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Subject: Technical Letter 11
Cost of Water Treatment in Illinois

October 1968

Information presented here on the cost of treating surface water and groundwater in Illinois represents one product of research currently under way at the Illinois State Water Survey on the cost of water resources development. Other studies in progress include cost of reconditioning water, sewage treatment, and waste disposal.

Previous technical letters issued have covered subjects as follows: Technical Letter 7, Water Transmission Costs; Technical Letter 8, Cost of Reservoirs in Illinois; Technical Letter 9, Cost of Pumping Water; and Technical Letter 10, Costs of Wells and Pumps.

The use of this material will give an estimate of the investment costs of water treatment and the total water treatment costs for surface water and groundwater supplies. This is intended only as an instrument for establishing orders of magnitude as a basis for comparisons, and of course does not substitute for detailed engineering studies.

Investment Costs for Surface Water

The study on investment costs of surface water treatment plants is based on information obtained from literature data in the *Journal of the American Water Works Association*. The data were adjusted to 1964 prices and to location differences by using the Handy-Whitman Utilities Indexes for small treatment plants, 0 to 1 million gallons per day (mgd), and large treatment plants, greater than 1 mgd.

Figure 1 shows the results of examining data from 42 plants. The measure of dispersion for the investment costs is given by the standard error of estimate expressed as 43 % above the regression line. For the purpose of making estimates of investment cost, we have selected values one standard error of estimate above the regression line. This implies that on the average we would expect to have actual values in excess of the estimated cost only 16 % of the time.

Surface Water Treatment Costs

Figure 2 shows the relationship between the total cost of surface water treatment, in cents per one thousand gallons, and the water treatment plant normal capacity, in mgd. The total cost to produce 1000 gallons of water consists of 50 % investment cost (figure 1), and 50 % for other costs as follows: 20 % manpower, 17 % energy, 7 % chemicals, 2 % maintenance, 2 % repair, and 2 % heating. In addition, a capital cost of 2 % of the investment cost is added for taxes and insurance. The investment cost is amortized at 4 % for 30 years. The economies of scale cannot decrease indefinitely and therefore figure 2 should not be extended beyond a plant capacity of 40 mgd.

The surface water treatment costs include purification and chlorination. Normal purification consists of chemical coagulation, sedimentation, and rapid sand filtration.

All costs are based upon the designed plant capacity in mgd. Since there is usually a utilization factor (ratio of mean daily pumpage to designed plant capacity), the actual production cost per gallon would be somewhat different from the designed plant capacity cost, but this can only be determined by an engineering study of specific details of plant and operations which is beyond the scope of this technical letter.

Investment Costs for Groundwater

The study on investment costs of groundwater treatment plants is based on 58 plants located in the state of Illinois. The data were adjusted to 1964 price levels, and additions were made for engineering, legal, administrative, and overhead costs plus interest during construction.

Figure 3 shows the resulting regression of investment costs versus water treatment plant capacity. The measure of dispersion by the standard error of estimate is expressed in percentage as 33.5 above the regression line. For the purpose of making estimates of investment cost, we have selected values one standard error of estimate above the regression line. This implies that on the average the estimated values would be exceeded only 16 % of the time.

Groundwater Treatment Costs

Figure 4 shows the regression line between the total costs of groundwater treatment and the water treatment plant normal capacity. The total cost to produce 1000 gallons of water consists of 50 % investment cost (figure 3), and 50 % for other costs including 20 % manpower, 17 % energy, 7 % chemicals, 2 % maintenance, 2 % repair, and 2 % heating. In addition, 2 % of the investment cost is added for taxes and insurance.

The groundwater treatment costs include treatment for iron removal, softening, and chlorination.

Example

A city of 5000 population needs a new water treatment plant. The present supply of groundwater is inadequate and not desirable because of minerals, taste, and odor. The city desires a plant of 1 million gallons per day. A surface water supply is available. What will the water treatment plant cost? What will it cost to treat the surface water? What would have been the cost to treat the groundwater source had it been available in sufficient quantity?

