaneous and special charges. Finally, costs must be identified and related to a unit of use so that an appropriate charge or fee can be developed. The utility will achieve greater equity and better efficiency to the extent that a utility has special service charges as part of its overall revenue strategy.

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Section X

Implementation Issues

Public Involvement Definition

Legal Considerations

Data Requirements

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Chapter 33

Public Involvement Definition

Designing water rates through a structured public decision process contemplates an interactive exchange of ideas and information between utility decision-makers and public stakeholders. It further requires that involved stakeholders have the ability to meaningfully participate in the decision-making process. As such, public involvement is distinguished from public relations or public education efforts. Public relations and education largely involve one-way communications from the water utility to affected or interested members of the community, where public involvement requires two-way communications and interaction.

The interactive nature of public involvement in water rate making demands the use of communications techniques that facilitate information exchange. These techniques range from use of Citizens Advisory Committees (CACs) to Internet site survey instruments. Open interaction also demands the establishment of a structured decision process to provide appropriate exposure to the democratic process.

GENERAL CONSIDERATIONS AND POLICY ISSUES

Public involvement is not required to design water rates that meet utility requirements. In fact, under certain circumstances, public involvement may not be a viable option. However, public involvement in decision-making processes that affect community stakeholders (over a broad range of issues) is a proven approach to enhancing public acceptance of utility policies. The general considerations involved in determining the degree to involve the public in water rate development, and the form of this involvement, relate to

- the magnitude of potential impacts on community stakeholders
- the extent to which options may reflect community values
- the extent to which the utility can (and is willing to) cede decision-making responsibility to community stakeholders.

Beyond these general considerations, the development of water rates raises a number of important policy issues. For example,

- How should revenue responsibilities be distributed across customer classes?
- Should variances from cost-of-service based rates be eliminated, and if so, over what time period?
- Should subsidies be provided to support economic development?
- Should water rates be structured to encourage water conservation, and if so, what conservation rate designs are appropriate for which customer classes?
- How should water rates be structured to address affordability concerns?

Resolution of these policy issues often involves balancing conflicting community values. For example, rates are often considered fair and equitable if they are based on cost-of-service. However, shifts in revenue responsibilities to effect cost-based rates may compromise economic development or affordability objectives.

Public involvement in utility rate development recognizes that affected parties are more likely to accept rate decisions if they have had the opportunity to participate in the rate development process. This principle is not unique to rate development but rather has been the basis for use of public involvement and structured public decision processes for a broad range of issues. Further, involving the public in rate development recognizes that affected parties may identify unique cost allocation and rate design approaches that reflect community circumstances and values better than rate designs developed in isolation. Most states have a utility consumer advocate office or public counsel that may be an important stakeholder representative in the rate setting, public involvement, and implementation process.

HISTORICAL PERSPECTIVES

Water rate development, like most utility decision-making, historically has been a relatively closed process. Typically, utility staff or consultants conduct all major steps of the rate development process—projection of usage characteristics, estimation of revenue requirements, allocation of costs to customer classes, and rate design—without input or review by affected customer representatives. For regulated utilities, this process culminates in submittals of rate filing packages in support of rate increase requests to the applicable regulatory body. Public involvement is essentially confined to participation by intervenors in subsequent rate hearings. For municipal utilities, the annual municipal budget adoption process is analogous to a rate filing package; public involvement occurs during budget hearings.

For water rate changes that preserved relatively low-cost water service, as was largely the case though the 1970s, this limited level of public involvement was not particularly problematic. However, several factors have heightened interest in water rate design and public involvement in rate development. Perhaps the most significant factor has been a trend of substantial increases in water rates in the 1980s and 1990s. As the stakes have increased, utility customers have increasingly demanded assurance that they pay their “fair share” of utility costs. Additionally, increased public interest in environmental stewardship in general, and water conservation in particular, has generated interest in conservation rate designs. Also, significant changes in the costs and rate designs of other utility services, most notably electric and telephone service, has raised the question of whether similar changes may be available for water service.

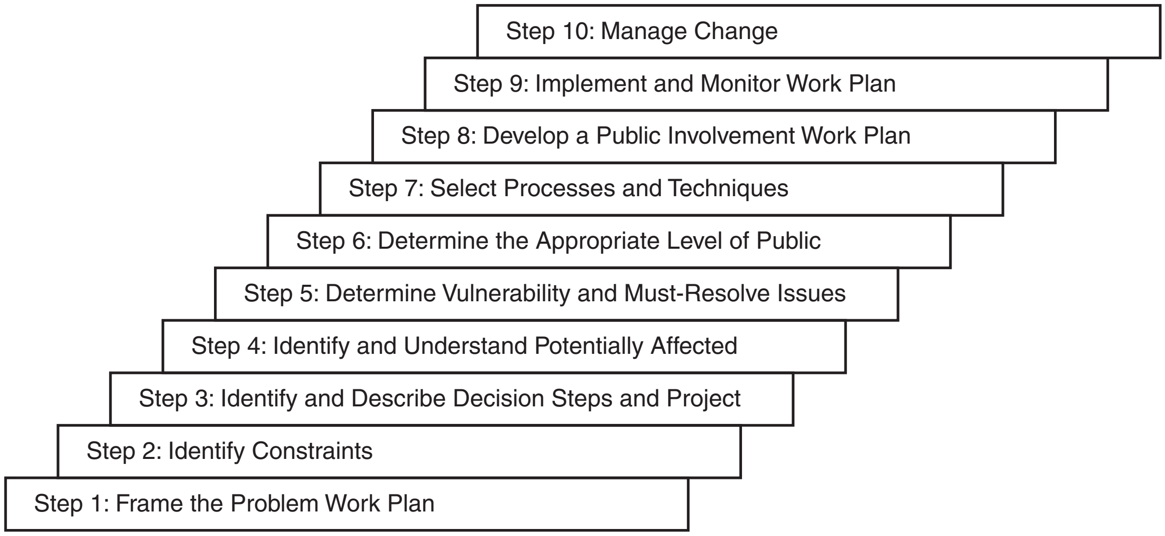

Figure 33-1 Ten-step approach to public involvement

PUBLIC INVOLVEMENT PLANNING

Heightened public interest in water rate development has increasingly led to implementation of public involvement strategies to gain acceptance of water rate changes. Utilities can follow the general ten-step process outlined in the American Water Works Association Research Foundation's report *Public Involvement Strategies: A Manager's Handbook*[*] to structure a public water rate decision process. This general ten-step process is shown in Figure 33-1.

The ten-step process highlights the importance of effective planning of public involvement programs. Eight of the ten steps precede implementation and focus on establishing a strategy that is responsive to the specific circumstances and interests of potentially impacted stakeholders. By employing these steps to the development of public involvement strategies for water rate making, specific issues or questions are raised.

Step 1: Frame the Problem

Water rate development, by definition, involves determining the appropriate distribution of revenue responsibilities among customer classes. Rate design relates to selection of the particular structure of charges that will recover allocated revenue responsibilities. Decisions on these issues reflect community values related to financial responsibilities of different ratepayer groups. Accordingly, public involvement on water rate issues will address questions of how costs are allocated between customer classes; whether one customer class subsidizes another; and whether incentives are provided to use, or conserve, water resources. In this step, it is generally useful to prepare a brief problem statement, review factual information about customer demands and utility revenue requirements, and identify critical assumptions needed to develop rate alternatives.

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* *Public Involvement Strategies: A Manager's Handbook,* American Water Works Association Research Foundation, 1995.

Step 2: Identify Constraints

Water rates are required to serve specific functions—most notably, generating adequate revenues to support utility performance and assure the financial integrity of utility operations. Further, in most jurisdictions, utility rates are legally required to be "just, reasonable, and non-discriminatory." Beyond these constraints, water rates generally will not obtain public or political acceptance if community values and sensitivities are not respected. The step of identifying constraints on water rate changes therefore will determine the boundaries within which water rate alternatives may fall. For example, if implementation of cost-of-service based rates will require substantial increases in residential rates, movement to cost-of-service based rates may effectively require a multi-year transition. Candidate rate structures generally will not be acceptable if they impose dramatic bill increases on selected users. If environmental stewardship and promotion of water conservation is a strong community value, declining block rate designs may be problematic. Similarly, inclining block rates may be equally problematic in communities seeking to encourage water-using development. Lastly, there may be logistical constraints on the level of public involvement available for water rate making. For example, rate adoption may be required within an internally or externally specified time frame or budgetary constraints may practically limit available communication vehicles.

Step 3: Identify and Describe Decision Steps and Project Milestones

These rate making constraints reflect the need to develop rate options that can gain the acceptance of utility decision-makers, municipal and regulatory authorities, and ratepayers in general. Designing a public involvement program requires integration of the public decision process with the formal, legal process required to enact rate changes. Accordingly, the steps by which rate changes are approved and enacted should be clearly understood by all participants in the public decision process. Moreover, public involvement program planning should identify the vehicles and timing by which program participants will have an opportunity to influence rate decision-making.

Careful delineation of how public involvement efforts will affect formal rate adoption steps is particularly important in the event that selected ratepayer representatives are asked to dedicate a substantial amount of time and effort to execute a public involvement program. For example, Citizens Advisory Committees (CACs) are commonly formed to serve as advisory bodies to either utility management or governing boards. These CACs often are not vested with decision-making authority, serving only in an advisory capacity. This aspect of the CAC's role should be clearly articulated at the outset of any public decision process to avoid unfounded expectations of decision-making authority.

Step 4: Identify and Understand Potentially Affected Stakeholders

Alternative assignments of class revenue responsibilities and rate designs will impact customer bills differently. Evaluating the merits of one alternative over another requires an understanding of the impacted parties. Moreover, an understanding of stakeholder perspectives is required to develop effective communication strategies about rate alternatives.

Importantly, stakeholder groups are not typically defined by the customer class groupings used to establish rates. Therefore, it is important to avoid the danger of evaluating stakeholder interests on the basis of customer class rate impacts. In many instances, stakeholder group interests cut across customer classes while in other instances they are quite specific. For example, environmental groups may be concerned about rate designs for industrial, commercial, and residential customers while gardening club members are primarily comprised of a subset of residential users. While each of these groups may have residential class members, their views about water conservation rate designs are likely to be much different, as are the communications media by which they obtain information. At a minimum, it is important to identify and engage stakeholders whose support is required to secure rate adoption or whose opposition could compromise public acceptance of proposed rates.

Step 5: Determine Vulnerability and Must-Resolve Issues

Public involvement in water rate making is fundamentally a tool for utility managers to gain acceptance of water rate changes. Preserving existing rates is generally not a problem. Accordingly, when planning a public involvement program, it is important to structure a public decision process that will ensure resolution of fundamental rate challenges. In some cases, this may be adoption of some form of system-wide rate increase. In other cases, the distribution of revenue responsibilities across customer classes may be at issue. In still other cases, rate designs to support water conservation, economic development, or other community goals may be of fundamental interest.

In any case, public involvement programs for water rate making should be focused on specific rate issues and be structured to assure timely development of acceptable rate options. To do so, while honoring stakeholder interests and concerns, an honest assessment of vulnerabilities is helpful. Vulnerabilities may be in the form of the potential for legal challenge of a given class's rates or simply (and commonly) the potential for given stakeholder groups to employ political influences to circumvent structured public decision processes. Vulnerabilities may range from a utility's credibility with potentially impacted stakeholders, to decision-maker inexperience with rate issues, to changes in economic conditions that alter perspectives on the viability of potential water rate changes.

Step 6: Determine the Appropriate Level of Public Involvement

Answers to Step 5 will indicate the extent to which public involvement may help resolve critical water rate issues and gain acceptance of water rate changes. In many instances, the must-resolve issues are limited and relatively simple. For example, acceptance of a limited system-wide rate increase without modifications to the distribution of class revenue responsibilities or rate structures is unlikely to require extensive public involvement. An appropriate level may be achieved through a limited number of public meetings (or other forms of information exchange) in advance of the annual budget adoption process. This level would typically be supplemented by one-way forms of communications to advise interested stakeholders of proposed rate changes. In other cases, a concerted effort using multiple outreach forms may be required. These cases will often involve consideration of changes in the distribution of revenue responsibilities across and within customer classes or acceptance of substantial increases in overall rate levels.

Step 7: Select Processes and Techniques

Once the appropriate level of public involvement has been determined, utility managers can select from a broad range of processes and techniques to solicit ratepayer input and inform interested stakeholders. For all but the most limited of rate issues, an effective public involvement program will employ multiple outreach mechanisms to access the broad diversity of stakeholder groups. Processes and techniques should be selected based on their effectiveness in communicating information to, and soliciting input from, particular ratepayer groups. Techniques should also be appropriate for the level of information detail to be communicated and the relative complexity of ratemaking decisions.

For example, cost-of-service studies focus on relatively complex issues of inter-class revenue distribution and rate structures. Public involvement programs for these studies often involve Citizens Advisory Committees (CACs) comprised of a broad spectrum of stakeholder representatives. CACs are particularly useful because of the zero-sum game nature of cost-of-service questions—every dollar of revenue responsibility not distributed to one customer class must be borne by other customer classes. For such studies, a forum for public discussion among representatives of all customer classes may avoid challenges by one customer class of preferential treatment of other classes. Because Citizens Advisory Committees are generally comprised of a diverse mix of community representatives with competing interests, it is important to establish guidelines for committee interaction and its role in the public decision process. An example of such guidelines is provided in appendix D of this manual.

For complicated rate issues, public involvement approaches may also include distribution of informational brochures or newsletters (possibly with accompanying survey instruments), speakers' bureaus, print or broadcast media articles as well as a variety of public meeting forms. Recently, computer technology advances have made available additional information exchange vehicles. Many utilities now have Internet home pages that can be modified to allow ratepayers to access a wealth of information and provide input on rate issues.

Step 8: Develop a Public Involvement Work Plan

The above-described steps involved in planning a public involvement program contemplate a number of activities that typically will cross the responsibilities of several functional organizations within a utility. Customer service personnel need to know about the planned rate development process and be able to direct inquiries appropriately. Financial management staff will be required to develop (and possibly present) information on utility costs. Frequently, plant and field operations managers and engineering staff will need to provide information and respond to questions. Public communications or top utility management personnel will need to represent the utility in public discourse and insure logistical support of public involvement activities.

If the utility fails to coordinate these activities effectively and to properly support a public decision process it will undermine rather than enhance the utility's credibility and public trust. Consequently, it is extremely important that public involvement programs be well planned and appropriately budgeted. A public involvement plan should provide a clear delineation of responsibilities, the scheduling of program activities, communications protocols, and the linkages between public input and the rate development process. It is often useful to develop a public involvement program mission statement to promote internal commitment to the program as well as external understanding. This statement is typically separate from that used to guide development of rate options and deals specifically with objectives of the public involvement program. For example, while the rate development process may be oriented to "developing cost-based, equitable water rates," the public involvement program may be developed to "ensure that water rates reflect community values through balanced and informed input of interested stakeholders."

