

Water

Mary -

Very useful work.

But the conclusion
peters out, leaves me baffled.
See p. 225. Think about
it some more & you will
see why there was some
"redemption". Please
you can help.
Thanks

Mason with regards
JRG

The Milwaukee Waterworks Expansion: A Case Study in Urban Investment Planning

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As early as 1927 the engineering officers of the city of Milwaukee had decided that a major expansion in the capacity of the waterworks—involving a new southside intake and pumping station—was needed in the “near future.” Expansion was indicated because growth in the water consuming area from 1919 to 1930 (chiefly by annexation) had produced an increase of one-third in water consumption, 50 per cent in distribution lines. With the Great Depression of the Thirties, commercial and industrial demand for water fell off while the residential consumption was virtually stationary. The issue of a major expansion program was laid aside. Increase consumption by outlying districts was satisfactorily met by the construction of storage tanks which we depleted during periods of peak demand and refilled during the off-peak periods of the day.¹

The 1955 Projection

After World War II a renewed program of annexation increased the city's area by 80 per cent. Renewed industrial expansion and induced urban growth again put pressure on the waterworks system. Total annual consumption steadily increased until 1955, when the decision to expand was in the making. The record of water consumption from 1940 to 1955 is detailed in Table I, showing an average annual postwar increase rate of 3.4 per

¹ Charles E. Beveridge, *History of Water Supply in the Milwaukee Area*, Metropolitan Study Commission Research Report, November, 1958, pp. 9-13 (mimeographed). Cited hereafter as *Beveridge Report*.

► All social science disciplines have much to offer the decision making process in specific areas of public policy and governmental services. The author, an economist, provides both a thorough case analysis of a waterworks expansion decision and an introduction to the literature of economic planning and projection.

cent. Existing facilities had a raw intake capacity of 400 million gallons daily (MGD), a filtration capacity of 290 MGD, and total treated water pumping capacity of 390 MGD. This compares with total gross pumpage at 1955 consumption levels of about 160 MGD.

Aside from the problem of seasonal peak demands associated with suburban (and outlying) lawn sprinkling and once through use in air conditioners, the basic intake, filtration and pumping capacity of 1955 was substantially adequate to meet the needs. The dis-

✓ Excess
Capac.

TABLE I

Total Water Pumped Milwaukee
Water Works Annually 1940-1955

Year	Total Pumped (Unit?) MGD
1940	31,445,110
1941	32,730,260
1942	33,562,300
1943	37,011,890
1944	38,039,410
1945	37,204,200
1946	37,831,610
1947	40,312,030
1948	42,320,280
1949	42,406,280
1950	43,494,080
1951	45,192,730
1952	47,278,800
1953	48,765,720
1954	48,213,346
1955	51,956,147

(Source: Milwaukee Waterworks)

TABLE II
Water Use Projection, Milwaukee, 1946-1975

Item	Unit	1946	1950	1955	1975 Estimated	Per Cent Index 1975 Over 1955
1. Water Service Population	thous.	666.0	714.9	797.2	1030.0	129.2
2. Average Daily Per Capita Consumption (Domestic and Commercial)	gallons	98.2	99.4	105.5	116.5	110.4
3. Industrial Daily Consumption	MGD	38.4	48.2	57.2	85.0	148.6
4. Average Daily Use	MG	103.7	119.2	142.3	205.0	144.1
5. Maximum Days Pumpage	MG	N.A.	183.6	251.5	370.0	147.1

(Source: *BV Report—1956*)

tribution facilities of the waterworks had been continuously expanded after the war as service was extended to the newly developing areas. Between 1949 and 1955 annual net property improvements in the system averaged some 2.2 million dollars.² The Black and Veatch report itself asserted that "past difficulties have been a result of an inadequate distribution system rather than limited supply facilities."³ Many of these deficiencies were being corrected through construction, then in process, of four major booster storage facilities to be operated primarily during peak demand periods to improve service in the so-called High Service Area. This area encompassed the newer parts of the city with a higher ground elevation.⁴

The engineering report, however, found major service inadequacies on a scale which required a massive increase in system capacity to meet estimated consumption needs for 1975. This is clearly exhibited in Table II.

Total water consumption for 1975 was projected at a 44.1 per cent increase over 1955 levels. Maximum daily and hourly consumption was expected to rise in about the same proportion. Over 90 per cent of the increased use was assigned to the newer and more outlying sections of the total water consuming area thus increasing disproportionately the regional load. Against projected requirements of this magnitude the 1955 capacity was inadequate.

² Black and Veatch, Consulting Engineers, *Report on Water Works System Milwaukee* (Milwaukee, Wisconsin, 1956), p. 106 (mimeographed). Two reports were issued, the first in 1956 and the second in 1959; they will hereafter be referred to as *BV Report—1956* or 1959.

³ *BV Report—1956*, p. 52.

⁴ *Ibid.*, pp. 54-55.

This projection of 1975 demands by Black and Veatch rested on three assumptions: (1) the increase in resident water-service population, (2) the rise in average daily per capita consumption, and (3) an increase in industrial water consumption. The first and third projections were intertwined since increased urban population was assumed to be an outgrowth of the industrial base of a community, but it will be convenient to appraise each projection separately and in the indicated order.

Problems of Population Projection

How can the resident population of an urban metropolitan community be predicted twenty years hence? Ideally, one might estimate for each forecast year the projected number of married women with child-bearing potential and for each cohort of such women their assumed fertility. The urges to marry and to bear children are powerful and persistent and the resultant population can normally be predicted with a small margin of error. This margin of error is traceable to unpredictable shifts in age of marriage and marriage patterns, in ideals of family size and in patterns of child-spacing. Such shifts will in part reflect the changing pressure of economic conditions and of the whole climate of life. Such shifts have led to gross error in many population forecasts prepared by eminent demographers.⁵ However, this method has

⁵ See the elaborate survey by J. V. Grauman, "Population Estimates and Projections," *The Study of Population*, ed. P. M. Hauser, O. D. Duncan (Chicago: University of Chicago Press, 1959), pp. 544-576 and bibliography. As Dudley Kirk noted in a recent Presidential Address before the Population Association of America, "The achievements of the profession have

many defects and is not sufficient to accurately project the resident population of an urban community.

At every age level there is a ceaseless flow of migration in and out of such communities.⁶ In the main this flow of migration will be accommodated to work opportunities. If these opportunities become enlarged relative to opportunities elsewhere people will be attracted; if these relative opportunities become reduced, population will leave. Opportunities are not only counted by number but also by quality so that a certain number of opportunities for better or more stable or more attractive or remunerative jobs will count for more—or exert more pulling power—than the same number of jobs of a lower order of quality. It is the relative balance of opportunities which governs the outcome. Improved opportunities in Milwaukee must be gauged against comparable opportunities in other communities within ready access.

