Village of Hyde Park
July 13, 2022

"County Lawsuit Defense"
Fixed Monthly Charge

Cost-Causation Principle

The cost-causation principle is considered by commissions, utilities and academics as the foundation of utility ratemaking.

The Federal Power Act gives FERC jurisdiction over facilities that transmit electricity in interstate commerce. *See* 16 U.S.C. § 824(b)(1); 42 U.S.C. § 7172(a)(1)(B). Under the Act, electric utilities must charge "just and reasonable" rates. 16 U.S.C. § 824d(a). For decades, the Commission and the courts have understood this requirement to incorporate a "cost-causation principle"—the rates charged for electricity should reflect the costs of providing it. *See Ala. Elec. Co-op., Inc. v. FERC*, 684 F.2d 20, 27 (D.C. Cir. 1982). We often frame this principle as one that ensures "burden is matched with benefit," so that FERC "generally may not single out a party for the full cost of a project, or even most of it, when the benefits of the project are diffuse." *BNP Paribas Energy Trading GP v. FERC*, 743 F.3d 264, 268 (D.C. Cir. 2014); *see Midwest ISO Transmission Owners v. FERC*, 373 F.3d 1361, 1368–69 (D.C. Cir. 2004). This cost-causation principle "add[s] flesh to [the] bare statutory bones" of the just-and-reasonable-rate requirement.1

Criteria

Cost allocation is made less arbitrary with the development of appropriate criteria on which cost analysts may rely. Several cost assignment criteria may be appropriate in allocating water utility costs: 2. page 52.

· Cost causation
· Traceability
· Variability
· Capacity required
· Beneficiality

The first criterion--and perhaps the most important--is cost causation. This emphasizes that costs should be assigned to the revenue generating customers or services that cause the costs to be incurred. 2

A closely related criterion, traceability, means that costs to be assigned must be identified with a revenue generating unit, that is, a customer class. Traceability (a primary test of cost causation) implies that costs and their causes either are empirically observable or conceptually logical. Variability suggests that costs, although not necessarily traceable, can vary with the usage volume associated with the revenue generating

unit. This criterion (a secondary test of cost causation) implies that certain costs exhibit a systematic relationship with specific measures of output. 2

The fourth criterion is capacity required, which means that costs are assigned according to whether the service could have been rendered if specific costs not been incurred. (This also may be a secondary criterion that can be applied in cases where both the traceability and variability criteria fail to be instructive in cost allocation.) 2

The criterion of last resort is beneficiality, which suggests that costs are assigned to customers or services that benefit from the costs; that is, incurring the cost is necessary to providing the service. This criterion implies that without the cost being incurred, the service would be provided inefficiently. Perhaps the most prominent application of the beneficiality criterion in water supply is in the allocation of fire protection costs. 2

Commission Perspectives on Cost Analysis

Twenty-four of the state commissions require some form of cost analysis in conjunction with water rate proceedings. Eighteen commissions require cost analysis of all water utilities in all rate cases. Results of the survey indicate a rather widespread use of the ratemaking manuals produced by the American Water Works Association. 2

Over half of the jurisdictions surveyed reported the use of American Water Works manuals; seven jurisdictions indicated they used the manuals primarily as a general reference tool. Additional comments provided on the survey indicated that most found the manuals to be highly useful. 2

The relationship of the quantity demanded of water service and price complicates the task of water system design. Water system design is a function of average and peak demands, which are a function of water price, which is a function of the cost of service, which is a function of system design, and so on. Therefore, price-elasticity coefficients exceeding zero produce a circularity problem that can be difficult to resolve in the context of traditional public utility regulation. 2

In the electricity sector, this circularity problem is sometimes referred to as a "death spiral," meaning that rate shock leads to reduced consumption which leads to the need for another rate increase with more rate shock, and so on. 2

Traceability

The cost-causation is traceable to the pressure zone and the GP, GP2 and C Classes within the zone.

- This pressure zone is located on Church Street, Fitch Hill Road, Eden Street to Main Street (turn right on Main Street) to Parish Hall area on West Main.

- 16 hydrants connected to water mains within the pressure zone were prohibited from use by the Fire Department and could not be opened in order to prevent the backflow of contaminants into the drinking water system.

- Homes within the pressure zone had adequate water pressure for residential use. Removing hydrants within the pressure zone could eliminate the risk of backflow of contaminants into the drinking water system.