Step 9: Implement and Monitor the Work Plan

Insofar as facilitation of public involvement activities is not the primary background of most utility personnel, implementing the public involvement work plan is likely to be uncomfortable. This is particularly true for water rate making in which a measure of controversy is generally unavoidable and concerns tend to be acute. Although effective program planning can go a long way toward easing the discomfort, several guidelines are key to successful program implementation. These include:

- Utility representatives must be able to communicate effectively and respectfully with stakeholder groups.
- Communication on the status of public involvement and rate development tasks must be regular and comprehensive to insure against miscommunications.
- Responses to information requests should be carefully reviewed and checked against other information provided to interested parties. Discrepancies should be clearly reconciled.

Step 10: Manage Change

Public involvement programs for water rate development will typically support some form of rate study (e.g., cost-of-service analysis, rate structure evaluation) that will generate new information on the utility's existing water rates and future rate options. As a consequence, the framework for public decisions on water rate issues will evolve. Additionally, external factors may alter the decision-making environment. These factors may range from unanticipated additions to utility revenue requirements to changes in the political landscape. The inevitability of change means that the public decision process must be responsive to new information and viewpoints. As changes occur, all participants in the decision process should be fully advised of modifications to the public involvement program and the reasons for these modifications. Utility representatives also should be extremely careful not to commit to granting authority that may be altered under new circumstances.

COMMUNICATIONS TOOLS

Applying the ten-step (or similarly comprehensive) process to developing public involvement strategies gives utility managers the opportunity to employ public outreach and communication tools to greatest effect. Ultimately, water rate decision-making may be improved by greater understanding of rate development challenges and informed community participation. As noted in the discussion of Step 7: Select Processes and Techniques, there is a broad range of communication tools that may be used to implement a successful public involvement program, each with its relative advantages and disadvantages. Several of the most commonly used tools for water rate public involvement programs are listed in the paragraphs that follow.

Bill Inserts/Stuffers

Brief letters or small-sized inserts that are distributed with each customer's bill offer a way to communicate with the entire customer population, but unfortunately these inserts are frequently viewed as "junk mail." Responses to insert survey instruments or service offerings typically obtain 10 to 20 percent response rates. Generally, bill inserts are recommended to announce significant rate study events such as the commencement of CAC meetings, reports of findings, and rate change implementation dates.

Newsletters

Topic-specific newsletters may be published and distributed to key community groups or mailed to all customers as a way of providing more in-depth information than is typically afforded through a bill insert. Newsletters can be particularly useful if a high level of interest or concern about the rate study has been expressed and interested parties have requested detailed information. The cost of publishing a newsletter, including staff time and printing and mailing costs, tends to be justified only in cases where significant issues are to be addressed and a sizable readership may be reasonably anticipated.

Speakers' Bureau/Community Group Presentations

A less expensive, and often more informative, vehicle for disseminating information to interested customers is to make presentations to requesting community groups. In-person contact allows utility representatives to communicate directly with customers and may express the utility's commitment to inform and involve the public more strongly than printed materials. Nevertheless, to be useful, in-person contact requires effective public speaking and facilitation skills by rate study representatives and community group use of the available service.

Information Line

A 24-hour telephone line with a recorded message can inform the public about rate study events, such as CAC meeting times and dates, locations of published study materials, and public hearing times and dates. In addition, the phone numbers of utility staff to contact with specific questions are listed.

Print and Broadcast Media Relations

Announcements of the times and dates of public hearings and work sessions on rates should almost certainly be made in the local print media and, if possible, broadcast media. Local public access channels may be used to broadcast CAC meetings or special informational programs on the rate study. Accurate coverage by the local press may be encouraged through media briefing sessions and advance notices of potentially "newsworthy" decision-making.

Internet Site

Internet sites may be used to allow access to a wealth of information about water rate issues. In addition to quick access to information about public involvement program events (e.g., CAC meeting or public hearing dates), actual materials from the rate study may be made available on the site. These may include issue papers generated as part of the rate study, presentations made to utility decision-makers, and general reference information. Information may be solicited from those accessing the site through survey instruments or general requests for comment. While this communication tool has a limited (and likely unrepresentative) audience, it is relatively inexpensive to update and is likely to become increasingly important.

This listing may serve as a "menu" of public communications options. Some, but likely not all, of these methods can be used effectively. The selection of methods should be oriented toward insuring opportunities for all ratepayers to learn about and become involved in the project, without incurring unnecessary expenditures.

EVALUATING COMMUNICATION

As noted, successful implementation of public involvement programs is promoted through continuous evaluation of the effectiveness of communication methods and responsiveness to change. However, while the ultimate evaluation standard for a public decision process is acceptance and adoption of proposed rates, this measure may be compromised by influences outside the scope of public discourse. Accordingly, the criteria used to evaluate public involvement programs should relate to those aspects of the program over which participants have a reasonable measure of control. For example, while consensus recommendations may not be reached, commendable public involvement programs generally are structured to provide interested parties the opportunity to learn about rate issues and participate in the discussion of proposed rates. Similarly, while attendance at public meetings on rates may be limited, utilities that attempt to provide information and solicit public input through a variety of communications vehicles are considerably less likely to be criticized for arbitrary rate development practices. Lastly, because public involvement simultaneously invites criticism and collaboration by members of the public, an important criterion for evaluation of public involvement activities relates to the professionalism and respect utility representatives demonstrate in the public decision process. Commendable performance with respect to this criterion will convey benefits far beyond the scope of rate development issues.

SUMMARY

Several factors, most notably substantial increases in system revenue requirements and conservation issues, have heightened public interest in water rate making. Concerns include questions about the distribution of revenue responsibilities across customer classes, incentives provided through rate structures, and the affordability of basic levels of service. Public involvement in water rate making is a potentially powerful tool to enhance community understanding of rate issues and gain acceptance of proposed rate changes. Public decision processes generally require careful planning and a high level of utility commitment. Comprehensive planning may be facilitated by reference to established processes for developing public involvement strategies. This planning will help identify the communication tools to be used to inform and engage community stakeholders. Fundamentally, public involvement requires that community stakeholders have the ability to participate in the water rate decision process; public involvement programs should be evaluated on the quality of this participation.

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Chapter 34

Legal Considerations

Regardless of whether a water utility is government- or investor-owned, unless a tariff design and rate structure comply with governing statutes and case law, the decisions implementing such structures may not be upheld by the courts if challenged. Procedural requirements such as public notice, public input via hearings or written comments, council votes, or referendums must be strictly followed to avoid a reversal by a court on procedural grounds. Such procedural requirements vary significantly by state and by municipality and are addressed in this chapter. While the substantive law relative to rate setting also varies by state, there are common guiding principles that will be addressed as well as significant differences among jurisdictions. Regardless of the statutory or case law at the time this manual is drafted, a review of the relevant statutes and case law with legal counsel should be made before a major decision or change regarding tariff design.

JURISDICTION OF ECONOMIC REGULATION OF WATER UTILITIES

Authority over regulation of rates and rate design of water utilities differs depending on whether the utility is owned by the government (public ownership) or by shareholders (private ownership). Generally, the rates for private water utilities are rate regulated by state or provincial utility commissions, while the rates for most public water utilities are rate regulated by municipal boards, councils, commissions, water districts, etc. There are some states and provinces in which public utility commissions exercise total or partial jurisdiction over public water utility rate setting. Moreover, some counties or municipalities have authority to set rates of private water utilities. It is important to be familiar with the specific regulatory approval for your particular utility in terms of setting rates, as this varies from state to state and province to province.

GENERAL LEGAL STANDARDS

In order to be upheld by the courts, rates, whether set by a municipal body or an investor-owned utility, need not be perfect to be upheld by the courts. They must, however, be just and reasonable, and bear a rational relationship to a legitimate governmental interest. The cases, which address rate setting, show that there are a myriad of factors that may justify different rates among various classes of users. The historical, as well as current, cases continue to hold that only *unjust* or *unreasonable* differences will render a rate or charge objectionable. It is important that in designing rates, all factors that create differences among classes of customers be analyzed and articulated in the ordinance or order that authorizes the rate structure. As water bills become a larger percentage of customers' income and total expenses, more attention will be focused on the procedural and substantive techniques for setting water rates.

A basic tenet of the law involving municipal rate setting is that rates established in a lawful manner by a municipality or municipal authority are presumed to be reasonable, fair, and lawful.[*] A presumption of validity is accorded rates enacted by municipal ordinance and those challenging the rates bear the heavy burden of proving that the rates charged are unjustly discriminatory or unreasonable.[†] However, once sufficient evidence is introduced to challenge the validity of the presumption, the presumption becomes inoperative.[‡] A showing that rates lack uniformity is by itself insufficient to establish that rates are unreasonable and hence unlawful. To be objectionable, the discrimination must "draw an unfair line or strike an unfair balance between those in like circumstances having equal rights and privileges. It is only unjust or unreasonable discrimination which renders a rate or charge unreasonable."[§] The rates charged by the municipality must be reasonable as well as free from unjust discrimination among the customers it serves "taking into account their situation and classification."[**]

The rate differential is but one factor to be considered in determining unjust discrimination. The rates charged by the utility must bear some relationship to the present or future costs of providing water service.[††]

FACTORS TO CONSIDER IN DETERMINING IF RATES ARE UNREASONABLY DISCRIMINATORY

Both the reasonableness of and the presence of unjust discrimination in a rate setting contract are questions of fact that must be determined from all of the

* *Elliott v. City of Pacific Grove,* 54 Cal.App.3d 53, 126 Cal.Rptr. 371 (1975); *Durant v. City of Beverly Hills,* 39 Cal. App.2d 133, 102 P.2d 759 (1940)

† *Village of Niles v. City of Chicago,* 82 Ill.App.3d 60, 37 Ill.Dec. 142, 401 N.E.2d 1235 (1980)

‡ *Franciscan Sisters Health Care Corporation v. Dean,* 95 Ill.2d 452, 463; 69 Ill.Dec. 960, 448 N.E.2d 872 (1983); *Inland Real Estate Corporation v. The Village of Palantine,* 146 Ill.App.3d 92, 99 Ill.Dec. 906, 496 N.E.2d 998, 1002 (1986); *Laramie Citizens for Good Government v. City of Laramie,* 617 P.2d 474 (Wyo., Sep 22, 1980); *City of Pompano Beach v. Oltman* 389 So.2d 283, 286 (Fl Dis Ct. App 1980)

§ *Durant v. City of Beverly Hills,* 39 Cal. App.2d 133, 102 P.2d 759 (1940)

** State ex rel. *Mt. Sinai Hospital v. Hickey,* 137 Ohio St. 474, 477; 30 N.E.2d 802 (1940)

†† *Fairway Manor, Inc. v. City of Akron,* 13 Ohio App.3d 233, 468 N.E.2d 927 (1983)

circumstances surrounding the contract.* When a municipal waterworks, which supplied water to a wholesale electric company which was located outside of its municipal boundaries, increased its rates by 350 percent in three years, while the record showed that its actual costs during that period increased by 28 percent, the court held that the municipality not only breached an agreement with the company, but also illegally discriminated against the company under common and statutory law because it charged industrial users outside the city limits a higher rate than industrial customers located inside the city.† The test to determine whether rates charged by a municipality are discriminatory is based on a consideration of such factors as differences in the amount of the product used, the time when used, the purpose for which used, or any other relevant facts reflecting differences in costs. Rates that are reasonably related to differences in costs of providing service are not unreasonably discriminatory.‡

In concluding that there was a reasonable basis for surcharging a group of customers for water service that was particularized to them, a Massachusetts court upheld a surcharge on water users in an area in which a new water main was installed.§

Unreasonableness will be shown where the discrimination rests on the nonresident status of the user without an explanation of why nonresidents rates should be higher.** When a municipality differentiates between customers inside the municipal limits and those outside those boundaries it must show that the rate differential is based on cost of service or some other reasonable basis.††

A city's first duty is to its own inhabitants who order and pay for municipal plant directly or indirectly and who, therefore, have a preferred claim to the benefits

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* *Orr Felt Co. v. City of Piqua*, 2 Ohio St.3d 166, 171; 443 N.E.2d 521 (1983)

† *Massachusetts Municipal Wholesale Electric Company v. City of Springfield*, 6 Mass.L.Rptr, 584, 1997 WL 225693 (Mass.Super.)

‡ *Austin View Civic Assn. v. City of Palos Heights*, 85 Ill.3d 89, 40 Ill.Dec. 164, 405 N.E.2d 1256 (1980)

§ *Morton v. Town of Hanover*, 43 Mass. App. Ct 197, 682 NE 2d 889 (1997)

** *Platt v. Town of Torrey*, 949 P.2d 325

†† *County of Inyo v. Public Utilities Commission,* 26 Cal.3d 154, 159, f.n.4; 604 P.2d 566 (1980); *Durant v. City of Beverly Hills,* 39 Cal.App.2d 133, 102 P.2d 759 (1940) Requiring a reasonable basis for higher nonresident rates accords with the overwhelming majority of cases from other jurisdictions. *See Jung v. City of Phoenix,* 160 Ariz. 38, 770 P.2d 342 (Ariz.1989); *Delony v. Rucker,* 227 Ark. 869, 302 S.W.2d 287 (Ark. 1957) (interpreting statute requiring reasonable rates); *Hansen v. City of San Buenaventura,* 42 Cal.3d 1172, 233 Cal.Rptr. 22, 729 P.2d 186 (Cal.1986); *Barr v. First Taxing Dist.,* 151 Conn. 53, 192 A.2d 872 (Conn.1963); *Mohme v. City of Cocoa,* 328 So.2d 422 (Fla.1976); *Cooper v. Tampa Elec. Co.,* 154 Fla. 410, 17 So.2d 785 (Fla.1944); *Inland Real Estate Corp. v. Village of Palatine,* 146 Ill.App.3d 92, 99 Ill.Dec. 906, 496 N.E.2d 998 (Ill.App.Ct.1986); *Usher v. City of Pittsburgh,* 196 Kan. 86, 410 P.2d 419 (Kan.1966); *Louisville & Jefferson County Metro. Sewer Dist. v. Joseph E. Seagram & Sons, Inc.,* 307 Ky. 413, 211 S.W.2d 122 (Ky.1948); *City of Hagerstown v. Public Serv. Comm'n,* 217 Md. 101, 141 A.2d 699 (Md.Ct.App.1958) (based on statute requiring PSC to fix reasonable rate for service to nonresidents); *County of Oakland v. City of Detroit,* 81 Mich.App. 308, 265 N.W.2d 130 (Mich.Ct.App.1978); *Borough of Ambridge v. Pennsylvania Pub. Util. Comm'n,* 137 Pa.Super. 50, 8 A.2d 429 (Pa.1939) (interpreting statute requiring reasonable rates); *Town of Terrell Hills v. City of San Antonio,* 318 S.W.2d 85 (Tex.Civ.App.1958); *Handy v. City of Rutland,* 156 Vt. 397, 598 A.2d 114 (Vt.1990); *Faxe v. City of Grandview,* 48 Wash.2d 342, 294 P.2d 402 (Wash.1956) (holding that state constitution required reasonable nonresident rates); cf. *Mayor & Council of Dover v. Delmarva Enterprises, Inc.,* 301 A.2d 276 (Del.1973); *Schroeder v. City of Grayville,* 166 Ill.App.3d 814, 117 Ill.Dec. 681, 520 N.E.2d 1032, 1034 (Ill.App.Ct.1988)

resulting from public ownership. Upon this reasoning, courts have typically held that the municipality, in the absence of legislative limitation, may discriminate as to rates based solely on the political boundaries of the municipality.*

Courts have noted several factors that justify increased rates to residents residing outside of the city: on average, the service to nonresidents involves greater expense to those outside of the city than service to its residents; the filter plant from which the water is distributed is inside the city; in any given direction, the suburban areas lie farther from the plant than the intervening urban territory and these greater distances are shown to entail greater costs in the installation and maintenance of water mains and in the pumping of water; the outlying districts are less densely populated than the city itself, which involves a greater average expense in the reading of meters and the making of service calls.† However, even if no cost differentials exist, other justifications could exist. Those factors may be additional risk of responsibility to finance a major repair in the event of catastrophe or breakdown; responsibility for ongoing replacement and repair of system components; contributions of residents to the initial construction of the system (tax or other funds or labor); moneys from general fund are used to pay salaries of those who manage and operate the system.

