PUBLIC SERVICE COMMISSION OF WISCONSIN

INVESTIGATION INTO THE METHODS USED BY WISCONSIN'S WATER UTILITIES IN ALLOCATING PUBLIC FIRE PROTECTION (PFP) COSTS

Final Staff Report

Docket 5-WI-104

December 15, 2016

Division of Water, Telecommunications, and Consumer Affairs

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Appendices

1. Purpose of Investigation

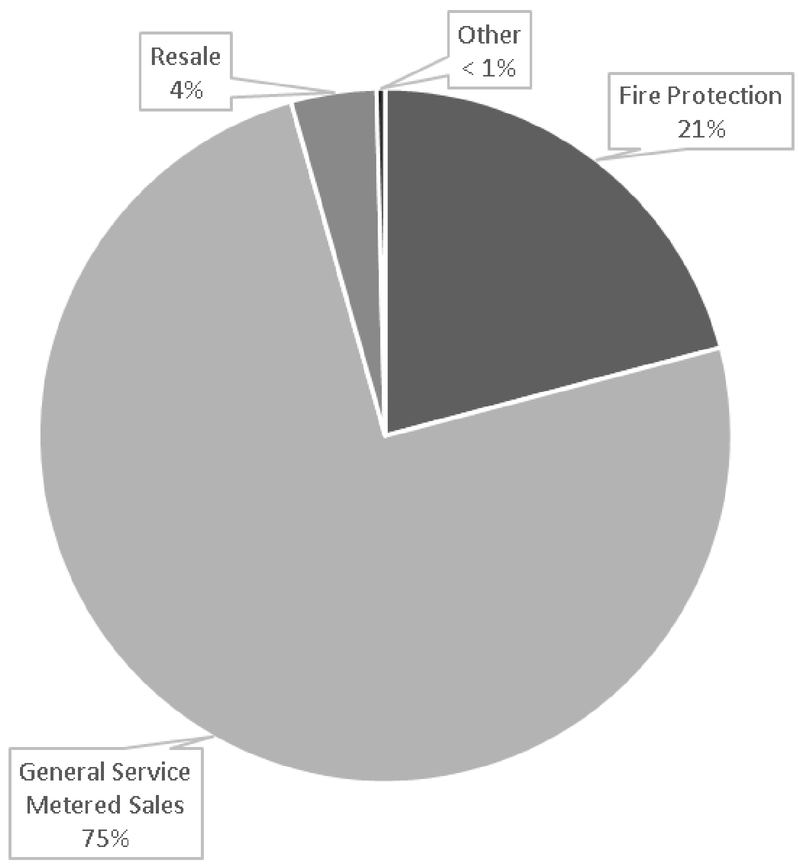
On October 30, 2014, the Public Service Commission of Wisconsin (Commission or PSC) issued its Final Decision in Docket 3720-WR-108, the "MWW, Milwaukee County, Wisconsin, for Authority to Increase Water Rates." (PSC REF#: 223601.) Order Point No. 14 of that decision included two parts. Part A stated that "the Commission shall open a generic investigation to study the methods of all water utilities in allocating public fire protection costs." Part B stated that "MWW and the Wholesale Customers shall work with Commission staff to further evaluate alternative methods for allocating fire protection costs for use in MWW's next rate case."

The following report addresses Part A by describing how the Commission currently computes the PFP charge, comparing that method with best practices used by other states, identifying the assumptions that underlie the Commission's cost-of-service model (PSC model), and determining if those assumptions are reasonable or not. The goal of this study is to provide information to the Commission on changes that could be made to the PSC model to ensure that the Commission's methods reflect reasonable assumptions and produce accurate PFP cost allocations. Also, it is hoped that this study will reduce the number of contested issues encountered in water rate cases. Part B will be addressed in a subsequent study.

2. Overview of the Public Fire Protection Charge

The Commission regulates 582 water utilities in Wisconsin. All but five of them are municipally owned. These 582 water utilities earned a total of $665 million in revenues in 2013, as shown in Figure 1. Approximately $140 million (21 percent) of those revenues were earned from fire protection charges. Since the PFP charge provides such a significant share of water utility revenues, it is important to make sure these charges are computed using the best methods available.

Figure 1. Wisconsin Water Utility Revenues in 2013
(Total Revenues of $665 million)



2.1 Definition of the PFP Charge

The PFP charge is a charge that covers the costs to augment the utility's water system in order to provide the high flows and pressures needed to fight fires.[1] These costs include a portion of the operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base attributable to the relevant water plant. The augmented water plant

[1] See comments by Municipal Environmental Group in PSC REF#: 286177

attributable to fire protection includes: wells, water treatment equipment, pumps, storage facilities, water mains, and hydrants. The cost of the water used to fight fires is not included as it is relatively insignificant compared to the cost of the related plant.

In many cases, if a water system did not have to provide the higher flows and required minimum system pressure needed to fight fires, its supply, storage and distribution infrastructure would be smaller and less costly to build, operate and maintain. Such a water system might need less supply capacity, less pumping capacity, smaller storage facilities, smaller diameter water mains, and few hydrants (flushing hydrants only). For many water systems, the addition of fire flow capacity results in additional costs to build and operate the water systems. For example, Wisconsin Admin Code § NR 811.70(5) requires that utilities install minimum 6-inch diameter water mains for fire protection purposes. Many small communities could operate with 4-inch diameter mains or smaller if they did not need to provide the higher flows required to fight fires.

The Commission has traditionally designed water rates to assign the cost to the cost-causer. Therefore, it has been the Commission's standard of practice to identify the PFP cost-of-service, and compute corresponding PFP rates, that assign costs to the appropriate users. The PFP charge is not simply a "hydrant rental" fee. The cost of the fire hydrants is only a small portion of the total cost of providing PFP service. It is also important to note that the PFP charge has no relationship with funding the fire department.

Costs associated with the augmented plant used to provide the high pressures and flows discharged at public hydrants are paid through Schedule F-1, Public Fire Protection Service. Costs associated with augmented plant to provide the high pressures and flows discharged through an unmetered private fire protection service (sprinkler system) are paid through Schedule Upf-1, Private Fire Protection Service – Unmetered (see Section 7).

2.2 Discussion of the PFP and General Service Customer Classes

A perfect cost-of-service model would allocate appropriate costs to each individual customer based on their unique demand patterns and use of the water system. Unfortunately, it is cost prohibitive to develop such a model for each water customer. Therefore, customers are aggregated into groups with similar demand patterns. These groups, called "customer classes," are specifically authorized by Wis. Stat. § 196.02(2).

The PSC model identifies the following customer classes: residential, multi-family, commercial, industrial, public authority, and the PFP customer class. The first five customer classes use water almost daily in identifiable demand patterns. Each one represents a group of specific water customer accounts. For that reason, these five customer classes are referred to as general service customer classes. In contrast, the PFP customer class is very different from the other five customer classes. The PFP customer class is essentially a standby service. It is not related to the water use of each customer, but rather the construction characteristics of the buildings found in the community. The PFP demand does not follow any identifiable demand pattern, as the water is only needed when and wherever a fire occurs. Therefore, this report recognizes PFP as a "customer class" that deserves special consideration in the cost-of-service model, different from the modeling performed for the general service customer classes.

2.3 Identifying the Demand that Controls the Water System Design

When evaluating the capacity of a water system, engineers consider the water system's ability to meet demand and its ability to provide reliable service. Typically, the engineer will make sure that the firm supply capacity (supply capacity with largest pumping unit out of service) plus effective storage meets or exceeds the 1)maximum day demand plus fire demand, or 2) maximum hour demand, whichever is greater. The maximum day plus fire demand represents demands created by both the general service and PFP customer classes. The maximum hour demand represents a demand created by only the general service customer class.

Then the engineer will evaluate the reliability of the water system. This assessment entails evaluating how the water system performs under various operating scenarios including: supply source or pump failure, maintenance of storage facilities, drought, etc. Since there is no universally accepted definition of water system reliability, water system engineers use their engineering judgement, state code requirements and standard industry engineering practice. (PSC REF#: 232974 and PSC REF#: 279866.) See Appendix A for an example of a water system capacity analysis developed by Andrew Jacque of Town and Country Engineering, Inc.

Over the life of a water system, infrastructure is being added and replaced based on estimates of current and future water system demand and reliability. Patrick Planton of SEH, Inc. states that, master planning for water utilities typically uses a 20-year planning horizon. Supply, treatment and storage projects can take years to implement, and some facilities have useful lives in excess of 50 years. Therefore, engineers need to take future demands and water supply needs into account. As water demand grows incrementally over years, a utility typically is only able to increase supply in large increments (e.g., new supply well that produces 1,000 gpm). (PSC REF#: 279873.)

Unfortunately, even the best planners and engineers cannot predict the future with certainty, so they may overestimate the water system capacity that a community needs in the future. A community's general service water demand may face unforeseen changes due to the loss of a large industrial customer. A lengthy economic downturn along with more water efficient appliances may reduce general service demand. As a result, some existing water systems may have excess capacity that was designed to meet general service demand that no longer exists.

The PSC cost-of-service model assumes that the cost to provide all extra capacity not required to meet a community's current water demand is to be allocated to both the general service customer classes and the PFP customer class based on their proportionate share of the current demand volume. Implementing cost-based rates requires an identification or estimate of the capacity costs attributable to the general service customer classes versus the PFP customer class. In doing so, it is helpful to consider how the size of the utility should affect whether the general service demand or the fire demand controls the design of the water system.[2] For regulatory purposes we can identify whether a utility's total demand is controlled by general service (maximum hour) or by PFP (maximum day plus fire demand). The non-controlling feature is redundant.

Wisconsin's 582 regulated water utilities are classified by size into Class AB (serving more than 4,000 customers), Class C (serving from 1,000 to 4,000 customers), and Class D (serving fewer than 1,000 customers). Figure 2 shows the number of utilities in each class.

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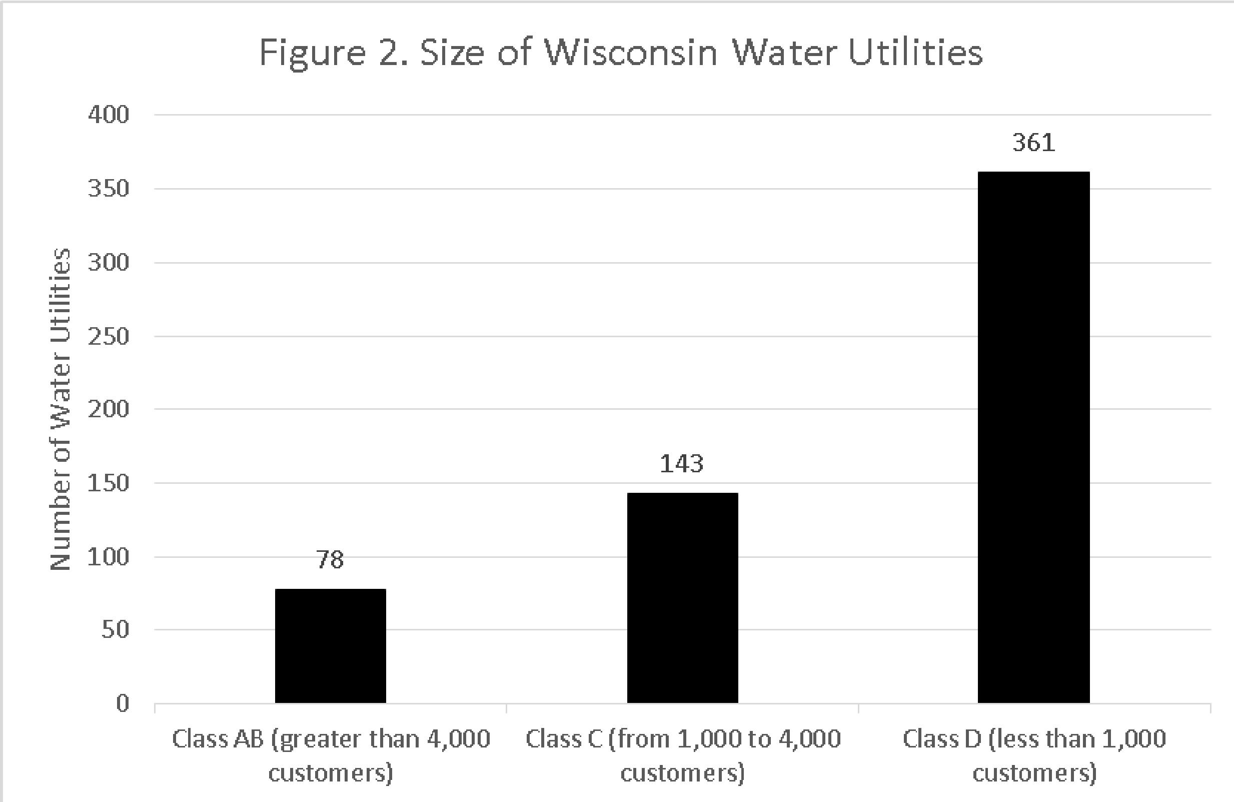
[2] See comments by Municipal Environmental Group in PSC REF#: 286177



In smaller water systems (Class D), the fire flow typically represents the largest potential demand on the system. In larger systems (Class AB), the maximum hour demand for general service may be larger than the fire flow requirements, therefore maximum hour demand controls the overall design and operation of the water system. For example, based on information from the most recent rate case, the Orfordville Municipal Water Utility (Class D) has a maximum day plus fire flow demand of 1,178 gpm (178 gpm + 1,000 gpm). The maximum hour demand is 250 gpm, which is much less than the maximum day plus fire flow condition. This analysis indicates that the maximum day plus fire flow demand is the controlling design condition of the water system. In contrast, Milwaukee Water Works has a current maximum day plus fire flow demand of 120,982 gpm (103,020 gpm plus 17,962 gpm). The maximum hour demand is 133,814 gpm. In this case, the maximum hour demand for general service would be the controlling condition for the design and operation of the Milwaukee water system. The PSC cost-of-service model uses the same methodology to compute PFP costs, regardless of whether the fire flow demand controls the design of the water system or not. Figure 3 shows a plot of the maximum day plus PSC fire flow demand versus number of customers and also a plot of the maximum hour demand versus number of customers. This graph is based on 218 water utilities in Wisconsin that have requested a full rate case since 2006. The data used to make the graph is included in Appendix B.

Linear trend lines were computed and are also shown on the graph. Figure 4 shows a detail of the same plot where the trend lines cross. Based on this analysis, the intersection of the two trend lines is at 30,437 customers. Therefore, when PSC assumptions on a utility's fire flow demand are used, it appears that the maximum hour demand is the controlling demand condition for water systems with more than 30,000 customers. There are six water utilities in Wisconsin where the maximum hour demand is greater than the maximum day plus fire flow. Five of these have more than 30,000 customers: Kenosha Water Utility (30,962 customers), Racine Water Works Commission (33,981 customers), Green Bay Water Utility (35,728 customers), Madison Water Utility (66,416 customers), and Milwaukee Water Works (162,373 customers). The sixth utility is the Manitowoc Public Utility (13,644 retail customers) that serves a very large wholesale population. Possible applications of this analysis will be discussed further in Section 4. If the analysis is performed using a different source for the fire demand data, then the intersection of the trend lines may change as discussed in Section 6.4.

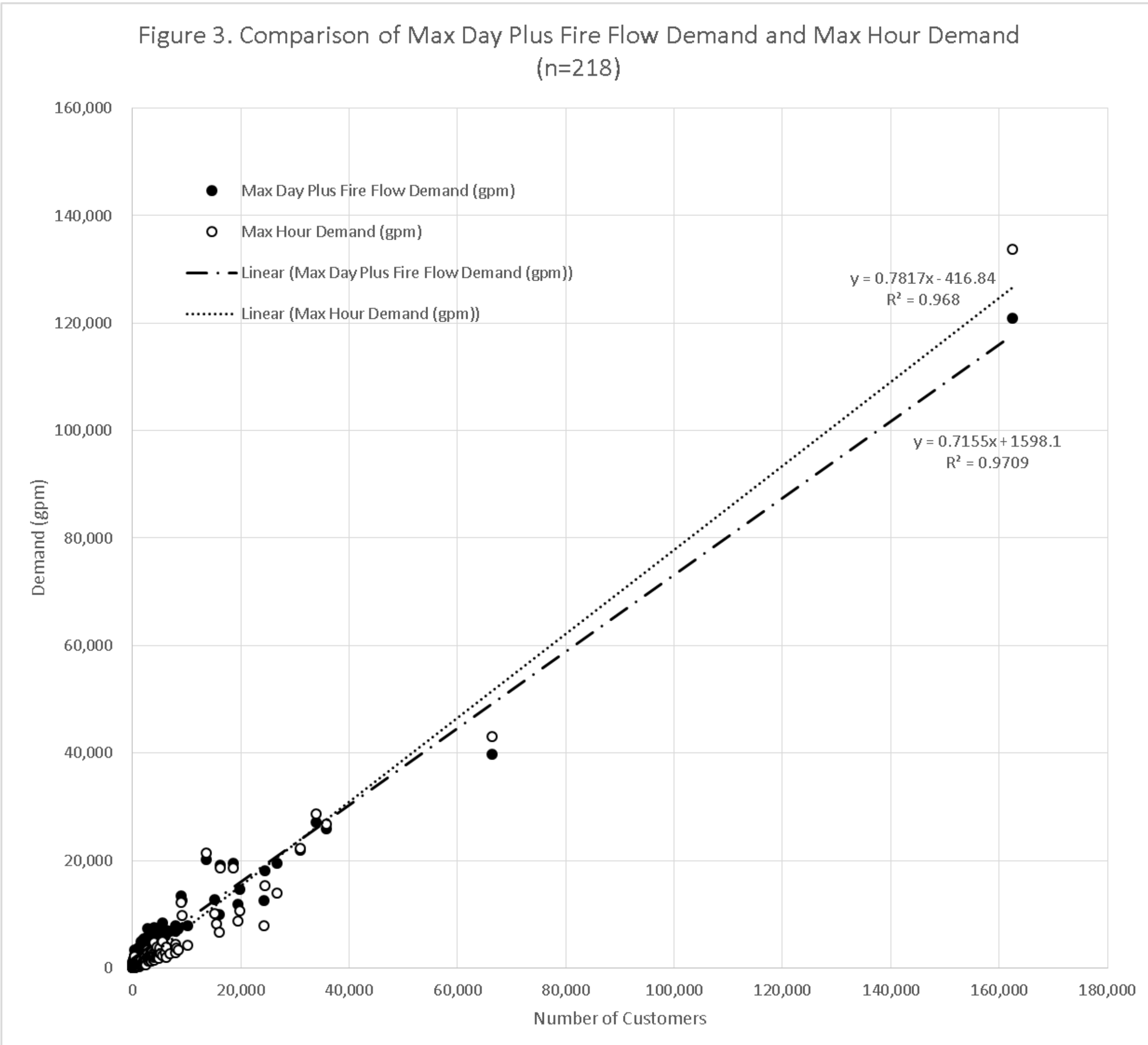
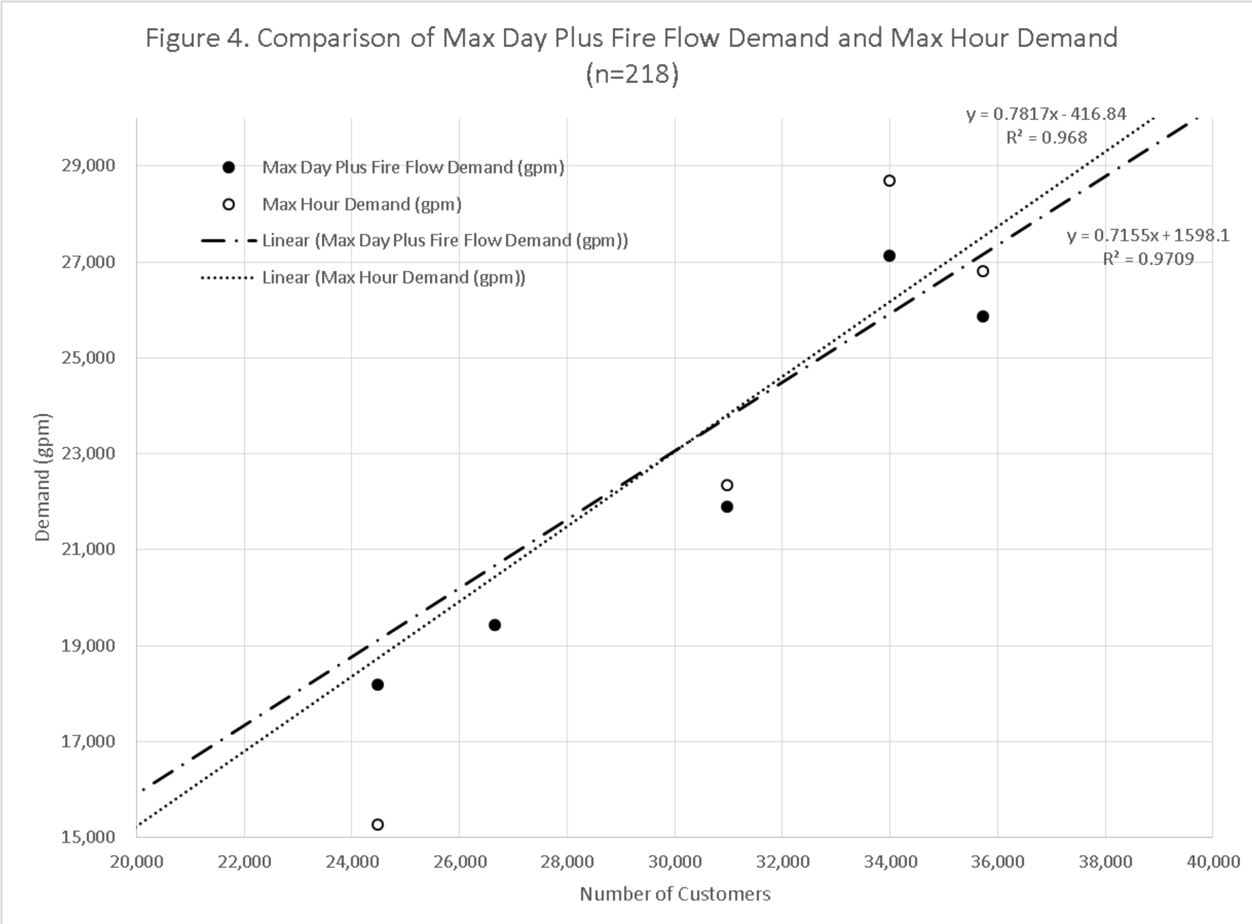


Figure 3. Comparison of Max Day Plus Fire Flow Demand and Max Hour Demand
(n=218)
Max Day Plus Fire Flow Demand (gpm)
Max Hour Demand (gpm)
Linear (Max Day Plus Fire Flow Demand (gpm))
Linear (Max Hour Demand (gpm))
y = 0.7817x - 416.84
R² = 0.968
y = 0.7155x + 1598.1
R² = 0.9709
Demand (gpm)
Number of Customers
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
180,000

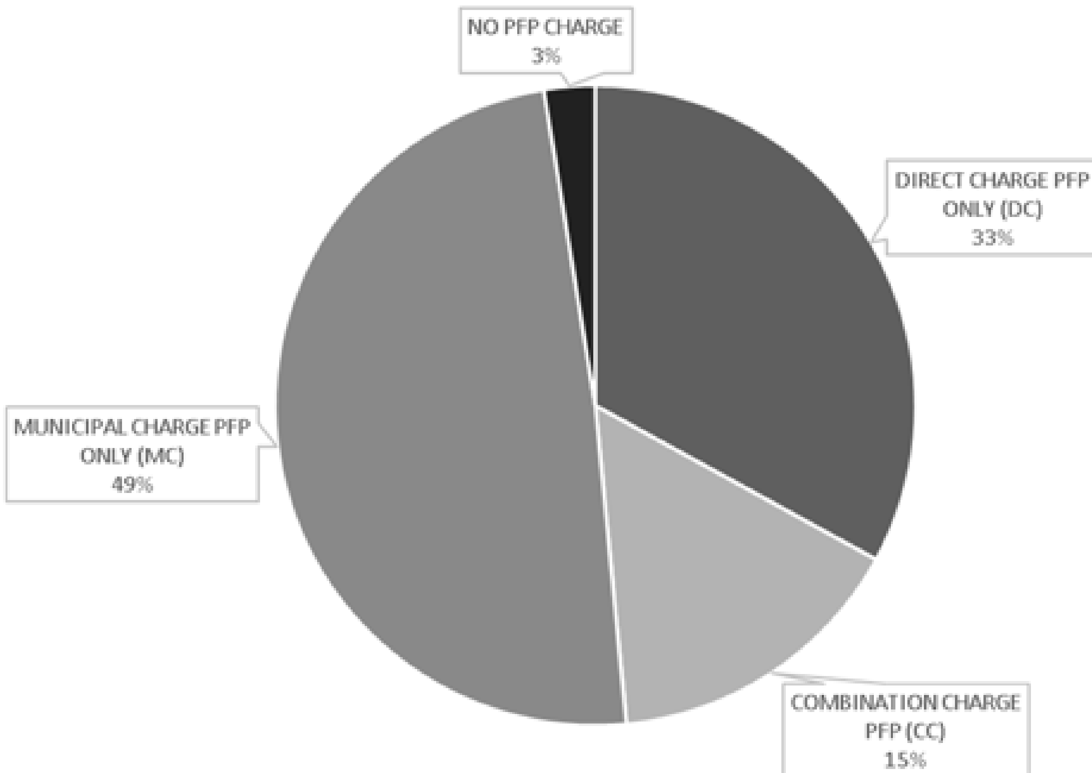


2.4 Types of PFP Charges

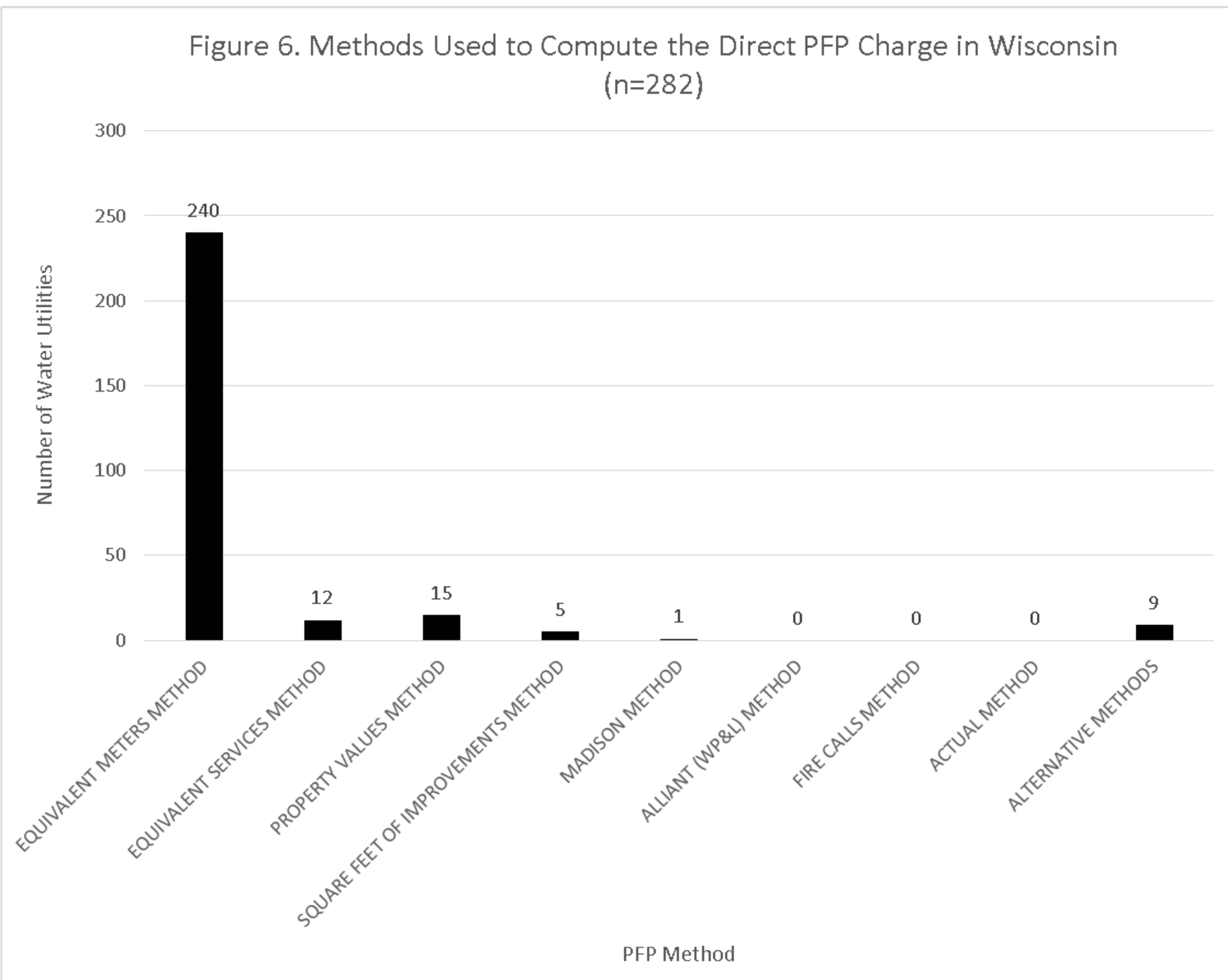
Prior to 1988, all water utilities in the state collected the PFP cost-of-service from the local government through a "municipal charge." The local government then recovered the municipal charge through the tax levy. In 1988, legislation was enacted that gave the governing body of any city, village, or town the option of collecting the PFP charge either through the tax levy ("municipal charge"), as a "direct charge" on general service water customer bills, or as a combination of these two options.

