SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, IMPROVEMENT DISTRICT NO.1

WATER SERVICE APPLICATION

PROPERTY OWNER NAME: ______________________________

MAILING ADDRESS: ______________________________

PHONE NUMBER: ____________________ EMAIL: ______________________________

FAX NUMBER: ____________________

AGENT NAME ON BEHALF OF PROPERTY OWNER: ______________________________

PHYSICAL ADDRESS OF PROJECT: ______________________________

APN: ____________________ PARCEL SIZE: ____________________

DESCRIPTION OF STRUCTURE AND PROPOSED USE (Attach additional sheet if necessary):

____

TYPE OF SERVICE APPLIED FOR:

- ☐ Dwelling Unit
- ☐ Additional Dwelling Unit
- ☐ Commercial/Institutional
- ☐ Agricultural
- ☐ Change in Meter Size/Use
- ☐ Fire Protection Service (Interior Sprinklers/Private Fire Hydrant)

The following items MUST be submitted to the District along with this Application. Failure to submit the required documents will delay processing of the application until all items have been submitted:

☐ Application fee ☐ Agent Letter (if needed)

☐ A detailed Plot Plan or Site Plan and Floor Plan of the proposed project

☐ Water Demand Calculations - Provide calculations for project water use, interior and exterior, from licensed engineer, architect and/or landscape architect

☐ A copy of the County of Santa Barbara Fire Department's Conditions letter. Required for all applications except those involving only agriculture meters.

☐ Assessor's Parcel Map of the property

☐ A copy of the Conditional Use Permit or Land Use Permit

☐ A full written description of all existing buildings and proposed project, specifying building types and square footage of each. Please use the attached sheet.

This application expires upon any modification of the proposed use described above, expiration of any building permit issued by the Santa Barbara County Building Department for construction on the parcel, **or one (1) year from the date below**, whichever occurs first. This Application is not transferrable to any other parcel, project or structure.

Please sign below:
I hereby acknowledge the terms and conditions of this Application, agree to comply with all the Rules and Regulations established by the District and declare that the information provided is true and applicable to the above property.

______________________________ ______________________________

Signature of Property Owner Date Print Name of Property Owner

Date Distributed:

Date Received:
Amount Received:

Santa Ynez River Water Conservation District
Improvement District No. 1

SUPPLEMENT TO
WATER SERVICE APPLICATION

Please provide a full written description of the existing buildings and proposed project, specifying building types, and square footage of each below:

AUTHORIZATION OF AGENT

Please fill in the following form including signatures. All signatures must be completed. If one or more of these signatures are the same, simply re-sign.
Thank you.

I hereby authorize the following person to act as my agent for the propertylocated at:

PROPERTY INFORMATION:

STREET ADDRESS: ______________________________

CITY, STATE, ZIP CODE: ______________________________

ASSESSOR'S PARCEL NUMBER: ______________________________

WATER ACCOUNT NUMBER(S): ______________________________

DURATION OF AUTHORIZATION (MONTH/DAY/YEAR): ______________________________

OWNER AUTHORIZATION:

NAME: ______________________________

STREET ADDRESS: ______________________________

CITY, STATE, ZIP CODE: ______________________________

DAYTIME PHONE: ______________________________

EMAIL: ______________________________

PRINT NAME: ______________________________

SIGNATURE: ______________________________

TITLE: ______________________________
(Property Owner, Partner, Corporation Officer, Specify Other)

DATE: ______________________________

AGENT:

NAME: ______________________________

FIRM NAME (IF ANY): ______________________________

STREET ADDRESS: ______________________________

CITY, STATE, ZIP CODE: ______________________________

DAYTIME PHONE: ______________________________

EMAIL: ______________________________

PRINT NAME: ______________________________

SIGNATURE-AGENT: ______________________________

DATE: ______________________________

SANTA YNEZ RIVER WATER CONSERVATION DISTRICT, IMPROVEMENT DISTRICT NO.1

ADDITIONAL PROJECT/PARCEL INFORMATION

Please answer the following questions by checking the appropriate box.

Project Information	YES	NO
Does the project require a county permit? (Bldg., Fire Dept., Planning Dept., Zoning Dept)	☐	☐
Does the project include remodeling and/or replacing any existing structures?	☐	☐
Does the project involve an additional dwelling unit?	☐	☐
Does the project involve creation of new dwelling unit?	☐	☐
Does the project involve new commercial or commercial expansion?	☐	☐
Does the project involve an addition, remodel or conversion of an existing building?	☐	☐
Does the project involve a lot split, lot line adjustment or subdivision?	☐	☐
Existing Conditions of Project Site		
Is the parcel currently vacant?	☐	☐
Does the parcel have an existing residence?	☐	☐
Does the parcel currently have more than one habitable structure? (i.e., guest house, apartment, mobile home)	☐	☐
Does the parcel have an existing barn or accessory structure?	☐	☐
Does the parcel have existing water service from ID No.1?	☐	☐
Cross-Connections		
Does the parcel have an existing private water supply (i.e. well)?	☐	☐
Does the parcel have a pond, watering trough, holding tank or booster pump?	☐	☐
Does the parcel have a pool, spa or jacuzzi?	☐	☐
Does the parcel have an existing Backflow Prevention Device?	☐	☐
Fire Protection		
Does the project require the installation of fire sprinklers in any of the structures on the parcel?	☐	☐
Does the project require the installation of a fire hydrant?	☐	☐
Easement/District Facilities		
Is there an existing easement (ID # 1, Public Utilities, Other, etc.) on the parcel?	☐	☐
Are there any underground distribution or transmission pipelines or utilities located on the property, or in an easement or road right of way adjacent to the property?	☐	☐

Please continue on the next page

For District Use Only

Atlas Sheet: ________________ Station Number: ________________ Long/Short Side: ____________

Yes	No	
☐	☐	Parcel has an existing service. Size: _________ Installation Date: _________________
☐	☐	Parcel has an existing meter. Size: _________ Installation Date: _________________
☐	☐	Parcel has an existing Backflow Prevention Device. Size: _____ Install Date: ___________
☐	☐	Verification of service, meter, & Backflow Prevention Device by Field Crew member

Crew Member: __________________ Date: _____________ Work Order #: __________

This application for water service is for the installation of new or modified service connections, meters, and/or fire service connections. Should the District determine that a main extension is required, this will be subject to a Main Extension Application process. This application may require the design and replacement or construction of water system improvements, such as water mains, booster pumps, pressure reducing stations, storage tanks, valves, etc.

After the actual terms, conditions and actual costs for connection of water system improvements, and installation of meters have been determined by the District, the applicant will be notified of the terms, conditions and actual costs in writing ("Requirements Letter").

The undersigned agrees to pay all fees and charges prior to construction and installation of water system improvements, service connections and meters and understands and acknowledges that:

> **The District's review and processing of an application does not constitute, nor commit or imply that the District will provide or approve water service to the proposed project. The review, processing and response to an application only states at that time what the District believes would be the conditions which would have to be met by an applicant in order to obtain water service.**

Water service is subject to the District's Rules and Regulations, as they exist from time to time, as well as the customer's compliance therewith, and payment of all fees and charges when due (Section 112). Attached for your reference are the following:

Article 2, Section 218: Private Fire Protection Service definition
Article 17, Sections 1701-1709: Private Fire Protection Service requirements
Article 8, Section 802: Separate Supply to each Dwelling Unit or Structure

I hereby acknowledge the terms and conditions of this Application, agree to comply with all of the Rules and Regulations established by the District and declare that this information provided is true and correct and applicable to the above property.

