Quality Considerations for Water Reclamation and Reuse

As discussed in Chapter 3, water reclamation (recycling) and reuse make more efficient use of existing supplies, but the extent of reuse depends on the quality of the source supply, local economic conditions, the amounts and types of reuse already instituted, and the intended applications of the recycled water.

Fresh water can be saved for environmental enhancement or other uses to the extent reclaimed waste water can be used in its place. However, there are also concerns about the use of reclaimed water. In some cases, human health risks may be increased by pathogenic organisms or chemical residues which could be present in reclaimed water.

The Office of Drinking Water within the California Department of Health Services is responsible for regulating use of reclaimed waste water. Regulations stipulate treatment levels for use of reclaimed water for various purposes such as irrigation, recreation, and ground water recharge. The objective of these regulations is to allow the maximum use of reclaimed water while protecting public health. More specific regulations are expected concerning the use of reclaimed water for recharge of ground water supplies.

The quality required of reclaimed water depends on its use. Possible uses include landscape irrigation, growing food for animals, industrial uses such as wash water, flushing toilets, ground water recharge, and other uses which do not involve direct human consumption. The concentration of salts in the waste water is a determining factor of its availability for most uses. Water increases in salt concentration as a result of being used. Also, some waste water pipelines have picked up salt from saline ground water, such as near San Francisco Bay. In cases where fresh water supplies already contain elevated salt concentrations, the waste water resulting from use of this water may be quite limited in its usefulness.

Limited quantities of reclaimed water are being used in California to recharge ground water for subsequent municipal water supply, and other potential projects are being studied. Water quality requirements are quite stringent for projects involving human consumption of reclaimed water. The primary concerns are pathogenic organisms and harmful chemical residues. Treatment processes used for recharging potable water supplies must not only successfully remove harmful constituents, but also be highly reliable.

The Department of Health Services evaluates all proposals for potable use of reclaimed waste water on a case–by–case basis. As treatment technology advances, it may become possible for waste water to be adequately and reliably treated for direct municipal reuse. Representatives of the Departments of Health Services and DWR currently co–chair a technical committee examining this issue.

Costs of Poor Quality Water

Water of reduced quality is generally associated with a cost to the user. The cost depends on the quality of the available water, its intended use, and the treatment processes required to meet standards specified for the intended use. Drinking water standards and those for municipal, industrial, and agricultural water use specify the quality requirements that must be attained before the water can be used beneficially. New standards, such as the one requiring drinking water filtration, and ones which have lowered the acceptable limit of lead and copper, often result in increased costs of treatment to meet the new standards. In some cases, the cost can be very high. The City and County of San Francisco, for example, may have to incur high costs if they are

required to construct filtration facilities as a result of the Federal Surface Water Treatment Rule which generally requires filtration and rigorous disinfection of surface drinking water supplies. In California, the SWTR will be administered by the State Department of Health Services.

In general, the better the quality of the source for drinking water, the less treatment it requires and, consequently, the less it costs to produce. Many water quality parameters affect treatment costs, including microbiological quality, turbidity, color, alkalinity, hardness, and bromide and organic carbon content. For example, MWD treats roughly 6,000 af of water per day at five major treatment plants. Recently, the district made improvements, costing about $5 million, to its treatment processes. To meet the expected more stringent trihalomethane rule, MWD is studying the need for further improvements with a capital cost range of $300 million to $2 billion.

The mineral quality of municipal supplies has a variety of impacts in addition to affecting drinking water quality. Hard water (high in calcium and magnesium salts) can cause corrosion, staining, and scale buildup and require excessive use of cleansers. Soft water may attack the metal in plumbing, increasing lead and copper concentrations at the tap.