In interpreting two provisions of the Municipalities Authorities Act in *Township of Racoon v. The Municipal Water Authority of the Borough of Aliquippa*,‡ the Pennsylvania Commonwealth Court held that there is no limitation that rates be reasonable and uniform where an authority contracts with another, presumably outside its limits (as compared to rates for service within its area). The Court explained that the "discrepancy is not illogical when the difference between the two situations is examined." "In the first case [inside the authority's limits], a municipal authority is granted the exclusive authority to set rates for its services. The recipient of these services has no input into the ratemaking process. It is therefore protected by the provision requiring the rates to be reasonable and uniform and subject to judicial review. Such is not the case when two municipal bodies contract for services … but that rate, of course, will be the subject of negotiation before a contract is concluded. There is nothing in the statute to prevent the inclusion of a clause providing for periodic rate increases and, conversely, nothing to prohibit setting a maximum rate…."

RECENT COURT DECISIONS

A review of the cases decided recently reveals that in the municipal rate setting arena, as in other areas of the law, courts are cognizant of economic and environmental change. This is particularly apparent in cases involving municipalities' attempts to set conservation rates and rates that attempt to attract or retain industry.

In *Brydon v. East Bay Municipal Utility District*,§ it was the owners of single family residences who challenged the municipal utility district's inclining block water rate structure. In this case, the water rate structure was adopted as part of a

* McQuillin, Municipal Corporations (3rd ed) § 35.37; *Collier v. City of Atlanta,* 178 Ga. 575, 173 S.E. 853; *Louisville & Jefferson County Metropolitan Sewer District v. Joseph E. Seagram & Sons,* 307 Ky. 413, 211 S.W.2d 122; *Childs v. City of Columbia,* 87 S.C. 566, 70 S.E. 296

† *Delony v. City of Little Rock,* et al., 277 Ark. 869, 302 S.W.2d 287 (1957)

‡ 142 Pa. Com. Ct. 508, 597 A.2d 757 (1991)

§ 24 Cal.App.4th. 178, 29 Cal.Rptr.2d 128 (1994)

Comprehensive Drought Management Program. The homeowners challenged the rate structure on the grounds that it violated the California constitutional prohibition against a "Special Tax" without two-thirds voter approval. In upholding the inclining block rate structure, the court noted that such structure was a response to state mandated water resource conservation requirements. The court also went into an in-depth discussion of water usage in various districts and relative levels of water consumption and pointed out that 11 percent of single family residences who use 35 percent of all water sold to the single family market were placing a disproportionate strain on a frail market. The court stated that, "To the extent that certain consumers over-utilize the resource, they contribute disproportionately to the necessity for conservation and the requirement that the District acquire new sources for the supply of domestic water."

The courts are cognizant, not only of environmental conditions, but also of economic conditions in reviewing challenged municipal rate structures. A recent Louisiana case, which addressed a charge against a municipality of discriminatory electric rates, is instructive. In *Liberty Rice Mill, Inc. v. City of Kaplan*,* the Louisiana Court of Appeals held that a city ordinance restructuring municipal electric rates so as to retain a large customer and employer, who had threatened to relocate if its rates were not reduced, was not unreasonable and impermissibly discriminatory. In that case after Garan, Inc. ("Garan"), a local garment manufacturer threatened to relocate if its electric rates were not reduced, the City reduced its rates from 8.7 cents to 8.0 cents per kWh and simultaneously raised Liberty Rice Mills ("Liberty") rates from 8.7 cents to 9.4 cents per kWh. Liberty alleged that the 0.7 cent rate increase to it, coupled with the 0.7 cent decrease to Garan, was unreasonable and discriminatory.

The issue presented was: "Is it unreasonably discriminatory to restructure rates because one entity has threatened to leave the system?"

The court referenced the leading Louisiana case of *Hicks v. City of Monroe Utilities Commission.*† The issue in Hicks was whether the City could charge more for water to customers outside the city limits who took water service only, than it did to customers also outside the city who took both water and electricity services. The court in Hicks held that setting water rates for customers not subscribing to the City's electric services four times higher than those customers subscribing to both water and electricity services was arbitrary, capricious, unreasonable, oppressive, and discriminatory and the rate could not be sustained since the basis for the classification was entirely collateral to and unconnected with the particular service being provided.

The municipal corporation has two classes of powers: one public (governmental) and one private (proprietary). In its proprietary functions, the municipality is held to the same responsibility as a private corporation. As a utility provider, the municipality acts in its proprietary role and one of its principal obligations, in that capacity, is the same as a private utility corporation—to serve its customers at a reasonable nondiscriminatory rate.

Although obligated to maintain a uniform nondiscriminatory rate among its customers, a municipal corporation operating a public utility nevertheless has the right to make a reasonable classification of its customers and to charge a different rate according to the classification based upon such factors as the cost of service, the

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* 95-1656, La.App. 3 Cir., 674 So.2d 395 (1996)

† 237 La. 848, 112 So.2d 635 (1959)

purpose for which the service is received, the quantity or amount received, the different character of the service provided, the time of its use, or any other matter that presents a substantial difference as a ground of distinction.

The underlying public policy rationale for approving discounted rates to a certain customer (Garan) was that eventually the entire community and all utility customers will benefit because of the effect that the preferential treatment has on attracting and retaining industry in the community. The court held that, "A classification and a rate schedule made for the purpose of keeping in the community industry that employs a large number of persons is not unreasonable." The court noted that there might have been better schemes, but that is not the standard. The classification merely has to be reasonable.

In one recent case, those challenging a city's rate structure claimed that certain rates or fees were "taxes" and thus subject to the jurisdiction of a state tax court. Although the determination of such cases is extremely dependent on state law, they are noteworthy because the appellate court held that the challenged rates were not taxes. In *West Capital Associates Limited Partnership v. City of Annapolis*,[*] the City brought an action against its water and sewer customer for breach of contract, seeking to collect unpaid real estate tax equivalent fees charged for water and sewer service to customers located outside city limits under a utility agreement. In this case, a developer owned a parcel of property, most of which was located outside of the city limits, and annexation was precluded by certain language in the industrial revenue bonds used to finance the project. The Annapolis City Code authorized the provision of water and sewer service to customers outside the city limits at twice the charge to customers inside the city limits, but allowed the City Council, by ordinance, to approve an agreement including a rate equal to that charged City residents if the outside user agreed to make annual payments to the City in amounts equivalent to city real property taxes, which would be imposed if the property were in the city. Such agreement was signed and for a number of years the payments in lieu of real estate taxes were made. After a number of years, the developer then refused to pay the fees and claimed that the fees were illegal and unconstitutional because there was no reasonable relationship between the amount of the user charge and the cost of providing service.

In this case, the court also rebuffed a challenge to rates that were higher to those outside the City limits. The court noted that absent a statute to the contrary, a municipality is not required and cannot be compelled to provide water or sewer service outside its geographic boundary. Further, the court stated that although municipalities are required to charge rates that are reasonable and not unfairly discriminatory, they may properly discriminate between residents and nonresidents and charge higher rates to the latter. The court then went on to discuss the facts that were not provided in the case.

In this case, appellant offered no evidence beyond the mere fact that the residential rates (inside the City) were lower than the rate contractually fixed for it (outside the City), to justify a charge that its rate was unreasonable or discriminatory. The court noted that no evidence was produced to show that the plant and facilities used to provide the water and sewer service were not, in some measure, supported by the general revenues of the city. If indeed, the ability to provide the service was funded to any extent by such revenues, even to the extent that the municipality owned plant and facilities themselves are not subject to municipal taxation would certainly

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* 110 Md.App. 443, 677 A.2d 655 (1996)

be reasonable for the City to impose, as a surcharge on nonresidents, an additional amount in lieu of taxes that would be paid if the property were subject to the City property tax. Otherwise, the court explained, the City residents would, in effect, be subsidizing the nonresident user.

SUMMARY

Whether one reviews the municipal rate setting cases from a historical or a current perspective, it is generally the case that rates that are legally passed bear a presumption of validity and the burden of showing that such rates are unreasonably discriminatory rests with those challenging the rates. Municipal leaders, however, should not be sanguine about such a presumption because as rates increase challenges to rate design will become more frequent and more organized. Well-organized challenges will present enough evidence that the burden will shift to the municipality to show the reasons why its rates are just and reasonable. Municipal officials can ready themselves for these disputes by preparing a cost of service study. Even if such study will not be used at all or as the sole basis for rate setting, deviations from the cost of service study should be carefully analyzed and documented. The key to having municipal rates upheld by the courts is to analyze and document the factual basis for the rates selected. Accordingly, municipal officials should familiarize themselves with the engineering and accounting rationales for setting rates as well as keeping current on cases that address rate design, in order to authorize rates that will be upheld by the courts.

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Chapter 35

Data Requirements

One of the key factors in developing supportable utility rates is the availability of sound, accurate records and data. Maintaining good records not only is helpful to the rate practitioner in establishing rates, but is also critical to the ability of the utility to adequately ensure and assess the impact of alternative rate forms on such issues as revenue sufficiency and stability, individual customer or customer class equitability, and conservation goals and objectives. Among the areas in which accurate and detailed records are important in developing rates and evaluating the impact of rates on customers are: (1) customer records (number of customers, billed usage, revenues, demographics, seasonal variations in use, and demand factors); (2) plant investment (functional breakdown and design capacities); (3) operation and maintenance expenses (functional and object class breakdowns, seasonal variations); (4) monthly cash flow for the utility; and (5) customer survey information. This chapter addresses these elements and why and how the maintenance of adequate records in these areas is important and helpful in establishing various alternative rate forms.

CUSTOMER RECORDS

From a rate making standpoint, probably the most important area in which the utility should maintain accurate and extensive records is in the area of customer related data and statistics. By far the most significant source of revenue for nearly every water utility is that produced from water sales or "rate" revenue. The application of a particular rate structure to the number of bills and/or metered water usage produces the billings and revenue that sustain the utility's financial well being. Without accurate customer billing records, the development of a rate structure can be hampered, with a potential result being the establishment of rates that do not generate sufficient revenue to meet the utility's revenue requirements and revenue bond covenants.

Number of Customers

As a starting point, most utilities do maintain certain standard customer related statistics. These typically include the number of customers by size of meter and by customer class (if customers are classified for rate making or other purposes). These records are generally kept on either a monthly or year end count. Since billing frequencies may vary by type or classification of customer (for example, residential accounts may be billed quarterly while other accounts are billed monthly), it is also common and important for utilities to maintain records regarding the number of bills issued by meter size and/or customer class. Detailed information on number of customers and bills by meter size and class of customer are utilized in the development of customer related charges such as minimum bills or service charges. These types of charges are common to virtually every type of alternative rate form, and are therefore necessary data requirements for all utilities. One point worth mentioning in the matter of customer account data is that if customer classifications are utilized by the utility, it is important to develop sound, consistent definitions for the classifications. This is very important if different rate forms are developed and applied to different classifications of customers.

Metered Consumption

Another common customer statistic that is often maintained is metered consumption by meter size or by class of customer, or both. Ideally this information should be maintained in as much detail as the utility's billing system or customer data base will permit. At the least the data should be maintained on an annual basis, but preferably it would be maintained on a billing cycle basis (monthly, bimonthly, etc.), again by class and/or meter size. In the development of seasonal rates, it is necessary to know the metered consumption for each month, since there is a different rate for defined monthly periods or seasons under this rate form. The maintenance of consumption data for individual customers is also important, particularly for certain types of rate structures such as "excess use rates," whereby each customer is charged at a higher unit rate when their water usage exceeds an established threshold, e.g., more than 125 percent of winter period use.

In order to design and evaluate different rate structures against a utility's goals and objectives, which as mentioned in the Overview above may include such elements as financial stability, enhanced equitability, and conservation, it is important to maintain detailed customer records such as number of bills and metered consumption for as many years as possible. This is particularly necessary in areas of the country where the weather can vary significantly from year to year and where water sales are sensitive to weather patterns. This would include regions in which discretionary uses such as lawn irrigation constitutes a large proportion of annual water sales. The maintenance of these types of records for a period of years (3–5 years, for example) should enable the utility to have a data base that encompasses a wide range of weather conditions and related water usage and demands on the system. The availability of this type of data enables the rate practitioner to "test" various alternative rate structures against a variety of weather conditions. This permits the determination of the sensitivity and variation in monthly and/or annual revenue of alternative rate forms to weather conditions. This further allows the establishment of the magnitude of necessary reserves or working capital balances that need to be maintained to protect the revenue stability of the utility.

Another important reason to keep detailed records of metered consumption by class of customer and/or meter size on a billing period basis, is to enable the development of a bill frequency distribution analysis or bill tabulation. These analyses are particularly important in the development of declining or inverted block rate structures, or in the establishment of lifeline rates, where a different unit rate is assigned to metered consumption, which falls in predetermined consumption or rate blocks. In these rate forms it is necessary to know the percentage distribution of the annual usage of the utility, by class, if appropriate or germane to the particular utility, into each of the rate blocks.

Billed Revenue Data

A third customer statistic that is important in the development of rates, and that is commonly maintained by most utilities, is customer billing information in dollars. Most often this information is available by customer class or meter size. It is important to keep this information to have a gauge or benchmark against which to measure the revenue anticipated from proposed new rates. Application of existing rates to the customer statistics discussed above (bills and consumption) to develop a "pro forma" level of billings, and comparison of those billings with actual known billings provides the rate practitioner with a measure of the "accuracy" of the billing statistics or units of service with which he or she is working. This allows for a level of comfort that when the proposed rates are applied to these billing units, the anticipated billings and revenue will be achieved.