Figure 5 shows the distribution of various types of PFP charges among Wisconsin's 582 regulated water utilities. There are 285 water utilities that use only the municipal PFP charge (MC), 192 that use only the direct PFP charge (DC), 90 utilities that use a combination of the municipal and direct charges (CC), and 15 utilities that have no PFP charge. A list of the regulated water utilities in Wisconsin and the type of PFP charge that they employ is found in Appendix C.

Figure 5. Type of PFP Charges for Wisconsin Water Utilities (n=582)



The Commission has permitted water utilities to choose between eight preapproved methods for computing direct PFP charges: equivalent meters method, equivalent services method, property values method, square feet of improvements method, Madison method, Alliant Method, fire calls method, and the Actual method. The last three methods are not currently being used. In addition, the Commission has allowed utilities to propose their own "alternative methods" for computing direct PFP charges. Any alternative methods must be approved by the Commission. Figure 6 shows each approved method and its frequency of use. This analysis is based on the 282 water utilities in Wisconsin that recover their PFP cost either by using a direct PFP charge where all of their PFP cost is collected directly through the water bills, or a combination PFP charge where some of the PFP costs are collected through a municipal charge, and the remainder is collected through a direct charge on the water bills. The equivalent meters method is far more popular than any of the other approved methods.



2.5 Statutes, Administrative Code, and Policies for the PFP Charge

The PSC's authority to regulate water utilities was created in 1907 by the Railroad Commission and reinforced in 1931 when the PSC came into existence. Prior to 1988, water utilities collected the cost of PFP by charging a "municipal charge" to the town, village, or city. The municipality then recovered this money through property taxes. In 1988, the Wisconsin State Legislature passed Wis. Stat. § 196.03(3)(b), authorizing direct charges and combination charges for public fire protection. Subsequently, the Commission issued an order in Docket 05-WI-100 that provided water utilities with a list of preapproved methods for computing a direct charge for PFP. Since 1988, approximately one half of Wisconsin's 582 regulated water utilities have shifted all or a portion of the PFP cost to direct charges on the water bill. Some utilities made this change to provide more room under the property tax levy limit. Others made this change in recognition of the fact that, as their communities used less water, more of the excess supply capacity cost was being allocated to the PFP charge. Although communities in the latter category were not building any new plant to serve the PFP customer class, they were still seeing an increase in the municipal PFP charge.

In 1994, the Court of Appeals of Wisconsin ruled that a charge for fire protection services under 196.03(3)(b) is a fee and not a tax, and therefore the charging of a PFP fee against a church is constitutional. *City of River Falls v. St. Bridget's Catholic Church of River Falls*, 182 Wis. 2d 436, 513 N.W.2d 673 (Ct. App. 1994).

In 2013, the Wisconsin State Legislature enacted Wis. Stats. § 66.0602(2m)(b). This statute provides that if a municipality adopts a new fee or a fee increase, on or after July 2, 2013, for covered services which were partly or wholly funded in 2013 by the property tax levy, that municipality must reduce its levy limit in the current year by the amount of the new fee or fee increase, less any previous reductions. This requirement does not apply if the municipality adopts a resolution that the levy limit should not be reduced and the resolution is approved in a referendum. For most communities, this statute effectively eliminated the shifting of the PFP cost from a municipal charge to a direct charge. As a result, Wisconsin's water utilities that rely on a municipal charge or a combination charge (about 64% of the state's water utilities) can expect to see a steady increase in their municipal PFP charges over the coming years for the reasons discussed above. This increase in the municipal charge may apply pressure on their levy limits, forcing reduced spending on other municipal services in order to pay the PFP charge if the municipality is already at its levy limit. The effect of this legislation has a particularly large impact on smaller communities. Approximately 29 percent of Class AB utilities rely on the municipal charge or combination charge, while 82 percent of Class D utilities rely on either the municipal charge or combination charge.

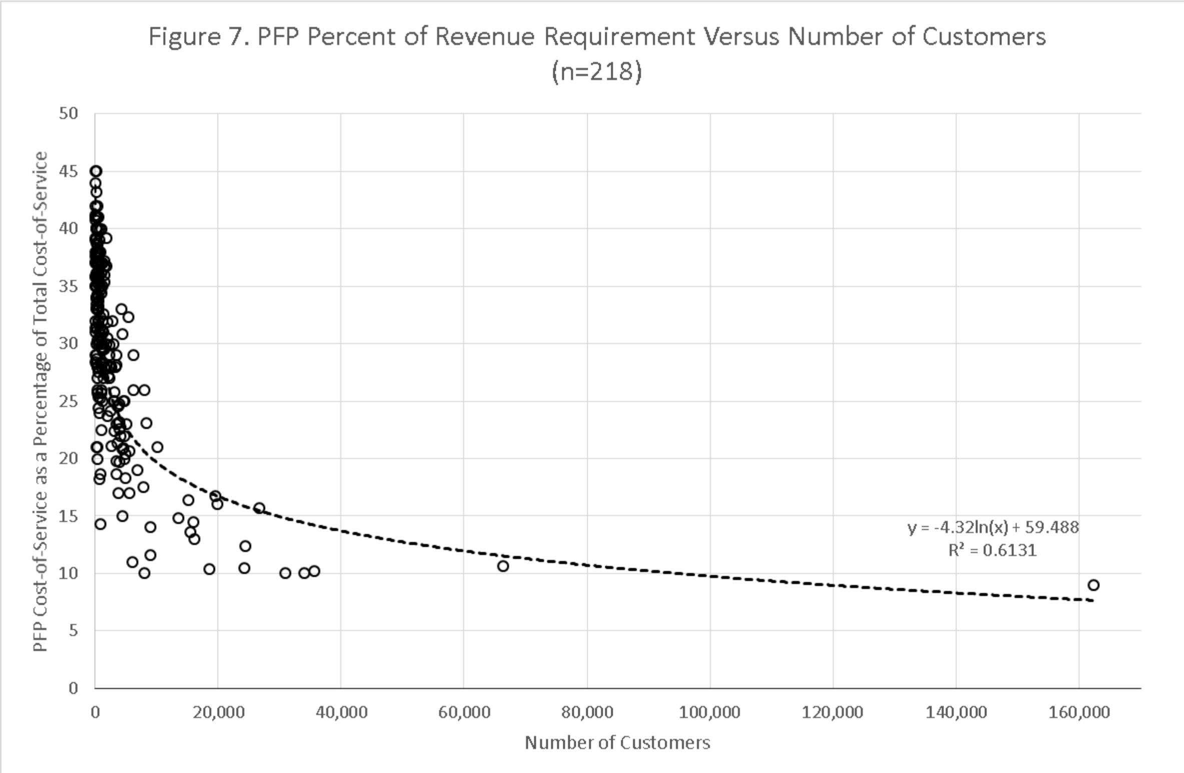
For illustrative purposes only, let's consider the Orfordville Municipal Water Utility. Currently it bills the Village of Orfordville an annual public fire protection charge of $88,602. Suppose the Orfordville Municipal Water Utility's next cost-of-service study results in a $20,000 increase to the PFP charge, and this exceeds the Village's levy limit. As the Village of Orfordville is already at its levy limit, it has three choices for handling this PFP increase: 1) It may pay the additional $20,000 using the Village's general fund (and proportionately reducing funding to other Village services); 2) It may shift the $20,000 increase to the water customer's bill as a direct charge (and proportionately reduce the Village's levy limit); or 3) It may shift the $20,000 (or more) to the water customer's bill as a direct charge and adopt a resolution for approval in a Village-wide referendum stating that the levy limit should not be reduced.

3. Public Fire Protection Cost Sensitivity Using the PSC Model

The Commission uses the base extra capacity cost-of-service and rate design model as included in the American Water Works Association (AWWA) Manual M1, 6^{th} Edition. The cost-of-service is based on the “base extra capacity” model. Once the model computes the cost-of-service for the PFP customer class, that amount is recovered through PFP rates. Characteristics of the resulting PFP cost-of-service are discussed in the following paragraphs.

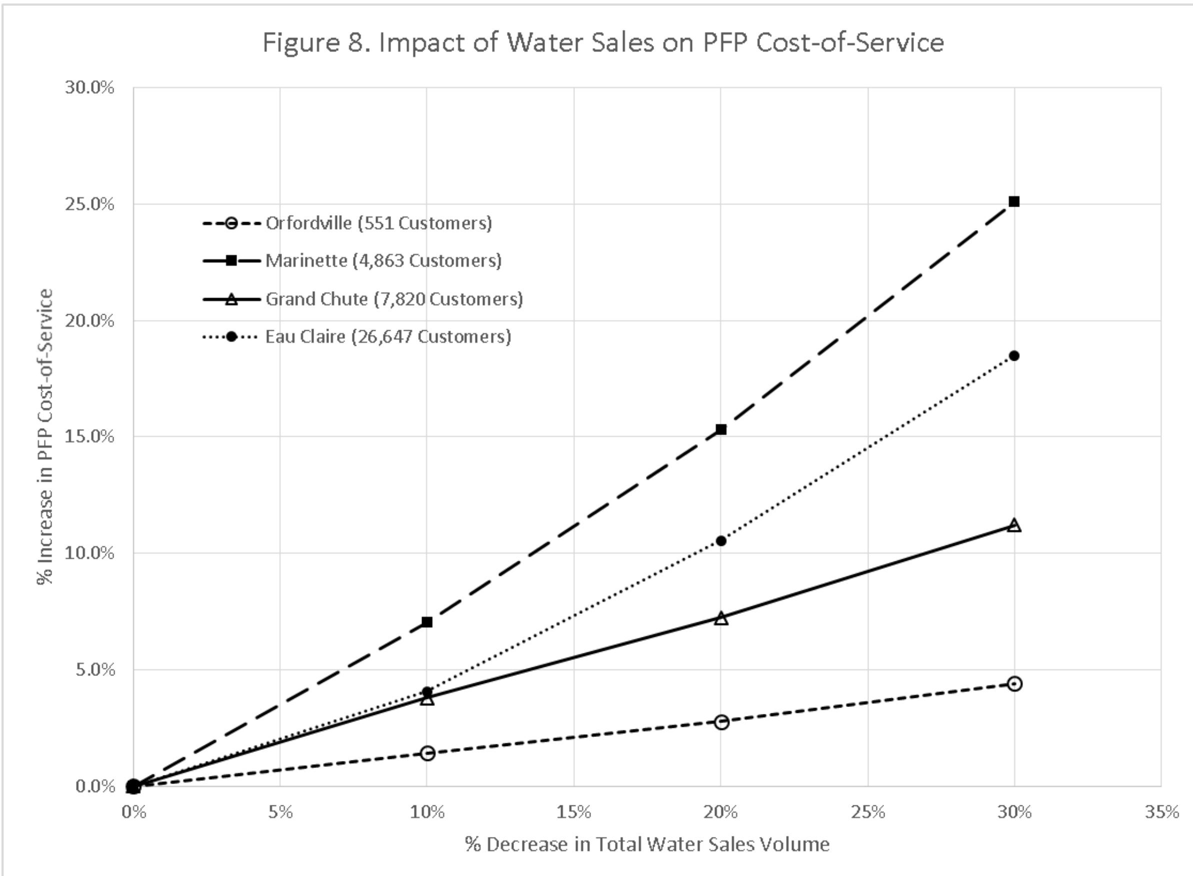
3.1 Relationship of Utility Size to the PFP Cost-of-Service

Based on the PSC cost-of-service model, the smaller the water utility (the fewer number of customers), the higher the cost of PFP as a percentage of the total cost-of-service. As shown in Figure 7, the PFP charge ranges from 9 percent of a water utility’s total annual cost-of-service (Milwaukee Water Works) to 45 percent of a water utility’s service costs (Tony Municipal Water Utility). Figure 7 is based on cost-of-service data from March 2006 to the present. This data is based on cost-of-service studies for 218 of Wisconsin’s 582 regulated water utilities. The data are included in Appendix D.



3.2 Relationship of Water Sales to the PFP Cost-of-Service

Due to the way the PFP customer class is calculated in the Commission's cost-of-service model, the PFP cost increases as the general service consumption (consumption from the residential, commercial, industrial, and public authority customer classes) decreases. From 2007 to 2014, there has been a decline in average residential water use in Wisconsin of almost 13 percent (2014 Wisconsin Water Fact Sheet, Public Service Commission of Wisconsin). As utility customers reduce water usage over time (e.g., through increased use of water saving appliances, industrial water reuse and process changes, and other efficiency improvements), the PFP cost-of-service increases. To illustrate this relationship, Commission staff ran the cost-of-service model for four sample utilities of various sizes. The PSC cost-of-service model for each utility was run with incrementally lower water sales, while all other parameters were held constant. The resulting plot of the percent increase in the PFP cost-of-service versus the percent decrease in total water sales is shown in Figure 8. The data are found in Appendix E.

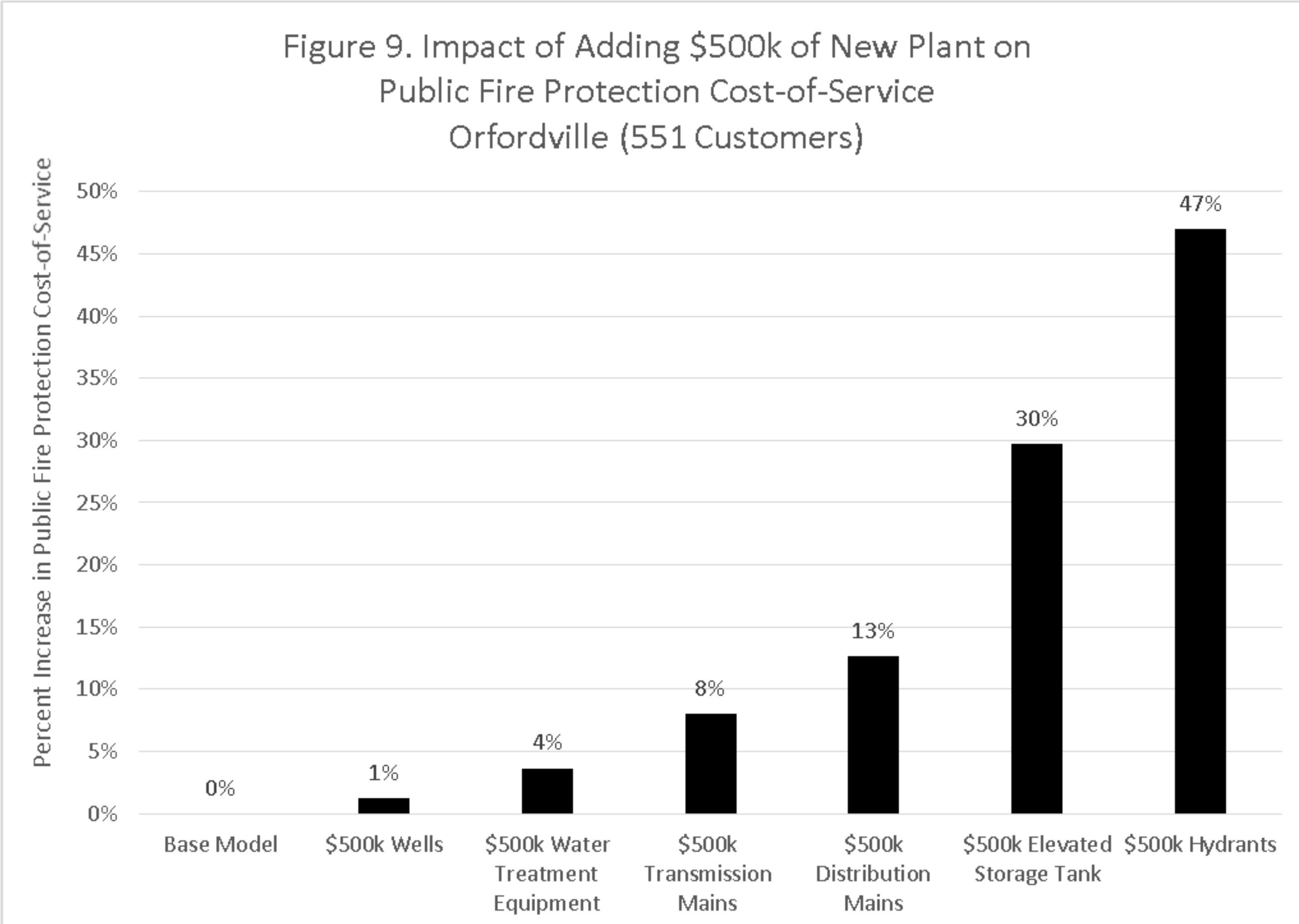


Reduction in water demand causes incremental increases in available water supply capacity. As a result the water system may be over designed for current conditions and perhaps over designed even for the foreseeable future. In cases where general service use decreases, the PSC model allocates a portion of the excess supply capacity costs to the PFP cost-of-service. Is it reasonable to allocate excess supply capacity costs to the PFP customer class, or should it be allocated only to the general service customers? This question will be discussed in more detail in Section 4.

3.3 Relationship of New Plant Additions to PFP Cost-of-Service

The PFP cost-of-service for a particular water utility may increase due to the additions of new plant. Wells, water treatment technology, booster pumping equipment, transmission mains, distribution mains, elevated storage tanks/standpipes/reservoirs, and hydrants all have some role to play in meeting fire demand. The relative importance of each of these components in meeting fire demand depends on the design of the particular water system.

The Orfordville Municipal Water Utility cost-of-service model is used as a "base model" to represent a small water utility without any new plant additions. Figure 9 shows how the addition of different types of new plant can increase the Orfordville PFP cost-of-service. By adding $500,000 in new wells to the PSC model, the PFP cost-of-service increased by 1 percent compared to the base model (without any new improvements). By adding $500,000 in new hydrants, the PFP cost-of-service increased by 47 percent compared to the base model.



4. PSC Cost-of-Service and Rate Design Model

4.1 Overview of the PSC Model

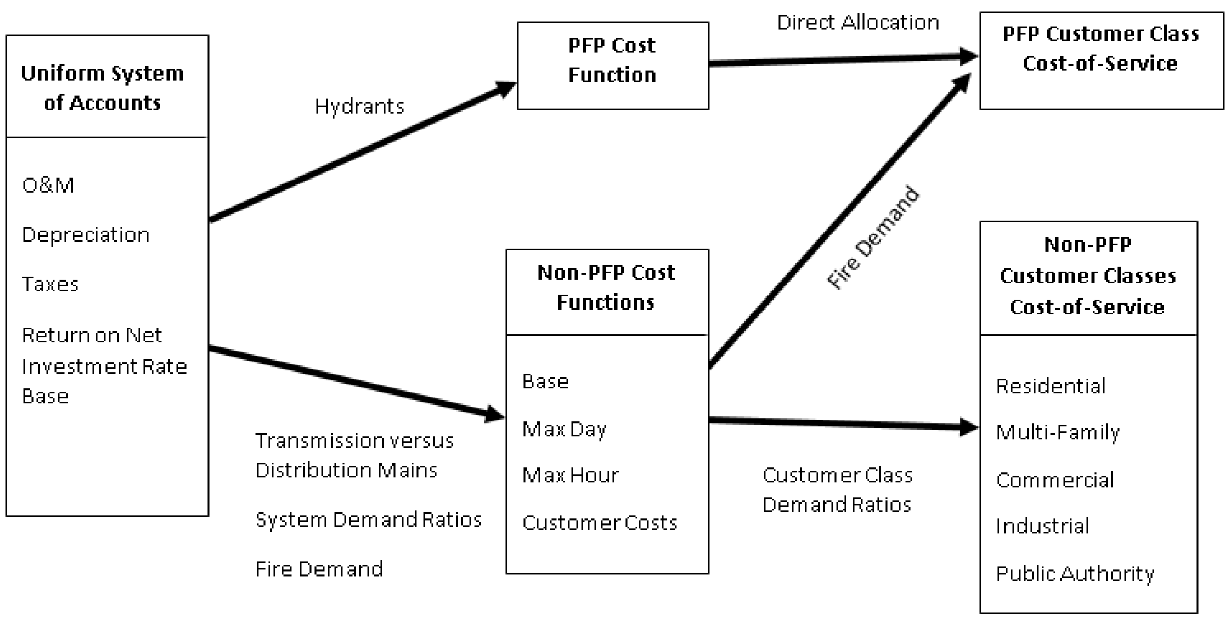
The Commission uses the base extra capacity cost-of-service model as presented in the AWWA Manual M1, 6th Edition. The PSC began using the AWWA-Base Extra-Capacity cost-of-service model in the l970's, first with the Milwaukee Water Works and then applied to all of the regulated water utilities in Wisconsin. (*See e.g.*, PSC REF#: 276315.)

The PSC model relies on the PSC's uniform system of accounts to categorize utility plant and expenses. Each plant and expense account pertains to one of the following operating costs:

operation and maintenance expenses, depreciation expenses, taxes, and return on the net investment rate base. These accounts are estimated for the test year, and their totals are allocated to the following service cost functions: base system, base distribution, maximum day system, maximum hour distribution, maximum hour storage, billing, equivalent meter, equivalent services, and public fire protection. Service cost functions are then allocated among customer classes: residential, multi-family, commercial, industrial, public authority, and public fire protection. Some utilities may have additional customer classes such as wholesale customers or a separate class for irrigation meters.

The hydrant accounts are allocated directly to the PFP cost function, which is then directly allocated to the PFP customer class. The non-hydrant accounts are allocated to the non-PFP cost functions. A portion of the amounts for the base system, base distribution, maximum day system, maximum hour distribution, and maximum hour storage cost functions are then allocated to the PFP customer class based on the fire demand maximum day and maximum hour PFP volume relative to the maximum day and maximum hour volumes computed for the other customer classes using their customer demand ratios. The total PFP customer class is then used to compute the PFP rates. Note that the fire demand and duration affects both the amount of costs allocated to the maximum day and maximum hour cost functions, and the share of those functions allocated to the PFP customer class. The non-PFP cost functions are affected by the system demand ratios and the proportion of transmission versus distribution mains (where there is not more specific cost data). Figure 10 summarizes how the PSC cost-of-service model computes the PFP cost-of-service.

Figure 10. Public Service Commission Cost-of-Service Model



4. 2 Comparison of the PSC Model with AWWA M1 Manual Model

The AWWA M1 Manual differs slightly from PSC cost-of-service model in how it allocates base and maximum hour costs to the PFP customer class. The PSC model allocates 1 percent of the total annual sales volume to the PFP customer class. This is a nominal amount that estimates the volume of water used to fight fires in the community. The AWWA M1 Manual does not allocate any base volume or cost to the PFP customer class. The PSC and AWWA Manual M1 models also differ in the way that they compute the PFP customer class maximum hour volume. The AWWA M1 Manual computes the maximum hour volume based on the fire demand over 24 hours. The PSC method computes the maximum hour volume over a one-hour period. Lastly, the AWWA M1 Manual computes maximum hour extra capacity to be that which is over and above the average hour on the maximum day, while the PSC model considers maximum hour extra capacity to be that which is over and above the average hour on the average day. Figure 11 identifies some of the differences between the two models.