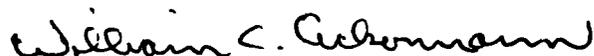
From figure 1, for 1 mgd plant capacity, the water treatment plant investment cost will be about 384 thousand dollars.

Pumpage of 1 million gallons per day will cost 14.3 cents per 1000 gallons to treat, as shown by figure 2.

Had the groundwater source been adequate, the water treatment plant investment costs would have been 153 thousand dollars (figure 3), and the normal pumpage of 1 million gallons per day would have cost 5.7 cents per 1000 gallons to treat (figure 4).

We hope this information will be useful to you in examining alternatives in water treatment.

Very truly yours,



William C. Ackermann

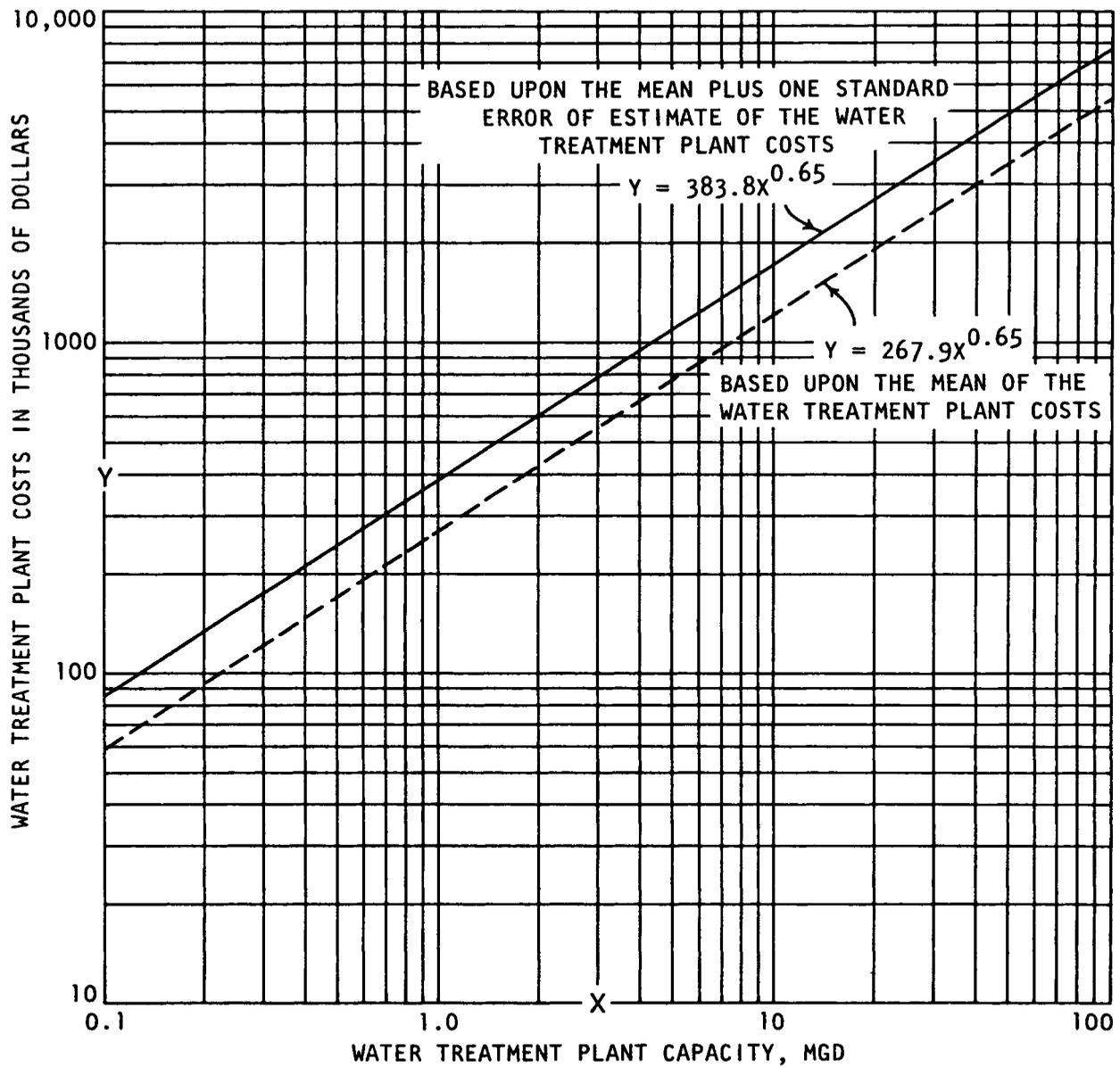


Figure 1. Investment costs of all types of treatment of surface waters

