WATER REUSE - WATER QUALITY AND WATER RIGHTS CONSIDERATIONS

Jay Lazarus and Paul G. Drake,
Glorieta Geoscience, Inc.
P.O. Box 5727
Santa Fe, New Mexico 87502-5727 U.S.A.
and
Peter B. Shoenfeld,
Attorney at Law
P.O. Box 2471
Santa Fe, New Mexico 87504-2421 U.S.A.

ABSTRACT

In the western United States most of the available surface and groundwater has been appropriated. Additional supplies of fresh water for new or increased municipal demands may not be available. Because new water sources may be prohibitively expensive or unavailable, alternative water sources such as treated wastewater should be considered.

Large volumes of treated wastewater are available for reuse after discharge from municipally-owned sewage treatment plants. Treated wastewater can provide water supplies for a wide range of municipal, industrial, agricultural, and recreational purposes. The sale of wastewater can produce additional revenue, as well as jobs in the industries using the effluent. Wastewater can also be used for artificial aquifer recharge through stream beds or slow percolation through sand filters.

INTRODUCTION

The efficient use of water and the reuse of large volumes of treated municipal wastewater can provide water supplies for a wide range of municipal, industrial, agricultural, and recreational purposes. In the past, most treated effluent was simply disposed of by discharging it to the nearest stream bed where it created perennial streams in ephemeral channels or mixed with natural stream flows. If it is reused, effluent from sewage treatment plants can generate revenue for the municipality which treats the water and also conserve the diminishing water resources of the western United States.

Land application of secondary-treated sewage effluent is the most common method of wastewater reuse. Land application can affect groundwater quality if concentrations of contaminants such as nitrates or heavy metals in the effluent exceed the nitrogen uptake of the irrigated crop or the sorptive capacity of the underlying soils. If the effluent quality is such that the irrigated crop completely removes contained contaminants from the wastewater, a percentage of the water recharges the aquifer with clean water.

WATER RIGHTS AND WATER QUALITY

The law governing usage and ownership of water in the western United States is the law of prior appropriation. The right to take the water is owned by he who makes the first appropriation. In some states there is no preference among the different kinds of water users, except on the basis of the antiquity of their water right. A farmer who first irrigated his land in 1900 established his date of first appropriation at that time. The farmer who began irrigating in 1900 has priority over a city whose water right was established in 1930. If drought or other factors cause a water shortage, the farmer who started irrigating in 1900 has the right to use available water before the city with the later appropriation date. In order to acquire the farmer's water right, the city must pay the farmer an agreed-upon purchase price.

In this system, one must distinguish between the water and the water right. The physical water is owned by the State government, and the administrative entity responsible for administering waters of the State grants to the user the legal/administrative right to appropriate the water for beneficial use. A water right is generally held to be part of the land on which the right is put to beneficial use. Beneficial use of water includes but is not limited to municipal, domestic, industrial, agricultural, and recreational uses (New Mexico State Engineer, 1966).

The owner of the water right may appropriate the volumes of water allowed by the right, at the times, and in the manner allowed by the right. The water is owned by the State until the water is in the possession of the owner of the right, at which time the water right becomes the personal property of the owner. For example, once the water flowing in an irrigation ditch is stored in an irrigator's pond, that water becomes the irrigator's personal property, and the irrigator can put the water to beneficial use for irrigation or stock watering, or he can sell or lease the water to another entity. Neither the livestock, nor the irrigator, nor the residents of a city can drink a water right, but only the water taken pursuant to a water right. Although the water right is associated with a specific tract of land, the right can be bought, sold, or traded, provided that the individual, corporation, or municipality which acquires the right has land on which to put the water to beneficial use.

Cities in the western U.S. generally take water pursuant to their water rights and deliver it to the domestic, industrial, and other users who return large percentages of it to municipally owned sewage treatment plants. Over the years, the general practice was to dispose of the treated effluent by discharging it to the nearest watercourse. In some areas the effluent water is blended with natural stream flow. In other areas, the effluent makes perennial streams out of ephemeral streams. To be eligible for discharge to a stream, the treated effluent must meet water quality standards for nitrates, chlorine, phosphorus, fecal coliform, and other regulated constituents.