Figure 11. Comparison of AWWA Manual M1 and Public Service Commission of Wisconsin Base Extra Capacity Models

Table III.2-1 **M1 Manual Model (Source: AWWA Manual M1, 6th Edition, p. 79)**

Line No.	Customer Class	Base Units: Annual Use, 1,000 gal	Base Units: Average Rate, 1,000 gpd	Maximum-Day Units: Peaking Factor, %	Maximum-Day Units: Total Capacity, 1,000 gpd	Maximum-Day Units: Extra Capacity, 1,000 gpd	Maximum-Hour Units: Peaking Factor, %	Maximum-Hour Units: Total Capacity, 1,000 gpd	Maximum-Hour Units: Extra Capacity, 1,000 gpd	Customer Units: Equivalent Meters & Services	Customer Units: Bills
	Inside-City:										
	Retail Service										
1	Residential	968,000	2,652	250	6,630	3,978	400	10,608	3,978	15,652	185,760
2	Commercial	473,000	1,296	200	2,592	1,296	325	4,212	1,620	1,758	14,640
3	Industrial	1,095,000	3,000	150	4,500	1,500	200	6,000	1,500	251	420
4	Fire Protection		0		840	840		5,040	4,200		
5	Total Inside City	2,536,000	6,948		14,562	7,614		25,860	11,298	17,661	200,820

M1 Manual does not allocate any base flow to PFP (0%), while PSC model allocates 1% of annual sales to PFP base flow

M1 Manual computes Max Day PFP Allocator as:
=3,500 gpm x 60 min x 4 hours
= 840,000 gpd
PSC model computes Max Day PFP Allocator same as M1 Manual

M1 Manual computes Max Hour PFP Allocator as:
=3,500 gpm x 60 min x 24 hours
= 5,040,000 gpd
While PSC model computes Max Hour PFP Allocator as:
=3,500 gpm x 60 min x 1 hours
= 210,000 gallons

Fire Demand
3,500 gpm at 4 hours

PSC Model – Schedule 9

PSC SCHEDULE 9 - CUSTOMER CLASS DEMAND RATIOS

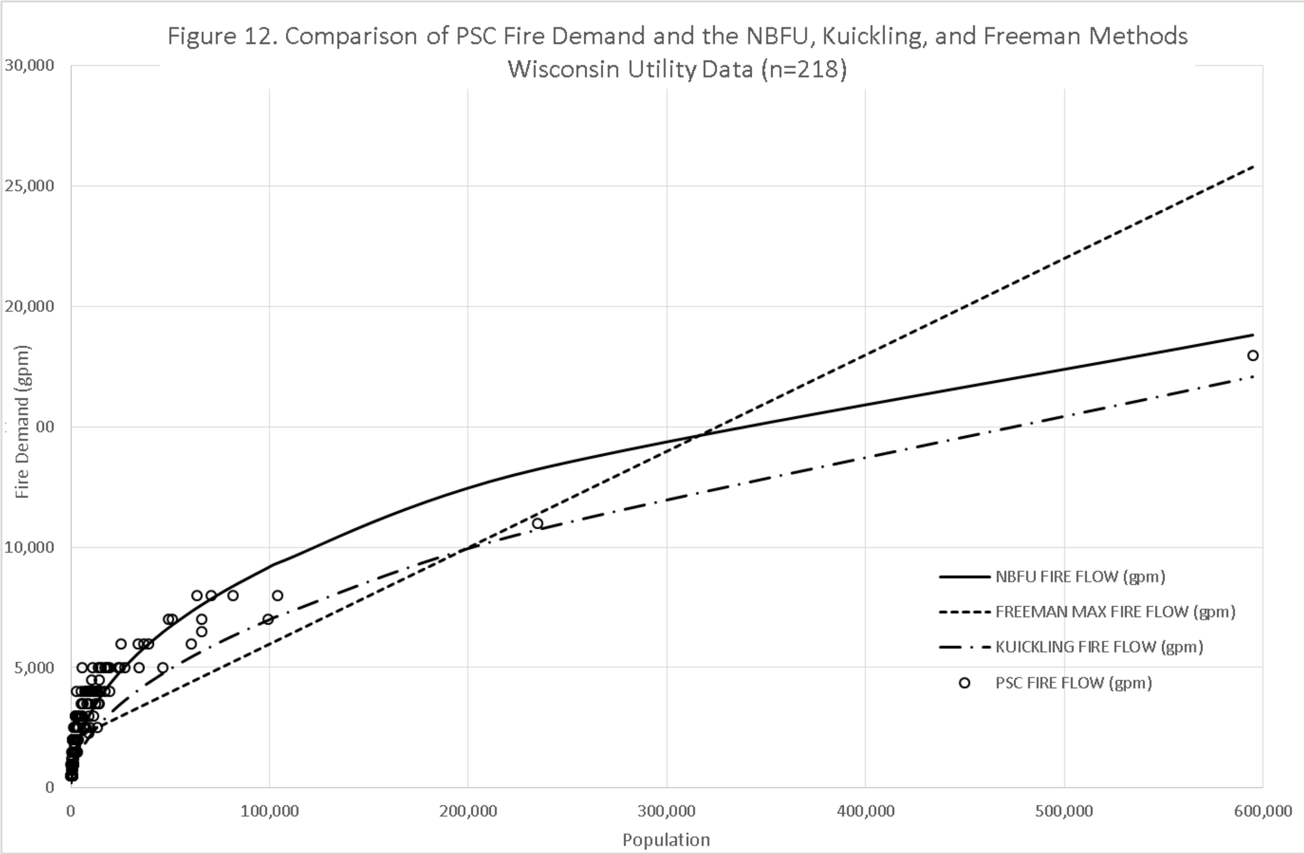
CUSTOMER CLASS	Annual Volume 1,000 Mgal	Average Day Volume Mgal	BASE COSTS: Percent (%)	BASE COSTS: System Adjusted Percent (%)	BASE COSTS: Distribution Adjusted Percent (%)	Extra Capacity Ratio	EXTRA-CAPACITY MAX DAY DEMAND: Volume Rate Mgal Per Day	EXTRA-CAPACITY MAX DAY DEMAND: Percent (%)	EXTRA-CAPACITY MAX DAY DEMAND: System Adjusted Percent (%)	EXTRA-CAPACITY MAX DAY DEMAND: Distribution Adjusted Percent (%)	Extra Capacity Ratio	EXTRA-CAPACITY MAX HOUR DEMAND: Volume Rate Mgal Per Hour	EXTRA-CAPACITY MAX HOUR DEMAND: Percent (%)	EXTRA-CAPACITY MAX HOUR DEMAND: System Adjusted Percent (%)	EXTRA-CAPACITY MAX HOUR DEMAND: Distribution Adjusted Percent (%)	EXTRA-CAPACITY MAX HOUR DEMAND: Storage Adjusted Percent (%)
Residential	968,000	2,652,055	37.79%	37.79%	37.79%	1.50	3,978,08[illegible]	52.25%	52.25%	52.25%	3.00	331,50[illegible]	42.07%	42.07%	42.07%	42.07%
Multifamily Residential	0	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00%
Commercial	473,000	1,295,890	18.44%	18.44%	18.44%	1.00	1,295,8[illegible]0	17.02%	17.02%	17.02%	2.25	121,4[illegible]0	15.42%	15.42%	15.42%	15.42%
Industrial	1,095,000	3,000,000	42.75%	42.75%	42.75%	0.50	1,500,[illegible]00	19.70%	19.70%	19.70%	1.00	125,[illegible]00	15.86%	15.86%	15.86%	15.86%
Public Authority	0	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00	0	0.00%	0.00%	0.00%	0.00%
Public Fire Protection	25,614	70,174	1.00%	1.00%	1.00%		840,000	11.03%	11.03%	11.03%		210,000	26.65%	26.65%	26.65%	26.65%
TOTALS	2561,614	7,018,119	100%	100%	100%		7,613,973	100%	100%	100%		787,997	100%	100%	100%	100%

4.3 PSC Computation of Fire Demand

The fire demand used for each of the regulated water utilities in Wisconsin were based on studies done by the National Board of Fire Underwriters (NBFU). NBFU's fire demand calculations, based on a population based equation, formed the basis for the municipal fire flows used in the PSC water rate cases in the 1970s. NBFU was the forerunner to the Insurance Services Office (ISO). As noted in comments received in this investigation: "Shortly after ISO was formed in 1971, it revised the method for identifying fire risk and associated fire flow for insurance purposes thus the PSC no longer had access to a specific 'community' fire flow rate as it had in the past under NBFU ratings. Because of this change, the PSC staff began prescribing fire flows in rate cases consistent with the now defunct NBFU grading schedule and over time has adjusted them as needed to maintain consistency among Wisconsin water utilities." (PSC REF#: 276315)

During a water rate case, Commission staff compares the community's fire demand with several population based equations: the National Board of Fire Underwriters (NBFU), the Freeman equation, and the Kuickling equation. Commission staff also estimates the water system's capacity to fight fires based on the capacity of existing wells and the effective storage volumes of reservoirs and elevated storage tanks. Usually, the fire demand used in the previous rate case is confirmed and carried through to the new rate case. Commission staff changes the fire demand only if the community's population has changed dramatically, the capacity of the water system is less than the community's estimated fire demand, or for some other compelling reason. The fire duration is usually the fire flow derived from the above formulas divided by 1,000 (e.g. 8,000 gpm for 8 hours). These NBFU, Freeman, and Kuickling formulas have been in use for over 70 years. The Kuickling formula was first published in 1911. The NBFU method is the most recent and dates from the 1940s. It uses data of actual fires between 1906 and 1911 (Carl, K., Young, R., and Gordon Anderson, "Guidelines for Determining Fire-Flow Requirements", May 1973, AWWA Water Technology/Distribution Journal).

Commission staff has developed a plot of the PSC fire demand versus population for a sample of regulated water utilities in Wisconsin. Figure 12 includes the data from 218 water utilities that have undergone a cost-of-service study between 2006 and the present. The figure also plots the computed fire demand based on population using the NBFU, Freeman, and Kuickling fire flow equations. The plot shows that the PSC fire demand closely follows the NBFU method up to a population of about 80,000 persons. The four data points representing Wisconsin's four largest water utilities more closely follow the Kuickling method. The data tables used to create this figure are found in Appendix F.



The population based estimates of fire flow can lead to some extreme fire flow estimates. For example, the last Milwaukee rate case used a fire demand of 17,962 gpm for 18 hours; an estimated flow which is far outside the need to fight any but the most extreme fires. On the other hand, the population estimates may underrate the fire demand for a small system. A small village with a few hundred residents may have a large industrial plant in the town that requires a much larger fire demand than one might expect based only on the size of the community. An example is Boyceville, a village with only 1,000 residents that has a large ethanol plant located within the village limits. The last rate case for Boyceville used a fire demand of 750 gpm.

4.4 Impact of Fire Demand on the PFP Cost-of-Service

In the PSC cost-of-service model, the utility's fire demand (gpm) and duration (hours) do not impact the computation of the PFP cost function (hydrant costs). However, the fire demand and duration do impact the calculation of the costs assigned to the PFP customer class (costs associated with hydrants and oversized infrastructure needed to generate fire flow). First, an increase in the fire demand and duration increases the maximum day and maximum hour system demand ratios. These in turn increase the allocation of operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base to the maximum day and maximum hour extra capacity cost functions, as shown in Figure 13 below.

Figure 13. Impact of Fire Demand on Allocation of Operating Costs to Cost Functions

Fire Demand (gpm)	Revenue Requirement ($)	Base Cost - System($)	Base Cost - Distribution ($)	Max Day -System($)	Max Day - Distribution ($)	Max Hour - System ($)	Max Hour (Distribution)	Max Hour (Storage)	Customer Costs	Fire Protection
↑	No Change	↓	↓	↑	No Change	No Change	↑	↑	No Change	No Change

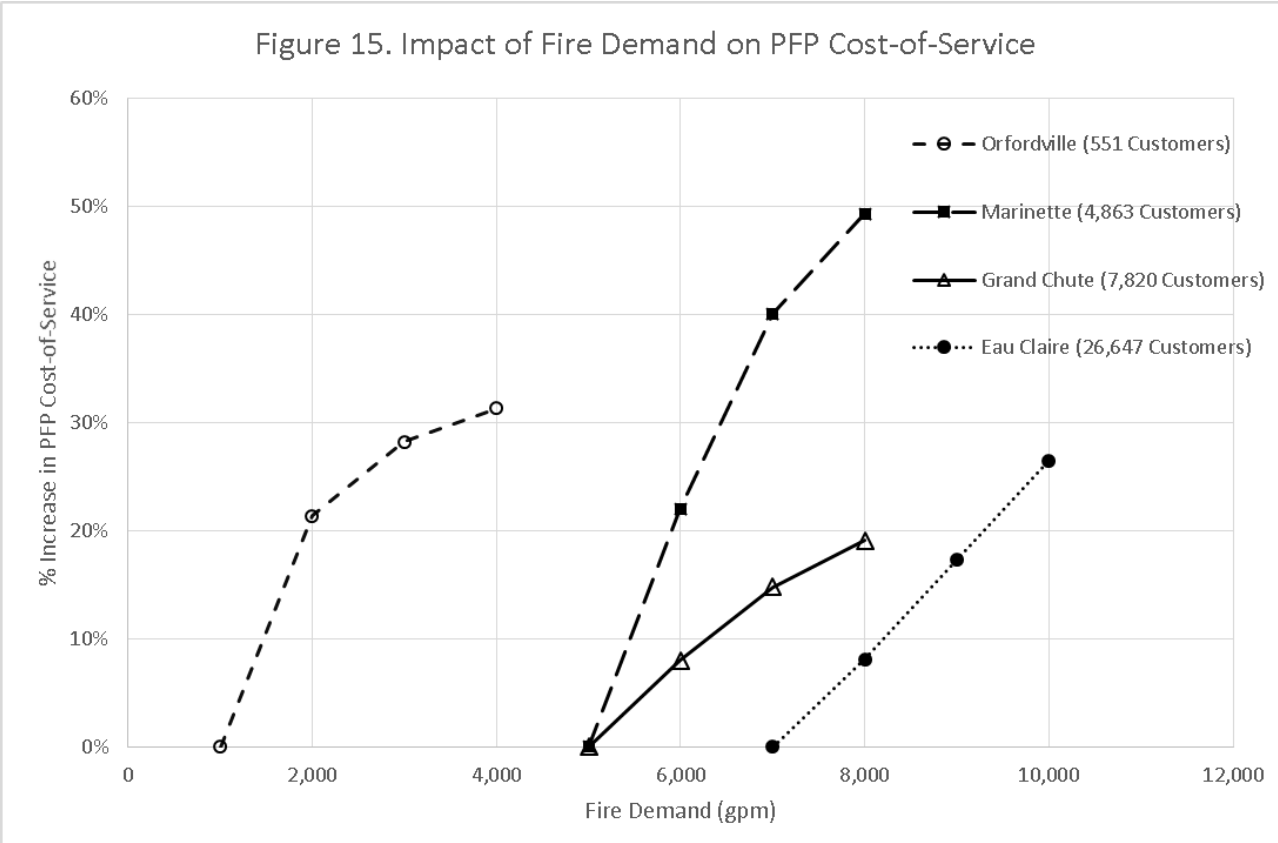
Second, an increase in the fire demand increases the volume rate per day and volume rate per hour that is used to allocate the non-PFP cost functions to the PFP customer class. See Figure 14 below.

Figure 14. Impact of Fire Demand on Volume Allocators Used to Allocate Cost Function Totals to the PFP Customer Class

CUSTOMER CLASS DEMAND RATIOS																		
		BASE COSTS					EXTRA-CAPACITY MAX DAY DEMAND					EXTRA-CAPACITY MAX HOUR DEMAND						
CUSTOMER CLAS	Annual Volume 1,000 Mgal	Average Day Volume Mgal	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Day	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Extra Capacity Ratio	Volume Rate Mgal Per Hour	Percent (%)	System Adjusted Percent (%)	Distribution Adjusted Percent (%)	Storage Adjusted Percent (%)		
Residential	22,874	62,668	75.71%	75.71%	75.71%	2.50	156,671	60.07%	60.07%	60.07%	5.00	13,056	17.05%	39.41%	39.41%	17.05%		
Multifamily Residen	1,091	2,989	3.61%	3.61%	3.61%	2.50	7,473	2.87%	2.87%	2.87%	5.00	623	0.81%	1.88%	1.88%	0.81%		
Commercial	4,053	11,104	13.41%	13.41%	13.41%	2.25	24,984	9.58%	9.58%	9.58%	4.25	1,966	2.57%	5.94%	5.94%	2.57%		
Industrial	0	0	0.00%	0.00%	0.00%	1.25	0	0.00%	0.00%	0.00%	2.50	0	0.00%	0.00%	0.00%	0.00%		
Public Authority	1,893	5,186	6.27%	6.27%	6.27%	2.25	11,669	4.47%	4.47%	4.47%	4.25	918	1.20%	2.77%	2.77%	1.20%		
Public Fire Protectio	302	828	1.00%	1.00%	1.00%		60,000	23.01%	23.01%	23.01%		60,000	78.37%	50.00%	50.00%	78.37%		
TOTALS	30,213	82,776	100%	100%	100%		260,[illegible]97	100%	100%	100%		76,563	100%	100%	100%	100%		
Docket 4450-WR-103																Schedule 9		

An increase in **Fire Demand** increases the "Volume Rate Per Day" and the "Volume Rate Per Hour". These in turn increase the "System Adjusted Percent", "Distribution Adjusted Percent", and "Storage Adjusted Percent" values. These values are then used to allocate costs to the PFP Customer Class.

Next, the non-billing cost function totals (base system, base distribution, maximum day system, maximum hour distribution, and maximum hour storage cost function) are allocated to the public fire protection customer class based on the PFP customer class' relative volume percentage. The bottom line is that an increase in the fire demand results in an increase in costs allocated to the PFP customer class. As shown in Figure 15, Commission staff plotted the impact of increasing fire demand on four different sized water utilities. Holding other factors constant, as the fire demand increased so did the percent increase in the PFP cost-of-service.



<u>4.5 Impact of System Demand Ratios on the PFP Cost-of-Service</u>

The PSC cost-of-service model uses system demand ratios to allocate operating costs to the base, maximum day, and maximum hour cost functions. The maximum day system demand ratio represents the ratio of the extra capacity maximum day volume divided by the maximum day volume. The maximum day volume is typically obtained from the total pumpage meter data. The maximum hour system demand ratio represents the extra capacity maximum hour volume divided by the maximum hour volume (use average hour plus one-hour fire flow, if greater). The maximum hour volume is either obtained from meter data or estimated by multiplying a maximum hour multiplier by the average hour on the average day. System demand ratios are used as allocators to determine the share of extra capacity cost (costs associated with meeting peak demand) versus base cost (costs to provide average rate of water use). Some factors that may impact the system demand ratios include: the loss or addition of a customer that has a high peak demand (power plant or canning company), or for example a change in the utility's fire demand. Figure 16 shows a plot of Wisconsin water utilities that have had a rate case from 2006 to the present (the two largest utilities have been removed from the figure for clarity purposes). The figure shows that, as utilities increase in size, their peak demands decrease in relation to their base demand. Please note that the system demand ratios do not impact the PFP cost function, because the PFP cost function only receives hydrant costs. The system demand ratios do impact the allocation of costs to the base, maximum day, and maximum hour cost functions, and ultimately it impacts the PFP customer class. The data used to produce Figure 16 is found in Appendix G. Figure 17 shows how the system demand ratios are calculated in the PSC cost-of-service model.

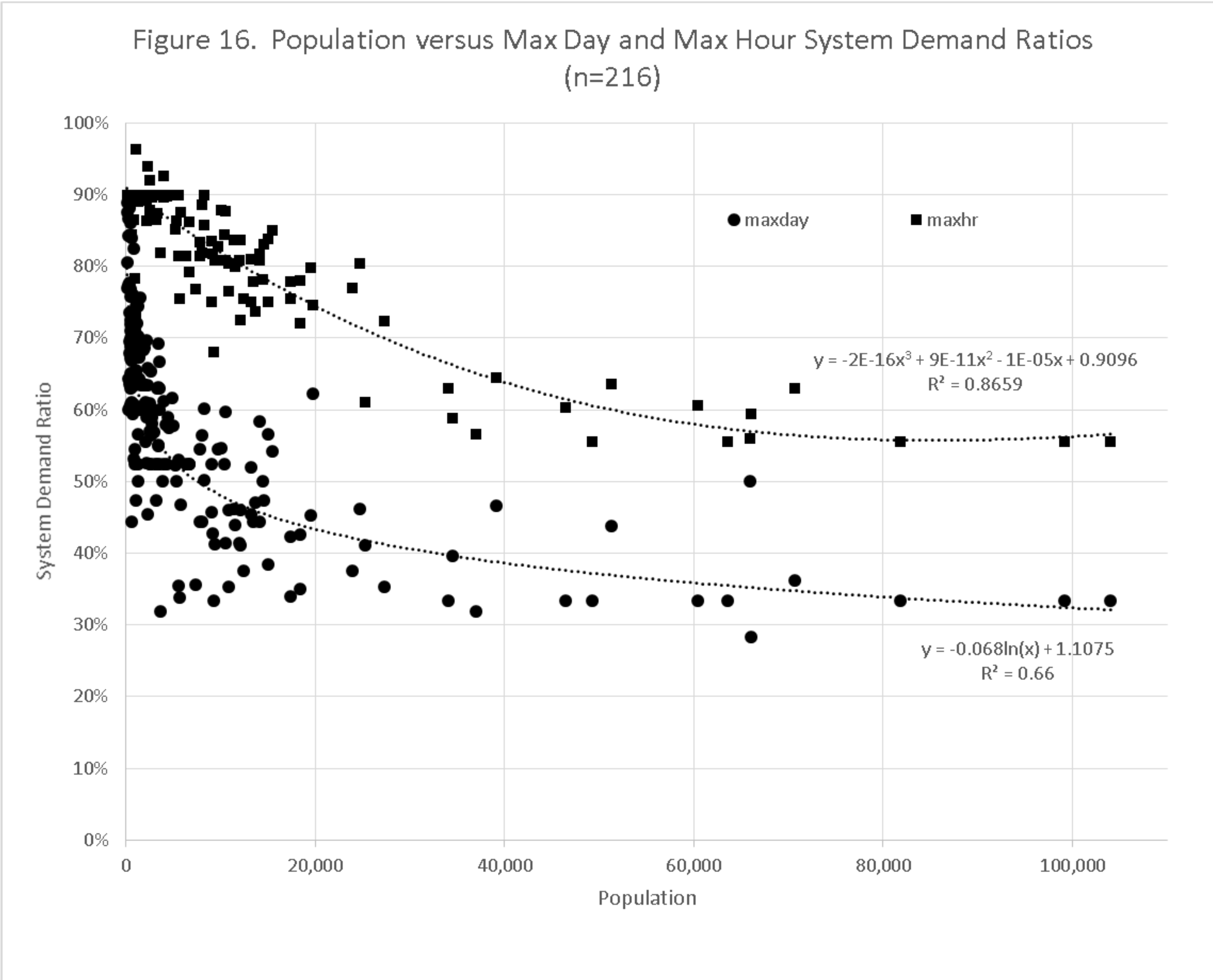


Figure 16. Population versus Max Day and Max Hour System Demand Ratios
(n=216)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
System Demand Ratio
maxday
maxhr
y = -2E-16x³ + 9E-11x² - 1E-05x + 0.9096
R² = 0.8659
y = -0.068ln(x) + 1.1075
R² = 0.66
0
20,000
40,000
60,000
80,000
100,000
Population

Figure 17. Impact of System Demand Ratios on Non-PFP Cost Functions

Docket 4450-WR-103				Schedule 4
ORFORDVILLE MUNICIPAL WATER UTILITY				
SYSTEM DEMAND RATIOS				
MAXIMUM DAY SYSTEM DEMAND				
TOTAL ANNUAL PUMPAGE	37,505,723	Gallons		
AVERAGE DAILY PUMPAGE	102,755	Gallons		
MAXIMUM DAY PUMPAGE	256,889	Gallons		
FIRE FLOW:				
GAL/MIN	1,000			
DURATION (HOURS)	1			
TOTAL FLOW	60,000	Gallons		
AVERAGE DAY PLUS FIRE FLOW	162,755	Gallons		
		102,755		
RATIO:	BASE =	―――	40.00%	
		256,889		
	MAX DAY =	100-BASE	60.00%	
MAXIMUM HOUR SYSTEM DEMAND				
AVERAGE HOUR ON MAX DAY	10,704	Gallons		
MAXIMUM HOUR PUMPAGE	14,985	Gallons		
AVERAGE HOUR PLUS ONE HOUR FIRE FLOW	64,281	Gallons		
		102,755		Use
RATIO:	BASE =	―――	6.66%	10.00%
		1,542,755		
				Use
	MAX HOUR =	100-BASE	93.34%	90.00%

Fire Demand impacts the system demand ratios below. Fire demand also impacts the allocation of the max day and max hour cost functions to the PFP customer class.

System Demand Ratios impact how operating expenses are allocated to the non-PFP cost functions.

4.6 Impact of Transmission and Distribution Mains on the PFP Cost-of-Service

The PSC classifies water mains into two categories: transmission mains and distribution mains. Generally speaking, water mains larger than 12 inches in diameter are transmission mains, and water mains less than 12 inches in diameter are classified as distribution mains. The PSC model typically classifies 12-inch diameter mains as transmission mains for Class C and D utilities, and as distribution mains for Class AB utilities. The reason for this classification is that the PSC model assumes that transmission mains are designed largely to meet maximum day demand, while distribution mains are designed to meet maximum hour demand. Therefore, transmission main costs are typically allocated to the base and maximum day cost functions, while distribution main costs are allocated to the base and maximum hour cost functions. The apportioning of transmission and distribution mains does not impact the PFP cost function, but it does impact the allocation of water main costs to the base, maximum day, and maximum hour cost functions, and ultimately it impacts the PFP customer class. Figure 18 shows how the PSC cost-of-service model uses the proportion of transmission mains to distribution mains to allocate main costs to non-PFP cost functions.

Figure 18. Length and Diameter of Transmission Versus Distribution Mains Impacts Non-PFP Cost Functions

4450-WR-103 ORFORDVILLE MUNICIPAL WATER UTILITY

Transmission Mains (12-inch and larger)

Diameter in Inches	Feet of Main	Diameter x Length
60	0	0
54	0	0
48	0	0
42	0	0
36	0	0
30	0	0
24	0	0
20	0	0
18	0	0
16	0	0
12	1,059	12,708
10	6,571	65,710
Total	7,630	78,418

Distribution Mains (smaller than 12-inch)

Diameter in Inches	Feet of Main	Diameter x Length
14		0
12	0	0
10	0	0
8	16,684	133,472
6	28,804	172,824
4	0	0
3	0	0
2	0	0
1.5	0	0
1.25	0	0
1	0	0
		0
Total	45,488	306,296

	Main Length	Percent of Total	D x L Diameter x Length	D x L Percent of Total	Utility Financed Dia x Length or Dollars	Utility Financed Percent of Total
Transmission M	7,630	14.36%	78,418	20.38%	387,794	36.67%
Distribution M	45,488	85.64%	306,296	79.62%	669,619	63.33%
Total	53,118	100%	384,714	100%	$ 1,057,413	100%

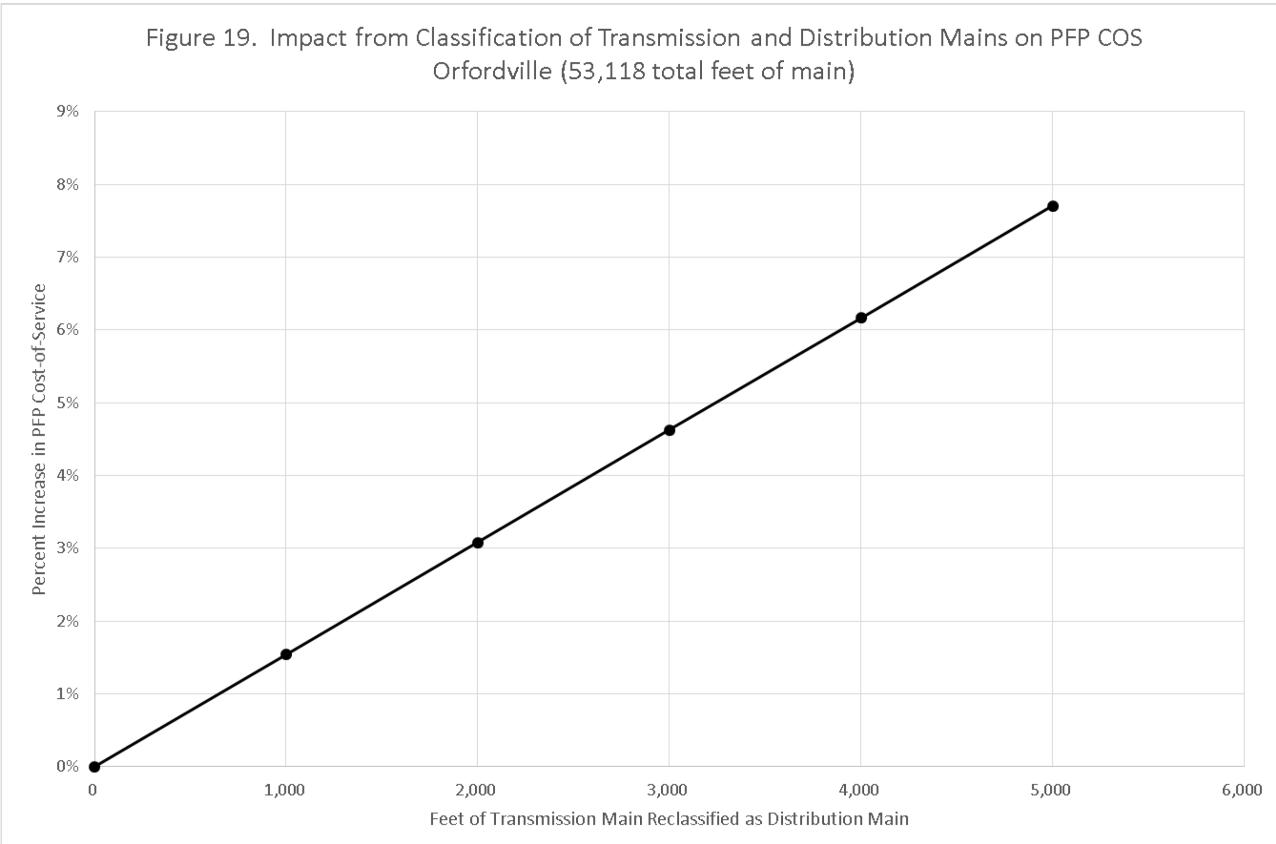
Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 7

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 5A

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 6

Percentage Transmission Versus Distribution Mains Impacts Allocation of Main Accts 343 to Non-PFP Cost Functions in Sch 5

Figure 19 shows the impact on the PFP cost-of-service model for the Orfordville Municipal Water Utility with the reclassification of 1,000, 2,000, and 3,000 feet of main from transmission main to distribution main.