Capacity Required

The water bond was required for Fire Flow Protection to the largest structures within the pressure zone.

Designing a water system with sufficient capacity to meet fire-flow requirements or NFFs can result in major economic and water quality impacts. Typically these impacts are manifested in increased pipe diameters, greater provision for reliability and redundancy in system design, increased system costs, and increased potential for reduced water quality. 3

The decision for a public water supply to provide fire flows can have significant impacts on the design and operation of the systems. Fire storage: Required or NFFs can be provided through a combination of fire storage in water tanks and reservoirs or through larger transmission lines and increased treatment capacities. In many water systems it appears that fire storage is the more economical means of meeting fire flow requirements. Dedicated water in storage for fire protection needs to be recycled weekly to prevent excessive aging and sedimentation. 3

Water quality changes within the distribution system are of increasing concern. Water distribution system design often is dictated by the need to provide fire flows. This leads to oversizing of the system for most normal conditions. An oversized system increases the resident time of water, increasing the possibility for depletion of disinfectant residual and the formation of disinfection byproducts. 3

An oversized water distribution system also increases the associated capital and operation and maintenance (O&M) costs. 3

The most common and least expensive water source for sprinkler systems is the public water supply system. If the public water supply is the only source of water for the sprinkler system, it must be reliable and maintain adequate pressure and volume at all times. 3

Water distribution system design often is dictated by the need to provide fire flows. This leads to oversizing of the system for most normal conditions. 4

Raw water storage facilities, such as reservoirs, are generally designed to meet average annual demand; transmission and treatment facilities as well as major feeder mains are generally designed to absorb maximum-day demand; and distribution mains, pumping stations, and local storage facilities are designed

to meet maximum-hour demand, or maximum-day demand plus fire protection flow requirements, whichever is greatest. 5

Beneficiality

The criterion of last resort is beneficiality, which suggests that costs are assigned to customers or services that benefit from the costs; that is, incurring the cost is necessary to providing the service. 2

Perhaps the most prominent application of the beneficiality criterion in water supply is in the allocation of fire protection costs. 2

The water bond financed fire flow protection to
property with a grand list value of over
$33 Million.
All properties are in the GP, GP2 and C Classes.

Village Grand List
$55.3 Million

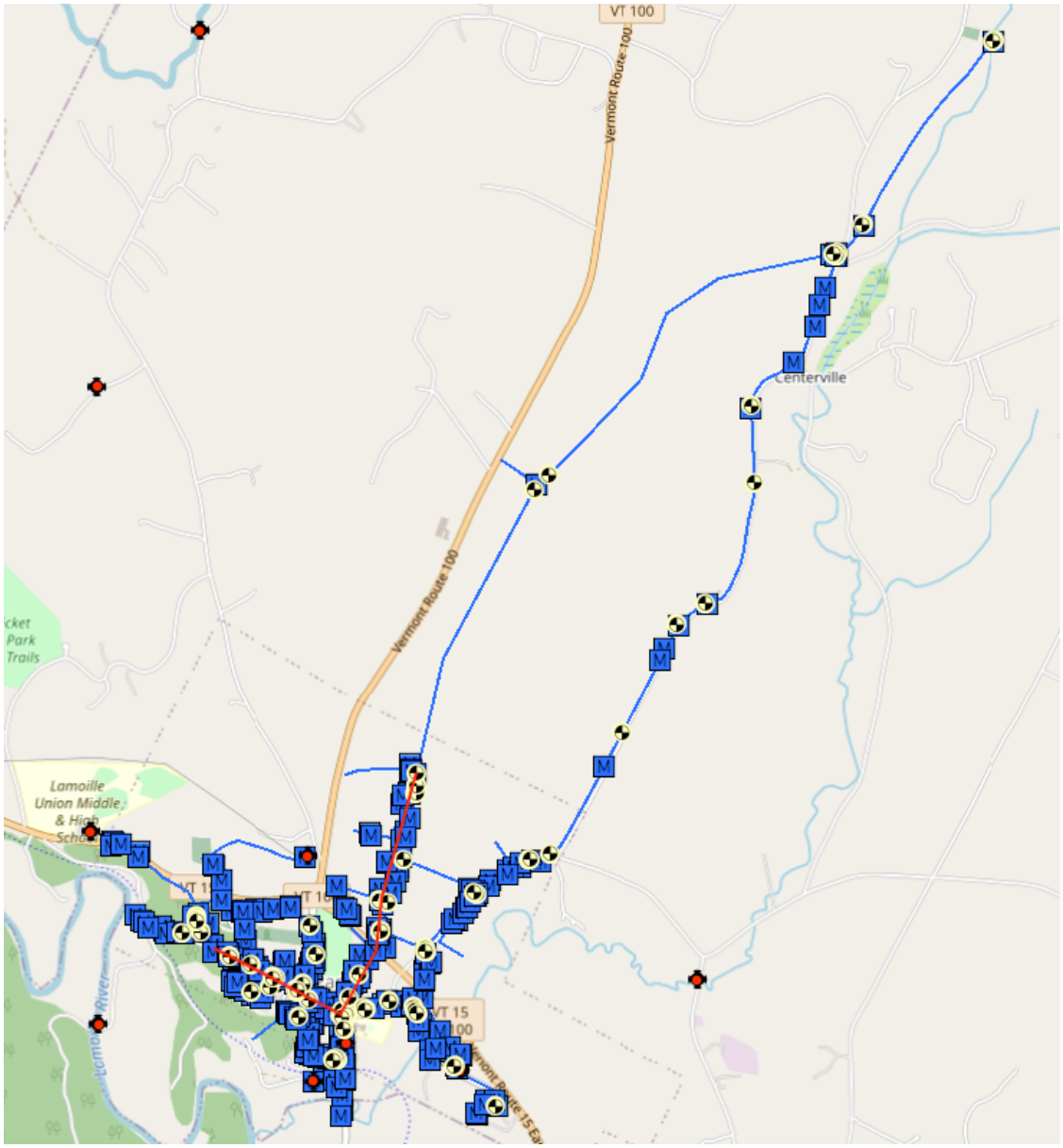
- Fire Flow Protection within the pressure zone is the benefit.
- In 2020, there were 233 active water meters and the majority are not within the pressure zone.
- There are 76 residential customers in the pressure zone.
- There are 23 fire hydrants. 70% are not within the pressure zone.
- Within the pressure zone, the water main was replaced and 16 dedicated hydrants.

