Guidelines for Re-Use of

Gray Water

2nd edition 1429H (2008G)

Introduction

The ministry adopted many programmes and plans that aims to aware with the significance of water and its rationalization including optimizing recycling of grey water (washer, and shower water) where the wastewater sector witnesses remarkable evolution pursuant to the Royals Decree Nr (288) dated 29/8/1426 stipulation recycling wash and shower water for discharge boxes in the government sectors and alike institutions and public agencies, residential, commercial, educational and industrial centers and complexes and adherence to execute two recycling networks when specifications and drawings of any new facility is created.

In this concise edition, the ministry aims to highlight to significance of optimizing the grey water recycling to recognize treatment and recycling method of grey water which shall be used in the flushing tanks and agriculture as well as the optimal treatment method due to the fact that it shall constitute the majority of used water. The treatment reduces the required demand of fresh water by (30 – 50%) and the thereafter saving of water bills and reduction of wastewater pumped to sewage treatment plant. Furthermore, the water treatment shall effectively participate in the rationalization message and maintain the environment clean.

May god bless these efforts and guide everybody to benefit from these guidelines.

Minister of Water and Electricity

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Wastewater:

Wastewater is the effluent of human use of water after having been Contaminated by organic material, grease, soap, detergents, hair, bacteria and other impurities.

Wastewater is divided into three categories:

1. Grey Water:

Grey water is the effluent of used water except toilets and in particular, hand basin, showers, cloth washing, kitchen, dishwasher waters etc. However, in this guidelines we recommend avoiding connection of kitchen, and dishwasher discharge water to the grey water tanks (as per the German specifications) due to the fact that it include oils, grease and food residuals which increase the treatment demands and costs.

2. Black Water:

Black water is the effluent of toilets which include remarkable quantities of organic contaminants of human waste.

3. Sewage Water

Sewage water is a mixture of grey water and black water.

❊ **Gray water generated from ablution washer in the mosques** is the most pure grey water indicated above and in turn may be reused in the flushing tank and in agricultural purposes after having been treated with simple and less cost treatment method. This type of water represents significant resource which can substitute remarkable portion of fresh water and reduces the total demand on the water.

Why Grey Water?

1. Grey water represents almost (45% – 74%) of the water used in buildings.
2. Grey water include low contamination percentage of organic material, nitrogen (nitrate and nitrite), germs and microbes and in turn allow easy handling via treatment methods
3. Reduced cost of treatment in comparison to wastewater treatment.
4. Acceptance of humans of reusing such waters
5. Recycling and reuse is environment and health friendly if the defined conditions and specifications are applied.

The following table defines some characteristics of water in terms of concentrations expressed in (grams per capita per day):

Item	Characteristics	Gray Water	Gray Water +Black Water
1	Biological oxygen demand (BOD5)	**20 - 34**	**50 - 71**
2	Chemical oxygen demand (COD)	**25 - 48**	**45 - 72**
3	Suspended solids (SS)	**9 - 18**	**50 - 70**
4	Total nitrogen (Tot.N)	**0.9 – 1.6**	**7 - 13.2**
5	Total phosphorus (Tot.P)	**2.5 - 3.1**	**3 - 4.6**
6	Total phosphorus without phosphoric detergent (Tot.P*)	**0.3 - 0.5**	**1 - 1.9**

Treatment Methods:

Grey water treatment requires construction of two wastewater networks, the first for grey water drainage where it is collected in ground tank for treatment then recycled to flushing tank and agriculture purposes and the second for black water drainage.

The grey water treatment requires also construction of devoted tank for collection of treated grey water and supply network devoted to flushing tank and agriculture purposes.

There are treatment methods of which the designer nominate the optimal pursuant to the site nature provided that the reclaimed water shall meet the defined provisions, criteria and requirements for the protection of public health and environment.

The following criteria and consideration must be considered when treatment equipment is selected:

1. Suitability of the plant to the intended recycled water quality.
2. The design capacity must bedefined to meet the actual demand of use.
3. Plant efficiency to achieve the highest return of the recovery water.
4. Plant efficiency to achieve highest quality of effluent pursuant to World Health organization and General Presidency of Metrology and Environment Protection specifications.
5. Suitability of plant to the site and users.
6. Reduction of cost, easy operation and maintenance.