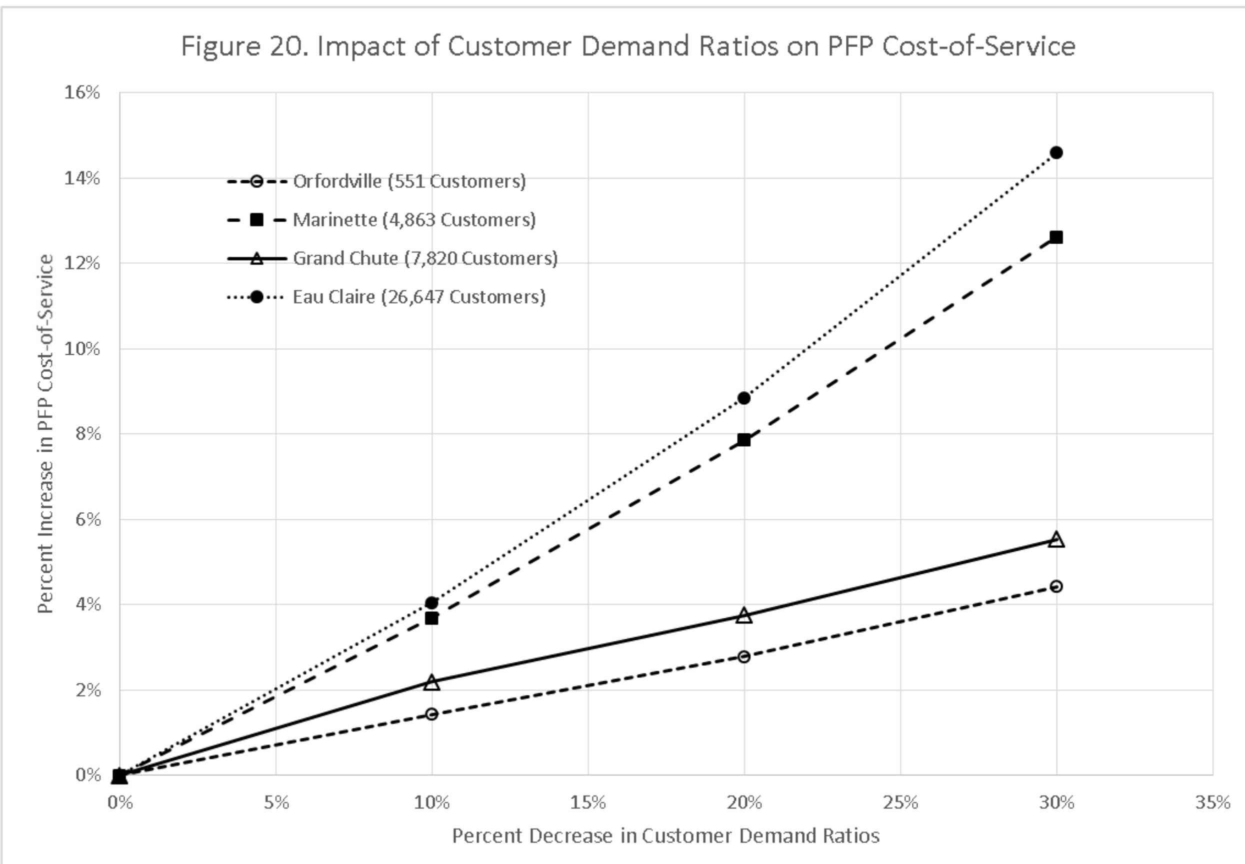
<u>4.7 Impact of the Customer Demand Ratios on the PFP Cost-of-Service</u>

The maximum day (hour) customer demand ratios are the difference between total maximum day (hour) demand of a particular customer class and the average day rate of use of that same customer class. Before the advent of advanced metering infrastructure, water utilities rarely collected customer class maximum day and maximum hour water use data, so Commission staff developed estimates of the customer demand ratios for each customer class.

These customer demand ratios were handed down from rate case to rate case. Now that some utilities have meters that are actually collecting maximum day and maximum hour customer class data, Commission staff will be able to refine these customer demand ratios accordingly. Customer demand ratios are community specific. For some communities the residential class is more demand oriented than the industrial class. The residential class may use water heavily in the mornings and evenings, while the industrial class may use water uniformly throughout the week. In other cases, the industrial customer class is more demand oriented than the residential class (such as power plants or canning factories). Non-uniform usage causes the utility to construct plant of a larger scale than would be needed if all usage were uniform. As such, other factors aside, if demand related costs are going up significantly in a rate case, classes with higher demand ratios will typically receive a higher percentage increase in rates than good load factor classes.

Customer demand ratios are used to compute maximum day and maximum hour demand volumes for the non-PFP customer classes including: residential, multifamily residential, commercial, industrial, and public authority customer classes. These volumes are then used (along with the fire demand) to compute the relative maximum day and maximum hour allocation percentages of the PFP customer class. The PFP allocation percentages are then used to allocate a portion of the base, maximum day, and maximum hour cost functions to the PFP customer class.

Figure 20 shows the impact of the customer demand ratios on the PFP cost-of-service. For each of the four utilities shown in the graph, if the maximum day and maximum hour customer demand ratios for the non-PFP customer classes are lowered, the PFP cost-of-service increases proportionately. This is due to the fact that the PFP customer class depends on the relative volume of each customer class, which in turn depends on the customer demand ratios. The smaller the customer demand ratios, the smaller the relative base, maximum day, and maximum hour volumes for each non-PFP customer class. As a result, the PFP base, maximum day, and maximum hour volumes increase, and the PFP cost-of-service increases. Generally, the larger the number of customers, the larger the PFP cost-of-service, but sometimes the cost of new plant can result in a smaller utility (Marinette) having a larger PFP cost-of-service than a larger utility (Grand Chute). Also note that while the customer demand ratios impact the PFP customer class, they do not impact the PFP cost function.



4.8 Allocating Costs to the PFP Cost Function

Within the PSC cost-of-service model, the PFP cost function essentially identifies the operating costs associated with fire hydrants. The hydrant costs are included in the following accounting schedules: operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base. The hydrant costs from each accounting schedule are then added together to compute the total PFP cost function. Figure 21 shows the PFP cost function amount compared to the number of hydrants for four selected utilities. The strong linear relationship shows that the PFP cost function is highly correlated with the number of hydrants.

Figure 21. PFP Cost Function Versus No. of Hydrants

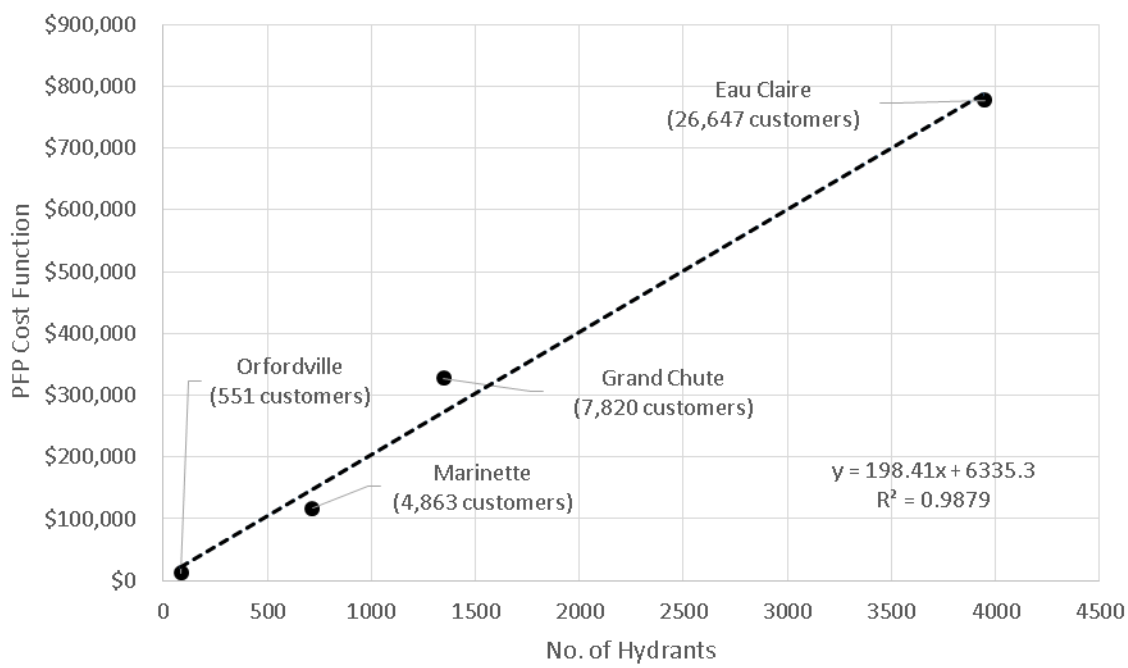


Figure 22 shows how the PSC model allocates the depreciation expense accounts to the PFP cost function (same for Utility Financed Plant and Total Plant schedules). Figure 23 illustrates how the operation and maintenance expense accounts are allocated to the PFP cost function. Figure 24 displays how the PFP cost function totals from each accounting schedule are then totaled to derive the total PFP cost function column. The total PFP cost function is then directly allocated to the PFP customer class. It is important to note that the total PFP cost function is not affected by the fire demand, the system demand ratios, or the amount of transmission mains versus distribution mains. Nor is it impacted by the water usage of the other customer classes.

Figure 22. Allocation of Depreciation Expenses to PFP Cost Function (same for Utility Financed Plant and Total Plant Schedules - Class AB, C, and D Utilities)

For Accts 340 thru 341 the PFP cost function = (Acct "Total") x (Sum of PFP cost function for Dep Exp Accts 342 thru 349) / (Sum of Total Dep Exp for Accts 342 thru 349)
= (Acct "Total") x ($1,968) / ($27,439)
= (Acct "Total") x (0.0496)

ALLOCATION OF DEPRECIATION EXPENSE
TO SERVICE COST FUNCTIONS
(continued)

ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	BASE COSTS System ($)	BASE COSTS Distribution ($)	EXTRA-CAPACITY MAX DAY System ($)	EXTRA-CAPACITY MAX DAY Distribution ($)	EXTRA-CAPACITY MAX HOUR System ($)	EXTRA-CAPACITY MAX HOUR Distribution ($)	EXTRA-CAPACITY MAX HOUR Storage ($)	CUSTOMER COSTS Billing ($)	CUSTOMER COSTS Equivalent Meter ($)	CUSTOMER COSTS Equivalent Service ($)	Fire Protection ($)
	TRANSMISSION & DISTRIBUTION PLANT												
340	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
341	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
342	Distribution reservoirs and standpipes	2,086	209						1,877				
343	Transmission mains	5,041	2,016		3,025								
343	Distribution mains	8,705		870				7,834					
345	Services	6,967										6,967	
346	Meters	2,472									2,472		
348	Hydrants	1,968											1,968
349	Other transmission and distr. plant	0	0	0	0	0	0	0	0	0	0	0	0
	GENERAL PLANT												
389	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
390	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
391	Office furniture and equipment	14	2	0	3	0	0	3	1	0	1	3	1
391	Office furniture & equip - Computers	771	132	18	192	0	0	158	38	0	54	140	40
392	Transportation equipment	8,007	1,372	182	1,993	0	0	1,639	393	0	559	1,458	412
393	Stores equipment	0	0	0	0	0	0	0	0	0	0	0	0
394	Tools, shop and garage equipment	0	0	0	0	0	0	0	0	0	0	0	0
395	Laboratory equipment	0	0	0	0	0	0	0	0	0	0	0	0
396	Power operated equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	Communication equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	SCADA equipment	0	0	0	0	0	0	0	0	0	0	0	0
398	Miscellaneous equipment	1,939	332	44	483	0	0	397	95	0	135	353	100
	TOTAL	49,001	8,396	1,115	12,194	0	0	10,031	2,404	0	3,421	8,921	2,520

Schedule 6

To Sch 8

For Accts 389 thru 398 the PFP cost function = (Acct "Total") x (Sum of PFP cost function for Dep Exp Accts 310 thru 349) / (Sum of Total Dep Exp for Accts 310 thru 349)
= (Acct "Total") x ($1,968) / ($38,270)
= (Acct "Total") x (0.0514)

Figure 23. Allocation of O&M Expenses to PFP Cost Function (Class D Utilities)

For Accts 600 thru 680 the PFP cost function = (Acct "Total") x (Total Plant PFP cost function from Sch 5A) / (Total Plant from Sch 5A)
= (Acct "Total") x ($172,287) / ($3,472,183)
= (Acct "Total") x (0.0496)

ALLOCATION OF OPERATION AND MAINTENANCE EXPENSES
TO SERVICE COST FUNCTIONS

			BASE COSTS		EXTRA-CAPACITY					CUSTOMER COSTS			
					MAX DAY		MAX HOUR						
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	PLANT OPERATION AND MAINTENANCE												
600	Salaries and wages	24,000	2,442	921	3,510	0	0	8,289	1,101	3,400	591	2,515	1,012
610	Purchased water	0	0										0
620	Fuel or power purchased for pumping	13,000	13,000										
630	Chemical	800	800										
640	Supplies and expenses	11,000	1,328	497	1,892	0	0	4,470	594	0	319	1,356	[illegible]
650	Repairs of water plant	21,700	2,619	980	3,733	0	0	8,817	1,171	0	628	2,675	1,077
660	Transportation expenses	2,000	241	90	344	0	0	813	108	0	58	247	99
	GENERAL OPERATING EXPENSES												
680	Administrative and general salaries	27,000	2,770	1,036	3,948	0	0	9,325	1,239	4,050	665	2,829	1,139
681	Office supplies and expenses	4,000	440	164	627	0	0	1,480	197	357	105	449	181
682	Outside services employed	6,000	659	247	940	0	0	2,220	295	536	158	674	271
684	Insurance Expense	7,400	813	304	1,159	0	0	2,738	364	661	195	831	334
686	Employee pensions and benefits	22,000	2,418	905	3,447	0	0	8,141	1,081	1,964	580	2,470	994
688	Regulatory commission expenses	1,000	110	41	157	0	0	370	49	89	26	[illegible]	45
689	Miscellaneous general expenses	3,000	330	123	470	0	0	1,110	147	268	79	337	136
690	Uncollectible accounts	0								0			
691	Customer service and informational expense	0								0			
	TOTAL OPERATION & MAINTENANCE EXPENSES	142,900	27,990	5,308	20,228	0	0	47,773	6,345	11,5[illegible]4	3,405	14,493	5,834

Docket 4450-WR-103 — Schedule 7

To Sch 8

For Accts 681 thru 689 the PFP cost function = (Acct "Total") x (Sum of PFP cost function for O&M Accts 600, 640, 650, 660, and 680) / (Total O&M for Accts 600, 640, 660, and 680)
= (Acct "Total") x ($3,873) / ($85,700)
= (Acct "Total") x (0.0452)

Figure 24. Cost Allocation to PFP Cost Function

PFP Cost of Service from Schedule 7, O&M Expenses = $5,834 (see Figure 1A)

PFP Cost of Service from Schedule 6, Depreciation Expenses = $2,520 (see Figure 1B)

PFP Cost of Service = (Taxes Schedule 1) x (Total Plant PFP Cost Function Schedule 5A) / (Total Plant Schedule 5A)

= ($76,981) x ($172,287)/ ($3,472,183) = $3,820 (same allocation as Fig. 1B)

PFP Cost of Service = (NIRB from Schedule 2) x (Rate of Return from Schedule 2) x (Utility Financed Plant PFP Cost Function) / (Total Utility Financed Plant Schedule 5)

= ($1,467,508) x (1.00%) x ($94,931)/($2,033,952) = $684 (same allocation as Fig. 1B)

Schedule 8 – PFP Cost Function

SUMMARY OF ALLOCATION OF OPERATING COSTS TO SERVICE COST FUNCTIONS

		BASE COSTS		EXTRA-CAPACITY					CUSTOMER COSTS			
				MAX DAY		MAX HOUR						
OPERATING COST	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
OPERATION AND MAINTENANCE	142,900	27,990	5,308	20,228	0	0	47,773	6,345	11,524	3,405	14,493	5,834
DEPRECIATION EXPENSE	49,001	8,396	1,115	12,194	0	0	10,031	2,404	0	3,421	8,921	2,520
AMORTIZATION EXPENSE	0	0	0	0	0	0	0	0	0	0	0	0
TAXES AND TAX EQUIVALENT	76,981	9,291	3,475	13,244	0	0	31,279	4,154	0	2,229	9,489	3,820
RETURN ON NET INVESTMENT RATE BASE	14,675	2,260	513	3,264	0	0	4,614	756	0	744	1,839	685
TOTAL	283,557	47,937	10,411	48,929	0	0	93,697	13,660	11,524	9,799	34,742	12,859

Docket 4450-WR-103 Schedule 8

Revenue Requirement

Total PFP Cost Function = $12,859

4.9 Allocating Costs to the PFP Customer Class

The PFP customer class represents the total PFP cost-of-service. It includes hydrant costs (PFP cost function), and it also includes the costs associated with oversized infrastructure (e.g. wells, mains, elevated storage tanks, etc.) needed to generate the high flows used to fight fires. A portion of the base, maximum day, and maximum hour cost functions capture the costs of these oversized facilities. The PSC cost-of-service model allocates operating expenses (including operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base) to the base, maximum day, and maximum hour cost functions based on the system demand ratios and the amount of transmission main to distribution main. Figures 25 and 26 demonstrate how the PSC model allocates the depreciation expense accounts to the base, maximum day, and maximum hour cost functions. Figure 27 shows how the operation and maintenance expenses are allocated to the base, maximum day, and maximum hour cost functions.

Figure 25. Allocation of Depreciation Expense to Non-PFP Cost Functions (same for Utility Financed Plant and Total Plant Schedules- Class AB, C, and D Utilities)

ALLOCATION OF DEPRECIATION EXPENSE TO SERVICE COST FUNCTIONS

For Accts 301 thru 303 the cost function amount = (Acct Row Total) x (Column Total for Accts 310 thru 349) / (Grand Total for Accts 310 thru 349)

For Accts 310 thru 334 the cost function amount = (Acct Row Total) x Base/MD or Base/MH System Demand Ratios

			BASE COSTS		EXTRA-CAPACITY: MAX DAY		EXTRA-CAPACITY: MAX HOUR			CUSTOMER COSTS			
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	INTANGIBLE PLANT												
301	Organization	0	0	0	0	0	0	0	0	0	0	0	0
302	Franchises and consents	0	0	0	0	0	0	0	0	0	0	0	0
303	Miscellaneous intangible plant	0	0	0	0	0	0	0	0	0	0	0	0
	SOURCE OF SUPPLY												
310	Land and land rights	0	0		0								
311	Structures and improvements	0	0		0								
312	Collecting and impounding reservoirs	0	0		0								
313	Lake, river, and other intakes	0	0		0								
314	Wells and springs	4,823	1,929		2,894								
316	Supply mains	0	0		0								
317	Other water source plant	0	0		0								
	PUMPING PLANT												
320	Land and land rights	0	0		0								
321	Structures and improvements	2,555	1,022		1,533								
323	Other power production equipment	0	0		0								
325	Electric pumping equipment	3,131	1,252		1,879								
326	Diesel pumping equipment	0	0		0								
328	Other pumping equipment	150	60		90								
	WATER TREATMENT PLANT												
330	Land and land rights	0	0		0								
331	Structures and improvements	0	0		0								
332	Sand or Other Media Filtration Equip	172	69		103								
333	Membrane Filtration Equipment	0	0		0								
334	Other Water Treatment Equipment	0	0		0								

Figure 26. Allocation of Depreciation Expense to Non-PFP Cost Functions (same for Utility Financed Plant and Total Plant Schedules – Class AB, C, and D Utilities)

ALLOCATION OF DEPRECIATION EXPENSE TO SERVICE COST FUNCTIONS (continued)

			EXTRA-CAPACI						CUSTOMER COSTS			
			BASE COSTS		MAX DAY		MAX HOUR					
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	TRANSMISSION & DISTRIBUTION PLANT												
340	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
341	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
342	Distribution reservoirs and standpipes	2,086	209						1,877				
343	Transmission mains	5,041	2,016		3,025								
343	Distribution mains	8,705		870				7,834					
345	Services	6,967										6,967	
346	Meters	2,672									2,672		
348	Hydrants	1,968											1,968
349	Other transmission and distr. plant	0	0	0	0	0	0	0	0	0	0	0	0
	GENERAL PLANT												
389	Land and land rights	0	0	0	0	0	0	0	0	0	0	0	0
390	Structures and improvements	0	0	0	0	0	0	0	0	0	0	0	0
391	Office furniture and equipment	14	2	0	3	0	0	3	1	0	1	3	1
391	Office furniture & equip - Computers	771	132	18	192	0	0	158	38	0	54	140	40
392	Transportation equipment	8,007	1,372	182	1,993	0	0	1,639	393	0	559	1,458	412
393	Stores equipment	0	0	0	0	0	0	0	0	0	0	0	0
394	Tools, shop and garage equipment	0	0	0	0	0	0	0	0	0	0	0	0
395	Laboratory equipment	0	0	0	0	0	0	0	0	0	0	0	0
396	Power operated equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	Communication equipment	0	0	0	0	0	0	0	0	0	0	0	0
397	SCADA equipment	0	0	0	0	0	0	0	0	0	0	0	0
398	Miscellaneous equipment	1,939	332	44	483	0	0	397	95	0	135	353	100
	TOTAL	**49,001**	**8,396**	**1,115**	**12,194**	**0**	**0**	**10,031**	**2,404**	**0**	**3,421**	**8,921**	**2,520**

For Acct 342 the cost function amount = (Acct Row Total) x Base/MD or Base/MH System Demand Ratios

For Accts 341 thru 342 the cost function amount = (Acct Row Total) x (Column Total for Accts 342 thru 349) / (Grand Total for Accts 342 thru 349)

For Acct 349 the cost function amount = (Acct Row Total) x (Column Total for Accts 342 thru 348) / (Grand Total for Accts 342 thru 348)

For Accts 343 the cost function amount = (Acct Row Total) x Trans/Dist Main Ratios

For Accts 389 thru 398 the cost function amount = (Acct Row Total) x (Column Total for Accts 310 thru 349) / (Grand Total for Accts 310 thru 349)

Accts 345, 346 and 348 directly allocated to cost functions as shown

Figure 27. Allocation of O&M Expenses to Non-PFP Cost Function (Class D Utilities)

For Accts 600, 640 thru 660 the cost function amount = (Acct Row Total) x (Same Cost Function Column Total from Total Plant Schedule) / (Grand Total from Total Plant Schedule)

Direct Allocation to Base System cost function

ALLOCATION OF OPERATION AND MAINTENANCE EXPENSES TO SERVICE COST FUNCTIONS

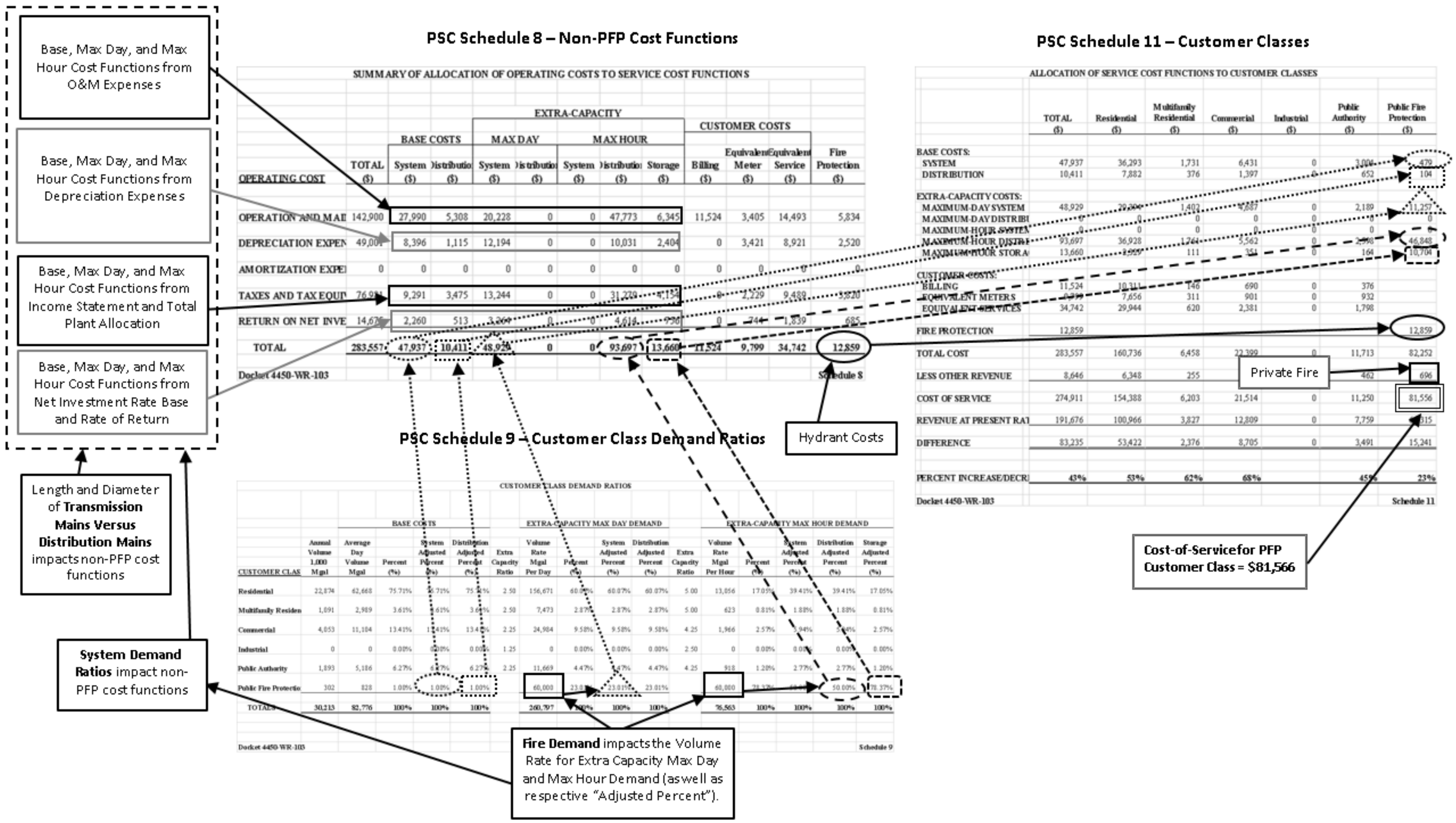
			BASE COSTS		EXTRA-CAPACITY: MAX DAY		EXTRA-CAPACITY: MAX HOUR			CUSTOMER COSTS			
ACCT NO.	ACCOUNT DESCRIPTION	TOTAL ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	System ($)	Distribution ($)	Storage ($)	Billing ($)	Equivalent Meter ($)	Equivalent Service ($)	Fire Protection ($)
	PLANT OPERATION AND MAINTENANCE												
600	Salaries and wages	24,000	2,462	921	3,510	0	0	8,289	1,101	3,600	591	2,513	1,012
610	Purchased water	0	0										0
620	Fuel or power purchased for pumping	13,000	13,000										
630	Chemicals	800	800										
640	Supplies and expenses	11,000	1,328	497	1,892	0	0	4,470	594	0	319	1,356	546
650	Repairs of water plant	21,700	2,619	980	3,733	0	0	8,817	1,171	0	628	2,675	1,077
660	Transportation expenses	2,000	241	90	344	0	0	813	108	0	58	247	99
	GENERAL OPERATING EXPENSES												
680	Administrative and general salaries	27,000	2,770	1,036	3,948	0	0	9,325	1,239	4,050	665	2,829	1,139
681	Office supplies and expenses	4,000	440	164	627	0	0	1,480	197	357	105	449	181
682	Outside services employed	6,000	659	247	940	0	0	2,220	295	536	158	674	271
684	Insurance Expense	7,400	813	304	1,159	0	0	2,738	364	661	195	831	334
686	Employee pensions and benefits	22,000	2,418	905	3,447	0	0	8,141	1,081	1,964	580	2,470	994
688	Regulatory commission expenses	1,000	110	41	157	0	0	370	49	89	26	112	45
689	Miscellaneous general expenses	3,000	330	123	470	0	0	1,110	147	268	79	337	136
690	Uncollectible accounts	0								0			
691	Customer service and informational expense	0								0			
	TOTAL OPERATION & MAINTENANCE EXPENSES	142,900	27,990	5,308	20,228	0	0	47,773	[illegible],345	11,524	3,405	14,493	5,834

Docket 4450-WR-103 Schedule 7

For Accts 681 thru 689 the PFP cost function= (Acct Row Total) x (Column Total for Accts 600, 640, 650, 660, and 680) / (Grand Total for Accts 600, 640, 660, and 680)

The total amounts of the base, maximum day, and maximum hour cost functions are then allocated to the PFP customer class based on the volume of the PFP customer class (annual, maximum day, and maximum hour volumes) as compared to the volumes from the other customer classes (residential, commercial, industrial, and public authority customer classes). The annual PFP volume is defined as one percent of the utility's total annual sales volume. The maximum day and maximum hour PFP volumes are a function of the utility's fire demand and duration. The relative volumes of each customer class are a function of their respective annual sales volume and their customer demand ratios. Figure 28 shows how the base, maximum day, and maximum hour cost functions are allocated to the PFP customer class.