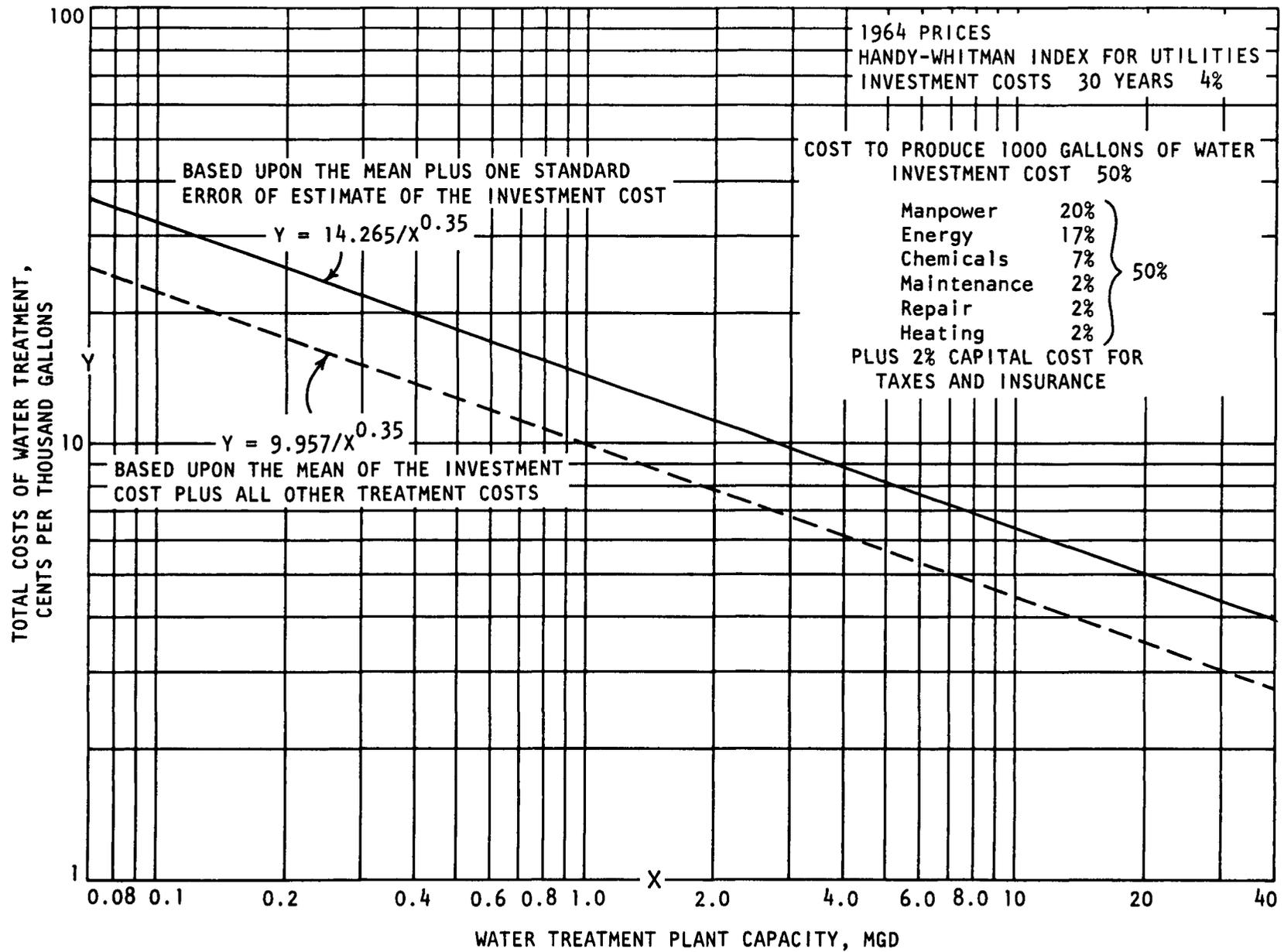


Figure 2. Surface water treatment costs

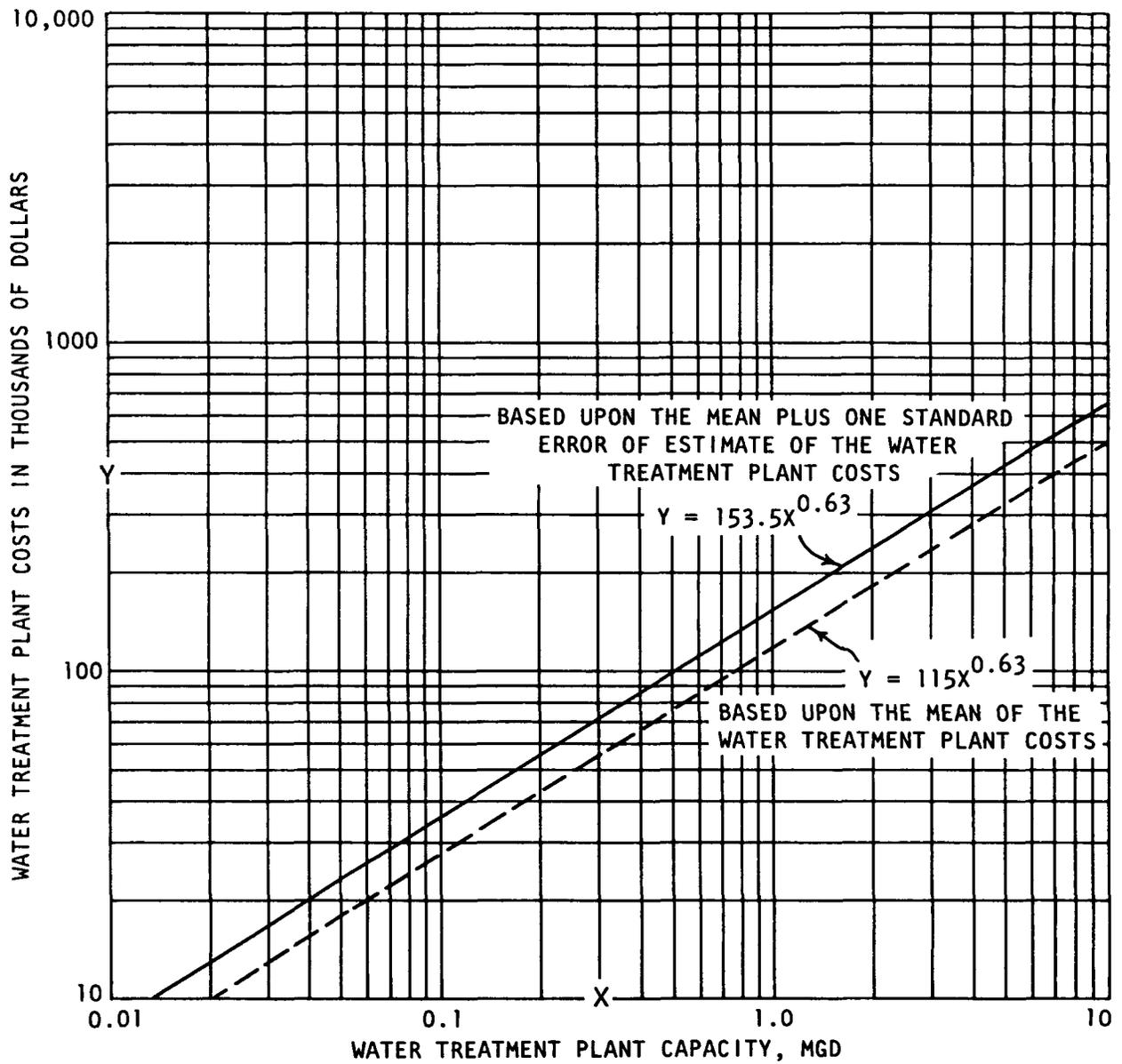


Figure 3. Investment costs of all types of treatment of groundwater

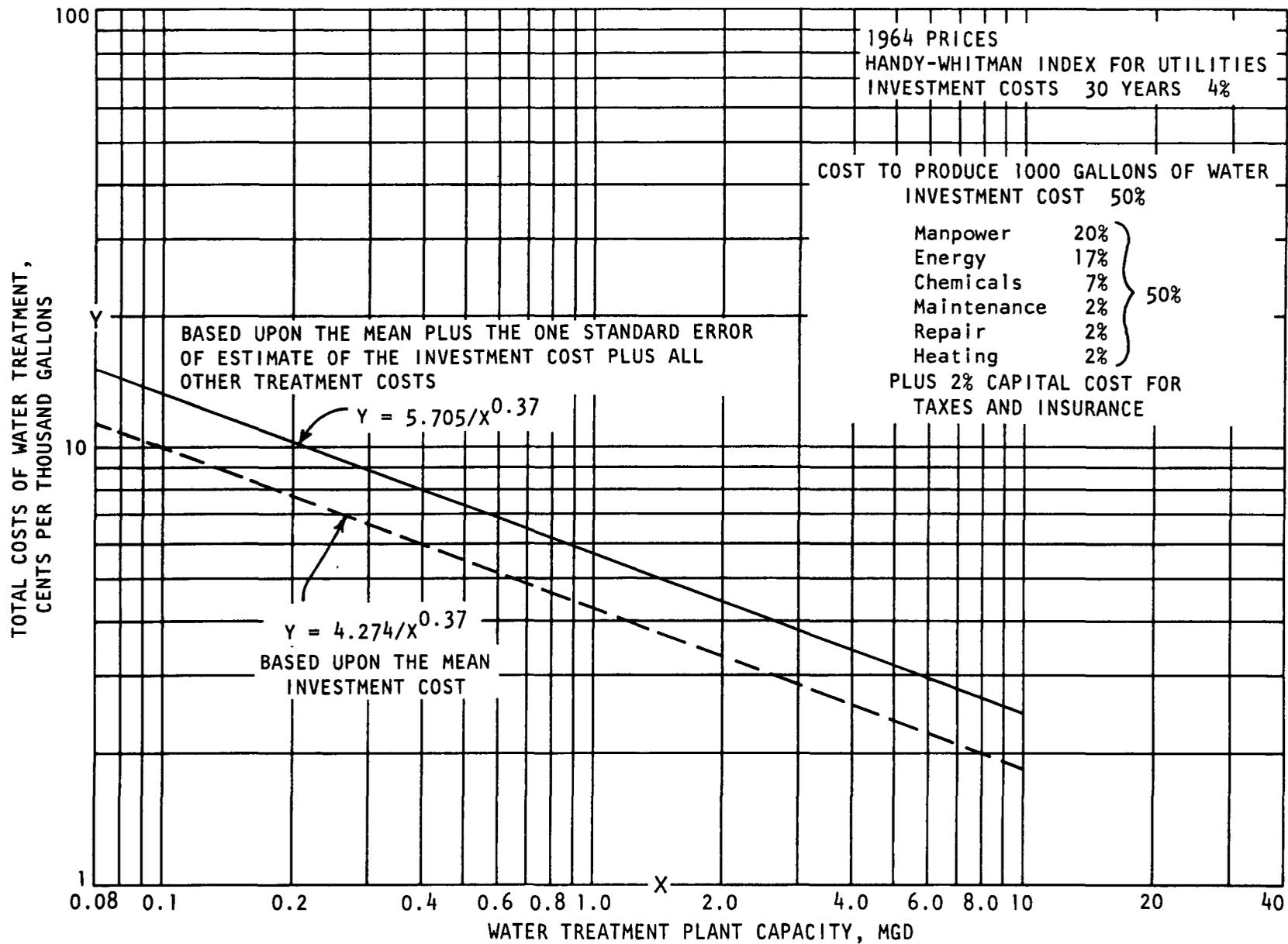


Figure 4. Groundwater treatment costs