Municipal Water Systems

Fire Hydrants and Potential Fees

November 11, 2020

Steven E. Cross, BS, CFO
Fire Management Consultant
The University of Tennessee
Municipal Technical Advisory Service

Municipal Technical Advisory Service
INSTITUTE for PUBLIC SERVICE

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Introduction

The State of Tennessee Fire Marshal's Office requested assistance in answering customer questions regarding municipal water systems and fire hydrant fees. UT MTAS conducted research using the American Water Works Association (AWWA) M1 Manual of Water Supply Practices to determine if there are recommended methods of developing a fee structure for fire protection.

When analyzing municipal water supply systems, fire protection services differ from any other services provided by the water utility. Without the need to provide for large volumes of water in a moment's notice, water systems would not have the need to plan for and provide infrastructure, like large water mains supplied by elevated storage tanks and/or high-volume pumps, to meet the needs of their customers.

With this extra capacity, comes extra costs. Based on the business model of the water purveyor, there can be a range of fees assessed that are associated with the extra capacity needed for fire protection. Some water purveyors assess no fee and others assess a range of fees. This research and report will attempt to outline some strategies for distributing the cost associated with the extra capacity needed for fire services.

Allocation of Extra Capacity Costs

Using the M1 Manual of Water Supply Practices published by the American Water Works Association (AWWA), it appears that there are three approaches listed in allocating the costs associated with fire protection to municipalities:

1. Allocating primary cost to general water service, with incremental costs allocated to fire protection service.
2. Allocating primary cost to fire protection service, with incremental costs allocated to general water service.
3. Allocating costs to general water service and fire protection service on a proportional basis.

Approach 1 allocates the primary costs to the water purveyor. The primary costs include items such as cost of larger water mains, larger water pumps, fire hydrants, valves, etc. associated with providing needed fire flow. Then the fire service would be allocated the incremental costs associated with hydrant maintenance, hydrant flushing, and hydrant flow testing.

Approach 2 is the opposite of approach 1. All the upfront costs are allocated to the fire service then the incremental cost associated with hydrants would be absorbed by the water purveyor.

Approach 3 allocates the cost to the water purveyor and fire service on a proportional basis. This means that the water purveyor is assessed for providing potable water and the fire service is assessed for the extra capacity components required to provide needed fire flow.

Costs Proportions

How do we determine the proportions and costs associated with the fire service? The AWWA M1 publication has an example whereas the water utility determined the extra capacity of the water utility to meet the needed fire flow requirements of the community would assess the public fire service for 71.5% and private fire service at 28.5% of the costs of the extra capacity. The proportion appears to have been based on the number of public vs the number of private fire connections. This report will focus on the public fire service proportion of the costs.

Extra Capacity Costs

One of the accepted methods of developing a cost associated with the extra capacity needed for fire services takes into consideration the system's annual water demand, the maximum-day demand, and maximum-hour demand. Referring to Figure 1, the base annual demand for water inside the city is 2,536,000-thousand gallons of water. This number is then multiplied times the fire service allocation ranging between 0.5% to 1.0% of the total demand to account for the part of the water used for fire services. In the example for this report, we chose 0.5% allocation for fire services. Using the basic demand of 2,536,000-thousand gallons, that equals 12,680,000 gallons of water.

We must now determine the maximum-day and maximum-hour demand on the system. Refer to the municipality's Insurance Service Office (ISO) Public Protection Classification Report to identify the needed fire flow in the community. This number will be used to complete the calculations for a specific community. For the example in this report, we will use 4,000 gallons per minute as the needed fire flow that must be sustained for a duration of 4-hours. This would equate to 240,000 gallons of water per hour and a total of 960,000 gallons of water over the 4-hours.

Customer Class	Base		Maximum Day			Maximum Hour			Equivalent Meters and Services
	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*	
Inside-City:									
Retail Service									
Residential	968,000	2,652	250	6,630	3,978	400	10,608	3,978	15,652
Commercial	473,000	1,296	200	2,592	1,296	325	4,212	1,620	1,758
Industrial	1,095,000	3,000	150	4,500	1,500	200	6,000	1,500	251
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
Outside-City:									
Wholesale service	230,000	630	225	1,418	788	375	2,363	945	34
Total system	2,766,000	7,578		16,100	8,522		28,943	12,843	17,695

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

Figure 1: Water Demand Records

Maximum-Day Units of Service

The maximum-day demand on the water system is calculated using the numbers we have identified. Using the same 4,000 gallons per minute needed fire flow for four hours, we determined we would need 960,000 gallons over 4-hours. Then we need to convert the annual gallons of water allocated to fire services of 12,680,00 to a daily usage. 12,680,000 / 365 = 35,000 (34,739.73) gallons per day. Now, we subtract 35,000 from 960,000 to calculate our 925,000-gallon maximum daily demand.

Maximum-Hour Units of Service

The maximum-hour demand on the water system is calculated using the numbers we have identified. Using the same 4,000 gallons per minute needed fire flow to make the following findings. 4,000 gallons per minute multiplied time 24-hours = 5,760,000 gallons per day. Now we subtract 925,000 maximum daily demand from the 5,760,000 to equal 4,800,000-gallon maximum hourly demand.

Distributing Costs

Using the calculations discussed previously and rate charts, we figure the cost allocations. Use Figure 2 as a reference on the cost per units, demands, etc. Base Demand at $7,281, Maximum Daily Demand at $62,196, Maximum Hourly Demand at $133,471, and Fire Protection at 58,100 for a total cost of service of $261,048.

To determine the per-hydrant charge AWWA M1 offers a method of using the total cost of service $261,048 subtract the Fire Protection of $51,800 = $209,248 then multiply times 71.5% (fire allocation) = $145,108 (Figure 3). In Figure 3 there is a typo in the "Number in Service" column. The correct number should be 1,155 instead of 1,115. Add the fire allocation of $145,108 to the Fire Protection of $58,100 = $203,208. This $203,208 is then divided by the number of fire hydrants in the jurisdiction to reveal the per-hydrant fee. In this example there were 1,155 which would equate to a $175.94 annually or $14.66 monthly per hydrant.

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

Figure 2: Unit Costs

	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

Figure 3: Number of Hydrants and Percentage of Fire Service Allocation

Conclusion

There appears to be no standard that requires a utility to charge fire fees to the municipality. Should the water purveyor and the municipality served agree to a fire fee, the fee should be justifiable to all parties based on accepted practices. The formula laid out in the AWWA M1 manual is complicated for a water utility layman, but it can be understood with explanation. In the example provided in this research the water utility has a demand of 2,535,000 thousand gallons of water annually with 1,155 fire hydrants on their system. Using the AWWA example, the utility would assess the municipality $203,208 annually which equals $175.94 annually per hydrant or $14.66 monthly per hydrant.

Reference:

Principles of water rates, fees, and charges (Fifth ed.). (2000). Denver, CO: American Water Works Association.

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