____

Applicant Signature Date

____

Owner's Signature (If different from Applicant) Date

Date Distributed:

Date Received:
Amount Received:

112. Administrative Charge.

A. Water Service Application Charge. In addition to any other fee or charge explicitly provided for in the Rules and Regulations, an applicant (including individuals, entities or agencies) shall pay an application charge to the District with each submitted Water Service Application for a new, expanded, or additional water service, modification to water service, Private Fire Protection water service, re-connection, main extension, annexation, meter modification, Can & Will or Existing Service determination, a permit compliance process, environmental documentation, a waiver, exception, exemption or relief from any of the District's Rules and Regulations based on special circumstances, a request for special studies or research, or for any other service provided by the District.

B. Deposits. In addition to the Water Service Application charge provisions pursuant to Section 112.A, an applicant (including individuals, entities or agencies) shall deposit at the time an application is submitted an amount sufficient to reimburse the District for reasonable administrative costs incurred by the District.

The General Manager is authorized to make an estimate of such administrative costs to determine the amount of any required charge and/or deposit, and is authorized to make a final determination of the actual amount of any such administrative charges, when, in the judgment of the General Manager may be necessary.

The General Manager is authorized to establish a Schedule of Administrative Charges including (a) a charge and/or deposit for the submission of an application to the District for any water service, and (b) a charge for certain types of routine services. In both cases the Administrative Charge shall be in an amount, which the General Manager determines will be sufficient to reimburse the District in accordance with this Article.

Administrative costs shall include but not be limited to the value of time spent by District employees and consultants, including attorneys and engineers, and any other cost or expense, the reimbursement of which is not otherwise provided for in these Rules and Regulations, incurred by the District in processing an application.

No action on an application shall be commenced until the appropriate water service application charge and/or deposit has been submitted to the District and no service or relief shall be provided until all such administrative charges are paid in full.

113. Public Entity Claims Against the District. Pursuant to the authority contained in Government Code section 935, the following claims procedures shall apply to those claims against the District for money or damages not now governed by state or local laws:

Notwithstanding the exemptions set forth in Government Code section 905, all claims for money or damages against the District when a procedure for processing such claims is not otherwise provided by state or local laws, shall be presented in the manner and within the time limitations specified by Government Code sections 910 through 915.2. Such claims shall further be subject to the provisions of Government Code sections 945.4 and 945.6 relating to the prohibition of actions in the absence of the presentation of claims and action thereon by the District.

B. Additional Dwelling Unit means a Dwelling Unit constructed or converted on any Premises in addition and subsequent to a Dwelling unit on the Premises which is already connected to the District by a meter.

217.6 Family means one or more persons living together as a single non-profit housekeeping unit, as distinguished from a group occupying a boarding or lodging house, hotel, club, or similar structure for group use. A family shall not include a fraternal, religious, social, or business group.

217.8 Kitchen means a room, all or any part of which is designed, built, equipped, used, or intended to be used for the preparation and cooking of foods.

218. Private Fire Protection Service means water service and facilities for building sprinkler systems, hydrants, hose reels and other facilities installed on private property for fire protection and the water available therefore.

219. Public Fire Protection Service means the service and facilities of the entire water supply, storage and distribution system of the District, including the fire hydrants affixed thereto, and the water available for fire protection, excepting house service connections and appurtenances thereto.

220. Regular Water Service means water service and facilities rendered for normal domestic, commercial and irrigation purposes on a permanent basis, and the water available thereto.

221. Rural Residential/Limited Agricultural water shall mean the use of water for a combined domestic and limited agricultural use including growing of crops for commercial agricultural or personal use, raising of domestic livestock for commercial agricultural or personal use, the watering of pasture for animals (e.g., horses) which are kept for personal enjoyment. In order to qualify as a Rural Residential/Limited Agricultural Use, a Customer may be required to submit to the District documentation, in a form satisfactory to the District, certifying that the property served by the meter is used for the purposes stated herein. Farming, horticulture, or ranching for commercial or personal use, including irrigation, stock watering, support of vegetation for range grazing, and the watering of pasture for animals (e.g., horses) which are kept for personal enjoyment.

222. Special Improvement District means Improvement District No. 1 or District and includes all previous or subsequent annexations thereto. It also means the Board of Trustees performing functions related to the District water service together with the General Manager, the Administrative Manager and other duly authorized representatives.

223. Suspension of Water Service is defined as a temporary or permanent stoppage of or ceasing to provide water service to a Customer for any or all violations of the District's Rules and Regulations. The District has the discretion to cause the stoppage of any Customer's water service with or without notice to the Customer unless otherwise stated in these Rules and Regulations. Suspension of water service by the District does not result in a credit or waiver of charges.

224. Temporary Water Service means water service and facilities rendered for construction work and other uses of limited duration, and the water available therefore. Temporary Customers do not become regular water service Customers

Article 17 - PRIVATE FIRE PROTECTION SERVICE

1701. Payment of Costs. An applicant for a new private fire protection service shall pay either (a) if a separate fire protection service and meter is requested, the total actual cost of installation of the separate fire protection service from the distribution main to the Customer's premises, including the cost of a detector check meter or other suitable and equivalent device, valve and meter box and the applicable connection charge and meter installation fee determined in accordance with Section 1609, said installation to become the property of the District; or (b) if the fire protection service is to be provided through the Domestic or Rural Residential/limited Agriculture meter, the capital facilities charge and meter installation fee for a larger meter and/or service connection, if determined to be necessary pursuant to Section 603 or 709.

1702. No Connection to Other System. If a separate private fire protection service is installed, there shall be no connections between the separate private fire protection service and any other water distribution system on the premises. If found an interconnection exists, then all service to the premises shall be suspended pursuant to Article 1400 and until such time the interconnection is mitigated.

1703. Use. If a separate private fire protection service is installed, there shall be no water used in any month through said service except to extinguish accidental fires, or for annual testing the Backflow Prevention Device. Should a misuse of the fire protection water occur, this is a violation of the Rules and Regulations and subject suspension.

1704. Actual Quantity Charge. Any quantity recorded on the meter of a separate private fire protection service will be charged at the Temporary rate for authorized backflow prevention device testing only except that no charge will be made for water used to extinguish accidental fires where such fires have been reported to the duly authorized fire protection agency and the District. Use of fire protection water for unauthorized purposes shall be charged at double the Temporary water rate for actual or estimated water used in HCF. If such misuse continues any other month within 12 calendar months after the first violation occurred, the charge for water shall be at 10 times the Temporary water rate and water service shall be subject to suspension (article 1400) which shall include reactivation fees when service is corrected.

1705. Monthly Meter Charge. The monthly rate for water service provided through a separate private fire protection connection is established pursuant to the District's charges as set forth in Exhibit A to these Rules and Regulations.

