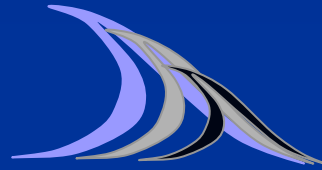


ONSITE GREYWATER TREATMENT AND REUSE IN IRRIGATION



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Technological Tools and Financing Mechanisms for IWRM

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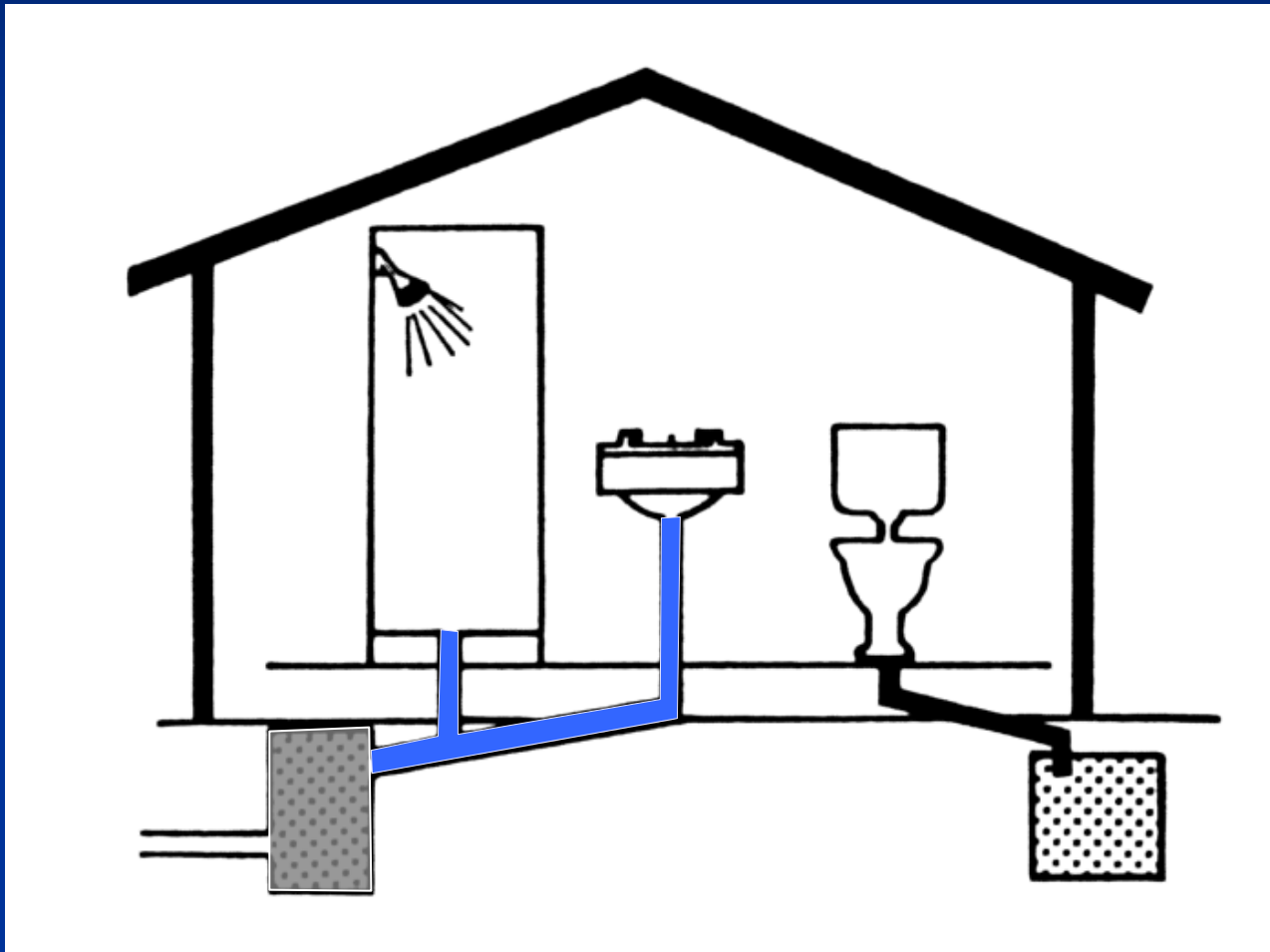
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What is Greywater ?

Greywater (GW) is a non- conventional water resource that is generated in every house, as the less polluted wastewater from kitchen sinks, washing machines, dishwashers, hand washing basins, and showers. It does not include “black” wastewater from toilets that contain large concentrations of fecal matter.