The following diagram defines one of the grey water treatments. However, other methods may be utilized that attain the water required quality as defined in the standard specifications.

Grey water plant effluent specifications and criteria:

First: Physical Characteristics:

Item	Parameters	Allowable maximum limits (mg/L)
1	Floating material	n/a
2	Total suspended solids (TSS)	10
3	pH	6 - 8.5

Second: Organic Chemical Characteristics:

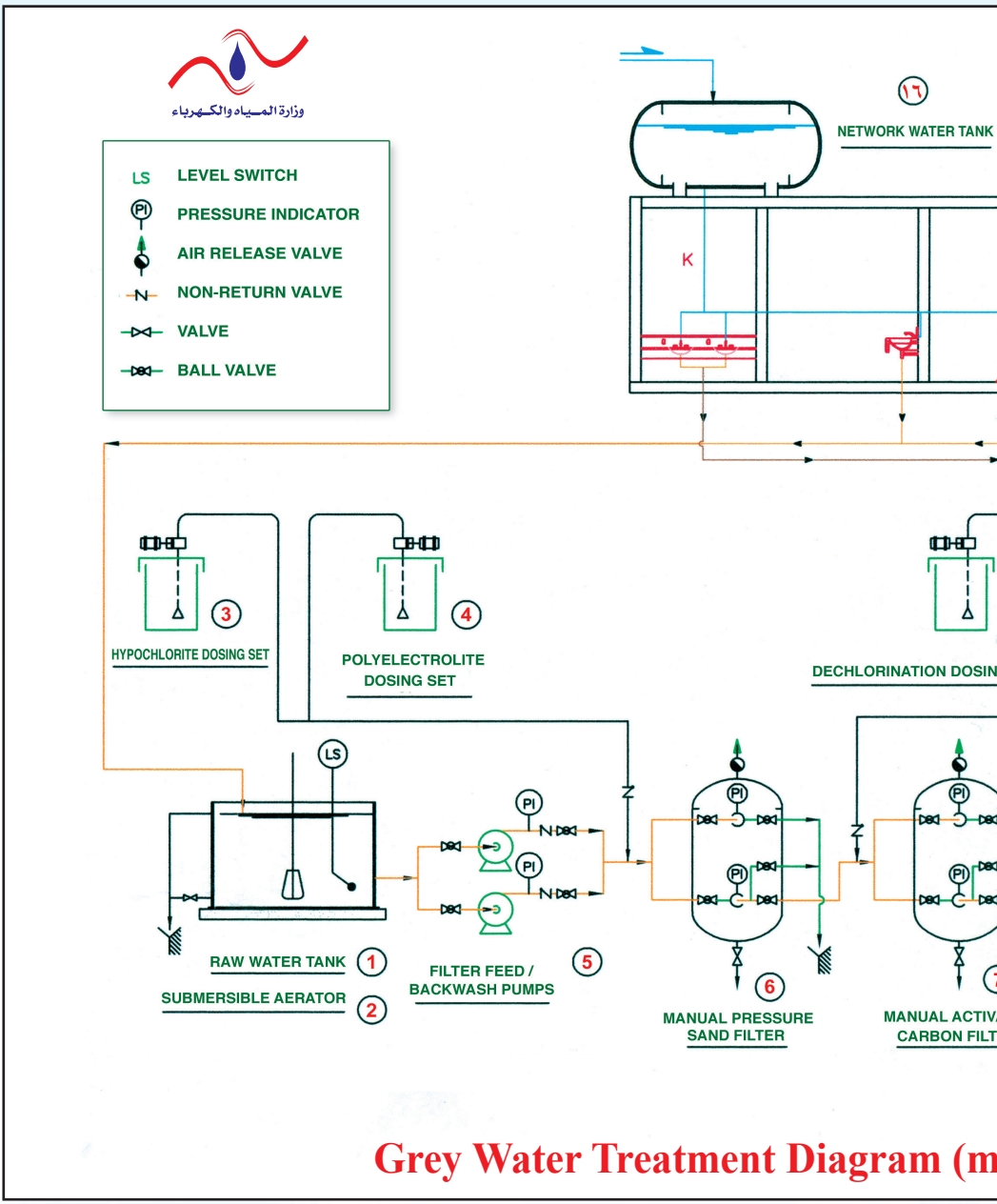
Item	Parameters	Allowable maximum limits (mg/L)
1	Biological oxygen demand (BOD5)	10
2	Chemical oxygen demand (COD)	50
3	Total Organic Carbons (TOC)	40
4	Oils and grease	n/a