Billing information by individual customer is also important to be retained in the utility's billing data base. This is particularly true whenever a change in the rate form is planned. Often with a change in rate structure, there are more customer inquiries. It is helpful to the customer service representatives to have billing history available to aid in answering the customers' questions. It is also helpful to the rate practitioner and the utility's public relations department to have such information available in order to establish profiles of "typical" customer impacts of changes in rates. These profiles are good tools to have available when addressing and explaining the new rate structure in public forums.

Peak Period Demand Data

Additional customer information that is extremely beneficial to the rate practitioner in cost of service allocations and in designing rates is customer class demand data. Very few water utilities have this type of information. To develop maximum day and maximum hour demand data on a customer or customer class basis can require significant financial resources. Demand meters must be purchased and installed, and the data must be reviewed, interpolated, and expanded to fit the entire class of customers. For measuring residential customers, careful planning, statistically valid samples, and coordination with other municipal agencies, such as the fire department when certain areas must be valved off, are required. If done properly, the results of these studies can be quite useful not only to the rate practitioner, but also the water utility's engineering and planning staff, as the demand data is also useful in sizing mains, storage reservoirs, etc.

Most often the information on customer class demands is based upon system-wide coincidental maximum daily and hourly demands, which are generally available or can be obtained from treatment plant pumping records and storage tank drawdown data. (See appendix A.) This information, combined with monthly metered consumption data by customer class, is utilized to estimate customer class demand data. While some utilities are installing automatic meter reading systems that can gather demand data, the presence of specific customer class demand data is likely not something that is available to most at present. Therefore, it is important to maintain good records of system-wide maximum daily and hourly demands to enable the simulation of class demands.

Other Data Requirements

Another element of customer records that is not typically maintained by water utilities, but is becoming an increasingly important piece of information as water rates across the country continue to climb in the face of increasing regulatory requirements, is a demographic distribution of the utility's customer base. Many utilities are implementing discount rates or lifeline rates to accommodate the increasing number of fixed income and low-income families and customers in their service areas. Whether the discount rates are targeted to a specific group of customers, or are available to the entire customer base, as in the case of some lifeline rates, it is necessary to know how many customers are impacted, and if targeted to a specific group, who they are. Often times utilities find it useful and cost effective to coordinate with other agencies in the community that already have a system and data base in place to address the needs of low-income customers. Checking with these agencies and utilizing their available resources makes sense in those instances where a utility is considering implementing these types of rates or rate considerations.

One final area of customer record keeping that is, in effect, a fallout of the information discussed above, is the ability to measure the price elasticity of customer demand for water. Price elasticity is the relationship of the change in the demand for a commodity (water, in this case) relative to the change in the price of the commodity. The need to have information regarding price elasticity is important whenever a utility is faced with implementing a rate increase. This need is particularly enhanced when a conservation rate structure is being implemented, since the intent of this type of rate structure is to encourage or achieve a reduction in water usage, either during peak demand periods or in total over the year. In order to properly design the water rates and to maintain financial stability for the utility, it is necessary to make some allowance for the amount of water use reduction that is anticipated to occur as a result of the rate increase. Measurement of price elasticity for water is a difficult and somewhat judgmental undertaking since there are many variables involved, including climatological considerations, educational and information programs regarding conservation and efficient use of water, economic cycles, etc. However, without sufficient detail and accuracy of customer billing records, the task of assessing price elasticity becomes extremely difficult and the results are not as meaningful.

A consideration that is particularly important during the implementation of any adjustment in the utility's water rates is the frequency of customer billing. Due to stipulations or constraints that may exist in the utility's regulations, ordinances, or policies, the billing frequency of each utility must be recognized in determining billings and collections under the new rates during the first year in which the rates become effective. Depending upon the utility's specific rate ordinance or regulation, the first bill rendered to each customer subsequent to the effective date of a rate adjustment must often be prorated between the previous rates and the new rates. This proration generally is based upon the number of days of service received by the customer before and after the effective date of the new rates. This proration may be applicable to both the volume related portion of the customer's bill as well as the fixed, or customer related, portion. The net impact of this proration process is that the new rates will not be fully effective the first year.

In establishing the necessary adjustments to rate levels to meet the utility's revenue requirements, in addition to the potential lag in realizing full billings under new rates, due to the proration process, the timing of the collections of the billings must also be recognized. This latter consideration is particularly important for those utilities whose accounting records and/or revenue bond debt service coverage requirements are legally established on the "cash" basis as opposed to the accrual basis of accounting. It is important when implementing proposed rate adjustments to recognize both the billing lag and the collection lag in fully recovering revenues under revised rates. Absent these considerations, utility revenues may fall short of the intended level of billings and receipts.

PLANT INVESTMENT

Also important in developing supportable rates is to have accurate and sufficiently detailed plant investment information. Plant investment is used in the rate making process in the allocation of capital related costs, such as debt service and annual cash financed capital additions and replacements under the cash approach to revenue requirements and rate making, and for allocation of return on investment related costs under the utility approach. It is recommended that the utility use the *Uniform System of Accounts for Class A Water Utilities* published by the National Association of Regulatory Utility Commissioners (NARUC) or another fully developed chart of accounts. Such an accounting system provides for the accumulation and accounting for additions, replacements, and retirements of utility property on a functionalized basis, representative of the various distinct service functions that various categories of property provide. Classifications of plant investment under the NARUC system include source of supply, raw water pumping and transmission, water treatment, treated water pumping, transmission and distribution, system storage, hydrants, meters and services, and administrative and general property. Functional classification of plant investment is necessary to allocate capital related costs to the appropriate functional category, whereby these functionally allocated costs can subsequently be distributed to the various classes of customers in proportion to their respective demands and usage of each of the plant facilities.

An associated element of plant investment that is useful in designing certain alternative rate forms is the design capacity of the various plant facilities. The majority of water system facilities are generally designed to meet peak system demands, whether it be maximum day demands (river source of supply, well fields, raw water pumping and transmission, treatment, treated water pumping, and certain treated water transmission mains) or maximum hour demands (transmission and distribution mains, system storage, booster pumps). In the design of certain types of rates, including seasonal, inverted, and off-peak rates, it may be useful to know what the non-peak season demands or capacity requirements of the utility system are and what the associated plant investment is to provide for these non-peak season demands. If this type of information can be determined by the utility staff, perhaps in conjunction with the utility's design engineer, this information can prove to be valuable in the determination of the costs of the system associated with providing off-peak demands, and the unit cost of service and appropriate rates associated with those demands.

OPERATION AND MAINTENANCE EXPENSES

As discussed in the section above on Plant Investment, detailed records of historical operation and maintenance expenses should also be maintained on a functionalized basis. The *Uniform System of Accounts for Class A Water Utilities* published by NARUC also provides guidelines for establishing accounting records that capture annual operation and maintenance data on a functionalized basis. For operation and maintenance expenses, in addition to recording the total expenses by function, it is also important to breakdown the functionalized expense by the object classifications for these expenses, which are utilized by the utility in its budgetary processes. These object classes typically include personal services (and related fringe benefit expenses), purchase of services (including power, which should be recorded separately from other expenses for cost allocation purposes), materials and supplies (including chemicals, which also should be recorded separately), and equipment expenses. As in the case of plant investment, the detailed accounting of operation and maintenance expenses, in accordance with the NARUC guidelines, provides for adequate breakdown of expenses for cost of service allocation and appropriated distribution of functionally allocated expenses to customer classes in proportion to their respective demands on the water system.

In designing certain types of rates, again including seasonal, inverted, and off-peak rates, it is useful to have the operation and maintenance expenses, in the detail described above, on a monthly basis. This information would be extremely helpful in determining the cost of water service on an off-peak period or season.

REVENUE STABILITY AND SUFFICIENCY

The principal objective of any rate structure should be to maintain the financial stability of the utility. Revenues must be, certainly on an annual basis, sufficient to meet the revenue requirements and revenue bond covenants, as applicable, of the utility. Reserve funds and rate stabilization funds may be available to assist in meeting these financial obligations on either a planned or an emergency basis. However, stable and adequate rate revenue, over the long run, must be the cornerstone of the utility's financial integrity.

During the course of the year, many utilities have seasonal demands on their system caused by climatological or economical cycles, or other events. This variation in demand also creates a variation in the associated billings and revenues throughout the year. Most water utilities' monthly costs, on the other hand, remain relatively fixed during the year, with perhaps the only monthly fluctuation being for power and chemical expenses, which tend to vary directly with water production. For utilities that have significant monthly swings in demand during the year, it is important to look at monthly cash flow analyses, in order to determine in which months a cash flow short fall can be expected. Working capital reserves or other sources of readily available funds for meeting the fixed costs of doing business during the negative cash flow months must be provided. When implementing a rate form that has as one of its objectives to encourage conservation or more efficient use of water, it is doubly important to have a good handle on the monthly cash flow situation, since revenue that may be counted on from, for example, higher peak season rates, may not materialize if the climatological conditions are such that the higher priced consumption does not occur.

CUSTOMER SURVEY INFORMATION

As a final element of the data requirements and information that may be of assistance to the utility in establishing a rate form that meets the objectives and goals of the utility, it is important to find out what your customers want, or perceive to be important. Before embarking on the implementation of a new rate form, or even continuing to use the existing rate form, the utility should investigate its customers' needs, attitudes, and preferences. A well-designed customer attitude survey should yield information that the utility can utilize in developing rates and other programs to best meet its customers' requirements.

SUMMARY

Many utilities maintain records, data, and statistics of the nature and detail described in this chapter (Figure 35-1). It is very important from a rate making standpoint to capture as much detail as possible in terms of customer information and cost and expense data. Not only does this facilitate the task of rate setting, but also it provides for a more defensible rate structure.

Table 35-1 Data requirements checklist

I. Customer Records

A. Number of Customers/Bills
   1. By Meter Size
   2. By Customer Class
   3. By Billing Frequency (if different for different classes)
   4. Monthly Summary
   5. Annual Summary
   6. Maintain Consistent Definition of Customer Classes (if applicable)
   7. Maintain Historical Data for 3 to 5 Years
   8. Number of Public Fire Hydrants
   9. Number of Private Fire Services by Size

B. Metered Consumption
   1. By Meter Size
      a. By Billing Frequency (if varies by class)
      b. Monthly Summary
      c. Annual Summary
   2. By Customer Class
      a. Monthly Summary
      b. Annual Summary
   3. Individual Customer
      a. For Customer Relations and Customer Service Purposes
      b. Necessary for Certain Rate Forms (i.e., “Excess Use” Rates Tied to Individual Characteristics)
   4. Bill Frequency Distribution (Number of Bills with Zero Usage, 1 Unit, 2 Units, etc.)
   5. Maintain Historical Data for 3 to 5 Years

C. Billed Revenue Data
   1. By Meter Size
      a. Monthly Summary
      b. Annual Summary
   2. By Customer Class
      a. Monthly Summary
      b. Annual Summary
   3. Maintain Historical Data for 3 to 5 Years

D. Peak Period Demand Data
   1. System Coincidental Demands
      a. Total Production or Output to Distribution System
      b. Maximum Day Demand
      c. Maximum Hour Demand
      d. Monthly Data for Each of Above Items
      e. Maintain History for 5 to 10 Years
   2. Customer Class Demands
      a. Requires Demand Meter Study (can be an expensive undertaking)
      b. Non Residential Demands
         (1) Select Representative Sample Accounts
         (2) Use Individual Demand Recording Meters or Establish Hourly Meter Reading Schedule by Utility Staff

Table continued next page.

Table 35-1 Data requirements checklist—*continued*

II. Plant Investment Records

A. Establish Uniform System of Accounts
   1. Classify Plant Investment by Function (raw water, treatment, etc.)
   2. Provide for Recording Annual Additions and Retirements
   3. Provide for Depreciation Accounting Records to Parallel Plant Investment

B. Determine System Capacity for Each Functional Plant Element

C. Separate Plant Investment between Peak Season and Non-Peak Season Demand (as necessary)

III. Operation and Maintenance Expense

A. Establish Uniform System of Accounts
   1. Classify Operation and Maintenance by Function (raw water, treatment, etc.)
   2. Classify Operation and Maintenance by Object Classification (salaries, purchase of services, materials and supplies, and equipment)
   3. Separately Identify Expenditures for Power and Chemicals

B. Identify Specific Expenses Associated with Seasonal or Peak Usage

C. Summarize Operation and Maintenance Expenses Monthly and Annually

D. Maintain Historical Data for 3 to 5 Years

Appendixes

Development of Capacity Factors by Customer Class

Equivalent Meter Ratios

Bill Tabulation Methodology

Example of Citizens Advisory Committee Guidelines

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Appendix A

Development of Capacity Factors by Customer Class

Perhaps one of the most puzzling “mysteries” in the art of rate making is the determination of appropriate capacity factors by customer class for use in cost of service allocations and/or rate design. Certainly one means for determining capacity factors by customer class is to undertake a formal demand study. With the increasing sophistication of billing equipment and computer processing, formal demand studies, wherein daily and hourly consumption records of samples of customers from each class of service are analyzed over a period of days or weeks, are not the significant, expensive undertakings that they have been in the past. However, these formal studies are not without costs, and there are less sophisticated, but perhaps equally relevant, demand studies that can be accomplished using data already at hand in the utility’s records. This appendix offers some relatively straightforward procedures that can be utilized in developing customer class capacity factors from available utility system demand data and customer billing records.

The system-wide demand data that are necessary to undertake the analysis include: (1) the highest ratio of system maximum-day demand to system average day demand over the most recent five year period; (2) the system maximum-month production or treatment plant output for that year; and (3) the system maximum-hour demand for that year. The customer billing records necessary to complete the analysis are the monthly billed consumption records by customer class, the annual billed consumption by class, and a general knowledge of the daily variation in usage throughout the week for each customer class. For utilities with other than monthly billing frequency, the available billing records will need to be used, but the results of the analysis will likely be less accurate. For purposes of this appendix, it is assumed that the example utility bills all customers on a monthly basis.

DETERMINATION OF NONCOINCIDENT CAPACITY FACTORS BY CLASS

The system demands for this example are the same as used in the example in chapters 7 and 8 of this manual. Accordingly, the system annual average day production is 7.5 mgd, the system coincidental maximum-day demand is 11.55 mgd, and the system coincidental maximum-hour demand is 16.65 mgd. For purposes of this example, the system coincidental maximum-month demand is assumed to be 8.60 mgd.

In terms of the necessary information regarding customer class billed consumption, the following data are applicable. From Table 8-1, the annual average day billed consumption for each of the retail service classes is as follows: residential (2.65 mgd); commercial (1.30 mgd); and industrial (3.00 mgd). From the example utility's billing records, the following average day consumption for the maximum-month for each class (it may be a different month for each class) is as follows: residential (4.75 mgd); commercial (1.70 mgd); and industrial (3.09 mgd).

