

SUMMARY

The Dan Region Project - Stage One consists of facilities for treatment and groundwater recharge of municipal wastewater from the southern parts of the Dan Metropolitan Area (South Tel Aviv-Jaffa, Holon and Bat Yam), and from the neighboring municipality of Rishon-Le-Zion.

The wastewater pumped to the treatment plant undergoes biological treatment in facultative oxidation ponds with recirculation, and chemical treatment by the high lime-magnesium process, followed by detention of the high pH effluent in polishing ponds. The partially-treated effluent is recharged to the regional groundwater aquifer by means of spreading basins.

A special recharge-recovery system is used, which consists of intermittent flooding of the spreading basins, controlled passage of the effluent through the unsaturated zone and a portion of the aquifer, and its subsequent pumping by means of recovery wells which surround the recharge area. A separate zone is created within the regional aquifer, which is dedicated to effluent treatment and seasonal storage (SAT or soil-aquifer treatment).

The project is in partial operation since 1970 and in full operation since 1977. During the 15-year period of project operation (1970-1984), a total raw sewage amount of 235 million cu.m (MCM) was conveyed to the plant, instead of polluting the Mediterranean Sea and its bathing beaches or the groundwater aquifer. In the eight-year period 1977-1984, 142 MCM of effluent were treated in the lime clarifiers, and 95 MCM of these were recharged to the groundwater aquifer in the Soreq basins plus 4 MCM in the Yavne basins. A total water amount of 100 MCM was pumped from the aquifer in the period 1974-1984 and supplied to the South of the country. In 1984, the amount of recharged effluent in Soreq basins was 13 MCM and that of reclaimed water-17 MCM.

Most of the water losses in the plant (a total of about 94 MCM) occurred by seepage from the oxidation ponds and the polishing ponds, but most of this amount is stored in the aquifer. The absolute water losses (evaporation and discharge to sea) in 1984 amounted to about 10% of the raw sewage conveyed to the plant.

The detention time in the oxidation ponds varied from 24 to 33 days, of which 11 to 15 days in the primary ponds. The detention time in the polishing ponds usually varied from 9 to 13 days. The yearly average organic load in 1984 was about 384 kg BOD/ha/day in the primary oxidation ponds, and 158 kg BOD/ha/day in all the oxidation ponds. The average recirculation ratio was 1.5 (effluent) to 1 (raw sewage).

The average lime dose was 590 mg/l as CaO and that of MgCl₂ solution about 260 mg/l (15 to 20 mg/l as Mg⁺⁺). The lime sludge has been disposed of in natural depressions found in the vicinity of the plant.

The treatment plant operation is followed up by a comprehensive water quality monitoring program, which includes a large number of physico-chemical and biological analyses carried out at 18 sampling points.

In the treatment plant, good to very good overall removal (above 70% efficiency) was obtained for: suspended solids, BOD, COD, TOC, detergents, mineral oil, phenols, ammonia, total nitrogen and phosphorus; for the following trace elements: Cd, CN, Pb, Cr, Ba, Ag, Cu, Fe, Zn, Ni, Al and Sn; as well as for turbidity, Mg and Si. Moderate removal (between 40% and 70%) was obtained for: alkalinity, B, F, K, Mn and SO₄. Concentrations of coliforms and E. Coli were reduced by about five logs, S. Faecalis by about four logs, and total bacteria by three logs. With one exception, no enteroviruses were detected in the treated effluent.

The recharge cycle usually included one day flooding and two to three days drying. The average hydraulic load varied between 50 and 100 m/year.

After eight years of recharge, groundwater elevations in the center of the recharge zone rose by about 6 m.

At the end of 1984, the front of 100% recharged water extended about 1 km south and north of the center of the recharge zone, and about 750 m east and west of it.

An extensive hydrological and water quality monitoring program, which accompanies the recharge operation, is carried out by means of a network of 20 observation wells, 16 recovery wells and 8 private wells.

The purification occurring by SAT was evaluated from the results of water quality analyses carried out in the recharge effluent and in a representative observation well pumping 100% recharged effluent (well 54).

In the SAT system, good to very good removal (above 70% efficiency) was obtained for: suspended solids, BOD, COD, TUC, UV absorbance, KMnO₄ consumption, detergents, mineral oil, ammonia, phosphorus and Hg; as well as for turbidity and K. Moderate removal (between 40% and 70%) was obtained for total nitrogen, phenols, Ni, Pb and Se.

Coli, E. Coli, S. Faecalis or enteroviruses were not detected in the reclaimed water. The recharge operation did not affect any of the private wells located in the vicinity of the zone dedicated to SAT.

The water pumped in 1984 by the southern Dan wells was native groundwater, whereas the western Dan wells pumped a certain percentage of high-quality reclaimed water. However, due to dilution with native groundwater and with water from the National Water Carrier in the main supply pipeline, the amount of reclaimed water in the supply network was very small (less than 5%).

The operating cost of the reclamation plant is about 12.5 US cent/m³, and the total operating cost of the plant (including the biological treatment plant) is 14 US cent/m³.