Industrial Employment and Multiplier

The flow of work opportunities in a metropolitan community such as Milwaukee will be governed largely by two basic factors, the primary industrial employment of the community and the employment multiplier or the number of jobs required to render some local service or product by way of trade, education, recreation and the like to each primary industrial producer. The primary industrial employment is made up of those men or women engaged in industrial or outside governmental construction work or in jobs which produce the commodities or services which are sold to tourists, outside government, or others in the outside world thus producing the vital revenues required to support the community.⁷

been more in documenting change than in forecasting it." Isard sums up his comprehensive review of methods of population projection: "This cursory examination . . . indicates the wide range of error possible in the use of any one method." (Walter Isard, *Methods of Regional Analysis* (1960), p. 32.

⁶"The severe difficulty in estimates for territorial segments arises from internal migration." Grauman, *op. cit.*, p. 564.

⁷What is termed "primary employment" in the text corresponds to what the Committee for Economic Development (CED) has recently termed "economic base." See the excellent chapter on "Need for Metropolitan Economic Base Studies" in Committee for Economic Development Research and Policy Committee, *Guiding*

The volume of this base employment will be governed chiefly by the investment decisions of the various commodity-producing organizations actually or potentially domiciled in the area, the terms on which they compete with similar organizations located elsewhere, and their relative success in winning patronage in the larger world-wide markets. Obviously, the rate of growth of this employment is very difficult to predict. There are hundreds of industrial enterprises participating in as many different markets, with many declining and as many or more increasing lines of activity. The factors that govern success in competitive enterprises are simply too varied and changeable in a dynamic and restless world to permit businessmen to predict the competitive outcome with any safety or assurance for many years ahead. Surveys of business forecasting show that individual firms are highly inept even in a twelve month or shorter-term forecast. Close to 40 per cent of the responding firms in a nationwide survey of annual one-year investment spending forecasts missed their predictions by 40 per cent or more.⁸ One-fifth of the larger firms with better budgeting systems were off the mark in their annual investment forecasts by 40 per cent or more and at least 45 per cent were off by 20

Metropolitan Growth (August 1960), pp. 31-34. For a comprehensive review see E. M. and R. M. Fisher, *Urban Real Estate* (New York: Henry Holt and Company, 1954), Chapter 12, "The Economic Base of a Community." The Fishers rightfully note that "Forecasting about the future growth or decline of a community involves a prediction about the prosperity or depression of its economic base" (p. 301). For an interesting effort to apply and statistically measure the concept, see E. Z. Palmer (ed.), *The Community Economic Base and Multiplier*, Business Research Bulletin No. 63, University of Nebraska, 1958. See the important criticism of many local multiplier measurements in "The Export-Local Employment Relationship in Metropolitan Areas," *Monthly Review*, Federal Reserve Bank of Kansas City, March 1960. The theoretical problems involved have been developed in the collection of articles edited by Ralph W. Pfouts, *The Techniques of Urban Economic Analysis* (West Trenton, N. J.: Chandler-Danis Publishing Company, 1960); Charles Leven, "Regional Income and Product Accounts: Construction and Application," *Design of Regional Accounts* (ed. by W. Hochwald, Resources for the Future, 1961), 148-195; Isard, *Methods Regional Analysis*, Chapter 6.

⁸Robert A. Levine, "Capital Expenditure Forecasts by Individual Firms," *The Quality and Economic Significance of Anticipating Data, A Report of the National Bureau of Economic Research* (Princeton: Princeton University Press, 1960), p. 352.

per cent or more.⁹ Even shipper's quarterly forecasts of expected carload shipments exhibit "an almost perfect record of failure."¹⁰ Forecasts over longer periods by larger business firms usually allow for contingent and changing circumstances and often are elaborated only as "directional guides."¹¹ Errors in fulfillment may offset each other so that the aggregate of forecasts are more reliable than the individual forecasts entering into them. Still forecast figures even for as short a period as one year can only be utilized on an aggregate basis after close statistical study is given to their behavior, their patterns of dispersion, and their biases.

Each person engaged in primary industry, or earning an equivalent in an educational or service institution or in the net balance of investment income, is supported by a definite number of workers providing locally consumed goods and services of all kinds, including building, government, primary and secondary education, medicine, law, entertainment and the like. In general the higher the standard of living the greater the size of this multiplier or ratio and the larger the total volume of job opportunities that will be supported by a given mass of primary employment. The multiplier will tend to increase if locally produced products or locally rendered services are substituted for products or services procured from the outside. If the residents of the city spend a larger portion of their income on locally produced goods this multiplier will rise; conversely it will fall. The employment multiplier or ratio is not easy to measure though it tends to behave with stability from year to year. The laws of behavior of this multiplier are as yet unknown. All we know is that over a twenty year period it could drift significantly in one direction or another; and *drift cannot*

*merely be projected from behavior in the more recent past periods.*¹²

The Issue of Employment Projections

Did the outside consulting engineering report make a study of primary employment prospects for the water consuming area of Milwaukee and of the size of the multiplier that might be involved twenty years hence? No such study deserving of that title is indicated.¹³ It was argued that "during recent years" the Milwaukee area has experienced a rate of growth "comparable to the average of the national trend" and that hence "it may be expected to continue expanding." This expectation was supported only by reference to the "fine harbor" on Lake Michigan, good railway service and the favorable effects of the St. Lawrence Seaway then in the offing.¹⁴ It was not noted that the shifting currents of industrial expansion, which underpin the city's continued growth, could readily turn in other directions. Few firms needed to locate new production establishments in the Milwaukee area and most firms already there could readily expand elsewhere.¹⁵ It was not noted that vigorous urban growth has usually had an uneven impact in metropolitan areas, developing new areas, pushing others ahead and leaving still others behind.

Per Capita Water Consumption

The engineering forecast of per capita consumption was no better grounded than the forecast of service population. A 15 per cent increase in domestic per capita water consumption was predicted for 1975 over the prevailing 1950-55 consumption levels. The report itself contained data which showed that over

⁹ D. M. Keezer and others, "Observations on the Predictive Quality of McGraw-Hill Surveys of Business Plans for New Plants and Equipment," *ibid.*, p. 374.

¹⁰ A. G. Hart, "Quantitative Evidence for the Inter-war Period on the Course of Business Expectations: A Revaluation of the Railroad Shippers' Forecast," *ibid.*, p. 209.