1706. Water for Fire Storage Tanks. Occasionally water may be obtained from a separate fire protection service for filling a tank connected with the fire service, but only if written permission is secured from the District in advance and an approved means of measurement is available. The Temporary water rate applies.

1707. Violation of Agreement. If water is used from a separate fire service in violation of the agreement or of these regulations, the District may, at its discretion, terminate and remove the service.

1708. Water Pressure and Supply. The District assumes no responsibility for loss or damage due to lack of water or water pressure and merely agrees to furnish such quantities and pressures as are available from time to time in its general distribution system. The service is subject to shutdowns and variation required by the operation and maintenance of the system and interruption of service as provided for in these Rules and Regulations.

1709. Connection Fee. A connection fee of seven hundred and twenty dollars ($720.00) per inch of diameter, or any fraction thereof, shall be charged for any separate private fire protection service or private fire hydrant installation. *(Effective Date January 1, 2017)*

Annually this charge shall be automatically increased by twenty dollars ($20.00) per inch of diameter at the beginning of each calendar year.

Article 8 - GENERAL USE REGULATIONS

801. Number of Services per Premise. The applicant may apply for as many water services as may be reasonably needed for the applicant's premise or as required by the District pursuant to these Rules and Regulation for water service, provided that the private pipe line system from each District provided water service be independent of the others and that they not be inter-connected internally within the premises, or inter-connected with the intent to provide water or actually serve water to any other premises under separate Ownership. The cost of all services shall be borne by the applicant.

802. Separate Supply to Each Dwelling Unit or Structure.

A. General Rule. Each Dwelling Unit, Additional Dwelling Unit and structure for which application for water service is made or as determined by the District according to these Rules and Regulations shall have a separate service connection including a separate meter, except (i) as provided in subsection E, or (ii) as approved by the Board.

B. Application. Any application for water service to for a Dwelling Unit or Additional Dwelling Unit shall be made in writing on a form provided by the District Water Service Application and shall be accompanied by a plans and specifications as defined in the requirements of the Water Service Application. The application shall be verified as true by affirmation. The application shall not be approved unless the fees required by Section 802.7 have been paid or agreed to be paid.

C. Limitation. For any application for water service filed on or after July 20, 1999, service shall be provided only to structures and for uses shown on the approved application.

D. Suspension of Water Service. Service may be suspended in accordance with the provisions of Section 1407.

E. Grandfather Provision. This Section shall not apply to any Dwelling Unit, Additional Dwelling unit, or structure which physically existed as of the effective date of Section 802.7 (Resolution No. 508 adopted July 27, 1999) and was in compliance with the applicable land use regulations as of that date.

802.5. Charges for Service to Any Additional Dwelling Unit. An Additional Dwelling Unit Impact Charge shall be paid monthly with respect to each Additional Dwelling Unit to which separate service is not required to be provided pursuant to Section 802.E. The amount of the Impact Charge shall be equal to the monthly meter charge for a 5/8-inch meter for service to any Additional Dwelling Unit. The Impact Charge shall be paid monthly beginning on the first of the following events: (a) application for new water service, (b) application by a tenant for water service, (c) request for a change of account name, (d) request for a change in meter classification, (e) request for an "Intent to Serve Letter" or "Can And Will Serve Letter", (f) District receipt of notification from the County of Santa Barbara, or an applicant, that application has been made for a building permit, (g) field inspection by District personnel of Customer services or meters, (h) inspection of any back flow device by District personnel, or (i) any other requested modification of water service to the Dwelling Unit or Additional Dwelling Unit on a Premises.

802.7. Capital Facilities Charge for Any New Additional Dwelling Unit.

A. General Rule. Each Dwelling Unit and Additional Dwelling Unit for which application for water service is made shall pay an amount equal to the Capital Facilities Charge for a 5/8-inch meter as provided in Section 603.

B. Payment. The Capital Facilities Charge shall be paid, at the Owner's election and upon notice of such election to the District either (i) in an initial lump sum due and payable within ten (10) days of Owner's receipt from the District of a request for payment, or (ii) in approximately equal monthly installments over a twelve (12) month period. If paid over a twenty-four month period, interest shall be charged at the rate at which interest would have accrued if the charge had been paid in a lump sum and invested in the Local Agency Investment Fund (LAIF).

C. Grandfather Provision. This Section shall not apply to any Dwelling Unit, Additional Dwelling Unit or structure which physically existed as of the effective date of Section 802.7 and was in compliance with the applicable land use regulations as of that date.

803. Water Waste. No Customer shall knowingly permit leaks or waste of water. Where water is wastefully or negligently used on a Customer's premises, seriously affecting the general service, the District may suspend water service if such conditions are not corrected, with or without notice to the Customer. Advance notice of suspension of service will be given if possible.

Chapter 4

Estimating Demands Using Fixture Values

INTRODUCTION

To properly size water taps, meters, and service lines, it is essential to know the peak demands that any specific tap will be called on to serve. This problem has been difficult to solve because there is no clear-cut way to calculate peak demands. Although it is certainly possible to calculate the maximum potential demand for a specific customer based on the simultaneous use of all the fixtures and appliances in the building, this calculation has little bearing on the actual peak flows because these are a function of the *probability* that multiple fixtures and appliances will be operated simultaneously. These probability patterns cannot be calculated theoretically but must be determined through empirical methods, i.e., through observations.

In 1940, Roy Hunter developed a method for estimating peak water demands in which peak flows were related to the number and type of fixtures being served by the tap, referred to as "fixture units" (Hunter 1940). The report contained tables of the load-producing characteristics of commonly used fixtures and—the Hunter curve—of peak flow versus fixture units that has found its way into many plumbing codes, where it has been institutionalized into the orthodoxy of plumbing and mechanical systems design. However, in many cases, these codes have failed to take Hunter's own words into consideration in their efforts to create a uniform procedure for engineers to follow in sizing systems. Hunter pointed out that "the details of application of any method in practice must be guided to a large extent by engineering judgment in order that it may lead to satisfactory results," and that the "choice of values employed in evaluating the probability function and in converting estimates in numbers of fixtures flowing to estimates in gallons per minute represents the author's [Hunter's] judgment."

Experience has shown that in many cases the Hunter curve approach overestimates demands in the building to which it is applied. These overestimates occur because Hunter developed the basic probability function with highly congested uses in mind, i.e., with the toilets, bathtubs, showers, and faucets in nearly continuous use. He recognized this tendency toward oversizing supply lines and ascribed it to difficulty in estimating the probability of overlapping demands among various types of fixtures and appliances in the buildings. In some cases, the Hunter's curve may be the method of choice for plumbing engineers in designs of interior plumbing systems. The selection of the most appropriate method for estimating water demand must involve careful consideration of many variables with site-specific weighting.

The 1975 edition of AWWA's Manual M22 employed a system of empirical measurements to replace the demand curves generated by Hunter's fixture unit approach. The 1975 manual presented a family of curves that were derived from a series of actual field measurements in the United States and Canada. The authors of the 1975 manual described this approach as "a matter of necessity in order to provide detailed and accurate design criteria" (AWWA, 1975, p. 24). Many practitioners have shied away from using the 1975 M22 demand curves because the M22 curves gave substantially lower demands than did the Hunter curves, and it was not clear how they were developed.

