MODULE 6

Agricultural Water Management and Alternative Production Systems

CARIBBEAN WaterNet

Cap-Net

UWI
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FACULTY OF FOOD AND AGRICULTURE

Global Water Partnership Caribbean

Goal

The purpose of this module is to increase awareness of traditional and alternative sources of irrigation water in SIDS. The legal and regulatory framework for water collection, distribution and use will also be highlighted with focus on the requirements to achieve improvements in productivity and water use. Assessment of irrigation water quality associated with different sources will also be covered.

Finally, alternative production systems including greenhouse, and soilless cultivation will be described in relation to water use efficiency.

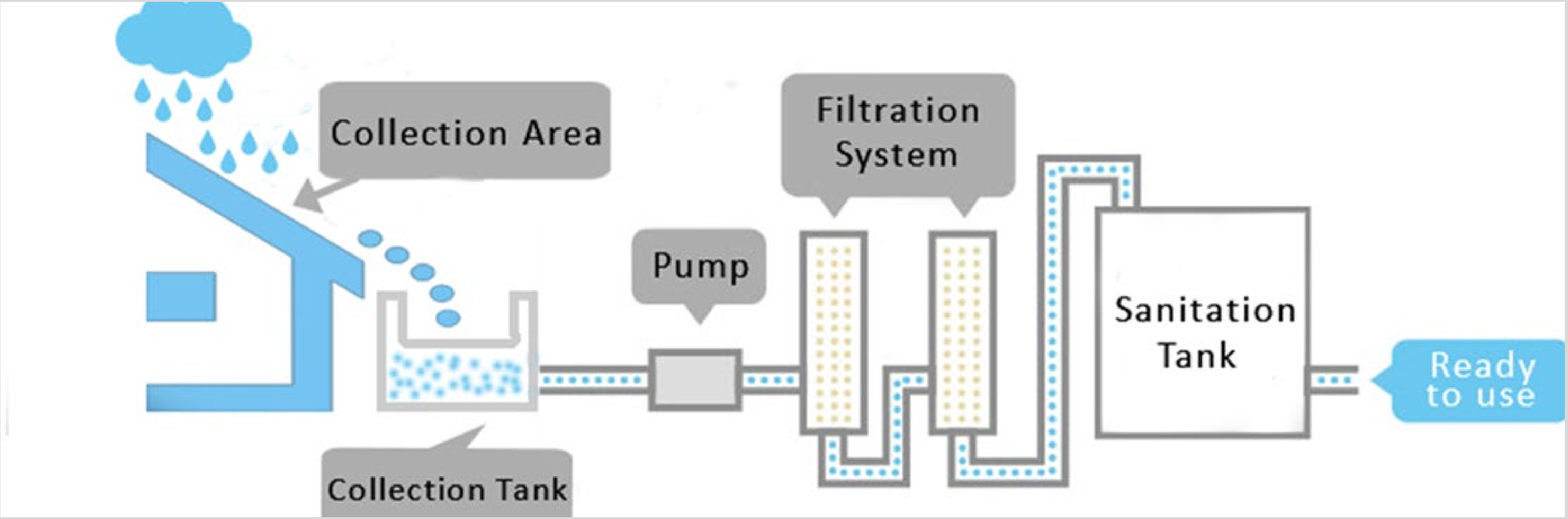
Learning Objectives

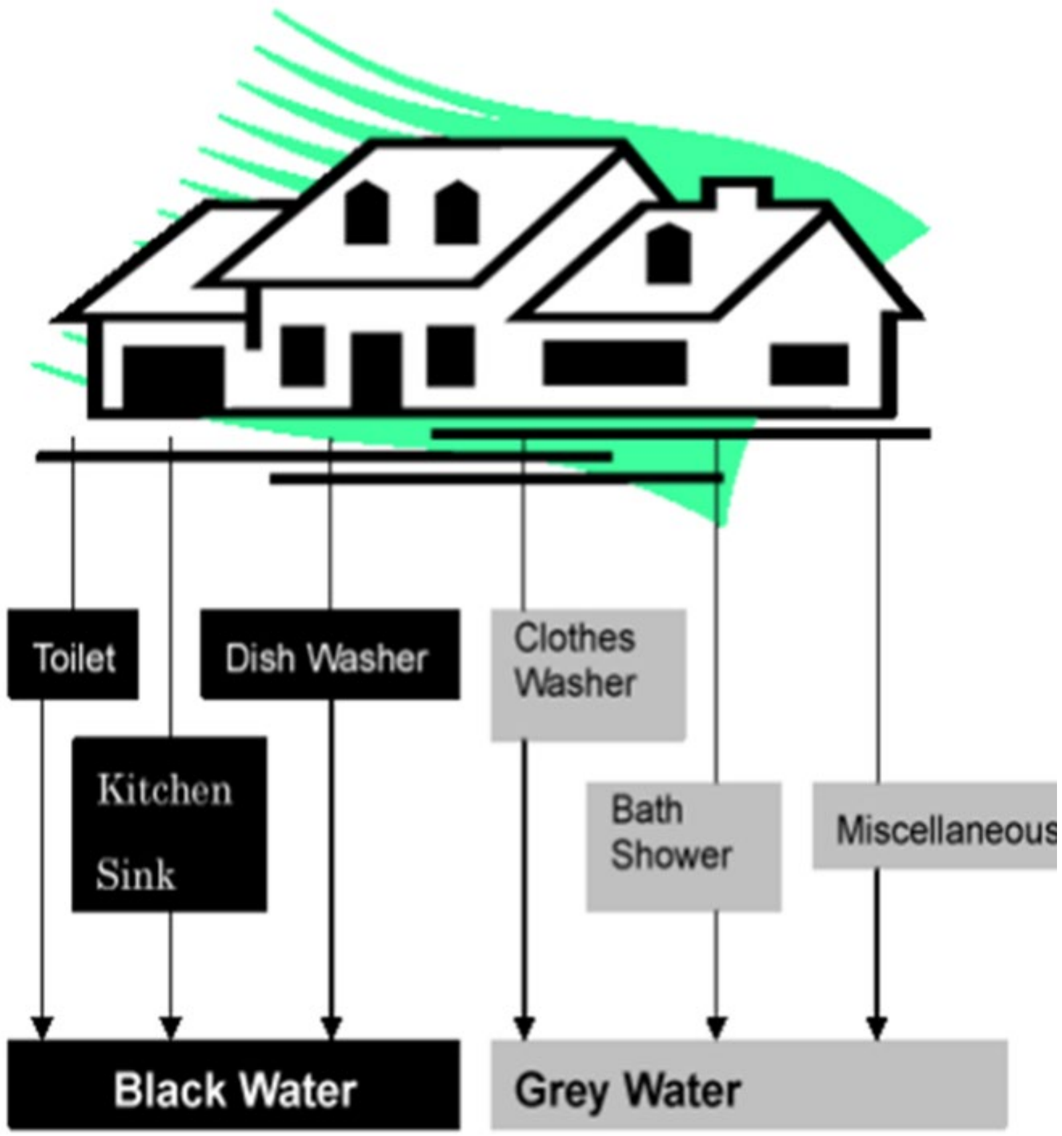
- Identify alternative sources of irrigation water at local level.
- Understand the legal and regulatory framework for water management within respective countries.
- Describe key water quality parameters important from irrigation use and how to mitigate against potential pollution.
- Compare water use efficiency of intensive and extensive production systems.

Agricultural Water Management

- Water management at farm level may involve storage conveyance, application and monitoring of quantity and quality.
- Regulated by policies and legal instruments across sectors.
- Limited as instruments do not encourage approaches to improve WUE across management zones.
- Encouraging alternate sources of water for irrigation with attention to quality.
- Greenhouse and other controlled production systems present the greatest opportunities for improving WUE.