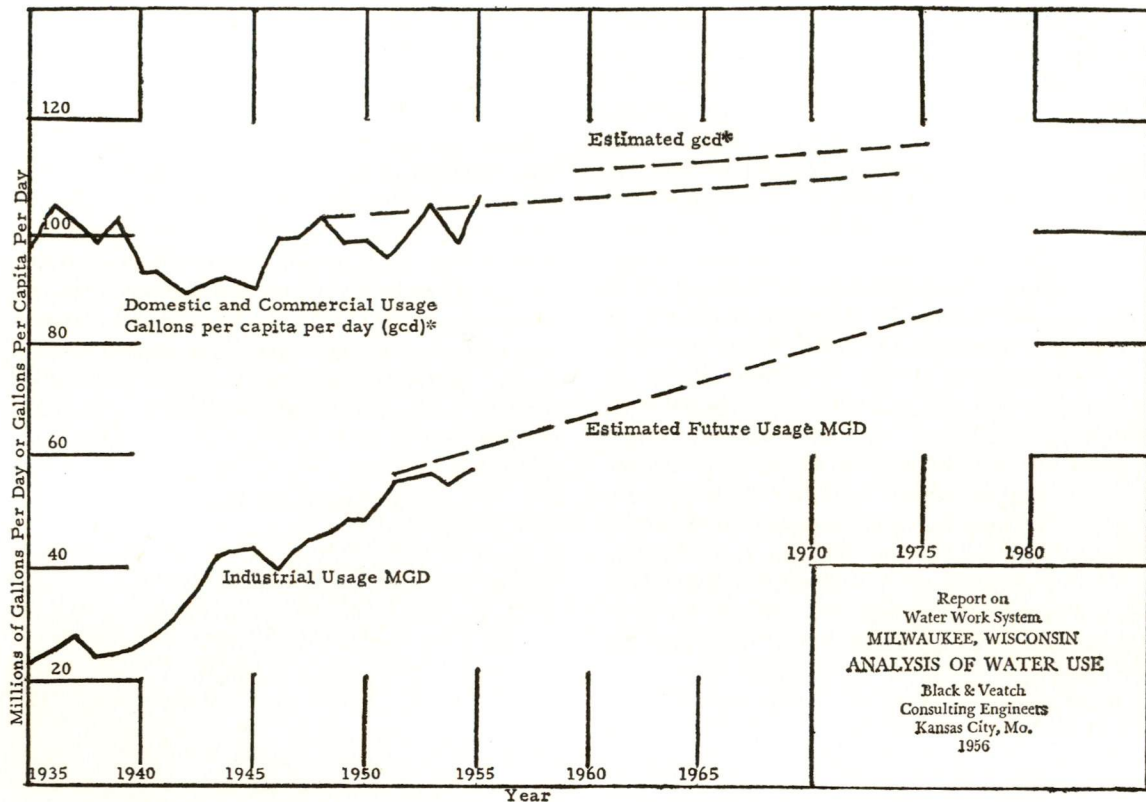
¹¹ See H. F. Klingman (editor), *Business Budgeting*, A Research Report Prepared for the Controllershship Foundation by B. H. Sord, G. A. Welsch (New York, 1958), pp. 28, 123ff. M. G. DeChazeau, "Regularization of Fixed Capital Investment by the Individual Firms," *Regularization of Business Investment*, A Report of the National Bureau of Economic Research (Princeton: Princeton University Press, 1954), p. 85.

¹² "... the export-local employment relationship should not be treated as a constant factor applicable to diverse times and places." Federal Reserve Bank of Kansas City, *Monthly Review*, March 1960, p. 6.

¹³ In fact no attempts at measuring the Milwaukee employment multiplier were made after the *BV Report—1956* was prepared. See Federal Reserve Bank of Chicago, *Annual Report*, 1956, p. 24; Alan Smith, *Study of Revenue Needs, Expenditures and Trends in Milwaukee County*, Marquette University Studies in Business and Economics (1959), pp. 42-53. (Mimeographed.)

¹⁴ *BV Report—1956*, p. 18f.

¹⁵ In his 1959 study, Allan Smith showed that manufacturing output was increasing between 1947-1957 at a slightly lower rate than elsewhere in the economy.



* As explained in the text (see page 220), the gallons per capita per day (gcd) was estimated at 15 per cent over the trend line based on active 1950-1955 consumption levels.

the whole period between 1935 and 1955 per capita daily consumption had fluctuated around an average of 97.94 gallons with no perceptible linear trend. The graph is reproduced above. The greatest per capita consumption was in 1936. It was argued that "the movement of people to less crowded suburban areas has resulted in an increase in per capita water use." More water "than was required in the past is now needed for the operation of home laundries, garbage grinders and dishwashers. As more people locate in the newer areas with larger lawns, more water will be required for lawn sprinkling and garden irrigation."¹⁶ Why these factors should not gradually have lifted per capita use over the prior twenty years was left unexplained.

No adequate account, moreover, was taken of the discouraging influence on per capita domestic and commercial consumption of two important factors considered in the report itself. The report estimated that a substantial

postwar increase in non-recirculating water-cooled air conditioners had boosted summertime water consumption for this purpose to a daily rate of approximately twenty per cent of the maximum daily 1955 use and 35 per cent of the yearly average daily use.¹⁷ The report also urged that such peakload use of water for air conditioning purposes was uneconomic and that Milwaukee should follow the practice of other cities which were attempting by rate surcharges or other means to curtail such uneconomic use.¹⁸ The 1975 water-use projection was premised upon the adoption of such curtailment. Yet little or no apparent allowance for such curtailment was reflected in the per capita usage projection.

The Effect of a Rate Increase

The second depressing factor on per capita consumption, namely the 85 per cent increase in water rates predicated in the report as the

¹⁶ BV Report—1956, p. 27.

¹⁷ *Ibid.*, pp. 31-32.

¹⁸ *Ibid.*, p. 32f.

financial price of expansion, had a more pervasive range of influence even if a smaller numerical weight in the outcome. The report dismissed the possible adverse effect of this rate increase on consumption as unimportant. "Experience in other localities indicates the reduction in sales is generally temporary and after a short time the water customers resume the normal use habits."¹⁹ Surely the experience of other communities is ambiguous in this regard. Evidence on this issue has been collected, appraised, and published elsewhere.²⁰ This evidence includes surveys for different time periods of twenty-nine New England waterwork systems, twelve Illinois waterwork systems, over a hundred in Kansas and 387 major systems distributed all over the United States. The evidence shows a strong tendency for higher rate levels to be correlated with lower levels of per capita consumption with the restraining influence of rate level approximated at an elasticity of response approximating .5 to .7. This elasticity measure indicates that a one per cent higher price tends to be associated with a .5 to .7 per cent lower level of per capita water consumption. The dispersion from the correlation is wide reflecting the presence of other influences, but the force of the tendency is indubitable. The fact that charges are low or that customer behavior is proximately governed by habits does not mean that the basic law of economic behavior, the inverse response under given conditions of customer use to price, is avoided or negated.