LEGAL, ECONOMIC, AND CONTRACT CONSIDERATIONS

Water quality regulations governing discharges to water courses are site-specific, depending on the type of stream system receiving the discharge. For high mountain streams or fishable/swimmable rivers, effluent limitation standards are very stringent. For discharges to perennial streams that are not fishable or swimmable, or to areas with no downstream users, effluent limitations are less stringent.

Regardless of the location of the discharge, cities must expend large amounts of money, labor and expertise to treat and dispose of wastewater. Some of that expenditure can be recovered through the sale of effluent water for irrigation, and for industrial and related uses. Other benefits to the municipality can arise from enhancement of local industry with resulting local employment, made possible by the availability of reused water for industrial purposes.

The cost of acquiring water rights can be very high. In Santa Fe, New Mexico, since 1967, the price of an acre-foot of water right has risen from about

$85.00 to $12,000.00. Transportation, purification and administration costs of municipal potable water supply systems have risen astronomically.

Effluent from sewage treatment systems is valuable. Although psychologically unsuited for human consumption, it is otherwise usable even for that purpose. Higher payments and creative leases for effluent water will become more common as arid regions of the world deplete readily available water supplies.

Effluent water from sewage systems presents unique economic and legal problems. Under New Mexico law, while the water remains in the possession of a City, it is personal property which can be sold, given away, or put to use for other purposes. Discharging effluent water to the nearest stream does not utilize its value.

If a City adopts a program to use the effluent previously discharged, it will remove that water from the local stream system, which may adversely effect downstream users. New Mexico partially solved this problem by adopting a statute recognizing that rights over released water might be created, but that the rights of the first owner are superior. While downstream users may have the right to take water from the stream, including the effluent, they have no right to demand that the city continue to discharge the effluent.

Cities in arid regions should make broad use of treated effluent water for purposes not requiring potable water. Two examples of uses of effluent water are industrial cooling and irrigation of recreation facilities. These uses of effluent water can offset a taking of potable water, greatly increasing the available supply for all requirements. Injection or seepage from surface flows into groundwater can recharge the local water supply. This method is currently in use in El Paso, Texas.

Where effluent is generated by a municipality, legal requirements for competitive bidding for the purchase of water may be in force. In practice, however, those lands closest to the point of discharge are most likely to use the effluent water because of proximity. A binding and reliable contract for the ongoing purchase of effluent water is essential to ensure that the purchasers' water requirements will be met for a predictable time in the future.

While a binding, reliable and long-term contract for the ongoing purchase of effluent water is essential for an enterprise which proposes to put it to use, municipal officials may properly be concerned that the city has a higher and better use for the water, as soon as its potable water supply reaches its limits. City officials must balance their present surpluses of fresh and effluent water, the costs of buying, leasing or using other fresh water, the benefits of

selling, leasing or using effluent water, and their ability to meet future demands. Selling effluent now at what appears to be a market price could be regretted in the future.

Where effluent is to be used for agricultural purposes, the lease agreement should state the water quality to be delivered so the user can calculate nitrogen loading potential on the irrigated land. If nitrate levels in the effluent exceed the crop's ability to use the nitrogen, the excess nitrogen can leach through the soil and vadose zone, thereby contaminating potable aquifers. The effluent user should assure that its intended use will conform to applicable regulations and standards, and that the intended use will not adversely impact existing water rights, or contaminate water supplies.

If the municipality does not presently use the effluent water, or no other prospective users are interested in the water, the municipality may be forced to sell the water at a low price. Unless there is high demand for the effluent, municipalities cannot expect to sell effluent water for a price equal to or greater than the cost of treatment at the sewage treatment plant. The effluent agreement may, however, create other financial benefits for the municipality. Where effluent use expands or creates business, employment and productivity are increased for the community. In addition, any amount of revenue generated by selling effluent which otherwise is simply discharged, represents a gain to the community.

