

CITY OF DAVIS
DEPARTMENT OF PUBLIC WORKS

STATUS REPORT
ON
MUNICIPAL WASTEWATER TREATMENT FACILITIES
March 28, 2003

OVERVIEW

The purpose of this status report is to inform the City Council and Davis citizens of the Public Works Department planning activities regarding the near-term and long-term treatment and disposal of municipal wastewater. State and Federal regulations now require the quality of treated municipal wastewater released back to the environment to be much improved compared to requirements of previous regulations.

The Davis wastewater treatment facilities were designed and built in the early 1970's, with major expansions occurring in the early 1980s and late 1990s. These facilities have served Davis residents well and been very cost effective for decades. However, it appears that the City of Davis will need to make major additions to the existing wastewater facilities to meet the new water quality requirements.

Providing this substantially higher level of treatment for the city's wastewater requires a similarly substantial investment in the plant and equipment. The Department of Public Works is currently studying the most cost effective alternatives for improving wastewater quality and achieving long-term, reliable treatment. Though not known with precision, it appears that the costs to achieve this newer, higher level of wastewater treatment will be substantial. Monthly sewer use fees in the \$30 to \$40 per month range can be anticipated.

BACKGROUND

The core of Davis' wastewater treatment plant (WWTP) is the wastewater treatment pond system constructed in 1972. The benefit of pond-type treatment processes is that they use low energy by making natural use of oxygen present in the atmosphere to treat wastewater. From a water quality perspective, however, the ponds tend to grow algae, they do not remove some types of wastewater contaminants, and their wastewater treatment performance is subject to uncontrollable variables such as weather (e.g., wind, fog, temperature, etc.) and ecological factors (e.g., diseases predation of algae, wildlife, etc).

To place the performance of pond type wastewater treatment systems in perspective, the “organic” and suspended solids concentrations of typical municipal untreated wastewater vary, but average around 220 mg/L each. The University of California at Davis recently constructed a new wastewater treatment plant that produces effluent organic and suspended solids concentrations around 3 to 10 mg/L, respectively. The communities of Roseville and Lincoln are in the process of constructing similar facilities to those in place at the University.

The wastewater effluent from pond systems has variable concentrations of organics and suspended solids, with typical values being reported to be about 45 mg/L and 90 mg/L, respectively; about an order of magnitude higher than that produced with more modern wastewater treatment facilities. These concentrations reflect the presence of algae in pond system effluent. With natural waters having organic concentrations of typically 3 to 5 mg/L and suspended solids concentrations of typically 10 to 15 mg/L, respectively, it is evident that wastewater effluent from ponds would be degrading if discharged directly to typical natural waters without further treatment.

The City, with its increasing environmental awareness, recognized in the early 1980s that additional suspended solids removal was needed and installed an overland flow system in an attempt to reduce the concentrations of algae in the effluent. Overland flow systems are also low energy, natural wastewater treatment processes. Their performance is also subject to uncontrollable variables such as weather and ecological factors. These systems also do not remove many types of wastewater contaminants. With the organic and suspended solids concentrations in overland flow effluent, like most natural processes, changes in weather can cause episodes of substantially higher concentrations or substantially lower concentrations. The overland flow system was an improvement over the ponds, but still was not producing water equivalent to background conditions. The overland flow system has served City residents well and been cost effective for decades, however, overland flow requires a substantial amount of management to stay functional.

With further environmental awareness and new water quality regulatory standards, the City in 1997 installed aeration equipment in some ponds, lemna covers in other ponds and a wetlands system to further “polish” the pond system effluent. With the aeration equipment, the City began to move away from natural wastewater treatment processes and their somewhat capricious wastewater treatment performance under varying weather and ecological conditions. With this repertoire of natural and modified natural wastewater treatment processes, including the wetlands, the City staff has been able to comply with most current wastewater treatment requirements via a complex ever changing management strategy employing use of the City’s various natural wastewater treatment systems. The Department of Public Works believes this complex strategy may not be sustainable, reliable, or consistent with the State’s wastewater treatment and disposal objectives.

By 2006, Nitrogen (e.g., ammonia) and pathogen (e.g., virus) removal is required in the currently held discharge permit. The natural treatment processes available at the City of Davis WWTP are not able to reliably remove nitrogen and pathogens to the degree required by the permit.

The City of Davis is at a critical point in its wastewater planning process. The treatment processes employed to date have been very cost effective in response to the regulatory environment in which they were designed and implemented. However, regulations are continually changing and the further process additions to the City of Davis WWTP should be adaptable to those changing regulations. Between the complexity of managing multiple natural systems and their varying responses to weather and ecologic factors, and recent changes in wastewater regulation and policy, Public Works believes that the City must make major additions and potentially process changes to the existing wastewater treatment facilities.

PLANNING CONCEPTS

With the promulgation of the California Toxics Rule by EPA in 2000 and the State's recent use of EPA water quality objectives in setting toxicity standards, wastewater effluent in California that is discharged to natural surface waters (such as done by the City) must comply with very stringent standards to provide long-term protection to both public health and aquatic ecology. As an example, many wastewater treatment contaminant concentration limits (such as copper) are substantially lower than the regulatory limits for drinking water. The notion that treated wastewater quality has to be better than treated drinking water quality seems ludicrous to some until they realize that aquatic life "breathes" water whereas people only drink water.