Figure 28. Cost Allocation to PFP Customer Class



4.10 Rate Design

The PSC rate design method strives to follow several important criteria identified by James Bonbright in his book, "Principles of Public Utility Rates" (Columbia University Press, 1961). Bonbright claims that well designed utility rates will meet the following criteria:

- Practical, simple, and easily understandable.
- Clear, having only one interpretation.
- Achieve proper revenue requirement.
- Provide relatively stable revenues.
- Avoid unnecessary rate shock.
- Based on the cost of providing service.
- Not be unduly discriminatory.
- Promote justified applications and discourage wasteful use.

Keeping these criteria in mind, the mechanics of how the PSC model computes PFP rates is summarized below. The total amount allocated to the PFP customer class is the PFP cost-of-service. This is the amount that the PFP rates must recover if the water utility is to remain financially viable. As discussed in Section 3 of this report, there are three types of PFP charges, the "municipal charge" (PFP cost-of-service billed to local government and collected through property taxes), the "direct charge" (PFP cost-of-service collected through water bills), and a combination of the two.

The municipal charge is simply that portion of the PFP cost-of-service that the utility and municipality have agreed should be paid for through property taxes. This charge is directly billed to the municipality. A sample tariff is shown in Figure 29.

Figure 29. Sample Tariff for Municipal PFP Charge.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

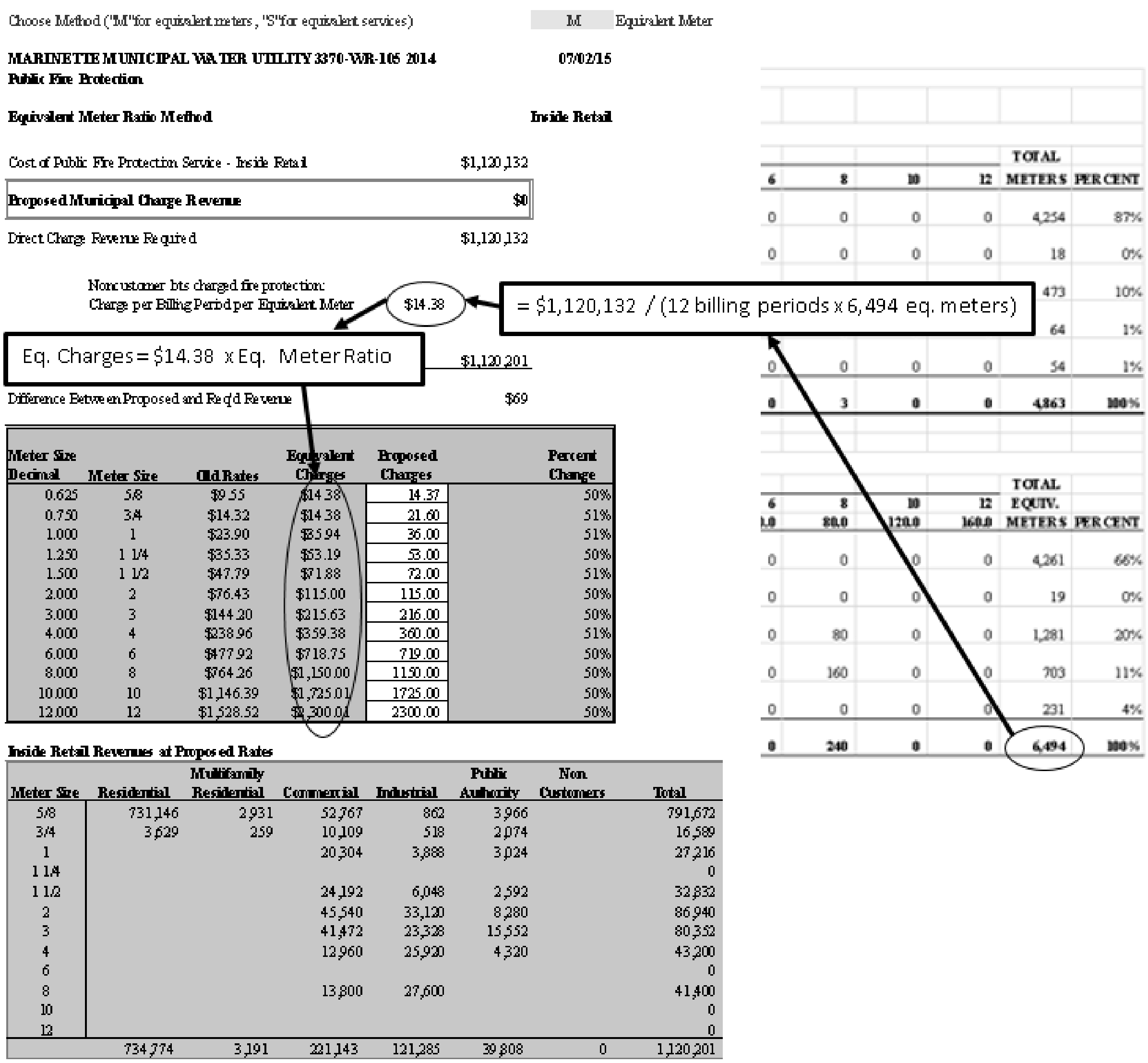
The annual charge for public fire protection service to the Village of Birnamwood shall be $32,140. The utility may bill for this amount in equal bimonthly installments.

Billing: Same as Schedule Mg-1.

The four most popular preapproved methods for computing the direct PFP charge are: the equivalent meters method, the equivalent services method, the property values method, and the square feet of improvements method.

The equivalent meters method is used by 240 of Wisconsin's 582 regulated water utilities. It computes charges based on ratios of meter size. Figure 30 shows how the equivalent meter ratios are used to compute the PFP rates. First, the PSC rate model divides the PFP cost-of-service by the number of billing periods per year and by the total equivalent meters for the particular utility. The resulting value is the "Charge per billing period per equivalent meter" which is $14.38 as shown in the figure. Then, this value is used to compute the equivalent charges for each meter size. For each meter size, the equivalent charge is equal to the charge per billing period per equivalent meter times the appropriate equivalent meter ratio. For example, a 6-inch meter would be charged the equivalent meter charge of $14.38 times an equivalent meter ratio of 50 which equals a quarterly fee of $718.75. Then, the proposed charges are entered by hand by rounding up or down the equivalent charges. The PFP cost-of-service is then compared to the total calculated PFP revenue using the proposed charges. The proposed charges are adjusted until the difference is deemed immaterial.

Figure 30. Equivalent Meter Ratios Used to Compute the PFP Rates.



Choose Method ("M" for equivalent meters, "S" for equivalent services) M Equivalent Meter

MARINETTE MUNICIPAL WATER UTILITY 3370-WR-105 2014 **07/02/15**
Public Fire Protection

Equivalent Meter Ratio Method **Inside Retail**

Cost of Public Fire Protection Service - Inside Retail	$1,120,132
Proposed Municipal Charge Revenue	$0
Direct Charge Revenue Required	$1,120,132
Noncustomer lots charged fire protection: Charge per Billing Period per Equivalent Meter	$14.38
	$1,120,201
Difference Between Proposed and Req'd Revenue	$69

Meter Size Decimal	Meter Size	Old Rates	Equivalent Charges	Proposed Charges	Percent Change
0.625	5/8	$9.55	$14.38	14.37	50%
0.750	3/4	$14.32	$14.38	21.60	51%
1.000	1	$23.90	$35.94	36.00	51%
1.250	1 1/4	$35.33	$53.19	53.00	50%
1.500	1 1/2	$47.79	$71.88	72.00	51%
2.000	2	$76.43	$115.00	115.00	50%
3.000	3	$144.20	$215.63	216.00	50%
4.000	4	$238.96	$359.38	360.00	51%
6.000	6	$477.92	$718.75	719.00	50%
8.000	8	$764.26	$1,150.00	1150.00	50%
10.000	10	$1,146.39	$1,725.01	1725.00	50%
12.000	12	$1,528.52	$2,300.01	2300.00	50%

Inside Retail Revenues at Proposed Rates

Meter Size	Residential	Multifamily Residential	Commercial	Industrial	Public Authority	Non Customers	Total
5/8	731,146	2,931	52,767	862	3,966		791,672
3/4	3,629	259	10,109	518	2,074		16,589
1			20,304	3,888	3,024		27,216
1 1/4							0
1 1/2			24,192	6,048	2,592		32,832
2			45,540	33,120	8,280		86,940
3			41,472	23,328	15,552		80,352
4			12,960	25,920	4,320		43,200
6							0
8			13,800	27,600			41,400
10							0
12							0
	734,774	3,191	221,143	121,285	39,808	0	1,120,201

6	8	10	12	TOTAL METERS	PERCENT
0	0	0	0	4,254	87%
0	0	0	0	18	0%
				473	10%
				64	1%
0	0	0	0	54	1%
0	3	0	0	4,863	100%

6	8	10	12	TOTAL EQUIV.	
.0	80.0	120.0	160.0	METERS	PERCENT
0	0	0	0	4,261	66%
0	0	0	0	19	0%
0	80	0	0	1,281	20%
0	160	0	0	703	11%
0	0	0	0	231	4%
0	240	0	0	6,494	100%

The equivalent meter method is popular because it is relatively easy to administer. Unfortunately, it is not perfectly equitable. For example, a warehouse with a 5/8-inch meter will pay the same PFP charge as a town home with the same size meter, even though the warehouse requires larger flows and higher pressures to fight a potential fire than does the town home. Figure 31 shows an example of a typical PFP tariff sheet using the equivalent meters method.

Figure 31. Sample Tariff for Direct PFP Charge Using the Equivalent Meters Method.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

Monthly Public Fire Protection Service Charges:

⅝ -inch meter - $	14.37	3 -inch meter - $	216.00
¾ -inch meter - $	21.60	4 -inch meter - $	360.00
1 -inch meter - $	36.00	6 -inch meter - $	719.00
1¼ -inch meter - $	53.00	8 -inch meter - $	1,150.00
1½ -inch meter - $	72.00	10 -inch meter - $	1,725.00
2 -inch meter - $	115.00	12 -inch meter - $	2,300.00

Customers who are provided service under Schedules Mg-1, Ug-1, or Sg-1 shall be subject to the charges in this schedule according to the size of their primary meter.

<u>Billing</u>: Same as Schedule Mg-1.

Twelve water utilities use the equivalent services method. The equivalent services method is virtually identical to the equivalent meters method. The only difference is that the charges are based on different ratios. The equivalent meters method relies on a 6-inch to 5/8-inch ratio of 50. The equivalent services method relies on a 6-inch meter to 5/8-inch meter ratio of 6. The equivalent services method has the same benefits and shortcomings as the equivalent meters method. Figure 32 shows an example of a typical PFP tariff sheet using the equivalent services method.

Figure 32. Sample Tariff for Direct PFP Charge Using the Equivalent Services Method.

Public Fire Protection Service

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

This service shall include the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Monthly Public Fire Protection Service Charges:

⅝ -inch meter - $	4.18	3 -inch meter - $	16.80
¾ -inch meter - $	4.18	4 -inch meter - $	21.00
1 -inch meter - $	5.50	6 -inch meter - $	26.00
1¼ -inch meter - $	7.20	8 -inch meter - $	30.00
1½ -inch meter - $	8.40	10 -inch meter - $	34.00
2 -inch meter - $	13.50	12 -inch meter - $	38.00

Customers who are provided service under Schedules Mg-1, Ug-1, Mgt-1, or Mz-1, shall also be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

The property values method is used by 15 water utilities. This method requires that the utility compute the assessed value of all of the municipality's taxable parcels. The utility then must also identify and estimate the value of parcels that are tax-exempt (tax-exempt properties must pay the direct PFP charge). The sum of these two amounts is the total property value. The PFP cost-of-service is then divided by the total property value amount to obtain a PFP rate of dollars in PFP charge per 100,000 dollars of assessed valuation. Each property owner is then directly billed a direct PFP charge based on its property's assessed value (or the property's estimated assessed value in the case of tax-exempt properties). This method may be more equitable in that the PFP charge closely reflects the benefits received. In addition, this method closely mimics how property owners would be charged if the PFP were collected as a municipal charge using property taxes. The downside is that it takes significant effort for utility staff to develop an accurate property value table and correlate that table with its list of water customers. However, this is not an issue if the utility chooses to bill its PFP charge to non-general service customers as well. Figure 33 shows an example of a typical PFP tariff sheet using the property values method.

Figure 33. Sample Tariff for Direct PFP Charge Using the Property Values Method.

Public Fire Protection Service

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

This service shall include the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Quarterly Public Fire Protection Service Charges:

$1.96 per $1,000 of assessed valuation.

Customers who are provided service under Schedules Mg-1, Ug-1, Mgt-1, or Mz-1, shall also be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

Five water utilities use the square feet of improvements method. This method is similar to the property values method, except that the square feet of improvements of each parcel is substituted for the assessed value. In this case, the PFP cost-of-service is divided by the total square feet of improvements of all the municipality’s parcels. This generates a PFP rate of dollars in PFP charge per square foot of improvements. This method correlates PFP charge with size of structure. It does not result in a PFP charge to vacant lot owners. This method may be difficult to administer for those utilities that lack a municipal Geographic Information System. Figure 34 shows an example of a typical PFP tariff sheet using the square feet of improvements method.

Figure 34. Sample Tariff for Direct PFP Charge Using the Square Feet of Improvements Method.

Public Fire Protection Service

Public fire protection service includes the use of hydrants for fire protection service only and such quantities of water as may be demanded for the purpose of extinguishing fires within the service area. This service shall also include water used for testing equipment and training personnel. For all other purposes, the metered or other rates set forth, or as may be filed with the Public Service Commission, shall apply.

Under Wis. Stat. § 196.03(3)(b), the municipality has chosen to have the utility bill the retail general service customers for public fire protection service.

Quarterly Public Fire Protection Service Charges:

$0.0113 per square foot of improvements.

Customers who are provided service under Schedules Mg-1, Ug-1, or Sg-1 shall be subject to the charges in this schedule.

Billing: Same as Schedule Mg-1.

4.11 Allocating PFP Costs to Wholesale Customers

There are 28 regulated water utilities in Wisconsin that provide wholesale water service. These wholesale providers serve 53 water utilities that act as wholesale customers. The largest wholesale provider in the state is Milwaukee Water Works. Appendix H contains a table of these wholesale providers along with the communities that it serves.

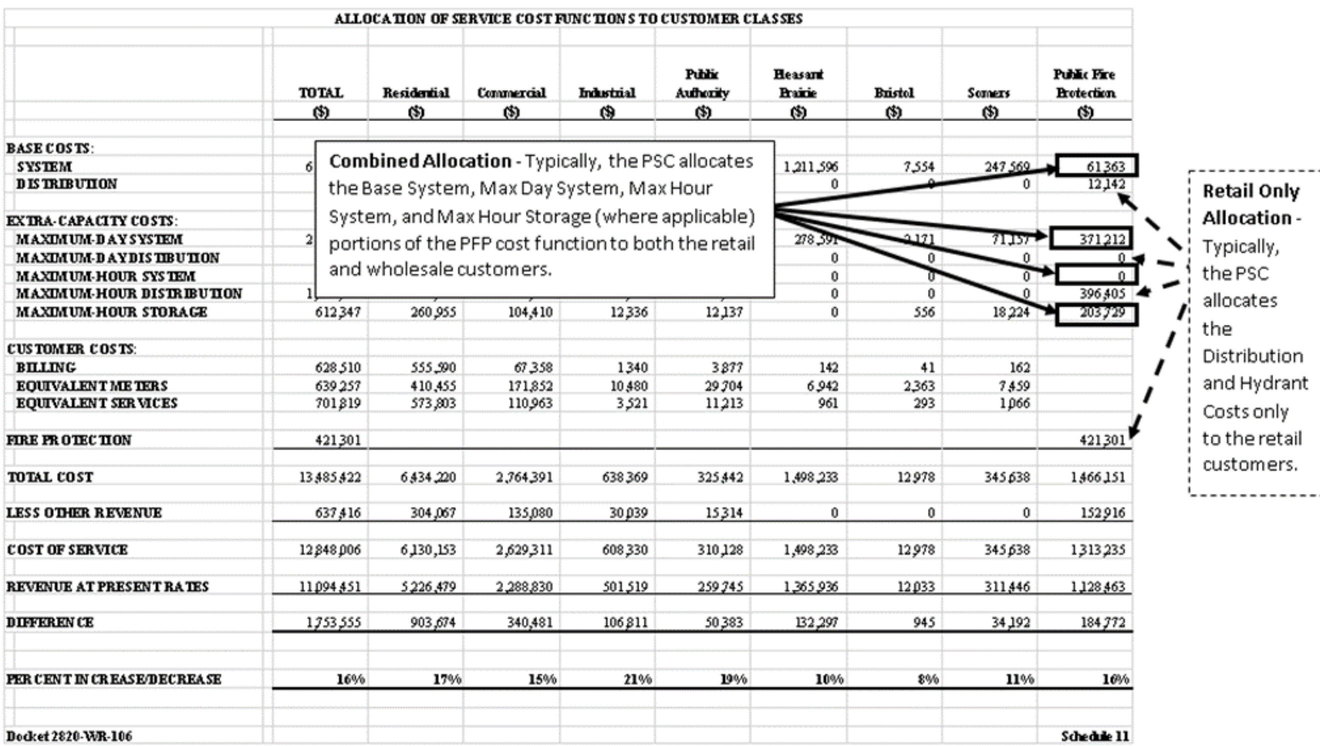
The existing PSC cost-of-service and rate design model was created to ensure that the wholesale customer pays the appropriate cost for any PFP benefits it receives. PFP benefits to wholesale customers include the cost to provide the higher flows at sufficient pressure and duration needed to fight fires in the wholesale customer community. If needed, a wholesale customer may rely on the wholesale provider's excess supply capacity, transmission mains, and water storage volume to meet the wholesale customer's PFP needs.

PFP charges to wholesale customers are often contentious issues in water rate cases. The wholesale provider and the wholesale customer could have a contract that clearly defines the water service being provided (maximum day, maximum day plus fire flow, etc.). In such cases, the cost-of-service and rate model could reflect the requirements of the contract. If the wholesale contract is not clear, or if the actual wholesale supplier's system hydraulics cannot meet the minimum contract requirements, then an analysis would be performed to determine what level of service the wholesale customer actually receives. In the final decision for the latest Milwaukee Water Works rate case (Docket 3720-WR-108) the Commission ruled that the "Oak Creek criteria" (Docket 4310-WR-104, p. 32) should be used to determine what PFP charge the wholesale customer should be allocated. Those criteria are:

- The wholesale customer has the capability to meet its maximum day plus fire flow based on its own distribution storage.
- The wholesale supplier cannot provide maximum day plus fire flow to the wholesale customer.
- There exist contractual limitations to the wholesale supplier's ability to provide maximum day plus fire flow.
- There exist technical limitations (i.e. flow control devices) to the wholesale supplier's ability to provide maximum day plus fire flow.

When performing a cost-of-service study for a wholesale provider, the PSC model first allocates a portion of the PFP cost-of-service (base distribution, maximum day distribution, maximum hour distribution, and the hydrants costs) solely to the retail customers (retail only allocation). Then, the PSC model allocates the remaining portion of the PFP cost-of-service (base system, maximum day system, maximum hour system, and maximum hour storage, where applicable) to both the wholesale and retail customers (combined allocation). The cost functions included in each of these two PFP allocations are shown in Figure 35.

Figure 35. PFP Cost Allocation to Retail and Wholesale Customers



ALLOCATION OF SERVICE COST FUNCTIONS TO CUSTOMER CLASSES

	TOTAL ($)	Residential ($)	Commercial ($)	Industrial ($)	Public Authority ($)	Pleasant Prairie ($)	Bristol ($)	Somers ($)	Public Fire Protection ($)
BASE COSTS:									
SYSTEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1,211,596	7,554	247,569	61,363
DISTRIBUTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	12,142
EXTRA-CAPACITY COSTS:									
MAXIMUM-DAY SYSTEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	278,591	2,171	71,157	371,212
MAXIMUM-DAY DISTIBUTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0
MAXIMUM-HOUR SYSTEM	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	0
MAXIMUM-HOUR DISTRIBUTION	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0	0	0	396,405
MAXIMUM-HOUR STORAGE	612,347	260,955	104,410	12,336	12,137	0	556	18,224	203,729
CUSTOMER COSTS:									
BILLING	628,510	555,590	67,358	1,340	3,877	142	41	162	
EQUIVALENT METERS	639,257	410,455	171,852	10,480	29,704	6,942	2,363	7,459	
EQUIVALENT SERVICES	701,819	573,803	110,963	3,521	11,213	961	293	1,066	
FIRE PROTECTION	421,301								421,301
TOTAL COST	13,485,422	6,434,220	2,764,391	638,369	325,442	1,498,233	12,978	345,638	1,466,151
LESS OTHER REVENUE	637,416	304,067	135,080	30,039	15,314	0	0	0	152,916
COST OF SERVICE	12,848,006	6,130,153	2,629,311	608,330	310,128	1,498,233	12,978	345,638	1,313,235
REVENUE AT PRESENT RATES	11,094,451	5,226,479	2,288,830	501,519	259,745	1,365,936	12,033	311,446	1,128,463
DIFFERENCE	1,753,555	903,674	340,481	106,811	50,383	132,297	945	34,192	184,772
PERCENT INCREASE/DECREASE	16%	17%	15%	21%	19%	10%	8%	11%	16%

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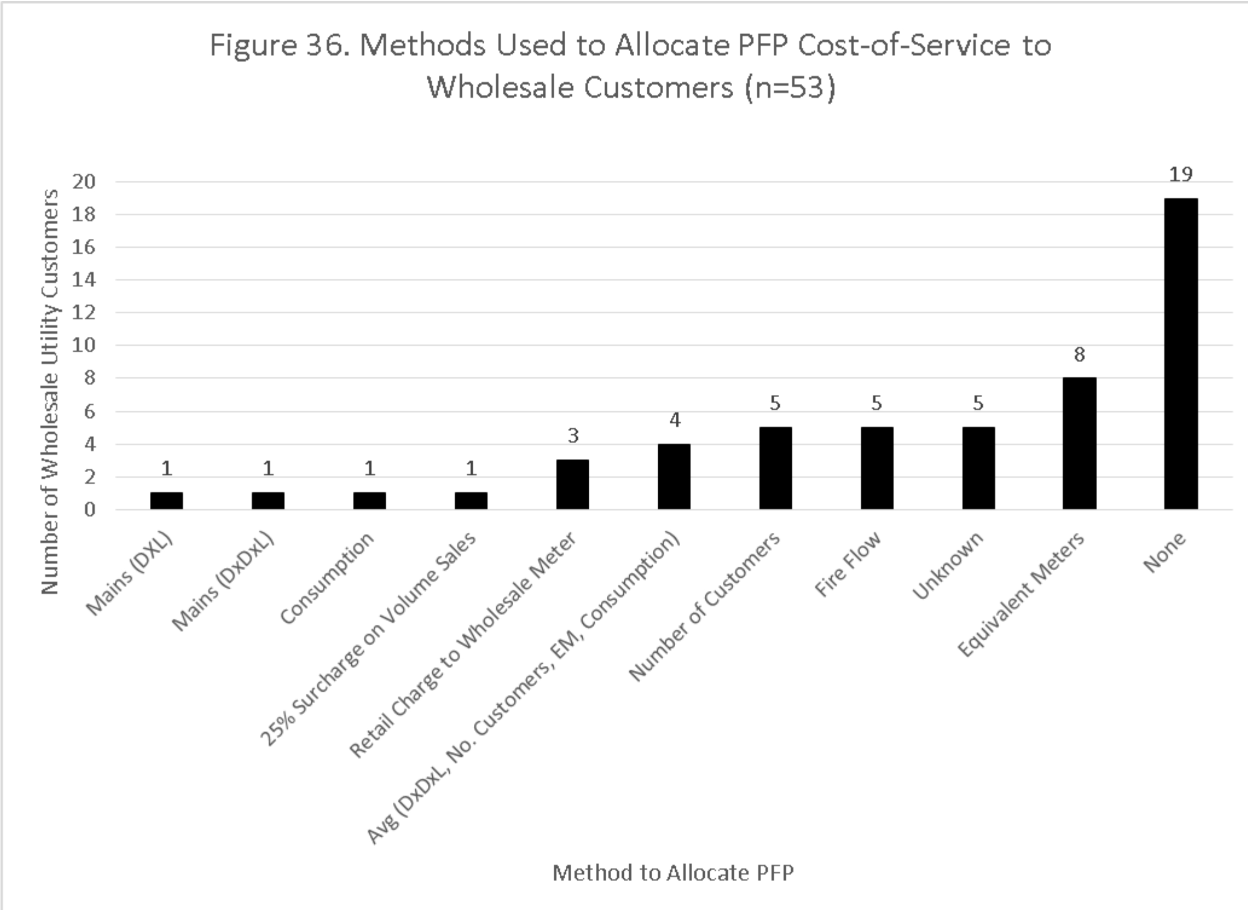
The "Combined Allocation" of the PFP customer class (base system, maximum day system, maximum hour system and maximum hour storage) is then allocated between the retail and wholesale customers using one of the following methods:

- Population-based methods – relative populations

- Milwaukee Method – average of Freeman's Formula maximum and min, NBFU Method, and Kuickling Method
- Equivalent meters
- Feet of main / D x L / D x D x L
- Number of customers
- Consumption
- Fire flows totals – flow rate x duration
- Elevated storage
- Number of hydrants
- Wholesaler's retail PFP charge to wholesale meter
- Combination of various methods

Appendix H also lists the methods used to allocate the PFP cost to the wholesale customers. Figure 36 shows the number of Wisconsin's wholesale customers using each PFP allocation method.