Maximum-Day Capacity Factors

The first step in determining the capacity factor by customer class is to calculate the ratio of the average day consumption for the maximum-month to the annual average day consumption for each class. This calculation results in the following factors:

Residential	4.75 mgd/2.65 mgd = 1.79
Commercial	1.70 mgd/1.30 mgd = 1.31
Industrial	3.09 mgd/3.00 mgd = 1.03

The ratio of the overall system coincident maximum-day demand (11.55 mgd) to the average daily demand for the system maximum-month (8.60 mgd) [11.55 mgd/ 8.60 mgd = 1.34] is an indication of the potential relationship between these two demands for each of the retail customer classes for the example utility. It must be recognized, however, that daily and weekly fluctuations throughout the month of maximum consumption for each customer class do occur. These variations would tend to understate the actual maximum daily demand for the class that occurs during the maximum-month if only the 1.34 factor applicable to the system were applied to the maximum-month ratios developed above for each class. Accordingly, there must generally be an allowance for such fluctuations factored into the calculation of the maximum-day capacity factor for each class.

For purposes of this example, it is assumed that for the commercial and industrial customers the vast majority of the water demand throughout the week occurs only 6 out of 7 days. Thus, an adjustment factor to recognize the daily variations in usage for these classes of 1.17 (7 total days/ 6 days of water use) might be used. For residential customers, there is also likely to be some daily variation in usage throughout the maximum-month, although it is typically likely to be less than the commercial and industrial class variations. For purposes of this example an adjustment factor of 1.05 is chosen for the residential class. It should be emphasized that these adjustment factors are assumed for purposes of this example. While they are reasonable assumptions, consideration should be given to the particular usage characteristics and periods of demands for the various customer classes of each individual utility, when analyzing and determining the applicable class capacity factors.

Multiplying the results of the analyses and factors described above to arrive at an initial estimate of the maximum-day capacity factors yields the following factors by class:

	Residential	Commercial	Industrial
Maximum-Month (MM)/Average Day (AD) Factor	1.79	1.31	1.03
System Maximum-Day (MD)/MM Ratio	1.34	1.34	1.34
Weekly Usage Adjustment	1.05	1.17	1.17
Calculated MD Capacity Factor	2.52	2.05	1.61
Capacity Factor in Chapter 8	2.50	2.00	1.50

In order to test the reasonableness of the maximum-day capacity factors, the noncoincidental demands resulting from the application of the above capacity factors to the annual average daily demands of each class must be summed and compared against the actual coincidental system demands. This relationship of the noncoincidental to coincidental demands is referred to as the measure of the system diversity of demand. The system diversity ratio could be in the range of 1.10 to 1.40 for many systems.

The test of the system diversity, utilizing the above capacity factors, is demonstrated in the following analysis.

Residential MD Demand	2.65 mgd × 2.50 =	6.63 mgd
Commercial MD Demand	1.30 mgd × 2.00 =	2.60 mgd
Industrial MD Demand	3.00 mgd × 1.50 =	4.50 mgd
Wholesale MD Demand*		1.42 mgd
Noncoincident Demand		15.15 mgd
Noncoincident MD Capacity Factor	15.15 mgd/7.50 mgd =	2.02
Coincidental MD Capacity Factor	11.55 mgd/7.50 mgd =	1.54
System MD Diversity	2.02/1.54 =	1.31

* Wholesale customer maximum-day demand based on demand meter readings.

As indicated by the above analysis, the initial maximum-day capacity factors computed for the retail customer classes produce an overall maximum-day system diversity factor of 1.31, which falls within an acceptable range of 1.10 to 1.40. This means that the maximum-day capacity factors selected for each of the classes, based upon the data available and the assumptions regarding variation in consumption throughout the week, likely result in reasonable approximations of the overall class maximum-day demands for cost allocation purposes.

Maximum-Hour Capacity Factors

The determination of maximum-hour capacity factors by customer class is similar to, and builds upon, the previous determination of the maximum-day capacity factors.

For industrial customers, the relationship of maximum-hour and maximum-day capacity factors is largely a function of the hours of operation, and hence, the period during the day in which the maximum-hour for the class is likely to occur. For purposes of this example it is assumed that the industries in the example utility operate two equal nine-hour shifts each day during the six-day work week. Thus, the maximum-hour demand is at least 1.33 times the maximum-day demand (24 hours per day/18 hours work period).

The relationship between the maximum-hour demand and maximum-day demand for the residential and commercial customer classes is not as easy or intuitive to compute. It is likely that the overall relationship of maximum-hour to maximum-day demands for these two classes is greater than that discussed above for the industrial class, since the time of consumption for these two classes is concentrated in a much shorter time frame throughout the day. For purposes of this example, a maximum-hour to maximum-day ratio of 1.66 is selected for the residential and commercial classes. This assumed ratio, and the resulting maximum-day capacity factors for the three retail classes, can be tested utilizing the diversity analysis that was previously described for the maximum-day capacity ratios.

The initial determination of the maximum-hour capacity factors for the residential, commercial, and industrial classes is shown below.

	Residential	Commercial	Industrial
MD Capacity Factor	2.50	2.00	1.50
Estimated Maximum-Hour (MH)/MD Ratio	1.66	1.66	1.33
Calculated MH Capacity Factor	4.15	3.32	2.00
Capacity Factor in Chapter 8	4.00	3.25	2.00

The diversity test to indicate whether the maximum-hour capacity factors developed above are reasonable is similar to the analysis performed for the maximum-day capacity factors. This analysis results in the following findings.

Residential MH Demand	2.65 mgd × 4.00 =	10.60 mgd
Commercial MH Demand	1.30 mgd × 3.25 =	4.23 mgd
Industrial MH Demand	3.00 mgd × 2.00 =	6.00 mgd
Wholesale MH Demand*		2.36 mgd
Noncoincident Demand		23.19 mgd
Noncoincident MH Capacity Factor	23.19 mgd/7.50 mgd =	3.09
Coincident MH Capacity Factor	16.65 mgd/7.50 mgd =	2.22
System MH Diversity	3.09/2.22 =	1.39

* Wholesale customer maximum-hour demand based on demand meter readings.

As indicated by the above analysis, the maximum-hour capacity factors computed for the retail customer classes produce an overall maximum-hour system diversity factor of 1.39, which is within an acceptable range of 1.10 to 1.40. This means that the maximum-hour capacity factors selected for each of the classes, based upon the data available and the assumptions regarding variation in consumption throughout the day, likely result in reasonable approximations of the overall class maximum-hour demands for cost allocation purposes.

These discussions demonstrate techniques for the development of *noncoincident* maximum-day and maximum-hour capacity factors by customer class. It is important that the reader understand the rationale of using the noncoincident demands in distributing the functionally allocated costs to each class. By way of example, assume that a utility were going to build a *separate system* (source of supply, treatment, pumping, T&D, etc.) for *each of the customer classes* served by the utility. These separate water systems would need to be sized to meet the Base, Maximum-Day Extra Capacity and Maximum-Hour Extra Capacity demands related to each class.

The sum of those systems would comprise the overall water system, and the costs associated with each of the individual systems would be allocable to each class (based upon their respective noncoincidental demands that were the basis for sizing the individual plants).

Assume that someone comes up with the concept that efficiencies, economies of scale, and reduction in the overall size of the "system" could be achieved if one were to look at the system as an integrated, diversified system. In so doing, recognizing the diversities of demands of the various classes and utilizing the coincidental demands of all classes to size the plant, a smaller system could be built. Total fixed capital costs and most operation and maintenance expenses, except perhaps for power and chemical costs, would be reduced.

The question at hand is, now that there is a smaller, more efficient, and less costly system, how should the costs of that system be allocated among the individual customer classes? One appropriate manner to allocate these costs, and have each customer class share equitably in the overall cost savings, is to allocate the total new, smaller system costs on the basis of the noncoincidental demands of each customer class. In this manner, all classes share proportionately in the economies of scale and cost savings of this smaller, integrated, and diverse system.

In using noncoincident customer class demands for the distribution of costs, this allows the inclusion of such additional types of demands, such as fire protection demands, in the cost allocation process on the same, diversified basis. Fire protection demands are most generally not coincident with the overall system maximum-day and maximum-hour demands in most systems. Accordingly, in incorporating the noncoincident demands for fire protection in the cost of service analysis, such demands received proportional treatment to other class demands.

Another consideration in using noncoincident demands occurs when there is wholesale service or other major customers within the system that are charged on the basis of demand meter readings. In using noncoincident class demands, the unit costs derived from the cost of service allocation process can be directly applied to the recorded maximum-day and/or maximum-hour demands for these types of customers in establishing the basis of charge.

The use of capacity factors by customer class based upon the estimated relative demands for each class on the system coincident maximum-day or maximum-hour, rather than the use of noncoincident demands, may be appropriate in certain circumstances. The following section discusses coincident class capacity factors.

COINCIDENT CAPACITY FACTORS

Some practitioners prefer to make use of coincident customer class demands rather than using noncoincident demands. Those undertaking cost of service allocations and water rate design must determine whether the use of capacity factors by class that are coincident with the system peak demand are more appropriate for their particular situation than the use of noncoincident capacity factors. This decision is important because the capacity factors can differ substantially between those reflecting water usage at the time of the system peak and those reflecting usage during various off-peak periods. Furthermore, the relative capacity factors among customer classes can be considerably different depending on the choice of a coincident or noncoincident peaking approach. These differences will then result in differences in cost allocations and average rate levels by customer class.

A basic principle inherent in the rate methodology contained in this manual is the concept of cost causation. Water rates are established so that users generally pay an amount equal or proportional to the costs the system incurs to provide them service. The resulting allocations and rates are then deemed equitable, given whatever data limitations were encountered and simplifying assumptions required. The existence of noncoincident peak demands means that the water system can be smaller and less costly to build and operate than if all customers had coincident peak usage. A cost allocation approach that employs coincident capacity factors by class results in the benefits of customer diversity being conveyed to the customer classes that create that diversity, and help minimize long-term system development costs. When cost allocations employ coincident capacity factors, customers may shift their peak usage to periods different from the system peak and may be rewarded for doing so. In other words, if customers help reduce the overall system capacity requirements by using water during off-peak periods, they will be "rewarded" for doing so through relatively lower cost allocations. The effect provides an incentive for peak shifting, which, in turn, may lower the overall system peak capacity requirements and save capacity costs.

The potential benefits of using coincident capacity factors may be best illustrated by two simple examples. First, consider a system with a coincident system peak demand during the summer, but with some classes having peak demands during other periods. As previously described in this appendix, the system can be built smaller (and less costly) than that which would be necessary for the sum of the demands of all classes. These cost reduction benefits are the result of diversity of customer demands. Diversity of demands means that because users peak during different periods they can therefore utilize the *same* capacity to some degree.

How is this benefit to be distributed to users in the form of cost allocations? Systems are typically sized and constructed to meet system-wide peak demands. Users contributing to the system peak are directly causing the system sizing and therefore its capacity costs. Off-peak users are contributing to the system capacity costs only to the extent that they are using water during the system peak. By using coincident capacity factors, costs are allocated in such a manner that those customers causing peak-related costs by using water during the system peak pay for these costs. Conversely, those customers using most of their water during off-peak periods are not allocated costs as if their demands were causing those costs. This provides benefits to these off-peak customers by allocating the majority of system peaking related costs to those classes, which directly contribute the most to the system coincident peak. Further, using coincident peaking factors, if a customer or customer class were to shift peak water use to an off-peak period, that customer or class is the recipient of the corresponding benefits of diversity that they created.

Another example illustrates that coincident peaking factors in cost allocations may aid conservation goals and help avoid water shortages. Consider a system in which there is generally an inadequate supply of water during the peak season, but usually an adequate supply during the rest of the year. Price incentives and conservation activities in such circumstances are best focused on reducing peak season demands or to shift those demands to off-peak periods, rather than on reducing annual demands or lowering smaller peaks during other time frames

SUMMARY

The examples and explanations regarding the determination of customer class maximum-day and maximum-hour capacity factors discussed above are intended to take some of the "mystery" out of this aspect of the cost of service process. As may be inferred from the examples, in order to be able to make these determinations, it is imperative that the utility maintain adequate system demand and billing records in order to perform the various calculations and analyses that are necessary for the development of these factors.

An important technical decision in performing cost allocations by customer class as described in this appendix is whether to use noncoincident or coincident capacity factors by customer class in the cost of service analysis. The resulting allocations using the two sets of factors could be considerably different, depending on the water demand characteristics of a system and its customers. Therefore, the choice of which method to use is important with respect to ratemaking principles, data and costs required to conduct the analysis, and assumptions that may need to be made. Selection of the appropriate methodology for determining customer class capacity factors should be considered on an individual utility basis.

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Appendix B

Equivalent Meter Ratios

In the overall rate setting process, there is often the need to establish a minimum threshold or "base" level of cost or demand for service, against which the costs or demands of larger customers can be measured. A convenient and readily available parameter for this purpose is the size of the customer's water meter. Typically the meter size, which is generally used as the "base," is the smallest available. The ⅝-in. meter is the most prevalent meter size found in many water utilities, and is also the size most often used for single-family residential customers. However, this varies by location, with some utilities using ¾-in. meters as the minimum size. Accordingly, care should be taken to select that meter size for the "base" that is most relevant to the particular utility. In the overall rate setting process, residential user characteristics are often used as the measure of the base level of service or upon which service equivalency units are measured.

There are different ways in which to measure or compute equivalent ratios for larger meters as compared to a ⅝-in. meter, or whatever the "base" size meter is appropriate. The two most commonly used ratios in the water rate making industry are equivalent meter cost ratios and equivalent meter capacity ratios. Generally, equivalent meter cost ratios should be used when assigning elements of costs specifically related to meters among the various sizes of meters used by the customers in the system. The allocation of customer-related costs associated with meters in conjunction with a cost of service study is an example of a use of equivalent meter cost ratios. Meter capacity ratios, on the other hand, are most often used when estimating potential capacity or demand requirements for customers on the basis of the size of their water meter. The determination of system development charges or impact fees for meters greater than ⅝-in., where potential customer demand is assumed to be proportional to meter size, is an example of the use of meter capacity ratios. Meter capacity ratios may also be appropriate in the design of the service charge portion of the general rate schedule when such charges include some recovery of fixed capacity related costs or readiness-to-serve related costs.

EQUIVALENT METER COST RATIOS

In determining the ratio of the cost of installing various sizes of meters relative to the cost of installing a ⅝-in. meter, it is important to include all of the costs involved in such installations. This includes the direct cost of the various categories of labor involved in the installation, fringe benefit related overheads and other appropriate administrative overheads applicable to the labor costs, all direct materials and supplies costs, and the cost of equipment used in the installation.

In the cost allocation examples in chapter 8 of this manual, the costs of meters and services were combined in the cost allocation procedure. This is an appropriate consideration when it is the responsibility of the utility to install both a portion of the customer service line (generally from the main in the street to the customer's property line), as well as the meter itself. Accordingly, the example derivation of the cost ratios shown in this appendix, and used in chapter 8, are related to the combined cost of meter and service installations for various sizes of connections.

Based, in part, on information developed in section VI of this manual, the following are the total costs of meter installations for ⅝-, ¾-, 1-, and 1½-in. meters and the associated services. Dividing the total costs of installing the meter and service installations of the larger meter sizes by the total cost of the ⅝-in. meter and service connection yields the cost ratios shown. The development of these ratios, along with the applicable ratios for larger size meters, are the basis for the tabulation shown in chapter 8 of this manual.