In the last few years there has been a great deal of discussion about how to improve the methodology for estimating peak demands in new buildings. Some have advocated a return to a modified version of the Hunter curve, and others have advocated continuing research on an empirical approach. This matter is still open for discussion, and the current revision of M22 seeks to add what new information is available and provide more flexibility for engineers to use current technology to estimate demands. It is anticipated that future M22 revisions will include new research to enhance the empirical demand projections because advances in technology have greatly simplified the acquisition of flow trace data from water meters.

In 1975, mechanical data loggers were used to collect peak flow data for a range of customers. This information was used to create a family of demand curves for several customer categories, including residential, apartments, hotels, commercial, and public (see Figures 4-1 through 4-3, which originally appeared in the 1975 edition of M22). These demand curves are not the same as the original Hunter curves, which have been incorporated into the Uniform Plumbing Code (UPC), and represent refinements of estimation technique. The major shortcoming of the 1975 curves is that they are based on a fairly limited sample of customers. It is hoped that future research will be conducted systematically to obtain flow trace data that can be used to refine the 1975 curves using representative samples of customers of all major categories. As to whether the Hunter or 1975 M22 approach is best, data collected in recent studies using the type of portable data loggers described in chapter 3 have shown that the 1975 M22 curves appear to match observed demands fairly well, with a reasonable margin of safety.

An example of the comparison between peak flow predicted by the Hunter curves, the 1975 M22 curves, and peak flows measured using data loggers between 1995 and 1999 is given in Figure 4-4. This figure is based on 36 multifamily buildings in the greater Denver area. In each case, the predicted peak flows were calculated from the fixture units using the Hunter curve and from fixture values using the curves from the 1975 M22 (see Figure 4-2), without any pressure adjustments. The Hunter curve predictions of peak flow are shown in the top line of Figure 4-4, the M22 predicted peak flows are shown in the middle line, and observed peak flows from the flow profile analysis are shown in the bottom line. Figure 4-4 shows clearly that in this specific situation the 1975 curves fit the observed data quite well while providing a reasonable margin of safety, while the Hunter curves from the UPC greatly overestimated peak demands. As noted earlier, the 1975 M22 demands presented in this example did not include any adjustment for pressure in the distribution system.