5. Methods Used by Other States to Compute and Recover the Public Fire Protection Cost

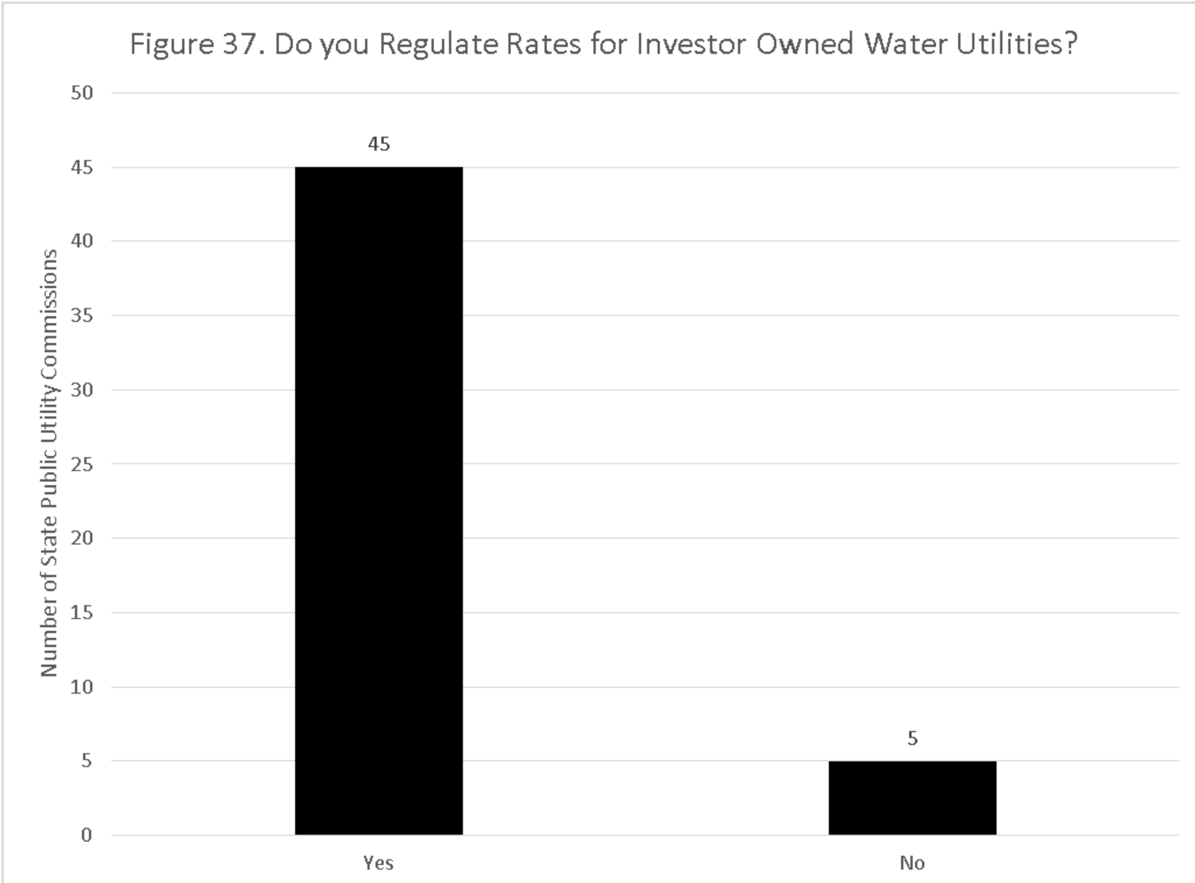
The PSC created a survey comprised of 20 questions to find out how other public utility commissions of each state in the United States computes public fire protection costs, allocates them to the cost functions and customer classes, and then develops appropriate rates. The survey was sent via email to all 50 public utility commissions. The first email was sent on April 14, 2015. As needed, follow-up emails were sent in May, June, and July 2015. The results of the survey are included in Appendix I. All 50 public utility commissions responded to the survey. The quality of the responses varied. The answers to Questions 1 and 2 are discussed below. The remaining answers are discussed in Section 6 of this report.

The first survey question asked, “Do you regulate rates for municipal water utilities?” As seen in Table 1, there were 10 states that responded that they do regulate municipal water utilities, at least under certain circumstances. Only Wisconsin regulates municipal water utilities under all circumstances.

Table 1. “Do you Regulate Rates for Municipal Water Utilities?”

	Number of Public Utility Commissions	States
Yes, Regulate Rates for All Municipal Water Utilities	1	WI
Yes, Regulate Rates for Certain Types of Municipal Water Utilities and/or Under Certain Conditions	9	AK, IN, ME, MD, MS, NJ, PA, RI, WV
No, Does Not Regulate Rates for Municipal Water Utilities	40	Remaining States

The second question of the survey asked, “Do you regulate rates for investor owned water utilities?” The response is summarized in Figure 37 shown below. The five public utility commissions that do not regulate rates for investor-owned water utilities are: Georgia, Michigan, Minnesota, North Dakota, and South Dakota.



6. Discussion of Options for Computing and Allocating the Public Fire Protection Charge

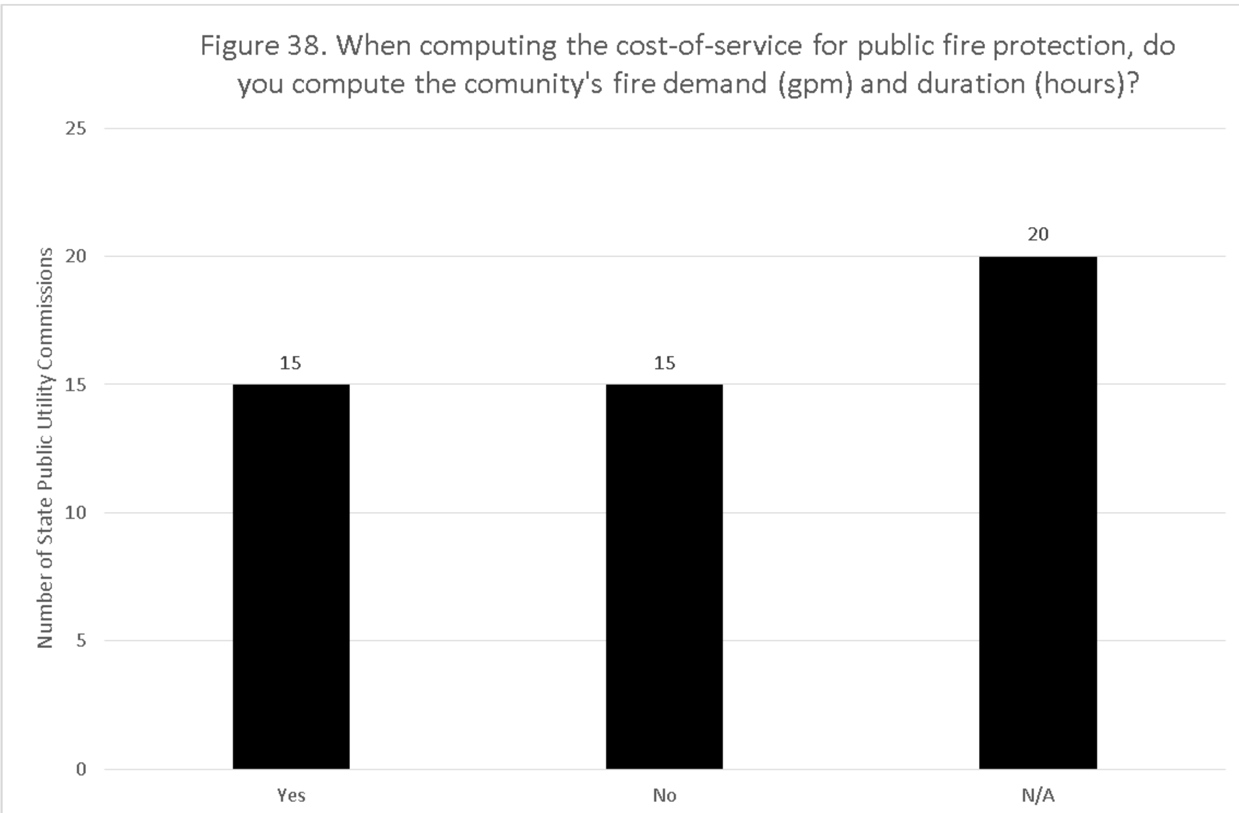
Section 4 of this report describes how the PSC model currently computes PFP cost-of-service and rates. The following sections discuss possible improvements to the PSC model.

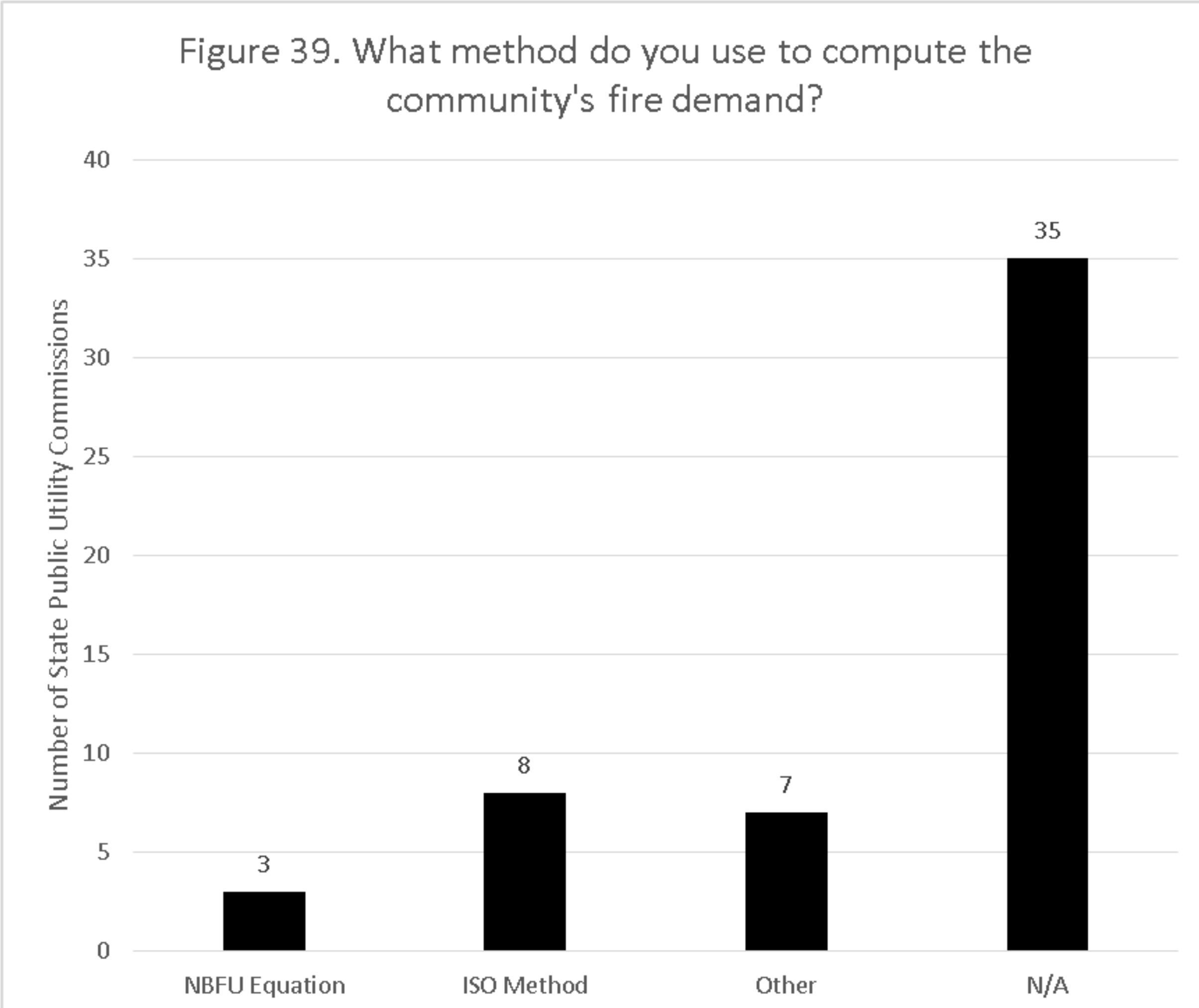
6.1 Computation of Fire Demand

As discussed in Section 4 of this report, the PSC model uses the community's estimated fire demand as one factor in computing the non-PFP cost functions. When performing a cost-of-service study, the PSC model relies on a previous estimate of fire demand from the most recent rate case, unless there is a reason to change it. Historically, PSC fire demands were based on the NBFU method. This population based equation has the advantage of being consistent with prior practice. Unfortunately, it may be overestimating the fire demand for large systems because actual fire demand tops out at the largest building fire, regardless of the size of the population being served. It also may be underestimating the fire demand of smaller communities because it does not take into account site specific fire hazards like large industries that may be located in small communities. In addition, the NBFU population-based equation is based on data that is over 70 years old, and it does not reflect the current state of fire science.

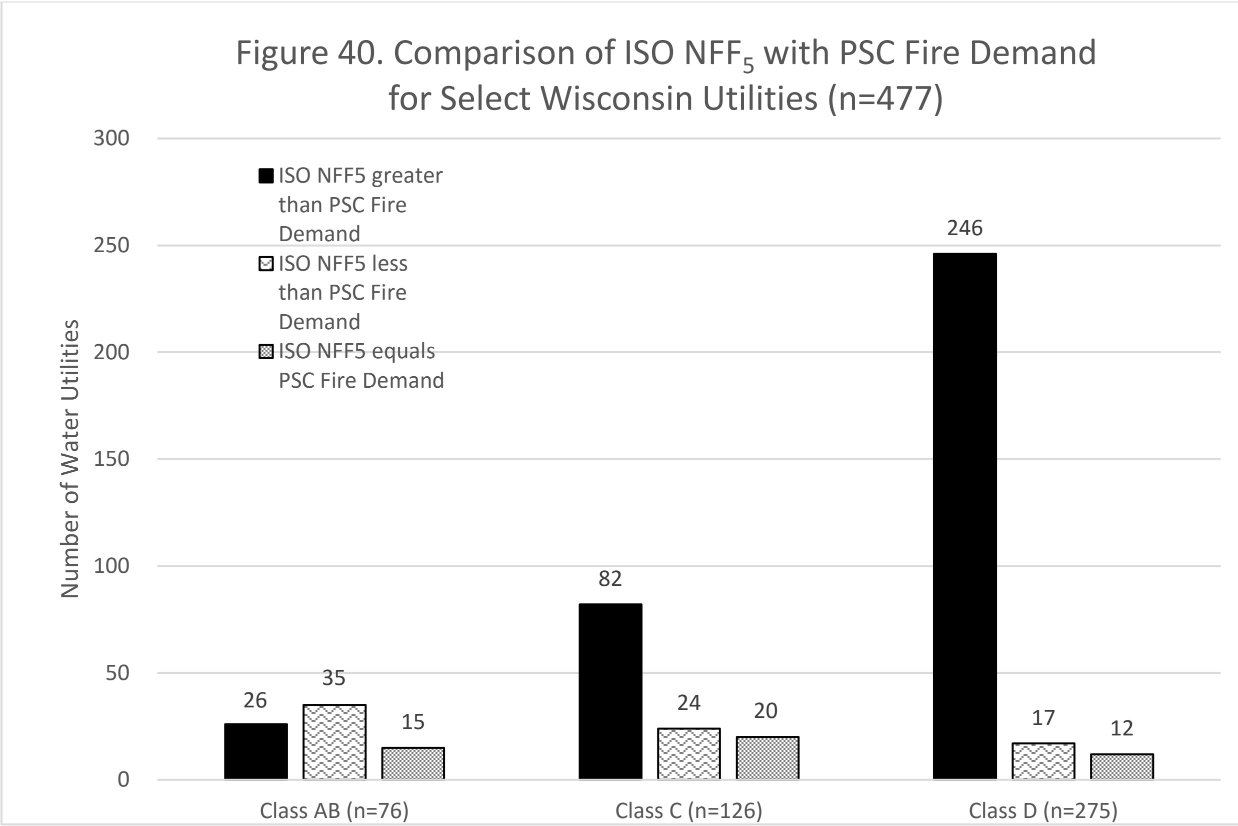
Today, the Insurance Services Office (ISO) has replaced the NBFU as the national standard for computing a community's fire demand. ISO assigns each community a rating between 1 and 10 based on its firefighting ability. This rating system is a national standard used by insurance companies to calculate property and homeowners' insurance premiums. To determine a community's rating, ISO conducts on-the-ground surveys of the structures in a community and calculates a "needed fire flow" (NFF) for each building. When computing each NFF, ISO takes into account the building area, occupancy, construction type, building use, and exposures, and the presence of sprinklers. ISO also performs actual hydrant flow tests in each community to rate the effectiveness of the distribution system to provide water for firefighting. As part of the rating process, ISO considers the fifth-highest NFF (NFF_5) as representative of the fire demand for a given community. Unlike the population based formulas, the NFF_5 is not an estimate. It is calculated directly from data about structures located within the community and, therefore, reflects the unique character of each community.

Figure 38 shows that, based on the survey of the 50 public utility commissions, there are 15 states that compute the community's fire demand and duration when they calculate the PFP cost-of-service. Figure 39 shows that 8 of those 15 utilities use the ISO method to compute fire demand, while three use the population based equations.





Commission staff obtained NFF_5 fire flow data for 477 of Wisconsin's 582 regulated water utilities as a result of generous help from the Insurance Services Office. The sample consists of 76 Class AB utilities, 126 Class C utilities, and 275 Class D utilities. The data are shown in Appendix J. Commission staff compared the NFF_5 fire flow with the PSC fire demand to see how they differ. Figure 40 shows that for 26 of the 76 Class AB utilities sampled, the ISO NFF_5 fire flow was greater than the PSC fire demand. The adoption of the ISO NFF_5 fire flow in the PSC cost-of-service study would result in an increase in the PFP cost-of-service for these 26 utilities. Another 35 Class AB utilities from the same sample had ISO NFF_5 fire flows less than the PSC fire demand. The remaining 15 Class AB utilities from the same sample had ISO NFF_5 fire flows equal to the PSC fire demand. Figure 40 shows that for 82 of the 126 Class C utilities sampled, the ISO NFF_5 fire flow was greater than the PSC fire demand. The adoption of the ISO NFF_5 fire flow in the PSC cost-of-service study would result in an increase in the PFP cost-of-service for these 82 utilities. Another 24 Class C utilities from the same sample had ISO NFF_5 fire flows less than the PSC fire demand. The remaining 20 Class C utilities from the same sample had ISO NFF_5 fire flows equal to the PSC fire demand. Among the 275 Class D utilities sampled, 246 had an ISO NFF_5 fire flow greater than the PSC fire demand. Only 17 Class D utilities had ISO NFF_5 fire flows less than the PSC fire demand, and another 12 utilities had ISO NFF_5 fire flows equal to the PSC fire demand. Assuming that the 477 utilities sampled are statistically representative of the entire population of the 582 regulated water utilities in Wisconsin, the use of the ISO NFF_5 fire flows would decrease the PFP cost-of-service for 46 percent of the Class AB utilities. Approximately 65 percent of the Class C utilities could expect to experience an increase in the PFP cost-of-service. For Class D utilities, about 89 percent of the utilities would experience an increase in the PFP cost-of-service.



Commission staff chose fifteen utilities to compute the actual change in the PFP cost-of-service that results from using the ISO NFF_5 fire flow. These sample utilities include those with some of the biggest difference between the ISO NFF_5 fire flow and the PSC fire demand. Table 2 summarizes the results. Based on the results displayed below, it is estimated that if the ISO NFF_5 fire flow is substituted for the PSC fire demand, the PFP cost-of-service for Class AB utilities may change from -35 percent to +4 percent. Similarly, for Class C utilities the PFP cost-of-service may change from -23 percent to +32 percent. Class D utilities may experience a PFP cost-of-service change from -19 percent to +28 percent.

Table 2. Comparison of the Impact Using the PSC Fire Demand Versus the ISO 5th Highest Needed Fire Flow on the PFP Cost-of-Service.

Utility Name	Utility ID	No. Customers	Utility Class	PSC Fire Demand (gpm)	PSC Fire Demand Duration (hours)	PFP Cost-of-Service Based on PSC Fire Demand ($)	ISO 5th Highest Needed Fire Flow (gpm)	ISO Fire Demand Duration (hours)	PFP Cost-of-Service Based on ISO Fire Demand ($)	Percent Difference Between PSC PFP COS and ISO PFP COS (%)
Milwaukee Water Works	3720	162,369	AB	17,962	18	$ 8,126,970	7,500	4	$ 5,310,862	-35%
Eau Claire Municipal Water Utility	1740	26,769	AB	7,000	7	$ 1,487,464	5,500	4	$ 1,265,292	-15%
Marinette Municipal Water Utility	3370	4,766	AB	5,000	5	$ 1,120,132	4,500	4	$ 953,829	-15%
Grand Chute Sanitary District No. 1	2310	8,332	AB	5,000	5	$ 567,876	5,500	4	$ 577,190	2%
West Allis Municipal Water Utility	6360	19,507	AB	6,000	6	$ 1,225,153	7,000	4	$ 1,276,468	4%
Wauwatosa Water Utility	6320	15,517	AB	5,000	5	$ 981,340	5,500	4	$ 1,025,414	4%
Sussex Water Public Utility	5835	3,380	C	4,500	5	$ 487,293	3,500	3	$ 376,016	-23%
Brown Deer Water Public Utility	780	3,734	C	4,000	4	$ 264,622	3,500	3	$ 242,626	-8%
Mineral Point Municipal Water Utility	3740	1,423	C	1,500	2	$ 137,471	2,500	2	$ 147,235	7%
Shorewood Municipal Water Utility	5440	3,534	C	2,500	3	$ 374,672	3,000	3	$ 409,965	9%
Mequon Municipal Water Utility	3595	3,724	C	2,300	2.3	$ 591,022	4,500	4	$ 765,295	29%
Poynette Municipal Water Utility	4810	997	C	2,000	2	$ 122,904	3,000	3	$ 162,672	32%
Bristol Water Utility	720	502	D	2,500	2	$ 78,213	1,750	2	$ 63,553	-19%
Orfordville Municipal Water Utility	4450	549	D	1,000	2	$ 88,602	2,250	2	$ 99,955	13%
Milltown Water Utility	3680	441	D	500	2	$ 33,277	3,000	3	$ 42,495	28%

In summary, Commission staff believes that the ISO NFF_5 fire flow may be viewed as superior to the current PSC method for computing fire demand that relies on population based equations like the NBFU or Kuickling equations. The ISO method is based on an analysis by a neutral party that results in a calculation of fire demand that could be defended in a contested rate case.

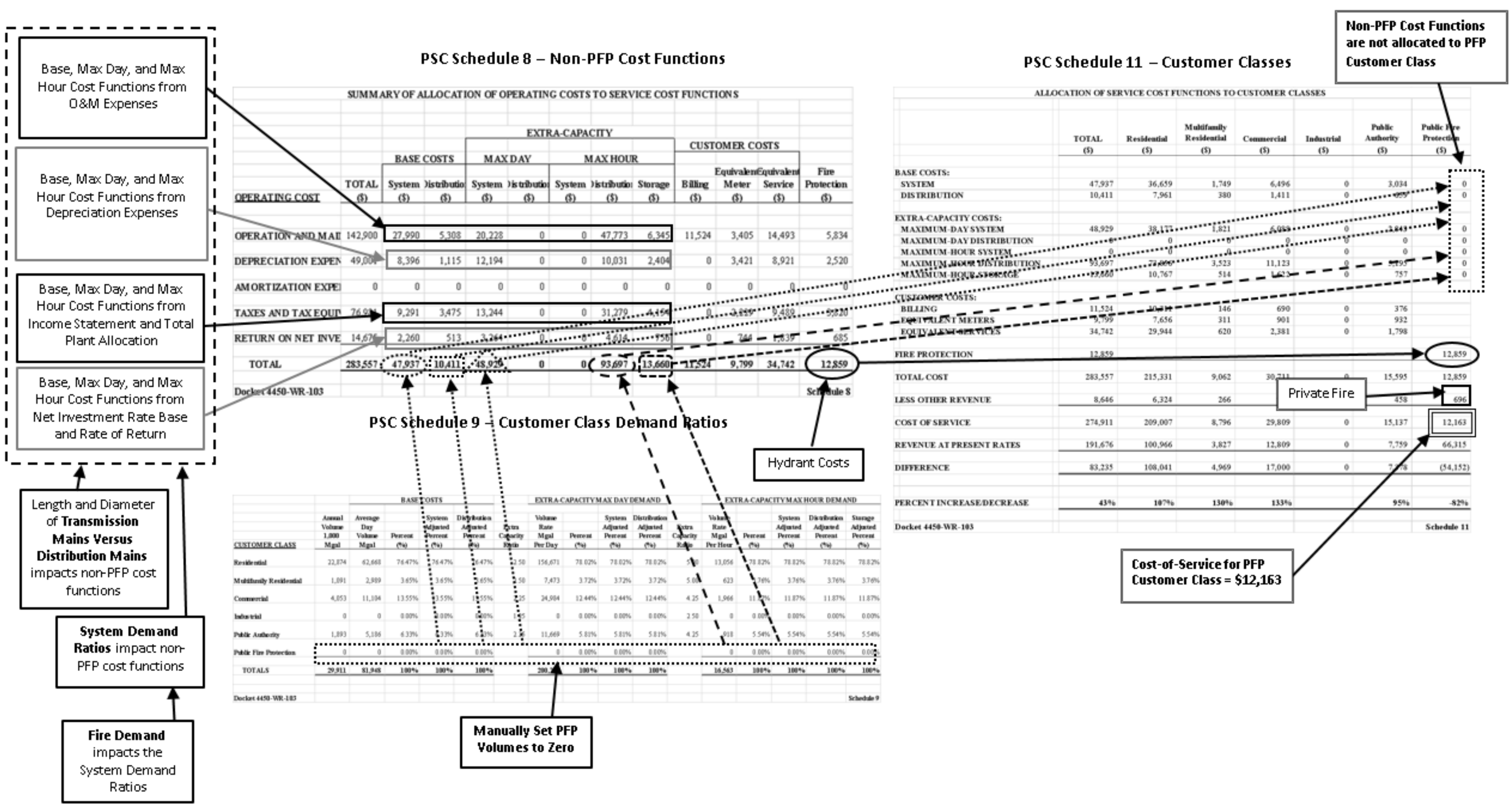
6.2 Allocation of Costs to the PFP Cost Function and PFP Customer Class

The existing PSC cost-of-service model allocates hydrant costs to the PFP cost function directly, which makes the PFP cost function simple to understand and to predict. In contrast, the PFP customer class is based on a calculated function of the hydrant costs, the fire demand, the system demand ratios, the proportion of transmission main versus distribution main, the customer demand ratios, and the water sales from each customer class. As shown in Figure 6, as general water service sales decrease, the PFP cost-of-service increases. This relationship is due to the fact that the cost of the created excess supply capacity is assigned not only to the general service customer classes, but also to the PFP customer class, even though the number of hydrants and the community's actual PFP demand may not have changed. To address this issue of increases in PFP charges with decreasing sales volume, the PSC COSS model could be modified to separate customer water sales volumes from the PFP customer class, or to at least mitigate the impact of water sales on the PFP customer class.[3] Commission staff describes the following three options for revising the PSC cost-of-service model with the goal of mitigating or separating customer class sales volumes from the final PFP customer class.[4]

Option #1 eliminates the allocation of non-PFP cost functions to the PFP customer class. The result is that the PFP customer class represents hydrant costs only. This result is accomplished by taking the standard PSC cost-of-service model and assigning zero volumes to the PFP customer class in the worksheet titled, "Customer Class Demand Ratios" (Schedule 9). The PFP cost function (hydrant costs) is then the sole amount allocated to the PFP customer class as shown in Figure 41. The actual model results are shown in Appendix K.