Third: Chemical compounds:

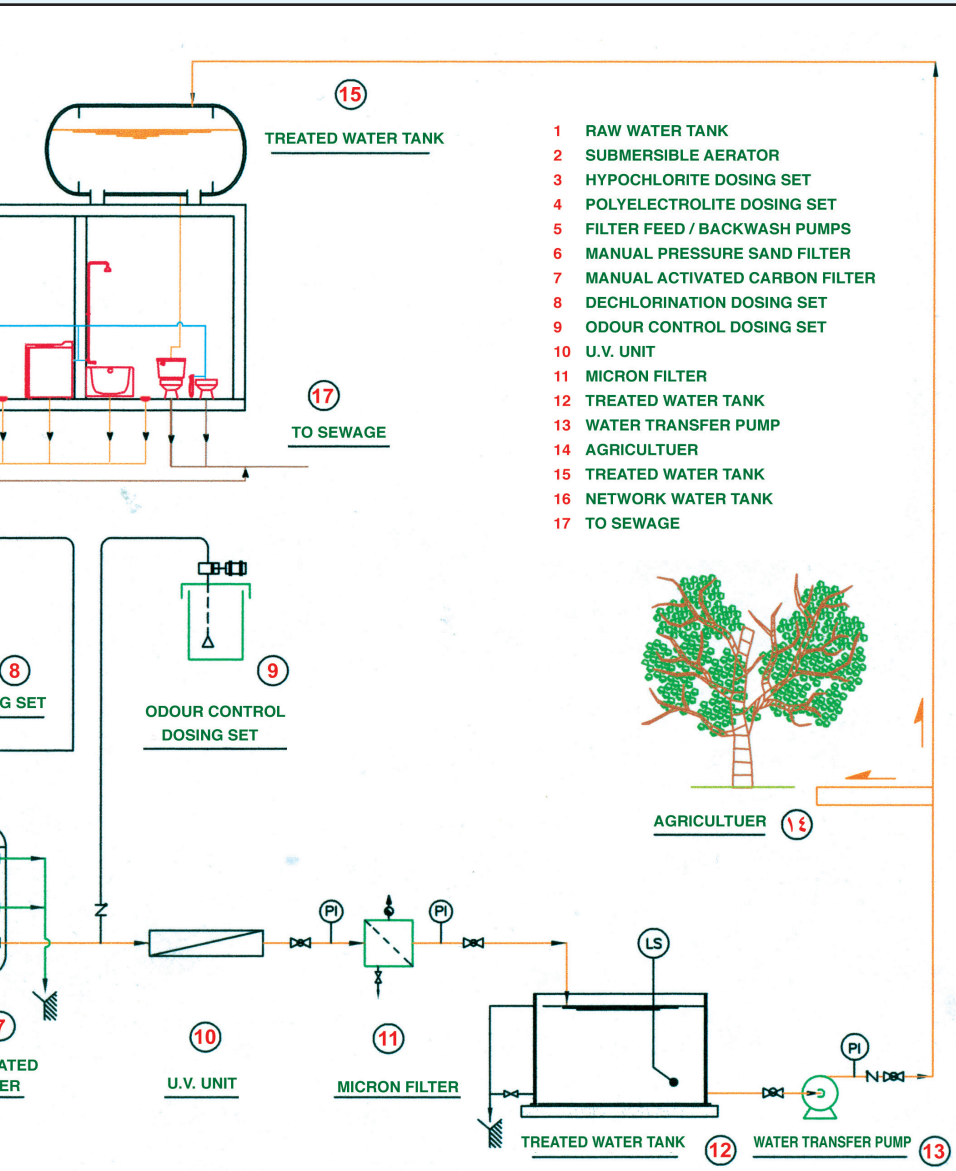
Item	Parameters	Allowable maximum limits (mg/L)
1	Nitrate-Nitrogen (NO3-N)	10
2	Ammonia-Nitrogen (NH3-N)	5
3	Residual free chlorine	0.2 – 0.5

Fourth: Microbial Characteristics:

The total coliform shall not exceed 2.2 for each 100-ml.