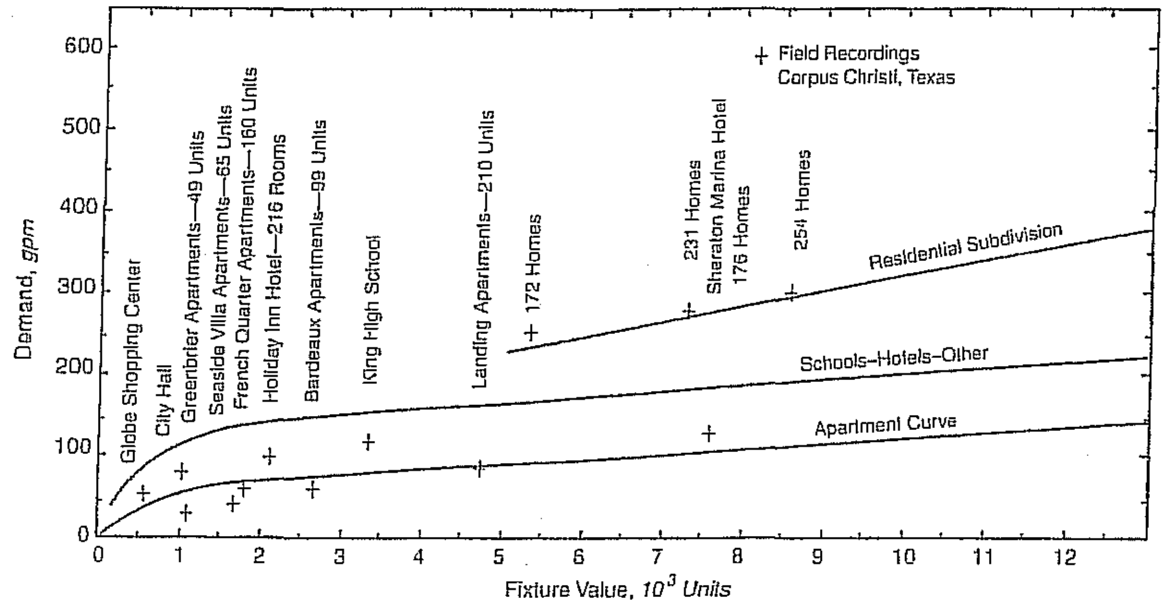

Figure 4-1 Peak flow demand of typical customer categories

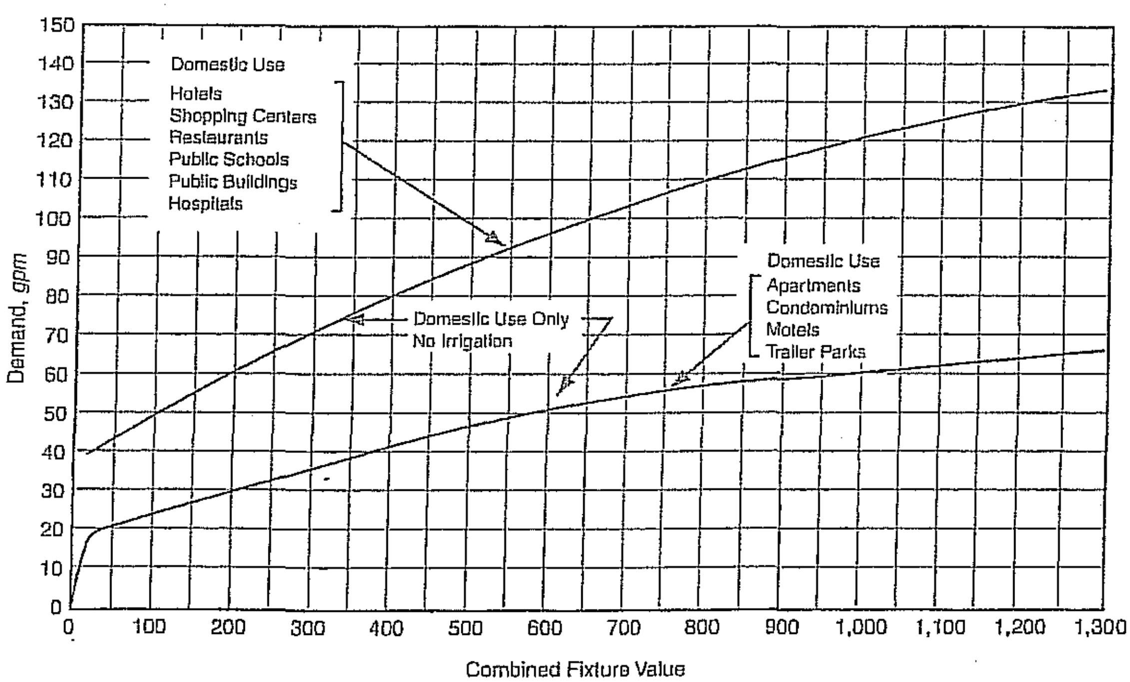

Figure 4-2 Water flow demand per fixture value—low range

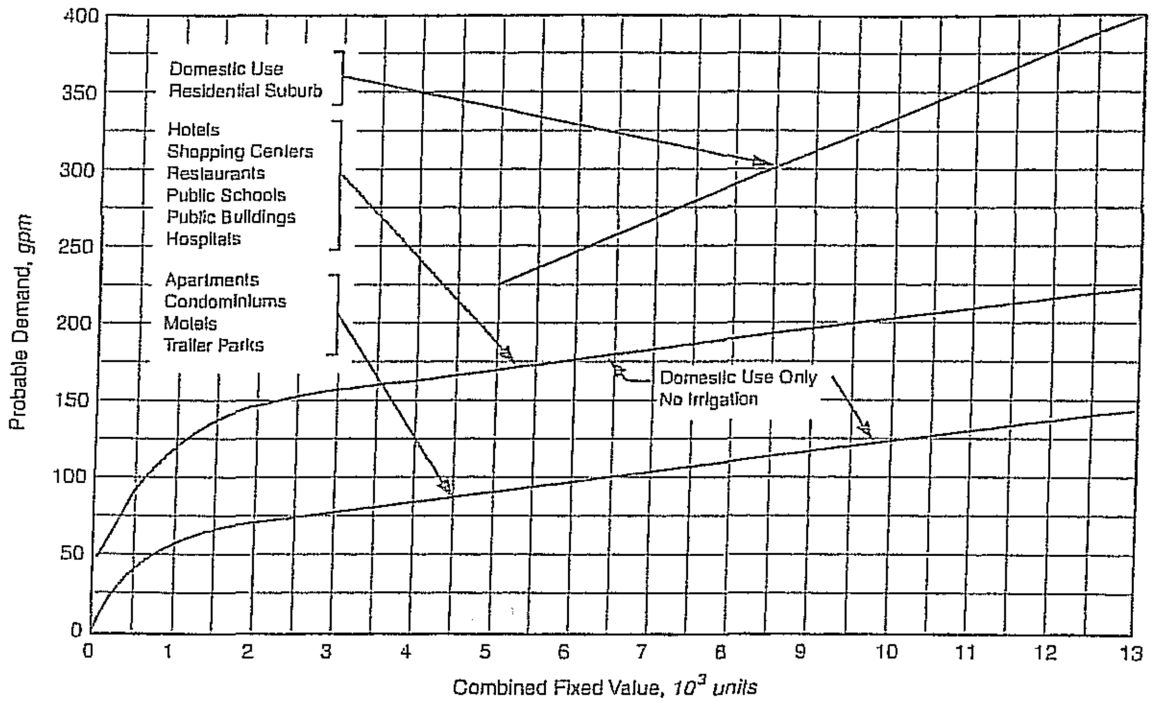

Figure 4-3 Water flow demand per fixture value—high range

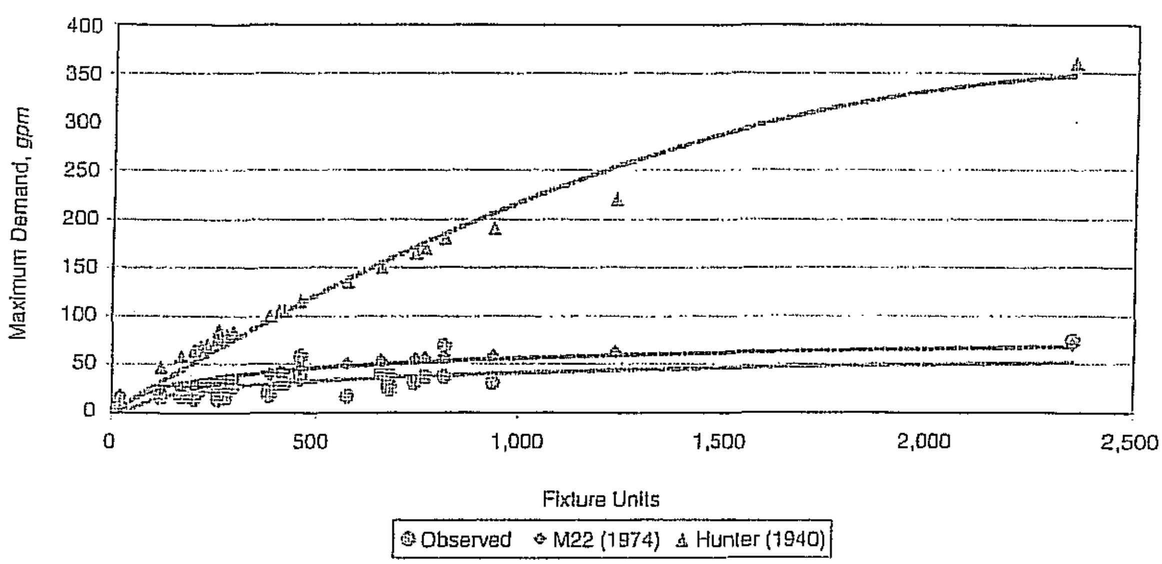

Figure 4-4 Fixture units versus maximum demand multifamily housing: Observed data and data predicted by M22 (1975) and Hunter (1940)

It should be kept in mind that Figure 4-4 is based on multifamily dwellings and each facility needs to be evaluated on its own merit. As another example, analysis of six hotels in Southern California and Phoenix provided very similar results. These results indicated lower peak demands than those obtained from Hunter curves and may be better represented by the curves from the 1975 manual M22.

Guidelines for determining peak demands in existing and new buildings are summarized in the following list. A sample form for calculating customer demand is also included as Figure 4-5.

It is suggested that an engineered design be employed that uses the modified fixture value procedure outlined in the next section. That method is based on the fixture value approach from the 1975 manual M22.

In some situations, when usage in a facility may be uncertain, the estimated peak demand may need to be increased, and the tap and service line sized accordingly. The size of the tap and service line could be larger than the meter since the cost to replace the service line will be significant. Both the service line and meter must be sized to avoid excessive head losses and must also include all minor losses (see chapter 5).

Where base-load continuous demands are present or intermittent irrigation demands occur, these demands must be considered. Irrigation demands that will occur simultaneously with peak domestic demands must be added to the domestic demands. Where irrigation demands normally occur during off-peak domestic use times, the controlling peak demand should be the larger of the two. Where continuous demands, such as cooling loads, occur, these must also be added to the peak domestic demands.

USING THE MODIFIED FIXTURE VALUE METHOD

Irrigation Demand

The 1975 edition of M22 described how to estimate peak irrigation demands based on the size of individual zones, the types of heads in use, and their design application rate. This information is provided in the following section. This approach, however, requires more information than most utility personnel will have about the systems (such as the types of heads in use and the areas of individual irrigation zones). A second approach is provided based on the overall target application rates, which can also be used to estimate the peak irrigation demands. This approach requires no detailed information about the specific system design and leaves that to the irrigation system designer.