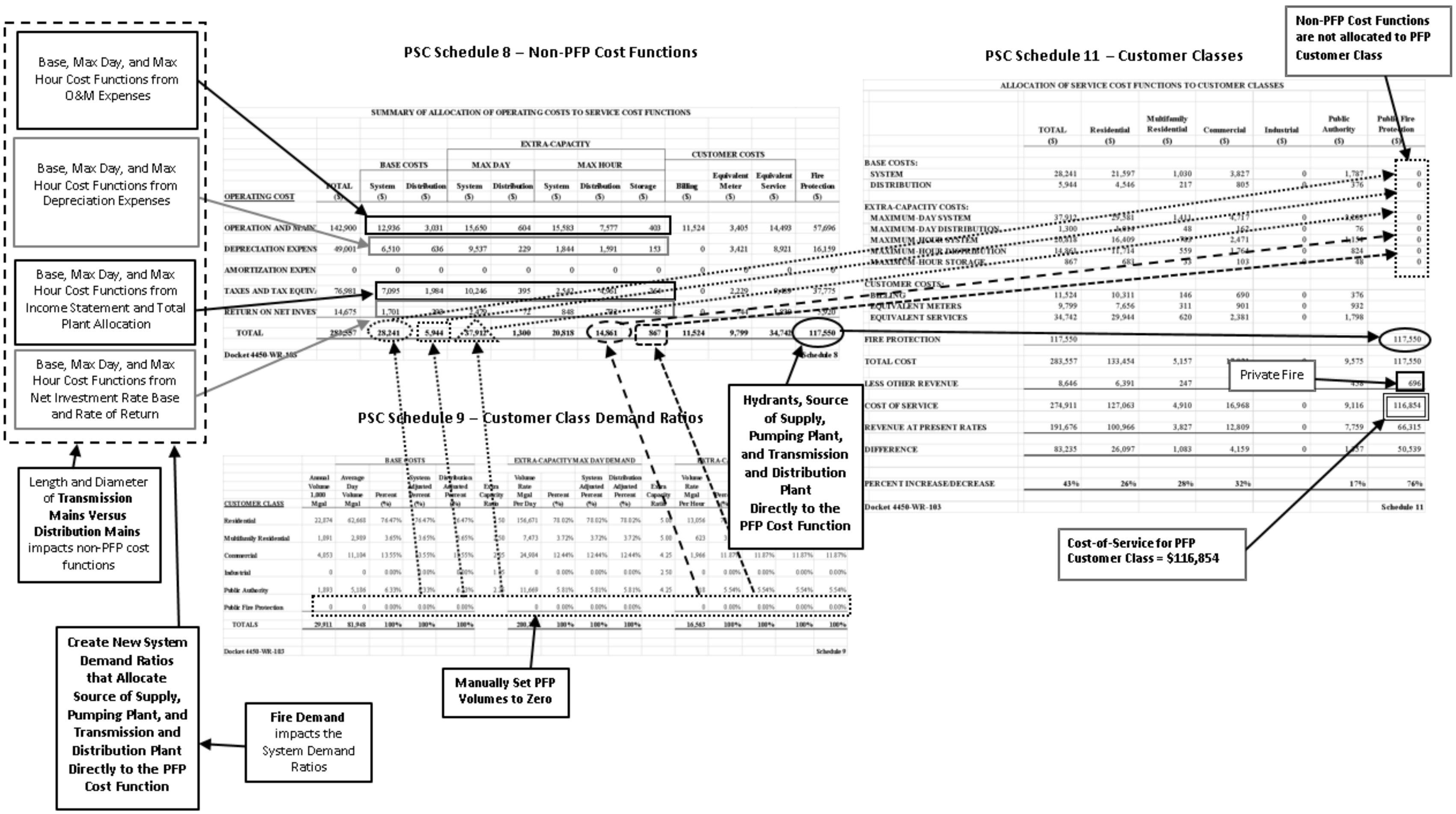
[3] See comments by Municipal Environmental Group in PSC REF#: 286177
[4] See alternative allocation method proposed by Kaempfer & Associates, Inc. in PSC REF#: 286151

Figure 41. Option #1 - Cost Allocation to PFP Customer Class



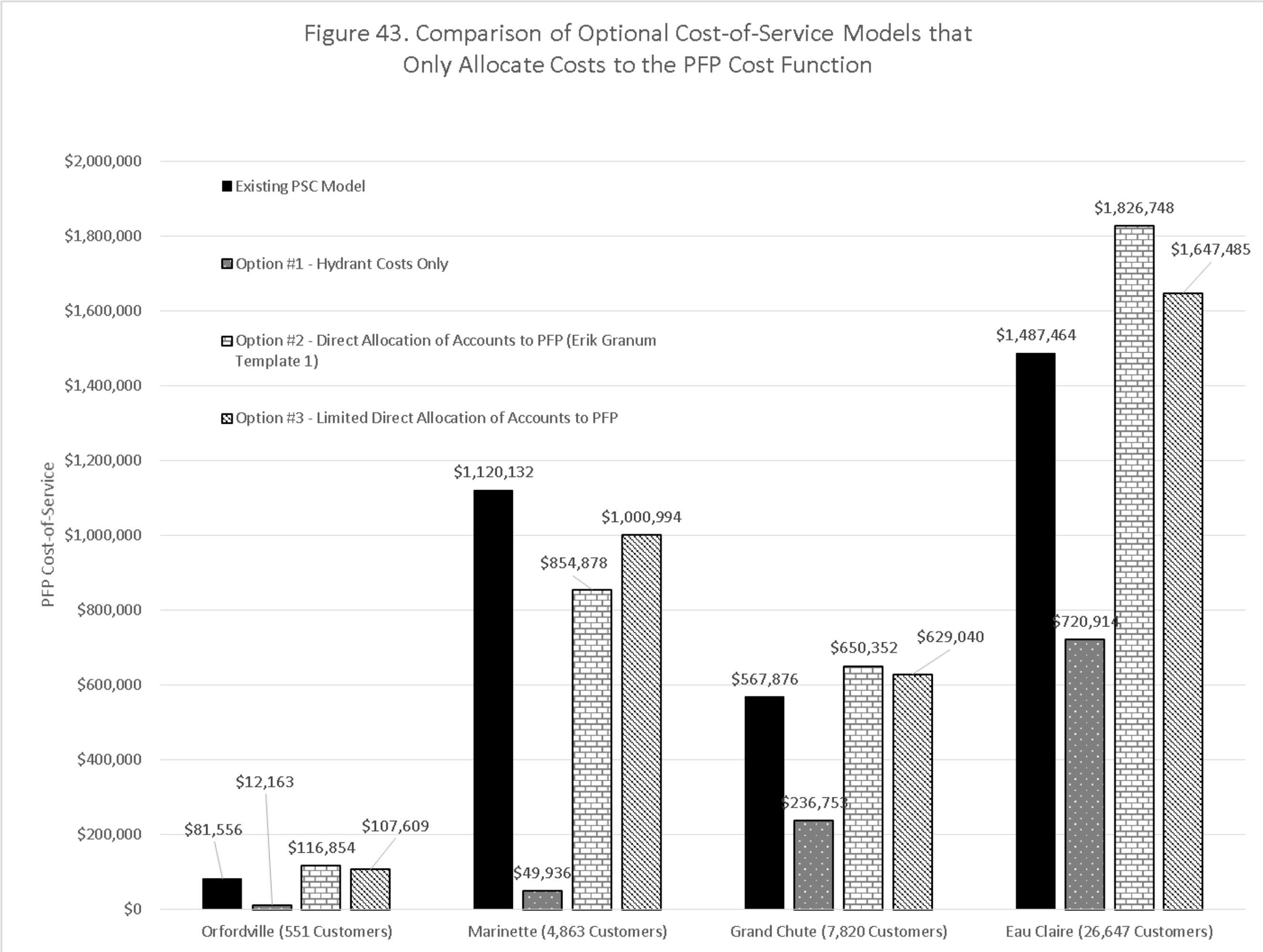
Option #2 allocates additional accounts directly to the PFP cost function by using additional system demand ratios that include fire demand. This option was developed by Erik Granum of Trilogy Consulting, LLC, as one of several possible methods to improve the PSC model for computing the PFP cost-of-service, as discussed in (PSC REF#: 237301). Option #2 is the same as Erik Granum's Template #1. It expands the type of facilities and costs directly allocated to the PFP cost function. The resulting PFP cost function includes contributions from hydrants as well as source of supply, pumping plant, distribution reservoirs and standpipes, and distribution main costs. Unfortunately, Option #2 does not significantly mitigate the impact that the volume of water sales has on the total amount allocated to the PFP customer class as compared to the standard PSC model. The allocation used in Option #2 is shown in Figure 42. The actual model results are shown in Appendix L.

Figure 42. Option #2 - Cost Allocation to PFP Customer Class



Option #3 is similar to Option #2, but it allocates fewer accounts to the PFP cost function. The resulting PFP cost function includes hydrants as wells as contributions from the distribution reservoirs and standpipes account and the distribution main account. Unfortunately, Option #3 does not significantly mitigate the impact that the volume of water sales has on the total amount allocated to the PFP customer class as compared to the standard PSC model. The actual model results are shown in Appendix M.

Four sample utilities (Orfordville, Marinette, Grand Chute, and Eau Claire) were used to compare the resulting PFP cost-of-service using the existing PSC cost-of-service model and the three options. It is worth noting that all three options are analyzed using the current PSC fire demand and not the ISO fire demand. The results are shown in Figure 43. Option #1 is the simplest of the three options because only the hydrant costs are allocated to the final PFP cost-of-service. Option #2 is the most thorough allocation of costs to the PFP cost-of-service. Option #3 produced results closest to the existing PSC model.



Based on the survey of the 50 public utility commissions, there are eighteen states that require regulated water utilities to include a separate cost allocation for public fire protection. The survey found that seventeen states require that cost-of-service studies treat public fire protection as a separate cost function. Sixteen states identify which assets are directly allocated to the PFP cost function. These assets are shown in Figure 44. The same sixteen states identified how costs are allocated to the PFP cost function, as shown in Figure 45. The survey found that 34 states either do not directly allocate assets to the PFP cost function or they did not respond to this survey question. These 34 states were identified as “Not Applicable” (N/A).

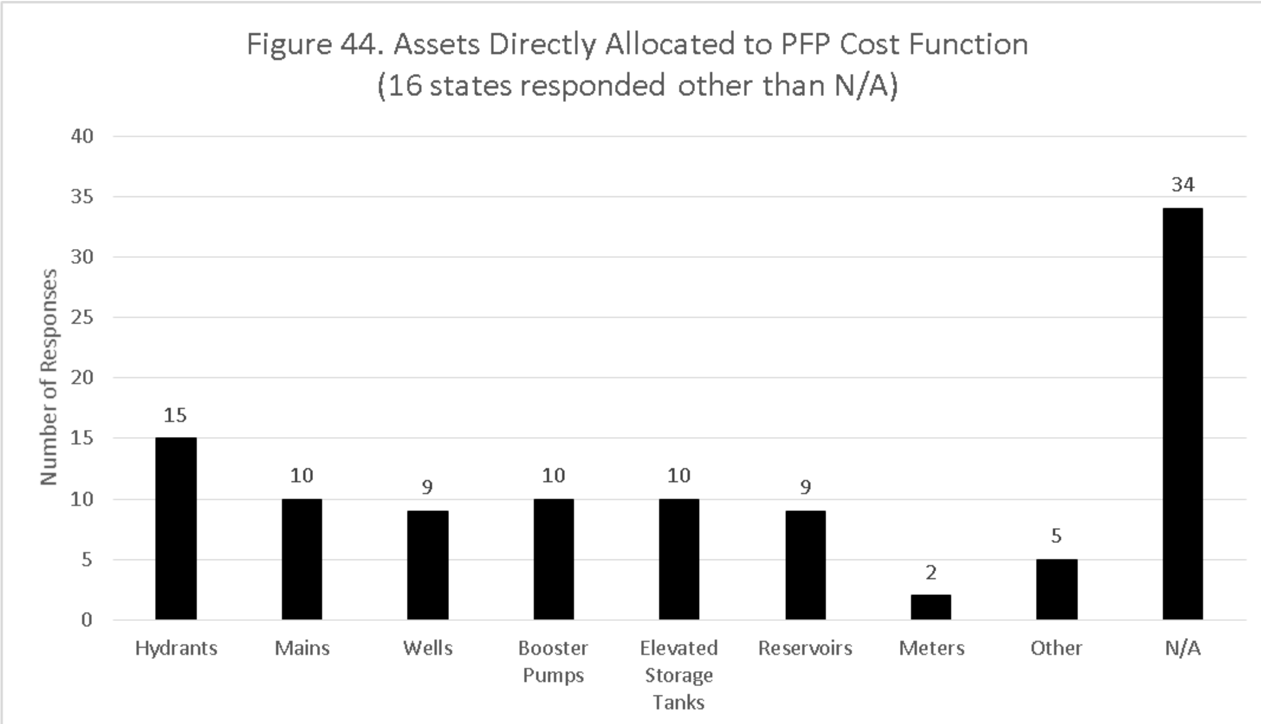
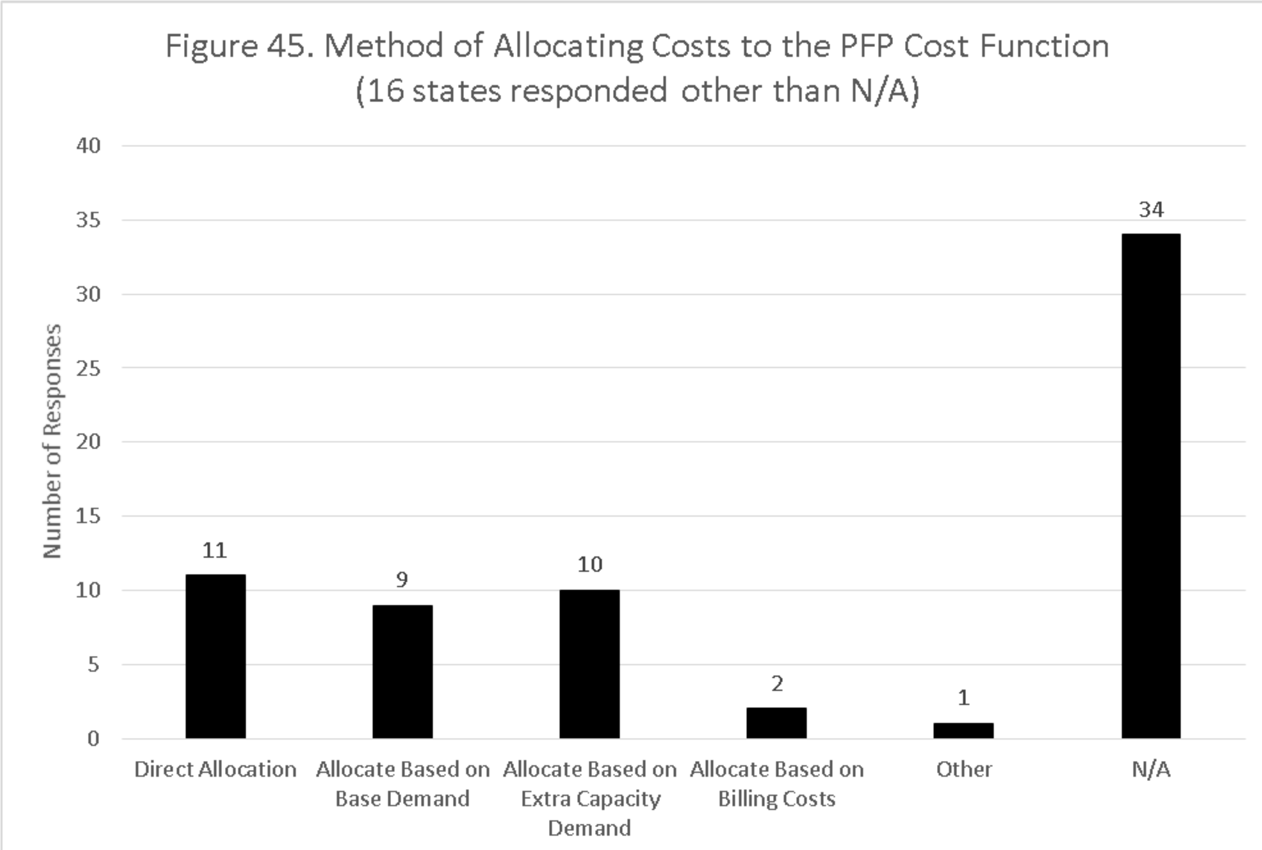


Figure 44. Assets Directly Allocated to PFP Cost Function
(16 states responded other than N/A)
Number of Responses
40
35
30
25
20
15
10
5
0
15
10
9
10
10
9
2
5
34
Hydrants
Mains
Wells
Booster Pumps
Elevated Storage Tanks
Reservoirs
Meters
Other
N/A



The survey found that eighteen states require that cost-of-service studies treat public fire protection as a separate customer class. Sixteen states identify which assets are directly allocated to the PFP cost function. These assets are shown in Figure 46. Seventeen states identify how costs are allocated to the PFP customer class as shown in Figure 47.

Figure 46. Assets Directly Allocated to PFP Customer Class (18 states responded other than N/A)

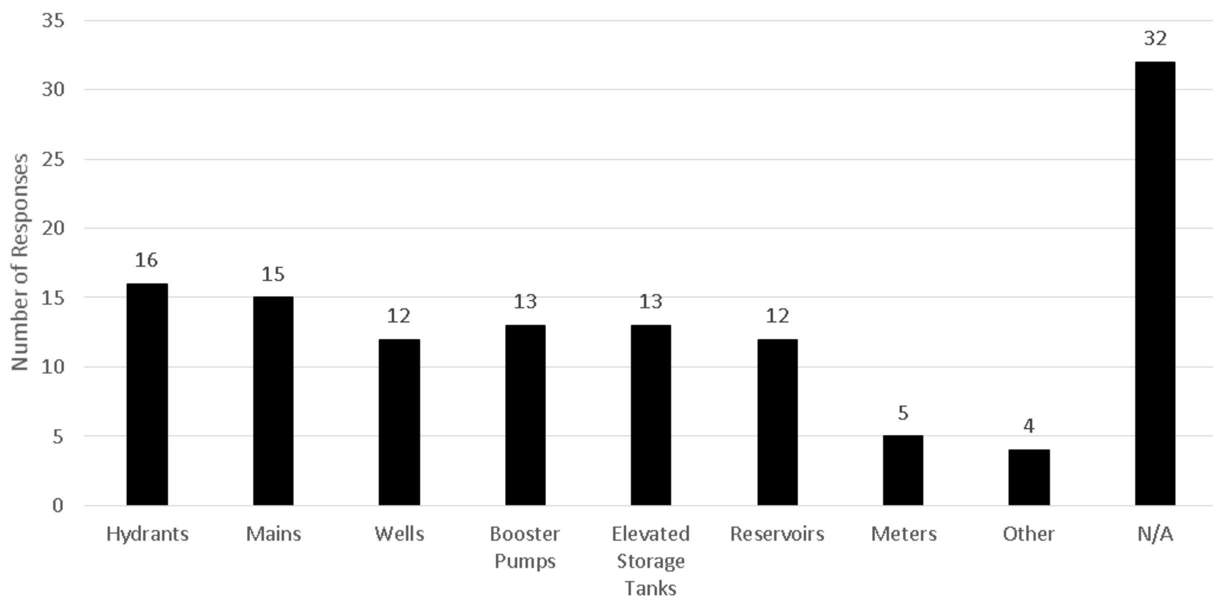
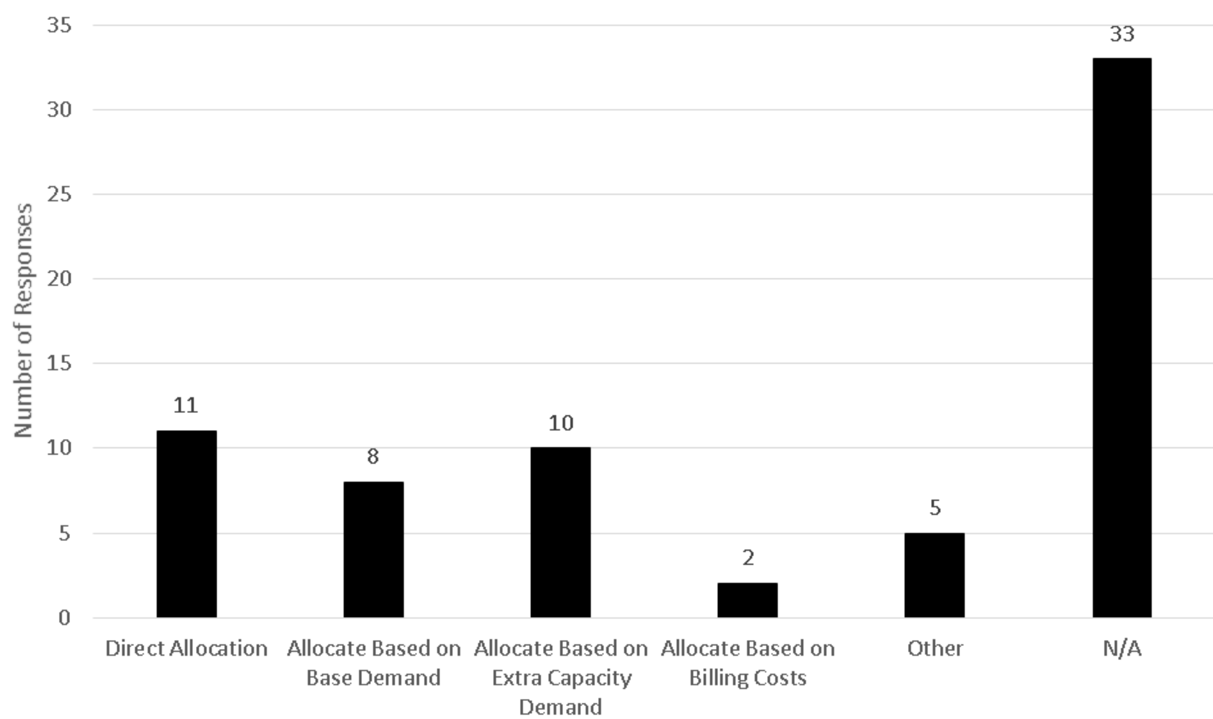


Figure 47. Method of Allocating Costs to the PFP Customer Class (17 states responded other than N/A)



6.3 Limit Maximum PFP Cost-of-Service

Another option for dealing with the issue of increases in the PFP cost-of-service as general water service sales decrease is to place a cap or maximum limit on the PFP cost-of-service. This cap could be calculated as a maximum percentage of the total cost-of-service. Based on the survey of the 50 public utility commissions, there are two states that report specific methods for capping the maximum allowable public fire protection cost. The Maine Public Utilities Commission does not allow the PFP cost-of-service to exceed 30 percent of the total cost-of-service. The Pennsylvania Public Utility Commission limits the PFP cost-of-service in some cases. For companies that are required to provide a cost of service study, the rate charged for PFP is limited to 25 percent of the PFP cost-of-service, with some exceptions.

One result of implementing a cap on the PFP cost-of-service is that if general service consumption decreases, the cap reduces the allocation of the excess capacity costs to the PFP cost-of-service. However, the application of a cap may appear to be subjective. Unless it is codified in statute or administrative code, it may become a contested issue.

Among Wisconsin's regulated water utilities, the PFP cost-of-service ranges from 9 percent of a water utility's total cost-of-service (Milwaukee Water Works) to as high as 45 percent of a water utility's total cost-of-service (Tony Municipal Water Utility). As shown in Figure 5, as the number of customers increases, the PFP cost-of-service as a percentage of the total cost-of-service decreases. Based on the same data set, Commission staff computed the average value for the "PFP cost-of-service as a percentage of total cost-of-service" for each utility class. The values are shown in Table 3 below. One alternative would be to use these average values as a cap for each utility class. If such a cap were adopted, those utilities experiencing a decrease in their PFP cost-of-service would see a proportionate increase in the cost-of-service for their residential, commercial, industrial, and public authority customers.

Table 3. Average PFP Cost-of-Service as a Percentage of Total Cost-of-Service (n=218)

Utility Class	Averge PFP Cost-of-Service as Percentage of Total Cost-of-Service
AB	18%
C	29%
D	34%

6.4 Class Absorption Method

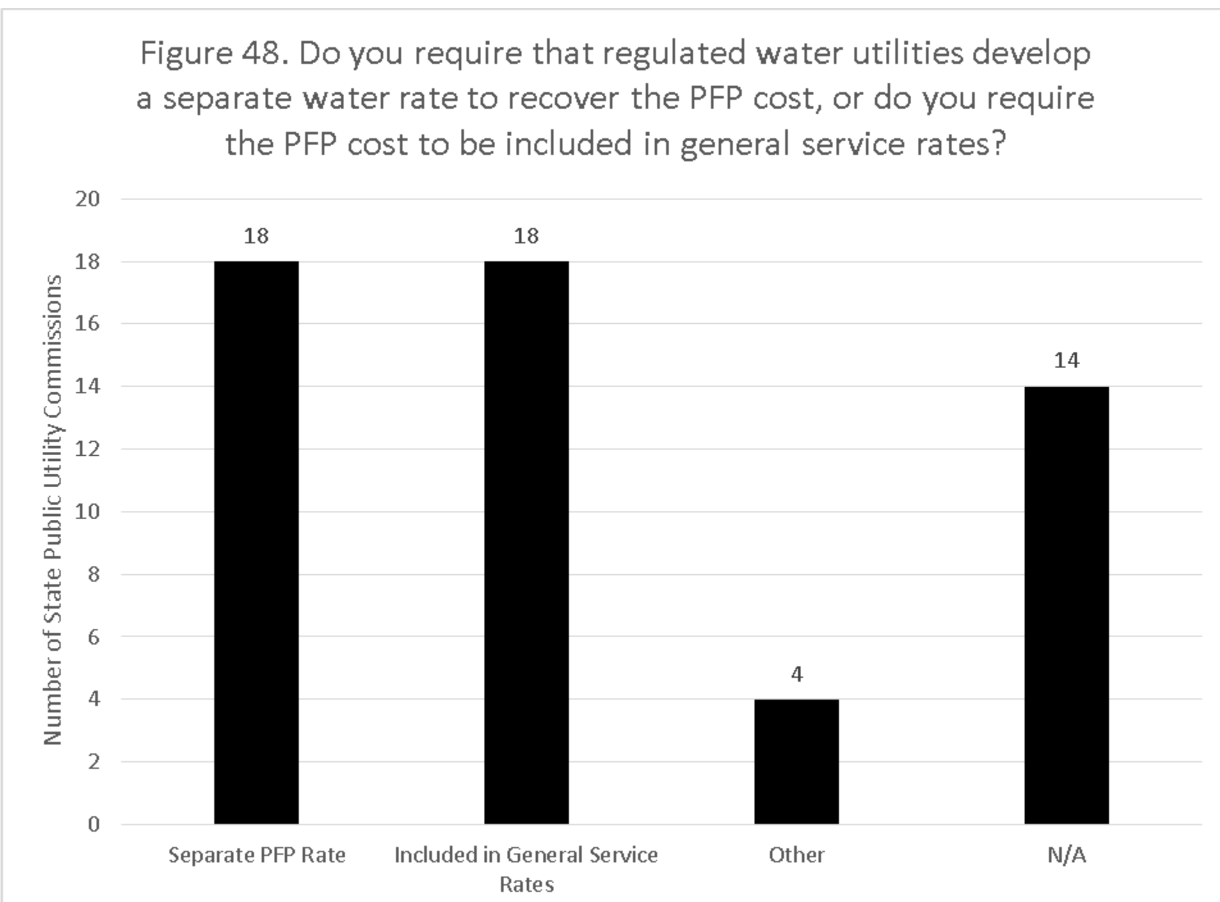
John Mayer, a utility rate consultant, proposed the "class absorption" method in his 1988 testimony submitted in Docket 05-WI-100. (PSC REF#: 230968) The class absorption method eliminates the PFP customer class. Under this method all PFP costs are absorbed into the other customer classes and recovered through general service rates. The same result has been achieved in this study by using the PSC cost-of-service model and allocating the hydrant costs in Account 348 (utility financed plant, total plant, and depreciation expenses schedules) to the cost functions of base distribution and maximum hour distribution. The allocation is accomplished using the same allocation factors as those used for Account 343, distribution mains. For Class AB utilities, the maintenance of hydrants cost in Account 677 of the operation and maintenance expenses schedule is also allocated to the same cost functions using the same allocation percentages as are used for Account 673, maintenance of distribution mains. The PFP volume is then set to zero in the customer class demand ratio schedule. An explanation of this method is found in Appendix N. Table 4 summarizes how the class absorption method impacts the cost-of-service amount for the non-PFP customer classes for a select sample of utilities. It is important to note that these results are the same regardless of whether the model uses the PSC fire demand or the ISO fire demand.

