Using cart paths and the frequent rinsing of the equipment with fresh water will minimize these problems.

Nutrient Content

Application of wastewater to crops can be beneficial because of nutrients in the liquid. Virtually all essential plant nutrients are found to some degree in wastewater. Constant monitoring of effluent water should be maintained to determine amounts of these individual nutrients and the fertility management of turf be adjusted to account for these. Potential nitrogen levels range from 10 and 35 mg/l, phosphorus 0 to 5 mg/l and potassium 5 to 25 mg/l (Table 27). To convert ppm to pounds of salt-per-acre foot of irrigation water, multiply ppm by 2.72.

Heavy Metals

Heavy metal concentrations usually are not a problem with urban effluent water sources but are potential major concerns with certain industrial effluent sources. This is why industrial effluent water sources are not generally recommended for turf irrigation.

There are several trace elements in domestic effluent water which could be present in potentially toxic amounts under certain conditions. They therefore should be monitored periodically. These include chlorine, boron, cadmium, copper, nickel, and zinc. Groundwater contamination is the main concern of their presence. Recommendations include a minimum soil depth of five feet to groundwater supplies and a upper irrigation limit of four inches per week. Groundwater monitoring wells are normally required in areas using effluent water. Suggested maximum levels of trace metals in effluent water are listed in Table 23.

Turfgrasses usually are tolerant to these levels but many trees and shrubs may be sensitive, especially when grown on heavy soils where their amounts of chloride often increase. Certain trees and shrubs are especially sensitive to chloride levels approaching 350 ppm.

Storage Ponds

A seasonal problem for turf managers using wastewater is most contracts require a specific amount be accepted daily, regardless of weather conditions. In other words, a pre-set level of wastewater must be accepted per-day whether it is needed or not. Storage capability, therefore, is a major requirement when using effluent water and must be adequate to store enough water for the maximum days of non-irrigation (usually a minimum of three).

Storage ponds generally are acceptable for wastewater storage as long as storage amount does not impair the pond's ability to function as a stormwater management system. Generally, storage ponds do not have to be lined but should be at least six feet deep, with good aeration, and have a 3-to-1 bankside slope to minimize aquatic weed problems. Use of a filter system also is suggested to reduce algae that may enter the sprinkler system and clog nozzles. Even distribution by the irrigation system also helps prevent buildup of any harmful substances.

A weeks's supply of water (assuming 1½ inches of water applied on 100 acres of turf) would be 4 million gallons or 533,300 cubic feet, translating into a lake 10 feet deep measuring approximately 180 feet by 300 feet in size. Several smaller ponds may fit a golf course layout better than one large lake.

Golf Greens

In light of previous discussed advantages and disadvantages of using effluent water for golf course irrigation, it is suggested that only tertiary treated wastewater be used on golf greens. Turf mowed excessively low, such as golf greens, are constantly on the management edge in terms of maintaining a healthy, acceptable playing surface. Although primary and secondary wastewater impurities are low, golf greens do not need added stress in terms of salinity and salts. Salinity can be extremely detrimental to golf greens due to their relative shallow and weak root systems. Continued use of wastewater with low to moderately TDS may, in time, reduce water infiltration and percolation to the point of reducing turf quality. For these and other reasons, primary and secondary reclaimed water sources are not recommended for golf greens.

If a turf manager must use one of these wastewater sources for irrigating golf greens, several prerequisites exist for any chance of turf survival. The golf green should have excellent (>6 inches-per-hour) infiltration and percolation rates to prevent salinity buildup. A superintendent must also be allowed to frequently aerify, spike and slice the soil surface to minimize crusting and algae development.