The Drinking Water System

The Hyde Park Water Department provides drinking water to Village residents as well as others outside Village boundaries on Centerville Road, North Hyde Park Road, Depot Street, Mill Street, Morey Road and Hwy 15 West

The red line runs along the pressure zone.

The state's compliance schedule required work in this zone.



16 hydrants replaced in the pressure zone.

Cash Needs and Debt Service

Rates must recover cash needs to pay the bond debt and other fixed costs required to operate the drinking water system in a manner that meets regulatory requirements. The bond bank required at least 70% of cash needs to be recovered in fixed charges. The bond bank Director of Capital Planning reviewed estimates of cost and expenses to be recovered in the rates.

$233,000 is the cash requirement, based on 2020 estimates.

Fixed Cost

$151,000 (65% of revenue requirement)

- $106,000 (45.5%) annual bond payment
- $45,000 (19.3%) other fixed cost

$12,000 (5.2%) Standby Water Charges)

70% of revenue requirement is achieved with Standby Water Charges

Consumption Charges

$70,000 (30% of required revenues)

- Should consumption charges fail to provide required revenues, fixed charges must be increased. Consumption charges are the same for all classes.
- In the electricity sector, this circularity problem is sometimes referred to as a "death spiral," meaning that rate shock leads to reduced consumption which leads to the need for another rate increase with more rate shock, and so on. 2

Debt Burden

The General Obligation Bond is the Debt Burden of the Village of Hyde Park.

- The majority of residential properties within the Village did not benefit.
- We expect an additional ongoing rate burden to all classes.
- The majority of customers who do not receive a benefit, yet bear the rate burden.

Cost Allocation

OBJECTIVES OF COST-BASED RATE MAKING

Principles of Water Rates, Fees, and Charges AWWA MANUAL M1 Sixth Edition

Water rates developed using the methodologies discussed in this manual, when appropriately applied, are generally considered to be fair and equitable because these rate setting methodologies result in cost-based rates that generate revenue from each class of customer in proportion to the cost to serve each class of customer. Water rates are considered fair and equitable when each customer class pays the costs allocated to the class and thus cross-class subsidies are avoided. While recovery of the full revenue requirement in a fair and equitable manner is a key objective of a utility using a cost-of-service rate-making process, it is often not the only objective.

OVERVIEW OF THE KEY TECHNICAL ANALYSES
ASSOCIATED WITH COST-BASED RATE MAKING
AWWA M1 manual, Water Rates Manual, First Edition, 1954, p. 1.