Table 4. Comparison of PSC COS Model and Class Absorption COS Model

Orfordville (551 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$154,388	$6,203	$21,514	$0	$11,250	$81,556	$274,911
Class Absorption Method	$218,561	$9,253	$31,276	$0	$15,821	$0	$274,911
% Difference	42%	49%	45%	0%	41%	-100%	0%
Marinette (4,863 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$1,582,988	$13,525	$567,130	$1,405,641	$194,275	$1,120,132	$4,883,691
Class Absorption Method	$2,082,754	$18,616	$758,638	$1,758,131	$265,552	$0	$4,883,691
% Difference	32%	38%	34%	25%	37%	-100%	0%
Grand Chute (7,820 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$2,264,420	$0	$2,132,788	$404,601	$112,762	$567,876	$5,482,447
Class Absorption Method	$2,543,180	$0	$2,379,253	$434,184	$125,830	$0	$5,482,447
% Difference	12%	0%	12%	7%	12%	-100%	0%
Eau Claire (26,647 Customers)							
	Residential Cost-of-Service	Multi-Family Cost-of-Service	Commercial Cost-of-Service	Industrial Cost-of-Service	Public Authority Cost-of-Service	PFP Cost-of-Service	Total Cost-of-Serivce
PSC Standard Model	$4,711,735	$348,402	$1,446,411	$1,030,616	$447,495	$1,487,464	$9,472,123
Class Absorption Method	$5,507,622	$423,762	$1,740,365	$1,223,566	$576,808	$0	$9,472,123
% Difference	17%	22%	20%	19%	29%	-100%	0%

Erik Granum has recommended that as an alternative, the class absorption method could keep the PFP cost function for hydrants so that their function and related costs are clearly identified. The fire protection costs could then be allocated to the other customer classes at the back end of the PSC cost-of-service model once all other costs have been appropriately allocated. This would allow utilities to collect hydrant costs through a fixed public fire protection charge.

Based on the survey of the 50 public utility commissions, there are eighteen states that require utilities to roll the cost of public fire protection into general service rates. The results are shown in Figure 48 below.



In 1989, the PSC allowed the Jefferson Water and Electric Department to adopt the class absorption method as a test case (Docket 2750-WR-101). The resulting cost-of-service design removed the PFP customer class and rolled that cost into the general service rates. In that case, the standard PSC cost-of-service model was used, and the total for the PFP customer class was distributed to the other customer classes. In 2005, Jefferson decided to abandon the class absorption method and to adopt direct PFP charges based on the equivalent meters method.

The class absorption method addresses the issue discussed in Section 2, namely, how to allocate costs for very large community water systems, where the maximum hour demand for general service is larger than the fire demand.[5] For these large utilities the general service maximum hour demand controls the design of the water system. From a regulatory standpoint, it is Commission staff's opinion that it does not make sense in these cases to allocate costs to the PFP customer class, since it represents a redundant demand that is already covered by the infrastructure needed to meet the general service maximum hour demand. The class absorption method is a cost-of-service model that assigns all system costs to the non-PFP cost functions for large utilities.

A potential benefit of using the class absorption method is to eliminate one of the more contentious issues that occurs during large contested rate cases. The elimination of the PFP customer class simplifies the overall cost-of-service methodology thus improving a utility's ability to predict the impact that increased expenses and new infrastructure spending will have on water rates. The elimination of the PFP customer class also helps municipalities to perform more accurate budget planning, as it is often difficult to predict in advance how the PFP cost will

[5] See comments by Municipal Environmental Group in PSC REF#: 286177 and by Manitowoc Public Utilities in PSC REF#: 286178

change until a new rate case is completed. The timing of the water rate case and the development of the municipal budget can create problems if PFP costs are higher than expected. It is Commission staff's opinion that the class absorption method provides a simpler cost-of-service analysis that is appropriate for the scale of analysis typically used to estimate other components of a utility's water rates such as demand forecasting, estimation of customer demand ratios, and many of the cost allocation assumptions built into the PSC model.

As discussed in Section 2, there are six water utilities in Wisconsin where the maximum hour general service demand controls the design and costs of the water system (as analyzed using the current PSC fire demand method, as opposed to the ISO fire demand). Those utilities are: Manitowoc Public Utilities, Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works.

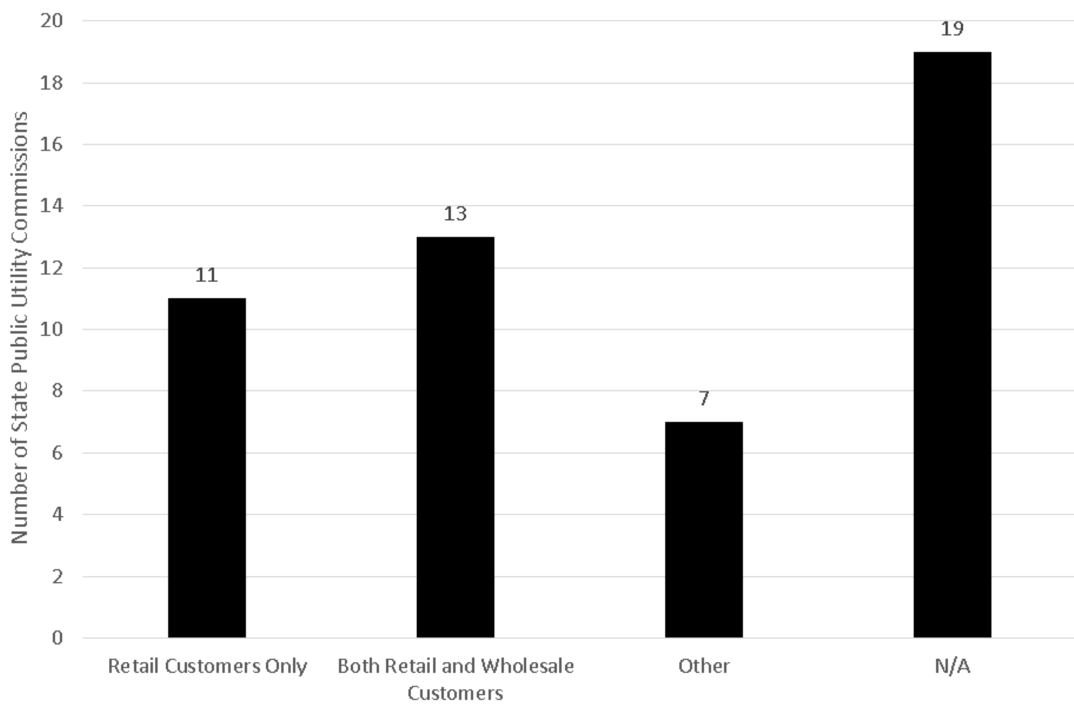
If the ISO NFF_5 fire flow (rather than the PSC fire demand) is used to perform the same analysis as in Section 2 of this report, then there are eight water utilities in Wisconsin where the maximum hour demand exceeds the maximum day plus fire demand. These eight utilities are as follows: Manitowoc Public Utilities, La Crosse Water Utility, Sheboygan Water Utility, Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works. The calculations using the ISO fire demand values are found in Appendix O. Appendix O does not represent a complete list, but only a list of municipalities for which ISO provided information.

The class absorption method does not compute a PFP cost, and as a result the hydrants are treated as part of the distribution system. A downside of this approach is that the customer classes pay for the hydrants in proportion to their base and maximum hour demand characteristics, which may have little to no relation to their fire demands. Another downside of this approach is that it reduces the amount of fixed revenues thus increasing the share of the volume based revenues.

6.5 Impact of Options on the PFP Cost-of-Service Allocated to Wholesale Customers

As discussed in Section 4 of this report, the PSC regulates 28 water utilities that provide wholesale service to another 53 utilities that act as wholesale customers. The PSC requires that wholesale providers identify their PFP costs and allocate them appropriately to their wholesale customers. This methodology typically results in the establishment of PFP rates for the wholesale customers. It is interesting to note that, based on the survey of the 50 public utility commissions, there are eleven states that require the PFP cost-of-service be allocated to retail customers only. Another thirteen states require that the PFP cost-of-service be allocated to both retail and wholesale customers (where applicable). The results are shown in Figure 49 below.

Figure 49. Do you require that the public fire protection cost be allocated to wholesale customers, or only to retail customers?



Commission staff used the most recent cost-of-service model for Milwaukee Water Works in Docket 3720-WR-108 to estimate how the use of the ISO NFF_5 fire flow would impact the general service and PFP charges billed to its wholesale customers. (PSC REF#: 222194) The current fire demand used in the Milwaukee Water Works model is 17,962 gpm for 18 hours. This value was changed to an ISO NFF_5 fire flow value of 7,500 gpm for 4 hours. The result of changing the fire demand was a 0.37 percent decrease in the total cost-of-service amount for retail customers. As shown in Table 5, the wholesale customers experienced a change ranging from a 2.50 percent decrease to a 5.40 percent increase in their total wholesale cost-of-service.

Table 5. Impact of the ISO NFF_5 Fire Flow on the Cost-of-Service Allocated to Milwaukee Water Work's Wholesale Customers

	Gen Service Existing COS	PFP Existing COS	Total Existing COS	Gen Service ISO NFF_5 COS	PFP ISO NFF_5 COS	Total ISO NFF_5 COS	Percent Difference Total COS
Retail							
Retail Total	$ 70,809,856	$ 7,990,659	$ 78,800,515	$ 73,232,005	$ 5,273,541	$ 78,505,546	-0.37%
Wholesale							
Brown Deer	$ 721,571	$ -	$ 721,571	$ 747,736	$ -	$ 747,736	3.63%
Butler	$ 165,550	$ -	$ 165,550	$ 169,681	$ -	$ 169,681	2.50%
Greendale	$ 729,359	$ -	$ 729,359	$ 768,753	$ -	$ 768,753	5.40%
Menomonee Falls	$ 1,604,903	$ -	$ 1,604,903	$ 1,658,680	$ -	$ 1,658,680	3.35%
Mequon	$ 542,431	$ 3,339	$ 545,770	$ 568,556	$ 907	$ 569,463	4.34%
New Berlin	$ 1,328,844	$ -	$ 1,328,844	$ 1,376,226	$ -	$ 1,376,226	3.57%
Shorewood	$ 717,632	$ 63,047	$ 780,679	$ 743,776	$ 17,416	$ 761,192	-2.50%
Wauwatosa	$ 2,462,185	$ -	$ 2,462,185	$ 2,549,882	$ -	$ 2,549,882	3.56%
West Allis	$ 2,622,493	$ 69,926	$ 2,692,419	$ 2,687,773	$ 18,998	$ 2,706,771	0.53%
County Institutions	$ 433,823	$ -	$ 433,823	$ 451,687	$ -	$ 451,687	4.12%
Wholesale Total	$ 11,328,791	$ 136,312	$ 11,465,103	$ 11,722,750	$ 37,321	$ 11,760,071	2.57%
Grand Total			$ 90,265,617			$ 90,265,617	0.00%

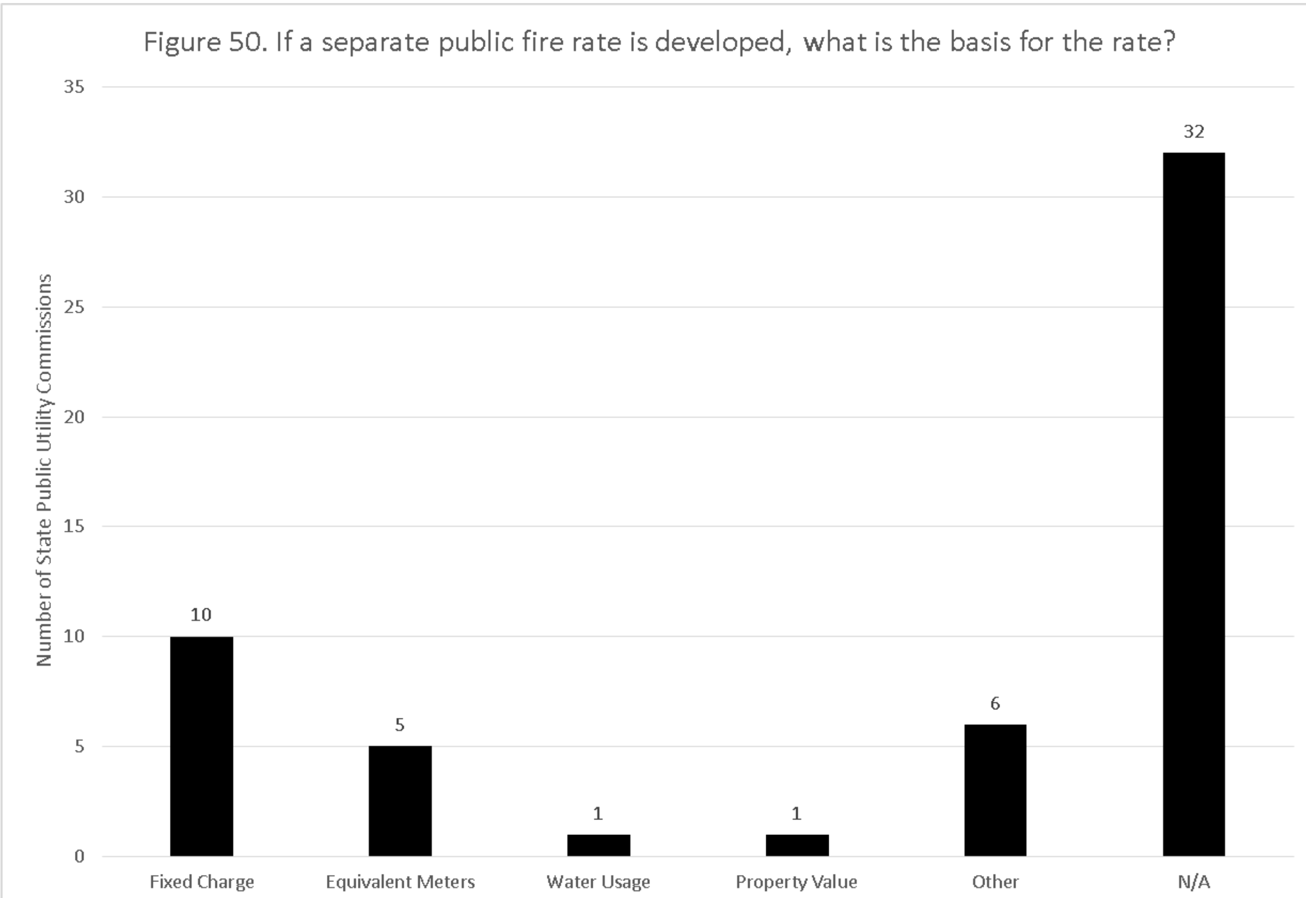
Commission staff then used Milwaukee Water Works' most recent cost-of-service model with the ISO NFF_5 fire flow to determine what impact the class absorption method would have on the general service and PFP charges billed to Milwaukee's wholesale customers. By rolling the PFP cost into the general service rates, the total cost-of-service for retail customers decreased by 0.54 percent. As shown in Table 6, the wholesale customers experienced a change ranging from a 3.33 percent decrease to a 7.05 percent increase in their total wholesale cost-of-service.

Table 6. Impact of the Class Absorption Method and ISO NFF_5 Fire Flow on the Cost-of-Service Allocated to Milwaukee Water Work's Wholesale Customers

	Gen Service Existing COS	PFP Existing COS	Total Existing COS	Gen Service Class Absorption COS	PFP Class Absorption COS	Total Class Absorption COS	Percent Difference Total COS
Retail							
Retail Total	$ 70,809,856	$ 7,990,659	$ 78,800,515	$ 78,378,085	$ -	$ 78,378,085	-0.54%
Wholesale							
Brown Deer	$ 721,571	$ -	$ 721,571	$ 758,796	$ -	$ 758,796	5.16%
Butler	$ 165,550	$ -	$ 165,550	$ 172,077	$ -	$ 172,077	3.94%
Greendale	$ 729,359	$ -	$ 729,359	$ 780,806	$ -	$ 780,806	7.05%
Menomonee Falls	$ 1,604,903	$ -	$ 1,604,903	$ 1,681,727	$ -	$ 1,681,727	4.79%
Mequon	$ 542,431	$ 3,339	$ 545,770	$ 576,934	$ -	$ 576,934	5.71%
New Berlin	$ 1,328,844	$ -	$ 1,328,844	$ 1,394,587	$ -	$ 1,394,587	4.95%
Shorewood	$ 717,632	$ 63,047	$ 780,679	$ 754,659	$ -	$ 754,659	-3.33%
Wauwatosa	$ 2,462,185	$ -	$ 2,462,185	$ 2,586,068	$ -	$ 2,586,068	5.03%
West Allis	$ 2,622,493	$ 69,926	$ 2,692,419	$ 2,723,527	$ -	$ 2,723,527	1.16%
County Institutions	$ 433,823	$ -	$ 433,823	$ 458,351	$ -	$ 458,351	5.65%
Wholesale Total	$ 11,328,791	$ 136,312	$ 11,465,103	$ 11,887,532	$ -	$ 11,887,532	3.68%
Grand Total			$ 90,265,617			$ 90,265,617	0.00%

6.6 Rate Design Options

Based on the survey of the 50 public utility commissions, there are eighteen states that identify a method for computing separate PFP rates. The results of the survey are shown in Figure 50.



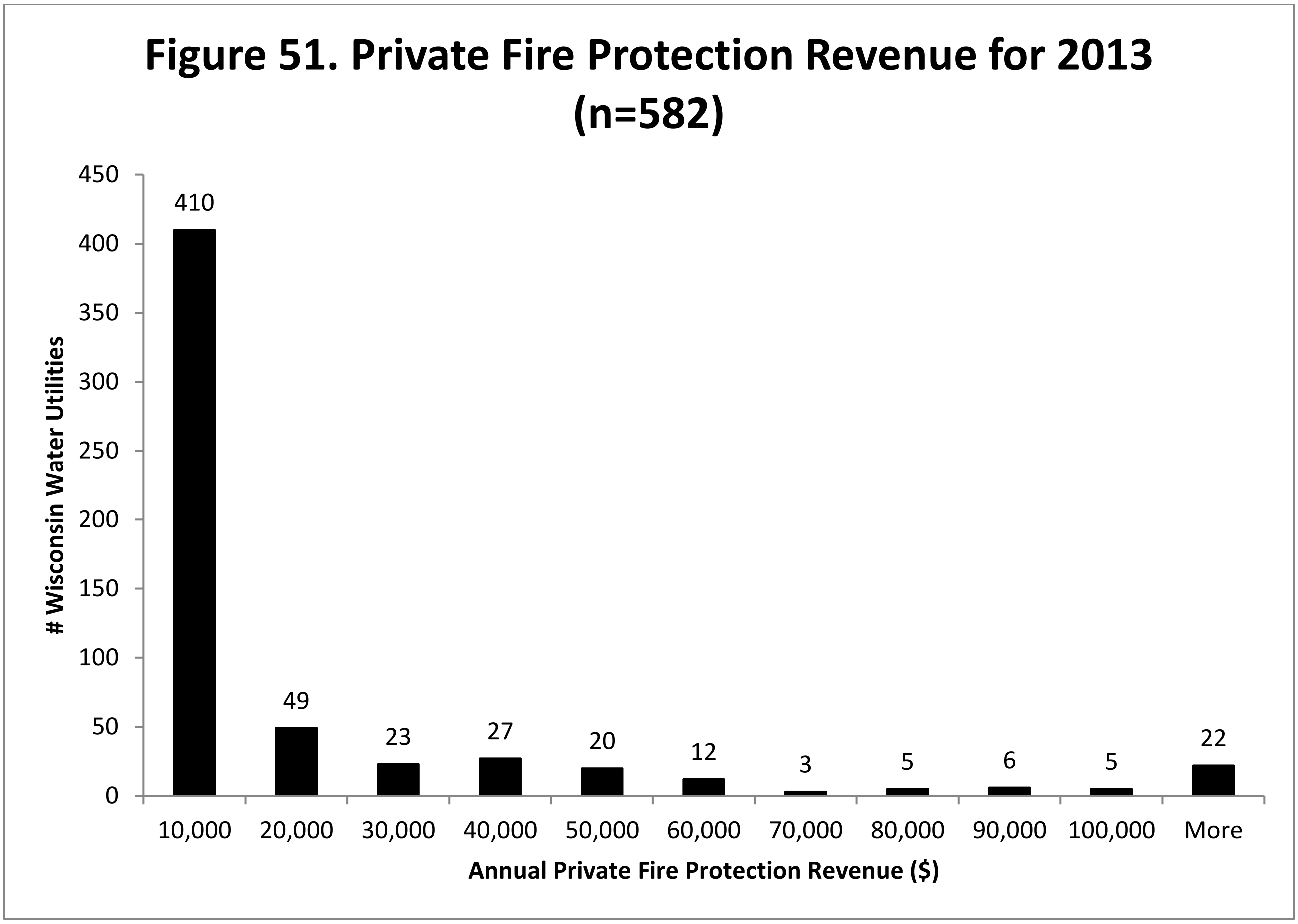
As discussed in Section 4 of this report, the equivalent meters method is the most popular used by Wisconsin water utilities, likely because it is relatively easy to administer. Some critics of the method have argued that the size of a water meter has very little correlation with the fire demand of the property. They contend that the property values method is the most equitable because PFP charges are more closely correlated with the value of the property than the meter size.

7. Private Fire Protection

The private fire protection charge represents the extra capacity of the water system needed to provide the high pressures and flows to fight fires through private fire suppression equipment, such as sprinkler systems. The private fire protection charge is a standby service, and the actual cost of the water used in fighting fires is considered immaterial. The charge is used to recover the extra cost required to oversize the wells, pumps, storage tanks, and water mains in the water system. This charge includes a portion of the operation and maintenance expenses, depreciation expenses, taxes, and return on net investment rate base attributable to the facilities available to supply fire protection. The private fire protection charge is computed on a parallel basis with the public fire protection charge. As such, it is a measure of the cost of providing the service.

The charge for an unmetered private fire protection connection is based on the potential demand which could be placed on the system because of that connection. Accordingly, the size of the connection to the utility's water main is used as the basis for the private fire protection service charge. For example, if a commercial property installs a 4-inch lateral to serve an unmetered private fire suppression system, the water customer is charged an unmetered private fire protection fee. The Commission has traditionally identified unmetered private fire protection as an additional service, above and beyond the public fire protection service. That is why the Commission allows utilities to charge a private fire protection fee included on Schedule Upf-1 of a utility's water tariff. The Commission, however, does not require any utility to charge a private fire protection fee. The decision is left up to each utility. A detailed explanation of how the private fire protection charge is computed is found in Appendix P.

For most Wisconsin water utilities, the private fire protection revenues do not constitute a significant portion of their total revenue requirements. In fact, 230 of Wisconsin's 582 regulated water utilities (40 percent) did not report any Private Fire Protection revenues for 2013. This lack of revenue may be due to water utilities choosing not to have a private fire protection tariff, or it may be that water utilities have a private fire protection tariff, but they do not have any private fire protection customers. Based on 2013 annual report data, the private fire protection revenues account for only 0 percent to 8 percent of the total water utility revenues for Wisconsin's 582 regulated water utilities. The median amount of annual private fire protection revenue was only $1,700 in 2013. The histogram below shows the number of utilities and the private fire protection annual revenue collected for 2013. Based on the 2013 annual report data, there are 410 (70 percent) Wisconsin water utilities with total annual private fire protection revenue below $10,000, based on 2013 annual report data. Milwaukee Water Works has the largest private fire protection revenue at $705,000 (1 percent of total operating revenues) for 2013. The data used to develop the histogram shown in Figure 51 is found in Appendix Q.



The Wisconsin State Fire Chiefs Association would like the state's water utilities to structure rates that encourage residential and small commercial customers to install sprinkler systems. They argue that today's building code requirements for sprinkler systems result in fires being extinguished quicker with less water. All these factors reduce a community's overall fire demand. From a design standpoint, if fire flow has been reduced for one of the five largest fire flows (NFFs) in the municipality, the utility's fire demand has also been reduced. Some might argue that such buildings should not be required to pay a private fire protection charge, or that such a customer may even deserve a discount from the public fire protection charge.

In their 2012 report, “Fire Flow Water Consumption in Sprinklered and Unsprinklered Buildings: An Assessment of Community Impacts,” Code Consultants Inc. states, “The required fire flow for a building protected with a sprinkler system is typically permitted to be reduced by 50 percent for one and two-family dwellings and 75 percent for buildings other than one- and two-family dwellings. Available studies of fire water usage in sprinklered and unsprinklered residential buildings show the volume of water to be conservative and indicate a reduction of water used in a sprinklered home to be approximately 90 percent less than that of an unsprinklered home.” Based on these claims, it appears that fire flow needs are significantly reduced for sprinklered buildings.

Others argue that residential sprinklered buildings do not lower the community-wide fire demand because the methods used to compute fire demand rely either on the community’s population or on the ISO NFF_5 fire flow. A few residential sprinklered buildings are not going to lower the community-wide fire demand. Therefore, since they are receiving standby services not offered to others, they should pay for this additional service. In addition, the owners of sprinklered buildings are likely receiving discounts on their property insurance. Therefore, these customers already receive a benefit from their sprinkler systems.

As stated previously, Wisconsin water utilities are not required to implement private fire protection charges. One tool for a community to encourage residential sprinkler systems is to request that the Commission remove Schedule Upf-1 from its water tariff.

8. Recommendations

The Final Decision in Docket 3720-WR-108, the “Application of Milwaukee Water Works, Milwaukee County, Wisconsin, for Authority to Increase Water Rates” directed

Commission staff to open a generic investigation to study the methods of all water utilities in allocating public fire protection (PFP) costs. The following paragraphs list Commission staff's recommendations for improving the methods used to compute the PFP cost-of-service and resulting rates for Wisconsin's 582 regulated water utilities.

1. Commission staff recommends that water utilities that have a general service maximum hour demand greater than the sum of the maximum day demand plus the ISO NFF_5 fire flow should eliminate their PFP customer class and use the class absorption method to roll PFP costs into the retail and wholesale general service rates.[6] For these water utilities, the overall water system design is controlled by the general service maximum hour demand and reliability issues. Based on the ISO NFF_5 fire flow data that is currently available, Commission staff estimates approximately eight of Wisconsin's larger water utilities fall into this category. These eight utilities include: Manitowoc Public Utilities, La Crosse Water Utility, Sheboygan Water Utility, Kenosha Water Utility, Racine Water Works Commission, Green Bay Water Utility, Madison Water Utility, and Milwaukee Water Works. General Service maximum hour demand is defined as the maximum hour demand seen in the previous three years. It does not include maximum hour demand created by temporary operations such as when a tower is down or while experiencing a main break.
2. Commission staff recommends that the remaining 574 smaller water utilities be given the option of using either the standard PSC model or Option #1.[7] If a water utility is experiencing significant reductions in water sales, then they may want to use Option #1

[6] See comments by Municipal Environmental Group in PSC REF#: 286177 and Milwaukee Water Works in PSC REF#: 286143

[7] See comments by Municipal Environmental Group in PSC REF#: 286177

to eliminate the link between declining general service sales and the subsequent increase in the PFP cost-of-service.

3. The ISO NFF_5 is appropriate for computing each utility's fire demand. The ISO method uses on-the-ground surveys of the structures in each community, which is more accurate than the older population based equations currently used in the PSC cost-of-service model.
4. The investigation of the wholesale PFP will be further addressed in Part B of this study. If a large wholesale provider, such as Milwaukee Water Works, adopts the class absorption method and rolls the PFP cost into general service rates, then there are no identifiable PFP costs. Even hydrants costs are included in the overall distribution system costs and recovered through general service rates.
5. It is apparent that sprinkler systems reduce community fire demand. The Commission currently allows each water utility to choose whether or not a private fire protection charge is included in their water tariff. It is Commission staff's opinion that the private fire protection charge should be eliminated.[8]

Please note: Any views by Commission staff in this report are not formal statements of Commission policy and are not considered precedential. The views of Commission staff expressed in this report are not binding on the Commission.

[8] See comments by Municipal Environmental Group in PSC REF#: 286177 and Milwaukee Water Works in PSC REF#: 286143