The municipal function requires provision of water for domestic and sanitary purposes, such as drinking, sanitation, and fire suppression. The inclusion of industrial uses within the definition of "municipal" use, we suggest is no longer appropriate. One of the ways in which industries can operate independently, and by which cities can retain their economic base and ecological integrity is to modify operations so that needs for water are satisfied with reclaimed water. An additional benefit to the city is the fact that waste water may not have to be treated to the same extent as when it is placed into a watercourse.

CASE STUDIES

Case 1. Santa Fe Racing, Inc. operates the Downs at Santa Fe Race Track near Santa Fe, New Mexico, U.S.A. The Downs has an effluent lease from the City of Santa Fe for up to 1.2 million gallons per day (mgd) of treated sewage effluent, for irrigation, resort, golf course irrigation and related purposes (Lazarus, 1990). The Downs contracted for a 30-year term, and the amount of water to be diverted is based on peak use during a seven-week period at the height of the summer irrigation season.

The Downs has an easement for its pipeline from the Santa Fe sewage treatment plant to the race track. The pipeline crosses City property. Fire hydrants were installed on the effluent pipeline to provide fire-protection water at the Santa Fe airport, a direct economic and safety benefit to the city. Effluent volume is metered at the sewage treatment plant and at the race track. The effluent is pumped from the sewage treatment plant to a 10,000 gallon lined holding pond at the track, and then pumped throughout the facility and used for irrigation, track conditioning, dust control on roads, and composting.

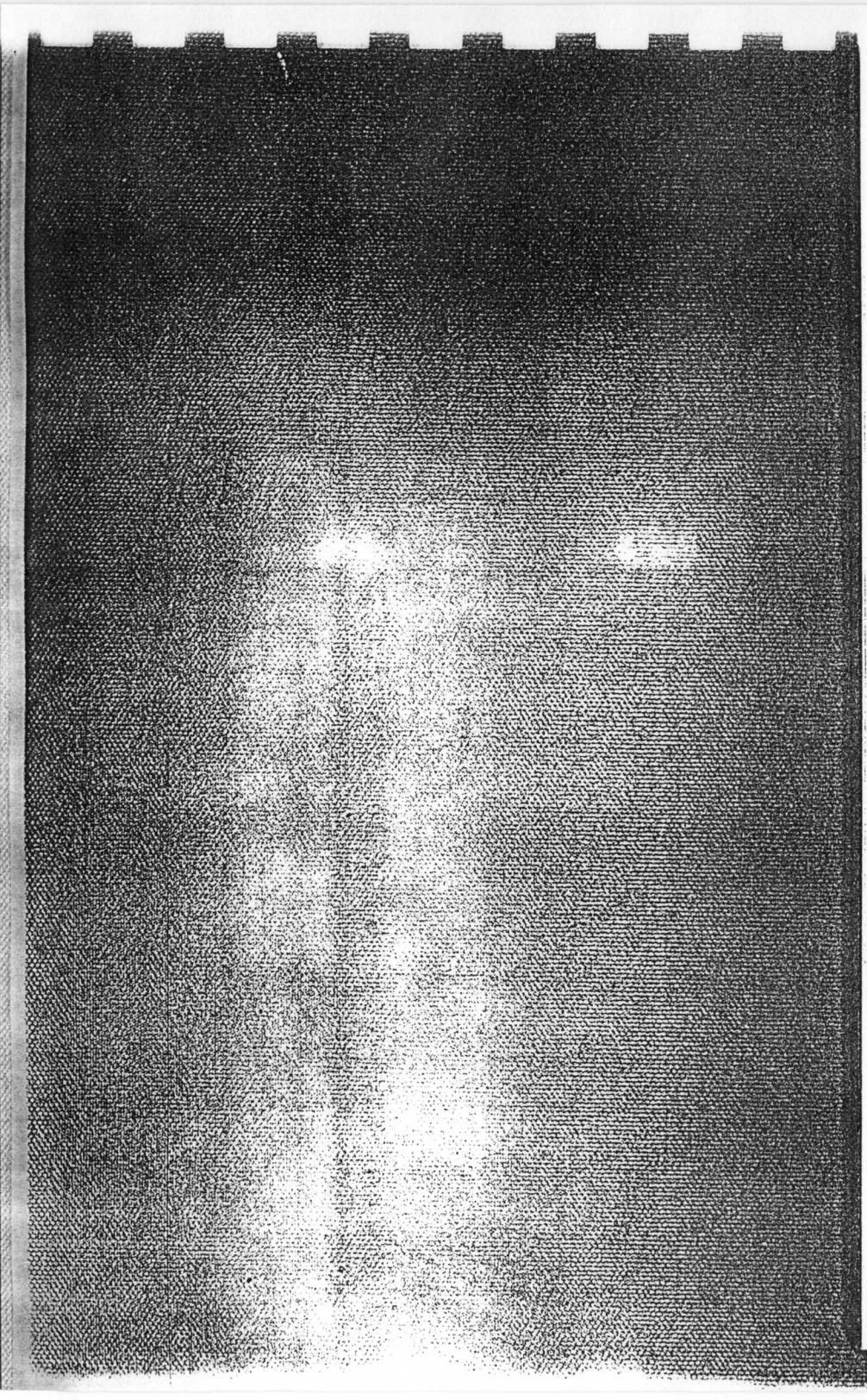
A total of 126 acres of land plus the track surface and ponds are irrigated at the Downs. The volume of water required to irrigate one acre of land per year is 3.0 acre-ft. Consumptive use of water by vegetation and evaporation is approximately 1.5 acre-ft per acre per year.