The depressing effects of an 85 per cent rate increase on per capita consumption would in part be offset by the stimulating effects on per capita consumption of an increase in per capita income levels. The same studies that disclosed the inverse influence of rate level changes on consumption also disclosed the positive influence of per household income changes on consumption. This reflects the tendency for a rise in per household income to be associated with larger lot sizes and more liberal use of water. However, the annual average increase in per household disposable income over the recent period has averaged

less than 2 per cent, and the total projected increase in per capita disposable income by 1975 could hardly run to more than 30 or 35 per cent.²¹ Thus on balance the combination of the income and price effect would tend in the negative direction. This negative tendency would be reinforced by the effects of elimination of peaktime seasonal use of water for non-conserving types of air conditioning. All this would seem to have justified a projection of a reduced rate by 1975 of per capita water consumption or at the very least an unchanged rate. There would seem to be no case indicated for the projected increase in per capita consumption.

Industrial Use

A similar overestimation may be found in the projection of industrial water use from 84.1 MGD in 1955 to 120 MGD in 1975, involving a 44.1 per cent increase. Trends of industrial water consumption are even less amenable to simple extrapolation and forecasting than the growth of industrial employment. Water is industrially utilized in a wide variety of ways, as cooler, as solvent, as catalyst, as conveying medium, as plant cleaning agent, and as a lubricant for production and distribution of heat and power.²² Industrial use of water is highly uneven between plants since 80 per cent of industrial water is consumed by about 5 per cent of the plants while nearly 70 per cent use less than 2 per cent.²³ Hence, the industrial water projection should have identified the major industrial users and have independently assessed their use patterns and demand potential. This study was particularly necessary since between 1951 and 1955 industrial use of water in the Milwaukee

¹⁹ The per capita disposable income growth trend reflects the working of a pervasive network of influences affecting productivity and income distribution. The trend is highly stable and is readily projected over coming decades. Between 1880 and 1955 per household income rose only by 141%. An authoritative 20-year projection of per family disposable income (from 1955 to 1975) involved a rise of 34%. See Committee for Economic Development, *Economic Growth in the United States*, February 1958, p. 28.

²⁰ M. J. Willis, "Forecasting Industrial Requirements," *Journal American Water Works Association*, March 1957, p. 236.

²¹ *Ibid.* See also Federal Reserve Bank of Kansas City, "Some Economics of Industrial Water Use," *Monthly Review*, April 1959, pp. 3-9.

¹⁹ *Ibid.*, p. 120.

²⁰ See by the present author, "Urban Domestic Demand for Water: A Kansas Case Study," *Land Economics*, May 1963, pp. 204-210.

TABLE III
Industrial Consumption of Water, Milwaukee Water
Works, 1950-1955
(million gallons)

1950	17,573
1951	20,054
1952	20,453
1953	20,492
1954	20,304
1955	20,886

(Source: *BV Report*—1956)

area had become virtually stabilized as may be seen in Table III. The possible adverse effect of higher water prices on industrial demand should have been taken into account since industrial development involving extensive water-usage would have been affected by a revolution in price structure of the magnitude proposed in the report. Yet the authors of the report chose to merely project, twenty years into the future, the boom-rate of increase in industrial water consumption experienced during the years 1945-1951.

Other Projection Factors

An over-estimate of water demand by the consulting engineers seems to be indicated by the record of water consumption since 1955. Table IV presents the record of water pumpage for the six transpired years 1957-63. On the basis of this record to date the position of Superintendent Tanghe who had consistently opposed massive waterworks expansion was more cogent than has generally been recognized.

TABLE IV
Total Water Pumpage
1957-1962
(billion gallons)

Year	Experienced	BV Forecast
1957	51.7	53.5
1958	52.5	55.8
1959	51.9	57.7
1960	52.4	58.6
1961	53.1	59.3
1962	55.4	60.9
1963	55.5	62.3

(Source: Milwaukee Waterworks)

Indivisibility and Economies of Scale

The difficulty of making a reliable projection of future demand for water is only one

side of a complex picture. The other side is represented by the comparable hazards in piecemeal enlargement of a waterworks. Waterworks engineering both at the production and distribution levels is permeated with the principles of economy of scale and indivisibility. The economies of scale make it possible to handle and distribute purified water over a given area more cheaply per gallon on a larger than on a smaller scale. This principle is commonly found in complex engineering projects and is borne out by the fact that water operating and maintenance costs per gallon are inversely associated with size of system.²⁴ Many of the costs of construction, land-clearing, excavation do not increase in proportion to capacity. Many items of waterworks equipment will produce more per gallon on a larger than on a smaller scale; and metering and communication networks will cost nearly as much to install and operate for smaller as for larger water outputs.

The principle of indivisibility resides in the fact that a waterworks is a coordinated network of pumping stations, storage depots and distributive mains each of which must be planned for mutual adjustment to maintain the needed water flow and a uniform state of water pressure. Growth at the extremity may involve modification of the system all along the line. Such piecemeal modification is very costly in terms of the additional output of water produced. Hence it may seem the wiser economy for a given water system to take a big risk and undertake a massive expansion program rather than a piecemeal adjustment to particular needs at the time they manifest themselves.

Peak Use

Under these circumstances it is a saving grace that the pressure of shortage in a water system first manifests itself at seasonal peaks during hot dry summers when water-cooled air conditioning devices and lawn sprinkling aug-

²⁴ See on this subject evidence indicated in my paper, "Urban Domestic Demand for Water," *loc. cit.*, p. 204. See also the illuminating article by F. T. Moore, "Economies of Scale: Some Statistical Evidence," *Quarterly Journal of Economics*, May 1959, pp. 232-246. Engineers have even developed a rough method of measuring increases in capital cost as capacity is expanded by a ".6 rule." Briefly the rule says that the increase in cost is given by the increase in capacity raised to the .6 power (p. 234).

anti-expansion
Pro peak pricing.

ments the normal level of year-around water demand. In Milwaukee the maximum summertime daily demand for water has been running from 1930 between 50-75 per cent over the average daily demand. In 1955 the figure rose to 76.63 per cent. Even on the hottest and driest summer day the rate of water use is not constant. The maximum hourly peak under conditions of unrestricted water usage will be found in the early evening hours when lawn sprinkling is a popular pastime. At these hours water pressure at many points in the system fell very low and water service proved inadequate. Popular discontent arising out of inadequate peaktime water service during peaktime use periods supplied much of the motivation to undertake a massive expansion program.

To expand capacity to meet peak demands is expensive, and in the early fifties regulations were adopted as air conditioning became more prevalent, diminishing water supplies more frequent. In a 1957 survey of 700 water systems, 244 had either adopted or were considering regulations or surcharges to meet air conditioning consumption. While peak demand for lawn sprinkling cannot be so easily curtailed in absolute terms,²⁵ it is possible by regulation to rotate this demand by prohibiting sprinkling during certain hours or on designated days.

