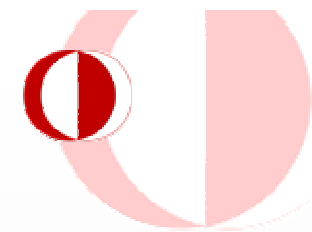


# Municipal Wastewater Management in Turkey: Impacts & Reuse

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## ABSTRACT

An inventory of the urban wastewater treatment plants in Turkey is presented. There are a total of 129 urban wastewater treatment plants (WWTPs) in Turkey within 43 cities. According to 2001 figures, 35% of the total population is served by urban WWTPs. Distribution of untreated and treated municipal wastewater disposal practices based on flow show the highly impacted water bodies. For a part of the WWTPs, discharging to inland water bodies, quantity and type of reuse was examined. Survey results indicate wastewater reuse either directly in agricultural irrigation, or indirectly through a receiving water body.

The provincial distribution of the wastewater generation throughout Turkey emphasize the metropolitan and highly populated cities (Fig. 2). Priority have been given to the treatment of municipal wastewaters originating from large cities. There are many other WWTPs either under construction or project phase for the large cities, such as those for Adana, Diyarbakir and Konya.

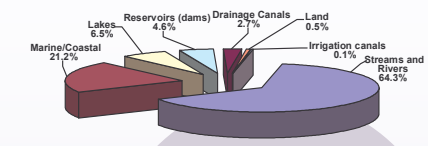


Figure 5. Distribution of treated municipal wastewater disposal for the 56 WWTPs in the survey region (based on flow rate)

WASTEWATER FACTS	
Population of Turkey in 2000 was 67.8 million	
2001 figures show that 60% of the total population is connected to a sewerage system	
More than 3 billion m <sup>3</sup> of municipal wastewater is generated yearly, of which:	
• 2.73 billion m <sup>3</sup> is collected by a sewerage system, and	
• 1.2 billion m <sup>3</sup> is treated in municipal WWTPs	

WASTEWATER TREATMENT FACTS	
Turkish Water Pollution Control Regulation - 1988, amendments: 1989-1993	
The population served by WWTPs in a continuously increasing trend: 20.4% in 1994, reached 35% in 2001	
There are 129 WWTPs located in 43 cities	
The type of treatment applied in the WWTPs (based on flowrate): 49% biological, 38% physical, 13% advanced	

The distribution of WWTPs as well as incident risks caused by water-borne diseases are given in Fig. 1. Since there are no direct records of epidemiological evidence concerning the impacts of untreated wastewater in Turkey, the latest statistics on the number of incidents of the waterborne diseases may provide some information regarding the health impacts of untreated wastewaters. South eastern region appears as the most problematic, having the cities with the incident risk values above the average for Turkey (0.093%). Reuse of untreated wastewater have been noted in Siverek located between Diyarbakir and Sanliurfa. Such practices in the region may contribute to the observed high incident risk values.

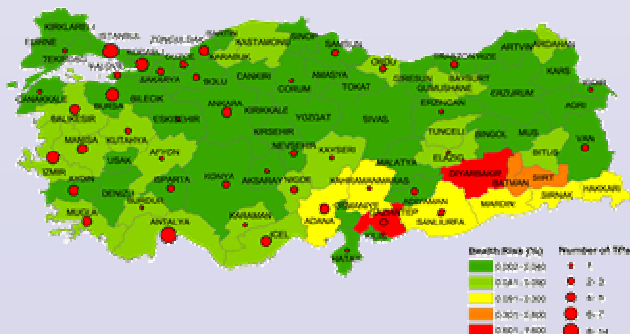


Figure 1. Incident risk distribution related to water-borne diseases in 2002

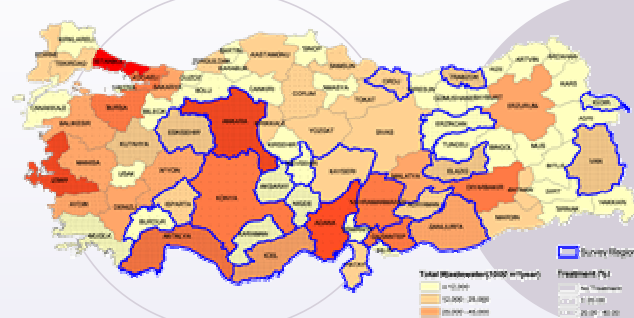


Figure 2. Provincial distribution of total municipal wastewater generation and treatment