Net evaporative losses from ponds are approximately 60 inches per year. The total amount of water diverted, including evaporative losses from pond surfaces and road use, approaches 530 acre-ft per year. Of this amount, 61.61 acre-ft per year is lost to evaporation beyond the consumption attributable to irrigation. Depending on the actual yearly volume of water diverted and consumed, up to 330 acre feet of water per year is returned to the aquifer and might result in return flow credits.

Case 2. Taos Golf Properties is constructing the Taos Country Club and Golf Course southwest of Taos, New Mexico. The golf course is located approximately 1 mile from the Town of Taos sewage treatment plant and benefits from a contract with the Town of Taos to divert up to 750,000 gallons of effluent per day for irrigation purposes for 275 days per year. A pipeline is being constructed over a County road easement. Effluent will be stored in plastic-lined holding ponds and will be distributed over the golf course through several additional elastic-lined holding ponds. The water will be blended with effluent water from a 50,000 gallons per day (gpd) on-site secondary-treated sewage treatment plant.

Effluent water will be stored in a 1-million gallon holding pond at the Taos treatment plant. A computerized monitoring system will distribute water over the golf course. Effluent volume is monitored by meters at the sewage treatment plant, meters at the golf course holding pond, and by staff gauges set in each pond. If leaks are detected, the holding pond that is leaking will be taken out of operation, and the liner material repaired.

The average total nitrogen concentration in effluent discharged from the Taos Sewage Treatment Plant is 10 mg/l. The area of golf course to be irrigated is 170 acres. Approximately 768 lbs./year of nitrogen is applied to the golf course from the effluent water (Lazarus, 1991). Nitrogen uptake by Kentucky



Blue grass is greater than 27,000 lbs. per year. Therefore, the irrigation water is nitrogen-deficient for fertilization purposes, and fertilizer is applied to the grasses.

CONCLUSIONS

Large volumes of treated wastewater are available for reuse from municipally-owned sewage treatment plants. Leasing effluent water for irrigation and related uses can allow municipalities to recover some of the costs of treatment through direct lease payments, or indirectly through jobs created by effluent reuse. If effluent is used for crop irrigation, the effluent quality can be lower than required if the effluent is discharged to a watercourse. Therefore, if the reuse of water allows water to be treated to a lesser standard, treatment costs would decrease while other financial benefits to the community accrue.

REFERENCES

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