Estimating based on specific system configuration. Turf irrigation represents one of the largest demands of water use by the utility customer. Large amounts of water in excess of domestic use are often required for short periods of time, thereby necessitating particular care in calculating the irrigation demand. If this demand is underestimated, there will be a possibility of insufficient pressure available to operate domestic fixtures during turf irrigation. Automatic sprinkler systems can and should be programmed to operate during periods of off-peak domestic demands (from late night to early morning). Consequently, it is not recommended that the full irrigation demand be simply added to the peak domestic demand in order to arrive at the maximum design demand for the customer. In systems where the irrigation system is governed by an automatic controller, the controlling demand should normally be the larger of the domestic demand or the irrigation demand. For manual systems, it makes sense to include the demand from at least one garden hose as part of the peak demand.

CITY OF ______________________

Water Customer Data Sheet

Customer ______________ Address ______________
Building Address ______________ Zip Code ______
Subdivision ______________ Lot No. ______ Blk. No. ______
Type of Occupancy ______________

Fixture	Fixture Value 60 psi		No. of Fixtures		Fixture Value
Bathtub	8	×	______	=	______
Bedpan Washers	10	×	______	=	______
Bidet	2	×	______	=	______
Dental Unit	2	×	______	=	______
Drinking Fountain – Public	2	×	______	=	______
Kitchen Sink	2.2	×	______	=	______
Lavatory	1.5	×	______	=	______
Showerhead (Shower Only)	2.5	×	______	=	______
Service Sink	4	×	______	=	______
Toilet – Flush Valve	35	×	______	=	______
– Tank Type	4	×	______	=	______
Urinal – Pedestal Flush Valve	35	×	______	=	______
– Wall Flush Valve	16	×	______	=	______
Wash Sink (Each Set of Faucets)	4	×	______	=	______
Dishwasher	2	×	______	=	______
Washing Machine	6	×	______	=	______
Hose (50 ft Wash Down) – 1/2 in.	5	×	______	=	______
– 5/8 in.	9	×	______	=	______
– 3/4 in.	12	×	______	=	______

Combined Fixture Value Total ______

Customer Peak Demand From Fig. 4 – 2 or 4 – 3 × Press. Factor = ______ gpm

Add Irrigation – ______ Sections* × 1.16 or 0.40† = ______ gpm
– ______ Hose Bibs × Fixture Value × ______ Press. Factor = ______ gpm
Added Fixed Load = ______ gpm
TOTAL FIXED DEMAND = ______ gpm

*100 ft^2 area = 1 section
†Spray systems – Use 1.16; Rotary systems – Use 0.40

Figure 4-5 Water customer data sheet

Lawn irrigation may be classified under two basic types:

1. End-of-hose sprinklers (manual)
2. Installed piping with (automated)
   - Spray heads
   - Rotary heads
   - Snap-valve heads
   - Buried perforated pipe

End-of-hose sprinklers

In many older residential areas, the homeowner supplies the lawn-watering needs from sill cocks located on the outside wall of the building and from yard-hose bibs. The sill cocks usually are connected to a ½-in. (13-mm) or ¾-in. (20-mm) supply pipe, and the use of these outlets has a direct effect on water pressures within the house. Hoses that connect the sprinkler to the hose bib vary from ⅜-in. (11-mm) to ¾-in. (19-mm) in diameter and generally govern the rate of flow due to friction loss. Sprinklers can be obtained in a wide range of water-flow capacities and types, which makes detailed estimation of peak demand difficult. However, the estimator can usually assume that the sprinkler will apply 1 in. (25 mm) of water over the effective area of the sprinkler in a given time period.

Flow tests under actual field conditions have been made on a ring sprinkler that will provide the water engineer or estimator with a general basis for an average of portable-sprinkler water conditions at various pressures. It was found that the flow variation through 50 ft (15 m) of ⅝-in. (15-mm) diameter hose and a brass ring sprinkler fed by a 1½-in. (40-mm) house service and a ¾-in. (20-mm) lateral to a ¾-in. (20-mm) sill cock is as shown in Figure 4-6.

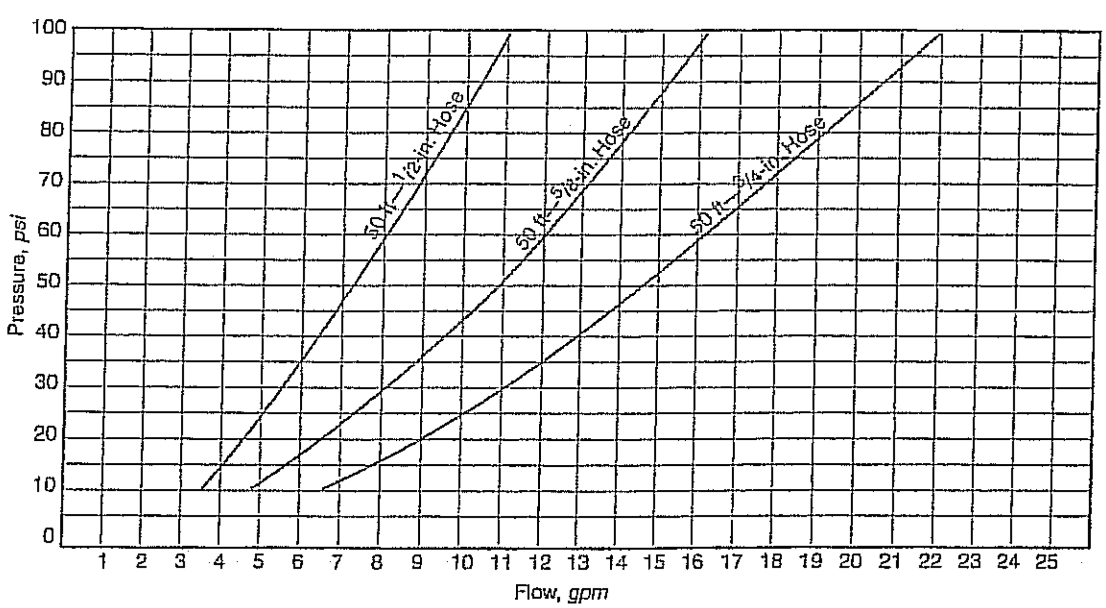

Figure 4-6 Variations in flow from garden hoses due to pressure changes

Installed Piping

Spray systems. The average turf-irrigation spray system requires a wide variety of heads in different spacing, capacities, and coverage patterns to provide uniform watering. When these systems are designed by an experienced company, the demand is carefully calculated. However, this information is not always available to the estimator. Also even when demand has been calculated, it is necessary to check to be certain that the distribution-system capability is sufficient.

Usually a spray head is installed flush with the turf and pops up when pressure is applied. The nozzle recedes and rests within the sprinkler body while not in use. The area of coverage for a pop-up head varies from 18 to 30 ft (5.4 to 9.1 m) in diameter in design increments of 1 ft (0.305 m) or more, depending on the nozzle and pressure that is available.

Heads are usually spaced from 15 to 25 ft (4.5 to 7.6 m) apart, with an average of 20 ft (6.1 m) after making allowance for overlapping circles. Nozzle arcs vary from 1/8 circle to a full circle with some heads designed for shrubbery watering. Normal spray trajectory varies from 30 to 40 degrees as measured from the horizontal, with low-angle heads designed for special water conditions.