The Economic Necessity for Regulation

Such restrictions merely embody an effort to conform to the acid test of economic rationality, the matching of returns against cost. In technical economic jargon this is known as the marginal-cost price rule: no parcel of additional business is justified which fails to produce enough revenue to pay for costs incurred. Violation of this rule is as unwise in public as in private undertakings. It is often not feasible to separate the particular customers or parcels of service which are expensive to serve; and the device of a uniform price has many practical advantages and corresponds to an ideal of uniform treatment. But this principle has to be limited to forms of service which are not

very costly or which cannot be restrained by price surcharges or by restrictions on use. Otherwise the public is called upon to bear burdens disproportionate to the benefits involved.²⁶

The issue for policy decision is now explicitly formulated. The pressure of use on capacity of water systems first takes the form of inadequate service at peaktime use. It is inexpedient to meet this pressure by capacity expansions in small increments, and risky to plan ahead for very many years. It is accordingly expedient to deny water users who have alternative means of satisfying their water needs (as is the case with non-conserving types of air conditioning), by assessing on such use of water a charge which corresponds to the costs properly imputed to it. Lawn sprinkling can also be regulated to the point that the vexation generated is strong enough to offset the risk inherent in plant expansion for indefinite future needs.

The response of the city of Milwaukee to its water problem went part way in the directions indicated. The first signs of shortage did not induce precipitate action. Lawn sprinkling was put under regulation. Understandably city officials were readily inclined to project continued growth of the urban area. Most blameworthy was the failure to curb the unrestricted use of water for air conditioning. The extent and danger of this use was reported in the Black and Veatch report in 1956. In 1957 the Zeidler administration advocated curtailment of air conditioning use and an ordinance to this end was prepared by the city public works department. Yet the Common Council refused to adopt the ordinance which asked for a \$20 per ton surcharge on the use of water for air conditioning without recirculation. The Council even delayed instituting a \$10 surcharge when in February, 1958 this was ordered by the state utility regulatory commission.²⁷ This charge was only put into

²⁶ As Jerry Milliman put it: "The urban water supply problem is in large part a peak load problem much like the problems of rush-hour congestion on urban transport systems . . . we need to consider and weigh the relative efficiency of alternative methods of rationing and allocating urban water service." J. W. Milliman, "Policy Horizons for Future Urban Water Supply", *Land Economics*, July 1963, pp. 120 ff.

²⁵ Not unless summertime lawn sprinkling is totally forbidden as it was in Fond du Lac, Wisconsin. See A. Saltown, "Role of Local Government in Water Law," *Wisconsin Law Review*, January 1959, p. 119.

²⁷ *Beveridge Report*, pp. 174 ff. In his as yet unpublished treatise on "Municipal Government and Its Improvement" (typescript dated Milwaukee 1960 and

Transition needed. We were talking about an overloaded system, so now in the situation "redeemed" by more demand?

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effect for the 1960 water-using season. All in all the record is spotty and shows both careless and highly prudent judgments.

Re-evaluation

Fortunately these judgments have been in some part redeemed since unanticipated developments have forced the expansion of the water-consuming area. For generations the city of Milwaukee as a corporate body had followed a policy of reserving its waterwork facilities for use within the boundaries of the city. These waterwork facilities constituted a choice asset which justified location within the city and would help to encourage outlying areas to favor annexation by the central city.²⁸

hence written directly under the influence of the course of events we have just described) the former mayor of Milwaukee, Frank P. Zeidler, in his illuminating chapter on "Water Supply" noted that the "heavy usage" of public water in certain ways, while representing "only a fraction of the total demand on waterworks" . . . has "certain inherent conditions about it that present critical problems." "One of these conditions is that the demands arise in some cities on warm days when the users desire to sprinkle lawns continuously, to use wasteful and non-conserving air conditioning units, to wash cars, and to increase their other domestic uses. The peak demands under such conditions caused by domestic use can cause a failure of supply." Section II A, "The Line Functions of Municipal Government," Chapter 25, p. 315.

²⁸ The traditional city attitude had been one of jealousy, even fervently, holding to its control over water facilities. This attitude is well expressed in the unpublished treatise "Municipal Government and Its Improvement" by the former Mayor of Milwaukee, Frank P. Zeidler: "With the rapid growth of suburban areas outside the formerly well-defined limits of the central city a problem has arisen in the form of the demands on the central cities to supply sewer and water services to such suburban areas. These demands have provoked a series of urban suburban conflicts. The urban position is frequently one of opposition to suburban demands. The urban government fears loss of business and industry to suburbs supplied with water. The urban government is also afraid that its policies of expansion and annexation will be frustrated if the suburban governments can get the functions they need from the central city without joining with it. Urban governments also fear the costs of extensions

From time to time service facilities were permitted certain smaller suburban communities but there was a record of nearly continuous litigation about city sale of water for suburban use. In 1961 three of the smaller suburban communities pulled away from the city waterworks system and established independent water service. The loss to the system has been more than made up by extension of service to the city of Wauwatosa pursuant to a decision in April, 1958, by the Wisconsin Public Service Commission. On balance the water service areas as of 1963 were enlarged by .77 per cent. The decision of the Commission was the more readily accepted since the production capacity was at hand and water could be sold wholesale at a negotiated price, meeting the additional pumping and distribution cost.²⁹ Still other suburban communities are anxious to draw upon the central city water system, and it appears likely that the waterworks expansion program will thus ultimately find a use for some, if not all, of its increased capacity.³⁰ Even a poorly designed planning effort may thus be justified when the boundary of service is expandable. This justification exists only at the expense of the city's traditional policy of resisting service to suburban communities in order to encourage outward expansion of the central city by annexation.

of such service to suburbs for these costs will have to be borne by the urban user and put on his rates. Moreover there is the technical problem of how far the urban government or water department shall be compelled to expand its service." And terminating his discussion he presciently noted: "Over a period of time it may be that the water system controlled by a single central municipality may be the exception in local government." See p. 325.

²⁹ The negotiated charges result in a level of user water charges considerably above the level prevailing for city customers and thus avoid the bias in "postage stamp" pricing with its flat charges which ignore space costs. See Mason Gaffney, "Land and Rent in Welfare Economics," *Land Economics Research* (Resources for the Future 1961, pp. 141-167).

³⁰ See Beveridge Report, pp. 127-134. See also the terms of reference and related discussion in *BV Report* —1959, pp. 1-11.