In establishing cost-based water rates, it is important to understand that a cost-of-service methodology does not prescribe a single approach. Rather, as the First Edition of the M1 manual noted, "the (M1 manual) is aimed at outlining the basic elements involved in water rates and suggesting alternative rules of procedure for formulating rates, thus permitting the exercise of judgment and preference to meet local conditions and requirements.

Fairness

Fairness of the specific rates in the apportionment of total costs of service among the different ratepayers so as to avoid arbitrariness and capriciousness and to attain equity in three dimensions:

(1) horizontal (i.e., equals treated equally);

(2) vertical (Le., unequals treated unequally); and

(3) anonymous (i.e., no ratepayer's demands can be diverted away uneconomically from an incumbent by a potential entrant)" 2

Taking Into Account Property Value

Matching Burden with Benefit

The water bond was required for Fire Flow Protection to the largest and most valuable structures within the pressure zone.

More complex pricing schemes for fire protection take into account such factors as property values and insurance rates. 2

Village Grand List Value $55,320,000

2020 values

Courthouse and Sheriff Facility: $14,721,700 - 26.6% of Total Village Value

26.6% of the annual bond payment is $28,196

26.6% of the annual total fixed revenue requirements is $61,978

$30,989 annually for each; $2,582 monthly

Courthouse Fixed Annual Service Charge: $17,010

16% of the annual bond payment / 11% of fixed revenue requirements (40% paid by the state)

Cost of Courthouse renovation: $8,790,000 - 16% of Village Grand List Value

The Lamoille County Courthouse renovation is listed a $8,790,000 and 31% over estimate by the June 16, 2017 Vermont Department of Buildings and General Services Report to the State Auditor.

More complex pricing schemes for fire protection take into account such factors as property values and insurance rates**.** While some view fire protection as a discrete service, others believe that it is essentially a public good that should be paid for through tax dollars. 2

Fire protection costs are those associated with the flow requirements needed to fight fires. In classification, all costs must be appropriately accounted for (that is, "fully allocated") and particular attention should be paid to the effects of some costs on others. 2

Once total costs are functionalized and classified, the final step is to assign costs to service (or customer) classes. Although many water utilities serve only one or two service classes, the possibilities include residential, commercial, industrial, wholesale, institutional, public authorities, and fire protection. 2

Cost assignment to customer classes, for the purpose of generating rates, usually involves assigning customer costs on the basis of service connections, assigning commodity costs on the basis of usage, and the difficult (and sometimes arbitrary) assignment of capacity costs. While some costs, such as fire protection and system development, are directly assignable to customers, most require the use of cost allocators. 2

Matching Burden with Benefit

Class	# meters	# in pressure zone	% benefit	% with debt burden / In Jurisdiction
R Residential	180	**76**	**1%**	**100% of debt burden / In**
R2 Residential	21			
C Commercial	20	**20**	**2%**	**100% In jurisdiction**
C2 Commercial	1			
GP Court House Elementary School Sheriff's Department	3	**3**	**90%**	
GP2 Library Opera House State Office 3 Sheriff's Properties	6	**6**	**7%**	
I Industrial	1			**100% in jurisdiction**

R Class contains one and two-family dwellings usually physically separated.

R2 Class contains out-of-jurisdiction residential properties defined as one and two-family dwellings usually physically separated.

C Class (Commercial) contains properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises.

C2 Class contains out-of-jurisdiction commercial properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises.

GP Class (Governmental/Public) contains properties defined as out-of-jurisdiction Federal, State, County and Town Providers of Global Services.

GP2 Class contains properties defined as out-of-jurisdiction Federal, State, County and Town Small Providers of Global Services.

I Class (Industrial) contains manufacturing and processing establishments.

I2 Class contains out-of-jurisdiction industrial properties defined as manufacturing and processing establishments. There are no current ratepayers in the I2 class

Taking Into Account Insurance Benefit

Matching Burden with Benefit

On April 19, 2022, after replacing the water mains and 16 hydrants within the pressure zone, the Insurance Services Office (ISO) performed tests on 5 hydrants, 4 connected to the water mains within the pressure zone and 1 located at the Fire Station on Centerville Road, as well as the fill pipe for tankers.