These systems are usually operated in sections to avoid overloading the utility system and the customer's service, as well as to obtain the proper lawn coverage. As an example, a residential installation on a lot of 100 × 200 ft (1,858 m^2) will require some 100 heads on 20-ft (6.1-m) centers with up to eight sections. The owner has the choice of a fully automatic system or one that is manually controlled. The automatic systems are usually programmed to apply water uniformly at timed intervals for short periods to produce 1 in. (25.4 mm) of water per week; whereas the owner is inclined to operate a manual system for 1 or 2 days each week to produce the same 1 in. (25.4 mm). The list below illustrates some common sprinkler timer features:

1. Multiple programs and start times
2. Programmable irrigation days on a 2-week cycle
3. Individual zones that can be grouped according to plant type
4. Run-time selection down to 1-minute durations
5. Seasonal percent adjustments to allow applications as a percent of maximum evapotranspiration (ET)

Spray systems can apply water at a rate of 1 in./hr (25.4 mm/hr) with uniform distribution. Since the time of operating is approximately one-fourth that of rotary systems, which can apply 1 in. (25.4 mm) of water each 4 hours, the evaporation is less. Automatic timing also reduces evaporation when the sprinkling is programmed for night hours. The overall watering efficiency of the spray heads has been estimated to be 90 percent as compared to from 60 to 70 percent for rotary heads and snap-on units. The rate of flow required for spray systems to produce 1 in./hr (25.4 mm/hr) of water is 1.16 gpm/100 ft^2 (0.26m^3/h/9.29 m^2) as shown in the following calculation:

$$\text{efficiency} = \frac{Q_r \text{ applied}}{Q_r \text{ total}} = 0.9 \text{ or } Q_r \text{ total} = \frac{Q_r \text{ applied}}{0.9}$$

$$Q_r \text{ total} = \left(\frac{1 \text{ in.}}{\text{hour}}\right) \times \left(\frac{1 \text{ hour}}{60 \text{ min}}\right) \times \left(\frac{1 \text{ ft}}{12 \text{ in.}}\right) \times (100 \text{ ft}^2) \times \left(\frac{7.5 \text{ gal}}{1 \text{ ft}^3}\right) \times \left(\frac{1}{0.9 \text{ efficiency}}\right)$$

$$= 1.16 \text{ gpm for } 100 \text{ ft}^2 \text{ area}$$

Where:

Q_r = rate of flow per 100 ft^2 of area

Q_r total = total rate of flow per 100 ft^2 of area

Q_r applied = rate of flow actually applied per 100 ft^2 of area

spray sprinkler precipitation rate = 1 in. of water per hour

application area = 100 ft^2

Rotary systems. Rotary sprinklers are usually pop-up-type heads equipped with two nozzles, one of which rotates the main nozzle slowly, which produces a high-velocity stream directed at a large circular area. These are available in sprinkling capacities of from 60 to 120 ft (18.3 to 36.6 m) in diameter, with 1/4, 1/2, and 3/4 circle coverage patterns. Since these systems are usually economical in cost and adaptable to large areas, they are often used for parks, schools, cemeteries, golf courses, and large urban homes or estates. Heads are usually spaced from 40 to 90 ft (12.2 to 27.4 m) apart, depending on the capacity of the unit and the water pressure that is available. A spacing of 65 ft (19.8 m) is economical in initial cost, (1) because smaller supply lines are required and (2) less operating pressure is required because of the discharge of the smaller heads.

The rate of precipitation for rotary units ranges from 0.20 to 0.25 in./hr (5.08 to 6.35 mm/hr) with adequate pressures, thereby requiring some 4 hours of watering per week to obtain 1 in. (25.4 mm) of irrigation. These units are usually operated approximately 1 hour on alternate days to total 4 hours a week with alteration to allow for natural rainfall. A section of these units will contain fewer heads than the spray system; however, some four times as much area will be watered at one time with the same water demand. Some spray units are usually required to cover small areas or planter strips; therefore, automation will require separate piping, valving, and programming.

As stated previously, rotary systems are estimated to be from 60 to 70 percent efficient. Since the units are usually designed to place 1 in. (25.4 mm) of water on the ground in 4 hours, the rate of flow can be calculated as follows:

$$\text{efficiency} = \frac{Q_r \text{ applied}}{Q_r \text{ total}} = 0.65 \text{ or } Q_r \text{ total} = \frac{Q_r \text{ applied}}{0.65}$$

$$Q_r \text{ total} = \left(\frac{0.25 \text{ in.}}{\text{hour}}\right) \times \left(\frac{1 \text{ hour}}{60 \text{ min}}\right) \times \left(\frac{1 \text{ ft}}{12 \text{ in.}}\right) \times (100 \text{ ft}^2) \times \left(\frac{7.5 \text{ gal}}{1 \text{ ft}^3}\right) \times \left(\frac{1}{0.65 \text{ efficiency}}\right)$$

$$= 0.40 \text{ gpm for } 100 \text{ ft}^2 \text{ area}$$

Where:

Q_r = rate of flow per 100 ft^2 of area

Q_r total = total rate of flow per 100 ft^2 of area

Q_r applied = rate of flow actually applied per 100 ft^2 of area

rotary sprinkler precipitation rate = 0.25 in. of water per hour

application area = 100 ft^2

Snap-valve systems. These units include the sprinkler that is manually plugged into a ground-level snap valve for use, then removed and plugged in at another location. Because the snap valve automatically shuts off when the sprinkler and coupler are removed, the system is under constant pressure. The large diameter of the sprinkler circle and slow speed rotation allows a person to approach and remove the head while it is operating. These sprinklers can be furnished in larger size and capacity than pop-up units; therefore, a greater irrigation range is available per unit. The effective range of the units most widely used is from 80 to 200 ft (24.4 to 61.0 m) in diameter. Spacing is usually recommended at 60 ft (18.3 m) between heads for small units and 150 ft (45.7 m) for the largest sprinklers.

The cost of labor and waste of water through human error that exist in the use of snap-valve systems have caused the consumers to trend toward the more economical rotary pop-up units. The water demand can be estimated for these units as set out in the previous description of water demand calculation for rotary pop-up units.

Buried perforated pipe. These soaking-type systems are not widely used, and it is advisable to estimate water demands based on the manufacturer's recommendations.

Estimating Peak Demands From Target Application Rates

Irrespective of the types of sprinkler heads and areas of individual zones, the peak demands of most uniform sprinkler systems can be estimated by knowing their total irrigated areas, the maximum week ET rate for the season, and the number of hours per week in which this amount of water must be applied. In order to calculate demand with this approach, first determine the maximum application rate based on the ET during the hottest week of the season. For this example, assume 1.5 in. (38.1 mm) must be applied to a 10,000 ft^2 (9.29 m^2) area of turf on no more than 2 watering days for no more than 4 hours per day (or 8 hours of application during the week).

Because 1 in. (25.4 mm) of water on the ground is equivalent to 0.623 gal/ft^2 (0.0254 m^3/m^2) (based on the ratio of 7.48 gal/ft^2 (0.305 m^3/m^2) per 12 in. (305 mm) of water), an application of 1.5 in. (38.1 mm) is equivalent to 0.935 gal/ft^2 (0.0381 m^3/m^2) that must be applied during the peak week. To apply this to 10,000 ft^2 (929 m^2) requires 9,350 gal (35.34 m^3) of water. Because the example requires this amount of water applied on the landscape in 8 hours of run time or 480 minutes, it must be delivered as a rate of 19.5 gpm (4.43 m^3/hr).