- GW constitutes about 60 to 70 % of the wastewater generated at households.
- In water scarce rural and peri-urban areas each household has the potential of generating between 100 to 150 m³ of GW for irrigation, per year.

Separation of Greywater and Blackwater at homes



Some basic facts on **water stress** in Lebanon

- Population is about 5 million and increasing
- Water availability has decreased to less than **1,500 m³/p/yr (2012)**
- There are official predictions of **640 million m³ annual water shortfall** by 2015.
- The new **Water Strategy** and **10 Year Water Plan** of Ministry of Energy and Water (MEW) includes the **reuse of non-conventional water resources**, including **grey wastewater**.
- Lebanon will achieve around **80 % wastewater treatment** by the year 2020.

Water Scarcity in Lebanon

There is severe water scarcity in North and West Bekaa, South Lebanon and other areas



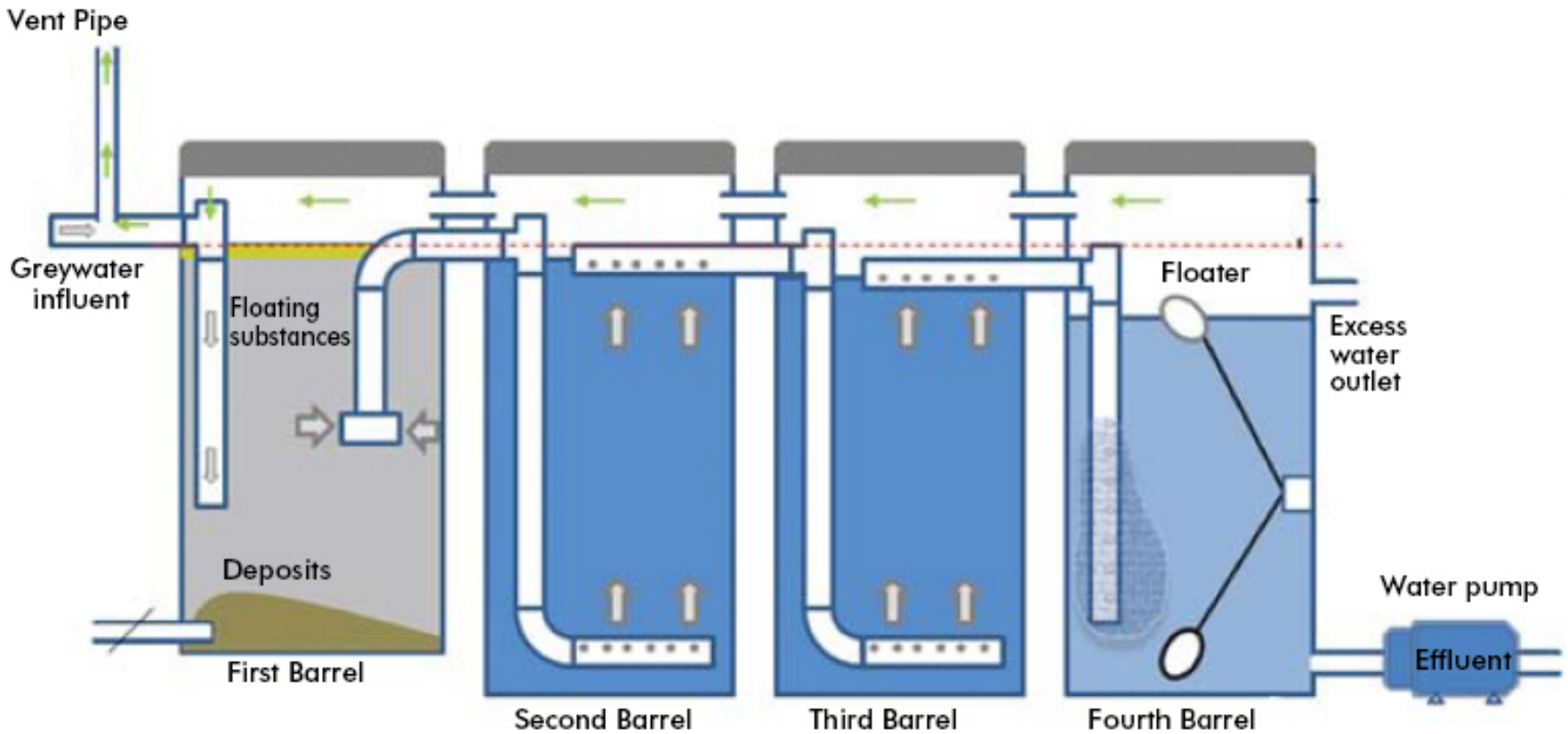
Technology is Mature for Onsite Treatment of GW