In this regard, the Department of Public Works recognizes that the City's potable water supply is adequate for drinking water purposes, but is contributing to some of the water quality problems with the wastewater treatment effluent. The Department is investigating the practicability and costs of improving the Davis water supply, and is considering this option as part of the overall water and wastewater planning process.

Besides the very low concentrations that are characteristic of the new wastewater regulatory standards, many of these new standards are regulated based on 4-day average concentrations. Thus, the new standards are intolerant of wastewater treatment processes with the variable performance characteristics inherent to virtually all-natural wastewater treatment processes. A related significant problem to achieving compliance with very restrictive standards regulated based on 4-day average concentrations is that the City staff can not receive analytical results back from the specialized laboratories doing this analytical work in time to adjust the wastewater treatment processes based on

those results. Thus, the reliability and predictability of wastewater treatment process performance has become paramount to achieving compliance. Again, natural wastewater treatment processes are inherently prone to having variable performance under varying weather conditions and ecologic factors. On a similar note, some natural wastewater treatment processes with their large water surface areas and/or large stands of vegetation have some tendency to concentrate some waste contaminants by the evaporation and evapotranspiration process, thus compounding problems associated with concentration-based regulatory compliance.

Lastly, with the use of the USEPA recommended criteria for Ammonia in 1999, wastewater treatment plants discharging to surface waters were required to undertake nitrogen removal. The City of Davis WWTP is not suited to the removal of nitrogen; thus, compliance with these requirements with the current means of disposal will require conversion to a nutrient removal process. Alternatively, identification of an alternative means of disposal could eliminate the need to remove nitrogen from City effluent. The City is currently investigating various treatment methods or disposal options that would allow for compliance with the 1999 USEPA Ammonia criteria.

Based on review of current wastewater regulations and credible forecasts of future regulations, the Department of Public Works after consultation with State agencies and specialized wastewater engineering firms believes that the City will need to make major improvements to the wastewater facilities to achieve the following general objectives if the City is to continue to discharge its treated wastewater to Willow Slough Bypass:

- Production of effluent with organic and suspended solids concentrations comparable to typical background values.
- Production of effluent essentially free of human pathogenic organisms.
- Production of effluent meeting CTR and related toxicity criteria.
- Construction of wastewater treatment facilities that have reliable wastewater performance characteristics.
- Construction of wastewater treatment facilities that maximize removal of contaminants and minimize addition of (or concentration of) contaminants during the wastewater treatment process.

A wastewater treatment facility meeting all of the foregoing objectives has the following characteristics:

1. Biological treatment to remove the bulk of wastewater organics, suspended solids and nitrogen compounds. This would normally be

achieved with an activated sludge process. The City is investigating this option as well as modifications to the pond system to improve both treatment performance and treatment reliability.

2. Long-term wastewater quality equalization so that spikes in effluent contaminant concentrations do not occur. The City believes the existing ponds with modification could serve this role, which further emphasizes the propriety of investigating the feasibility of modifying the ponds to provide the biological treatment per 1.
3. Microfiltration to remove virtually all wastewater particulates (and associated toxicants) and to set the stage for effluent disinfection by ultraviolet (UV) light, and for reverse osmosis treatment should that ultimate treatment technology become needed and practicable.
4. Effluent disinfection using UV light to reduce salt addition to the effluent, to maximize pathogen destruction, and to minimize the production of carcinogenic effluent disinfection by products associated with using chlorine as the effluent disinfectant.

The forgoing plan is practicable, but does not address the high salinity of City effluent caused by a combination of factors including 1) the salinity of the City's water supply, 2) the use of water softeners by some residents to mitigate the hardness of the City's water supply, 3) water conservation, and 4) evaporation/evapotranspiration from the City's natural wastewater treatment processes. Some effluent compliance strategies being considered by the Department include:

1. Improving the potable water supply (e.g., pipe Sacramento River water to Davis from West Sacramento).
2. Piping the Davis effluent for discharge to the Sacramento River, which can assimilate the City's effluent salinity load.
3. Recycling the effluent to grow fodder crops and apply to the State for relief from Regional Board salinity standards under Water Code Section 13523.5, the salinity exception.

Conversion to one or more of the alternate disposal methods will substantially affect the degree of treatment required of City wastewater. For example, disposing of the effluent on land relieves the City from the need to comply with aquatic toxicity requirements because there is no "aquatic life" in fields of fodder crops. The downsides of this effluent reuse option are that:

- The effluent salinity stays on the land and eventually migrates back to the groundwater resource at high concentrations.

- Large amounts of land are necessary, probably around 400 to 500 acres per MGD of wastewater capacity needed. The City's near term need for about 5.4 MGD of capacity translates into a land need of approximately 2700 acres.

Alternatively, disposal to the Sacramento River could allow the City to make use of the great assimilative capacity present for nitrogen in the Sacramento River so as to prevent the need to make use of a nitrogen removal treatment process and potentially enable continued use of the current wastewater treatment system.

The Department of Public Works is studying the merits and demerits of the various treatment and disposal alternatives. The Department is looking for the most cost effective, reliable plan. The Department proposes to make quarterly reports to the City Council on these planning efforts

The first quarterly report is tentatively scheduled for a June 2003 City Council meeting.