Rainwater Harvesting





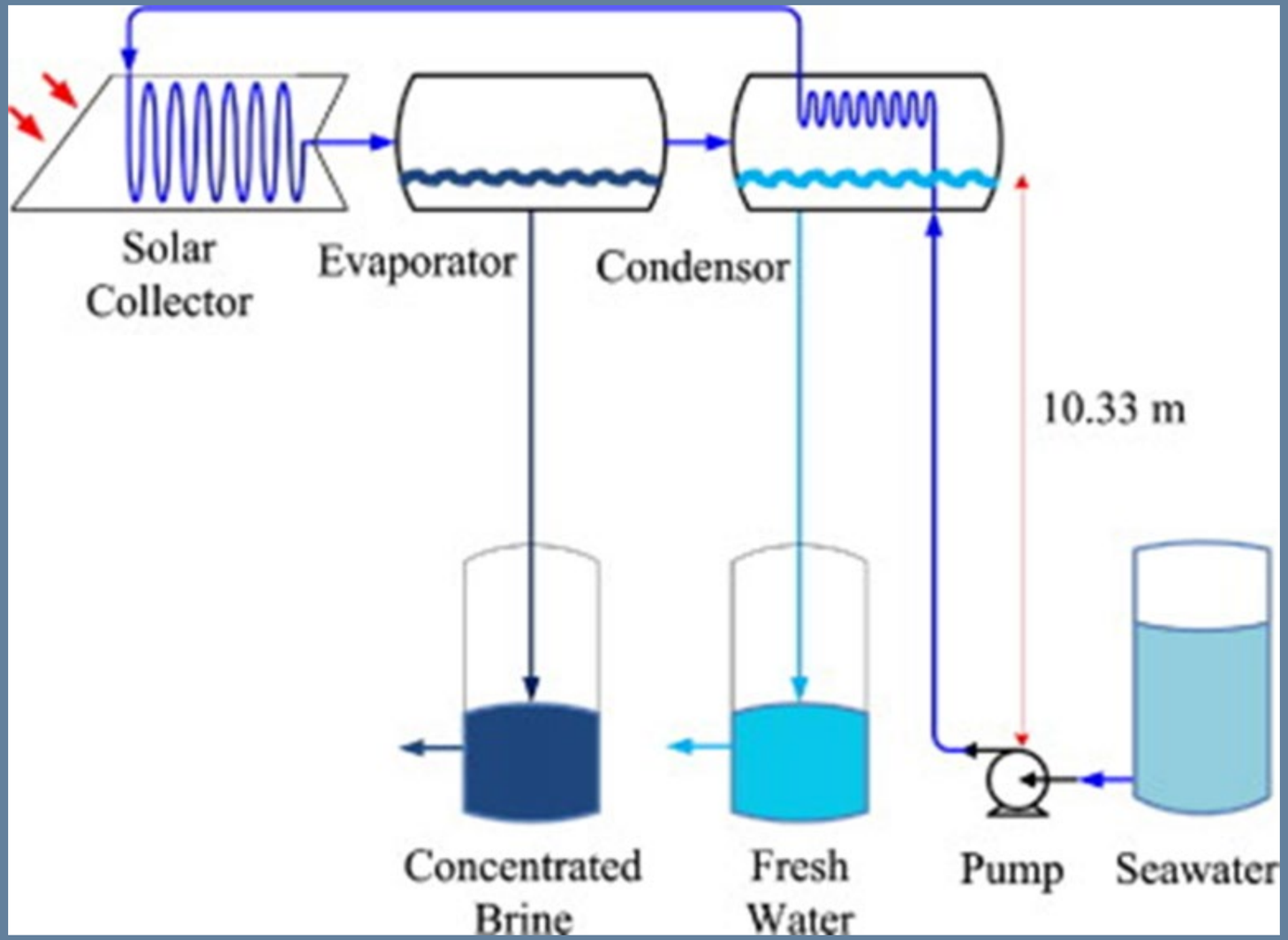
Treated Wastewater

- Wastewater is any water which has been affected by anthropogenic influence.
- When treated to meet strict health and environmental regulations and reused for irrigation purposes, reducing environmental degradation while addressing water scarcity.

Wastewater Treatment

- Screening: Large (and often very visible) objects are removed from wastewater.
- Primary: Organic and inorganic solids are then removed along with other floating materials.
- Secondary: Organic residue and other suspended particles are removed through aerobic degradation.
- Tertiary and/or Advanced: Removal of heavy metals and nutrients. Microbial load is reduced through disinfection and the treated water discharged.

Desalination



Legal and Regulatory Framework for Water Sources

Poor implementation of IWRM proposals.

Linkages between land and water management not incorporated into policies and planning.

Water management has continued to be public sector driven and managed with service providers duplicating as resource managers.