Cost Item	⅝-in.	¾-in.	1-in.	1½-in.
Service Connection	$322.38	$322.38	$345.66	$358.80
Meter Installation	162.55	195.66	337.36	488.61
Total Cost	$484.93	$518.04	$683.02	$847.41
Ratio to ⅝-in.	1.00	1.07	1.41	1.75
Ratio Used	1.0	1.1	1.4	1.8

EQUIVALENT METER CAPACITY RATIOS

The safe operating flow, or capacity, of a particular size of meter is essentially the limiting factor in terms of the demand that can be exerted on the water system through the meter. In establishing a schedule of system development charges, the potential demand or capacity requirements placed on the water system by a new customer is generally an accepted basis for determining the level of charge applicable to the customer. Accordingly, when the base system development charge is established for a single-family residential customer with a ⅝-in. meter (as is often the case), the ratio of the safe operating capacity of various sizes of meters, relative to the capacity of a ⅝-in. meter, may be used to determine appropriate charges for the larger meter sizes.

In section VI of this manual, the maximum safe flow or capacity of ⅝-, 1-, 1½-, 2-, and 3-in. meters are tabulated, based on AWWA Manual M6, *Water Meters—Selection, Installation, Testing, and Maintenance*. The ratios of these capacities, relative to that of a ⅝-in. meter, are computed, and range from 2.5 for a 1-in. meter up to 15.0 for a 3-in. meter. As pointed out in that chapter, while capacity ratios for larger than 3-in. meters can be computed, the use of such ratios for larger meters may or may not provide a true indication of the potential demand requirements of the larger meters.

It is important to understand and recognize the types of costs that are to be recovered using equivalent meter ratios in order to develop the appropriate meter equivalency factors. As discussed in section VI of this manual, developing equivalent capacity ratios specific to a particular utility and its system characteristics may be appropriate, as opposed to using a "standardized" table of meter equivalencies. For example, a water utility may have significant investment in impounded reservoir source of supply facilities (designed on the basis of annual average day demands), as well as treatment plant, pumping, and transmission facilities (designed on the basis of maximum day and/or hour demands). In this instance, the utility would need to recognize both annual usage requirements, as well as peak demand requirements, for each of its sizes of meters in establishing relevant equivalent capacity ratios appropriate for system development charge determination.

SUMMARY

The selection of equivalent meter ratios is dependent upon the purpose for which the ratios are to be used. In certain instances it may be necessary to develop ratios that are applicable to an individual utility's particular circumstances and facilities. The purpose of this appendix is to clarify the various types of equivalent meter ratios that may be used in rate making, and the general applicability of each of the measures of equivalency. Selection of the appropriate measures for distributing costs should be considered on an individual utility basis.

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Appendix C

Bill Tabulation Methodology

INTRODUCTION

The summarization or tabulation of customer bills provides a useful basis for identifying and analyzing customer usage patterns, selecting water-usage rate blocks, and determining utility billing revenue under any rate schedule. Tabulation of customer bills and usage, commonly referred to as a bill-frequency distribution analysis or simply a bill tabulation, may be accomplished either manually or by data processing. Normally, it is best to initiate bill tabulation procedures during the early stages of a cost-of-service rate study due to the potentially time-consuming work involved in summarizing billing data and in testing the completeness and accuracy of the results of the bill tabulation. If the utility billing system is computerized, the time required for the preparation of the bill tabulation may be relatively short, perhaps only one or two weeks. The computer staff may, however, be required to develop specific programs to extract and summarize data in the form required, and delays are often encountered because computer time is not readily available when needed. By beginning the bill tabulation early in the cost-of-service study, the results should be available to avoid delay both in the design of rates and in the evaluation of the adequacy of proposed rates to recover allocated costs of service from customer classes.

A bill tabulation shows the number of customer bills rendered at various levels of water usage during a specified period of time for each customer class served by the utility. The tabulation of bills for a historical period provides the basis for identifying typical customer-class usage patterns and aids in the development of rates recognizing such usage patterns. Rate schedules that are intended to be applicable throughout an entire year generally require a bill tabulation for a historical

12-month period in order that annual usage patterns are properly identified. On the other hand, if a seasonal rate schedule is to be developed, separate bill tabulations would need to be made to coincide with the periods for which each part of the seasonal rates are to be effective. For instance, if a summer–winter seasonal rate were to be developed with one rate applicable for usage during the 6-month summer period and another for the 6-month winter period, the bill tabulation would need to be made in two parts so as to coincide with the summer and winter periods as defined. This permits recognition of customer usage patterns and variations in use between seasons.

In the example presented here, bills are tabulated for one customer class for a continuous 12-month period. Tabulating bills for a continuous 12-month period is strongly recommended in order to properly account for seasonal variations in customer water-usage patterns. In addition, the selection of the 12-month period should coincide as closely as possible with the utility's fiscal accounting period so that the accuracy of the bill tabulation in generating revenue can be more easily ascertained. The possibility that the period selected for study may represent a year in which water usage was abnormally high or low, due to climatic or other conditions, should be considered when utilizing the bill tabulation for rate-design purposes. If possible, the selection of bills for tabulation should reflect a year in which average conditions prevail.

BILL TABULATION

Bill Summarization

The first step in tabulating customer bills is to separate billing records into customer classes, if available, and into meter sizes. Next, a manual bill-tabulation process involves entering individual customer usage for each billing period on summary sheets that are separated into various levels of usage. If a computer is utilized for the summarization of bills, the manual process described herein would be simulated on the computer. For small utilities, each customer's usage may be tabulated for the 12-month period. However, for larger utilities, a sample tabulation of the residential class, on the order of 10 to 20 percent of the total number of customers in the class, may be adequate to establish usage patterns for that class. It is suggested that a 100 percent tabulation be made for other customer classes, because the use per customer in other classes is likely to be much more variable than for the residential class. A less than 100 percent sample, particularly for large customers, may not provide a representative distribution of water-usage patterns. If a sample of customers is to be made, random sampling procedures should be used.

The bill-tabulation process is initiated by selecting the smallest meter size for a particular customer class and tabulating identified individual customer usage onto the summary sheet for that meter size and class. This procedure is continued for each meter size until all customer bills in the class have been summarized. The same process would be repeated for every other customer class.

It is important to summarize bills for each identified customer in all customer classes unless a sample for the class, as previously discussed, has been selected. Bills issued to inactive accounts should be excluded. Bills issued to active customer accounts with zero usage during any billing period should be included as "zero-usage" bills.

To illustrate the bill summarization procedure, hypothetical customer-billing account records and a bill tabulation sheet are shown in Figures C-1 and C-2, respectively. Figure C-1 shows two customer billing accounts, presenting each customer's monthly water use and the amount billed. Both customers are inside-city

Customer Account No.: 115147
Meter Size: 5⁄8-in.
Customer Class: Residential
Jurisdiction: Inside city

Name: John Doe
Address: 154 Main St.

Billing Date	Meter Reading *Ccf*	Use *Ccf*	Amount Due *$*	Date Paid	Amount Paid *$*
Dec.	1637				
Jan.	1642	5	3.24	1/13	3.24
Feb.	1648	6	3.70	2/17	3.70
Mar.	1654	6	3.70	3/18	3.70
Apr.	1661	7	4.14	4/12	4.14
May	1671	10	5.49	5/11	5.49
June	1683	12	6.39	6/14	6.39
July	1692	9	5.04	7/13	5.04
Aug.	1700	8	4.59	8/11	4.59
Sept.	1707	7	4.14	9/17	4.14
Oct.	1713	6	3.69	10/13	3.69
Nov.	1719	6	3.69	11/14	3.69
Dec.	1724	5	3.24	12/11	3.24

Customer Account No.: 175358
Meter Size: 5⁄8-in.
Customer Class: Residential
Jurisdiction: Inside city

Name: Thomas Smith
Address: 1212 Dover St.

Billing Date	Meter Reading *Ccf*	Use *Ccf*	Amount Due *$*	Date Paid	Amount Paid *$*
Dec.	1945				
Jan.	1945	0	1.00	1/15	1.00
Feb.	1951	6	3.69	2/11	3.69
Mar.	1959	8	4.59	3/10	4.59
Apr.	1967	8	4.59	4/13	4.59
May	1977	10	5.49	5/15	5.49
June	1989	12	6.39	6/18	6.39
July	2002	13	6.83	7/12	6.83
Aug.	2012	10	5.49	8/10	5.49
Sept.	2020	8	4.59	9/16	4.59
Oct.	2025	5	3.24	10/17	3.24
Nov.	2030	5	3.24	11/15	3.24
Dec.	2030	0	1.00	12/12	1.00

Figure C-1 Hypothetical customer-account billing records

residential customers with 5⁄8-in. meters, as indicated on the billing record. Figure C-2 shows an example of the type of sheet on which the usage for each monthly bill is tabulated when a manual bill tabulation is necessary. As indicated at the top of the sheet, the usage for inside-city residential customers with 5⁄8-in. meters is to be summarized on this sheet. In the left-hand margin of the tabulation sheet appear the various possible levels of customer usage for each billing period in terms of hundred cubic feet (Ccf). Thus, in the example in Figure C-2, the number "2" is equal to a monthly usage of 200 ft^3. It is noted that usage levels or use blocks should be established to cover the largest monthly usage in each class. Several summary sheets

Customer Class: Residential
Meter Size: ⅝-In.
Jurisdiction: Inside city

Water Usage Per Period *(Ccf)*		Total Number Bills	Total Water Usage
0	II	2	0
1			
2			
3			
4			
5	IIII	4	20
6	~~IIII~~	5	30
7	II	2	14
8	IIII	4	32
9	I	1	9
10	III	3	30
11			
12	II	2	24
13	I	1	13
14			
15			
16			
17			
18			
19			
20			
21			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			
TOTAL		24	172

Figure C-2 Example of a water-bill tabulation sheet may be required for a given customer class and meter size in order to accommodate the range of monthly usage by customers in the class.

Beginning with customer account number 115147, shown in Figure C-1, a tick mark is made on the line in Figure C-2 that corresponds to the usage billed in a given month. Each tick mark is equivalent to one bill. From Figure C-1, for the January billing period, the usage for customer account 115147 is indicated to be 5 Ccf. Therefore, a tick mark is made on the usage-block line marked "5" on Figure C-2, as shown. A tick mark is made for each monthly usage quantity on the appropriate line on Figure C-2 for both customers' monthly usage quantities. This procedure would be repeated for all 5⁄8-in. residential inside-city accounts billed during the 12-month period. Similarly, a separate tabulation sheet or sheets for each meter size by customer class would be completed.

Once the bill tabulation is complete for each meter size by class, the number of tick marks or bills is totaled for each usage block and summarized at the bottom of the appropriate column on each sheet. Usage associated with the bills tabulated in each usage block is determined by multiplying the number of bills by the usage amount—shown in the left-hand column of each line. If the two hypothetical customers shown in Figure C-1 were the only 5⁄8-in. residential inside-city customers, the total number of bills and usage would be those shown in Figure C-2 at the bottom of the two right-hand columns.

After all bills and associated usage have been summarized for each meter size and class, total customer-class usage and bills would be determined by adding the bills and usage for all meter sizes for a given customer class. The selection of the period for which bills are to be summarized to coincide with the utility's fiscal accounting period greatly enhances the ability to check the accuracy of the bill tabulation since cumulative data as to the number of bills, total water sales, and revenue for that period would be readily available. The final check as to the accuracy of the bill tabulation is based on the revenue that the tabulation generates when applied to the existing schedule of rates.

Development of Cumulative Billed Usage

After tabulating the number of bills and usage for each customer class by meter size, the next step is to determine the cumulative billed water usage by various usage blocks or increments for each customer class and meter size. The procedure includes several steps and is best accomplished by using a computation table similar to the one shown in Figure C-3. The data summarized in Figure C-3 are for a hypothetical residential customer class. Column 1 shows the usage blocks for which water-usage and bill data are summarized. Selection of usage blocks for summarizing cumulative billing data does not need to set forth all usage blocks used in the bill-tabulation sheet described earlier. The usage blocks used in summarizing cumulative billed usage are generally established to include single-unit increments at the lower usage levels to coincide with the use of smaller users and larger increments or groupings of several unit increments at the higher usage levels. As shown in Figure C-3, increments of usage from 1 Ccf up to 10 Ccf are used, and larger increments are utilized thereafter. For example, the bills and usage recorded for the unit increments of 11 through 15 Ccf from the bill tabulation sheet (see Figure C-2) would be combined for the purposes of Figure C-3 and would be recorded on the line opposite the usage-block category marked "11–15" in columns 2 and 4, respectively. The numbers entered on this line would represent the total number of bills and associated usage for customer usage of 11 through 15 Ccf per billing period.

(1) Usage Block *Ccf*	(2) Number of Bills in Block	(3) Cumulative Bills Through Block	(4) Total Use of Bills Stopping in Block *Ccf*	(5) Cumulative Use of Bills Stopping in Block *Ccf*	(6) Total Use to This Block of All Bills Passing Through Block *Ccf*	(7) Cumula-tive Billed Usage *Ccf*	(8) Cumulative Billed Usage *%*
0	4,134	187,836	0	0	0	0	0
1	11,531	183,702	11,531	11,531	172,171	183,702	14.6
2	18,013	172,171	36,026	47,557	308,316	355,873	28.4
3	24,317	154,158	72,951	120,508	389,523	510,031	40.7
4	20,089	129,841	80,356	200,864	439,008	639,872	51.0
5	20,065	109,752	100,325	301,189	448,435	749,624	59.8
6	17,141	89,687	102,846	404,035	435,276	839,311	66.9
7	13,807	72,546	96,649	500,684	411,173	911,857	72.7
8	11,468	58,739	91,744	592,428	378,168	970,596	77.4
9	14,909	47,271	134,181	726,609	291,258	1,017,867	81.1
10	7,943	32,362	79,430	806,039	244,190	1,050,229	83.7
11–15	13,149	24,419	167,764	973,803	169,050	1,142,853	91.1
16–20	5,635	11,270	92,309	1,066,112	112,700	1,178,812	94.0
21–25	2,817	5,635	60,576	1,126,688	70,450	1,197,138	95.4
26–30	784	2,818	22,823	1,149,511	61,020	1,210,531	96.5
31–50	1,389	2,034	49,027	1,198,538	32,250	1,230,788	98.1
51–100	564	645	39,569	1,238,107	8,100	1,246,207	99.4
101–250	72	81	11,617	1,249,724	2,250	1,251,974	99.8
251 and over	9	9	4,584	1,254,308	0	1,254,308	100.0

Figure C-3 Development of cumulative billed usage residential class—annual number of bills and usage—5⁄8-in. meters

Usage blocks summarized should be selected in part to coincide with the existing rate blocks. This will result in a readily identifiable cumulative level of usage in each rate block against which existing rates may be applied for purposes of checking the accuracy of revenue generated by the bill tabulation. Other usage blocks should be summarized in sufficient detail to prepare a representative graphical curve.