3 types of treatment systems are developed in MENA that operate on the principle of **up-flow anaerobic digestion**:

- **4-Barrel System** for up to 6 family members
- **Confined Trench (CT) System** for up to 10 people
- **Institutional System** for up to 100+ people

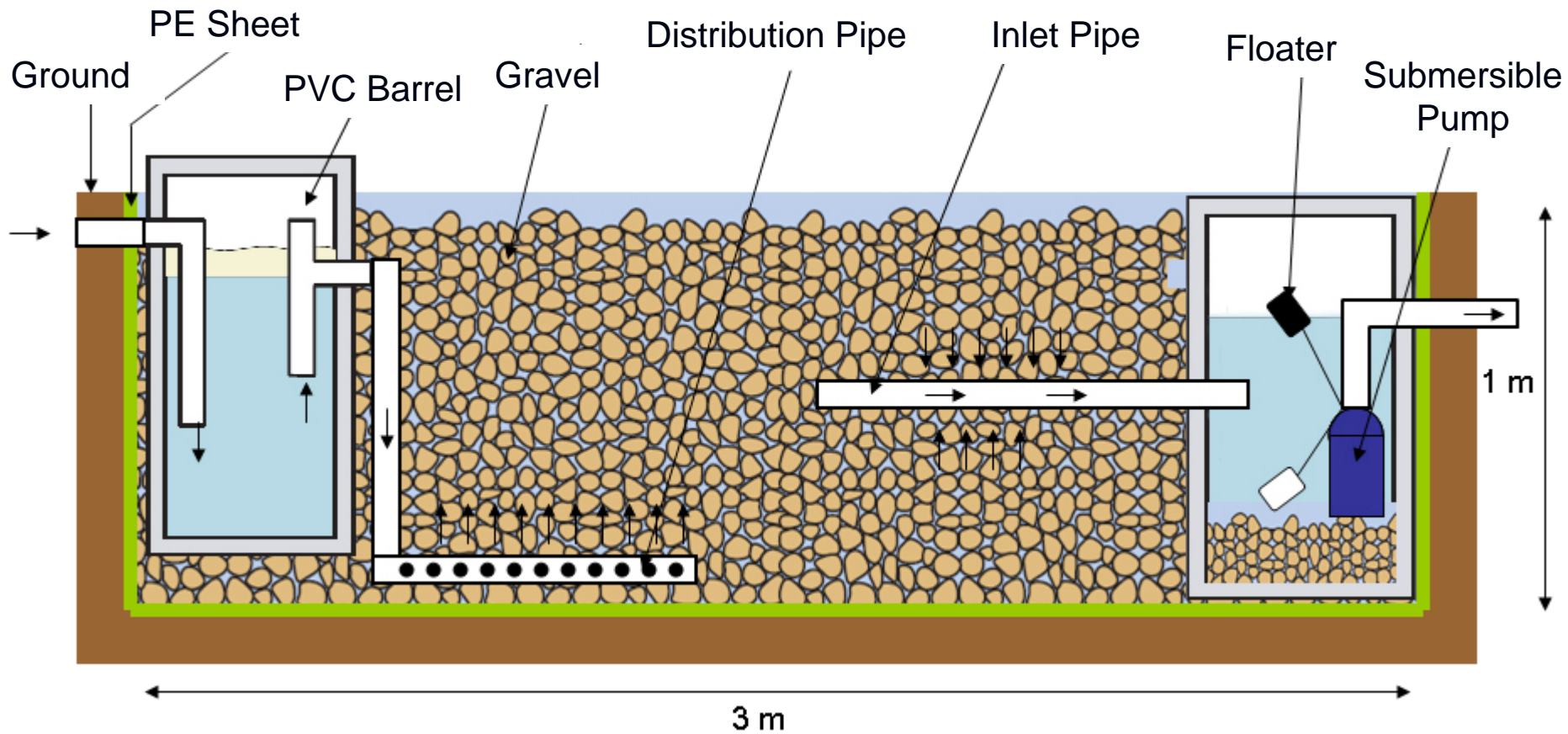
The different treatment systems are viable and simple technology in most of the situations that can be built with local skills and manpower.