Many studies have cited the impacts of water quality on the value of water to urban consumers, and all have cited the difficulty of expressing quality impacts in a simple way. A 1989 review of consumer impacts of the mineral content of Delta water proposed a generalized cost of $0.68 per acre-foot per milligram per liter of incremental total dissolved solids. The current generalized value would be about $0.80 per acre-foot per milligram per liter (adjusted using the Consumer Price Index), or about $0.30 per pound of dissolved mineral matter in the water. The impact of this added cost can be quite significant.

Studies have also shown that lower water quality in urban supplies increases consumer use of bottled water and home treatment devices. Surveys of California communities indicate that about half of all California residences use some bottled or home-treated water. The collective cost of these choices by California's residents is over a billion dollars annually. Some of these expenditures would, of course, be made regardless of local water quality.

A less obvious impact of water mineralization is the limiting of water recycling opportunities, especially in areas where reclaimed water percolates back into ground water basins. With each reuse, the reclaimed water is more heavily mineralized and thus eventually becomes unusable. This phenomenon is more pronounced where common salt is added to regenerate water softeners, and the waste brine also enters ground water. Under these conditions, the mineral pickup per cycle of use can be increased several fold. Several areas of California have banned the use of water softeners because of these circumstances.

There is great variation in the water quality requirements for industry. In many industries, tap water is not of adequate quality for certain processes and must receive additional treatment, such as softening. The costs of having unacceptable water quality for industry generally depend on the cost of the additional treatment that may be necessary.

Salty irrigation water presents several costly problems for farmers. In many agricultural areas, it is common to recirculate irrigation water a number of times to increase irrigation efficiency. Salty water can be recycled fewer times than water that is initially low in salt. Also, more salty water must be used for irrigation than is re-

quired when using supplies low in salt. The requirement to use more water results in significant additional cost for pumping and handling the water and, perhaps, additional cost to purchase the water.

Generally, the most salt-tolerant crops are not the ones having highest value. Therefore, given a salty water supply, a farmer may be required to grow less valuable crops than is possible when low-salt irrigation water is available. Finally, crop yields fall as salt in the irrigation water increases beyond the optimal ranges specific to individual crops.

Numerous aspects of water quality can affect fish and wildlife habitat and result in monetary or environmental costs. An example is selenium in agricultural drainage from the San Joaquin Valley which was used to supply wetland habitat in the valley. In this case, elevated selenium concentrations caused severe reproductive damage to fish and wildlife species, particularly to birds using the wetlands.

There are many water quality problems which can result in cost, either direct or environmental. In turn, these impacts reduce flexibility in water supply planning and water management. The real challenge is to avoid these costs by protecting water sources from quality degradation in the first place. California's record has been a good one, for an industrialized state. Most of our waters remain fit for fish and wildlife, and for multiple uses by people. However, the rapidly growing population, along with continued industrialization, will continue to greatly challenge our ability to maintain and improve water quality. If we are to meet this challenge successfully, it will require the best efforts of government, the water industry, and, most of all, concerned citizens. To fail to meet this challenge would be to lose the use of precious water resources that cannot be spared.

Recommendations

1. Increasingly stringent and costly drinking water quality standards for public health protection will affect the continued availability and cost of water supplies. More effort must be made by State and federal agencies to balance the cost with public health and other benefits of such standards.

2. Research into relationships and effects of water quality degradation on fish and wildlife should continue. In particular, more information is needed on acute and chronic effects of low-level toxicants on the health and reproductive capacity of aquatic organisms. (Research should be a cooperative effort by State and federal agencies.)

3. Urban water supplies diverted from the South Delta face the threat of increasing water quality degradation from both salinity intrusion and organic substances originating in Delta island drainage. Factors responsible for quality degradation from Delta island drainage should be investigated by State agencies, and potential means of mitigating problems identified.

4. Reuse of adequately treated waste water can, in some areas, provide alternative sources of supply as well as benefit fish and wildlife resources, particularly in arid portions of the State. Efforts by State agencies should be continued to define the conditions and degree of treatment needed to allow use of treated waste water for beneficial uses and discharge of effluents to water courses so that these benefits can be realized.