Water for Wauwatosa " by David Gladfelter, Ch 22 in
pp 280 - 291
summarize for Gaffney

Cases in State & Local Government, Richard T. Frost, ed.
Englewood Cliffs, NJ, Prentice Hall Inc 1961

"Government in the states is of the cities, by the farmers,
and for the suburbs" - Professor Wallace Sayre of
Columbia, ~~for~~ quoted in introduction, p 280

280 - In 1954, Tosa developed a serious problem of water supply -
shortages -

Wells were sufficient for old area, but in 1954, it
annexed 8.5 new sq. mi. with 12,000 inhabitants.

282 To drill additional wells would further lower the water table.

"Milwaukee had had the authority to sell its water outside the city limits since 1887,
had done so since 1902, and was doing so to six suburbs in the year 1954"

The milwaukee common council "had opposed further extensions of service, not only because
the city lacked the facilities to provide it, but because Council had always considered
water service to be related to a larger political problem, that of annexation and
consolidation.

"The Milwaukee Council has long assumed that by withholding city water, it could
induce suburbs needing water to become a part of Milwaukee. Conversely, it has feared
that to give suburban users Milwaukee water without requiring their commitment to a
annexation would be to lose the opportunity to draw them into the city. Why should the
suburbs receive a vital city service without incurring the higher city taxes? Council
felt that to provide ~~the~~ the suburbs with water would be tantamount to inviting city
industry to migrate to the suburbs."

(good summary of zeidler's opinion, as well.)

283 In january, 1955, milwaukee rejected wauwatosa's proposal.

Wauwatosa, in the year and a half following, made more engineering studies, and investigated
the other alternatives...drilling additional wells, or join in forming a suburban utility
with other suburbs.

The problem became more acute...

284 New industries (harley davidson, briggs and stratton, mayfair shopping center) were
to provide their own water until the suburb could. Samuel J. Gates, an executive of a
firm of consulting engineers retained by the city, recommended drilling two new wells at
a cost of \$2 million, and renewing efforts to convince milwaukee or other suburbs,
~~xxx~~ or else three more wells would be needed.

in may, 1956, wauwatosa mayor william b. knuese, in a letter to his common council,
urged the suburb to start a proceeding "in the proper state commission (the public service

p. 289- Milwaukee argued that Tosa annexed areas without thinking ahead & created its own problems. Tosa retaliated that Milwaukee must have done the same thing, since it was maintaining it couldn't serve Tosa because it couldn't serve its own present area - (see*)

p 284

cont commission~~xxxx~~ - PSC) or in the courts" to force Milwaukee to supply water to wauwatosa.

285 "His position was simply this -- since the Milwaukee water department was a public utility already selling water outside the Milwaukee city limits, it could not legally refuse to sell water to wauwatosa."

passed a resolution asking Milwaukee for water, and authorizing the Tosa attorney to start proceedings in the courts if it wouldn't, to establish a metropolitan water district.

(Milwaukee) Alderman Matt Schimenz, chairman of the Council's utilities committee, emphatically stated: 'The city's water will go to Wauwatosa over my dead body unless there is a political ~~consolidation~~ consolidation of Milwaukee and Wauwatosa.'

Mayor Frank P Zeidler added: 'Wauwatosa wants city services without paying city taxes. When a city like wauwatosa holds itself out as a city, it takes on the obligation of supplying all services from its own sources.... If we extend our water to everyone outside the city, we will lose industry itself just as we have lost the captains of ~~an~~ industry.'" (of milw. aldermen & administration)

286 * A special committee recommended that Milwaukee not serve any new municipal customers until it could take adequate care of its present customers in the City and in six suburbs. Council rejected the proposal.

Herbert L. Mount, special counsel for Wauwatosa, said

Wauwatosa petitioned the PSC to ~~xxx~~ fix a ~~xx~~ schedule of expansion for Milwaukee to meet wauwatosa's needs.

~~Because of xxxxxxxx~~ The PSC's actual jurisdiction and powers were unclear, as established in previous decisions by the PSC and the state Supreme Court.

287 Hearings were held on wauwatosa's application throughout 1957 and early 1958.

288 The ~~xx~~ PSC ordered, on April 2, 1958 that: 1) Milwaukee within 60 days provide temporary service of up to 2 million gallons a day to wauwatosa "on an off-peak basis," (IE, fill Tosa's reservoirs during off-peak periods) and 2) "proceed with due diligence" to provide additional plant and facilities as are necessary to supply wauwatosa permanently.

Its reason was that the city held itself out as a water utility by supplying the six suburbs, and could not discriminate against other suburbs.

289 Milwaukee Common Council voted to appeal in the courts, but Mayor Zeidler vetoed it, thinking that the courts might take the entire water works out of the city's hands.

290 Gladfelter says "Another rural legislature had done its work," when the Governor's appointment of Alderman Matt Schimenz ~~xxxxxx~~ as chairman of the Wisconsin public service commission was rejected. The vote was: republicans, 18-2 against; democrats, 12-0 for. A suburban representative was reported in the Milwaukee Journal to have said, "Our only hope of blocking the appointment is to make it a republican party issue, one of party loyalty."

Pat:

This Beveridge Report is a morass. Don't get stuck in it.

Let's try to learn a few basic facts, from Water Dept.

1. Map of system, with
dates of components
capacity of "

2. Water rates.

a. changes over time

b. Differential charges, by —
peak load + time
area of city
jurisdiction
volume per customer

c. Philosophy, rules, or principles of rate-making

3. ~~the~~ Surplus or deficit

Costs should include

Current expenses: opns., maintenance, admin.

Debt service

Return on (and of) city's investment from
funds other than debt (i.e., plowed-back surplus from
earlier years). Probably you cannot get this last,
due to bad bookkeeping.

Hypothesis: with the expansion of ~~the~~ ~~late~~ around 1960 ± 3 , rates went up sharply. More costs were assigned to water dept. to cover, [†] and it yielded a surplus, too.

Gross income -- compare to income of city from all taxes.

4. What share of total costs are the costs of subdivision.

i.e. suppose one block has one big user, and he is replaced by 20 small users, requiring separate laterals and meters, but keeping same volume in same area, how much is cost increased?

5. Are high water rates for industry considered a barrier to attracting industry?

How do Milw. water rates compare with competing cities?

6. Bonds.

Amounts

Date issued

Revenue or gen. oblig.