The number of bills issued for water usage corresponding to the various consumption blocks is shown in column 2. The number of bills issued for each usage block would be taken directly from bill tabulation sheets similar to the one shown in Figure C-2. In this example, total bills represent the summation of bills issued to residential-class customers with 5⁄8-in. meters. For example, during the 12-month period represented by the bill tabulation, 24,317 bills were issued to the group of customers having a monthly usage of 3 Ccf. Bills for each usage block are summarized in this manner for each customer class and each meter size individually.

Once the number of bills is summarized by usage block, the bills are accumulated up in column 3 of Figure C-3 by starting with the bills in the largest usage block and adding the next above usage block's number of bills to it. As shown in Figure C-3, beginning with the "251 and over" Ccf usage block and summing up the number of bills, a total of 187,836 bills issued to the residential class is represented in the figure. The number of cumulative bills in any particular usage block represents the number of bills issued for the amount of water use shown in that block or more. For instance, at the 3 Ccf consumption block, 154,158 bills have been issued for usage of 3 Ccf or more.

Column 4 represents the total use of bills stopping in each usage block and corresponds to the number of bills listed in column 2. These numbers are taken from the far right-hand column of each bill-tabulation sheet (an example of which is shown in Figure C-2). In the example in Figure C-3, 24,317 bills are issued for the 3 Ccf usage block for a total of 72,951 Ccf in total water use.

The total water use of bills stopping in each usage block shown in column 4 is accumulated, beginning with the 0 Ccf usage block, as shown in column 5. The value in column 5 for a given usage block represents the cumulative billed usage of all bills with monthly usage less than or equal to the usage represented by the usage block. Consequently, the summarization of usage for all usage blocks yields the total use of the customer class for the meter size during the bill tabulation period. In the example, 5⁄8-in. residential-class customers used 1,254,308 Ccf during the 12-month bill tabulation period, as shown in the last line of column 5.

While the accumulated usage shown in column 5 provides a measure of total customer-class water use, it does not indicate the quantity of water used in a given usage block by bills that exceed that usage level. That is, at the 3 Ccf usage block, column 5 indicates that a total of 120,508 Ccf of water was used by those customers billed for 0, 1, 2, and 3 Ccf. This quantity does not include water used by customers who use more than 3 Ccf. For rate-design purposes, the total quantity of water used at a particular usage block needs to be determined, including the usage in the block by customers whose usage exceeds the block. Therefore, the next step is to determine the total use in the block of all billed usage passing beyond each block. This quantity may be determined from data in columns 1 and 3 and is summarized in column 6. The values shown in column 6 are calculated for each usage block by multiplying the usage block value in column 1 by the number of cumulative bills through block corresponding to the next larger usage block, as shown in column 3. For example, the column 6 value for the 31–50 Ccf usage block is calculated by multiplying 50 Ccf by the number of cumulative bills for the 51–100 Ccf block of 645 and totals 32,250 Ccf. The 32,250 Ccf of water use is the quantity of usage in the 31–50 Ccf block of monthly use for the 645 bills whose usage exceeds this block.

The cumulative billed usage of all 5⁄8-in. residential customers may be developed at this point by adding the values shown in columns 5 and 6 for each usage block. Total cumulative usage for the 5⁄8-in. residential class is shown in column 7. The cumulative usage figures in column 7 indicate the total usage that would be billed at any given usage block. To determine the usage at interim blocks (for example, the usage between 3 Ccf and 10 Ccf), the cumulative usage corresponding to the smaller block would be subtracted from the cumulative usage of the larger block. In this example, 1,050,229 Ccf less 510,031 Ccf, or 540,198 Ccf, would be the use in a rate block of 4–10 Ccf.

Once the bill tabulation has been completed for all customer classes, the cumulative usage (shown in column 7 of Figure C-3) for each existing rate block would be determined. Application of existing rates to the cumulative usage in each rate block as determined from the bill tabulation would result in the indicated "bill-tabulation" revenue under existing rates, which is related to existing volume-related charges. Applying existing service charges to the number of bills by meter size and adding the volume-charge revenue produced from the bill tabulation would yield the total bill-tabulation revenue under existing rates. This revenue figure can then be compared with the billed revenue recorded by the utility to test the accuracy of the bill tabulation. A correlation of bill-tabulation revenue to actual billed revenue of 3 percent or less generally indicates that the bill tabulation is sufficiently accurate for rate-design purposes. Where initial charges in the form of a minimum bill are utilized, precaution must be taken to avoid multiple counting of minimum usage in computing revenues.

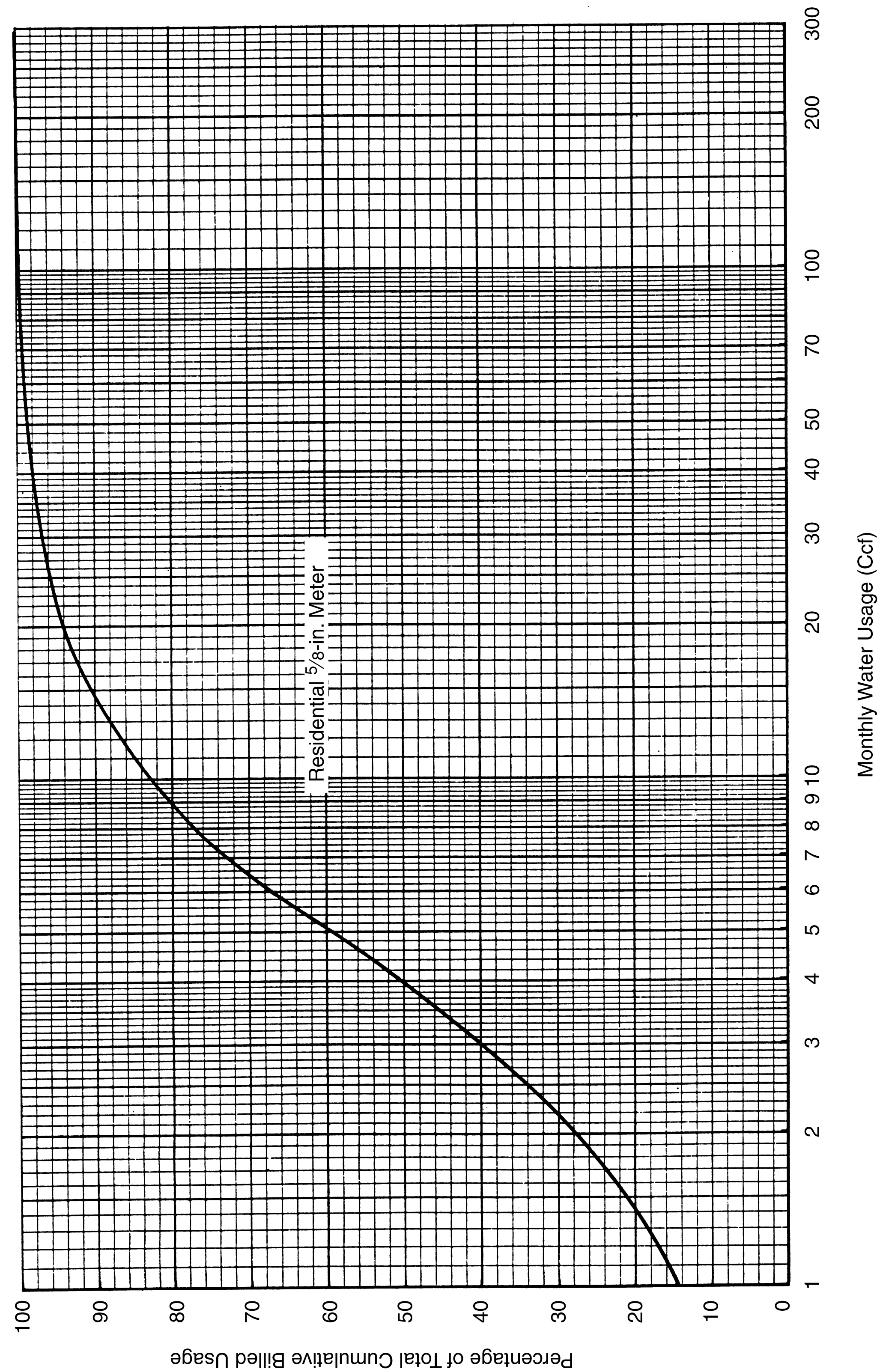

Figure C-4 Metered water-use condition (example)

Application of Bill Tabulation for Rate Design

The bill analysis, once verified for accuracy, provides a useful tool for rate design. The usage pattern of each class of customers, as determined from bill tabulation, is generally considered to remain relatively stable over a period of several years. In designing rates for future study periods, the usage pattern from the bill tabulation may be applied to projected water usage of various classes to determine estimated water usage applicable to each rate block.

If it becomes necessary to change existing blocks in order to more equitably recover allocated costs of service from the various customer classes, the bill tabulation provides a means for selecting alternative rate blocks and the associated amount of water usage with the new blocks. To aid in the selection of the proposed rate blocks, cumulative usage curves may be derived from the bill analysis. To construct the necessary curves, the percentage of cumulative billed usage must be determined. Column 8 of Figure C-3 presents the percent of cumulative billed usage for each usage block and is determined by dividing the cumulative billed usage for each block in column 7 by the total cumulative usage times 100.

Construction of a curve for the hypothetical residential customer class is shown in Figure C-4. The curve is constructed on semilogarithmic graph paper with cumulative billed percent usage shown on the vertical linear axis and monthly usage levels shown on the horizontal logarithmic axis. To construct the curve representing cumulative usage for the hypothetical residential class shown in Figure C-3, the cumulative billed percent usage figures from column 8 are plotted for each level of usage, and a line is drawn through all plotted points. The resulting curve may then be used to determine an estimate of the cumulative percent of future water usage that will occur at a given usage level. For example, if a proposed rate block is chosen at a monthly usage of 3 Ccf, from the curve it is determined that approximately 40 percent of the total water use of customers in this class for this meter size would be expected to be billed in the 0–3 Ccf block.

Similar curves can be developed for each customer class and meter size. In some instances, it may be more desirable to determine the cumulative billed usage and graph the curve for the combination of all meter sizes in each class. This may be accomplished simply by adding together the cumulative billed usages (similar to those shown in column 7 of Figure C-3) determined for each meter size in a class for each respective usage block. In order to add cumulative billed usages for each meter size, the usage blocks established for each meter size must be exactly the same. The value determined from the summation would represent the cumulative billed usage of all customers in the class and would be used to calculate cumulative billed usage percentages and, subsequently, to graph the customer-class curve.

It is generally useful to plot all customer-class curves on the same graph as an aid in the selection of proposed rate blocks for rate design. Trial rate blocks may be chosen that effectively separate the majority of the usage for each class into one or more rate blocks simply by visual inspection of the family of customer-class curves.

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Appendix D

Example of Citizens Advisory Committee Guidelines

The Citizens Advisory Committee (CAC) will primarily serve to advise the utility's rate study project team on public concerns and perspectives regarding water rate making issues. The CAC will operate under the following general guidelines and conditions, subject to consensus revision of rate study participants.

- CAC members will be appointed by the utility's governing board and will be selected to assure representation of a diversity of ratepayer groups. CAC members are asked to solicit the opinions of their constituency and articulate the positions of their memberships.
- CAC meetings may be open to the public and may include a period for general public comment.
- Members of the CAC will not hold "voting" positions or adopt recommendations under majority rule requirements. Rather, members will participate in discussions of rate making principles with the objective of developing consensus recommendations. In the event that consensus may not be achieved on specific issues, both majority and minority opinions will be considered by the project team and reported to the utility's governing board.
- CAC discussions will review rate making options for water rates to reflect, to the extent practicable, community values and concerns. The rate study project team will provide objective information on these rate making options

to the CAC and solicit CAC recommendations. The project team will balance CAC recommendations with its fiduciary and management responsibilities in selecting from available rate making options. CAC recommendations are non-binding on either the rate study project team or the utility's governing board. However, all CAC recommendations will be documented and forwarded to the utility's governing board for their review and consideration.

- Project team decisions will be reported to the CAC once determined but will not be subject to re-review during subsequent CAC meetings. Similarly, the CAC will not review and recommend reconsideration of past utility decisions. In particular, CAC activities will not duplicate existing budget practices or processes.
- Project team support of CAC activities will be limited to provision of information necessary for consideration of outstanding rate making issues and decisions. The project team will provide information that is available from utility records that can be collected and distributed without extensive expenditures of staff time or budget resources.

The CAC will discontinue once the rate study project is completed and water and wastewater rates have been adopted for one year. CAC membership is voluntary and will not be compensated by the utility.

Glossary

accelerated depreciation Depreciation methods that amortize the cost of an asset at a faster rate than under the straight-line method. The three principle methods of accelerated depreciation are sum of the year's digits, double declining balance, and units of production.

accrual basis The basis of accounting under which revenues are recorded when earned and expenditures are recorded when they become liabilities for benefits received, notwithstanding that receipt of the revenue or payments of the expenditure may take place, in whole or in part, in another accounting period.