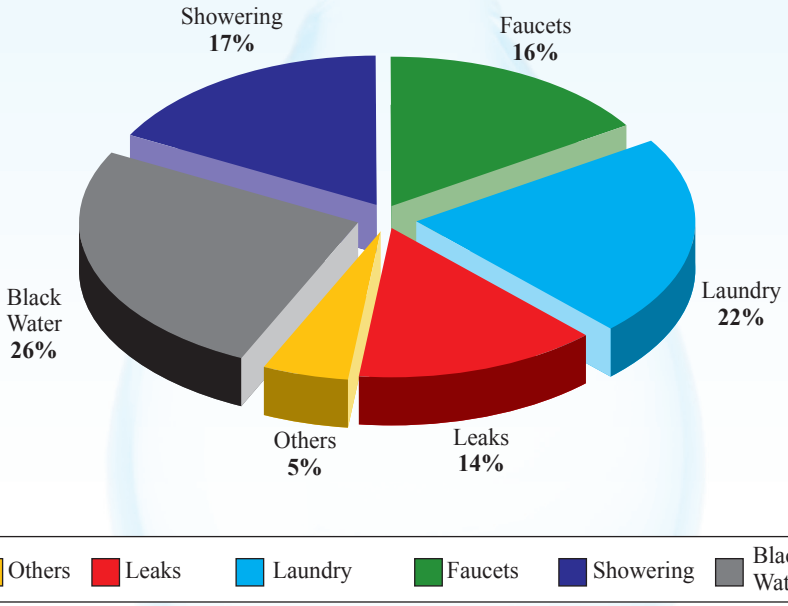
Grey Water Treatment Diagram (m



aster plan of one treatment system)

Grey water recycling and re-using in toilet flushing tanks expected savings:

Assuming that the daily consumption of water per capita is (250) liters and that such volume is used pursuant to the percentages defined hereafter:



Based on the above, it is clear that the grey water quantity which can be treated as an effluent of washers, cloth washing except toilets and kitchen is approx (55%) of the daily water consumption per capita. Such water can be recycled and reused of which (92% - 98%) can be utilized.

The remaining (2% - 8%) is the suspended solids and settled material on the filter media which imply that exploitation of grey water treatment and recycling to flushing tank in the toilet and other uses (agriculture) means actual saving of (50%) of the daily total consumption per capita.

Estimates Costs Calculations:

	Characteristics	Plant Ca. 50m^3/d	Plant Ca. 250m^3/d	Plant Ca. 500m^3/d
1	Plant depreciation Cost (per m3)	SR 0.36	SR 0.22	SR 0.2
2	Operation and Maintenance Cost (per m3)	SR 1.59	SR 0.78	SR 0.59
	Total cost of treatment of cubic meter.	SR 1.95	SR 1.00	SR 0. 79

- Assumed that the expected life cycle of the plant: 20 years

$$\text{Plant depreciation Cost (per cubic meter)} = \frac{\text{Total Cost (A+B+C+D)}}{\text{P. volume x expected life cycle x 365}} \quad (1)$$

(A) Treatment equipment and instrumentations

(B) Site mobilizations

(C) Supply of recycling dedicated network

(D) Tanks

$$\text{O \&M Cost (per cubic meter)} = \frac{\text{O\&M Cost (A+B+C+D)}}{\text{P. volume x 365}} \quad (2)$$

(A) Power

(B) Chemicals

(C) Spare parts

(D) Labor

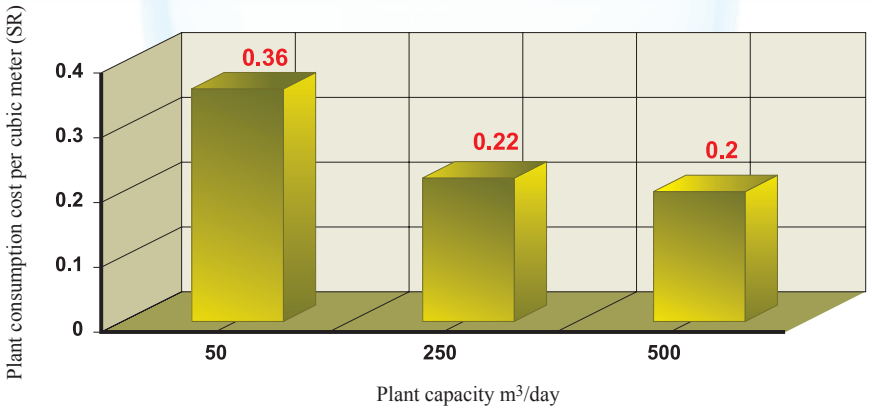
Annual Expected Savings:

	Plant Capacity (m3/day)	Annual savings (SR)	Capital Recovery (months)
1	50	73.912	21
2	250	476.325	10
3	500	987.325	9

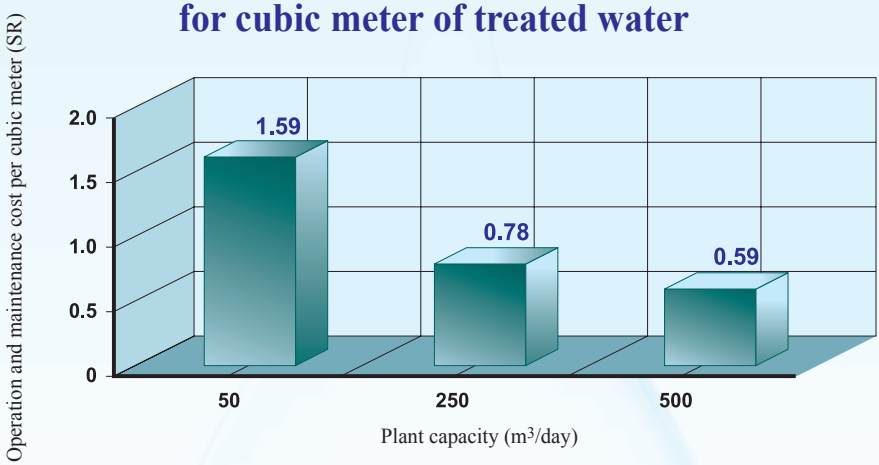
Assuming that the cost of cubic meter of the city water is (6 SR)

- The annual estimated saving = plant capacity x 365 x (cost of cubic meter of the city water (6 SR) – annual treatment cost (capital + operation and maintenance).
- Capital Recovery period = capital / annual saving.

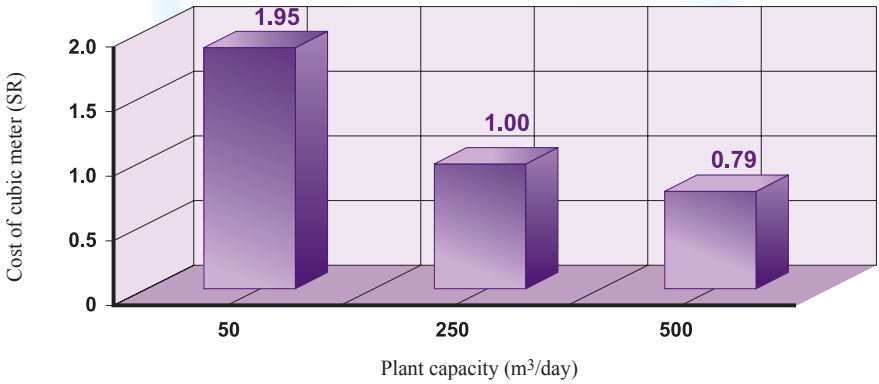
Total cost of the plant consumption for each cubic meter of recovery water



Total cost of operation and maintenance for cubic meter of treated water



Total cost of cubic meter of treated water



General requirements:

1. Obtaining required licenses to construct grey water treatment plant from ministry of water and electricity.

2. Avoid using grey water for other purposes except as designated or otherwise compatible with water's specification. In case of irrigation, avoid using such water in water sprinkler unless irrigation was within periods in which irrigated region is free of individuals.

3. Water treatment plant operator shall adhere to the scientific and technical principals of operation defied in the operation manual and performing analysis and periodic tests in approved laboratories by the ministry of water and Electricity.

4. Avoid storage grey water more than (24) hours to avoid proliferation of bacterial and odors.

5. Necessity that all community individuals, and public and governmental organizations shall participate in the awareness of recycling and reusing of water significance either grey water or treated black water as one non-traditional resource to mitigate the total demand on fresh water needs.

JOINTLY

Save《30% - 50%》of individual daily water requirements

Via Re-using Gray Water

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