Rate of Interest

Maturity

[†] ~~M~~ Examples are administrative costs; and in-lieu-of-tax payments; use of revenue bonds instead of plowed back surplus

Ch I Growth of the water system & organization

- 7 Began metering in 1912. As a result, the average daily consumption, which had increased 2,800,000 gallons between 1911 and 1912, increased only 370,000 gallons between 1912 and 1913
- 9 "The year 1925 marks the beginning of a period of rapid expansion in water works pumpage, income and expansion that reached its peak in 1929 and 1930. Average daily pumpage increased from 69 mg in 1924 to 84 mg in 1930; total annual gross income from \$2,175,000 to \$3,125,000, and the distribution system grew from 605 miles of mains to 905 miles."
- "The addition of 33,582 services from 1900 ~~to~~ through 1913, and the annexation of over four square miles ~~from~~ by the city created a pressure problem in the outlying areas that was met by raising the standpipe at the high service station to 185 feet above the lake."
- 10 "Even as early in the period of expansion as 1922 there were areas in the city during the summer...that received poor service."
- "Most of the population growth in Milwaukee during the decade of the twenties took place in newly annexed areas. ...In 1920, Milwaukee, having annexed only 3.5 s.m. since 1900, found itself the second most congested large city in the nation (NYC first)."
- "This caused grave concern, and led to a vigorous program for annexation...that added 17 s.m. in 34 separate annexations by the end of 1930. The moving force in this annexation drive was Arthur Werba, who in the spring of 1923 was made supervisor of annexation... Werba felt it most important that the newly annexed areas receive all city services as soon as possible to demonstrate to nearby areas the advantages of annexation."
- (note: can get a total history of all costs of additions to the system.) ~~where?~~
- 11 "In the period 1921 through 1931 the total mileage of mains in the system increased from 560 to 930 miles. The total cost of extension of the distribution system in that period was \$11 million."
- 12 A "comparatively economical means of meeting peak demands" -- that of constructing storage tanks in the outlying areas, ~~and then~~ drawing from them at peak periods and refilling them during the night -- was used during the 30's.
- 13 "The increase in water consumption on the northwest and south sides created inadequacies sufficient to lead to the introduction of resolutions in the common council during the fall of 1941 proposing investigations of the water service in those areas. The coming of the war precluded any major action to improve service in these areas."

CHAPTER II THE FIGHT FOR THE FILTRATION PLANT.

- 14 Citizens had little active concern with water service in general, but water purity became a political issue. *History of the fight. ↓ not essential.*
- 15 The common council authorized a study of sewage disposal in 1910. Socialists, after getting no reply from the city engineer on water purity, asked that the study be expanded to this matter. ~~Nothing was done, and the next year~~ The study commission said filtration was the best method to ensure water purity, but no action was taken on the recommendation.
- 16 Dr. Gerhard Bading was elected mayor in 1912. *The city put in a* ~~the city put in a~~ hypochlorite plant (hypochlorite) and typhoid death rate was reduced.

Evidently a sewerage plant, and a water purification plant, are alternatives.

- 16 The common council's inaction on the sewerage matter led the state legislature to establish the mil. sewerage commission in 1913, which was to establish a system only and then turn it over to a city dept.
- The socialists wanted water purification rather than a sewerage plant because the sewerage plant would necessitate a large bond issue, which would make their pet project, a municipal light plant, which had already been authorized in a referendum, ~~imp~~ delayed again.
- 17 When Hoan was elected in 1916 he asked the US Public health service to investigate milwaukee water. The service recommended a ~~fi~~ water filtration plant. (IE, purification)
- 18 Hoan appointed a non-partisan committee to review the report, thus delaying the sewerage plant, and forwarding the purification plant.
- 19 December, 1917, \$30,000 was ~~appx~~ budgeted for purification experiments & works.
- 20 March ~~20x~~ 1920, the chemist recommended immediate construction of a rapid sand type filtration plant. Hoan, in his campaign, accused the non-pratisans of favoring a ten million dollar sewerage plant so that the city couldn't issue bond s for street railways.
- 23 Already had ~~16~~ 16 million invested in the sewerage plant.
- 24 Common council decided to ~~xxx~~ postpone work on the filtration plant until the sewerage plant be built. 1921
- 25 Jones island sewerage plant began operation, 1925.
- Despite increases in typhoid deaths, filtration question was not taken up until 1931. The issue was promoted as one of community pride in having the best system, not as healt issue.
- "With the problem of need for relief employment, the filtration plant project now assumed more the character of a community venture, with the intention of giving milwa kee the finest possible quality of water supply. ...health and community pride" appeals.
- 29 = Common council authorized construction, 1933, with ~~20 percent~~ loan from federal government. Completed 1939, 29 years after original agitation.
- 32 "The south side intake and pumping station was quite naturally postponed when the de pression reduced consumption and brought an end to the annexation program that had been the cause for much of the expansion of facilities and consumption during the previous decade." (in the 20's).
- "The areas in which the water department did overexpand during the twenties was in the installation of small distribution mains with connection taps and fire hydrants as a result of pressure by real estate developers who wished to increase the value of theri land. Aside from this, ~~xxx~~ all expansions...were designed to meet curre nt needs.... (this is in his summary - can't find source)
- 34 In 1893, the water department broke even. There were arguments that the city should pay for the water itx used, which mayor David Rose made them do in 1898. Also in his administration, water rates were "equalized," so as to favor the small consumer by the institution of a flat rate of $4\frac{1}{2}$ ¢ x for every "

p35
cont

100 cubic feet of water used. Had been a two step rate, then a 5 step rate.

36 ✓ 1899: first establishment of a rate for outside the city, at 6¢/100 cubic feet. Compared to 4½¢ inside. Wisconsin statutes then provided that the charge must be less than 1/4 more.

37 ✓ Financed a pavilion, band concerts, ash removal, from surplus water revenue. Common council voted the surplus could be used for general fund. Several city departments were exempted from paying water rates.

38 ~~1905. CCouncil made charitable insti~~

38 Mayor rose wanted to reduce the rates, but couldn't afford it because the CCouncil had appropriated some of the money for other purposes. 1908

39 Seidel's socialist administration. "No free water to anyone" began. Straightened up water accounting procedures too. Also began ~~real~~ universal metering; found that 23% of consumption was lost due to leaks or illegal use. Especially residences many weren't metered.

41 1909-1913 - long battle between city & state regulatory commissions over city's rates.

~~1910~~ 1909: two firms and 23 citizens filed a complaint on water rates with the railroad commission. Hearings held in 1912 (yes). RR Comm. ~~said~~ ordered sliding service charge, and a stepped output charge.

✓ The city objected so much the RR C backed down; decision not published. "The city won a clear-cut victory" ~~xxxxxxx~~ on the rate question by avoiding "a rate schedule that would reflect more accurately the actual cost of service." ie - stepped rates.

42

Rates increased, Jan. 1921, with plans for new filtration plant, to 7¢ per 100 cubic feet, plus \$2 per meter per year.

Note: the Railroad commission was under the Public Utility law of 1907.

43 After a jurisdictional fight, the State Supreme court said the RR Comm had jurisdiction, and the city submitted its plans to it. Four large water users petitioned for stepped rates, 1926, but no action was taken. Went to SC on another technicality, which ruled

44 again that the RR Comm had power to set rates. The city wanted to be able to do it.