To establish the capabilities of water supply systems, Verisk field representatives or other designated officials can conduct hydrant flow tests. The objective of the flow test is to determine the quantity in gallons per minute (gpm) and pressure available at a specific location. We can conduct the tests during public protection gradings, or the local fire department or water company can conduct the tests. The testing process can identify closed valves and changes in the carrying capacity of mains. 6

ISO is the premier source of information, products, and services related to property and liability risk. For a broad spectrum of types of insurance, ISO provides statistical, actuarial, underwriting, and claims information and analyses; consulting and technical services; policy language; ISO serves insurers, reinsurers, agents, brokers, self-insured, risk managers, insurance regulators, fire departments, and other government agencies. 6

One of ISO's important services is to evaluate the fire suppression delivery systems of jurisdictions around the country. The result of those reviews is a classification number that ISO distributes to insurers. 6

Insurance companies use the Public Protection Classification (PPC™) information to

help establish fair premiums for fire insurance generally
offering lower premiums in communities with better fire protection. 6

ISO uses the Fire Suppression Rating Schedule (FSRS) to define the criteria used in the evaluation of a community's fire defenses. 6

Within the FSRS, a section titled "Needed Fire Flow" outlines the methodology for

determining the amount of water necessary for
providing fire protection at selected locations
throughout the community. 6

Water supply

A maximum of 40 points of the overall score is based on the community's water supply. This part of the survey focuses on whether the community has sufficient water supply for fire suppression beyond daily maximum consumption. We survey all components of the water supply system. We also review fire hydrant inspections and frequency of flow testing. 7

Cost Causation Allocation

a	b	c	d	e	f	g	h	i	j
					$106,000 Annual	Annual	*Depreciation Monthly*	*Bond Plus Deprec.*	Bond Monthly
Benefit	Class	#	Grand List	%	Bond Share	Per Meter	*Per Meter*	*Per Meter*	Per Meter
100%	GP	3	$ 25,000,000	76%	$ 80,303	$ 26,768	*$ 1,122*	*$ 3,353*	$ 2,231
100%	GP2	6	$ 4,000,000	12%	$ 12,848	$ 2,141	*$ 90*	*$ 447*	$ 357
100%	C	20	$ 4,000,000	12%	$ 12,848	$ 642	*$ 27*	*$ 59*	$ 32
		29	$ 33,000,000						

a. Cost causation allocated to the largest structures within the pressure zone.

b. Classes receiving 99% of the benefit of Fire Flow Protection in the Pressure Zone.

GP Class (Governmental/Public) contains properties defined as out-of-jurisdiction Federal, State, County and Town Providers of Global Services.

GP2 Class contains properties defined as out-of-jurisdiction Federal, State, County and Town Small Providers of Global Services.

C Class (Commercial) contains properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises.

c. Number of properties in each class.

d. The total grand list value of each class.

e. The annual bond payment amount of $106,000 allocated by a pro-rata share of the total grand list value.

f. The bond annual payment of each class.

g. The annual bond payment per meter.

h. The amount of the annual 75% depreciation expense allocated to these three properties. Reference the attachment, Bond Resolution

i. The monthly depreciation amount plus the monthly bond amount per meter.

j. The monthly amount without bond depreciation.

Allocating Other Fixed Costs

a	b	c	d	e	f	g	h
Water	Class	#	Other Fixed $ 45,000 %	Class	Fixed Monthly Per Meter	Bond Monthly Per Meter	Total Fixed Per Meter
Benefit	GP	4	2%	$ 773	$ 16.09	$ 2,230.64	$ 2,246.73
Benefit	GP2	6	3%	$ 1,159	$ 16.09	$ 356.90	$ 373.00
Benefit	C	20	9%	$ 3,863	$ 16.09	$ 32.12	$ 48.22
	C2	1	0.43%	$ 193	$ 16.09		$ 16.09
	R2	21	9%	$ 4,056	$ 16.09		$ 16.09
	I	1	0.43%	$ 193	$ 16.09		$ 16.09
42% Benefit	R	180	77%	$ 34,764	$ 16.09		$ 16.09
		233					

a. Other fixed charges are applied equally to all classes. Depreciation and O&M burdens of Fire Flow Protection will be allocated among the classes, which may shift additional cost burden to those without benefit.

b. All rate classes

GP Class (Governmental/Public) contains properties defined as out-of-jurisdiction Federal, State, County and Town Providers of Global Services.

GP2 Class contains properties defined as out-of-jurisdiction Federal, State, County and Town Small Providers of Global Services.