Treatment of GW in 4-barrel kits



4-Barrel GW systems are watertight, airtight and odorless

Confined Trench (CT) Treatment System

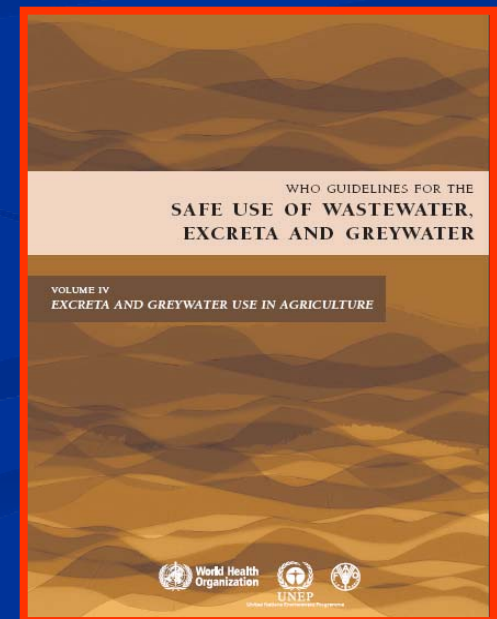


CT GW systems are watertight and odorless

Health and Safety of GW systems

Reuse of treated GW in irrigation has so far not posed any health problems in terms of epidemic diseases. It also has not resulted in any health hazard for the users.

This is due to the incorporation of principles of *WHO (2006) guidelines for reuse of GW in restricted irrigation.*



Safety Standards when using GW

In order to avoid health risks, **WHO (2006) guidelines** for reuse of GW should be applied.

Criteria includes:

1- **GW treatment** is obligatory to the secondary level treatment of wastewater

2- **Good practices** should be applied, such as:

- No **Spray irrigation**
- No **Direct contact, washing and bathing** with **GW**
- No irrigation of **vegetables** that are **eaten in raw state**



Safety Standards when using GW

Lab Test Results of effluents show that available GW treatment systems comply with WHO's 2006 Guidelines, for **BOD reduction**.

BOD level is the main parameter of concern when GW is used for restricted irrigation.

Both 4-barrel and CT systems have demonstrated the capacity for reducing the **BOD** of influent GW to below 300mg/l, which is within the limits of WHO guidelines.

Health and Safety of GW systems (Cont.)

GW systems are watertight, airtight and odor proof



Installation of a 4-barrel type GW kit with locally available material and skills



Costs of Standard Treatment Systems

- The average unit cost of **4-barrel** type GW treatment system ranges between \$250 to \$350 for a household of 5-6 members.
- The unit cost of **CT** type GW treatment unit ranges between \$400 to \$500 for a household of 7-10 members.
- The unit cost of **Institutional systems** depend on the size of the systems.

Why reuse of treated GW?

- **Water saving significance**, as it represents most of the household Wastewater (WW)
- **Culturally more accepted** as there is a tradition in irrigating home gardens with GW
- There are situations in MENA region where **little options are available to the communities** except onsite treated and reuse of GW
- GW is relatively **easier and cheaper to treat** since it is not contaminated with heavy metals and other pollutants
- **Less environmental and health risks** compared to mixed WW
- Potential **benefits to marginal communities** as a water source and an income generating activities (irrigation, less cesspit emptying)
- Can be **implemented in scattered households** and small rural and peri-urban communities

Benefits in using GW

The successful implementation of GW projects in Lebanon and other MENA countries has allowed for:

- An average GW recovery rate of about 100 to 150m³ of irrigation water a year per family.
- Water bills for truck-delivered water reduced by 20%.
- Costs related to the emptying of septic tanks fell by about 60%.
- Cost-benefit ratio of one-to-three have been realized.
- The GW projects have motivated funding agencies to implement similar projects in other water stressed areas.
- **Policy considerations:** GW treatment and reuse for irrigation is seen by the local officials as an appropriate WDM measure that leads to socio-economic and environmental benefits.

Experience of GW projects in MENA region (1995-2010)

Projects that have been implemented for research and demonstration purposes and up-scaled in some areas.

- **Lebanon:** A total of more than 250 GW treatment units of 4-barrel and CT types installed at households and institutions in 20 towns of West Bekaa and S. Lebanon.
- **Jordan:** More than 2500 GW treatment systems of 4-barrel and CT types installed in more than 100 villages.
- **Palestine:** 50 GW systems installed in 3 areas.
- **Yemen:** More than 30 CT systems installed for poverty alleviation in old Sana'a gardens.

Way Forward

- Treatment and reuse of GW has **a potential** for poverty alleviation but more on **water scarcity management/ Climate change adaptation** in the context of MENA
- Establishment of **National guidelines** for GW treatment and reuse is needed, based on the WHO guidelines of 2006 and local GW research projects results.
- Introduction of the GW concept in the **building codes** of countries.
- It is needed to set **standards and specifications for the production of GW treatment systems.**
- Ministries of water resources to start promoting the reuse of GW through pilot and other projects, in water scarce zones.

The financial and technical feasibility of GW projects are proven, and their sustainability is widely demonstrated

Thank You !