Noting the absence of a policy framework at national level, sectoral management of water resources is ever more difficult.

Aligning current water resources management to IWRM and WUE

- Legislation governing agricultural water use.
- Wastewater reuse including irrigation supplementation and aquifer recharge.
- Institutional coordination and harmonization of water resource management and professional capacity building.
- Implementation of IWRM.
- Improvements of systems of transparency and accountability.

Irrigation Water Quality

There are four major criteria for assessing irrigation water quality:

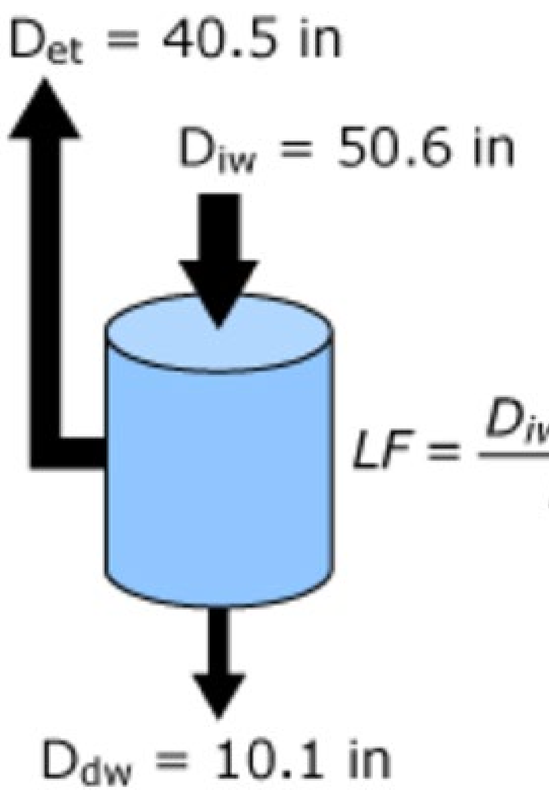
- pH: Acid, basic or alkaline
- Salinity: Amount of dissolved salts
- Specific ions: Sulphates, chlorides, heavy metals and trace elements
- Microbial pathogens

Classes of Water	Electrical conductivity ($dS\ m^{-1}$)
Class 1- Excellent	0.25
Class 2- Good	0.25 – 0.75
Class 3- Permissible	0.76 – 2.00
Class 4- Doubtful	2.01 – 3.00
Class 5- Unsuitable	3.00

Salinity

- Salinity refers to the salt content of the irrigation water. It is perhaps the most prevalent issue pertaining to irrigation water as it can have devastating effects on plants.
- Most agronomic crops have low salt tolerance and begin to show reduced productivity at salinity levels approaching 2 dS m -1.

Leaching Fraction



$$LF = \frac{D_{iw} - D_{et}}{D_{iw}} = \frac{D_{dw}}{D_{iw}} = \frac{10.1\ in}{50.6\ in} = 0.2$$

- If saline water is the only option, a leaching fraction must be included to compensate for the adverse effects of the saline water on crop and soil health.

- The leaching fraction (LF) is defined as the ratio of the quantity of water draining past the root zone to that infiltrated into the soil's surface. An additional amount of poor quality water is applied to drain excess salts out of the root zone.

Controlled Agricultural Systems

- Greenhouse farming is a form of controlled environment agriculture. This system allows for the control of most to all the factors of production, providing increased control over water use efficiency and productivity.

- Vertical farming uses shipping containers and warehouses to provide a controlled environment for producing food. These crops are grown in vertically stacked layers using hydroponics or aeroponics systems. The system is fitted with electronic sensors that ensures that crops are provided with sufficient LED light, nutrients, heat and water. In this intensive system, approximately 70 –90% of water is saved compared to extensive systems.

Lessons Learnt

- Rainwater harvesting, desalinated water and treated / reclaimed can be accessed for agricultural use in Caribbean SIDS.

- There are opportunities for Caribbean SIDS to improve WUE in agriculture through the development of policies and legislation to support it.

- Irrigation water quality is of utmost importance when considering alternative sources for agriculture. It impacts the environment, human health and the agricultural production systems.

- Intensive systems of agriculture allow for more control over WUE and is an area that can be tapped to increase WUE in SIDS.