

9.10 Exercises

1. Diagram (styled like figure 9.1) a completely specified multiblock rate structure using the actual rates for a utility you have accessed online. Provide a reasonably accurate, hand-drawn diagram and a corresponding equation for bill computation. If you would prefer to use a utility that has a uniform rate, you must include wastewater charges in the diagram and equation. The equation should include the applicable recurring meter charge(s). Include a web address citation for your data. Are new connection fees obtainable elsewhere on this website?

2. Aridton is a growing town in a basin hosting an active water market. Water rights are commonly leased or sold. Average summer leases are \$50 per acre foot among agricultural irrigators, but winter leases are nonexistent because of absent demand. Lease prices are weather dependent, varying from \$10 to \$100. Ordinarily, Aridton and the basin's other towns do not participate in lease markets as buyers. Current sales are being conducted at \$5000 per acre foot. One acre foot is the approximate annual consumption of three households. In Aridton's case, 40% of water removed at the town's supply source is lost to evaporation and leakage before it reaches customer meters. What are the implications of these conditions for the rates Aridton charges?

3. Southern Irrigation District (SID) enjoys a 365-day growing season, but it has no storage facilities to use in conjunction with its surface water rights. The district funds its operations using a \$15 per acre annual assessment on all acreage, irrigated or not, and a \$10 per acre-foot charge on metered water deliveries (currently 28,000 af/yr). Assume no conveyance losses.

SID's water rights are correlative and entitle the district to 20 percent of the river flow throughout the year. Water rights are owned by the nonprofit district, not owners of the 10,000 acres in its fixed service area. There is an active regional water market among private, water-owning agents and towns. SID does not participate in this market. Summer water is leasing at \$163 per acre-foot whereas there is no market interest in winter water rights.

Can you recommend policy revisions that would be welcomed by typical landowners in the district? Attempt to integrate proper terminology into your suggestions. Be as specific as possible.

4. Ground water is being depleted so rapidly in Highflat County that the economic merits of a very expensive, yet unbuilt, surface water project are rapidly getting better. The Shallow Reservoir project still has a negative net present value, however (no incommensurables or intangibles are relevant). Careful analysis indicates that at the current pace of change, Shallow Reservoir will pass a cost-benefit test in another five years, when project costs will be \$15,000 (real, current dollars) per perpetual acre-foot of natural, undelivered water. The optimal time to build Shallow Reservoir is calculated to be in ten years, when project costs will be \$16,000 per perpetual acre-foot. Can you make a specific recommendation for a beneficial action to occur this year? What effects will this policy have the future project and why?

5. Due to local political interventions, a growing town cannot establish efficient connection charges. Growth-driven production costs are recovered through water rates. The current policy is to annualize capital costs over ten years at an 8 percent real discount

rate. These costs are then assigned to each of the ten years. Recovery is made via increases in volumetric water rates using average-cost pricing. Because the town has different winter and summer rates, analysts applying this averaging process pay attention to capital's relative use across seasons.

Counting associated permitting costs and linkage capital, a new well to be installed next year will cost \$200,000. During the first five years this well will only be used during the summer (in progressively larger amounts). Demand will be sufficient for the well to be partially used during the winter of year 6 as well as all summer. Commencing in year 10, the well will be in full time-winter operation.

- a. Undertake the steps you can to resolve rate changes for next year. Explain additional steps and needed information. If nothing else changes, how will rates change in year 2?
- b. List and explain the opportunities you see for accomplishing more efficient pricing policy.

6. Ever since a city utility revised its uniform rate to \$4/1000 gal. three years ago, everything has been working pretty well. Under present conditions, aggregate monthly demand for delivered water is $w = 54000p^{-0.5}$. (w units are 1000 gallons.) The present difficulty is that there has been a pipeline failure that will take one month to fix. During this time, no more than 18000 thousand gallons can be delivered through the remaining facilities of the city. While every customer can still receive water, a temporary policy is required to manage the shortfall. If the only available policy is a temporary rate change, what concept best describes the increase in volumetric rate? Interpret this concept for city staff and calculate its level. What pros and cons are accompanied by this policy? What related advice do you have to offer?

7. Drycreek Suburb is fully utilizing its available water supply. There is neither shortage nor surplus. Prospects for an increase in water supply are quite poor because cities in the region have obtained all water rights except those dedicated to environmental uses. There have been no problems with the fixed water supply, for the suburb has had a constant population for many years. Drycreek operates its own water utility. At the present time, utility revenues match costs exactly, as long as the utility continues to exclude water right values from its accounting costs. The utility currently serves ten thousand connections receiving two billion gallons annually. Each of these ten thousand clients pay a monthly meter charge of \$30 and a uniform rate of \$2 per thousand gallons. Demand elasticity is thought to be in the -0.4 to -0.6 range.

Development interests are willing to convert some neighboring desert into a residential area if Drycreek will annex the property. If this happens, the utility must serve an additional one thousand connections without an increase in natural water supply.

Developers have offered to separately pay for all necessary new capital, including all additions and improvements for storage, pumping, treatment, and conveyance. The additional property tax base is somewhat attractive to Drycreek, so leaders are contemplating the proposal.

- a. If a revision of rates is the only approach for coping with the expanded number of clients, what are your recommendations for it? Explain your work.

- b. Apply appropriate techniques to measure the impact of this development on existing consumers. (Hint: first decide which policy type from chapter 6 this is.)