C Class (Commercial) contains properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises.

C2 Class contains out-of-jurisdiction commercial properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises.

R2 Class contains out-of-jurisdiction residential properties defined as one and two-family dwellings usually physically separated.

I Class (Industrial) contains manufacturing and processing establishments.

I2 Class contains out-of-jurisdiction industrial properties defined as manufacturing and processing establishments. There are no current ratepayers in the I2 class.

R Class contains one and two-family dwellings usually physically separated.

c. Number of ratepayers in each class.

d. Class percentage share of $45,000 other fixed costs that are in addition to the bond payment.

e. Additional fixed charge rate burden of each class.

f. Additional fixed charge rate burden per meter.

g. Monthly bond burden per meter.

h. Total of bond burden and additional fixed charge per meter.

Results

Cost Shift

Class	#	Other Fixed Monthly Per Meter	Bond Monthly Per Meter	Total Monthly Per Meter	2020 Rate Per Meter	Cost Shift Per Meter	% Cost Shift
GP	4	$16.09	$ 2,231	$2,247	$1,417.5	-$829.2	-37%
GP2	6	$16.09	$ 357	$373	$125.6	-$247.4	-66%
C	20	$16.09	$ 32	$48	$72.9	$24.7	51%
C2	1	$16.09		$16	$125.6	$109.5	680%
R2	21	$16.09		$16	$32.4	$16.3	101%
I	1	$16.09		$16	$202.5	$186.4	1158%
R	180	$16.09		$16	$20.3	$4.2	26%
	233						

GP **(37%)** Class (Governmental/Public)

GP2 **(66%)** GP Class properties out-of-jurisdiction

C **51%** Class (Commercial) contains properties defined as multifamily apartment buildings and non-residential, non-industrial business enterprises

C2 **680%** C Class properties out-of-jurisdiction

R2 **101%** R Class properties out-of-jurisdiction

I **1158%** Class (Industrial) contains manufacturing and processing establishments

R **26%** Class contains one and two-family dwellings usually physically separate

Taking into Account Property Values

More complex pricing schemes for fire protection take into account such factors as property values and insurance rates. 2

Class	#	2020 Rate Per Meter	$8,833 Monthly Bond Payment	Average Property Value	Benefit Fire Flow
GP	4	$1,417.5	16.05%	$8,333,333	Yes
GP2	6	$125.6	1.42%	$666,667	Yes
C	20	$72.9	0.83%	$200,000	Yes
C2	1	$125.6	1.42%		NO
R2	21	$32.4	0.37%		NO
I	1	$202.5	2.29%		NO
R	180	$20.25	0.23%	$74,340	42% Yes
	233			$ 9,274,340	

Burden Matched with Benefit
Final Results

Class	Rate Per Meter 2020	$12,583 Monthly % Share of Fixed	Property Fire Flow Protection % of Benefit	Average Property Value
GP	$ 1,417.50	11%	89.9%	$ 8,333,333
GP2	$ 125.55	1%	7.2%	$ 666,667
C	$ 72.90	1%	2.2%	$ 200,000
C2	$ 125.55	1%	0.0%	
R2	$ 32.40	0.3%	0.0%	
I	$ 202.50	0.2%	0.0%	
R	$ 20.25	0.2%	0.8%	$ 74,340
			100.0%	$ 9,274,340

Wastewater

1. Debt Burden falls on the Residential Class.
2. Affordability

The median household income in Hyde Park is $70,871.
Source: US Census Bureau

Under a high future costs scenario,
CBO estimates that water and wastewater bills
will consume 0.9 percent of household income. 8

Combined Water and Wastewater

Residential customers pay 79% above CBO highest estimate of 1% of household income.

					a	b	c	d	e	f
Class	Fixed Charge Water Monthly	Fixed Charge Wastewater Monthly	Fixed Charge Total Monthly	Total Fixed Charges Annual	Consumption W & WW Annual	**Total Fixed & Cons. Annual**	Median Household Income	**CBO Highest Total**	Variance $	**Variance %**
GP	$ 1,418	$ 882	$ 2,300	$ 27,594						
GP2	$ 126	$ 129	$ 254	$ 3,050						
C	$ 73	$ 92	$ 165	$ 1,977						
C2	$ 126	$ 129	$ 254	$ 3,050						
R2	$ 32	$ 44	$ 77	$ 918						
I	$ 203	$ 441	$ 644	$ 7,722						
R	$ 20	$ 37	$ 57	$ 684	$ 588	**$ 1,272**	$ 70,871	**$ 709**	$563	**79%**

