

Chapter Water Quality (Wolf Raber)

Table 2-1 shows the major water uses, and their percentage of the total water withdrawal in the Yemen of the year 2000 (FAO). For the presented uses the summed up withdrawal is $6.63 \times 10^9 \text{ m}^3/\text{year}$. Preservation of the ecosystem does not have a percentage because it can be seen as the follow up user of all other uses, and thus receives 100% of the water. The quality requirements on water for the ecosystem are often ignored because there is no direct economical benefit. Consequently, water discharged in the environment is often of poor quality. Minor uses that are not regarded in the listing are: animal supply, recreation and leisure, generation of electricity, landscape harmony and the dilution and transport of wastes.

Table Error! No text of specified style in document.-1: Examples for water use with the percentage of the total amount of withdrawn water (FAO, 2000), (modified, from Sperling and Chernicharo, 2005)

General use	Specific use	Required quality
Domestic supply 4.1 %	Uses in direct contact with the human body: - drinking - cooking - washing	- Free from chemical substances harmful to human health - Free from organisms harmful to human health - Low aggressiveness and hardness
	Uses not in direct contact with human body: - cleaning - toilet flushing - watering plants	- Aesthetically pleasant (low turbidity, color, taste and odor; absence of macro-organisms)
Agricultural Irrigation 95.3%	Horticulture, products ingested raw or with skin	- Free from chemical substances harmful to human health and/or plant growth and soil - Free from organisms harmful to human health and/or plant growth - Non-excessive salinity
	Other plantations	- Free from chemical substances harmful to the soil and plantations - Non-excessive salinity

Industrial supply <i>0.6%</i>	Water incorporated into the product: <ul style="list-style-type: none"> - food - drinks - medicines 	<ul style="list-style-type: none"> - Free from chemical substances harmful to human health or product - Free from organisms harmful to human health or product - Aesthetically pleasant (low turbidity, color, taste and odor; absence of macro-organisms)
	Water that comes into contact with the product	<ul style="list-style-type: none"> - Variable with the product
	Water that does not come in contact with the product: <ul style="list-style-type: none"> - refrigeration units - boilers 	<ul style="list-style-type: none"> - Low hardness - Low aggressiveness - Low particle concentration
Preservation of the Ecosystem	Natural Water circle: <ul style="list-style-type: none"> - Surface water bodies - Groundwater bodies - Soil of water bodies and aquifers - In the circle Included animals, plants and microorganisms - Coastal zones 	<ul style="list-style-type: none"> - Free from chemical substances harmful to animals and plants - Free from organisms harmful to animals and plants - Low levels of suspended solids, Nutrients, BOD, COD, oils and greases to avoid eutrophication - Low aggressiveness / natural pH

Looking at water treatment from the side of the discharger raises certain issues regarding wastewater characteristics which are listed below:

- quality of user emitted wastewater
- quantity of user emitted wastewater
- spatial and temporal distribution of user emitted wastewater

To assess these factors we have to look at the water users again. This time we are not interested in the quality requirements of the different users, but in the characteristics the consumer is giving the water by using it.

A general description of wastewater characteristics for different uses can only be done in a general and broad way. Characteristics of domestic use are strongly depending on cultural, regional, and socio-economical factors, as well as the time of the year. Similarly are the characteristics of industrial uses, these depend on the kind of industry and the type of technique used. Industrial water is either being treated on-site with specialized treatment techniques, mixed together with domestic wastewater, or, in the worst case, emitted directly to the ecosystem. The effluent of agricultural water uses depends on agricultural practice, crop type, climatic conditions, soil quality and geological formation. Agricultural effluents are usually not treated directly in a wastewater treatment plant, but occur sometimes as infiltration inflows.

The components that make up the wastewater flow from a community depend in praxis on the type of collection system used and may include:

- Domestic wastewater
- Industrial wastewater
- Infiltration and diffuse inflow
- Storm water