45 A reason given by Henry Bohmann (can't immediately find his position) for not wanting to reduce rates in 1925: "If they were reduced, the continuing construction needed to keep pace with annexation could be provided for only by issuing bonds, " ~~book's~~ quote, not Boh's.

✓ In fact, however, no bonds had been issued since 1913; construction during the twenties was from ~~xxxxxxxxx~~ revenues. "But because no reserve had been built up before the First World War, and because large annual payments to the general (city) fund were continued, the department was in the red from 1919 to 1931, when construction dropped off. (Although, the department was able to meet expenses day by day on its cash basis).

46 ✓ In 1932, at recommendation of the public service commission (successor to railroad comm) the common council lowered both the city & suburban rates by ~~xxxxxxx~~ 1¢ per 100 cu.ft. (doesn't say what they were).

✓ 1932-35, ~~\$800~~ \$880,000 a year was transferred from the water department funds to the general fund to cut the tax rate. --was about 40% of ~~water~~ revenue, from water sales.

- 36 Mayor David S. Rose, preeminent political figure of 1900-1910. ~~He~~ He "sought to make political capital by the manipulation of the policies of the city's water utility. ...During this decade the central point of controversy in regard to the water department was whether the surplus revenue of the department should be used to provide various services in the city, or whether such surplus should be eliminated by a reduction in rates... ...many of the projects put forward to be financed by surplus water revenues were quite evidently proposed for their vote getting value.

Rose succeeded in having \$200,000 of the \$300,000 surplus in the water fund transferred to the general city fund, ~~to~~ 1900-1. He also wanted "outstanding water bonds be refunded as they matured rather than paid," because he thought the 'next generation should bear its just share of this expense.'.

- 37 Used the extra water money for a pavilion, band concerts, ash removal.

Under the 2 "point of view that revenues taken in ax by a municipally owned utility in excess of expenses should be used to finance services provided by the city functioning in its governmental capacity, rather than to reduce the rates of the consumers who have provided the surplus.

✓ became a state law in 1905 that milwaukee could "appropriate surplus earnings of the water works to the general fund, so long as there was on hand enough money to pay two years' installment on principal and interest of any bonded indebtedness of the water works."

- 38 1905 - discontinued the practice of remitting water assessments for charitable institutions.

Rose wanted a rate reduction, but the common council had appropriated \$150,000 of the water funds for other purposes, so he couldn't. 1909.

(note....it doesn't say how much was transferred to the general fund each year) but

- 45 Trasnfer payments were increased to \$225,000 per year in 1921, and to \$300,000 per year in 1925.

✓ Not clear The last issue of general obligation bonds for water & works construction was for the amount of \$300,000 in 1913 ...The large amount of construction carried out during the twenties was paid for out of revenues of the water department. But because no reserve had been built up before the first workd war, and because large annual payments to the general fund were continued, the department was in the red from 1919 to 1931, when construction dropped off. Th at is, the comptroller's figures, which included all encumbrances, showed a deficit. The department itself, which ran ~~alls~~ its accounting on a "cash basis," was able to meet al expen~~des~~es without requiring transfers from & other city funds due to the fact that reve~~neus~~ were always sufficient to pay the bills as they came in, although never enough to cover all encumbrances. The comptrollers' figures, on the other hand, showed a deficit in the department's account from 1921 to 1931 of between \$220,000 and \$890,000.

- 46 Supreme court (US, on another case) in 1931 that ¹⁾in ascertaining the value of a water wirks in order to determine the rate-base, due consideration should be given to reconstruction cost new of the facilities. This had not been done by the commission in 1911 when it set the fair value of th e city's water system at \$17 million. Moreover, since the city was entitled to earn 8 percent on its fair value, the assistant city attorney calculated that even on the inadequate figure of \$17 million the city was losing \$240,000 a year on the rates then in effect."

- 46 1932-35 -- ~~\$800,000~~ \$880,000 a year transferred to the general fund, to help cut the tax rate. "The first year this was done it reduced the city rate about 96 cents on each \$1000 of assessed valuation. ..The sum transferred amounted to about 40 percent of the total revenue from water sales, and ~~1~~ in 1932 and 1933 the amount transferred exceeded the operating expenses of the utility itself."

1936 -\$750,000 transferred

1937- \$600,000

1938 650,000

1939 950,000

- 47 The transfers "meant that some highly assessed commercial establishments that used little water had more money taken off their taxes than they paid in water bills.... opponents of transfers "felt that it was of considerable benefit to large property owners, or holders of vacant property, and that the small property owner and consumer benefitted far less.

(note: doesn't this look like the suburbs then buying water from the city (not available in here which ones they were) were paying subsidies to city property owners??? or at least offsetting the effect of not paying cost for their water???) *In part, yes, but remember it takes longer lines to reach the suburbs, and zonally stepped rates would hit them hard.*
"despite the large amounts transferred to the general fund, the water fund was in much better condition during the thirties than it had been during the twenties. After 1930, the department was in the red only one year, 1932, and then only by \$8,000. This was due in large part to the fact that the only considerable construction project during this time, the filtration plant, was financed by bonds and loans from the federal government.

- 48 the commission (public service) determined a new rate base in 1934, of \$23 million, in which figure reproduction cost new was given one-third weight.

The city submitted requests for rates of 7¢ and 10¢ for suburbs per 100 cubic feet of water, plus a \$3 meter service charge.

commission said the net earnings requested "are so far below what is ordinarily considered a reasonable rate of return for a water utility that the problems of determining a rate base and rate of return thereon become matters merely of academic interest.

"The commission had figured on a return of 5 1/2 percent on the \$23 million rate base, which amounted to \$1,265,000. as contrasted with the \$92,000 requested by the city."

All this was part of a 5 year investigation of ~~mixture~~ rates and practices of milwaukee water works by the commission.

- 50 New rates set: first 500,000 cu. ft, 6 3/4¢ per 100 ~~cu~~ cu.ft.
next 500,000 cu ft, 6 1/2¢
over 5 1/2¢
plus graduated service charge,

also new charges for private fire protection service.

- 51 The rates were established for filtered water, but the rate basis didn't include the city's 5¹/₂ million investment in the purification plant. The city was supposed to submit evidence the next year to the commission, on which the rates would be revised, but it never did. submit evidence.

Summary of his

- 52 "It is evident the city continued to want rates to be as low as possible. The chief illustration of this is the low rate of return requested by city in the rate case of the late thirties, and its failure to go back for an increase in return once completion of the filtration plant had expanded its rate base by over 20 percent."

CHAPTER IV WATER SERVICE EXTENSION POLICY 1897-1942

*Not consistent
with surplus.
right*