Residential Customers

Total of Fixed Service Charge and estimated Consumption for Water and Wastewater

a. $588 Annual Consumption Charges for Water and Wastewater

b. $1,272 Annual Total of Fixed Charges for Water and Wastewater plus Annual Consumption Charges for Water and Wastewater

c. $70,871 median household income Hyde Park, 2020 census

d. $709 equals 1% of $70,871 which is the high cost CBO scenario.

e. $563 is the amount households pay above the high cost CBO scenario.

f. 79% is the percentage above the high cost CBO scenario.

Affordability

The Congressional Budget Office (CBO) estimates that combined water and sewer bills currently average one-half (0.5) of 1percent of household income in this country (Congressional Budget Office, Future Investment in Drinking Water and Wastewater Infrastructure, 2002). When compared to other developed countries, consumers in the United States are paying the lowest percentage of income for water and wastewater services. In this same report, CBO provided an estimate of the percentage of household income that would be needed in the year 2019 to pay for future infrastructure investments. Under a low future costs scenario, water and wastewater bills can be expected to consume 0.6 percent of household income. Under a high future costs scenario, CBO estimates that water and wastewater bills will consume 0.9 percent of household income. Under either scenario, combined average water and wastewater bills for Americans are expected to remain under 1 percent of household income, extremely low compared to other countries. 9

Because these statistics are national averages and do not reflect regional differences or effects on low-income groups, the issue of affordability must be addressed. The best rate design involves taking into account the characteristics of particular customer classes. When considering conservation pricing, a utility, water planning body, or local government might consider the service area population's ability to pay higher rates. Appropriately designed programs can mitigate the hardship of rate increases on low-income families. Not only does this have humanitarian benefits, but well-designed affordability programs can also benefit the utilities by avoiding costs associated with late payments, disconnection notices, and service terminations. 9

Cap on Metered Charges for Residential Premises

NYC Rates

A Residential Premises receiving metered water and wastewater service is eligible to have its metered water and wastewater charges limited to a maximum amount. The maximum metered charge applies to all routine domestic use of water and wastewater service. 9

New York City Water and Wastewater Rates

More complex pricing schemes for fire protection take into account such factors as property values and insurance rates. 2

- The Attributed Consumption fixed charge for non-residential premises is due even if there is zero consumption or no meter installed. 9

- The wastewater charge for any property supplied with water from the Water Supply System is one hundred fifty-nine percent (159%) of the charges for water supplied to that property from the system, including any surcharges. 9

Courthouse	HPE Fixed	NYC Fixed	Attributed Consumption
Water	$17,010	$ 17,245	zero consumption
Wastewater	$10,584	$ 27,247	159% of water charges
Total	$27,594	$ 44,492	

References

1 *K N Energy, Inc. v. FERC*, 968 F.2d 1295, 1300 (D.C. Cir. 1992). 1 *Reference: No. 17-1040, U.S. Court of Appeals*

2 NKRI90-17, COST ALLOCATION AND RATE DESIGN FOR WATER UTILITIES, THE NATIONAL REGULATORY RESEARCH INSTITUTE, December 1990,
This project was made possible in part by a grant from the American Water Works Research Foundation.

3 U.S. Fire Administration Water Supply Systems and Evaluation Methods Volume II: Water Supply Evaluation Methods October 2008

4 https://www.verisk.com/insurance/capabilities/underwriting/commercial-property/sprinkler-systems/water-supplies/

5 F. Pierce Linaweaver and John C. Geyer, "Use of Peak Demands in Determination of Residential Rates," American Water Works Association Journal 56 (April 1964); and Charles W. Howe and F. Pierce Linaweaver, "The Impact of Price on Residential Water Demand and its Relationship to System Design and Price Structure," Water Resources Research 3 (First Quarter 1967): 13-32.

6 https://www.isomitigation.com/siteassets/downloads/guide-determinerequiredfireflow.pdf

7 https://www.isomitigation.com/ppc/

8 Office of Wastewater Management, EPA 832-F-03-027, Water and Wastewater Pricing
Holly Stallworth, Ph.D., Economist, Office of Wastewater Management, U.S. Environmental Protection Agency, EPA 832-F-03-027

9 New York City Water Board, Water and Wastewater Rate Schedule, effective July 1, 2022