***ad valorem* tax** A state or local tax based on the assessed value of real or personal property.

advance for construction An advance made by or on behalf of customers or others for the purpose of construction, which is to be refunded wholly or in part. When applicants are refunded the entire amount to which they are entitled according to the agreement or rule under which the advance was made, the balance, if any, remaining in this account shall be credited to contribution in aid of construction.

ancillary charge A separate charge for ancillary services that is not included in costs for general water service. Often, in providing water service, the utility must perform these ancillary services, which benefit only the individual customer using the services and have no systemwide benefit.

annual operating revenue requirement The total revenues required on an annual basis adequate to meet all expenses and capital requirements of the utility.

availability charge A limited-use charge made by a water utility to a property owner between the time when water service is made available to the property and the time when the property connects to the utility's facilities and starts using the service.

base costs Costs that tend to vary with the total quantity of water used and operation under average load conditions. Costs included are operation and maintenance expenses of supply, treatment, pumping, and transmission and distribution facilities, and capital costs related to plant investment associated with serving customers at a constant, or average, annual rate of use (100 percent load factor).

base-extra capacity The method of cost allocation in which the costs of service are classified to the functional cost components of base, extra capacity, and customer costs.

bill frequency analysis A tabulation and summarization of customer bills and usages showing the number of bills rendered at various levels of water usage during a specified period of time.

bond covenants Terms of obligations incurred as conditions of the issuance of bonds.

bonded debt Indebtedness represented by outstanding bonds.

budget An estimate of proposed expenditures for a given period or purpose and a statement of the means of financing them.

capacity The water utility's ability to have resources available to meet the water service needs of its customers. Capacity is the combination of plant- and service-related activities required to provide the amount of service required by the customer. The plant facilities required are a composite of all types of facilities needed to provide service. It represents the ability of the water industry to meet the quantity, quality, peak loads, and other service needs of the various customers or classes of customers served by the utility.

capacity factor Ratio of peak rate of demand to the average rate of demand over a specified period of time (hour, day, etc.) for a customer, class, or system. It is generally greater than 1.

capital expenditures Expenditures that result in the acquisition of or addition of fixed assets.

capital program A plan for capital expenditures to be incurred each year over a fixed period of years to meet capital needs arising from the long-term work program or otherwise. It sets forth each project or other contemplated expenditure in which the entity is to have a part and specifies the full resources estimated to be available to finance the projected expenditures.

cash basis The basis of accounting under which revenues are recorded when cash is received and expenditures are recorded when cash is disbursed.

cash-needs approach The method of determining annual operating revenue requirements based on all cash needs, including but not limited to, operation and maintenance expense, debt service, and capital expenditures from current revenues.

commodity costs (variable costs) Costs that tend to vary with the quantity of water produced, including the costs of chemicals, a large part of power costs, and other elements that follow, or change almost directly with, the amount of water produced. Purchased water costs, if the water is purchased on a unit volume basis without minimum charges or any associated demand charges, may also be considered as commodity costs.

commodity-demand The method of cost allocation in which the cost of service is allocated to the functional cost components of commodity, demand, and customer cost. Variable costs are allocated to the commodity component, with the balance of costs being allocated to the demand and customer components.

commodity-demand rate A multiple-part rate containing both fixed and variable components, generally requiring the fixed portion (or a percentage of it) to be paid independent of volume of water usage, while the variable portion is based on the volume of water usage. The fixed portion is generally based on the customer's peak demand requirements; it may also include customer charges (billing, metering, etc.).

connection charge A charge made by the utility to recover the cost of connecting the customer's service line to the utility's facilities. This charge often is considered as contribution of capital by the customer or other agency applying for service.

construction work in progress (CWIP) The utility's investment in facilities under construction, but not yet dedicated to service. The inclusion of CWIP in rate base varies from one regulatory agency to another.

contract demand An agreement between the water utility and a large-use customer who requires a significant amount of the total capacity of the utility. The agreement fixes the terms and conditions under which the water utility provides service to the customer. Such an agreement has been called contract capacity.

contribution in aid of construction (CIAC) Any amount of money, services, or property received by a water utility from any person or governmental agency that is provided at no cost to the utility. It represents an addition or transfer to the capital of the utility, and is used to offset the acquisition, improvement, or construction costs of the utility's property, facilities, or equipment used to provide utility services to the public. It includes amounts transferred from advances for construction representing any unrefunded balances of expired refund contracts or discounts resulting from termination of refund contracts. Contributions received from governmental agencies and others for relocation of water mains or other plant facilities are also included. All contributions are carried as equity capital in audited balance sheets of publicly owned utilities.

cost allocation The procedure for classifying or assigning the costs of service to functional cost components for subsequent distribution to respective customer classes.

cost of capital A utility's cost of capital is the weighted sum of the costs of component parts of the capital structure (that is, debt, preferred equity, and common equity) weighted by their respective proportions in the capital structure.

cost of common stock The cost of common stock is determined by estimating the current investor required rate of return to invest in subject common stock. Recovery of flotation cost expenses should be addressed. Current investor required return can be estimated using financial models such as: the discounted cash-flow model and the capital asset pricing model.

cost of debt Commonly referred to as the embedded cost of debt, it is determined by taking the weighted average cost of the embedded debt securities. The cost of each security should include issuance expenses, discounts/premiums, and coupon payments. Under most circumstances, only long-term debt is used in the embedded debt-cost determination.

cost of preferred stock The cost of preferred stock is determined by taking the weighted average cost of each preferred stock issuance. The cost of each issuance should include the unamortized balance of premium/discounts and flotation expenses.

costs of service The operating and capital costs incurred in meeting various aspects of providing water service, such as customer billing costs, demand-related costs, and variable costs.

coverage ratios The margin of safety ratios associated with bonded indebtedness and preferred stocks, reflecting the ratio of the actual or projected net revenue available for debt service to debt service or other costs. These ratios range from debt-service coverage of principal and interest, to interest only, to all fixed charges, including preferred stock dividends and lease payments. Coverage may be expressed as a ratio or as a percentage.

curb cock *See* curb stop.

curb stop A shut-off valve attached to a water service line from a water main to a customer's premises, which may be operated by a valve key to start or stop flow in the water-supply lines of a building. Also called a curb cock.

customer classification The grouping of customers into homogeneous classes. Typically, water utility customers may be classified as residential, commercial, and industrial for rate-making and other purposes. For specific utilities, there may be a breakdown of these general classes into more specific groups. For example, the industrial class may be subdivided into small industry, large industry, and special. Some water systems have individual customers (large users) with unique water-use characteristics, service requirements, or other factors that set them apart from other general customer classes and thus may require a separate class designation. This may include large hospitals, universities, military establishments, wholesale service districts, and other such categories.

customer costs Costs directly associated with serving customers, irrespective of the amount of water use. Such costs generally include meter reading, billing, accounting, and collecting expense, and maintenance and capital costs related to meters and associated services.

debt An obligation resulting from the borrowing of money or from the purchase of goods and services.

debt service The amounts of money necessary to pay interest and principal requirements for a given or series of years.

declining-block rates A schedule of rates applicable to blocks of increasing usage in which the usage in each succeeding block is charged at a lower unit rate than in the previous blocks. Generally, each successive block rate is applicable to a greater volume of water delivery than the preceding block(s).

dedicated capacity The portion of the water utility's total capacity that is set aside, or dedicated, for use by an individual large-use customer or group (class) of customers whose total use is a significant part of the utility's total capacity requirement.

demand costs Costs associated with providing facilities to meet demands placed on the system by customers. They include capital-related costs associated with those facilities plus related operation and maintenance expenses.

demand patterns Profiles and characteristics of the demand requirements of the system, specific customer class or classes, or an individual customer, indicating the frequency, duration, and amount of demand placed on the water production and delivery system.

depreciation The loss in service value not restored by current maintenance as applied to depreciable plant facilities. Depreciation is incurred in connection with the consumption or prospective retirement of plant facilities in the course of providing service. This depreciation is the result of causes known to be in current operation and against which the utility is not protected by insurance. Among the causes are wear and tear, decay, action of the elements, inadequacy, obsolescence, changes in technology, changes in demand, and requirements of public authorities. The proper level of depreciation expense at any given time should be based on the costs of depreciable plant in service. The funds resulting from depreciation are available for replacements, improvements, expansion of the system, or for repayment of the principal portion of outstanding debt.

depreciation rate The annual rate at which capital facilities are depreciated, based on the estimated loss in value of the facilities, not restored by current maintenance, that occurs in the property due to wear and tear, decay, inadequacy, and obsolescence. It provides for the recovery of a utility's capital investment over the anticipated useful life of the depreciable assets.

discounted cash-flow (DCF) model The DCF model is often used in rate making for estimating the investor required rate of return on common equity. By definition, the DCF model contends that the market price of a common stock is equal to the cumulative present value of all future cash flows to investors produced by said common stock.

dividend payment Payment made by an investor-owned water utility to its shareholders, based on its earnings.

equity The net worth of a business, consisting of capital stock, capital (or paid in) surplus, earned surplus (or retained earnings), and, occasionally, certain net worth reserves.

equivalent customer The means of relating large-use customers to a base customer, typically a single-family unit or other small-use customer unit, such as a ⁵⁄₈-in. meter customer. It represents a composite of all elements of cost differences between the base customer and the large-use customers to be served. Typically, it is expressed as a ratio of the base customer unit.

equivalent meter-and-service ratio The ratio of the cost of investment in larger meters and services to those of a base meter size, such as the ⁵⁄₈-in. meter typically used for residential customers. Meter capacities may be used rather than investments.

expenditures Amounts paid or incurred for all purposes, including expenses, provision for retirement of debt, and capital outlays.

extra capacity costs Costs of capital and operation and maintenance associated with meeting rate-of-use requirements in excess of average rate-of-use requirements.

fire protection charges Charges made to recover the cost of providing both public and private fire protection service to the communities served by the utility. Usually, charges include both the direct capital-related and maintenance costs for fire hydrants and private fire connections, as well as applicable indirect costs for source of supply, treatment, transmission, and distribution of water to the fire protection facilities.

firm service Dependable service in the amounts and at times as desired by the customer.

flat rate A periodic stated charge for utility service not based on metered quantity of service. Such a rate is used where service is provided on an unmetered basis.

flotation costs The costs incurred by the issuer of securities incident to the planning and sale of securities. These costs include the spread for underwriters, feasibility studies, printing, advertising, the fees of counsel, costs of presentations to potential investors, and the value of staff time and facilities required in the planning and sale of the bonds. They ordinarily do not include the costs of holding elections, when required as a part of the process of authorization.

functional cost components The distinct operational components of a water utility to which separate cost groupings are typically assigned. In the base–extra capacity method of cost allocation, these are usually the components of base, extra capacity, customer, and direct fire-protection costs. In the commodity–demand method, they are the components of commodity, demand, customer, and direct fire-protection costs.

future capacity The capacity for service somewhat in excess of immediate requirements that is built into a utility in anticipation of increased demands for service resulting from higher uses by existing customers or from growth in the service area.

government-owned water utility A water utility created by state or other government-agency legislative action, with the mandate that the purposes of the utility are public purposes and that its functions are essential governmental proprietary functions. Its primary purpose is to provide its designated service area with potable water in an adequate supply at reasonable costs so that people of the area may promote their health, safety, and welfare. A government-owned water utility may be part of a municipal government operation, a county agency, a regional authority, or take such other form as is appropriate for its service area.

gross receipts tax Payments made to a government entity based on the gross revenues received by the water utility from its revenues.

indenture The formal agreement between a group of bondholders, acting through a trustee, and the issuer as to the terms and security for the debt. Ordinarily, it involves the placement of a lien upon either the income, property, or both, being acquired from expenditure of the proceeds of the bond issue.

inverted block rates A schedule of rates applicable to blocks of increasing usage in which the usage in each succeeding block is charged at a higher unit rate than in the previous blocks. Generally, each successive block rate may be applicable to a greater volume of water delivery than the preceding block(s).

investor-owned water utility A utility owned by an individual, partnership, corporation, or other qualified entity with the equity provided by shareholders. Regulation may take the form of local or state jurisdiction.

least-squares method The mathematical process for determining the relationship between two or more variables, so that, when expressed as a curve, the sum of the square of the distances (deviations) of the plotted available data (observations) from the curve is the least possible.

lifeline rates Rates applicable to usage up to a specified level that are below the cost of service for the purpose of meeting the social goal of providing so-called minimum annual water requirements to qualified customers at a below-cost price.

marginal cost rates Rates based on the cost of providing the next unit of production.

minimum bill A minimum charge to a customer that includes a fixed volume of water delivered to the customer during the applicable period of time.

net revenues available for debt service Operating revenues less O&M expenses but exclusive of depreciation and bond interest. Net revenue available for debt service as thus defined is used to compute coverage for revenue-bond issues. Under the laws of some states and the provisions of some revenue-bond indentures, net revenues available for debt service for computation of revenue-bond coverage must be computed on a cash basis rather than in conformity with generally accepted accounting principles (GAAP). Sometimes, indenture provisions permit the inclusion of nonoperating revenue and system-development-charge receipts with operating revenue when determining net revenue available for debt service.

off-peak rates Rates charged for usage during certain designated off-peak periods.

payment in lieu of taxes A payment made to a governmental entity by the government-owned utility instead of taxes.

peak-load pricing rates A multiple-part rate structure in which charges vary and are based on the higher costs of providing water during the system peak periods of use and on the lower cost of providing water during the system off-peak periods.

rate base The value of a water utility's property used in computing an authorized return under the applicable laws and/or regulatory policies of the agency setting rates for the utility.

rate blocks Elements of a schedule of charges for specific usages within certain defined volume and/or demand boundaries.

rate-making process The process of developing and establishing rates and charges. The process is comprised of four phases: (1) determination of revenue requirements; (2) allocation of costs to the functional components of the cost of service; (3) distribution of the function costs of service to customer classes; and (4) development and design of a schedule of rates and charges to recover the revenue requirements.

rate schedule Schedule of the rates and charges to the various customer classes and customers.

raw water Water that is obtained directly from the supply sources, such as wells, reservoirs, rivers, etc., that has not been treated to produce potable water.

return on rate base The percentage of earnings on the rate base.

revenue bond A bond payable solely from net or gross nontax revenues derived from tolls, charges, or rents paid by users of the facility constructed with the proceeds of the bond issue.

seasonal excess-use charges Charges for usage above pre-established levels, typically used during periods of peak use relative to use during off-peak periods.

seasonal rates Rates based on the cost of service variations with respect to system seasonal requirements. For example, higher rates may be charged during the summer months when a system peak occurs, which requires facilities not needed to meet lower winter loads.

self-sustaining water enterprise A water utility operating without subsidies given to or received from non-water utility operations.

service charge A fixed charge usually designed to recover customer costs.

service connection That portion of the service line from the utility's water main to and including the curb stop at or adjacent to the street line or the customer's property line. It includes other valves or fittings that the utility may require at or between the main and the curb stop but does not include the curb box.

service line The pipe and all appurtenances that run between the utility's water main and the customer's place of use—including fire lines.

standby service Service provided occasionally under certain defined conditions, such as in the event of failure of the customer's normal water supply system. Fire protection is another form of standby service.

system development charge A contribution of capital toward existing or planned future back-up plant facilities necessary to meet the service needs of new customers to which such fees apply. Two methods used to determine the amount of these charges are the buy-in method and incremental-cost pricing method. Various terms are used to describe these charges in the industry, but these charges are intended to provide funds to be used to finance all or part of capital improvements necessary to serve new customers.

system development charge facilities Those facilities, or a portion of those facilities, that have been identified as being required for new customer growth. The cost of the facilities will be recovered in total or in part through system development charges.

test year The annualized period for which costs are to be analyzed and rates established.

treated water Water that has been obtained from supply sources and treated to produce potable water.

unit cost The cost of producing a unit of a product or service. An example would be the cost of treating a thousand gallons of potable water for use by the water utility's customers.

unit of service An element of service for which a cost can be ascertained, such as thousand gallons, hundred cubic feet, million gallons per day, monthly bill, etc.

uniform volume charge A single charge per unit of volume for all water used.

unmetered or flat rate A fixed charge for unmetered service, often simply based on the number of fixtures and water-using devices of the customer.

user charges The monthly, bimonthly, quarterly user charges made to the users of water service through the general water rate structures of the utility for the utility's share of the cost of providing water service.

utility approach The method of determining annual operating revenue requirements, which includes operation and maintenance expense, depreciation expense, and return on rate base.

wheeling charge The charge made by a utility for transmission of water of another party through its system.

wholesale service customers Service in which water is sold to a customer at one or more major points of delivery for resale within the wholesale customer's service area.

working capital Cash, materials, supplies, and other similar current assets necessary in the operation of the enterprise. It is usually measured by the excess of current assets over the current liabilities, or sometimes as a percentage of annual operation and maintenance expense levels.

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