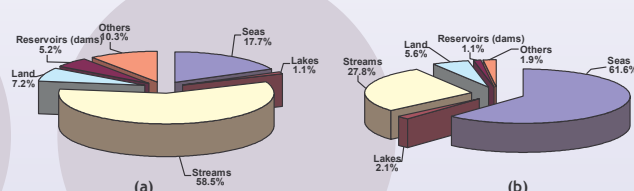


Figure 3. Distribution of a) untreated, b) treated municipal wastewater disposal (based on flow rate)

Majority of the untreated municipal wastewater is discharged into streams (59%) pointing to the significant potential impacts on these water bodies and communities surrounding them (Fig. 3). The majority of the treated wastewater, on the other hand, is discharged into seas (62%) making it very difficult for these wastewaters to be reused since most WWTPs that practice sea disposal have only preliminary treatment.

In order to investigate Turkey's potential for treated wastewater reuse especially in agriculture (within the MEDAWARE project), mainly inland provinces for which boundaries are outlined with bold in Fig. 2 are selected. There are 56 WWTPs located within these provinces. The size of these WWTPs as well as the types of treatment they apply can be seen in Fig. 4. Both the treatment technologies applied, and the effluent disposal from these plants (Fig. 5) depicts the high potential for the effluents from these plants to be reused.

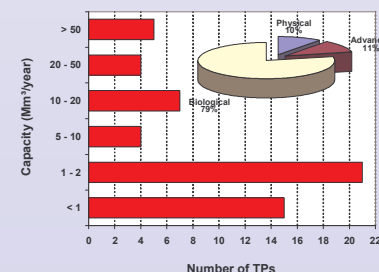


Figure 4. Capacity of the 56 WWTPs located within the survey region

## REUSE FACTS

### DIRECT REUSE

Treated effluent from :

- Igdir WWTP - 7,300,000 m<sup>3</sup>/yr is used to irrigate 5000 ha of field,
- Konya-Kadinhani - 1,400,000 m<sup>3</sup>/yr is used to irrigate 100 ha of field,
- Nigde-Bor - 2,800,000 m<sup>3</sup>/yr is used to irrigate 150 ha of field, all within 5 km of the WWTP.

### INDIRECT REUSE

- Treated effluent reused via the water body the effluent is discharged from:
  - Eskisehir WWTP - 24,820,000 m<sup>3</sup>/year is used to irrigate 50,000 ha of field
  - Gaziantep WWTP - 73,000,000 m<sup>3</sup>/year is used to irrigate 8,000 ha of field
  - Konya-Ilgın - 1,000,000 m<sup>3</sup>/year is used to irrigate fields
  - Nevsehir-Urgup - 213,000 m<sup>3</sup>/year is used to irrigate fields
- Other WWTPs where the streams that the plants discharge are known to be used extensively for agricultural irrigation:
  - Ankara WWTP - 192,700,000 m<sup>3</sup>/year discharges to Ankara Creek
  - Aksaray WWTP - 9,125,000 m<sup>3</sup>/year discharges to Karasu Creek
  - Adana-Kozan WWTP - 2,780,000 m<sup>3</sup>/year discharges to Kozan Stream

Investigation of the removal efficiencies for the selected WWTPs show that the plants utilizing biological and advanced treatment have effluent water qualities better than the required levels. The effluents from these plants have a high potential to be reused in agricultural irrigation with minimum technology improvements. Nowadays in Turkey reuse is starting to be a concern during the planning of WWTPs, for example Kayseri WWTP, having a capacity of 40 Mm<sup>3</sup>/yr was put into operation in 2003 with agricultural reuse planned and will start in the near future. Currently, 75% of Turkey's freshwater consumption is used in agricultural irrigation. Reuse of WWTP effluents in agriculture would lower the demand on freshwater and help realize sustainable use of our water resources.

## SOURCES OF INFORMATION

1. State Institute of Statistics (SIS) Municipal Sewerage and Wastewater Statistics Survey: SIS has been conducting Sewerage and Wastewater Statistics Survey throughout Turkey within the context of a project covering a period of 1999-2003. The most recent survey data for 2001 was used in this study.
2. Surveys Conducted: Survey forms were prepared in parallel to SIS survey forms, but with more emphasis on reuse practices, were sent out to selected TPs. The TPs were selected based on the population served and the wastewater reuse potential in the region.
3. Contact with Treatment Plant Personnel: In order to confirm the data collected, direct contact with most of the TPs was established.

## ACKNOWLEDGEMENTS

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