Although allowances must be made for variations among the zones, this approach can provide a quick estimate of the minimum demand for the system, where the zones are fairly similar in their application rate and plant type. If this irrigation were programmed to occur from midnight to 4 a.m., it would have little or no effect on indoor use.

Domestic Demands

The next portion of the chapter will involve only that water demand that is caused by the single and multiple use of plumbing fixtures and wash-down facilities. Most types of fixtures and uses are included to permit the water engineer to estimate the probable use of residential, public, office, schools, shopping centers, and other customers. However, the criteria as set out will not serve as full assurance that the user will not exceed the estimated demand. The engineer should thoroughly evaluate the customer's future demand and piping before reaching a conclusion.

A number of estimating methods are in use today, the most prevalent being that published by the National Bureau of Standards entitled Plumbing Manual Report BMS-66 (Hunter 1946). This method includes a list of fixtures and a table of values for each fixture, as well as a value for the fixture if it is in public use. These are applied to a graph that compensates for a reduced average fixture demand as the number of fixtures increases. This general procedure is followed in this chapter, with the exception of the means of establishing the values.

Pressure adjustment. Because the pressure that is available at the fixture influences flows in fixtures that do not have a pressure-reducing valve, it is necessary to establish a base pressure for estimating fixture flows. The increase in flow through plastic garden hoses caused by pressure changes is readily seen in Figure 4-6. Utilities generally design from a minimum pressure at the outlet of the meter; therefore, this location was selected. All calculations in the current version are made on the base pressure of 60 psi at the meter outlet, and pressure adjustment factors are included in Table 4-1 to assist the estimator in adjusting data from the graphs to the standard minimum delivery pressure of the estimator's utility.

Fixture values. As defined in the 1975 M22, a fixture value (as opposed to a fixture "unit" used by Hunter) is simply the best estimate of the peak instantaneous demand of a given fixture or appliance, depending on circumstances and based on the actual conditions at its point of use. This parameter was arbitrarily chosen to serve as a simple variable against which measured peak demands could be plotted in order to develop demand probability curves. Some suggested fixture values are provided in Table 4-2. Fixture values represent the peak flow in gallons per minute of each fixture or appliance when it is operated without the interference of other fixtures at 60 psi (414 kPa). The user is reminded that these are only suggested values for domestic-type uses with ½-in. (13 mm) connections, and that actual demands for the fixtures and appliances being used in the proposed building should take preference. For example, the suggested shower value is 2.5 gpm (0.57 m^3/hr) and the bathtub flow rate is 8 gpm (1.8 m^3/hr). If the actual showers and baths being used have flow rates greater or less than these rates, then the actual values, not the values from Table 4-2, should be used. It is especially important to consider actual values in commercial, industrial, or institutional buildings and in cases where connections larger than ½-in. (13 mm) are used. Values for fixtures or appliances not listed in Table 4-2 should be obtained from the manufacturer.

Table 4-1 Pressure adjustment factors*

Working Pressure at Meter Discharge (*psi*)	Average Flow from 50 ft of ⅝-in. Hose and Sprinkler (*gpm*)	Pressure Adjustment Factor
35	6.7	0.74
40	7.2	0.80
50	8.1	0.90
60	9.0	1.00
70	9.8	1.09
80	10.5	1.17
90	11.2	1.25
100	12.1	1.34

*derived from Table 4-1 and 4-2 of Manual M22 (1975).

NOTE: To convert psi to kPa: psi × 6.89476; to convert gpm to m^3/hr: gpm × 0.227.

Table 4-2 Suggested fixture values based on 60 psi (414 kPa)

Fixture or Appliance	Suggested Fixture Value, *gpm*
Toilet (tank)	4
Toilet (flush valve)	35
Urinal (wall or stall)	16
Urinal (flush valve)	35
Bidet	2
Shower (single head)	2.5
Faucet (lavatory)	1.5
Faucet (kitchen sink)	2.2
Faucet (utility sink)	4
Dishwasher	2
Bathtub	8
Clothes washer	6
Hose connections (with 50 ft of hose)	
1/2 in. (13 mm)	5
5/8 in. (16 mm)	9
3/4 in. (19 mm)	12
Miscellaneous	
Bedpan washers	10
Drinking fountains	2
Dental units	2

NOTE: To convert gpm to m^3/hr: gpm × 0.227.

Demand. After the total fixture values have been determined, the results can be applied to demand curves, such as shown in Figures 4-1, 4-2, or 4-3. Similar curves developed by the utility or project engineer with locally obtained data or data from similar structures elsewhere should be considered by the utility. Notice that the demand curves are not linear. The reason for this pattern is that the accumulated maximum flow of one fixture type will always be greater than many fixture types operating in service. That is, the probability of all fixtures operating at one time diminishes as the number of fixtures or appliances increases. It is also critical to note that a fixture value in different types of customers will have different impacts on peak demands. The current figures only include three curves: one for residential suburbs, one for various commercial and institutional uses, and one for apartments, condominiums, motels, and trailer parks. There is no reason for not developing a much wider range of curves for more specific types of customers over time. The demands for supermarkets, office buildings, restaurants, and high schools could be separate curves altogether.

Sample Probable Domestic Demand Calculation
Hypothetical Apartment Complex (working pressure 80 psi)

Step 1. Calculate the demand from the Fixture Values

Fixtures/Appliances	Number	Fixture Value *gpm*	Total Fixture Value *gpm*
Toilets (tank)	205	4	820
Faucets (lavatory)	259	1.5	388
Dishwashers	138	2	276
Clothes washers	10	6	60
Faucets (kitchen)	165	2.2	363
Bathtubs	162	8	1,296
Showers	162	2.5	405
		TOTAL FIXTURE VALUE	3,608
		Demand (gpm) from Fig. 4.3	**80 gpm**

Step 2. Add in demand for hose bibs

(Number of hose bibs) × (Fixture value at 60 psi is 9 gpm)

In this example there is only one hose bib so: 1 × 9 = **9 gpm**

Step 3. Total probable demand

Add demand from step 1 and step 2 gpm **89 gpm**

Step 3. Apply pressure adjustment

Multiply total probable demand at 60 psi from step 3 by adjustment factor from Table 4.1.
Adjustment factor for 60 psi to 80 psi is 1.17.

In this example, the total probable demand is 89 gpm × 1.17 = **104.1 gpm**

NOTE: To convert gpm to m^3/h: gpm × 0.227, to convert psi to kPa: psi × 6.89476

The sample above provides an example of estimating the probable domestic demand for a hypothetical apartment complex with a working pressure at the meter outlet of 80 psi (548 kPa). This demand comes out at approximately 104 gpm (23.61 m^3/hr).

REFERENCES

Hunter, Roy. 1940. *Building Materials and Structures, Report BMS-65, Methods of Estimating Loads in Plumbing Systems*. Washington, D.C.: National Bureau of Standards.

Hunter, Roy. 1946. *Plumbing Manual Report, BMS-66*. New York: National Bureau of Standards.